

URBAN-RURAL LINKAGE IN DESAKOTA REGION:

Enhancing Urban-Rural link by a Chess-Inspired
Metro-Matrix Approach in Delhi-Meerut Corridor



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Politecnico di Milano

School of Architecture Urban Planning Construction Engineering

Master of Science in Architecture and Urban Design

A/Y 2022-2023

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Abstract

Rapid urbanization, driven by industrialization and population growth, caused fragmentation within city landscapes, dividing them into urban, peri-urban, and rural zones. Desakota, a fusion of ‘desa’ (village) and ‘kota’ (city), embodies the blurred boundaries between these regions. Found in quickly urbanizing areas, Desakota zones integrate agricultural, residential, and industrial elements, showcasing intricate interdependencies between rural and urban spaces. This hybrid approach emphasizes efficient management and resources for metropolitan growth while highlighting the necessity of a macro framework connecting rural and urban infrastructure.

This thesis explores the complex urban-rural dynamics in the Indian outer metropolitan areas (the Desakota regions). By visualizing cities (Delhi NCR) as chess pieces at both macro and local scales, it makes use of Pedro B. Ortiz’s chess analogy and the metro-matrix concept to identify nodes and their characteristics as well as to establish the continuity between these metropolitan nodes by connecting the green and grey infrastructures. To strengthen regional relationships, the study is supported by several analyses, including those of the ecological system, rail network, and grey-blue infrastructure.

Centred on the Delhi-Meerut corridor, the study advocates advancements aiming to smoothly harmonize urban and rural spaces. Utilizing the insights from the metro matrix, the paper identifies three nodes within the matrix and finds a common DNA illustrating a shared pattern across these sections that form the character of the city. The paper then proposes a detailed design model for each urban-rural fragment that respects the environmental elements and provides a better continuity within the fragments.

Through this designed template, the paper advances a design project proposing a new green-grey gradient form that aims to strengthen urban-rural connections while respecting each fragment’s unique qualities. As a result, this metropolitan morph-type generates another layer of DNA for the metropolitan region, benefiting both the chosen local scale nodes and subsequently the metropolitan nodes.

Objective: This thesis aims to extensively explore the urban-rural interface in the context of urbanization by leveraging the chess analogy and metro-matrix concepts to strengthen connections. The specific objectives include:

1. Investigating the evolution and consequences of urbanization, analyzing megacities, urban sprawl, and the urban bias debate within desakota regions, particularly in India’s peripheral metropolitan areas, identifying interdependencies between rural and urban spaces.
2. Analyzing diverse grey-green-blue infrastructural networks and creating a comprehensive mental map of these systems.
3. Applying Pedro B. Ortiz’s chess analogy to visualize critical urban development aspects at both macro and local scales, identifying potential areas for intervention.
4. Constructing a matrix representation of the urban-rural landscape, proposing strategic enhancements and interventions to reinforce regional connectivity.
5. Formulating a strategic design template adaptable to any global desakota region with urban-rural settings.
6. Proposing design concepts tailored for the Delhi-Meerut corridor, employing the design template to harmonize urban and rural spaces, fostering socio-economic and environmental facets of the city.
7. Employing detailed analyses of specific city sections to pinpoint areas for targeted intervention and development, highlighting recurring patterns shaping the city’s identity.
8. Outlining design strategies to integrate various aspects of urban-rural fragmentation, preserving existing elements, introducing new green spaces, and benefiting the local community.

Keywords: Urbanisation; Urban sprawl; Desakota regions; Fragmentation; Urban- Peri-urban- Rural interdependencies; Grey-green-blue infrastructure; Spatial network; Urban pattern; Chess analogy; Metro-matrix; Nodes; DNA analogy; Urban, peri-urban, rural linkages; Green-grey gradient form

Aknowledgment

We extend our deepest gratitude to Professor Antonella Contin, a beacon of support and guidance throughout our thesis journey. Her unwavering dedication, insightful feedback, and encouragement have been pivotal in shaping the direction and quality of this research. Professor Contin's expertise and commitment to our academic growth have left an indelible mark on our scholarly journeys.

Professor Contin's mentorship has been characterized by a perfect balance of challenge and encouragement, pushing us to exceed our expectations. Her wealth of knowledge and profound insights into the subject matter have been a constant source of inspiration.

We are also grateful for the collaborative atmosphere she fostered, sharing a diverse array of books and resources that enriched the intellectual fabric of our work. Professor Contin's mentorship extends beyond the confines of this thesis, influencing not only our academic pursuits but also shaping our broader understanding of the field.

We would also like to express our sincere appreciation to Mr. Pedro B. Ortiz for his exceptional guidance and invaluable contributions to our work. Mr. Ortiz's generous sharing of data, coupled with the time and expertise he invested in our project, significantly enriched our research. His groundbreaking book, "The Art of Shaping Metropolis," provided a conceptual framework that profoundly influenced our thesis.

Once again, we express our heartfelt thanks to Professor Antonella Contin and Mr. Pedro B. Ortiz for their exceptional guidance and the invaluable resources they shared. And without a doubt, thanks to our unwaveringly supportive parents, their positivity and calming presence steadied us through every step, easing our worries.

As Professor Contin once wisely said, "This is not the last project of your academic path, but is the first project of your professional career path." This perspective resonates deeply with us, and we carry this invaluable insight into the next phases of our journeys.

Urban-Rural Linkage in Desakota Region:

Enhancing Urban-Rural link by a Chess-Inspired Metro-Matrix Approach in Delhi-Meerut Corridor

Abstract	ii
Aknowledgement	iv
01. Introduction	1
1.1 Urbanization	
Definition	
Effects worth Noticing	
1.2 Urban Bias Debate	
Are we living in an urban chauvinistic society?	
1.3 Expanding the spectrum with Rural	
1.4 Urban and Rural- A complex relationship	
Defining Urban-Rural Linkages	
Interdependencies	
1.5 Effect of political models on the spectrum	
Industrial Policy Urbanisation Policy Infrastructure policy Agriculture Policy	
1.6 Desakota Region under the spotlight	
Defining Desakota Region	
Desakota region in India	
02. Context of the plat- India	9
2.1 Background of the linkages	
2.2 Rich waterscape of India	
2.3 Longest tributary of India- River Yamuna	
2.4 Ecoscape study	
Northern India	
NCT Delhi Region	
2.5 NCT Delhi Region Urban Expansion	
03. NCT Delhi- Cynosure of all	23
3.1 M-Scale Spatial Characteristics	
Ecological study	
Water network	
Rail network	
Rapid Rail Transit System-RRTS (Transit Oriented Development)	
Road network	
Green-Grey infrastructure	
Radial Pattern	

<p>04. Unravelling the Linkages</p> <p>4.1 Delhi & 16 Nodes- The influencing cities</p> <p>4.2 Delhi's Anatomy Main Character Urban Expansion- 1990 2000 2010 2020</p> <p>4.3 16 Nodes' Anatomy Main Character Urban Expansion- 1990 2000 2010 2020</p> <p>4.4 Synthesis Main Character Demographics</p> <p>4.5 Policies- Major state policies</p>	<p>39</p>	<p>07. Design Project</p> <p>7.1 Analysis- North Central South Meerut Grey Infrastructure Green Infrastructure Landuse Study DNA Analogy</p> <p>7.2 Analysis- North Central South Meerut Existing Mssterplan Flood Map Land Elevation Gradient Synthesis Scale reference for visual representation Section Study: Urban Peri-urban Rural Spectrum</p> <p>7.3 Concept Urban Contrast Peri-Urban Contrast Rural Contrast Strategy Design Detail Design Process: Prelim Approach Design Process: Phases</p> <p>7.4 Design Project Masterplan and Sectional Composition Typologies & Modules Design Illustrations</p>	<p>97</p>
<p>05. The Chess Analogy</p> <p>5.1 Building the Chess Web Significance and Criteria</p> <p>5.2 Building the Metro-Matrix Existing Metro-Matrix Interpretation Proposed Metro-Matrix</p>	<p>59</p>		
<p>06. Meerut as the testing ground</p> <p>6.1 Premises Delhi-Meerut Corridor RRTS (FOD network)- Delhi to Meerut</p> <p>6.2 Meerut Masterplan Existing Meerut Masterplan Proposed Meerut Masterplan 2031 (Draft)</p> <p>6.3 Background History Places of Significance</p> <p>6.4 S-Scale Spatial Characteristics Meerut Green-Blue infrastructure RRTS (FOD network)- Meerut</p> <p>6.5 Urban Pattern Orbital Urban Pattern Morphological Study</p> <p>6.6 City Chess Analogy Building Chess Analogy Building the Existing Metro-Matrix Proposed Metro-Matrix Potential Areas</p>	<p>67</p>		
		<p>08. Bibliography</p>	<p>144</p>



1. Introduction

1.1 Urbanisation

Definition

Effects worth noticing

1.2 Urban bias debate

Are we living in an urban chauvinistic society?

1.3 Expanding the spectrum with Rural

1.4 Urban-Rural: A complex relationship

Defining urban-rural linkage

Interdependencies

1.5 Effects of political models on spectrum

1.6 Desakota region under the spotlight

Defining desakota region

Desakota region in India



1.1 Urbanisation

Definition

“Urbanisation is the increase in the proportion of people living in towns and cities. Urbanisation occurs because people move from rural areas (countryside) to urban areas (towns and cities). This usually occurs when a country is still developing.” Source: EEA

Over the past few hundred years, the global population has increased dramatically, and our economies have industrialized. Consequently, many people have shifted to urban areas. We call this process “urbanization.” But even after cities arose, most people continued to live and work in rural areas. Cities did not really start to boom until widespread industrialization started in the eighteenth century. Today, about half of all people live in cities. Manufacturing and professional occupations, as well as more options for learning and entertainment, are all things that draw people to them.

Effects worth noticing

One result of this enormous increase in urban population is the emergence of the megacity or a city with more than 10 million residents. Cities today contain far more than that. For instance, Delhi, India, is home to around 35 million people. Urban sprawl is another outcome of urbanization. Urban sprawl occurs when a city’s population is scattered over an expanding geographic area. As cities grow, they frequently begin to occupy substantial swaths of land that were originally utilized for agriculture because of this transition from dense urban centres to less dense suburbs.

The requirement for transportation infrastructure, such as highways, is also increased by sprawl because people’s homes are likely to be located further from their places of employment and preferred amenities.

Figure 1: (On the left) Image portrays urbanization overtaking rural areas.

1.2 Urban bias debate

Are we living in urban chauvinistic society?

Urban areas are sometimes regarded as dominant because they are given primacy in political preferences, development initiatives, and resource distribution. Therefore, a major part of the spectrum that a nation comprises of is regarded to be the megacity or significant large cities. By default, this creates an urban chauvinistic society among people.

Living in a society that is “urban chauvinistic” or “urban bias” would mean that urban areas are given an unfair advantage over rural areas, frequently resulting in a dominant attitude toward urban values, habits, and interests. This bias may lead to the unequal distribution of opportunities, resources, and services, which may cause differences in the level of living between urban and rural communities. Using Delhi as an example, a city with a population of 35 million, several individuals are interested in “settling down” here and building a life for themselves because of the welfare system and other benefits it provides. The spectrum of a nation, however, goes beyond its urban centers. Even though they are occasionally disregarded, the rural places (other part of the continuum) are just as significant as any urban location, especially India that consists of rural population of 68.8% and an urban population of 31.2%.

1.3 Expanding the spectrum with Rural

It is important to acknowledge the varied contributions of different sections that make up a nation while discussing the well-being of that country and the sustainability of its society. Most of the nation’s processes are centered in the rural areas, which helps the other regions survive by providing them with necessities like food and materials. Even so, when development occurs, urban areas, which hold technical power, occupy center stage. Therefore, expanding the continuum is vital as it encourages an in-depth awareness of societal dynamics, resulting in more inclusive and successful development initiatives.

1.4 Urban-Rural: A complex relationship

Defining urban-rural linkage

Urban-rural linkage implies the interconnected relationship between urban and rural areas within a region. It encompasses the economic, social, and environmental interactions and dependencies that exist between urban and rural communities. Urban and rural areas are not isolated entities but rather closely connected through various channels, such as people, goods, services, resources, infrastructure, and information.

Interdependencies

In terms of environmental, social, and economic factors, urban and rural areas are highly interdependent. This interdependence acknowledges the contribution of both urban and rural areas to the general functioning and well-being of a community.

1.5 Effects of political models on the spectrum

Political models can have a substantial impact on the urban-rural spectrum, affecting the growth, governance, and relations between urban and rural areas.

Industrial Policy: Through distribution networks, market access, and supply chains, industrialization can strengthen ties throughout urban and rural communities. Rural linkages could be reduced, though, if policies favor metropolitan areas.

Urbanization Policy: Political models have an impact on urbanization policies that promote or impede urban growth. Pro-rural policies may impede urbanization and economic progress, whereas pro-urban policies may result in urban sprawl and the neglect of rural areas.

Infrastructure Policy: While more inclusive models work to construct rural infrastructure to improve connection and services. And to encourage expansion, policymakers may put a strong emphasis on creating the necessary transportation networks, ports, and logistical hubs in urban regions. As a result, infrastructure development in urban and rural areas may differ significantly.

Agriculture Policy: Political ideologies influence agricultural policies that influence rural economies. Sustainable agriculture can be supported by policies that aid smallholder farmers and the agro-industry.



1.6 Desakota region under the spotlight

Defining desakota region

The term “Desakota” describes a particular habitation layout that has developed in various densely populated areas of Asia, especially in Indonesia. Desa, which means village, and Kota, which means city, are combined to form the word “Desakota.” A Desakota area is a hybrid zone where rural and urban regions are blended and coexist to produce a distinctive landscape and economy.

They give possibilities for resource preservation, community-based governance, and balanced urban and rural development. The Desakota regions have received a great deal of attention from researchers who are trying to understand the complex relationships between rural and urban areas in places that are quickly urbanizing.

These regions generally develop in peri-urban conditions where traditional rural areas are being encroached upon by urban areas. These areas contain a mixture of commercial, industrial, residential, and agricultural terrain. People who work in both the urban and rural sectors benefit from the unique social and economic environment created by the rural-urban mix.

Desakota region in India

Although the name “Desakota” was first used to refer to settlement patterns in Indonesia, similar areas can be found throughout South and Southeast Asia, including India. Desakota regions are mainly located in India’s outlying metropolitan areas.

A representative of a Desakota region in India is the Greater Delhi Region, which encompasses Delhi and its neighboring areas in Haryana and Uttar Pradesh. One of the world’s most densely inhabited regions, this one is home to more than 30 million people. With a complex network of land uses and economic activity, the Greater Delhi Region is distinguished by a mix of urban, peri-urban, and rural areas.

This area is a mixture of residential regions, industrial areas, agricultural land, and commercial places. Vegetables and flowers are frequently grown in the area’s agricultural land and sold in the markets of Delhi. Numerous farmers in the area also hold jobs in non-agricultural industries like transportation, construction, and services. Despite the region’s difficulties with land use conflicts, environmental deterioration, and traffic congestion, it also presents potential for sustainable growth.

Figure 2: (On the left) Image illustrates the unique landscape of desakota regions.



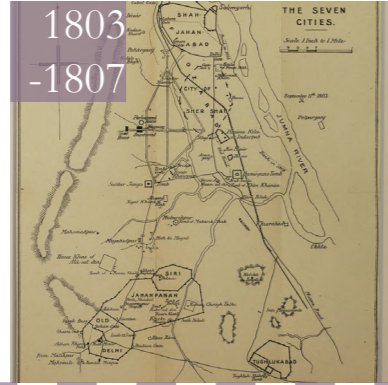
2. Context of the plat- India

- 2.1 Background of the linkages
- 2.2 Rich waterscape of India
- 2.3 Longest tributary of India
- 2.4 Ecoscape study- Northern India
 - Northern India
 - NCT Delhi Region
- 2.5 NCT Delhi Region Urban Expansion



Silk Route

Linkage: Water and Road network. Indians from the northwest who resided close to the Ganges River were vital mediators in the China-Mediterranean silk trade.



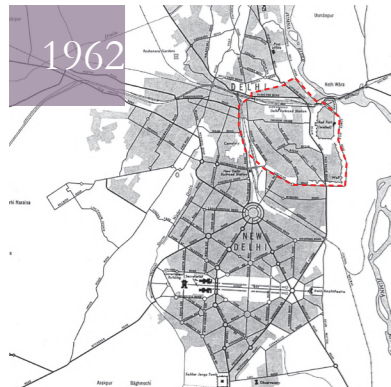
The Seven Cities

Linkage: Major Arteris inside the fortified cities & small connections amongst the seven cities. The Yamuna River as water route and road network used for trading and traveling.



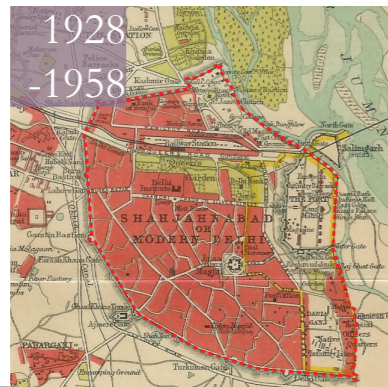
British Invasion

Linkage: Telegraph link between Delhi & the ports of India. Arteries roads & small bridges connected the new built areas. North-South and East West routes were the processional routes, as well as commercial arteries.



The first Master Plan of Delhi

Linkage: Well planned road network between villages at the periphery and the interiors mainly, the urban part.



Emergence of Railway

Linkage: Railway network from old (rural) Delhi to New (urban) Delhi.



Delhi- the capital city

Linkage: Disappeared linkage. Britishers barred any connections with Shah-janabbad (now rural).

2.1 Background of the Linkages

Silk Route

The route passed through Italy, Greece, Arabia, Persia, India, and finally China.

The Seven Cities

Since the establishment of seven historic cities, Delhi became the historical spotlight (urban).

British Invasion

Britishers made their cantonment area which unofficially became the new urban area.

The first Master plan of Delhi

Delhi was independent & rapidly growing, people started to migrate at higher pace. As the central part & areas near to Yamuna river were already congested, the new areas went south.

Emergence of Railway

The railways began to progressively extend along the west of the walled city, between the city to the east and the west, in the second part of the 19th century, cutting through northern Shahjahanabad (the current Old Delhi railway station).

Delhi- The capital city

Given its potential as a land route convergence point, Delhi was chosen for the future capital. It was in a triangle formed by terrain, river, and a natural projection on the west side of the Yamuna.

Figure 3: (On the left) Images illustrate India's linkage evolution from the 14th century to 1914, offering a historical perspective on connectivity changes.



2.2 Rich waterscape of India

The immense network of rivers, lakes, reservoirs, and other water bodies that make up India's waterscape have had a significant impact on the nation's geographic, cultural, and economic landscape.

India has long used its waterways as an efficient means of moving people, products, and services. The development of today's road and rail networks has lessened reliance on water-based transportation. Due to the easy access to water for residential use, transportation, and agriculture, settlements have organically grown along waterways. The ancient cities of Varanasi on the banks of the Ganges and Udaipur on the shores of beautiful lakes serve as excellent examples of the interdependence between human settlements and water resources.

The ability of the waterscape to blur the line between urban and rural areas is one of its most important functions. Numerous important rivers in India, like the Ganges and Yamuna, act as lifelines that link thriving cities with rural hinterlands. These rivers play a vital role in the nation's economic structure by facilitating trade and commerce while also sustaining agricultural activities.

However, India's waterscape has seen significant alterations as a result of urbanization. Industrial and domestic contaminants have been introduced to water bodies as a result of rapid urbanization and poor waste management.

Figure 4: (On the left) Map highlights the significant presence of water in India, underscoring its pivotal role as a major asset to address.

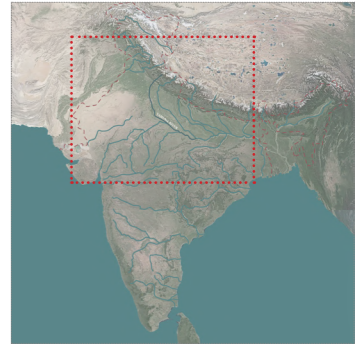


2.3 Longest Tributary of India

Since ancient times, the Yamuna River has played an important role as a trading route and a source of food for several civilizations. It was crucial for the movement of people and products in recent times, linking towns and cities all across India's northern plains.

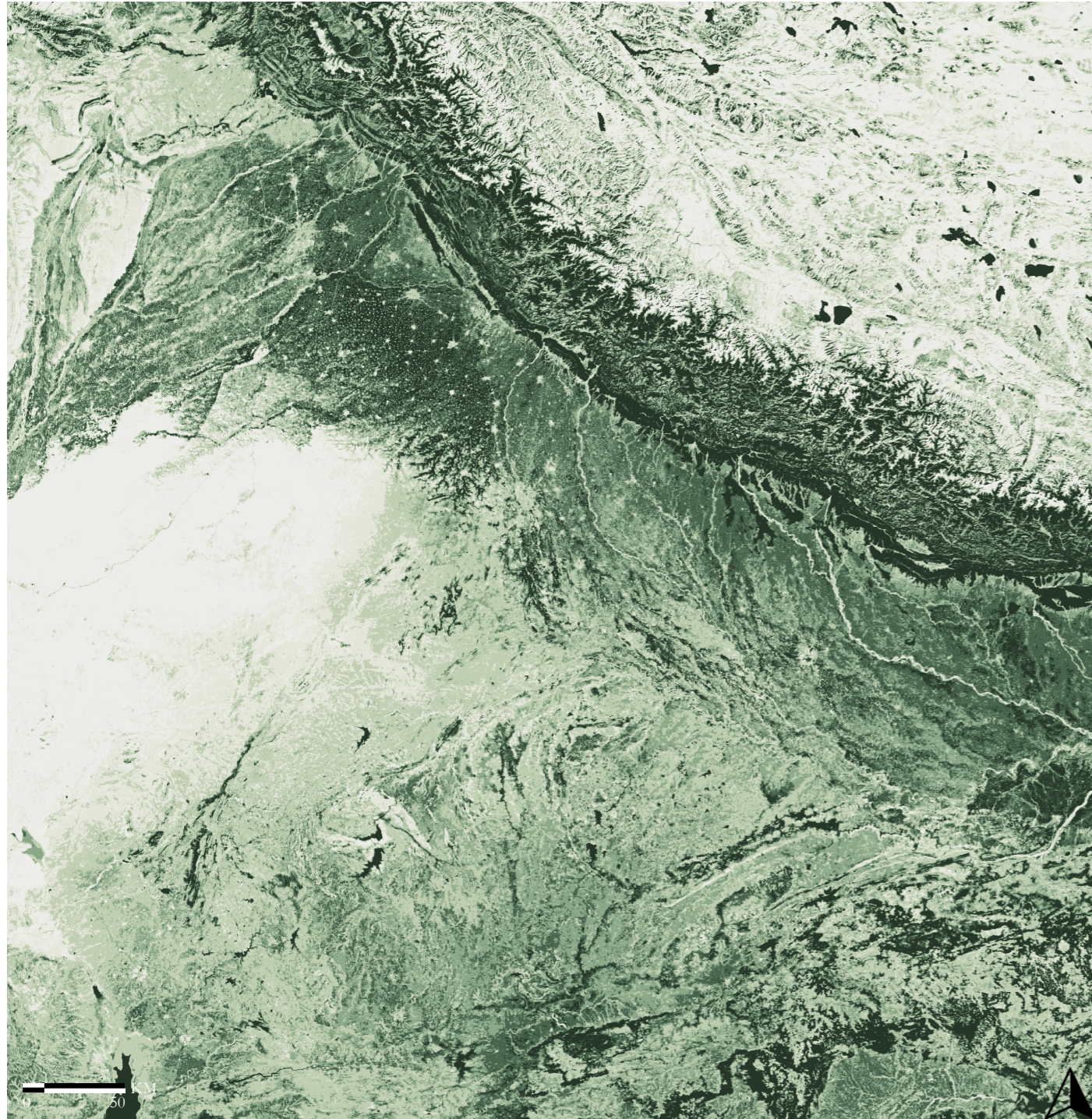
However, because of pollution, sedimentation, and decreased water flow, this navigability has decreased over time. Along its rivers, ancient cities like Delhi, Mathura, Agra, and Allahabad have prospered. These cities relied on the Yamuna for trade and intercultural interchange in addition to water supply and agriculture. In addition to acting as a lifeline, the river in northern India continues to be a crucial bridge connecting urban and rural areas.

However, the Yamuna's health has been negatively impacted by the growing development in its basin. River banks have encroached due to urban growth, lowering the river's breadth and flow capacity. The creation of a "dead zone" in the Yamuna River is one of the most concerning effects of urbanization and pollution. As a result of the significant oxygen depletion present in this region, aquatic life cannot exist. And most of the settlements can be located near the dead river zone which is a clear result of building to avoid flood risks.



Jamnotti-Prayagraj

Figure 5: (On the left) Map shows depict the northern region of India, specifically focusing on the Yamuna River and its associated dead zone.



2.4 Ecoscape Study

Northern India

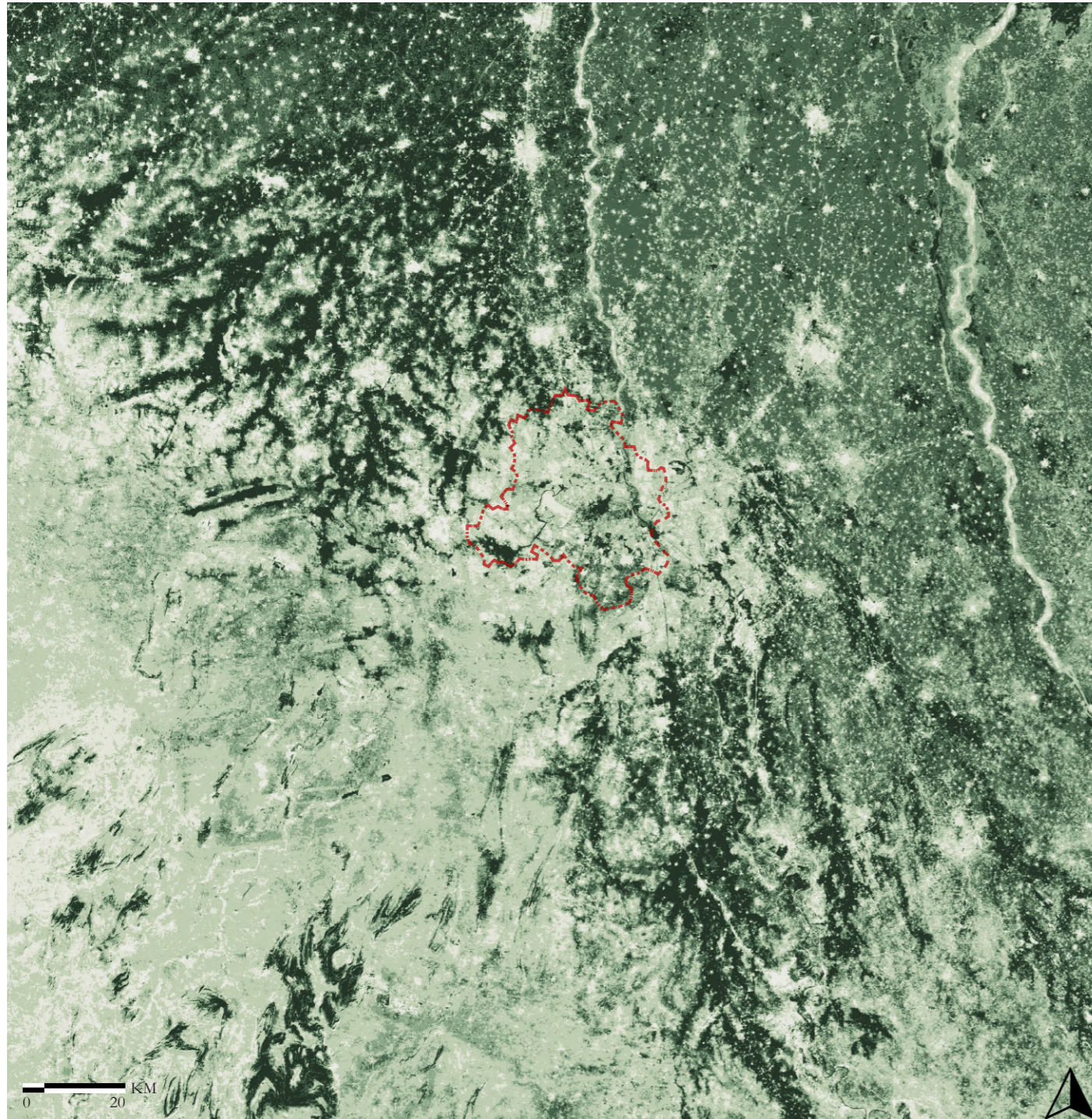
For centuries, India's ecoscape has provided pride and nourishment with its varied ecosystems and greenery. Although many habitats have been protected by conservation efforts, sustaining a healthy ecoscape has proven difficult due to the increasing pace of urbanization.

However, the state of the ecoscape cannot change the reality that India's green cover is essential for bridging urban and rural areas. Green cover is crucial to agriculture, the main rural industry. For rural people, forests and agricultural areas supply food, cash, and raw materials.

Green spaces like parks, gardens, and green belts are becoming more and more important, even in urban areas. In addition to offering recreation, these places also improve the city's air quality and citizens' general well-being. And green corridors, made up of forests and other protected places, allow species to migrate more easily between urban and rural regions, maintaining ecological harmony.

This presents an opportunity to reevaluate the appropriate course of action, including whether to retain existing greenery or add new ones to offset the deterioration brought on by urbanization.

Figure 6: (On the left) Map displays the North Indian ecoscape study, emphasizing the significance of ridges and lush greenery as prominent assets within the landscape.



NCT Delhi Region

The eco-scape of Delhi and its nearby areas encompasses a diverse range of ecosystems, including forests, wetlands, rivers, and agricultural lands. Delhi itself is home to several urban parks and green spaces that provide recreational areas and contribute to the city's biodiversity.

The nearby areas of Delhi, such as the Aravalli hills and the Yamuna floodplains, are important ecological zones. These areas support a variety of plant and animal species, including endangered and migratory species. The Aravalli hills act as a natural barrier and play a crucial role in regulating the city's climate and air quality.

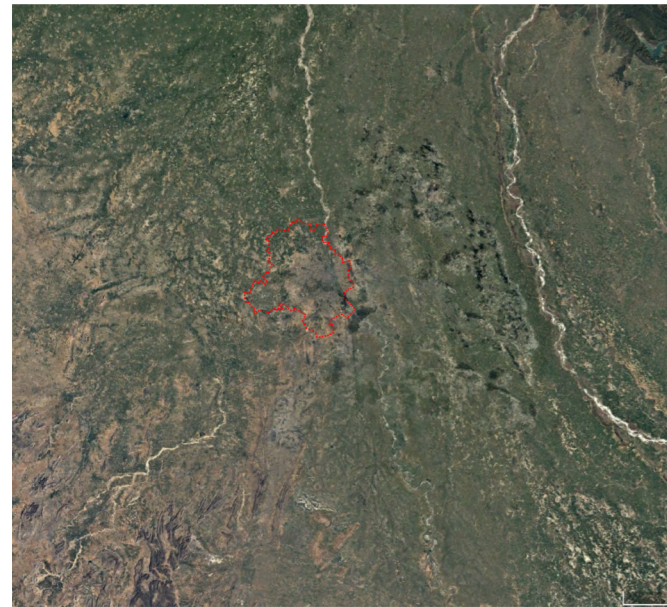
Figure 7: (On the left) Map exhibits the ecoscape study of New Delhi and its neighboring cities, highlighting the importance of ridges and abundant greenery as pivotal features within the landscape.

2.5 NCT Delhi Region Urban Exapnsion

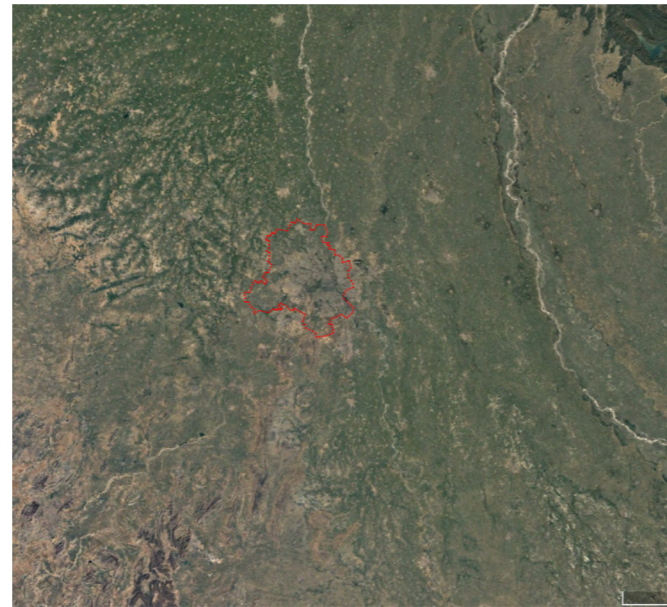
Over the past four decades, urban expansion in the Delhi NCR region has undergone a dramatic transformation, characterized by rapid and extensive growth. The burgeoning population, coupled with industrialization and economic development, triggered an unprecedented demand for urban spaces, resulting in the sprawling expansion of cities and towns. This expansion has seen a surge in real estate development, leading to the conversion of agricultural lands, open spaces, and green belts into built-up areas. Consequently, there has been a substantial reduction in green cover and natural landscapes, contributing to environmental degradation, increased pollution levels, and amplified urban heat island effects.

Additionally, this expansion has witnessed the emergence of new infrastructure networks, including roads, highways, and residential complexes, causing the fragmentation and loss of biodiversity in previously interconnected ecosystems. The surge in urbanization also escalated the pressure on water resources, depleting groundwater reserves and straining existing water bodies due to over-extraction and pollution from industrial and domestic sources.

