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P & D DEPARTMENT GOVERNMENT OF SINDH

Directorate of Urban, Regional Policy and Strategic Planning, Planning and Development Department, Government of Sindh

"Preparation of Development Master Plans for Twelve (12) Major Secondary Cities of Sindh
(Package-1 Khairpur, Ghotki, Mirpur Mathelo and Rohri)"

DRAFT STRATEGIC DEVELOPMENT PLAN REPORT

[Ghotki City]

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SECTION - 1: STRATEGIC DEVELOPMENT PLAN – AN OVERVIEW

1.1 Project Background

The Government of Sindh established the Directorate of Urban, Regional Policy, and Strategic Planning to provide technical assistance to the Planning and Development Department of the Government of Sindh on policies, plans, issues, programs, projects, and schemes related to urban revitalization and development.

So far, Directorate has completed 17 Development Master Plans of District Head Quarters / Secondary cities of Sindh. In order to maximize the coverage of the Master Plans for developing other important secondary towns of Sindh as engines of growth, development master plans of the following 12 major secondary cities of Sindh are planned to be prepared through hiring of consulting firms i.e., Kotri, Hala, Moro, Tando Adam, Khairpur, Rohri, Mirpur Mathelo, Ghotki, Shikarpur, Jacobabad, Kashmore and Kambar. This activity will be beneficial for developing the regional plans of different urban/ peri-urban centers of Sindh.

The scheme will be carried out in Three (03) different packages i.e.

Package - 1. Khairpur, Ghotki, Mirpur Mathelo and Rohri

Package - 2. Shikarpur, Kandhkot, Jacobabad and Kambar

Package - 3. Kotri, Hala, Tando Adam and Moro

In line with this mission, we are proud to announce the initiation of the "Development Master Plans Preparation Project" for Twelve (12) Major Secondary Cities of Sindh, specifically Package-1, which includes Khairpur, Ghotki, Mirpur Mathelo, and Rohri. This significant endeavour has been entrusted to Asian Consulting Engineers Pvt. Ltd., following a comprehensive assessment of their technical and financial proposals and a compelling presentation to our esteemed client. The formal agreement for this project was formally executed on March 31, 2023.

The four cities of Package 1 are located in Sukkur Division which is a significant administrative unit and comprises of multiple districts. Khairpur city is located in District Khairpur, Ghotki and Mirpur Mathelo city is in District Ghotki and Rohri city is in District Sukkur. Each district has its own Deputy Commissioner (DC), who is responsible for the overall administration and law and order within the district. Within each district, there are several talukas. These talukas are responsible for local administration, revenue collection, and land record maintenance. The four cities Khairpur, Ghotki, Mirpur Mathelo and Rohri are located in their respective taluka's.

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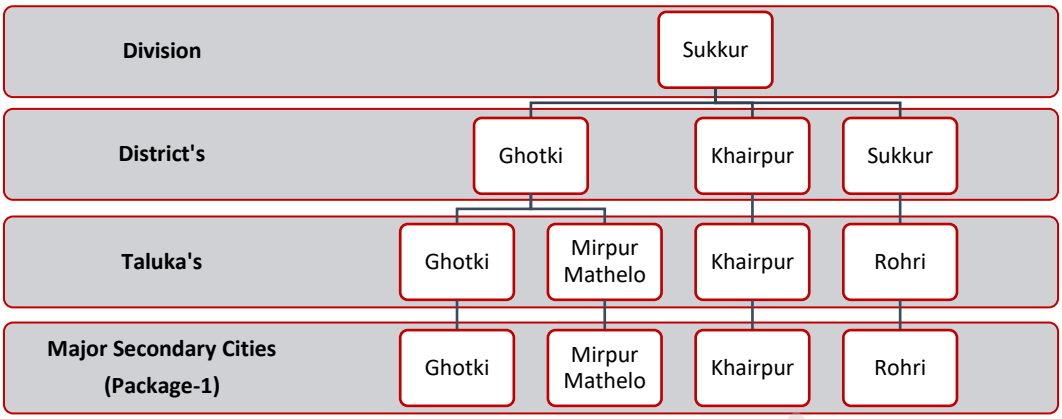