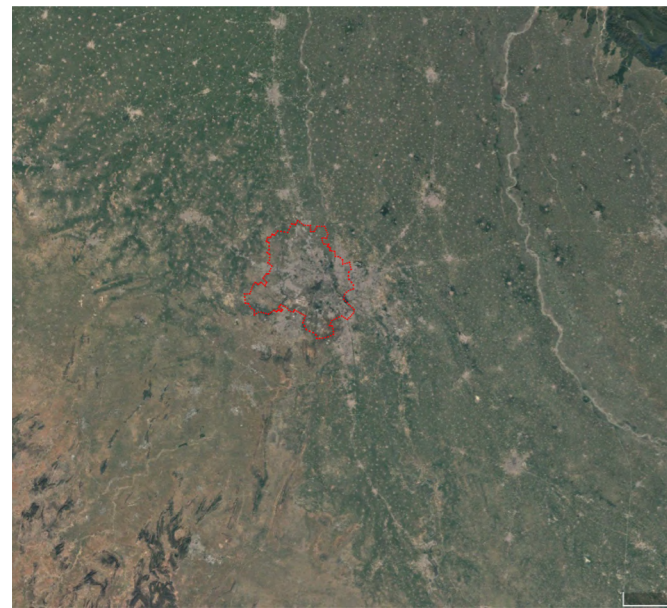
Furthermore, the unchecked expansion has exacerbated socio-economic disparities, with disparities in access to basic amenities, healthcare, and quality living standards becoming more pronounced between urban and peri-urban/rural areas. This urban sprawl has posed significant challenges in terms of urban planning, sustainable development, and environmental conservation, calling for comprehensive measures to mitigate its adverse effects and promote a more balanced and sustainable growth trajectory for the region.



1990



2000



2010



2020

0 10 KM



Figure 8: (On the left) Maps illustrate the urban expansion that occurred in the Delhi NCR region from 1990 to 2020.



3. NCT Delhi- Cynosure of all

3.1 M-Scale Spatial Characteristics

Ecological study

Water network

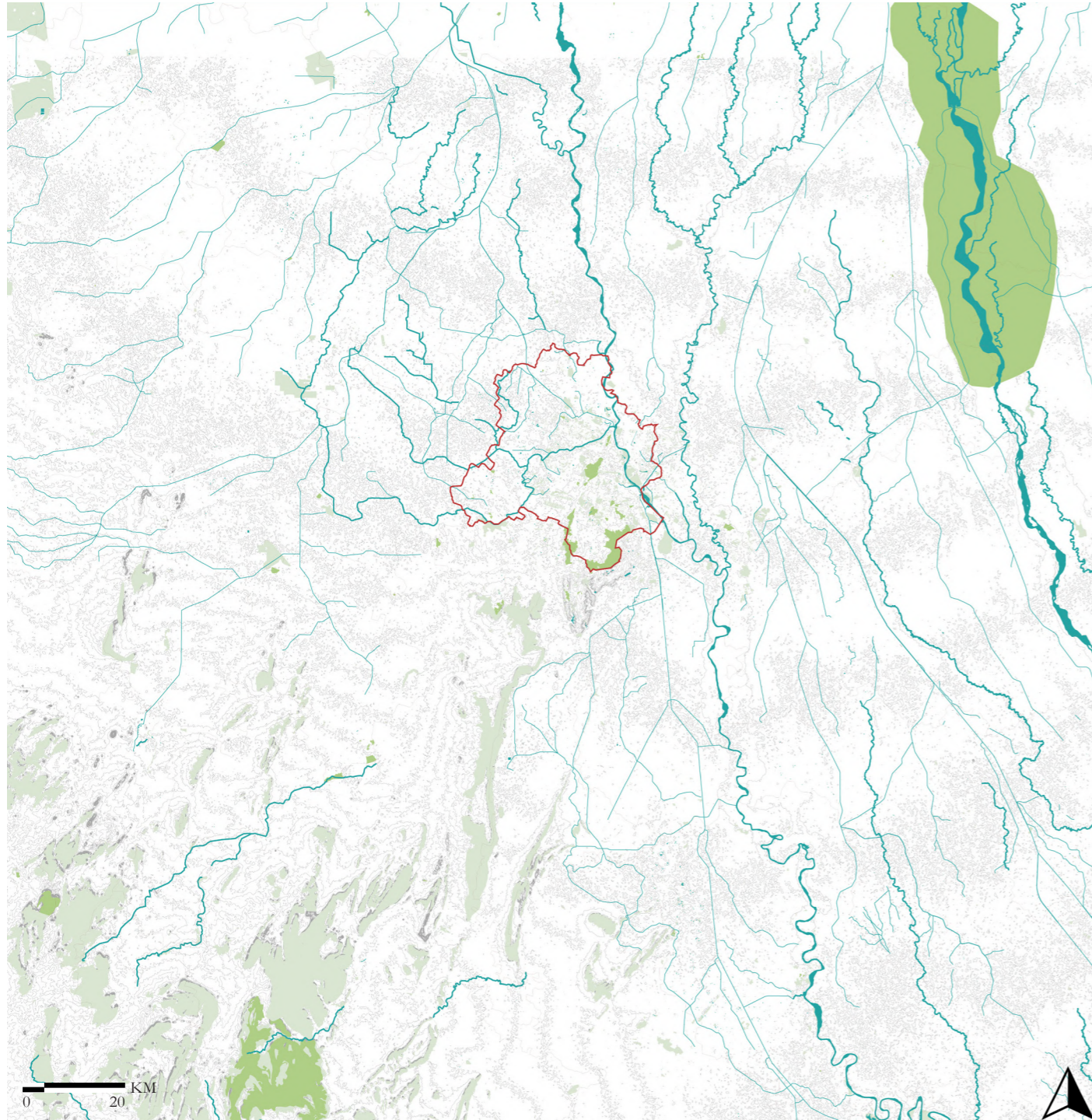
Rail network

Rapid Rail Transit System-RRTS

Road network

Green-Grey infrastructure

Radial Pattern

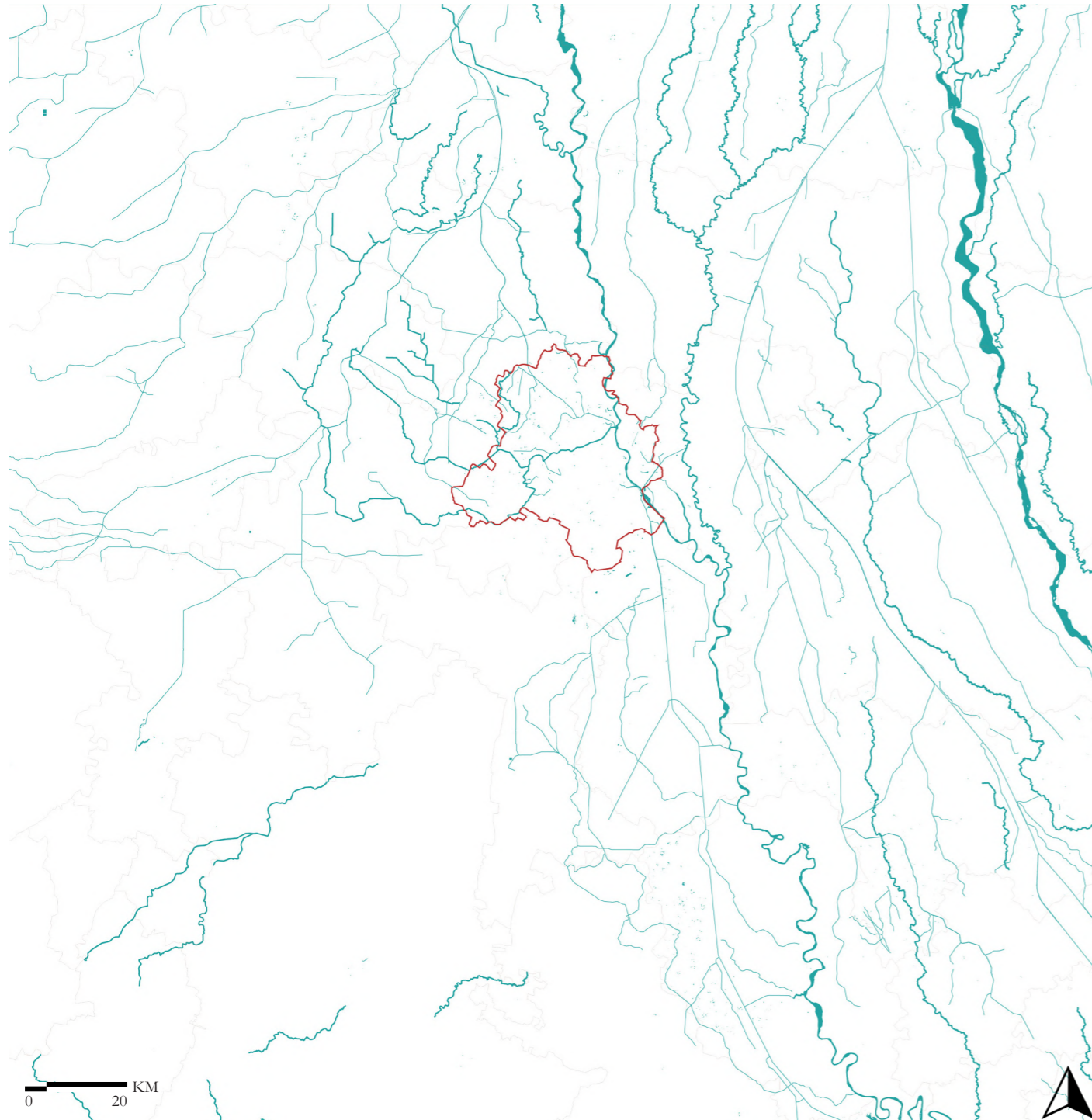


3.1 M-Scale Spatial Characteristics

Ecological Study

Delhi NCR's ecology is diverse, including forests, wetlands, rivers, and agricultural lands. The Aravalli Range is a prominent feature, supporting wildlife and maintaining ecological balance. The Yamuna River faces pollution challenges but is crucial for irrigation. Wetlands like Okhla Bird Sanctuary are vital for birds and water purification. Agricultural lands support food production but face encroachment. Balancing urban development and ecological preservation is essential for a sustainable environment.

Figure 9: (On the left) Map details Delhi and nearby cities, showing contours, greenery, and water sources.



Water Network

The water scape of Delhi NCR includes the Yamuna River, lakes, canals, and reservoirs. The Yamuna River is heavily polluted, while lakes like Surajkund and Damdama contribute to water conservation. Canals serve for irrigation and water supply, but pollution and encroachment pose challenges. Efforts are being made to improve water quality and conservation through treatment plants and conservation programs. Managing and conserving water resources is crucial for the well-being of the region.

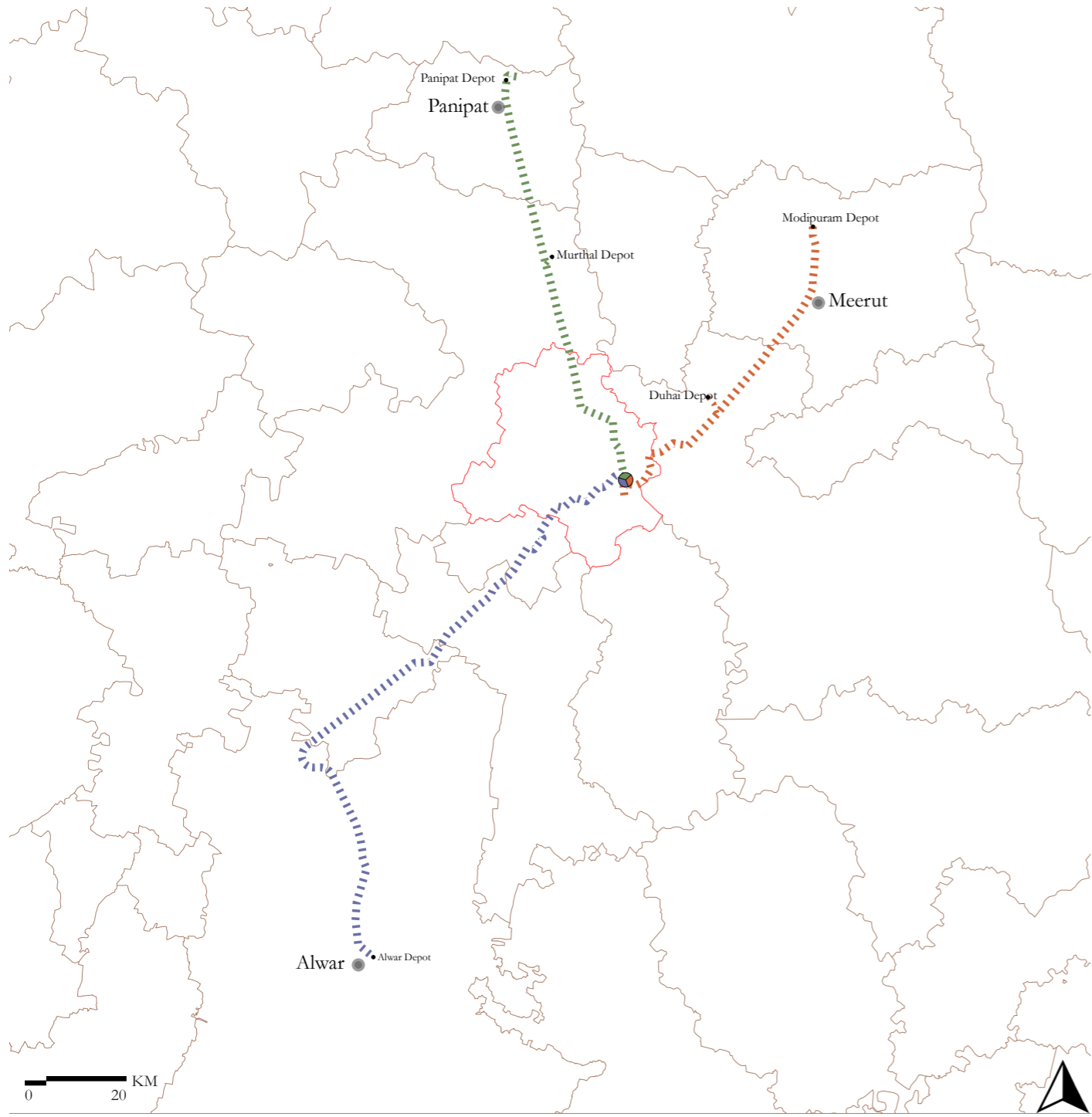
Figure 10: (On the left) Map intricately showcases the river networks, canals, and streams in Delhi and its neighboring cities.



Rail Network

The rail network in Delhi NCR consists of the Delhi Metro, Indian Railways, Rapid Rail Transit System (RRTS), and suburban rail services. It provides convenient and efficient transportation options for commuters within the region and to other parts of the country. The rail network continues to expand and improve to meet the growing transportation needs of the region.

Figure 11: (On the left) Map exhibit the extensive rail network that spans across Delhi and its neighboring cities.



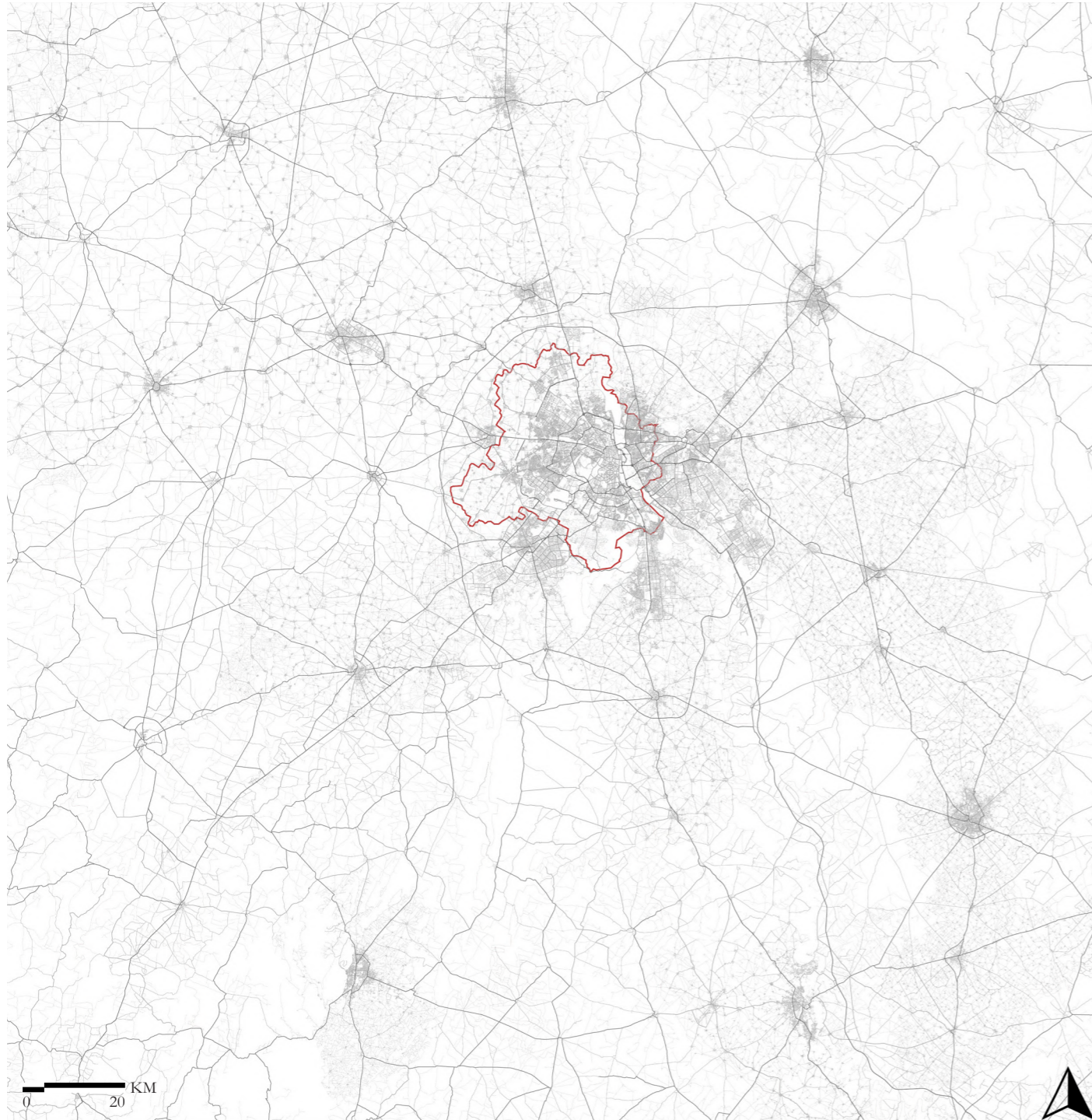
Rapid Rail Transit System- RRTS (Transit Oriented Development)

The rapid rail transit system envisioned for the Delhi-Meerut-Aligarh-Alwar corridor encompasses several phases, aimed at enhancing connectivity and facilitating seamless travel across these cities. Initially conceived to address burgeoning traffic and ease congestion, the system’s proposed phases involve infrastructural development, including track laying, station construction, and integration of advanced signaling systems.

Designed to provide swift, efficient, and eco-friendly transportation, this transit system aims to significantly reduce travel times between these cities. By enabling quick movement across these regions, the rail system is anticipated to foster economic growth, ease commute woes, and promote regional development.

The project is expected to bring forth transformative changes by bolstering inter-city connectivity, streamlining transportation, and facilitating efficient movement of people and goods across this extensive urban corridor.

Figure 12: (On the left) Map shows the RRTS network for Delhi-Meerut-Aligarh-Alwar. (Source: Redrawn from NCRTC.In)

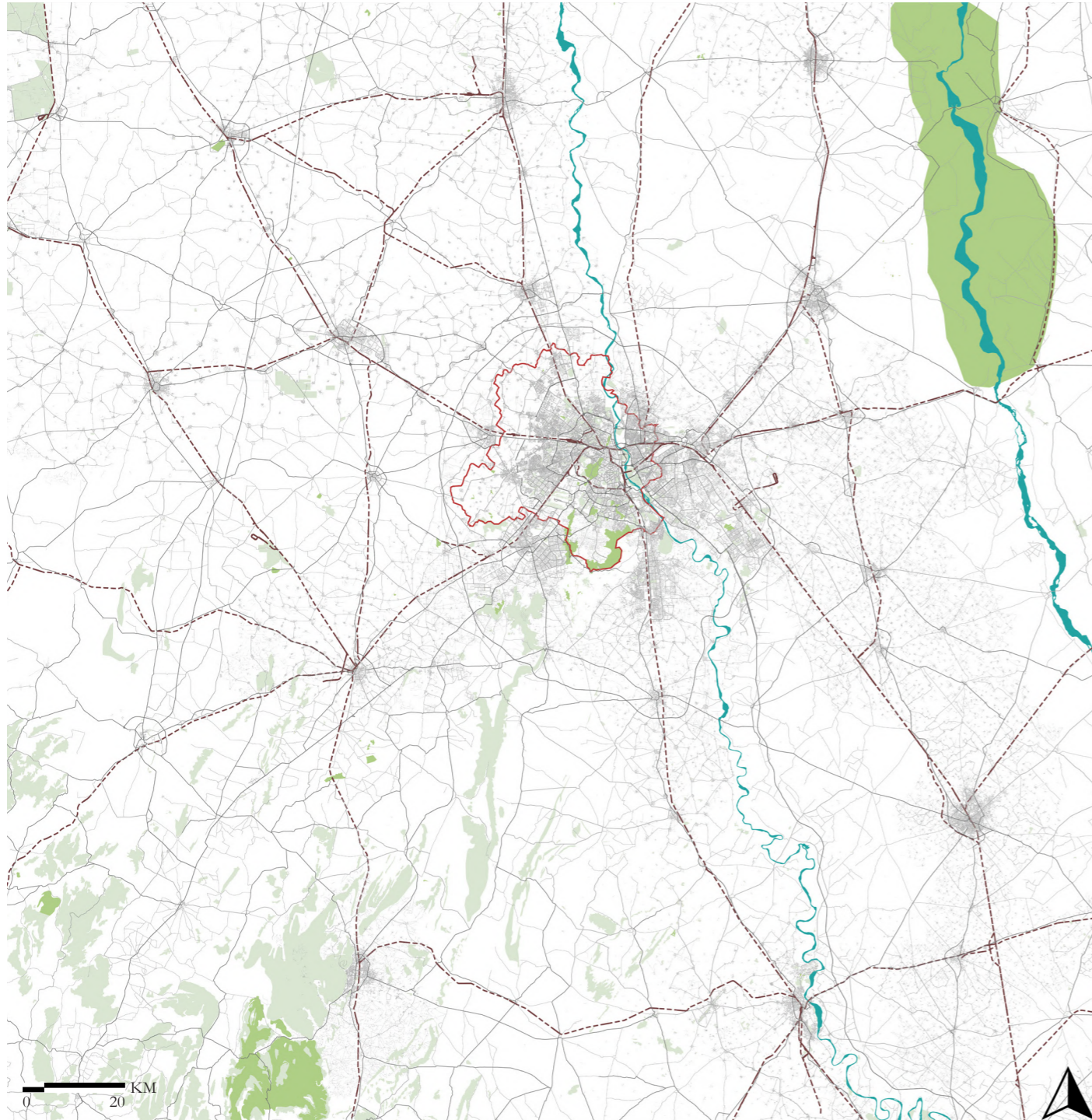


Road Network

The road network of Delhi NCR is extensive and well-developed. It consists of a network of highways, expressways, and arterial roads that connect the various cities and towns in the region. The major highways in Delhi NCR include the Delhi-Meerut Expressway, the Eastern Peripheral Expressway, and the Kundli-Manesar-Palwal Expressway. These highways help facilitate the movement of goods and people between different parts of the region.

This visual representation aims to delve into the comprehensive connectivity system, outlining the primary thoroughfares alongside the secondary and tertiary routes. Through this detailed cartographic depiction, the interconnectedness and accessibility between Delhi and its adjacent urban centers become apparent, shedding light on the various road hierarchies and their contributions to the broader transportation infrastructure.

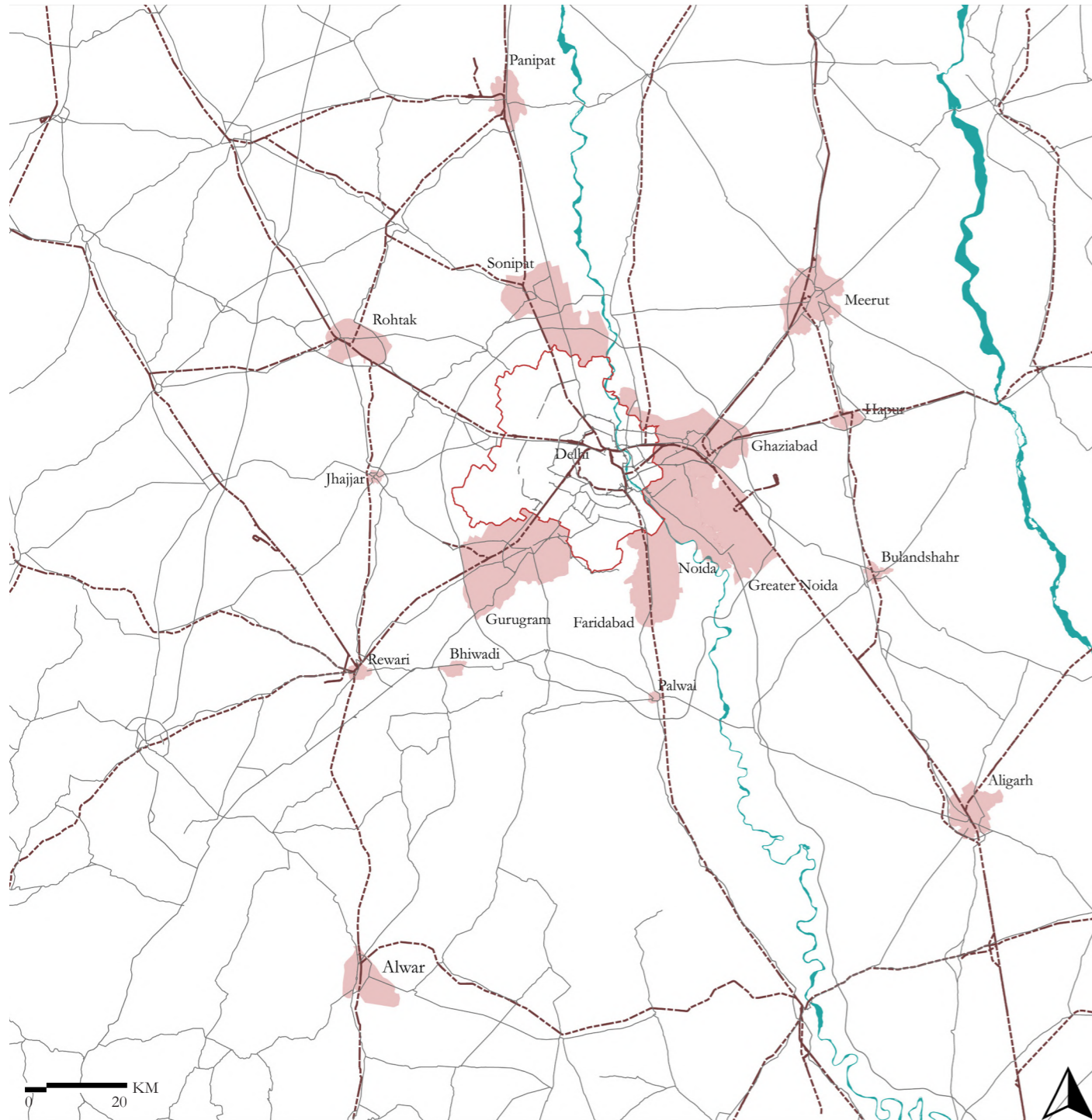
Figure 13: (On the left) Map illustrates the intricate network of primary, secondary, and tertiary roads linking Delhi and neighboring cities.



Green-Grey Infrastructure

The green-grey infrastructure in Delhi NCR consists of a mix of natural and built elements. While there are extensive built infrastructure networks, there are also green spaces, parks, and water bodies. However, rapid urbanization has put pressure on these resources, leading to challenges such as encroachment, pollution, and inadequate waste management. Efforts are underway to develop new green spaces, restore water bodies, and promote sustainable urban planning. The goal is to create a balanced and sustainable infrastructure that enhances residents' quality of life and supports environmental well-being.

Figure 14: (On the left) Map shows the existing patches of green across Delhi and neighbouring cities.



Radial Pattern

The radial road network in Delhi and neighboring 16 cities forms a vital connection system. Each city acts as a hub from which multiple roads emerge and extend outward like spokes on a wheel. These roads serve as primary conduits, linking the cities with one another and facilitating smoother travel and transportation across the region. From the central hubs of Delhi and its neighboring cities, these radial roads branch out and interconnect, fostering an intricate web of travel routes that cater to various destinations and communities.

The roads emerging from each city form a well-designed radial pattern, enhancing connectivity and accessibility between urban centers and surrounding regions. This network not only supports transportation within the cities but also serves as crucial arteries for inter-city travel, allowing for efficient movement of people and goods across the area. The radial configuration of the roads showcases a strategic approach to urban planning, optimizing travel routes and providing a well-structured framework for regional connectivity. Overall, this radial network significantly contributes to the seamless integration of these cities and the overall efficiency of the transportation system in the region.

Figure 15: (On the left) Map displays radial roads connecting Delhi to 16 neighboring cities, forming a crucial transportation network.

4. Unravelling the Linkages

4.1 Delhi & 16 nodes- The influencing cities

4.2 Delhi's Anatomy

Main Character

Urban Expansion- 1990 | 2000 | 2010 | 2020

4.3 16 nodes' Anatomy

Main Character

Urban Expansion- 1990 | 2000 | 2010 | 2020

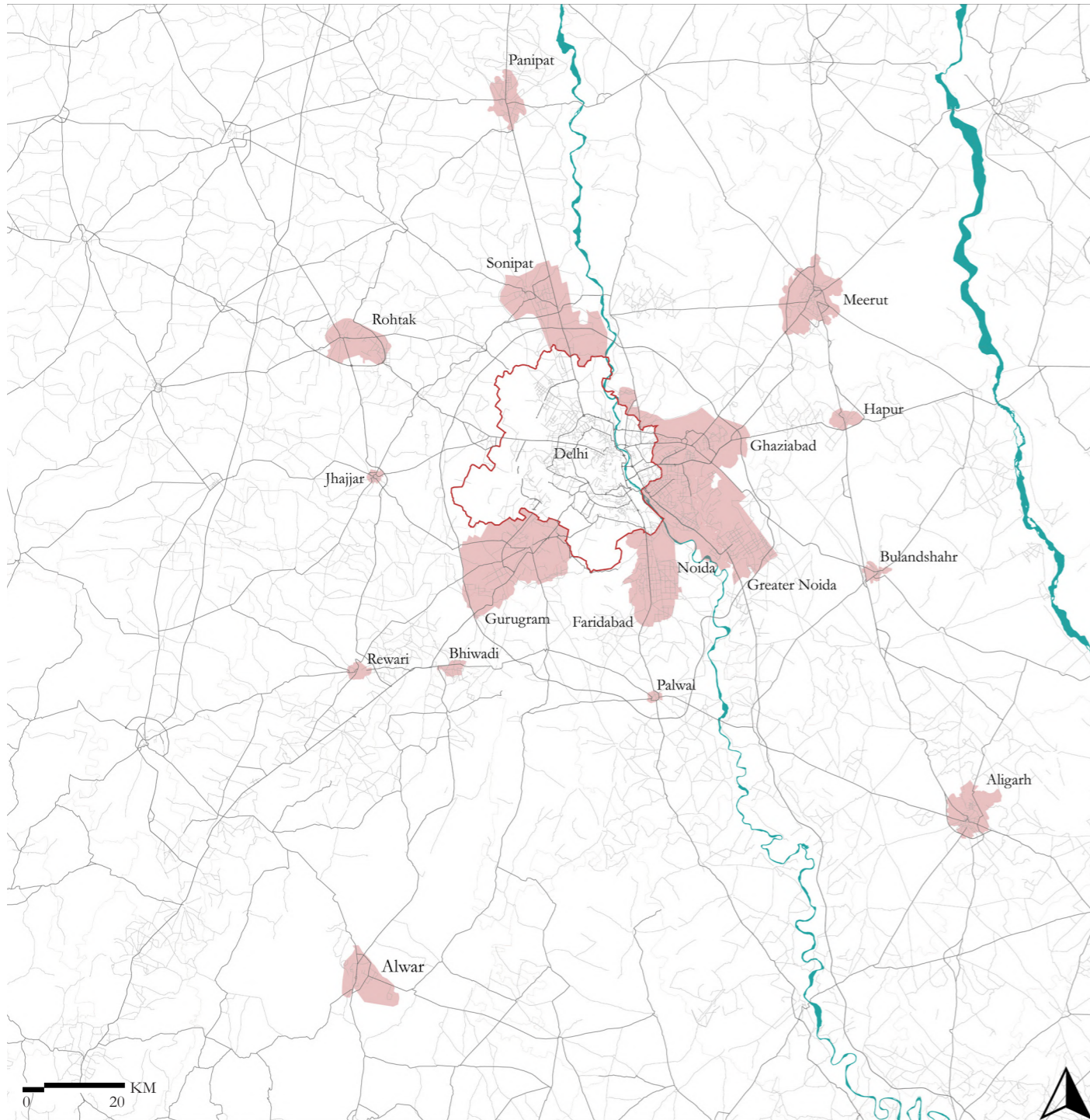
4.4 Synthesis

Main Character

Demographics

4.5 Policies- Major State Policies





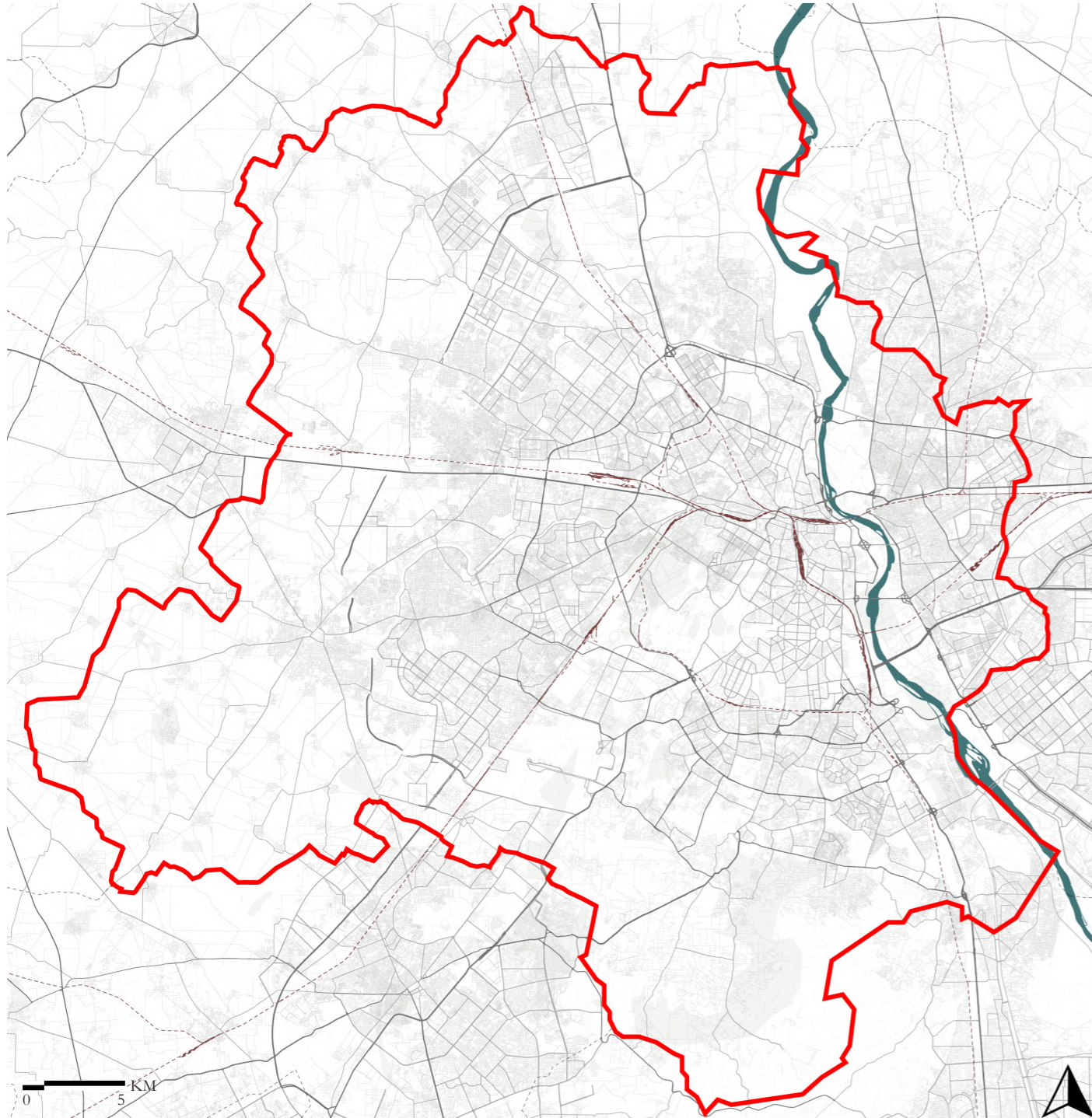
4.1 Delhi & 16 Nodes- The influencing cities

The Delhi National Capital Region (NCR) constitutes a vast network of interconnected cities, encompassing Delhi, Gurugram, Noida, Faridabad, Ghaziabad, and more. Each city contributes uniquely to the regional economy and society. For instance, Gurugram thrives as a corporate and IT hub, while Noida houses various industries and manufacturing units. Faridabad specializes in manufacturing and engineering, and Ghaziabad is pivotal in housing and real estate.

The interconnectivity among these cities is evident through an intricate web of transportation systems like highways, expressways, metro lines, and railways. Their mutual reliance is reflected in daily commutes, resource sharing, and cultural exchanges, contributing to the NCR's integrated and dynamic economic fabric.

Understanding the complexities of these cities within the NCR is crucial for grasping emerging urban-rural dynamics and identifying areas for potential development. Analyzing their infrastructure, economic activities, and spatial arrangements reveals untapped potential and areas needing attention. This understanding helps envisage interventions that enhance connectivity, sustainable growth, and urban-rural integration. It also allows foresight into growth zones, potential infrastructure upgrades, and areas requiring interventions for balanced development. This comprehensive understanding serves as a road-map for a more efficient, integrated, and sustainable urban landscape in the future.

Figure 16: (On the left) Map illustrates the spatial interconnection of Delhi and 16 adjacent cities.



4.2 Delhi's Anatomy

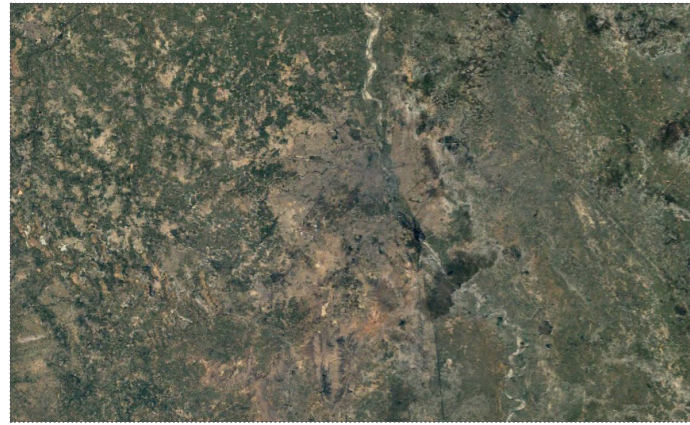
Main Occupation

Government Services
Information Technology
Retail and Trade
Education
Manufacturing

Landuse

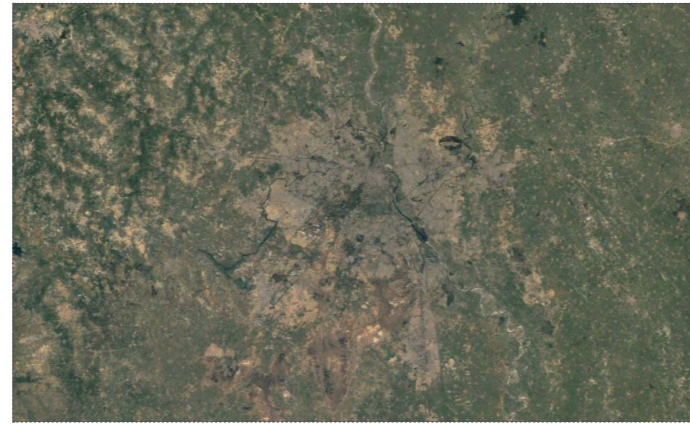
Total Area- 1483 sq.km
Residential- 50% of total area
Commercial- 13% of total area
Industrial- 5% of total area
Public & Semi-Public- 25% of total area

Figure 17: (On the left) Map depicts the road, rail, and key features of Delhi.



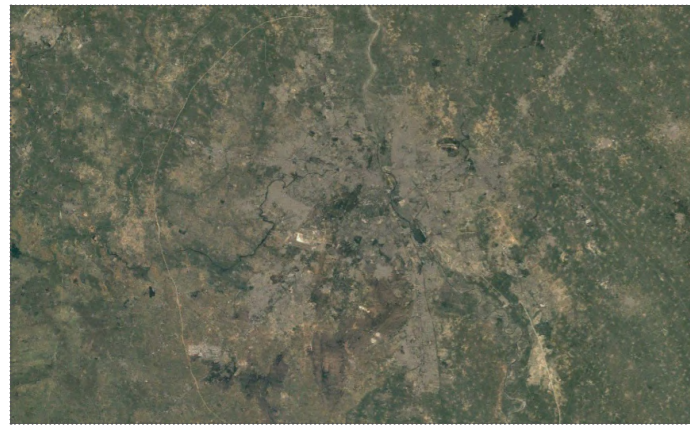
1990

Approx area: 267 sq.km



2000

Approx area: 429 sq.km



2010

Approx area: 761 sq.km



2020

Approx area: 1087 sq.km

Urban Expansion (1990 | 2000 | 2010 | 2020)

Over the span of four decades, Delhi has experienced a monumental urban expansion, transforming from a compact city to a sprawling metropolis. This growth surge, fueled by population influx and rapid urbanization, has triggered extensive construction, encroachment on green belts, and an amplified demand for resources and infrastructure. Such expansion has yielded significant environmental consequences, chiefly the depletion of green spaces, heightened pollution levels, and a strain on natural resources.

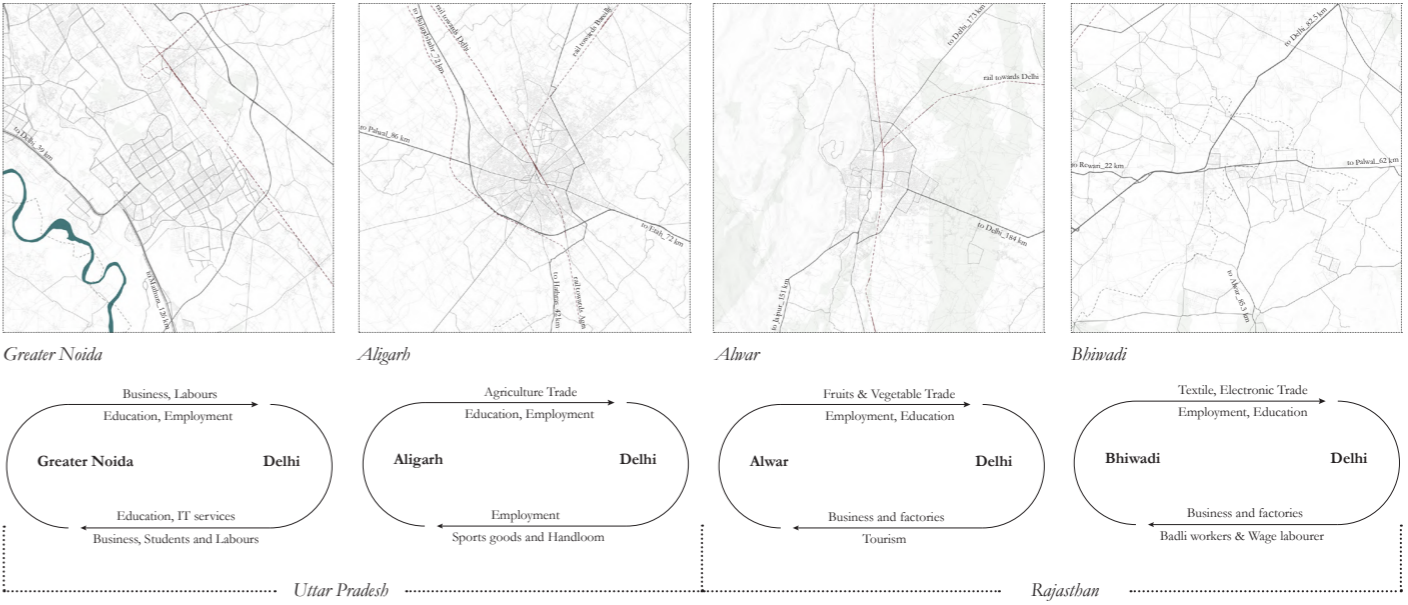
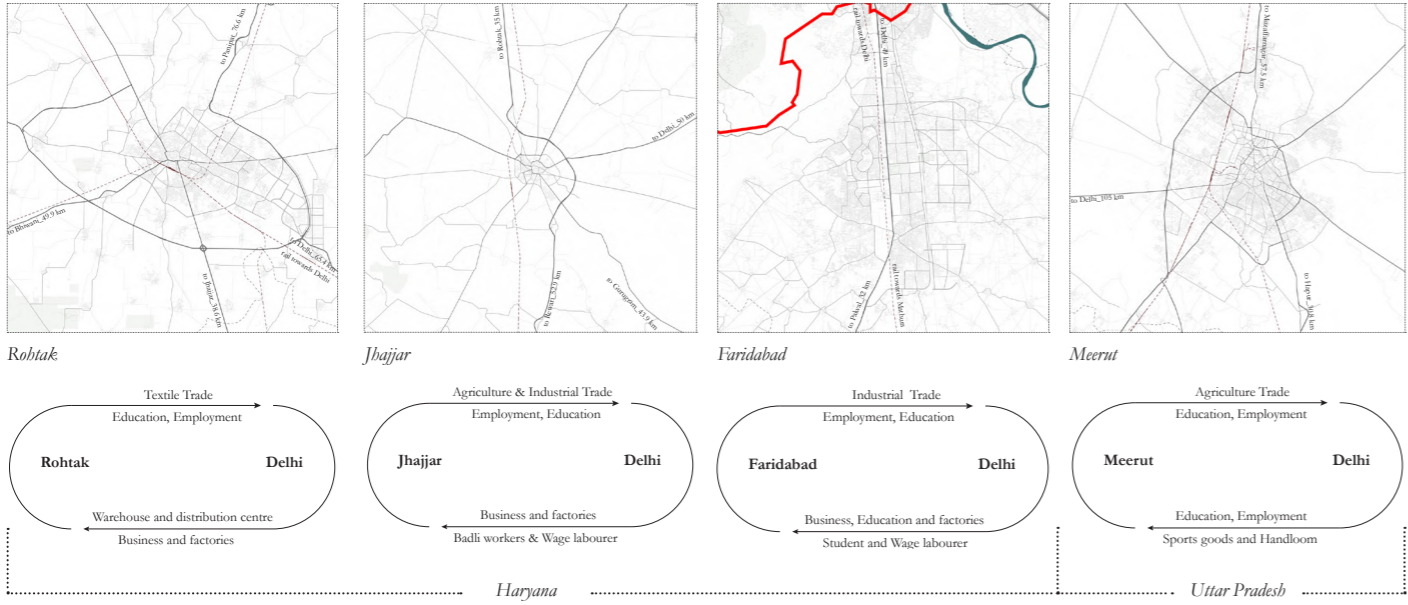
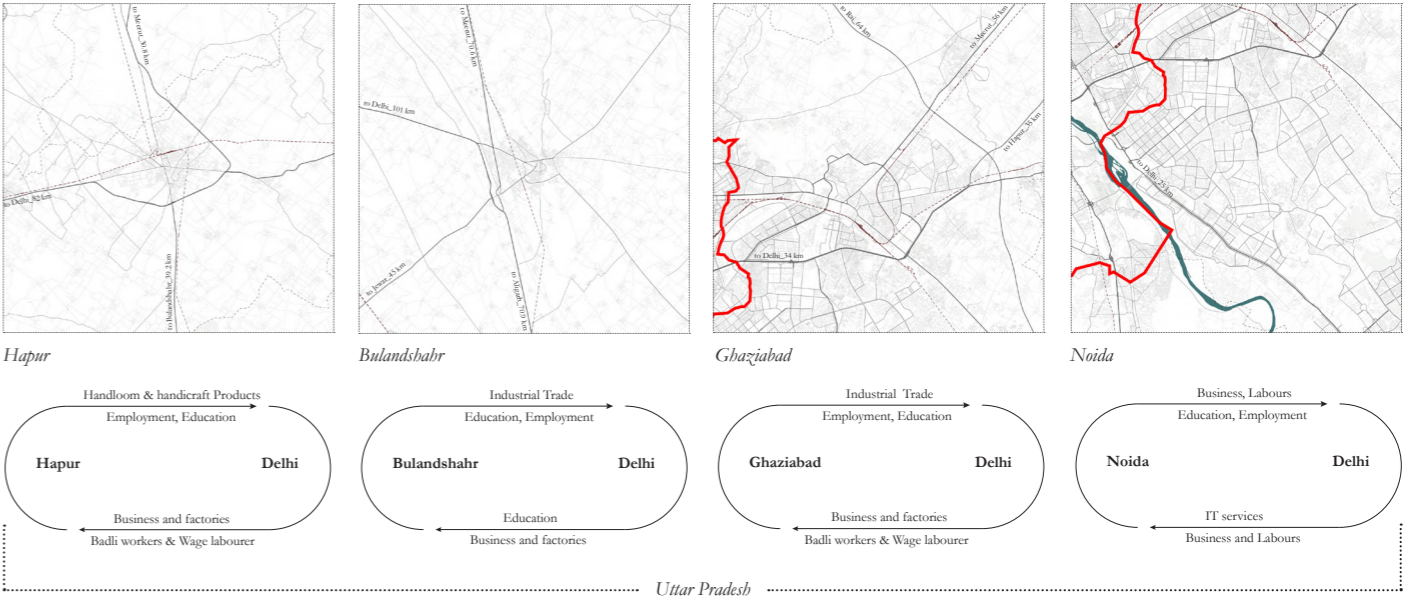
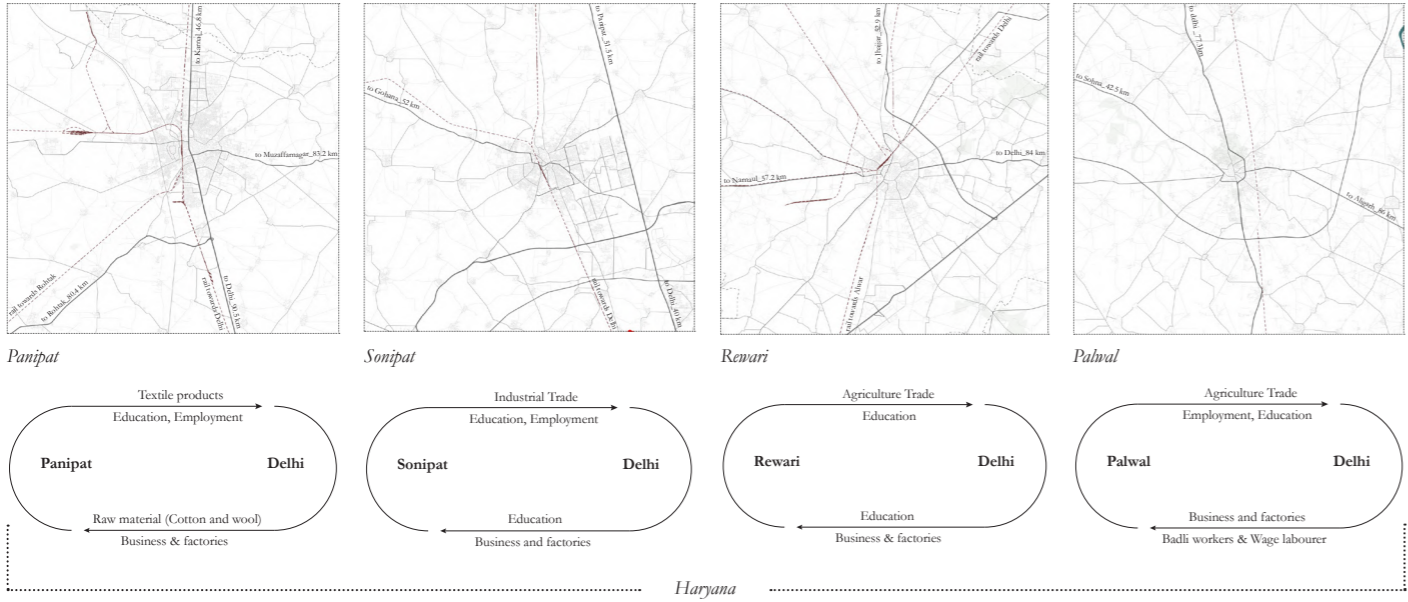
The encroachment on green zones, encompassing forests, wetlands, and agricultural terrains, has severely disrupted the ecological equilibrium of the region. The reduction in green cover has intensified air pollution, exacerbated by emissions from vehicles, industries, and construction, thus causing detrimental health effects for residents and escalating air quality concerns.

Furthermore, the urban sprawl in Delhi has widened the divide between urban and rural landscapes, disrupting the connectivity between the two. This expansion often entails the conversion of agricultural lands into residential or commercial areas, impacting local livelihoods and reducing agricultural output. As a result, traditional linkages between urban and rural zones have been compromised, affecting rural communities' access to resources and markets.

Figure 18: (On the left) Maps depict the sprawling urban growth that Delhi has undergone across a span of four decades.

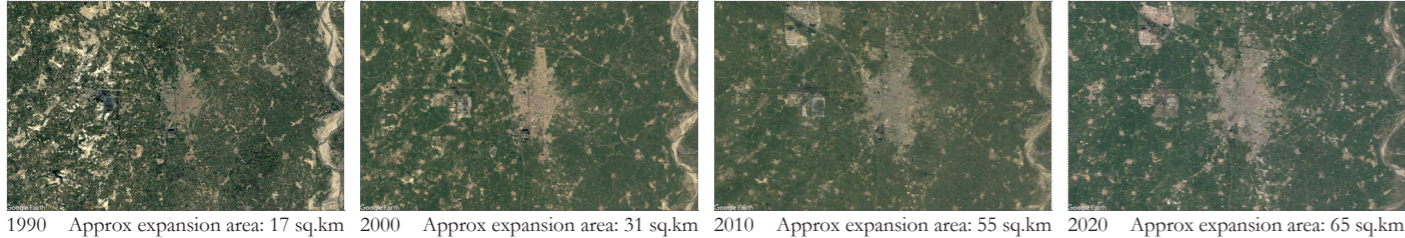
4.3 16 Nodes' Anatomy

Main Character



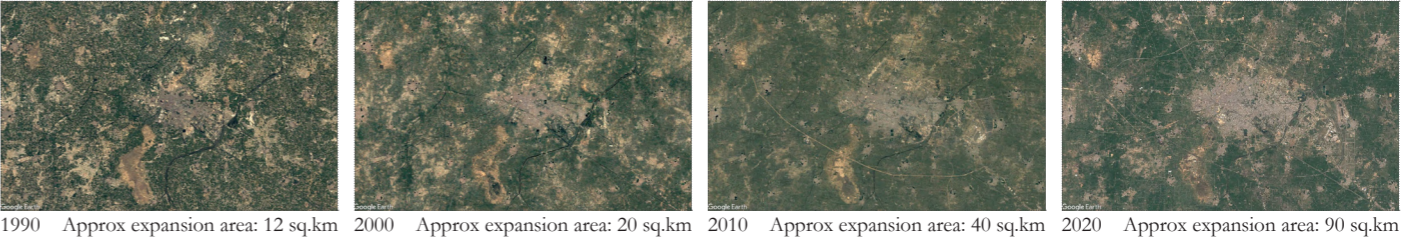
Urban Expansion- 1990 | 2000 | 2010 | 2020

Panipat



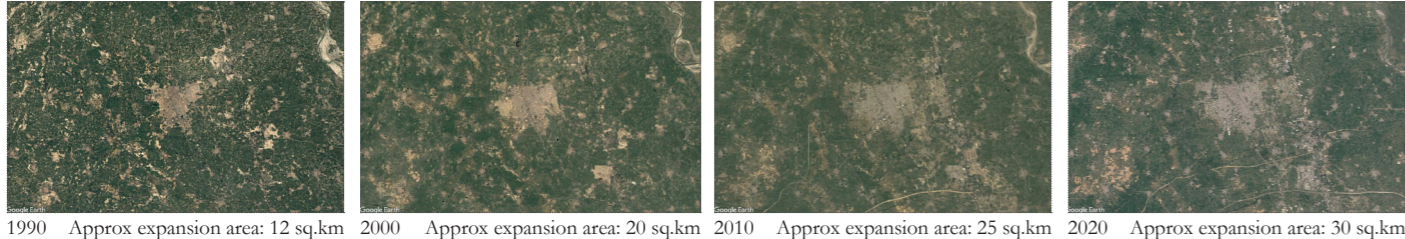
1990 Approx expansion area: 17 sq.km 2000 Approx expansion area: 31 sq.km 2010 Approx expansion area: 55 sq.km 2020 Approx expansion area: 65 sq.km

Rohtak



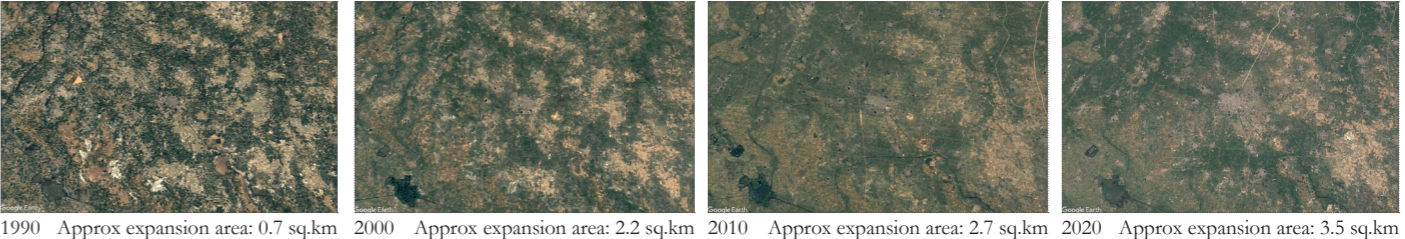
1990 Approx expansion area: 12 sq.km 2000 Approx expansion area: 20 sq.km 2010 Approx expansion area: 40 sq.km 2020 Approx expansion area: 90 sq.km

Sonipat



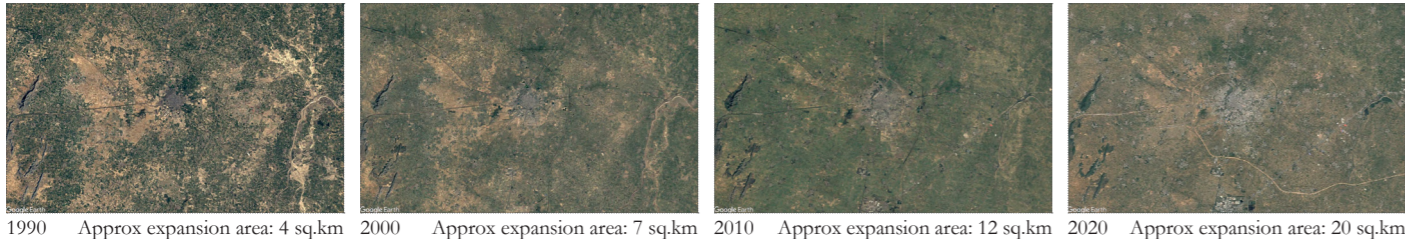
1990 Approx expansion area: 12 sq.km 2000 Approx expansion area: 20 sq.km 2010 Approx expansion area: 25 sq.km 2020 Approx expansion area: 30 sq.km

Jhajjar



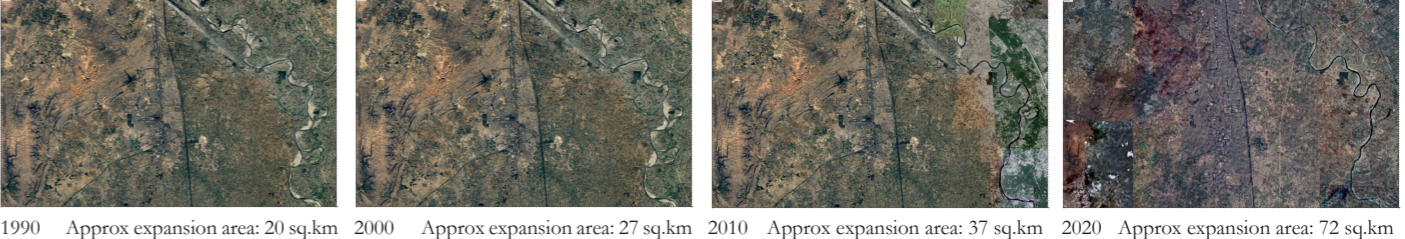
1990 Approx expansion area: 0.7 sq.km 2000 Approx expansion area: 2.2 sq.km 2010 Approx expansion area: 2.7 sq.km 2020 Approx expansion area: 3.5 sq.km

Rewari



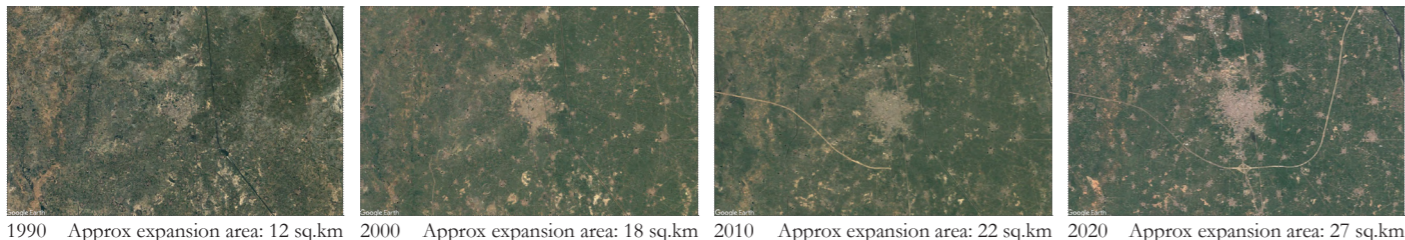
1990 Approx expansion area: 4 sq.km 2000 Approx expansion area: 7 sq.km 2010 Approx expansion area: 12 sq.km 2020 Approx expansion area: 20 sq.km

Faridabad



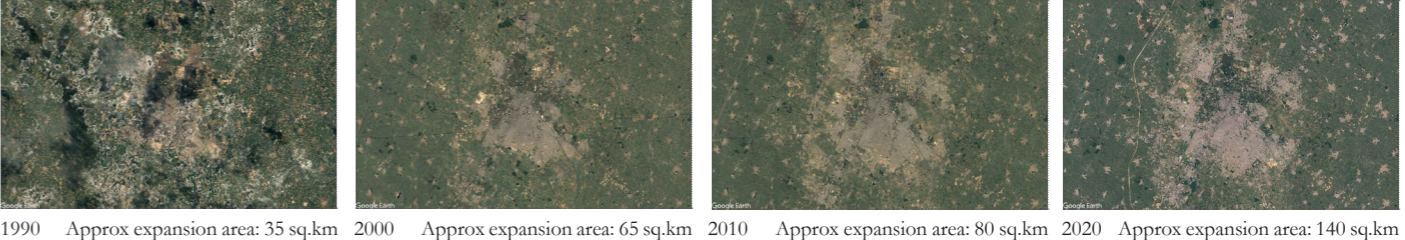
1990 Approx expansion area: 20 sq.km 2000 Approx expansion area: 27 sq.km 2010 Approx expansion area: 37 sq.km 2020 Approx expansion area: 72 sq.km

Palwal



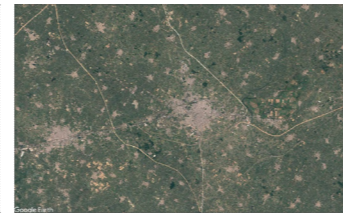
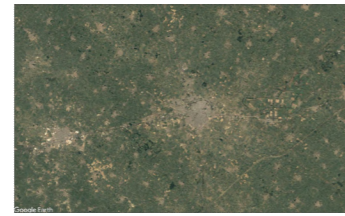
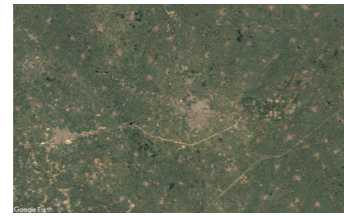
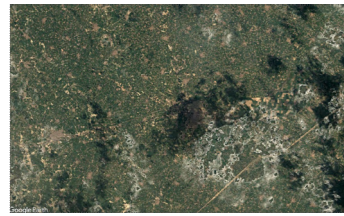
1990 Approx expansion area: 12 sq.km 2000 Approx expansion area: 18 sq.km 2010 Approx expansion area: 22 sq.km 2020 Approx expansion area: 27 sq.km

Meerut



1990 Approx expansion area: 35 sq.km 2000 Approx expansion area: 65 sq.km 2010 Approx expansion area: 80 sq.km 2020 Approx expansion area: 140 sq.km

Hapur



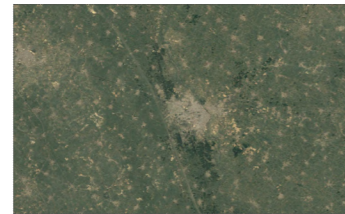
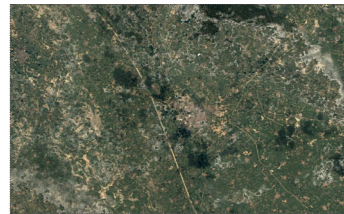
1990 Approx expansion area: 3 sq.km

2000 Approx expansion area: 6 sq.km

2010 Approx expansion area: 9 sq.km

2020 Approx expansion area: 16 sq.km

Bulandshahr



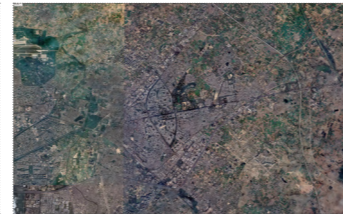
1990 Approx expansion area: 5 sq.km

2000 Approx expansion area: 8 sq.km

2010 Approx expansion area: 11 sq.km

2020 Approx expansion area: 16 sq.km

Ghaziabad



1990 Approx expansion area: 17 sq.km

2000 Approx expansion area: 23 sq.km

2010 Approx expansion area: 39 sq.km

2020 Approx expansion area: 48 sq.km

Noida



1990 Approx expansion area: 1.5 sq.km

2000 Approx expansion area: 3.7 sq.km

2010 Approx expansion area: 12 sq.km

2020 Approx expansion area: 40 sq.km

Greater Noida



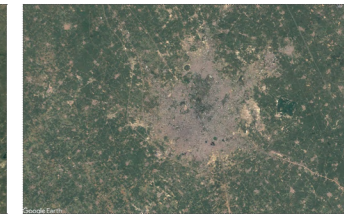
1990 Approx expansion area: 13 sq.km

2000 Approx expansion area: 24 sq.km

2010 Approx expansion area: 31 sq.km

2020 Approx expansion area: 60 sq.km

Aligarh



1990 Approx expansion area: 13 sq.km

2000 Approx expansion area: 16 sq.km

2010 Approx expansion area: 20 sq.km

2020 Approx expansion area: 60 sq.km

Alwar



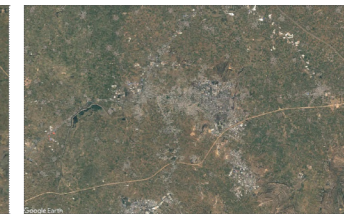
1990 Approx expansion area: 14 sq.km

2000 Approx expansion area: 24sq.km

2010 Approx expansion area: 58 sq.km

2020 Approx expansion area: 70 sq.km

Bhiwadi

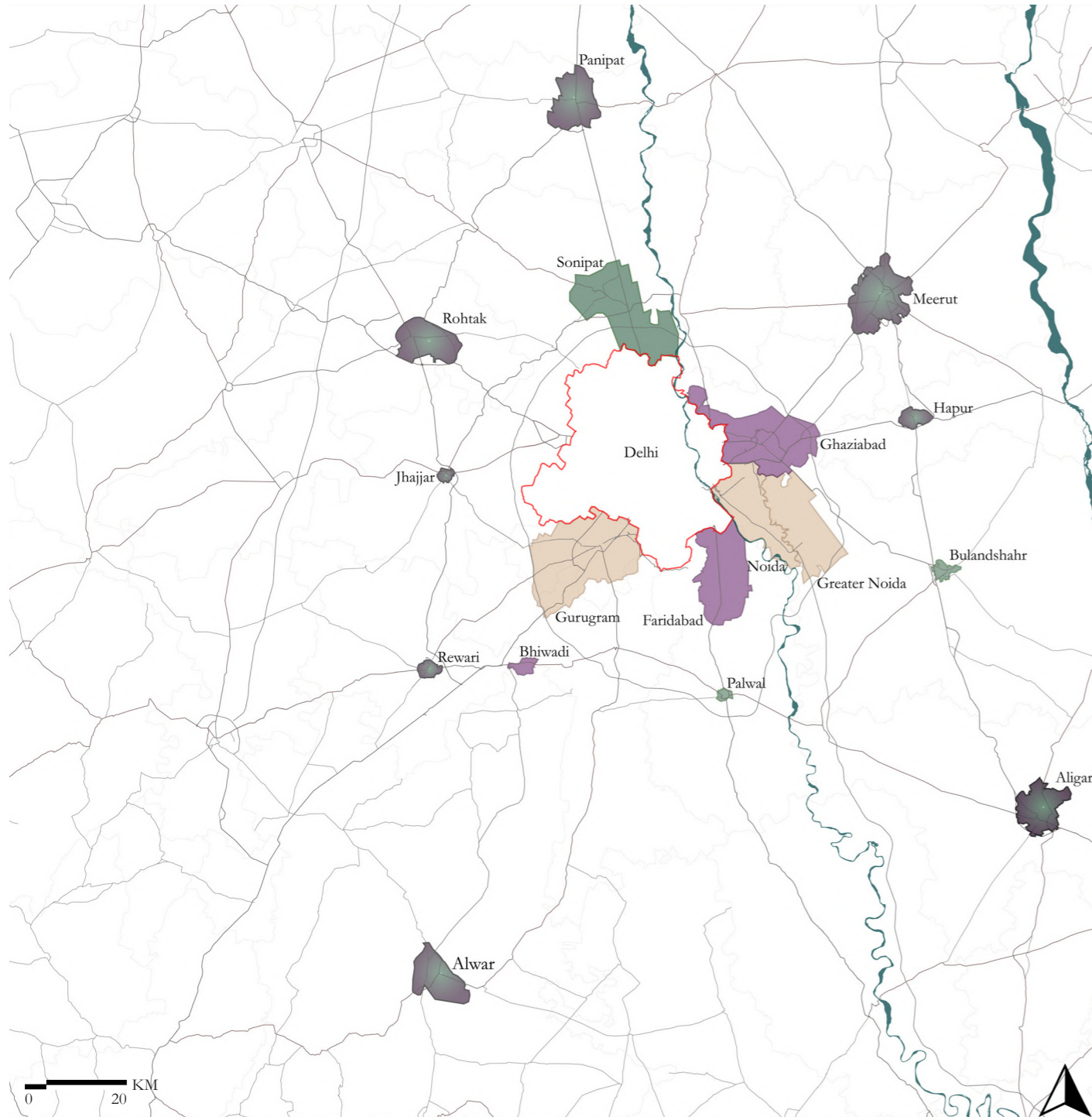


1990 Approx expansion area: 4 sq.km

2000 Approx expansion area: 10 sq.km

2010 Approx expansion area: 16 sq.km

2020 Approx expansion area: 30 sq.km



4.4 Synthesis

Main Character

S.no	CITIES	MAIN CHARACTER		
		Main Occupation	Physical Connection	Landuse
1	Panipat	Industry (Manufacturing & Textiles) Agriculture (Rice, wheat & sugarcane)	Road transport Rail Warehouse & Distribution Centres	Total Area- 1268 sq.km. Industry- 28% of Total area Agriculture- 18% of Total area
2	Sonipat	Agriculture (Rice, wheat & sugarcane)	Road- NH-44 & NH-352 Rail Warehouse & Distribution Centres	Total Area- 181 sq.km. Agriculture- 52% of Total area
3	Rewari	Industry (Manufacturing, electrical & Textiles) Agriculture	Road- NH-48 Rail	Total Area- 35.93 sq.km. Industry- 7% of Total area Agriculture- 19% of Total area
4	Palwal	Agriculture	Road- NH-48 & NH-19 (Delhi-Kolkata Highway), Eastern Peripheral Expressway (EPE) Rail	Total Area- 22.10 sq.km. Agriculture- 85% of Total area
5	Rohtak	Industry (Trade & Commerce) Agriculture	Road- NH-9 (Delhi-Mumbai) Rail Warehouse & Distribution Centres	Total Area- 139 sq.km. Industry- 16% of Total area Agriculture- 28% of Total area
6	Jhajjar	Industry Agriculture (Cotton, sugarcane & mustard)	Road- NH-9 & NH-48, KMP Expressway, Western Peripheral Expressway Rail	Total Area- 1834 sq.km. Industry- 17% of Total area Agriculture- 25% of Total area
7	Meerut	Industry (Manufacturing) Agriculture	Road- NH-34 & Delhi-Meerut expressway Rail	Total Area- 450 sq.km. Industry- 8% of Total area Agriculture- 7% of Total area
8	Hapur	Industry (textiles, chemicals, engineering products) Agriculture (Rice, wheat & sugarcane)	Road- NH-9 & EPE Rail	Total Area- 660 sq.km. Industry- 16% of Total area Agriculture- 30% of Total area
9	Bulandshahr	Agriculture (Rice, wheat & sugarcane)	Road- NH-9 & NH-34 Rail Warehouse & Distribution Centres	Total Area- 72 sq.km. Agriculture- 10% of Total area
11	Ghaziabad	Industry (metalworking, pharmaceuticals, engineering) IT services	Road- NH-9 & NH-24 Rail EPE	Total Area- 210 sq.km. Industry- 20% of Total area
12	Greater Noida	IT services Industry (engineering)	Noida Metro Rail Corporation (NMRC) Expressway, EPE Public transport	Total Area- 360 sq.km. Industry- 31% of Total area
13	Noida	IT services Industry (Automotive) Service sector(Education)	Delhi Metro Rail Expressway, EPE Public transport	Total Area- 203 sq.km. Industry- 25% of Total area Agriculture- 6% of Total area
14	Faridabad	Industry (metalworking, Automotive, engineering) Service sector(Education)	Delhi Metro Rail Expressway, EPE, Road- NH-19 & NH-44 Public transport	Total Area- 215 sq.km. Industry- 18% of Total area
10	Aligarh	Industry (Utensil) Agriculture Service sector(Education)	Rail Road- NH-34 State Highway	Total Area- 1240 sq.km. Industry- 58% of Total area Agriculture- 6% of Total area
15	Bhiwadi	Industry (textiles, chemicals, engineering products)	Road- NH-48, Delhi-Mumbai, Industrial Rail Warehouse & Distribution Centres	Total Area- 250 sq.km. Industry- 45.26% of Total area
16	Alwar	Industry (Manufacturing & Textiles) Agriculture (Crops, fruits & vegetables)	Road- NH-48 Rail Warehouse & Distribution Centres	Total Area- 8380 sq.km. Industry- 10% of Total area Agriculture- 25% of Total area

CITIES	MAIN OCCUPATION
Panipat	Agriculture, Industry
Sonipat	Agriculture
Rewari	Agriculture, Industry
Palwal	Agriculture
Rohtak	Agriculture, Industry
Jhajjar	Agriculture, Industry
Gurugram	Welfare
Meerut	Agriculture, Industry
Hapur	Agriculture, Industry
Bulandshahr	Agriculture
Ghaziabad	Industry
Greater Noida	Welfare
Noida	Welfare
Faridabad	Industry
Aligarh	Agriculture, Industry
Bhiwadi	Industry
Alwar	Agriculture, Industry

Figure 19: (On the left) Map illustrates key traits of Delhi and neighboring cities, focusing on their occupations, land use, and physical connections with the metropolitan center, Delhi.

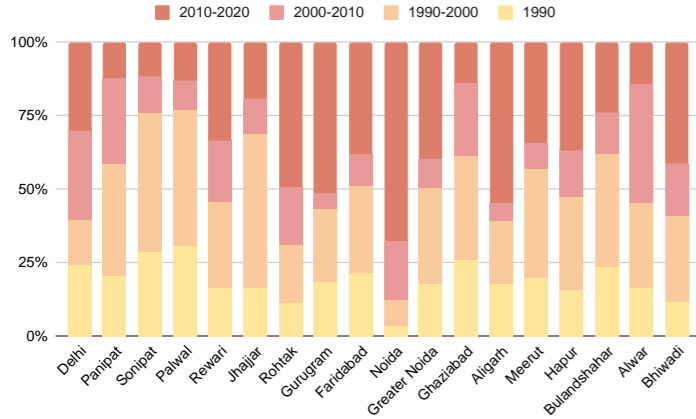
Demographics

By assessing demographic indicators such as population growth rates, occupational structures, and economic contributions, it becomes feasible to delineate the most promising city for intervention. A city with a robust economy, sustained population growth, diversified occupations, and consistent GDP progression emerges as a prime contender. This comprehensive analysis aids in selecting a city that demonstrates resilience, steady development, and favorable prospects for further growth and improvement in urban-rural linkage.

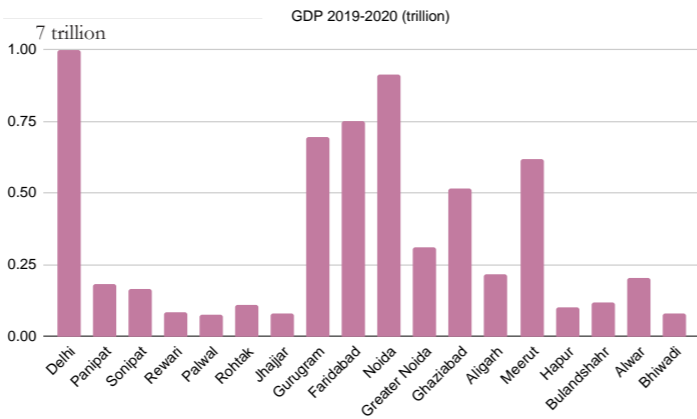
This study presents a comprehensive analysis of 16 diverse cities, aiming to delineate the intricate urban-rural connections across policy, economic, and social domains. Chart 1 illustrates the decade-wise growth percentages within these cities, revealing intriguing patterns where cities within the same state exhibit similar growth trajectories. Notably, Uttar Pradesh cities experienced substantial urban expansion, notably during the 2010-2020 period.

Chart 2 delves into the distribution of agricultural and industrial zones, while Chart 3 depicts population trends over the decades. Chart 4 provides insights into the corresponding Gross Domestic Product (GDP) variations. Notably, cities proximal to Delhi such as Noida, Greater Noida, and Ghaziabad emerge as focal points for accommodating escalating urban populations due to urban sprawl.

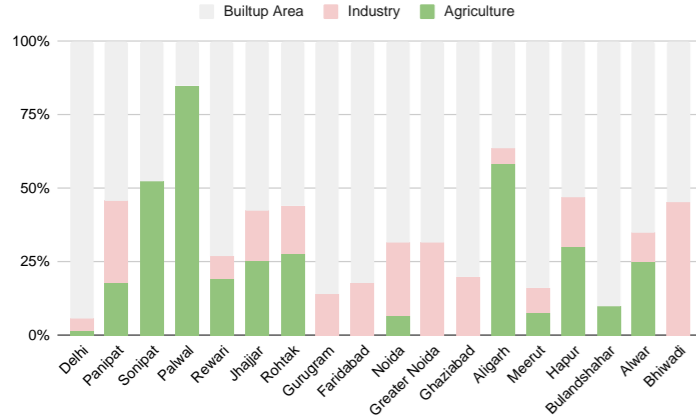
Moreover, this analysis underscores the untapped potential for growth in cities like Meerut and Sonipat, contingent upon fostering enhanced linkages. By leveraging these findings, policymakers can strategize urban planning initiatives, capitalizing on emerging opportunities for sustainable development and inclusive growth within these urban landscapes.



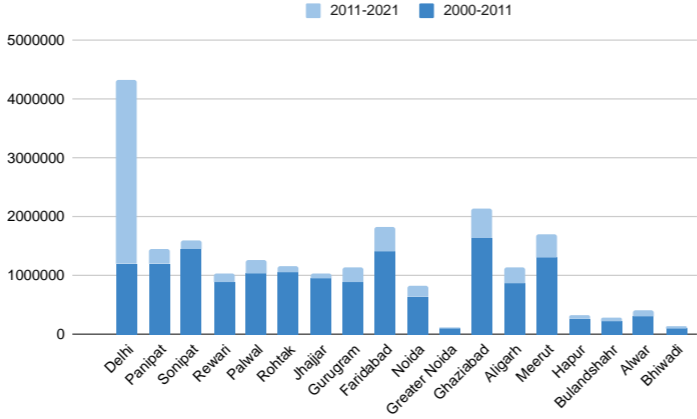
Urban Growth



Gross Domestic Product

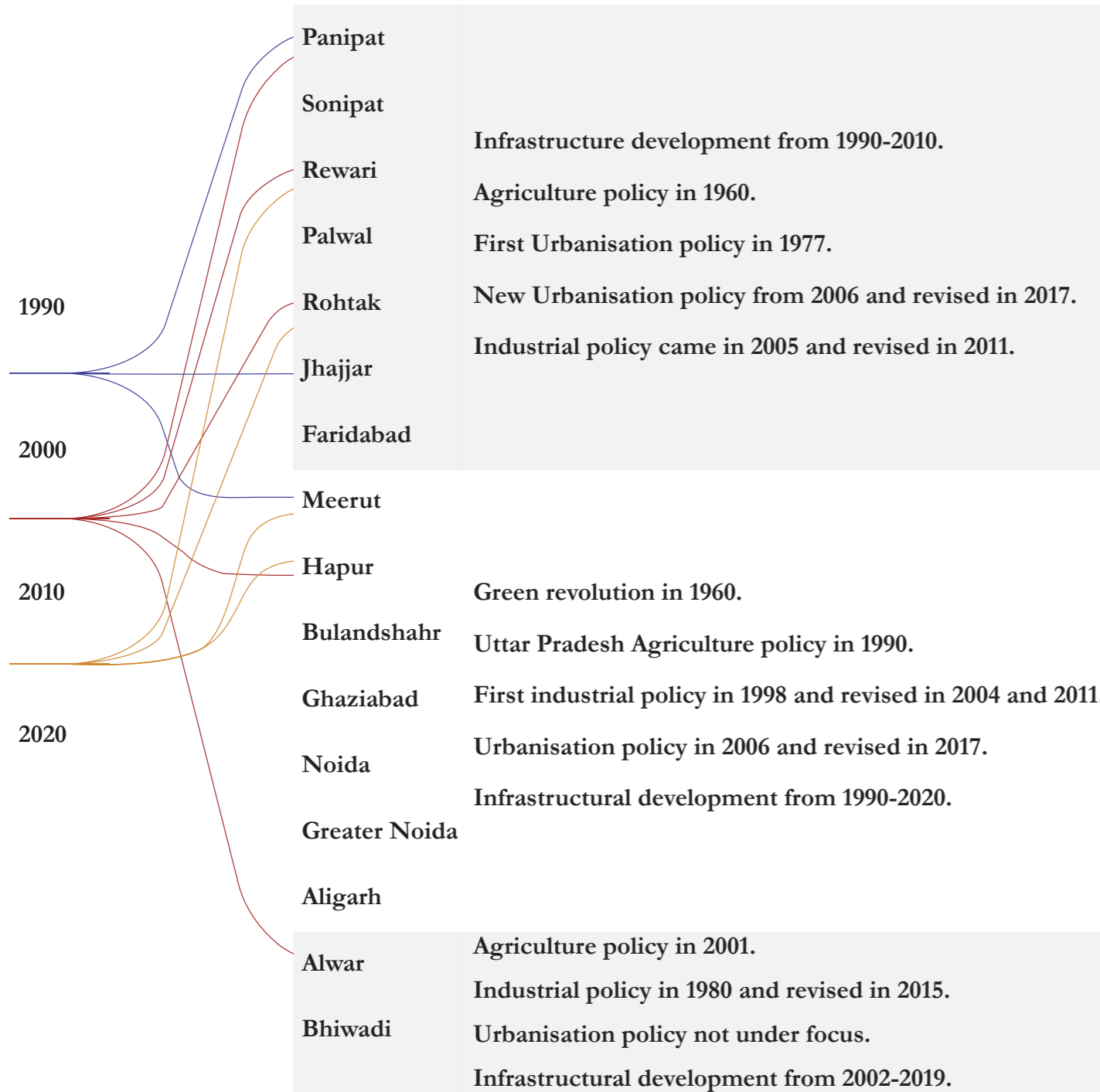


Landuse



Population

Figure 20: (On the left) Graphs display demographic data, aiding in understanding growth patterns and identifying potential cities.



4.5 Major State Policies

Policies related to urbanisation, infrastructure development, and industrial growth have played a significant role in the urbanisation of Delhi, Haryana, Rajasthan, and Uttar Pradesh. In Delhi, the Master Plan of Delhi (MPD) has been instrumental in the growth and development of the city since the 1960s.

The policy aimed to provide a framework for the planned development of the city, taking into account the growing population and increasing demand for housing, infrastructure, and services.

In Haryana, the Industrial and Investment Policy of Haryana 2011 played a significant role in the growth and development of the state. It led to the creation of several industrial hubs which helped in the urbanization of the state.

In Rajasthan, the Rajasthan Investment Promotion Scheme (RIPS) played a crucial role in attracting investment in the state. The policy aimed to provide financial incentives and support to industries, leading to the creation of several industrial hubs, including Jaipur, Bhiwadi, and Kota, which led to the urbanization of the state.

In Uttar Pradesh, the Uttar Pradesh Industrial Investment and Employment Promotion Policy 2017 played a significant role in promoting investment, job creation, and economic growth.

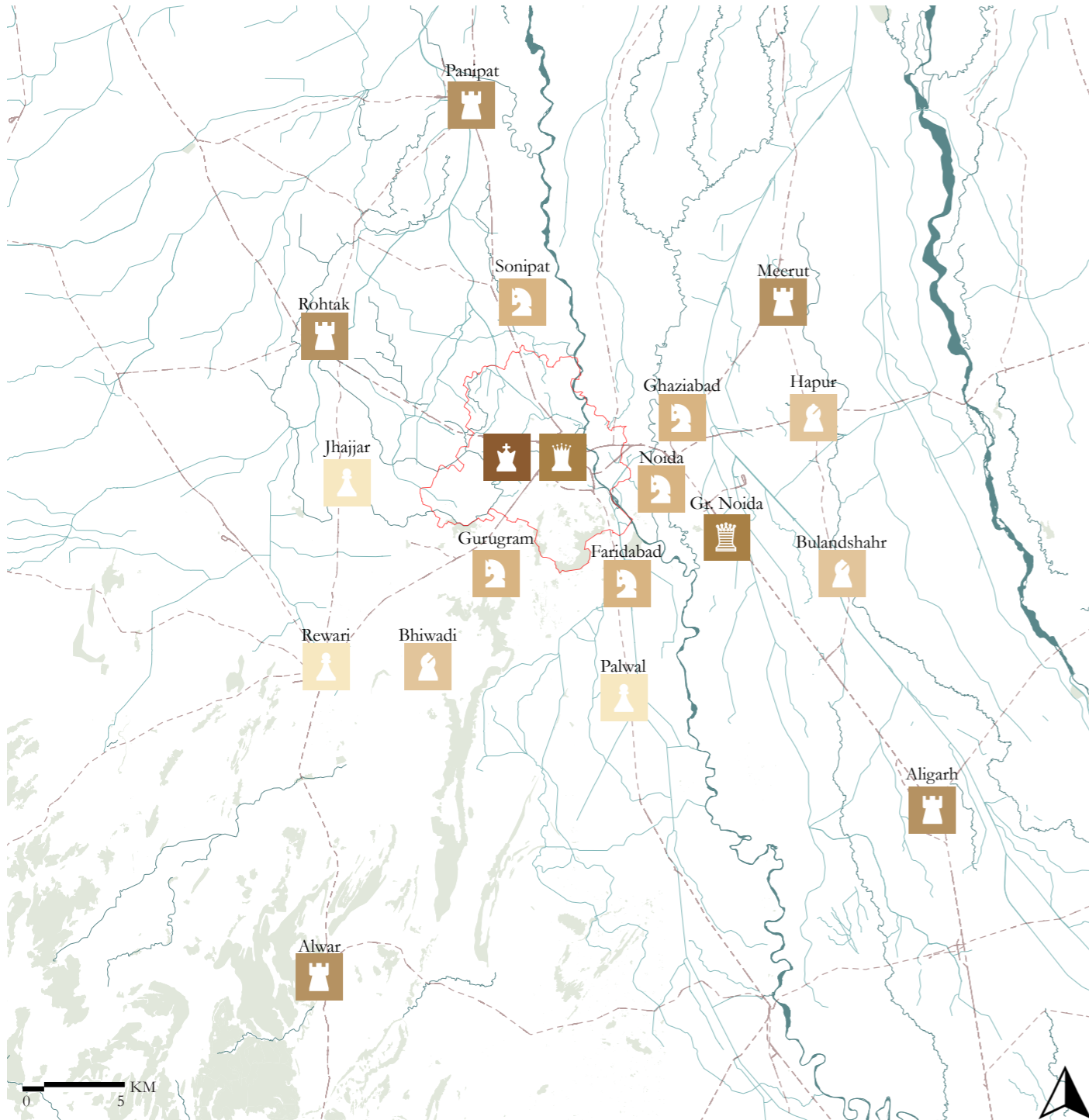
Policy decisions regarding land use, water management, industrial incentives, infrastructure development, and urban planning significantly shape the trajectory of agricultural, industrial, and urbanization growth within the Delhi NCR region. These policies can either facilitate or hinder the sustainable development and balanced growth of these sectors. Hence, this policy analysis will guide the identification of a city that potentially harbors supportive policies for intervention.

Figure 21: (On the left) An Overview of Policy Evolution in Delhi NCR Over Four Decades.



5. The Chess Analogy

- 5.1 Building the Chess Web
Significance and Criteria
- 5.2 Building the Metro-Matrix
Existing Metro-Matrix Interpretation
Proposed Metro-Matrix



5.1 Building the Chess Web

Significance and Criteria

Pedro B. Ortiz’s chess analogy cleverly relates urban planning to the strategic moves in a game of chess. In this analogy, each piece on the chessboard represents an essential aspect of urban development.

The chess analogy portrays Delhi and neighboring cities as distinct chess pieces, each representing various aspects and activities crucial to urban life. The analysis conducted in the preceding chapter, encompassing the city’s prominent characteristics, primary functions, interdependencies among cities, and their spatial traits, collectively forms the basis of this conceptual framework, akin to the intricate moves of chess pieces on a board.

This study aims to uncover regions of high potentiality for initial interventions. At this scale, the rook emerges as the focal point, showcasing significant promise and serving as a prime candidate for further investigation and potential intervention.

At this juncture, this paper introduces a new element called the “Prospective Queen,” representing an area poised to ascend to the status of a queen. This designation is based on the forthcoming development of an airport in that region, signifying its potential transformation and future significance.

- King* Central historic district
- Queen* Main productive infrastructure-port/airport
- Prospective Queen* Prospective port/airport
- Rook* Main secondary metropolitan centre
- Knight* Territorial sub-centre
- Bishop* Industrial & entrepreneurial production centre
- Pawn* Residential municipalities

- King
- Queen
- Prospective Queen
- Rook
- Knight
- Bishop
- Pawn

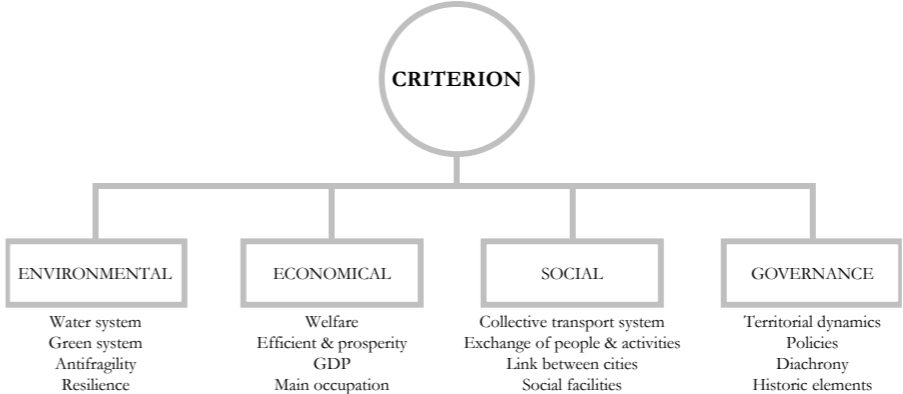
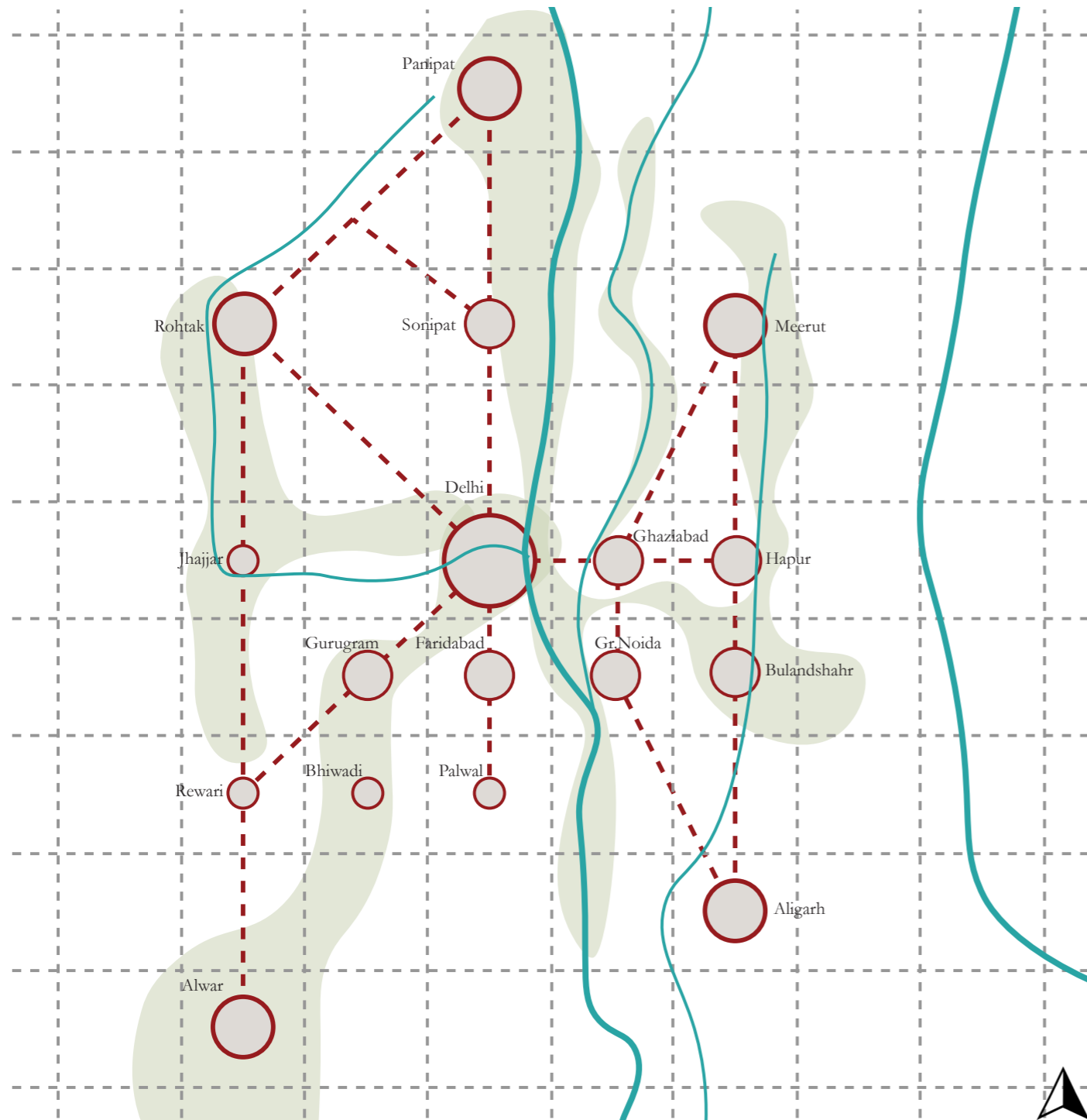


Figure 22: (On the left) The chess analogy symbolizes Delhi and nearby cities as key chess pieces, embodying vital urban aspects and activities.



5.2 Building the Metro-Matrix

Existing Metro-Matrix Interpretation

The chess theory and its application as a chess web, previously explored, can now be transformed into a matrix format to represent the current urban scenario. Within a 5km x 5km grid, each chess piece—symbolizing different urban aspects—holds significance based on its role. The king and queen, embodying greater influence, are denoted by larger circles within the grid. Additionally, other chess pieces are marked based on their potential for intervention and their relevance to urban development initiatives.

The connections established between these pieces within the matrix represent the intricate network of railways and roads, illustrating the connectivity and interdependencies among different cities in the region. Through this matrix representation, the emphasis lies on the spatial arrangement and the significance of various urban elements in shaping the urban fabric and planning interventions. The larger circles dedicated to the king and queen pieces denote their substantial influence on the urban landscape, while the connections illustrate the extensive transportation network facilitating connectivity between these cities.

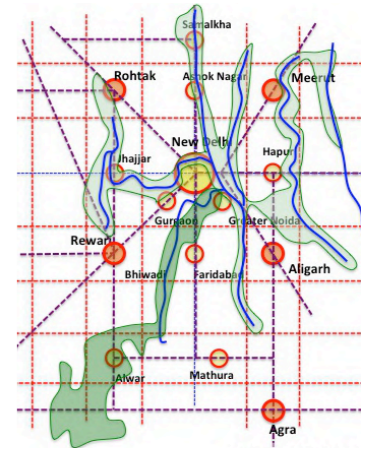
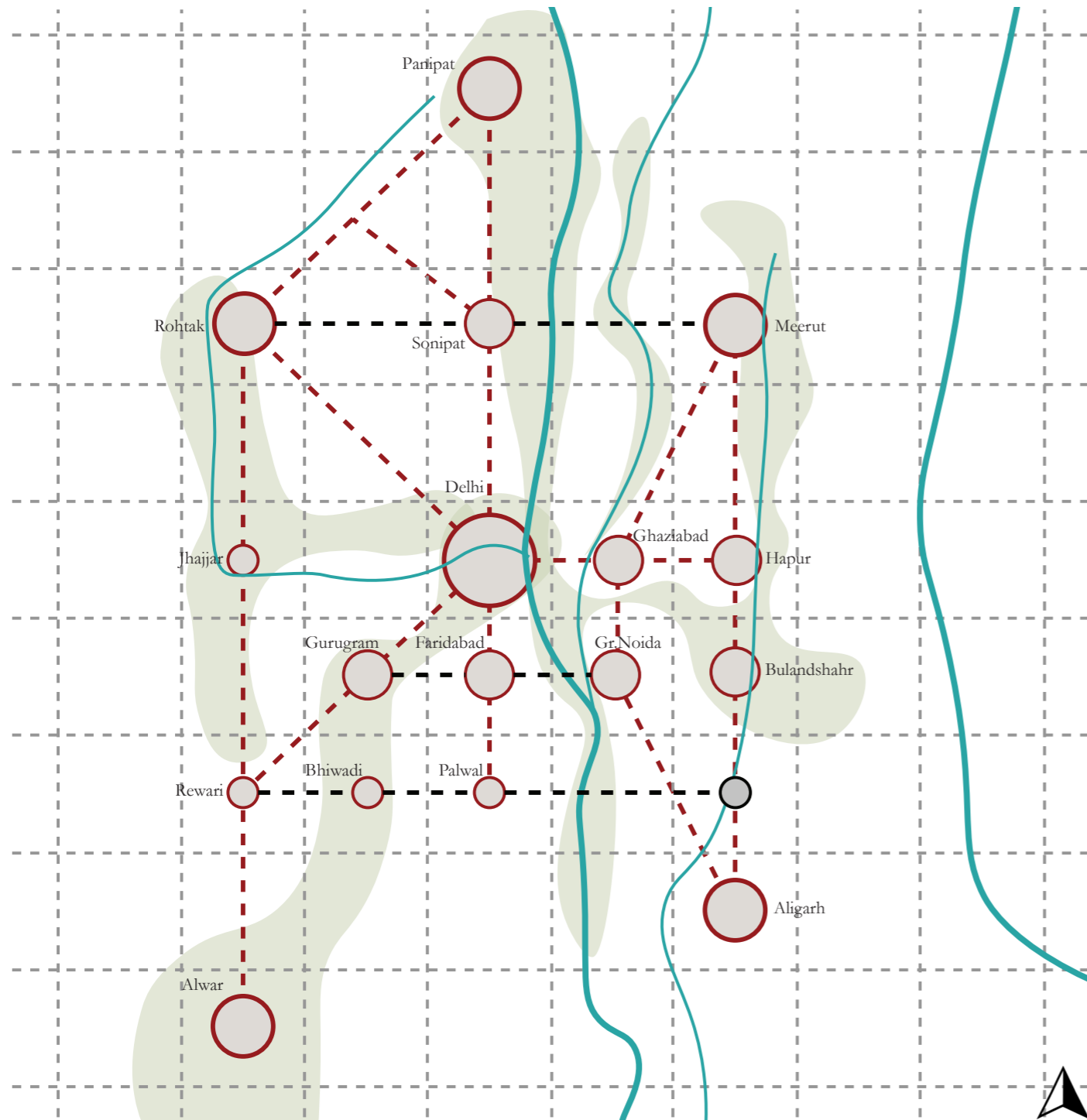


Figure 23: (On the left) Metro-Matrix New Delhi drawn by Mr. Pedro B. Ortiz in June, 2013 (Source: New Delhi D4D Metro Matrix Tic Tac Toe, Pedrobortiz.com)

Figure 24: (On the left) Revitalised existing Metro-Matrix using chess analogy.



Proposed Metro-Matrix

After delving into the chess theory and constructing a matrix reflecting the current scenario, the subsequent phase focuses on proposing potential enhancements within the matrix. An advisable and logical step involves connecting Rewari-Bhiwadi-Palwal and Gurugram-Faridabad-Greater Noida due to the future establishment of the Jewar airport in Uttar Pradesh. This airport is slated to serve the National Capital Region (NCR), making this linkage strategically significant for enhancing connectivity and facilitating regional mobility.

Another viable proposition entails linking Rohtak-Sonipat-Meerut, which promises to significantly enhance travel quality and fortify the existing connections. This potential addition stands as an essential measure to further improve the overall transport network, fostering seamless movement between these areas and contributing to the region's integrated development.

Figure 25: (On the left) Proposed metro-matrix created by fusion of chess web & existing Metro-Matrix.



6. Meerut as the Testing Ground

6.1 Premises

Delhi-Meerut Corridor
RRTS (TOD network)- Delhi to Meerut

6.2 Meerut Masterplan

Existing Meerut Masterplan
Proposed Meerut Masterplan 2031 (Draft)

6.3 Background

History
Places of Significance

6.4 S-Scale Spatial Characteristics

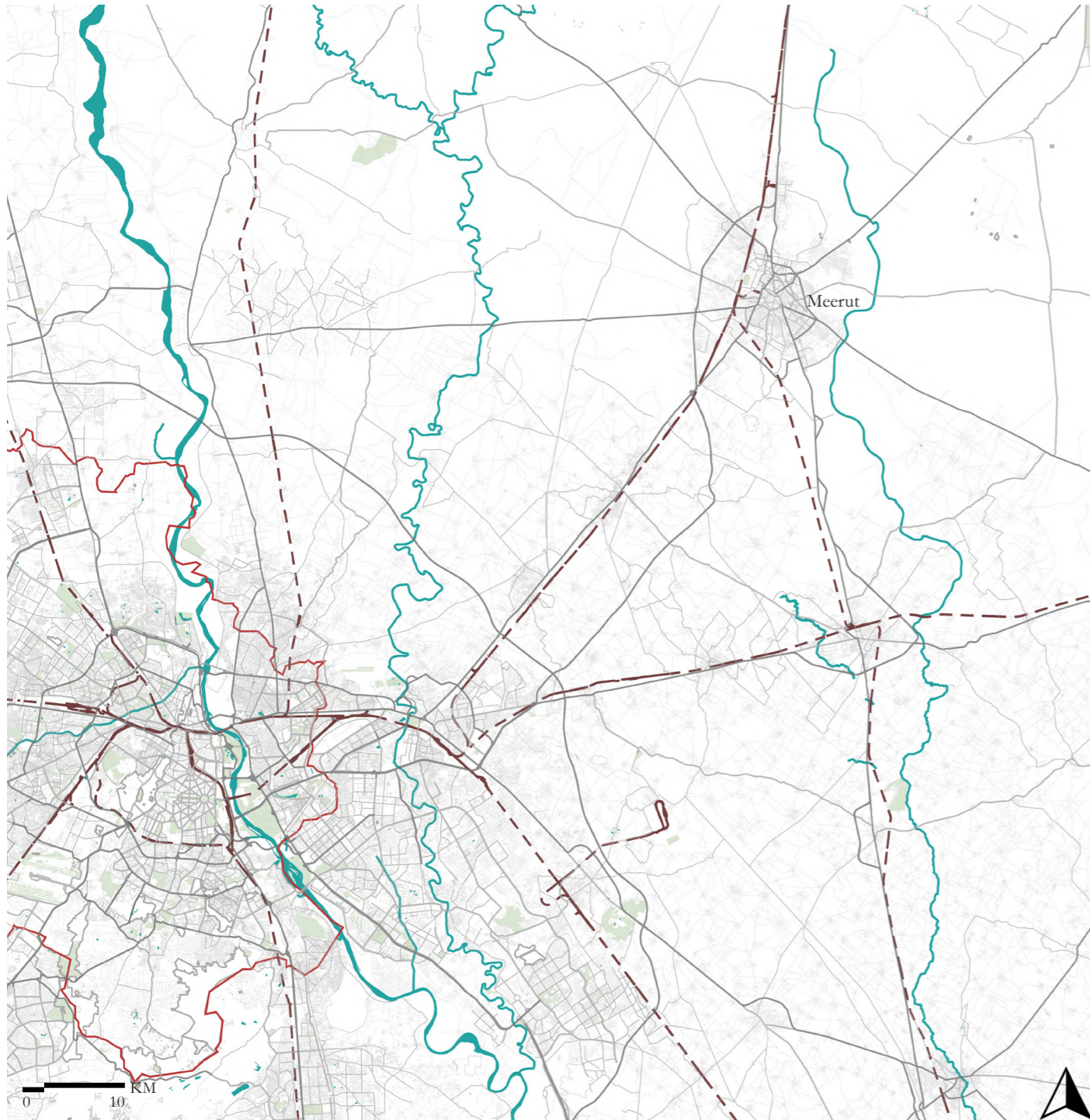
Meerut
Green-Blue infrastructure- Meerut
RRTS (TOD network)- Meerut

6.5 Urban Pattern

Orbital Urban Pattern
Morphological Study

6.6 City Chess Analogy

Building Chess Analogy
Building the Existing Metro-Matrix
Proposed Metro-Matrix
Potential Areas



6.1 Premises

Delhi-Meerut Corridor

Delhi and Meerut, both historically significant cities in India, have a connected history dating back centuries. Meerut, one of the oldest cities in India, has witnessed various rulers from different dynasties, including the Mauryas, Mughals, and Marathas. Delhi, as a capital city, has been at the epicenter of numerous historical events and has seen the rise and fall of several empires.

The relationship between Delhi and Meerut has been shaped by trade, culture, and strategic importance. Meerut, located about 60 kilometers from Delhi, served as a crucial trade center and military outpost due to its geographical position. Throughout history, the two cities were interconnected through trade routes and played roles in various historical events.

In modern times, the proximity between Delhi and Meerut has led to closer economic ties, infrastructural development, and a growing commuter population between the two cities. Their historical significance continues to shape their relationship and mutual growth.

The proposed matrix in the preceding chapter reveals substantial potential along the Delhi-Meerut diagonal. Leveraging this potential could significantly bolster the urban, peri-urban, rural linkages, fostering community development and environmental enhancement. By intervening strategically in this corridor, the connectivity between urban and rural realms can be improved, offering opportunities for balanced growth, sustainable practices, and community well-being. This intervention aligns with the broader objective of harmonizing urban and rural spaces, contributing positively to both societal needs and environmental conservation.

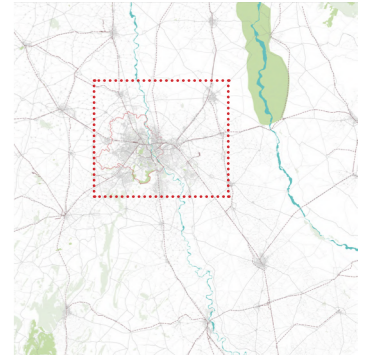
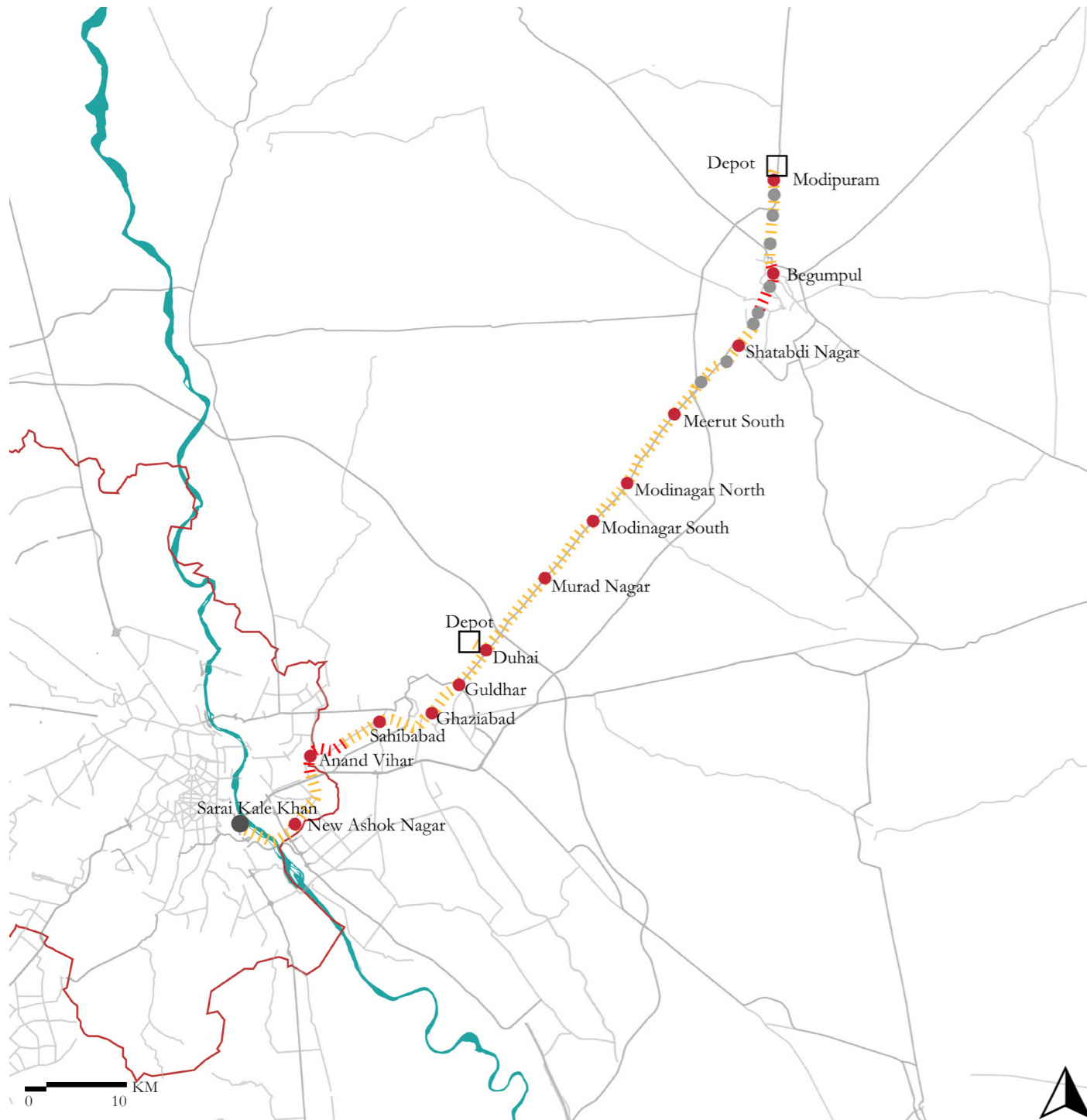


Figure 26: (On the left) The specific section focused on in relation to the matrix refers to the corridor spanning between Delhi and Meerut.



RRTS (TOD Network)- Delhi to Meerut

The Delhi-Meerut Regional Rapid Transit System (RRTS) construction aims to revolutionize connectivity between Delhi and Meerut, offering a high-speed rail network. This initiative promises reduced travel time between the two cities to approximately one hour, significantly cutting down the existing commute duration. The project facilitates efficient transportation, easing congestion on roads and highways.

Moreover, the RRTS line is anticipated to enhance economic activities, foster regional development, and stimulate employment opportunities along its route. It's poised to strengthen the urban-rural linkage, encouraging more seamless and swift movement of people and resources between Delhi and Meerut.







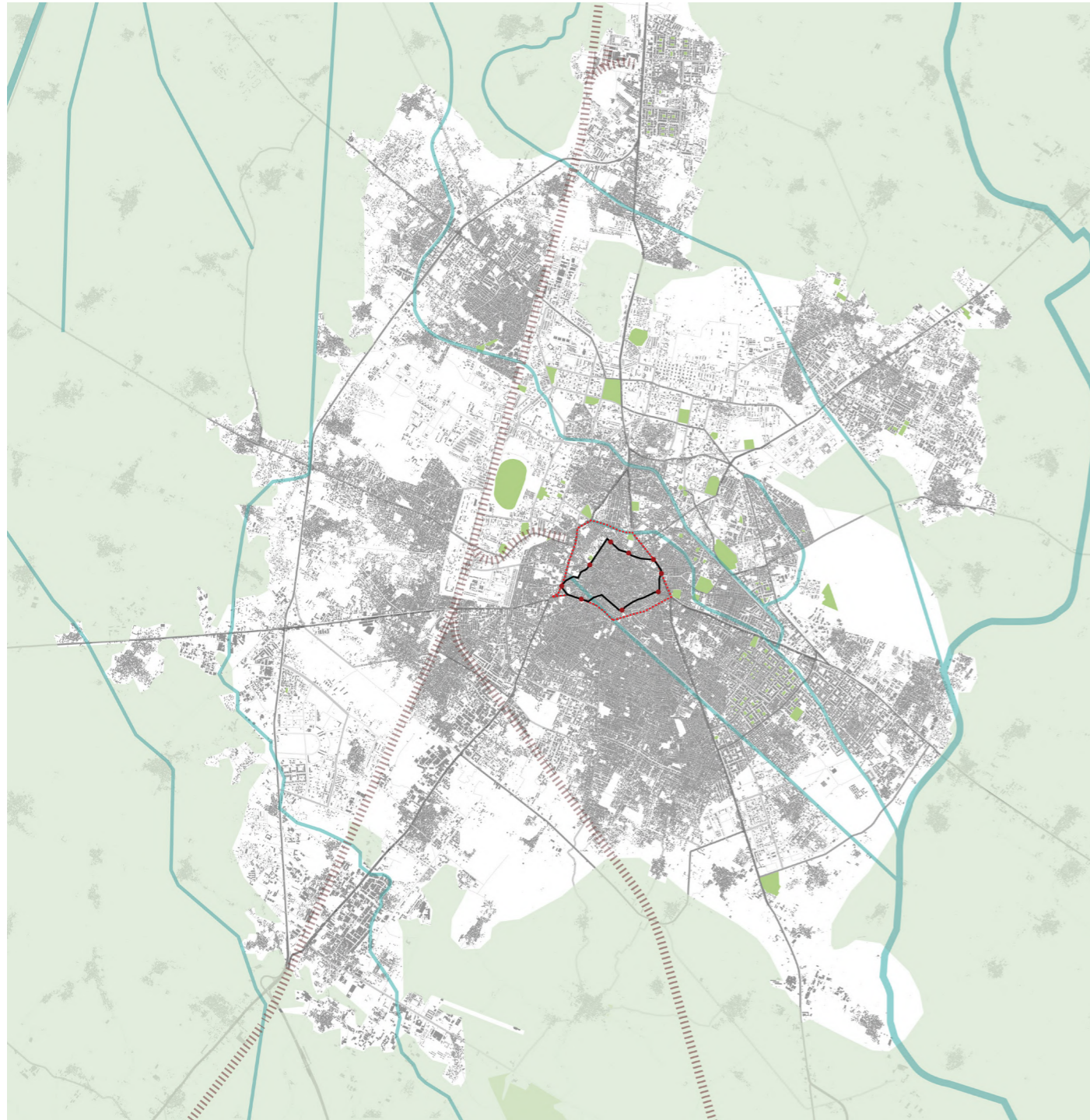
-  Elevated RRTS line
-  Underground RRTS line
-  RRTS Station
-  Metro Station
-  RRTS Depot
-  Sarai Kale Khan Station

Figure 27: (On the left) Map shows the RRTS network for Delhi-Meerut. (Source: Redrawn from NCRTC.In)



6.2 Meerut Masterplan

Existing Meerut Masterplan

The current masterplan of Meerut delineates a distinct orbital road pattern, encircling the city, yet revealing several unconnected nodes within its framework. Notably, the city's outskirts are enveloped by extensive agricultural areas, drawing considerable attention due to their noticeable presence. Settlements within Meerut show diverse densities; the central regions are densely packed, contrasting with the more grid-like formations observed towards the city's periphery. However, the encroachment of settlements has notably diminished the expanse of green spaces, relegating parks and recreational areas to a minority in terms of area distribution.

Among the notable features defining Meerut's landscape are the multiple rivers and canals, including the Kali Nadi, Hindon, and various smaller streams, stemming from the Ganges. These water bodies traverse the city diagonally, offering opportunities for multi-use. Their presence holds promise for diverse modes of water usage and management within the urban-rural environment, presenting prospects for environmental enhancement and infrastructural development in Meerut.

Figure 28: (On the left) Existing Meerut Masterplan

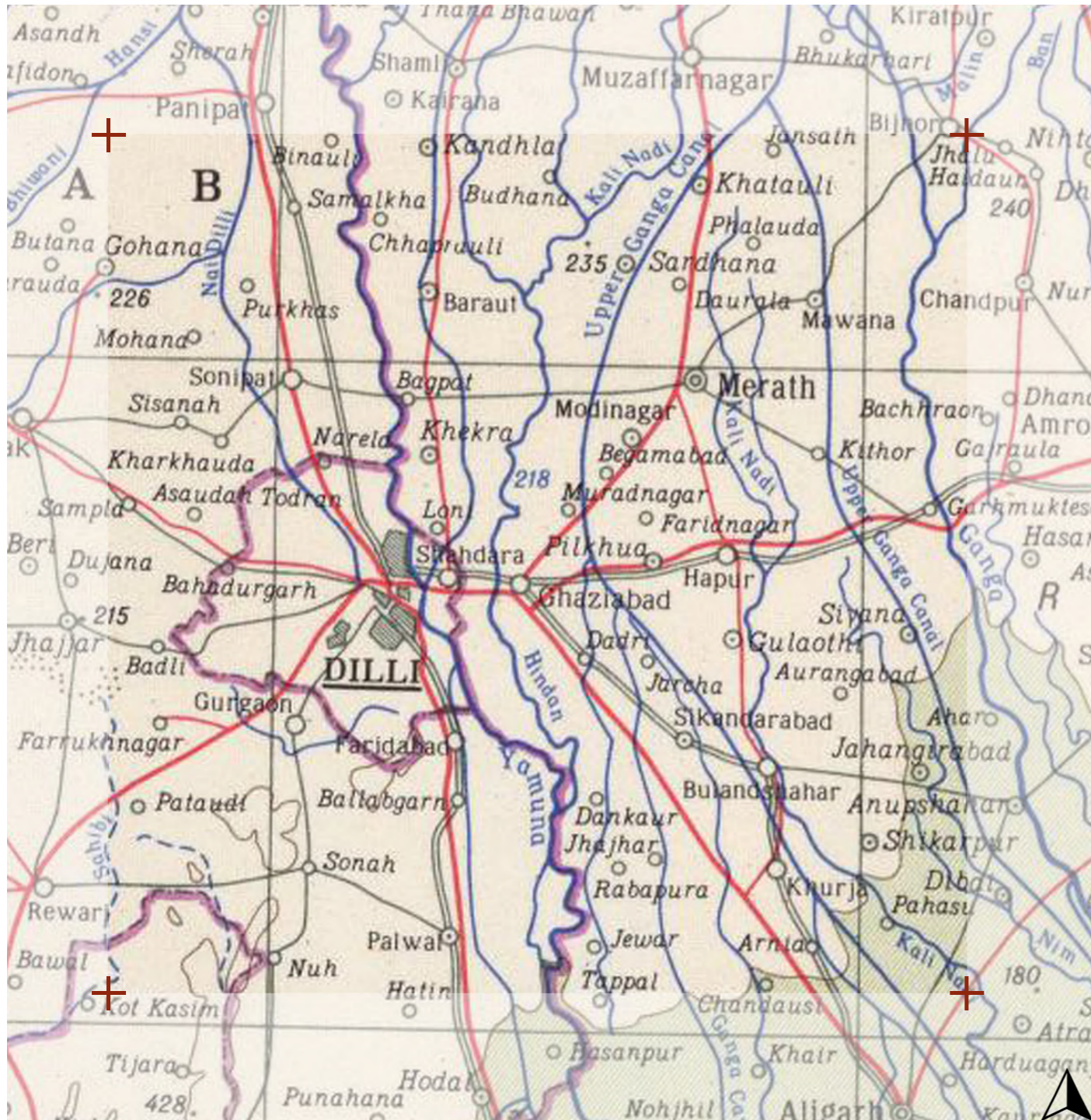


Proposed Meerut Masterplan 2031 (Draft)

The Meerut Masterplan 2031, as outlined by the Meerut Development Authority, offers insights into the urban-rural layout within the city. The plan strategically situates industrial and agricultural sectors along the city's outskirts, utilizing primary roads for seamless access to neighboring areas for transportation purposes. Meanwhile, residential zones are interspersed with public amenities and educational facilities, fostering a mixed-use environment. Notably, an unclassified area demarcates the military zone, impacting the spatial continuity around the Daurli region by creating a distinct boundary that separates the left and right flanks of this area. This masterplan's delineation presents a strategic balance between urban and rural elements, contributing to Meerut's overall spatial organization and functional efficiency. This also marks an attempt to improve the existing masterplan studied before.



Figure 29: (On the left) Meerut Masterplan 2031(draft). (Source: mdameerut.in)

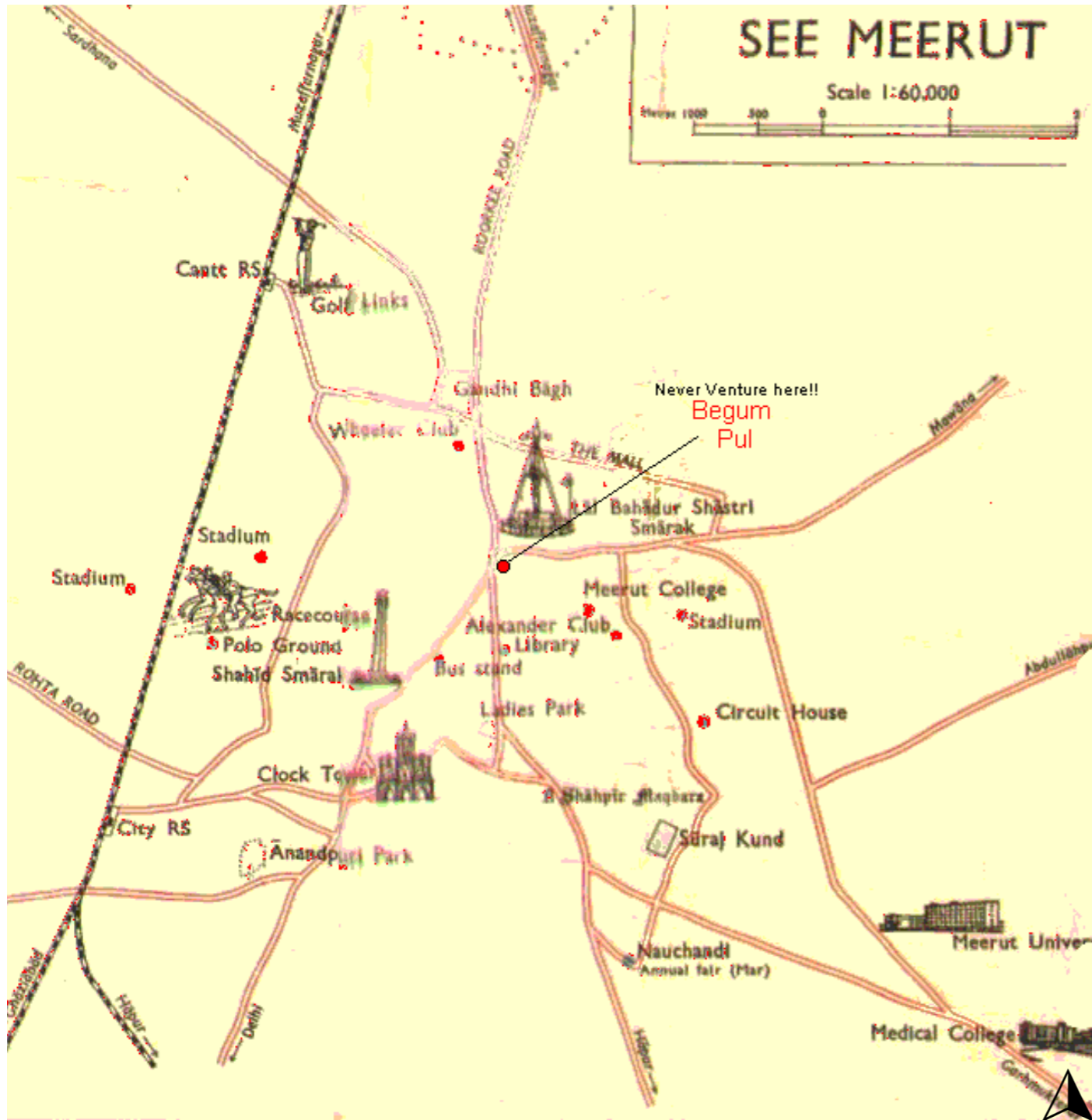


6.3 Background

History

Meerut, Uttar Pradesh, carries a storied past dating to the Indus Valley Civilization and witnessing rule under various dynasties. It rose as a key trade and military center in medieval times, pivotal in India's struggle for independence during the 1857 Rebellion. The mutiny, originating in Meerut, sparked a widespread revolt against British rule, altering India's historical course. Today, it stands as a bustling city known for its industries and educational institutions, embodying a heritage deeply entwined with pivotal moments in India's history.

Figure 30: (On the left) Historical map shows Delhi & Meerut in 1967. (Source: Upper Ganga (Ganges) valley. Delhi. The World Atlas, Oldmapsonline.org)

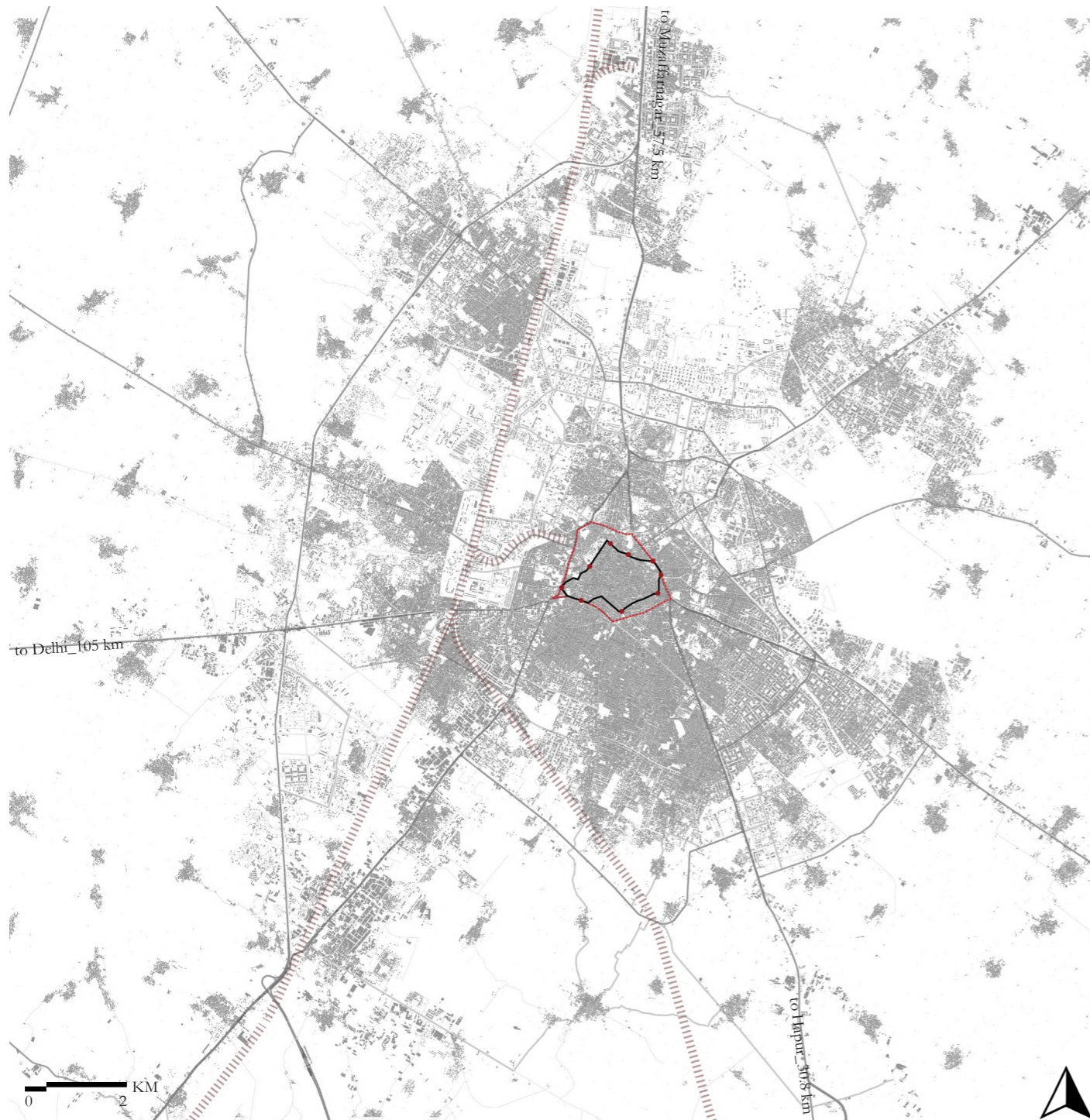


Places of Significance

Meerut, situated amidst the sacred rivers Ganga and Yamuna, boasts a bustling trade center in western Uttar Pradesh. Renowned as the “sports city of India,” it hosts a thriving sports goods industry. Flourishing in the fertile Ganga-Yamuna doab, Meerut has a legacy dating back to the Vedic Civilization, marking it as a crucial center of ancient human activities. Additionally, the region thrives in the production of sugar and electronics goods.

Moreover, in Meerut, notable landmarks and structures include the Augarnath Temple, revered for its religious significance and historical value, and the Shahi Eid Gaah Mosque, which stands as a symbol of cultural diversity and architectural splendor. Additionally, the St. John’s Church, constructed during the British era, is an iconic architectural marvel. The town hall, popularly known as Ghantaghar, stands tall in the heart of the city, serving as a historical and administrative landmark. These landmarks not only signify Meerut’s rich heritage but also contribute to its cultural diversity and architectural magnificence.

Figure 31: (On the left) Historical map of Meerut & places of significance. (Source: Map of Meerut, -meerutup.tripod.com)



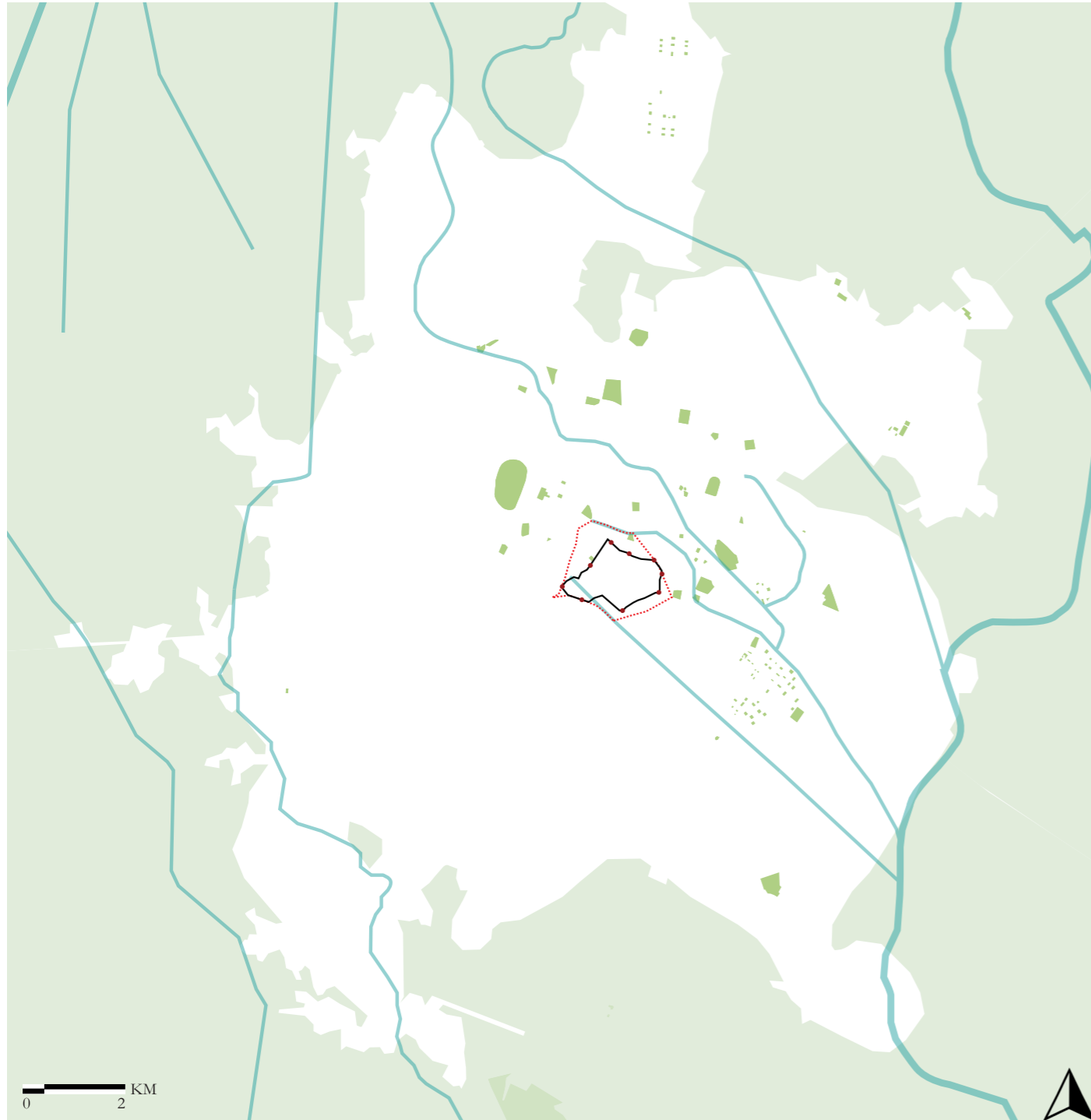
6.4 S-Scale Spatial Characteristics

Meerut

Meerut’s urban structure showcases a distinctive orbital layout of grey infrastructure, radiating outward from a bustling center. This pattern is notably prominent, converging various routes towards the heart of the city. A significant railway line, originating from Delhi and extending toward Muzaffarnagar, runs parallel to one of the primary roads, contributing to the city’s transport network. The central region appears densely populated, hosting the historical core, while newer settlements sprawl towards the periphery.

The convergence of major roads at the city center results in substantial traffic congestion, especially around the historical core. However, some areas experience disruptions in connectivity, exhibiting inadequate linkages between different parts of the city. This sporadic disconnection impacts the fluidity of movement and the overall accessibility within Meerut, highlighting the need for strategic enhancements in infrastructure and connectivity to ensure smoother navigation and efficient transportation across the city’s diverse regions.

Figure 32: (On the left) Map shows the spatial composition of Meerut.



Green-Blue Infrastructure

The examination of green-blue infrastructure within Meerut offers an illuminating insight into the distribution and nature of natural elements across the cityscape. The city's periphery is primarily characterized by expansive agricultural fields that stretch outwards, occasionally infiltrating residential zones, especially within the peri-urban areas. Concurrently, water features comprising canals, streams, and rivers, emanating from the Ganges, intricately weave through the landscape, creating a network of vital water resources across the region. These elements, while contributing to the city's ecological balance, play a crucial role in defining its spatial composition.

Interestingly, parks and recreational green spaces, though present, occupy a relatively smaller proportion of the city's terrain, while built-up areas dominate the landscape extensively.

This comprehensive understanding of the city's natural elements, their distribution, and their relationship with built environments, stands as a valuable foundation for identifying potential project sites and areas that can have intervention. It serves as a blueprint for fostering sustainable development, improving urban-rural connectivity, and enhancing the overall livability of Meerut.

Figure 33: (On the left) Map shows the green-blue infrastructure of Meerut city.



RRTS (TOD Network)- Meerut

The proposed Rapid Rail Transit System (RRTS) network in Meerut originates from Sarai Kale Khan, Delhi. This transit system strategically aligns with the existing railway line and the primary diagonal road extending from Delhi. The network, incorporating elevated and underground lines, intricately weaves through key sectors within the city. Its design and connectivity render it a significant Transit-Oriented Development (TOD) opportunity, poised for intervention.

The forthcoming RRTS infrastructure holds substantial promise as a foundational element to benefit the urban-rural link within Meerut. Leveraging this advanced transit system could serve as a catalyst for fostering improved connectivity, accessibility, and mobility across the city. Integrating modern transit systems with thoughtful urban designing stands to positively impact Meerut's urban-rural fabric by facilitating efficient transportation and enhanced access to diverse areas within the city.

By viewing this transit initiative as a potential intervention point, it offers the potential to significantly bridge the urban-rural gap, potentially fostering synergies between different zones and communities across Meerut.







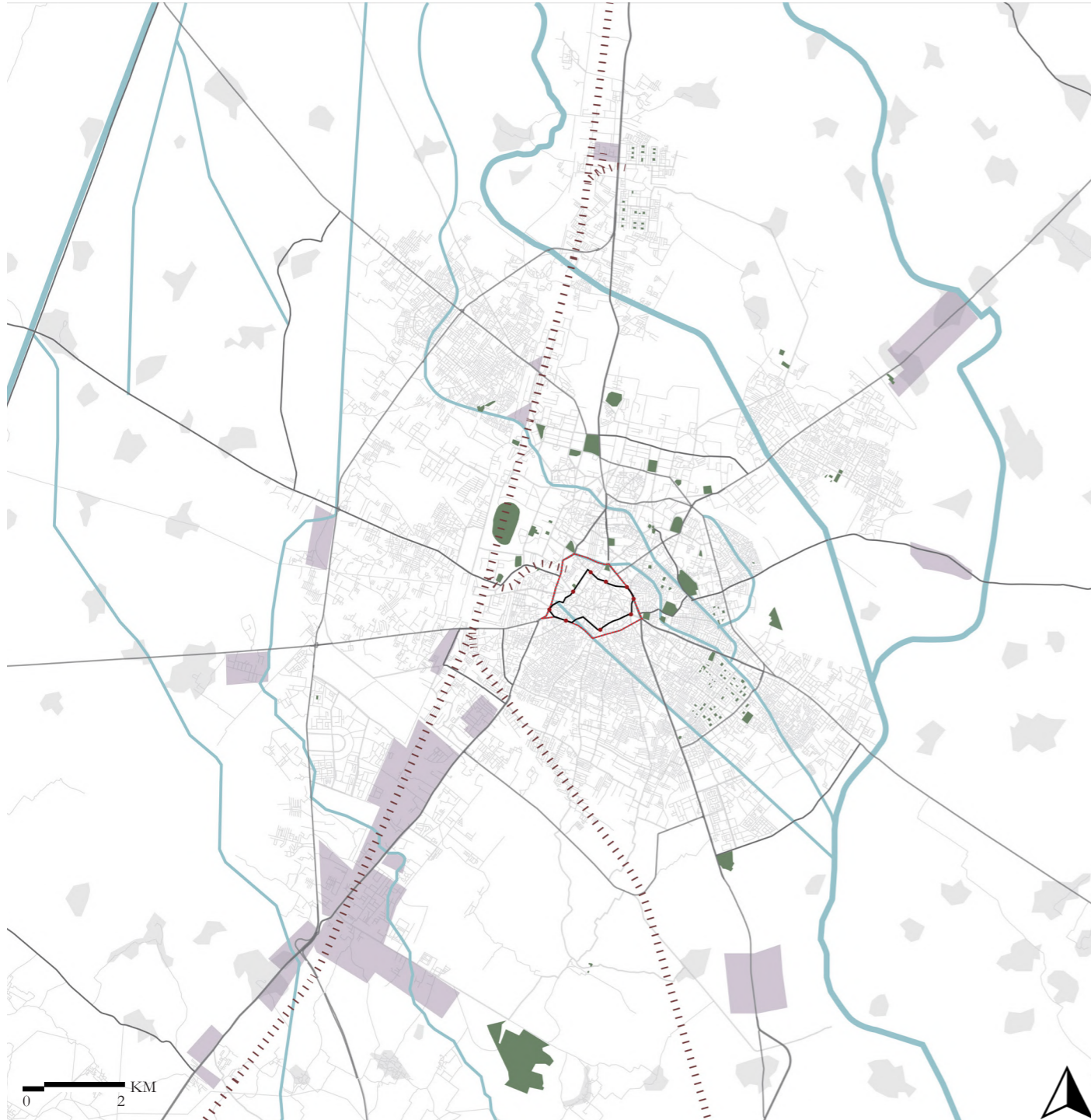
-  Elevated RRTS line
-  Underground RRTS line
-  RRTS Station
-  Metro Station
-  RRTS Depot
-  Sarai Kale Khan Station

Figure 34: (On the left) Map shows the RRTS network for Meerut. (Source: Redrawn from NCRTC.In)



6.5 Urban Pattern

Orbital Urban Pattern

Studying Meerut's urban layout is pivotal for grasping its cityscape. The map illustrates an orbital pattern with radial roads emanating from the core and intersecting with linear roads, forming concentric circles. The city center houses administrative and historical landmarks, surrounded by residential areas. Further outward, industrial zones flourish, leveraging the orbital roads for efficient connectivity and distribution of goods and services.

This distinct pattern highlights the functional distribution across Meerut, revealing how the city's design accommodates various activities, from governance and culture at the core to residential and industrial sectors extending to the periphery.

Figure 35: (On the left) Map shows orbital pattern of the primary & secondary roads emerging from the centre of the city with railway running parallel.



Historical Core



Peripheral to Historical Core



Newly Built settlements



Newly Built settlements



Peri-Urban area next to Agricultural fields



Peri-Urban area next to Agricultural fields

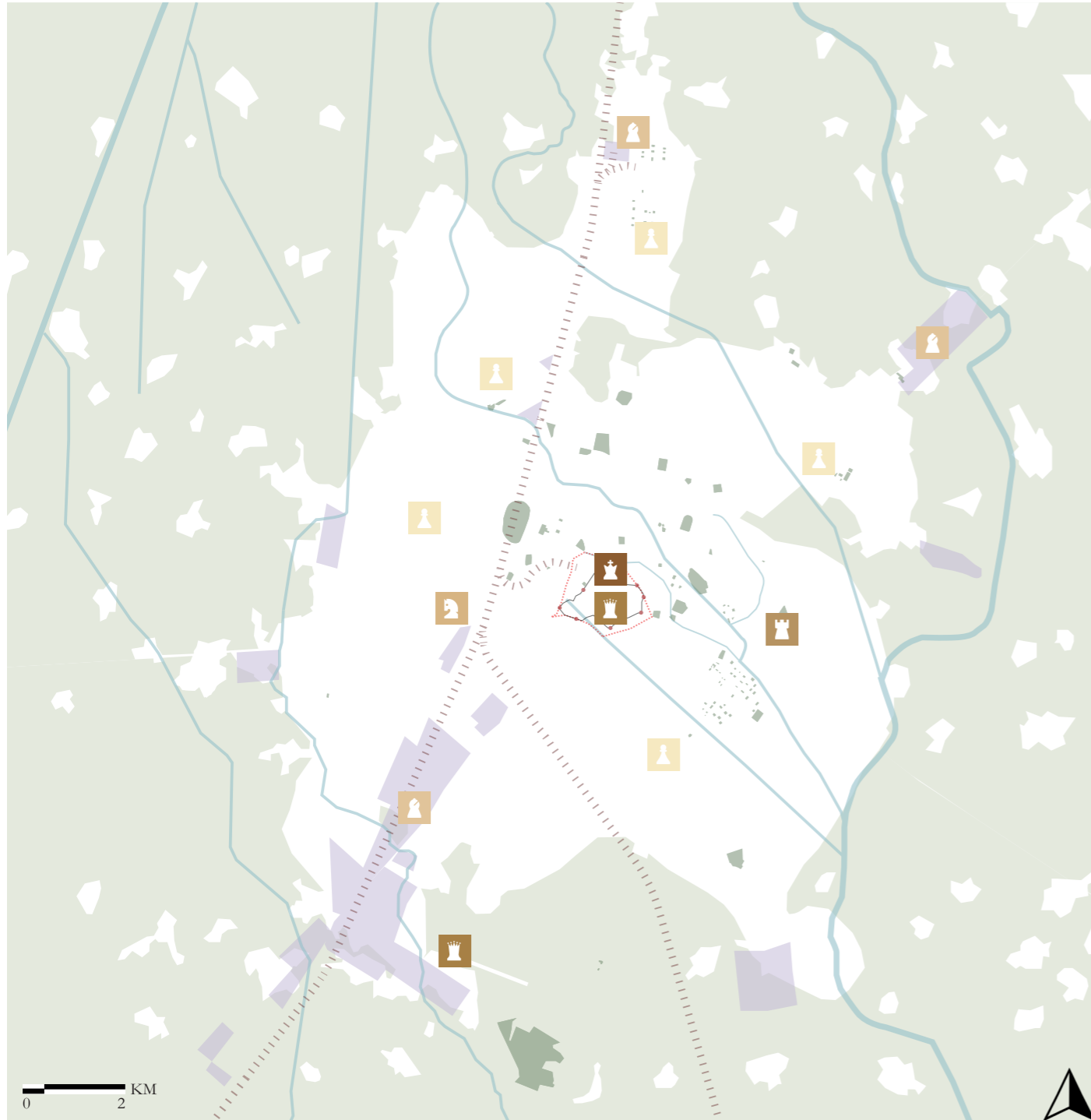
Morphological Study

An interesting aspect of the urban pattern involves deciphering Meerut’s morphological patterns derived from a comprehensive examination across six diverse instances within the city. The historical center, intricately knitted within the boundaries of the ancient fortifications, reveals a dense, clustered settlement devoid of a discernible pattern. This dense clustering extends to the periphery of the historical center, albeit gradually adopting a linear connecting arrangement.

Contrarily, the newly developed settlements, predominantly situated on the outskirts or distanced from the historical core, display a more organized, grid-like structure—an outcome of contemporary urban planning practices. Additionally, the peri-urban zones bordering agricultural fields exhibit a more scattered and sparse layout, aligned with natural elements such as canals or streams.

This analytical overview shows the city’s evolving formation, elucidating distinctive patterns that could shed light on existing challenges within specific regions while identifying potential zones amenable to new interventions. It facilitates a comprehensive understanding of Meerut’s spatial dynamics, offering insights into the historical, contemporary, and peri-urban development patterns that shape the cityscape and potentially influence future urban planning initiatives.

Figure 36: (On the left) Images show a study for various arrangements of the settlements in Meerut.



6.6 City Chess Analogy

Building Chess Analogy

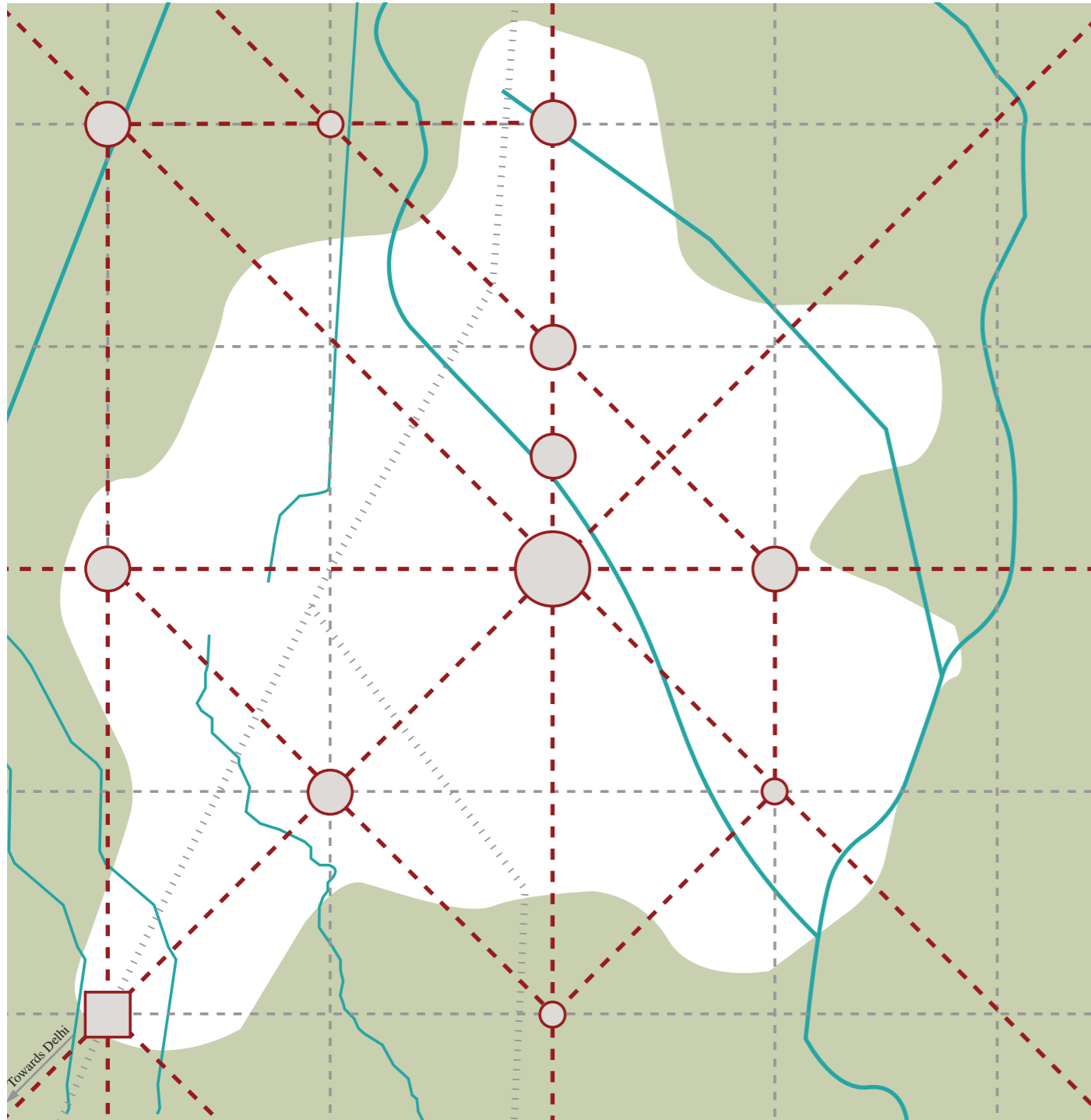
This segment of the study introduces an innovative application of chess theory at the city level. Expanding on the concept of chess coins as per the chess analogy, it proposes a city-scale analysis using similar principles. Much like how chess analogy aids in assessing the potentialities of cities, this approach aims to identify and delineate potential zones within the cityscape. This methodology will inform the design and implementation of necessary interventions based on these identified areas.

The city-scale adaptation of the chess analogy aligns analogous meanings of chess coins from the broader-scale analogy. In this context, the study focuses on designating the bishop, unlike the rook in the larger-scale analogy, as the potential area necessitating intervention within the urban setting. This innovative approach provides a strategic framework to evaluate and address key areas for development and improvement within the cityscape.

Chess Coins	M-Scale	S-Scale (City Scale)
<i>King</i>	Central hisoric district	Administrative or Historic centre
<i>Queen</i>	Main productive infrastructure- port/airport	Main productive infrastructure: airport/airstrip
<i>Prospective Queen</i>	Prospective airport/port	
<i>Rook</i>	Main secondary metropolitan centre	Educational area
<i>Knight</i>	Territorial sub-centre	Main railway station
<i>Bishop</i>	Industrial & entrepreneurial production centre	Industrial/production centre
<i>Pawn</i>	Residential municipalities	Residential area



Figure 37: (On the left) The chess analogy symbolizes Meerut as key chess pieces, embodying vital urban-rural aspects and activities.

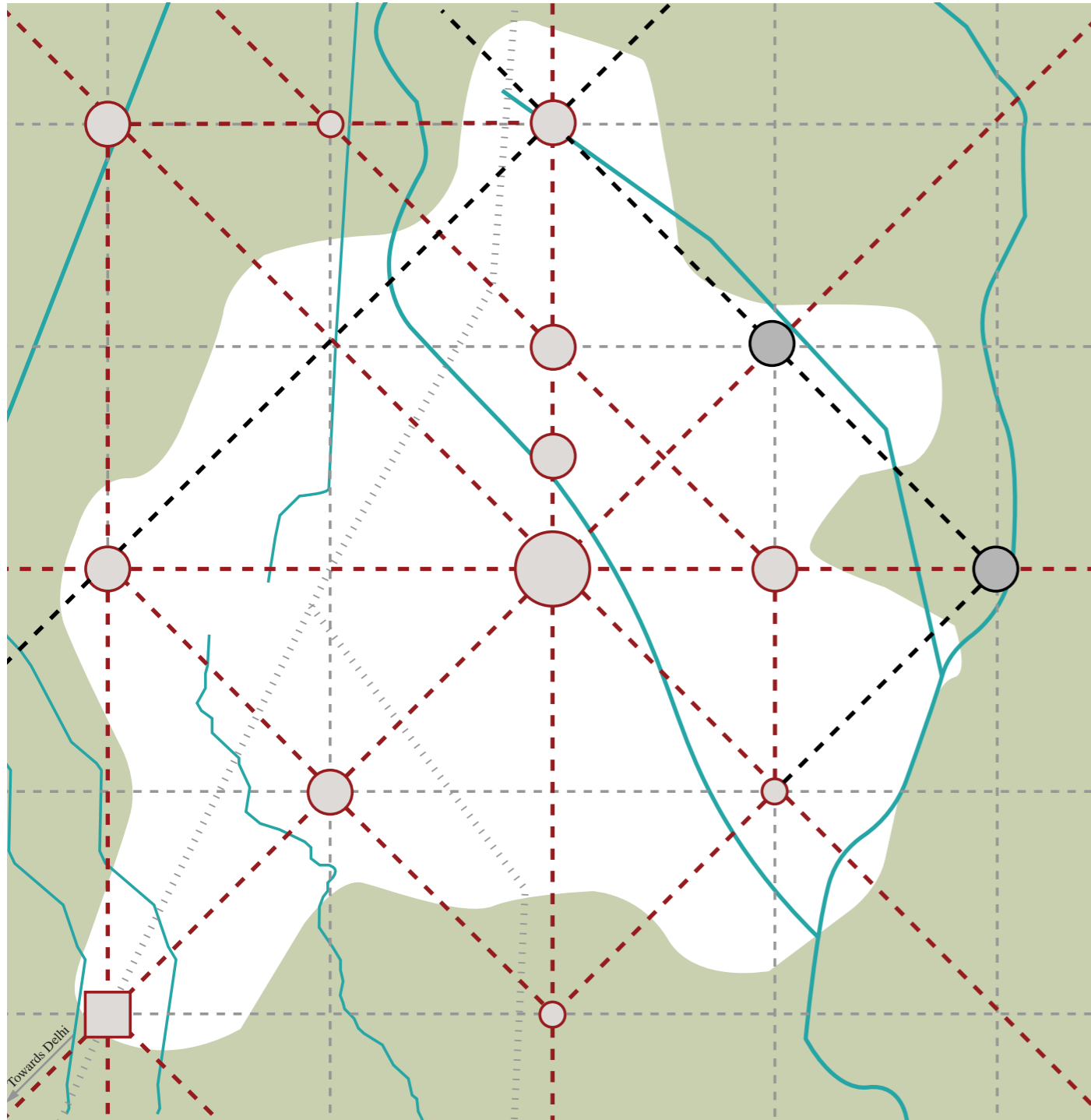


Building the Existing Metro-Matrix

The implementation of chess theory, initially explored through the chess web concept, now transitions into a matrix configuration to depict the contemporary city landscape. Within a confined 2km x 2km grid, diverse chess pieces symbolizing distinct urban-rural facets assume pivotal roles. The king and queen, representing paramount influence, occupy larger circles, signifying their pronounced impact. Complementing these, other chess pieces are delineated based on their potential for strategic intervention and relevance in city developmental strategies.

The interconnections among these chess pieces within the matrix articulate the intricate web of roads, delineating the comprehensive interlinkages and co-dependencies among neighboring areas within the city. This matrix portrayal accentuates the spatial layout and the criticality of varied urban-rural elements in molding the city's structure and orchestrating effective intervention strategies.

Figure 38: (On the left) Applied Chess Analogy to understand the existing Metro-Matrix

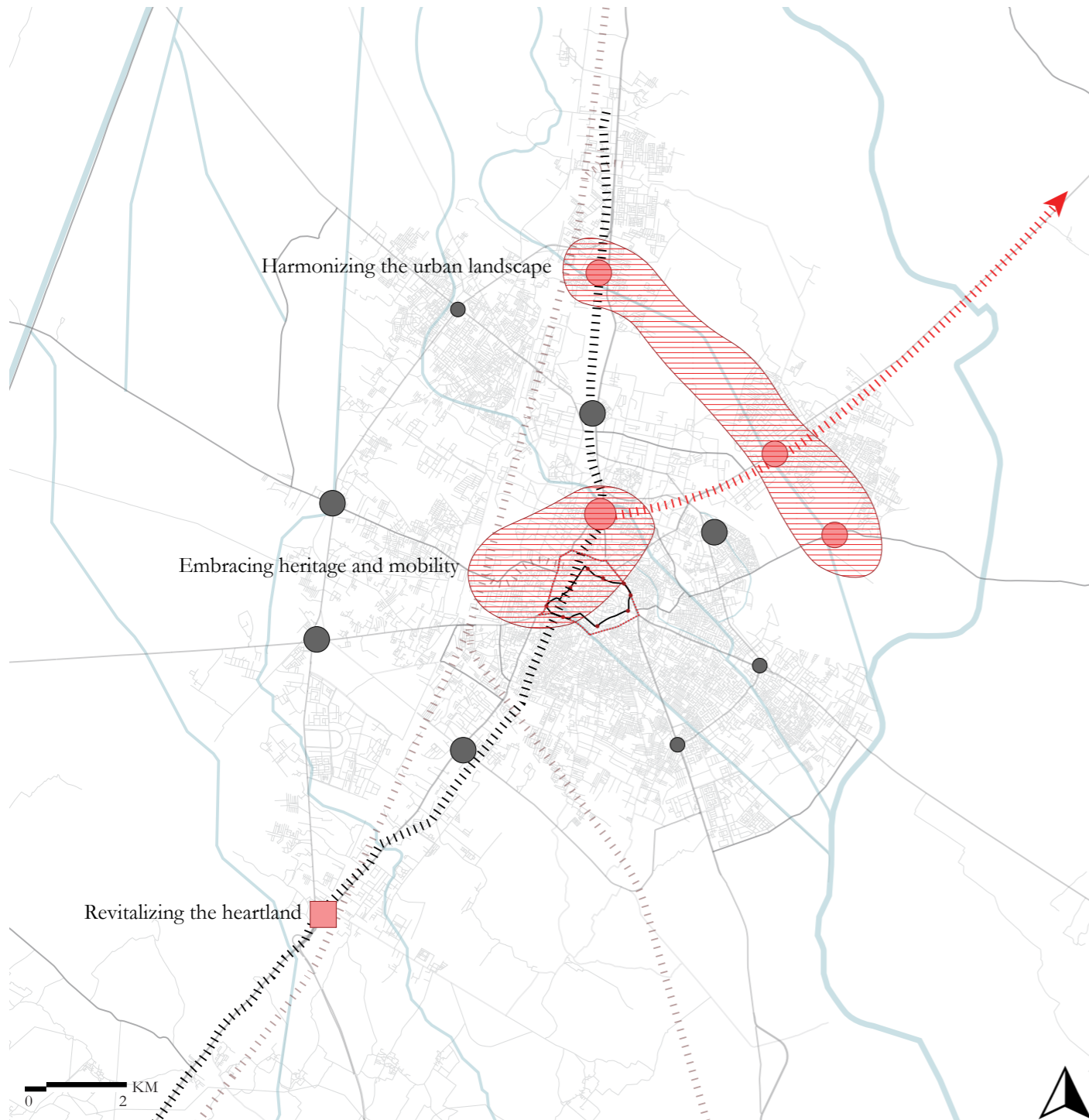


Proposed Metro-Matrix

Following the exploration of chess theory and the development of a reflective matrix, the subsequent phase of this study aims to introduce potential enhancements within this matrix. The proposed modifications primarily revolve around leveraging the robust diagonal connection originating from Delhi, advocating the introduction of a parallel diagonal connection to alleviate congestion within the Delhi-Meerut corridor. Another proposition entails the completion of a comprehensive reticular network, envisaging a transformation from the prevailing orbital layout to a reticular infrastructure design. This envisioned reticular framework aims to optimize community connectivity, transcending the conventional radial patterns.

Furthermore, emphasizing the importance of the bishop—representative of the industrial epicenter—the proposed interventions aim to harness the full potential of the primary occupation, orchestrating a multifaceted design that harmonizes social, environmental, and economic dimensions within the urban landscape. This strategic focus on the bishop emphasizes a shift towards holistic urban development, integrating multiple facets for a more comprehensive and sustainable urban-rural linkage.

Figure 39: (On the left) Proposed City-scale Metro-Matrix created by the fusion of chess web & existing Metro-Matrix.



Potential Areas

“Harmonizing the urban landscape:

A design concept merging the tranquility of waterways, the efficiency of fast roads, and the accessibility of medium-speed routes, fostering enhanced connections for residents.”

“Embracing heritage and mobility:

A design concept that unites the city’s historic core, its bustling railway station, and the rapid rail transit system through a vibrant green corridor, creating an inviting hub for commuters and visitors alike.”

“Revitalizing the heartland:

A design concept integrating an abandoned airstrip and agriculture, promoting source-based freight processing, enabling agricultural activities, elevating agricultural standards, and enhancing the Delhi-Meerut connection.”

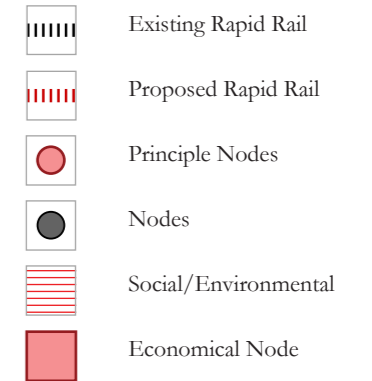


Figure 40: (On the left) Combining insights from the chess analogy & the Matrix, the synthesis map pinpoints key zones for strategic intervention.



7. Design Project

7.1 Analysis- North | Central | South Meerut

- Grey Infrastructure
- Green Infrastructure
- Landuse Study
- DNA Analogy

7.2 Analysis: North Section- Daurli

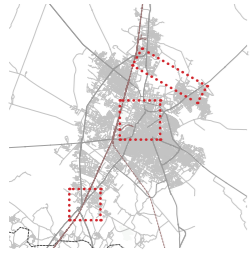
- Existing Masterplan
- Flood Map
- Land Elevation Gradient
- Synthesis
- Scale reference for visual representation
- Section Study: Urban | Peri-urban | Rural Spectrum

7.3 Concept

- Urban Contrast
- Peri-Urban Contrast
- Rural Contrast
- Strategy
- Design Detail
- Design Process: Prelim Approach
- Design Process: Phases

7.4 Design Project

- Masterplan and Sectional Composition
- Typologies & Modules
- Design Illustrations



North Section

Primary roads handle most traffic, smaller roads wind around them, but tertiary roads ends abruptly, making a city's traffic puzzle.



Central Section

A rich historical heart encircled by a ring road, with radial pathways extending from its core, all alongside a parallel railway line.



South Section

An industrial sector with few secondary and tertiary roads, interwoven by a railway, a national highway connecting New Delhi.

7.1 Analysis-North | Central | South Meerut

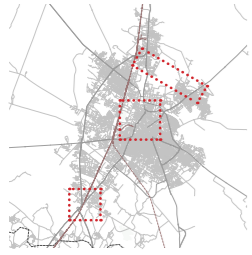
Grey Infrastructure

Understanding Meerut's spatial and environmental make-up hinges significantly on a meticulous examination of its grey infrastructure. Focusing on three distinct sections, the morphology, road networks, and settlement patterns showcase intriguing variations.

In the northern section, primary roads bear the brunt of traffic, while smaller roads intricately wind around them. However, the abrupt termination of tertiary roads presents a perplexing traffic puzzle within the city.

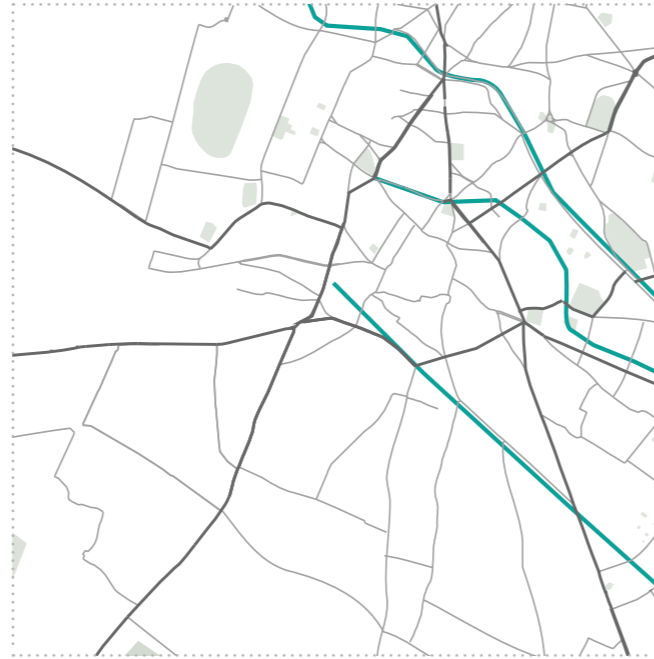
Transitioning to the central segment, a historically rich core sits encircled by a ring road, with radial pathways extending outward from its epicenter, paralleling a railway line. Meanwhile, the southern area hosts an industrial hub, where secondary and tertiary roads intersect a network of railways, with a prominent national highway connecting to New Delhi.

This diverse distribution and configuration of grey infrastructure across these sections paint a vivid picture of Meerut's urban landscape and offer crucial insights into its functional dynamics and connectivity. The variation in road networks and settlement arrangements among these sections not only highlights the city's historical and industrial importance but also underlines the complexities of urban planning and infrastructure development within Meerut's diverse urban fabric.



North Section

Agriculture land at the city's edges, with a scattering of parks and private green spaces closer to the center.



Central Section

Scarcity of green infrastructure amid densely packed buildings



South Section

Vast expanses of agricultural fields stretching far and wide, along with presence of small forest areas.

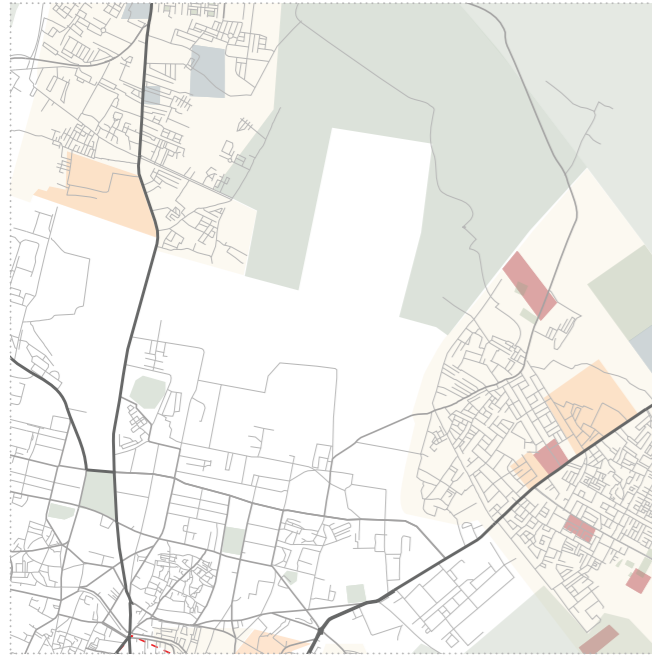
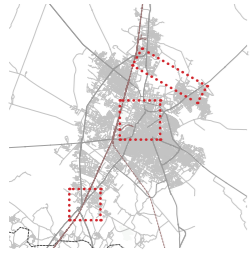
Green Infrastructure

The study of Meerut's greenscape provides a detailed and informative perspective on the city's natural surroundings, shedding light on the diverse natural elements present in close proximity to residential zones and public areas. This analysis delves into the arrangement and composition of green spaces, highlighting their spatial distribution across different sections of the cityscape.

In the north-eastern segment, the city's outskirts boast expansive tracts of agricultural land that frame its edges, accompanied by sporadic green pockets in the form of parks and private green spaces more centrally located.

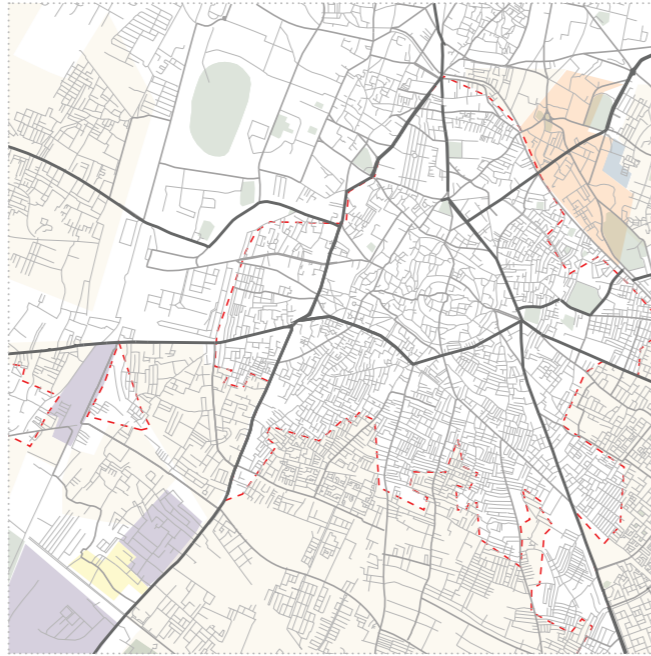
Contrastingly, the central district of Meerut portrays a notable dearth of green infrastructure, characterized by dense clusters of buildings with limited vegetative cover. However, as one moves towards the periphery, vast swathes of agricultural fields sprawl extensively, while small woodland areas dot the landscape.

This disparity in greenscapes, delineated across Meerut's various sectors, underscores the uneven distribution of natural spaces within the urban fabric. The outskirts exhibit a more pronounced presence of agricultural expanses and pockets of greenery, offering a stark contrast to the central district's densely constructed urban environment, emphasizing the distinct composition and distribution of green spaces throughout the city.



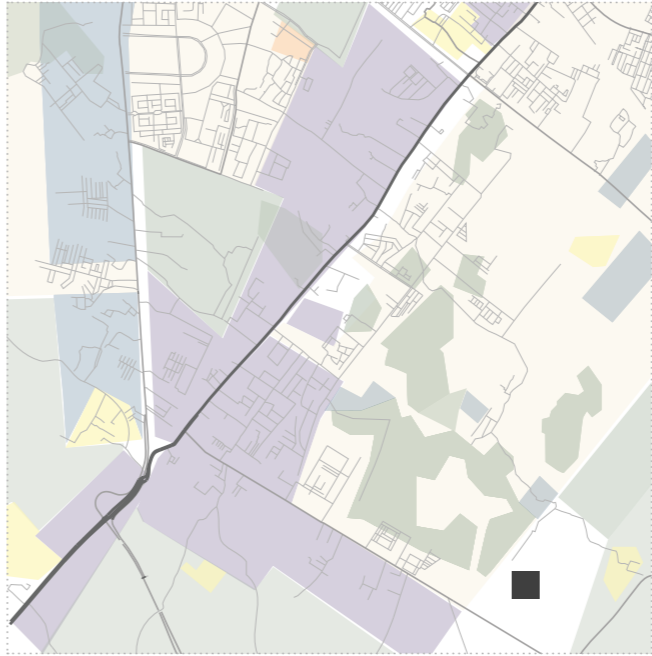
North Section

Agricultural landscapes frame the city's fringes, flanked by residential quarters on either side, while offices and essential public services stand adjacent, bridging urban and rural domains.



Central Section

At the city's heart, a historical core holds its heritage, encircled by residential neighborhoods, with government offices standing by its side.



South Section

A patchwork of agriculture fields, an industrial hub, and essential public services intermingle with pockets of residential zones.

Landuse Study

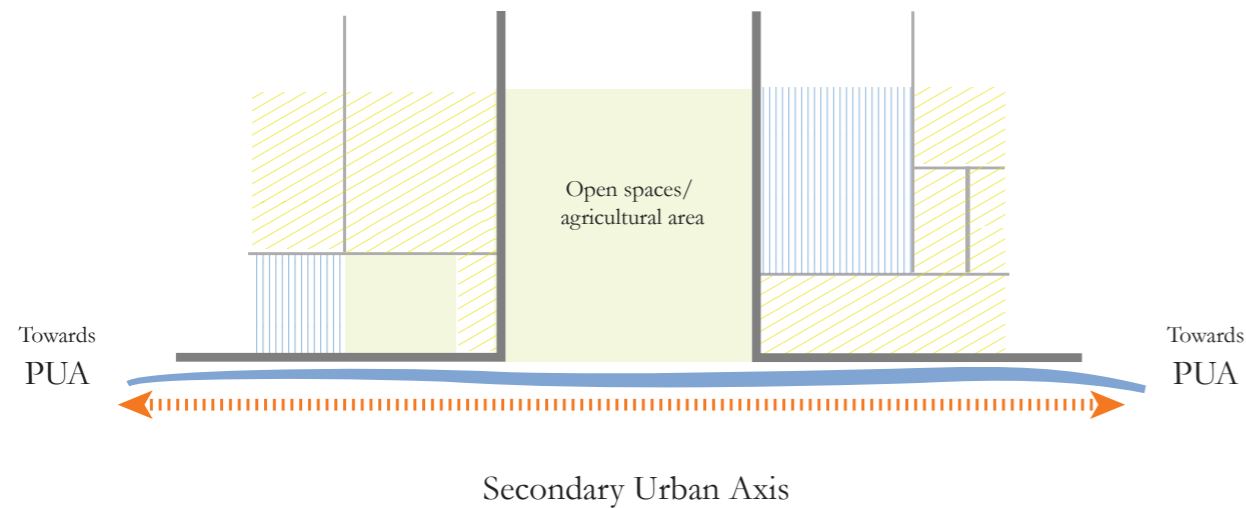
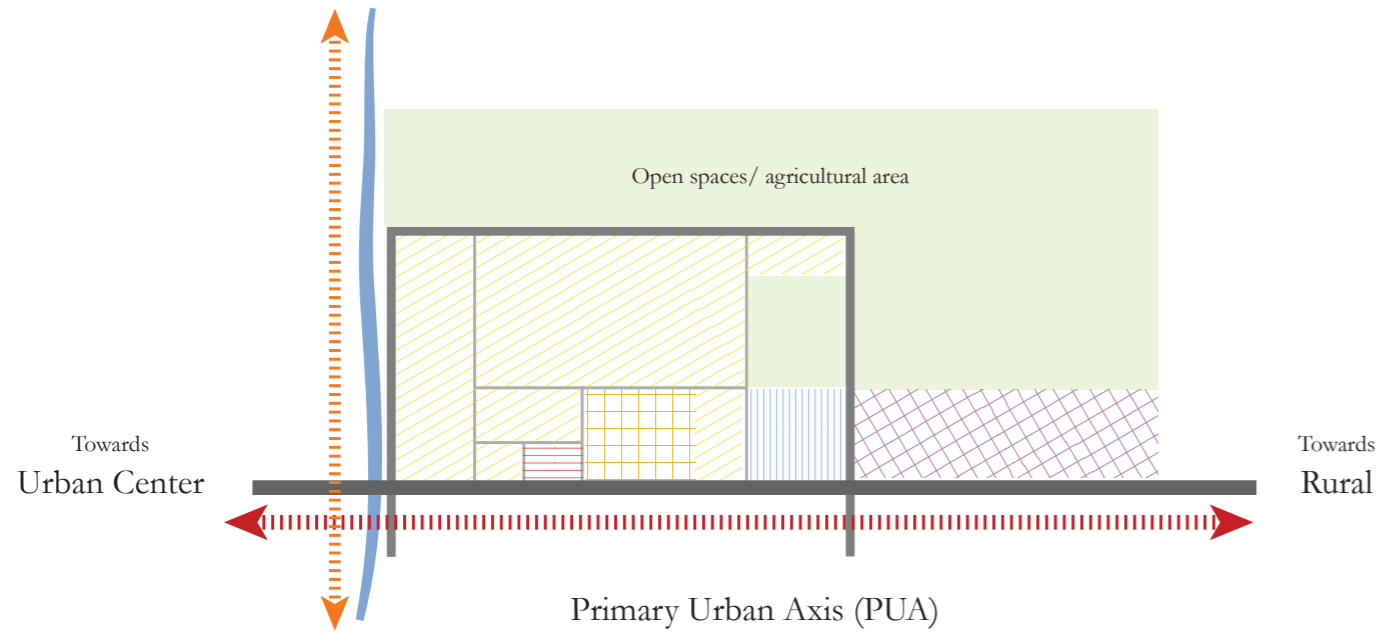
In Meerut, a comprehensive study of land use reveals an intricate tapestry across its northern, central, and southern sectors, showcasing a diverse landscape that weaves urban and rural elements into a cohesive fabric.

In the outskirts, expansive agricultural expanses envelop the city's edges, harmonizing with pockets of residential areas that flank these verdant stretches. Adjacent to these areas lie offices and crucial public amenities, serving as vital connectors bridging the gap between the urban and rural realms.

Venturing towards the city's core, a historic district takes precedence, encircled by neighborhoods that proudly preserve and showcase the city's rich heritage. Alongside this historical core, government administrative precincts are strategically placed, seamlessly integrating their functions within the residential surroundings.

The city's diverse mosaic extends further as one navigates through its expanse. A juxtaposition of sprawling agricultural fields, an industrious hub, and essential public amenities intermingles with residential zones, forming a dynamic landscape that encapsulates Meerut's essence.

- Commercial
- Residential
- Industrial
- Office
- Public Facility

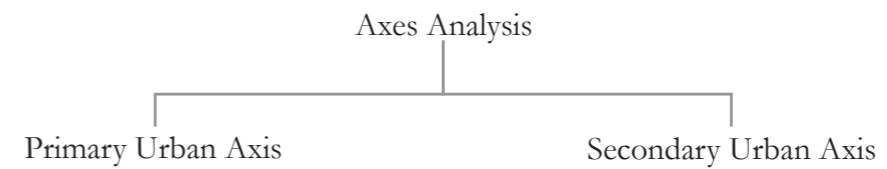


DNA Analogy

The extensive analysis conducted across three distinct sections uncovered a unifying essence prevalent despite their diverse locations and characteristics within the city. This revelation was likened to a DNA analogy, illustrating a shared pattern across these sections that forms the city's character.

The first illustration showcased bustling traffic streams adjacent to settlements arranged perpendicularly along the primary axis. This alignment was complemented by a canal running parallel to this primary thoroughfare. In contrast, the secondary illustration depicted sparser settlements adjacent to expanses of agricultural greenery, indicative of a slower pace of traffic along the secondary axis.

These consistent features, spanning different sections, not only characterize the unique identity of these specific areas but also play a significant role in shaping the overarching identity and essence of the city as a whole.

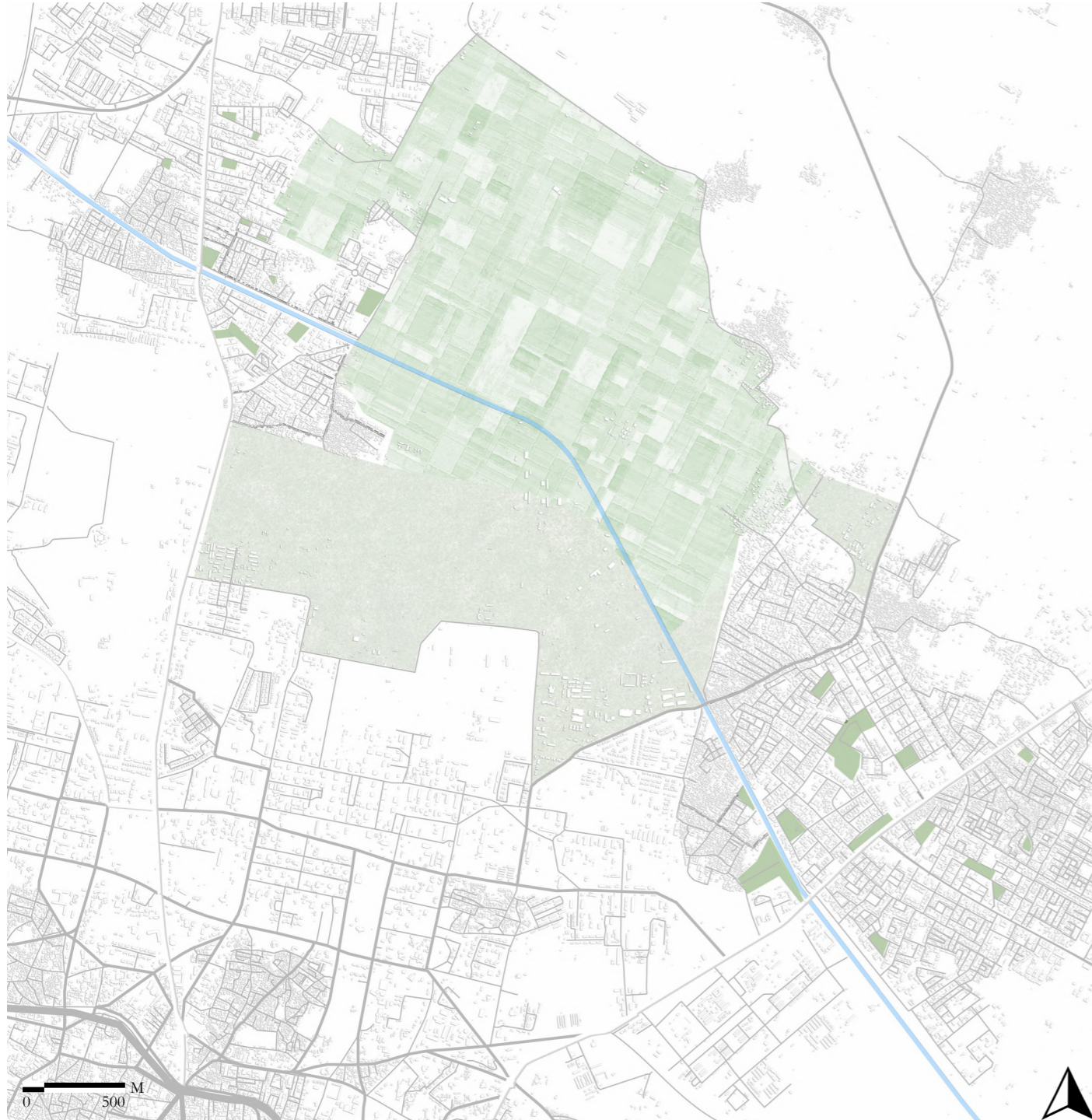


- Major assets (Commercial, Work, Etc.)
- Peak hour congestion
- Need of high capacity and high frequency transit
- More Infrastructure

- Minor assets (Residential, Public Spaces, Etc.)
- Leisure and recreational activities
- Need of Low capacity and frequency transit
- More Ecological

- Residential
- Public spaces
- Office
- Industrial
- Commercial
- Open spaces/agriculture
- Fast Spine
- Medium Spine
- Slow Spine
- Water Body

Figure 41: (On the left) Illustration shows DNA analogy present in north, central, south Meerut.



7.2 Analysis: North Section- Daurli

Existing Masterplan

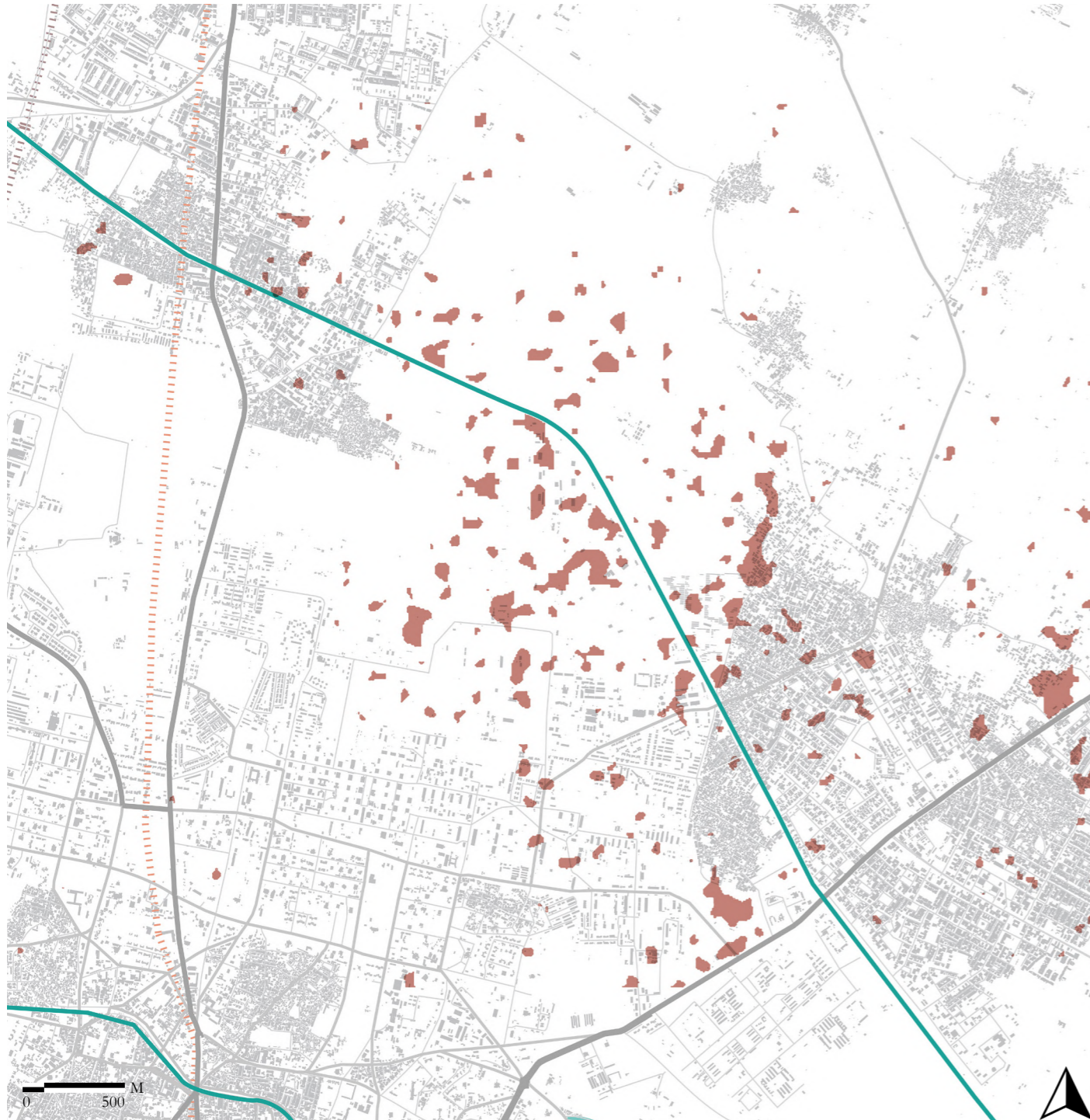
The map unveils a vivid portrayal of Meerut's northeastern landscape (Daurli region), emphasizing its distinctive green and blue elements. Prominently featured are the meandering pathways of the Kali Nadi originated canal, vast stretches of agricultural fields, and existing recreational green spaces. These elements collectively contribute to the region's visual identity, marking key facets of its natural and developed environments.

In addition to the delineation of natural features, the map intricately outlines the settlement composition across the area. High-density settlements are prominently clustered in close proximity to primary roads, exhibiting a gradual dispersion pattern as one moves outward into peri-urban and rural territories.

A compelling observation emerges regarding the morphological arrangement within this region. A concentrated and denser pattern of habitation is notably centralized, suggesting a more intense concentration of structures and residences. In contrast, settlements arranged perpendicular to the primary roads seem to populate the outskirts, contributing to a spatial distribution that transitions from high-density clusters near thoroughfares to sparser residential pockets away from these primary routes.

This detailed visual representation offers valuable insights into the composition and spatial organization of Meerut's northeastern region, effectively capturing the intricate interplay between natural features and settlement patterns within the area.

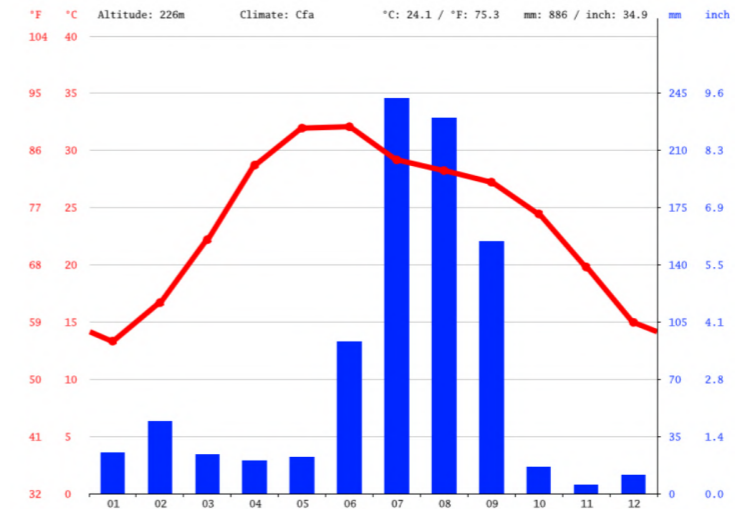
Figure 42: (On the left) Map displays the green and blue aspects of Meerut's northeast (Daurli), including the Kali Nadi canal, agricultural fields, and recreational green areas.



Flood Map

Northern India, including Meerut, grapples with recurring flooding, primarily during monsoon seasons, due to heavy rainfall and inadequate drainage systems. The map intricately highlights the vulnerable low-lying areas susceptible to flooding, notably at the +222 level. This identification is crucial as it marks zones prone to inundation, presenting an opportunity rather than a challenge. Leveraging these low-lying areas during heavy rainfall allows for the strategic collection and utilization of rainwater for community benefits.

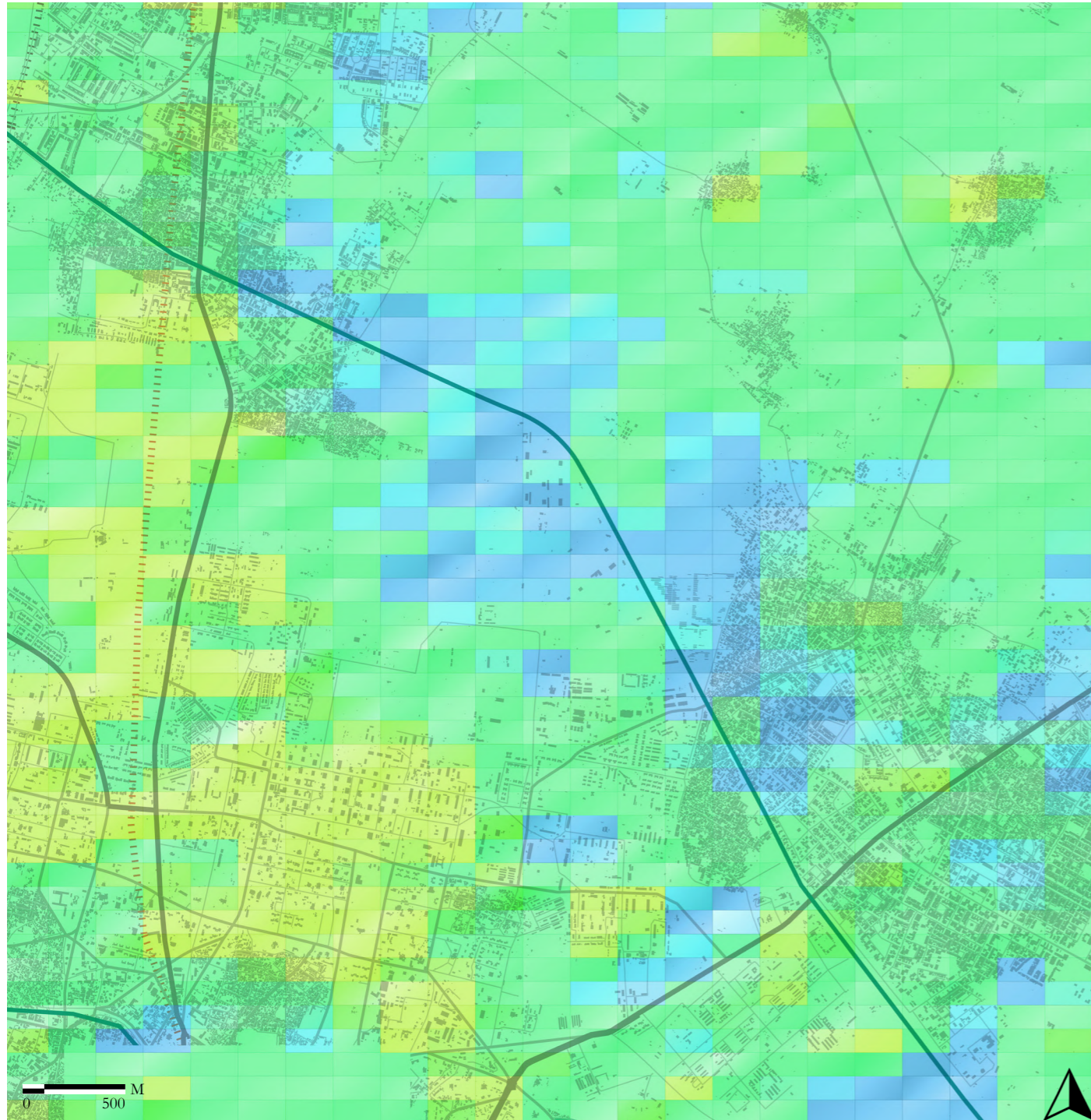
Implementing rainwater harvesting initiatives, reservoirs, or artificial ponds within these regions could help alleviate flooding by channeling excess rainwater, subsequently serving as a sustainable water resource for the community. Such measures not only mitigate flooding risks but also promote water conservation and management, ensuring a more resilient and water-secure environment for Meerut and its surrounding areas. Efforts focused on harnessing rainwater at these identified levels offer a promising solution, turning a vulnerability into an invaluable resource for the community's well-being and sustainable development.



Climate Data

During the months of July to September, the region experiences high rainfall, often exceeding 150mm compared to the preceding months. Conversely, the months from October to December witness significantly lower rainfall, often below 20mm. Consequently, excess water during these rainy months either leads to flooding or is discharged into the river.

Figure 43: (On the left) Map shows the lowlying areas that are prone to get flooded in rainy season. (Source: floodmap.net)



Land Elevation Gradient

The northeastern sector of Meerut exhibits a land elevation gradient ranging from +222 to +230 above sea level, as visually represented on the map. This color-coded depiction utilizes blue to denote the lowest points, green for intermediate elevations, and yellow for the highest zones within the area of study.

A noticeable trend emerges from the map’s visualization: the majority of settlements are strategically positioned atop higher elevations, while expanses of greenery predominantly occupy the lower-lying areas. This historical settlement pattern aligns with the natural contours of the land, suggesting a deliberate effort in the past to establish habitable spaces on elevated terrain, potentially as a precautionary measure against potential flooding.

This historical inclination toward constructing settlements on higher ground presents an intriguing opportunity for contemporary urban planning. By revisiting and considering the natural topography, there exists a chance to employ this inherent land formation to inform modern design interventions. Such an approach could significantly impact the urban-rural connectivity, optimizing the linkages between diverse landscapes.

The map itself is a product of analyzing Meerut’s contour data, facilitated through the utilization of grasshopper software. This visualization provides valuable insights into the region’s elevation gradients, offering a foundational resource for future urban planning strategies and informed decision-making processes.

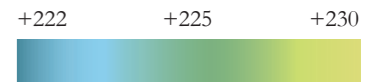
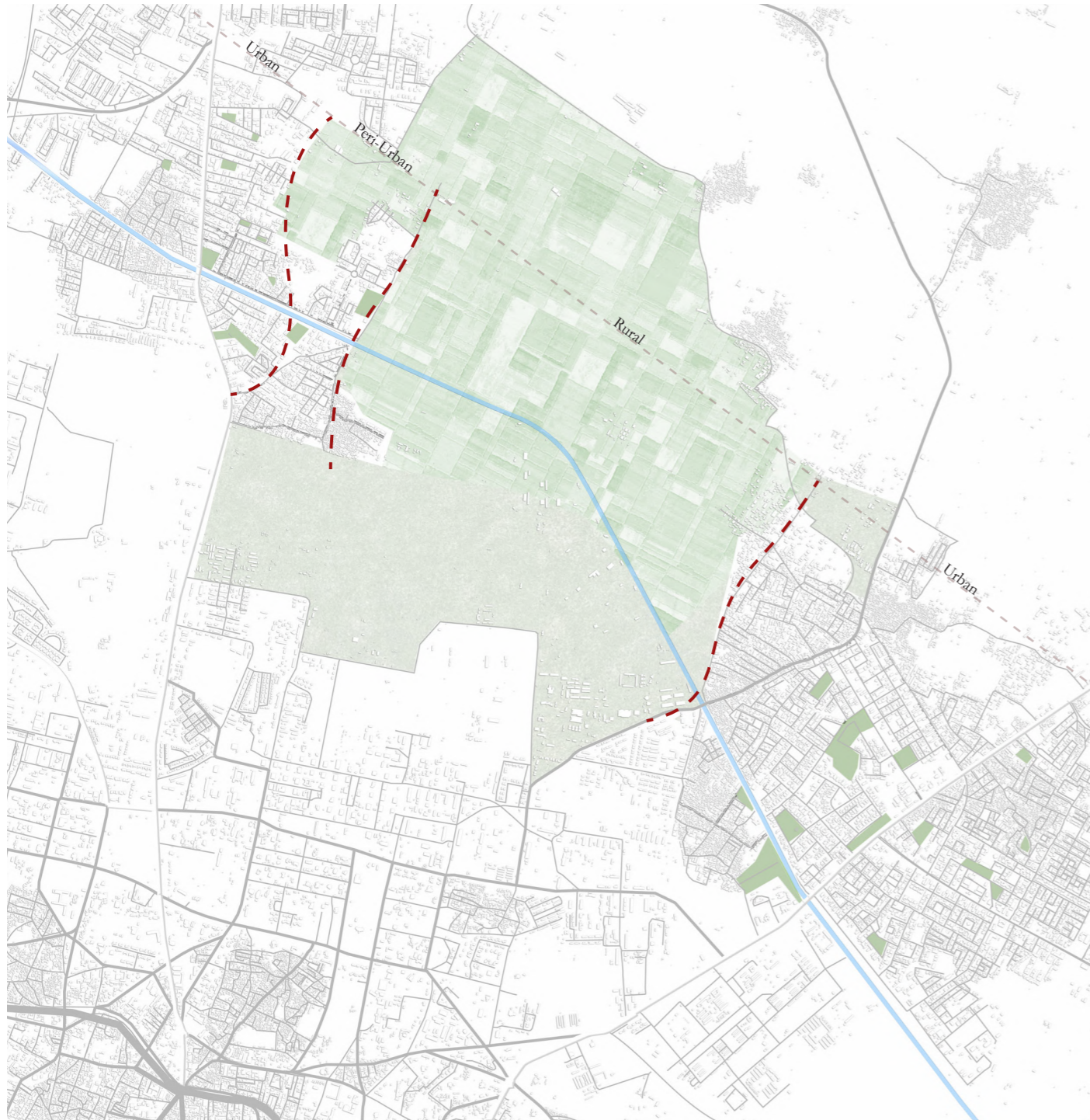


Figure 44: (On the left) Map visually represents the land elevation gradient spanning from +222 to +230.



Synthesis

The decision to focus on the north section for intervention stems from a meticulous analysis, drawing inspiration from the intricate strategies akin to chess analogy and the insights derived from the metro-matrix study. Several prominent factors solidify this choice: a robust diagonal pattern originating from Delhi, the expansive ecological canvas prevalent in this area, and the presence of a significant water canal bridging two primary roads. This strategic selection aligns with a holistic view portrayed on the map, portraying settlements, green spaces, grey infrastructure, and water bodies as a unified spectrum worthy of in-depth scrutiny.

The area's breakdown into urban, peri-urban, and rural segments offers a comprehensive understanding of the city's fabric. Urban pockets neatly cluster along primary roads, while peri-urban zone is indirectly tethered to these thoroughfares through secondary pathways characterized by moderate traffic flow. It is also noticeable that the south-east part is composed of urban and rural without an intermediate transition zone. On the other hand, rural regions connect via tertiary routes to secondary roads, inhabiting a more serene distance from the urban bustle.

Despite this division, a semblance of connection intertwines these areas; yet, the linkages reveal some degree of ambiguity, contributing to discontinuities within the overall network.

Figure 45: (On the left) Map outlines green-blue-grey infrastructure in the northern section, marking the urban-rural spectrum division.

2 Km

Daurli (Design Project), Meerut



Piacenza, Italy



Parco delle Cave, Milan

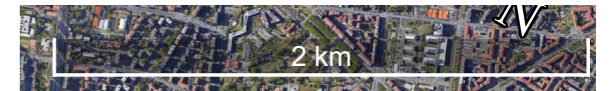


Scale reference for visual representation

The images provide a visual representation for scale reference by showcasing design projects like Central Park in New York and Parco delle Cave in Milan.

5 Km

0 1 KM





Section Study: Land Profile

The varying elevations found across the city sections, spanning from the urban epicenter to the rural outskirts, showcase a significant altitude range, oscillating between +222 to +230 above sea level. A discernible pattern emerges, indicating that settlements predominantly thrive on the elevated terrains, with their foundations resting comfortably between +230 and +225. However, as one moves towards the rural peripheries, there's a noticeable descent, settling around the +222 mark.

This striking observation presents an intriguing avenue for design innovation, emphasizing the paramount significance of these land profiles in shaping the urban fabric. Harnessing the inherent slopes and contour formations becomes pivotal, offering an exciting canvas to blend these natural land features harmoniously within the design framework. These undulating topographies, if deftly incorporated, could serve as instrumental components, intricately weaving a tapestry of connectivity and fluid transitions across the urban continuum.



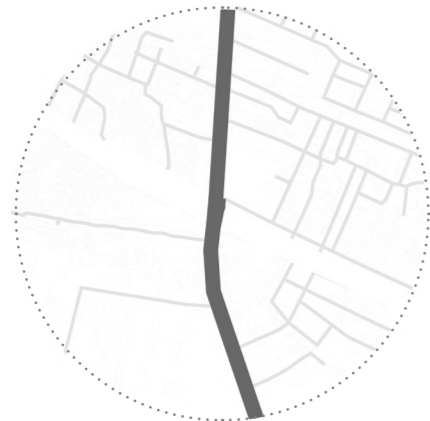
Figure 46: (On the left) Map & sections showcase the land profile with settlements at higher level.



Primary Axis



Secondary Axis



Grey Infrastructure



Green Infrastructure



High population traffic



Low population traffic

7.3 Concept

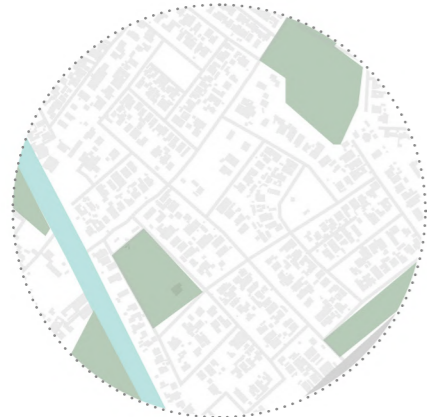
Urban Contrast

As we traverse the urban-rural spectrum, there's a subtle yet distinct transformation in spaces, elements, and features. Although these transitions occur seamlessly, they exhibit contrasting characteristics that warrant attention for designing a cohesive environment that embraces these differences.

In the urban landscape, the transition from urban to peri-urban unveils a stark contrast in elements. Here, primary roads coexist with a secondary axis, illustrating a distinct shift. This change is notably reflected in the infrastructure, as the scene transforms from the concrete, grey structures emblematic of urban settings to vibrant greenery and blue features characteristic of peri-urban spaces.

Moreover, this transition isn't solely defined by infrastructure but also by user dynamics. Bustling traffic nodes, bustling with the convergence of trains, cars, and pedestrians, dominate the urban milieu. However, as the landscape progresses towards peri-urban zones, these busy thoroughfares gradually give way to quieter surroundings with noticeably diminished traffic volumes.

Figure 47: (On the left) Maps and images show contrast present in urban-peri-urban areas



Parks and Recreation green



High Density



High Elevational Skyline



Agriculture



Low Density



Low Elevational Skyline

Peri-Urban Contrast

As we venture into the peri-urban expanse, a distinctive shift from peri-urban to rural landscapes begins to unfold. This transition is discernible in the diversity of green infrastructure, particularly evident in the abundance of parks and recreational spaces tailored to meet the residential requirements within peri-urban zones. This contrasting landscape gradually transforms into vast stretches of agricultural lands as we traverse towards rural expanses.

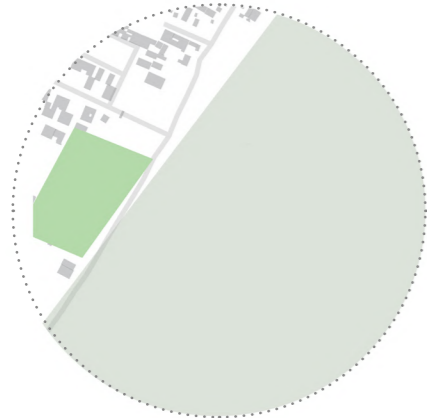
Furthermore, this shift isn't solely confined to green spaces but is also evident in the varying densities of built-up structures. Peri-urban areas boast higher density constructions, bustling with more substantial development, gradually diminishing as we progress towards rural territories.

Additionally, this transition is accompanied by an apparent shift in elevation dynamics, with peri-urban settings characterized by taller built-up structures, distinctly different from the relatively lower rural landscapes.

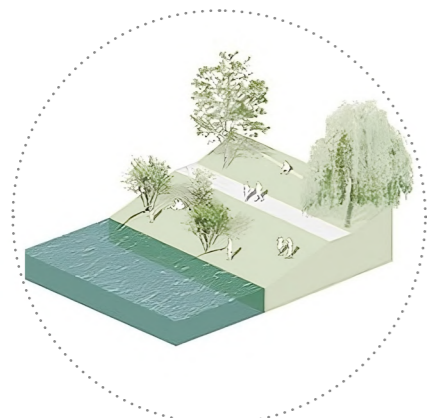
Figure 48: (On the left) Maps and images show contrast present in peri-urban-rural areas



Agriculture



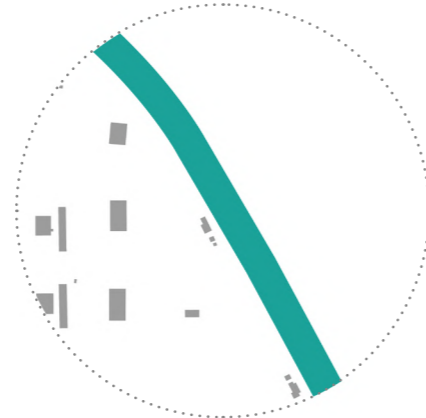
Water



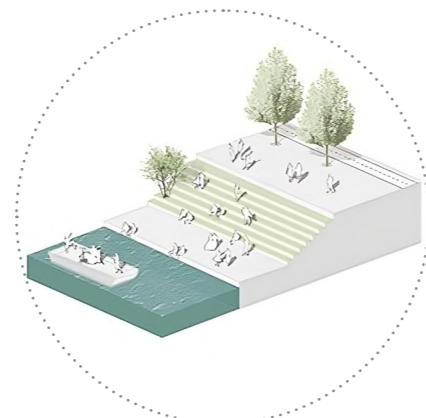
Soft Landscape



Parks and Recreation green



Green



Hard Landscape

Rural Contrast

As we journey through rural landscapes, a gradual shift unfolds from rural to peri-urban settings, unveiling a notable transformation in green spaces. This transition witnesses the emergence of lush, verdant areas that become increasingly abundant as we progress towards peri-urban zones.

Furthermore, the difference extends beyond the abundance of greenery. Rural areas boast softer landscapes, characterized by their natural, gentle compositions and serene surroundings. This scenery gradually gives way to peri-urban spaces adorned with sturdier, harder landscapes specifically designed to cater to leisure activities for the area's residents.

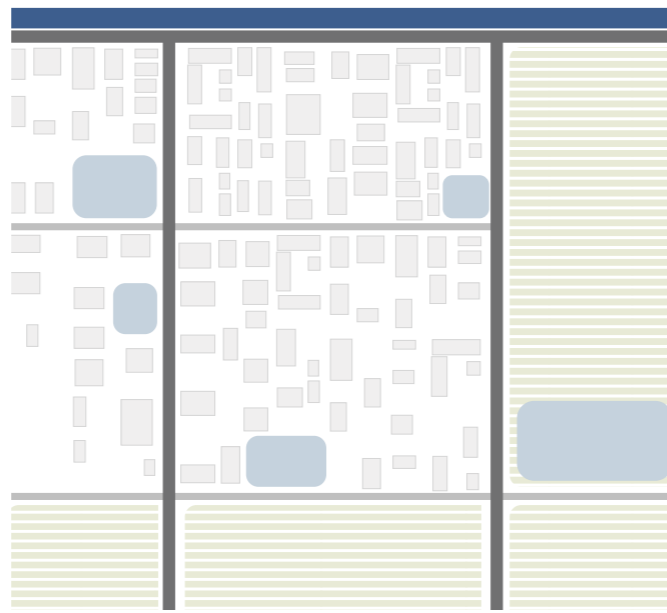
The contrast in landscape composition becomes more pronounced, offering a tangible distinction between the tranquility of rural settings and the purposeful, recreational design of peri-urban environments.

Figure 49: (On the left) Maps & images show contrast present in rural-peri-urban areas



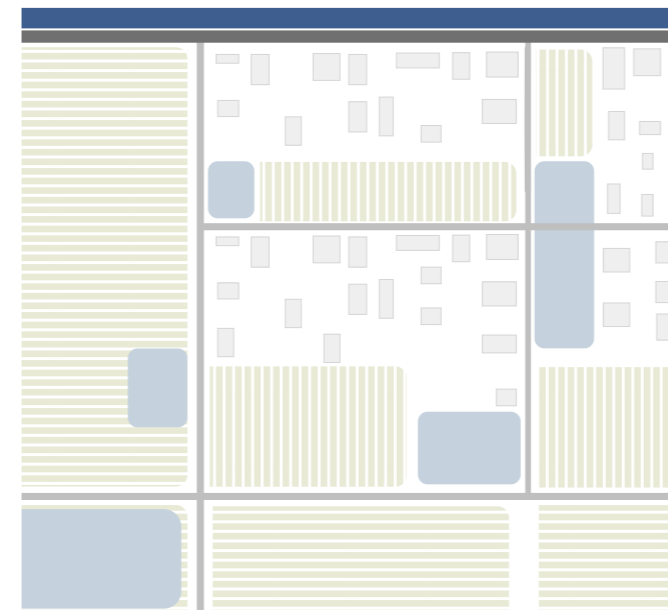
Urban

- 1 Mobility Hub
- 2 Public Service



Peri-Urban

- 3 Horticulture
- 4 Education/ Community centre



Rural

- 5 Agricultural Processing
- 6 Industry

Design Detail

This design framework offers a comprehensive approach to address the fragmented nature of urban, peri-urban, and rural regions within the desakota area. It establishes settlements, interconnectivity, and activities aligning with each zone's necessity, promoting stewards and protectors. Additionally, this adaptable template can be implemented across all three sections of Meerut selected from the matrix.

Emphasizing the settlement pattern distinctions among fragments, the transition will showcase a gradual decrease from urban to peri-urban and notably less in rural areas. This approach respects the distinct character of each zone, acknowledging and preserving their individual essence.

Urban areas accommodate fast, medium, and slow spines, fostering denser settlements, offering public services, and integrating public-private green spaces while minimizing interference with agricultural zones.

In the transition to peri-urban spaces, the design harmonizes agricultural lands with proposed wetlands, creating interconnected areas. It features medium spines connecting to canals, accommodating less dense settlements, and emphasizing agricultural and public green spaces. The design preserves existing green areas and introduces new ones.

Rural zones prioritize agricultural activities and feature fewer settlements with low-rise structures. Here, vast agricultural lands are preserved, limiting public accessibility along the canal's edge to balance accessibility with conservation. And the proposed wetlands play a crucial role in optimizing agricultural productivity by serving as an irrigation source for farmers.

Stewards

Public spaces- well-maintained, accessible, and serve the community

Green

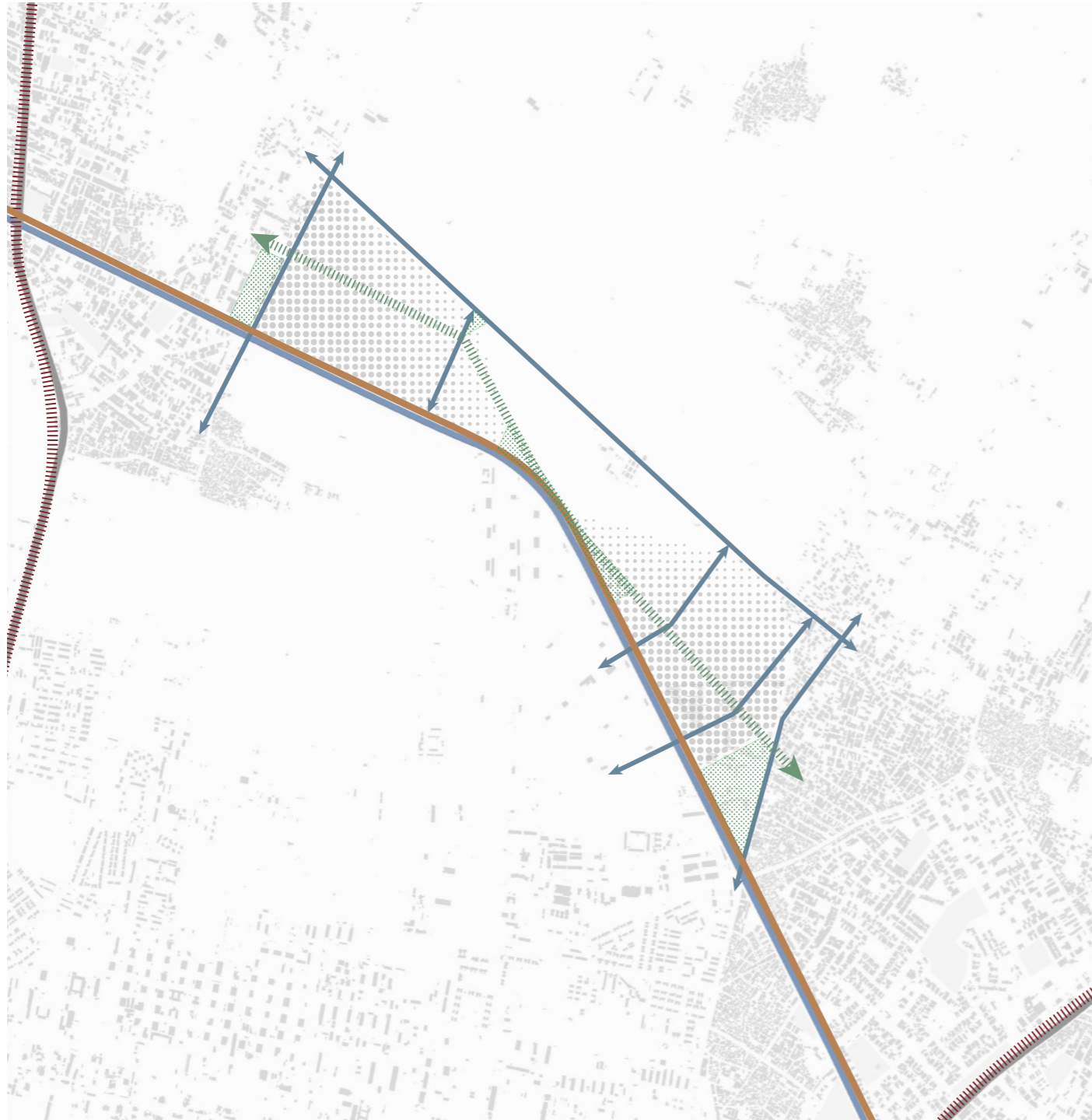
- Agricultural Green
- Existing Public Green
- Proposed Public Green

Water

- Existing Canal
- Existing Pond- Water at Rest
- Proposed Wetland- Water in Action

Infrastructure

- Fast Spine
- Medium Spine
- Slow Spine



Design Process: Prelim Plan

The initial planning phase integrates three key elements: morphological studies of the city, landuse analysis, and the green infrastructure network. The plan involves establishing a secondary axis that links the primary axes on either side, spanning across all urban-rural segments. Intermediate connectors are designed to bridge the secondary axis with settlements bordering the canal. Reflecting the city's character, emphasis is placed on enhancing public green spaces by introducing a green boulevard, serving as a connector with slower mobility, unifying diverse areas along this spectrum.

Another focal point of this approach is the implementation of a fading settlement pattern, advocating reduced volume in rural zones. This strategy aligns with the concept of gradually decreasing settlement density as areas transition from urban to peri-urban and finally to rural, respecting the distinct character and needs of each zone within the broader urban-rural spectrum.







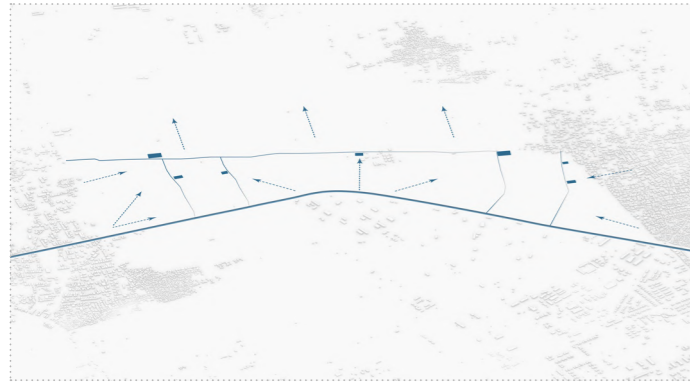
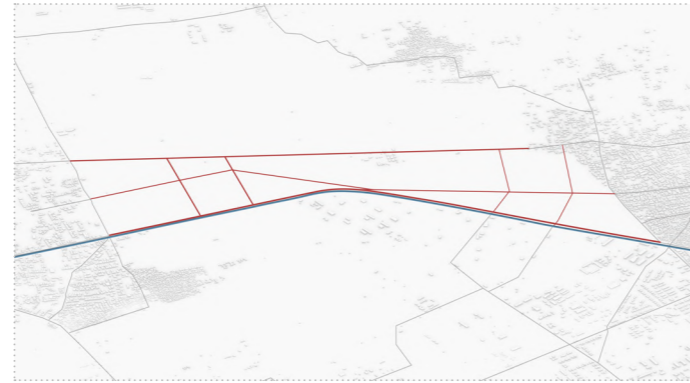
-  Primary Axis
-  Secondary Axis
-  Intermediate Connector
-  Green Connector
-  Green
-  Settlement

Figure 50: (On the left) Map shows the preliminary planning of the connection between all the fragments.



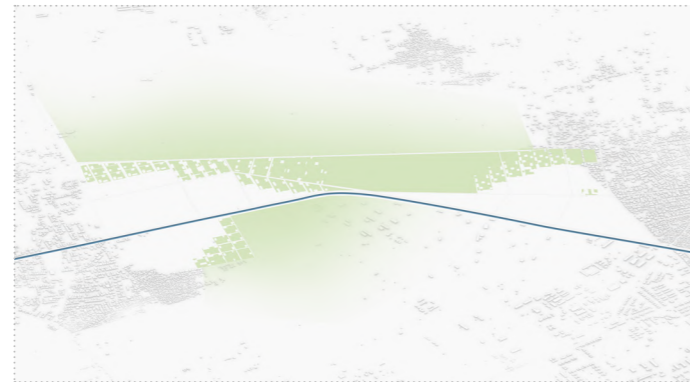
Water and Slope



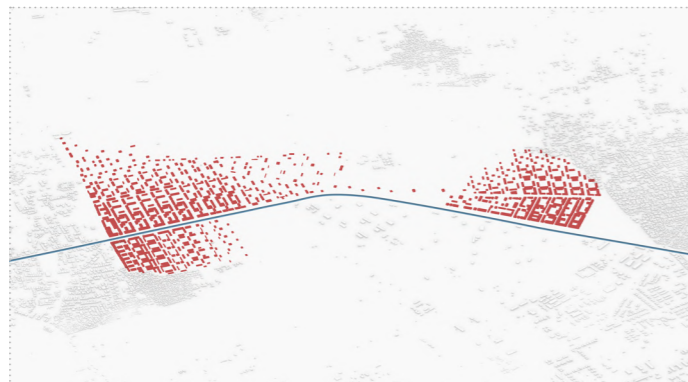
Links



Public/ Private Green



Public/ Private Agriculture



Built-up

Design Process: Phases

The systematic approach unfolds across five distinct phases, harmonizing practicality and creativity seamlessly.

Water and Slope: The natural topography guides the allocation of water elements, with wetlands positioned at the lowest elevation, and directional indicators representing water flow out from the settlements. A conduit running below the ground facilitates a direct link between the canal and wetlands, enabling water flow.

Links: These connectors, aligned with the preliminary plan, illustrate the connections between different zones, incorporating medium and slow connectors for differentiated purposes. The directional layout of these connectors respects the existing morphological patterns to maintain the area's original character.

Public/Private Green: Preserved and newly introduced green spaces cater to public leisure, strategically placed to manage and integrate green spaces effectively. This deliberate arrangement ensures a cohesive flow between built-up areas and green zones.

Public/Private Agriculture: Existing agricultural zones are preserved, offering two distinct zones: public areas for community engagement in agricultural activities and private sections for exclusive farmer access, limiting human intervention.

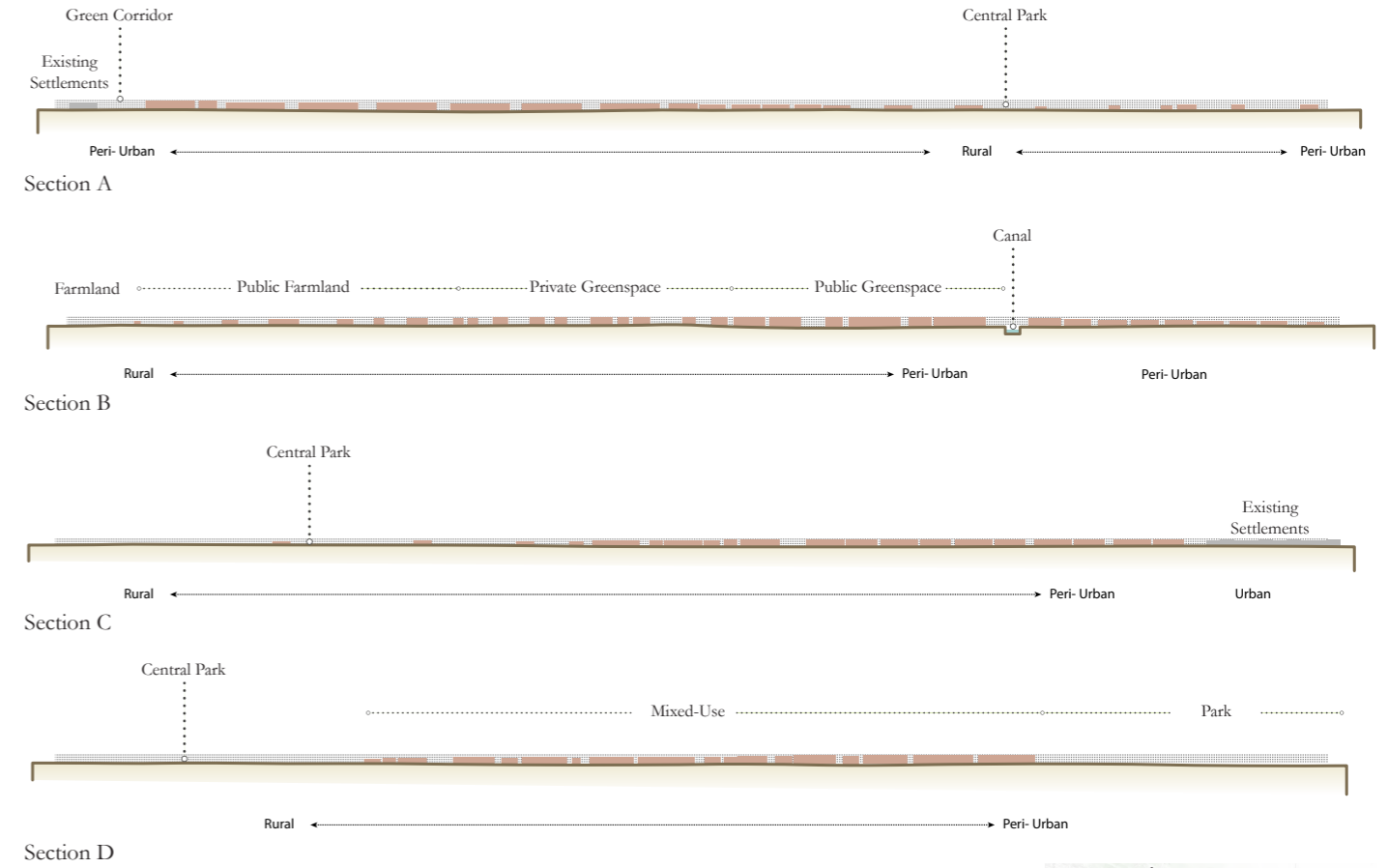
Built-up: Addressing the uneven transition from urban to rural zones, this design phase introduces transitional spaces on the left and peri-urban zones on the right. This strategic step aims to create smooth shifts, bridging fragmented areas with the canal to enhance connectivity and cohesion.

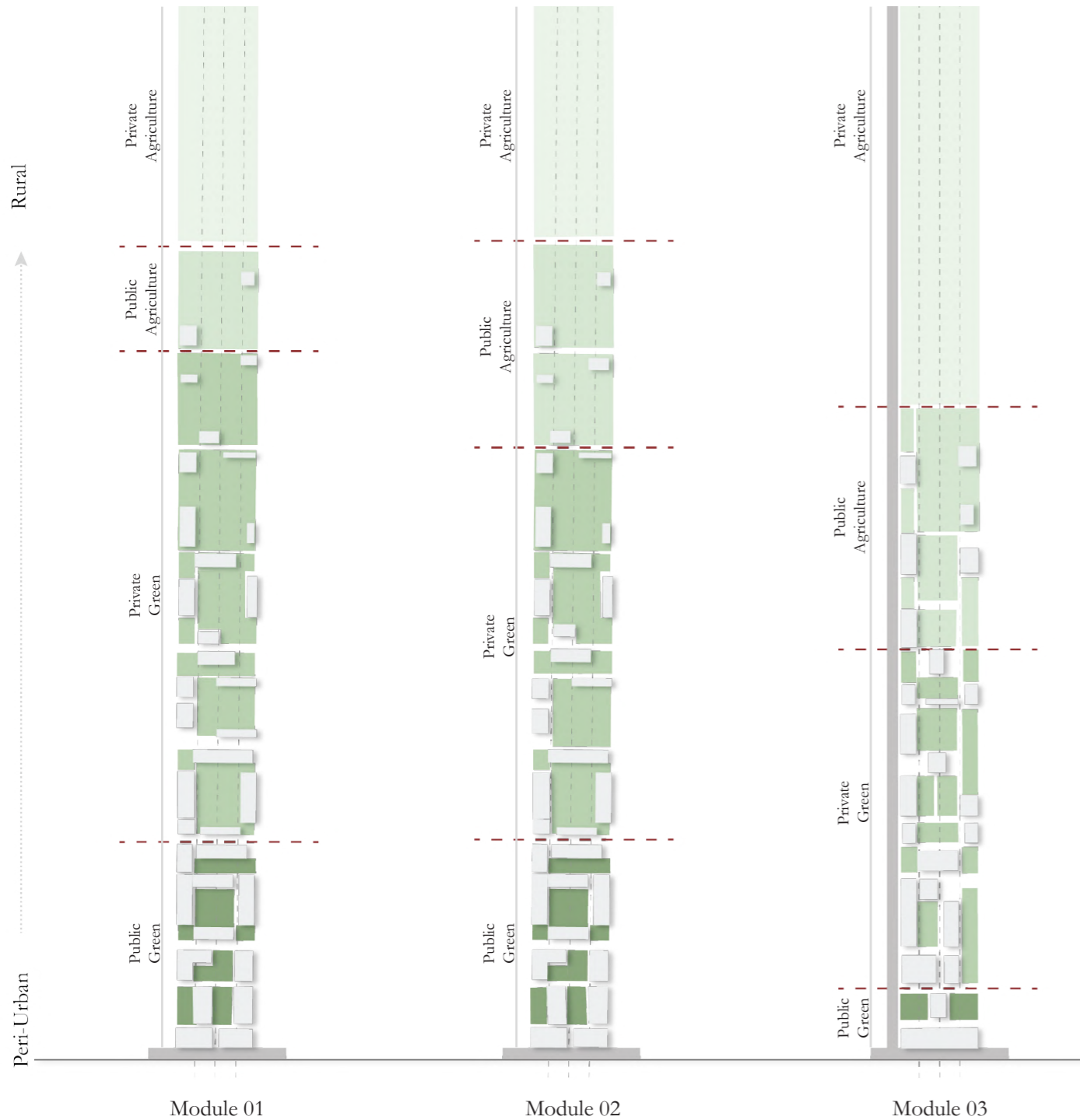
Figure 51: (On the left) Maps show illustrate the five sequential stages of the design process.



7.4 Design Project

Masterplan & Sectional Composition



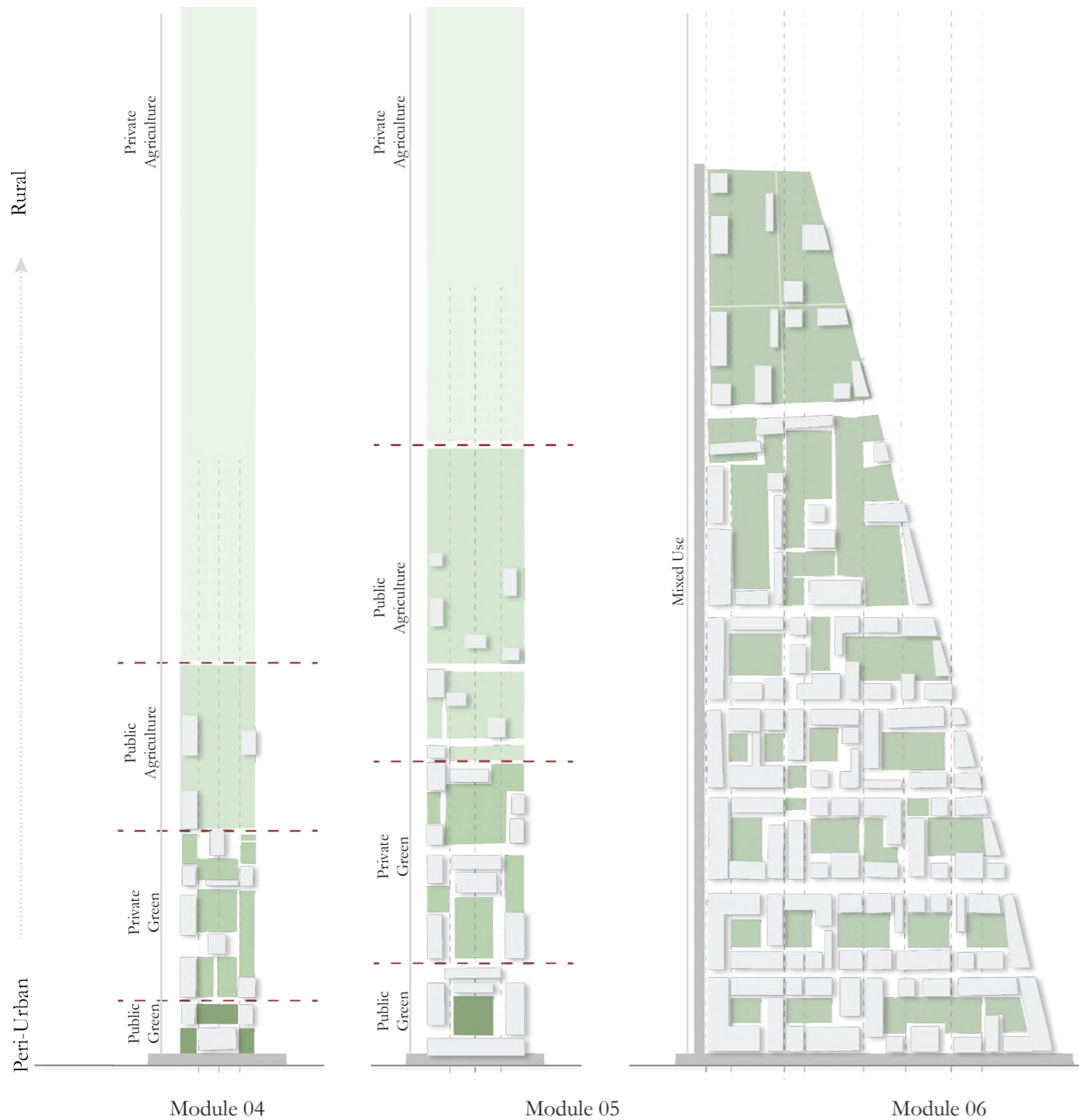


Typologies & Modules

The settlement's composition aims to bridge the gap between urban and rural landscapes, offering a transformative approach that introduces a new scale of settlement types and their interrelations. This method brings about a significant shift in the urban-rural dynamic through the implementation of a form-gradient settlement typology. At its root, this typology integrates reticular shape with public services and connectors aligned with the mobility network, facilitating continuous movement and connectivity within the settlement. These typologies, when put together, showcase gradient horizontally but also vertically embracing agriculture from both ends.

Moreover, this settlement prototype emphasizes a green-gradient approach, prioritizing various forms of greenery. The purposeful focus on diverse green spaces fosters an amalgamation of green and grey elements, generating a harmonious green-grey form gradient throughout the settlement.

Figure 52: (On the left) Typologies depicting the gradient approach for settlement and green.



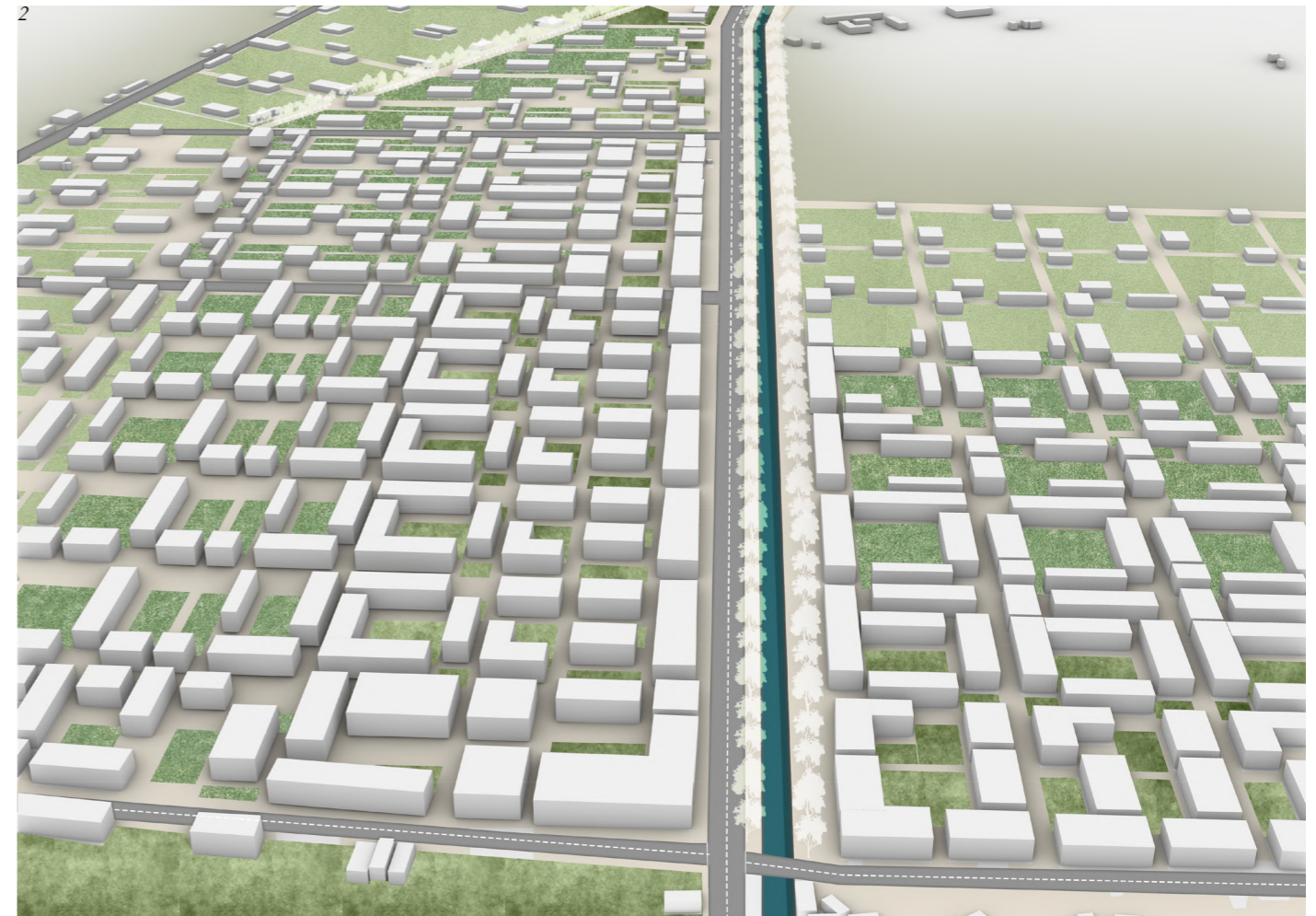
The settlement typology goes beyond the physical layout; it also serves as a link to the surrounding agricultural areas. These zones possess dual roles, serving as potential sources of agricultural goods for local consumption and trade through initiatives like farmer's markets. Simultaneously, they play a pivotal role in the urban renewal process, acting as a bridge between environmental components affected by ongoing urbanization. The interconnectedness of green and blue infrastructure, the environment, and agriculture form a cohesive and continuous system alongside grey infrastructure elements, fostering a balanced and corresponding urban-rural interface.

Figure 53: (On the left) Typologies depicting the gradient approach for settlement and green.

Design Illustrations

1. The illustration shows the right flange of the design project consisting of mixed use settlement and merging into agriculture.

2. This illustration shows the composition of the space from Peri-urban smoothly transitioning to the rural.



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Urban-Rural Linkage in Desakota Region:

Enhancing Urban-Rural link by a Chess-Inspired Metro-Matrix Approach in Delhi-Meerut Corridor

Prajith Pradeep Kumar | Tanya Gupta



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