Figure 1-1, Administrative Division of the Package-1 Cities

Source: *The Consultant Team*

1.2 General Planning Issues

Despite its significant contribution to the national GDP, the province of Sindh has not received the development funding it deserves. The Directorate of Urban, Regional Policy and Strategic Planning (DURPandSP) serves as a platform through which grassroots development strategies are formulated by professionals to improve the quality of life for residents. An extensive review of the existing literature reveals several critical issues impacting Sindh's development:

- The lack of a comprehensive and sustainable urban planning policy and regulatory framework has hindered effective urbanization across Sindh, leading to unchecked, haphazard growth in cities.
- Without an updated housing policy that supports sustainable and smart growth, the province faces inadequate housing solutions that fail to meet the demands of its growing population.
- Fragmented coordination among the numerous institutions responsible for urban development has led to ineffective planning and execution of development projects.
- Past master and development plans have seen minimal implementation due to a lack of robust enforcement mechanisms, stalling urban development progress.
- Local cultural preferences and traditional settlement patterns often resist modern urbanization efforts, posing challenges to implementing contemporary urban strategies.
- Many district headquarters face critical deficiencies in municipal infrastructure, particularly in essential services such as water supply, wastewater management, and solid waste management.
- The province lacks comprehensive spatial and non-spatial databases necessary for effective planning, monitoring, and management of development initiatives.

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1.3 Project Objectives

The project's primary objectives revolve around establishing a comprehensive policy framework aimed at enhancing the holistic development and governance of Sindh's major secondary cities, specifically Khairpur, Ghotki, Mirpur Mathelo, and Rohri. This strategic initiative is driven by the need to pinpoint strategic areas and corridors that will guide the cities' future spatial expansion while fostering environmental sustainability and equitable economic progress.

Key objectives of the project include:

- Crafting a cohesive policy framework that seamlessly integrates physical, environmental, social, and economic aspects to drive a well-rounded urban development approach.
- Identifying areas for future spatial expansion that are conducive to environmentally sustainable development, with a keen focus on minimizing ecological impacts and optimizing resource use.
- Promoting economic growth that benefits all strata of society, ensuring that the fruits of development are shared inclusively among the population.
- Enhancing the governance mechanisms within these cities to foster more efficient, transparent, and responsive administrative structures.

1.4 The Strategic Development Plan Output

The strategic development plan for Sindh's secondary cities charts a roadmap for sustainable urban growth, infrastructure enhancement, and quality of life improvements. Each city is envisioned with a cohesive, unique vision aligned with regional goals, emphasizing balanced urbanization, economic vitality, social equity, and environmental resilience. Detailed land use and zoning guidelines prevent sprawl and protect sensitive areas, while infrastructure plans prioritize efficient transport and connectivity, encouraging non-motorized options for pedestrian-friendly environments.

Housing strategies focus on affordable solutions and essential services like schools and healthcare, while economic zones aim to attract investments, support local industries, and create jobs. Environmental sustainability is central, with measures for pollution control, waste management, and climate resilience. Social inclusivity promotes equitable access and community engagement, preserving cultural heritage.

The plan outlines an actionable framework with phased goals, clear responsibilities, and timelines, supported by monitoring mechanisms for adaptive management. Policy recommendations also strengthen local governance and capacity-building, guiding Sindh's secondary cities toward vibrant, inclusive, and resilient futures.

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SECTION - 2: OVERVIEW OF GHOTKI AND ITS ENVIRONMENT

2.1 Introduction

In this section, the current situation of Ghotki city and its surrounding district is explained. This section outlines the current demographic, climatic, geographic, cultural, and historical features of Ghotki city and its district. It highlights the area's strategic location, environmental conditions, and rich heritage, providing a foundation for understanding its existing situation and development potential.

2.2 District at Glance

The Ghotki District is one of the districts of Sukkur division. Ghotki was one of the talukas of district Sukkur at the time of partition, but in 1993, due to administrative reasons, it was given the status of a district with Mirpur Mathelo as its District Headquarter. It is the northernmost district of Sukkur Division. Ghotki District consists of 5 talukas: Mirpur Mathelo (District Headquarter), Ghotki, Khangarh, Daharki, and Ubauro.

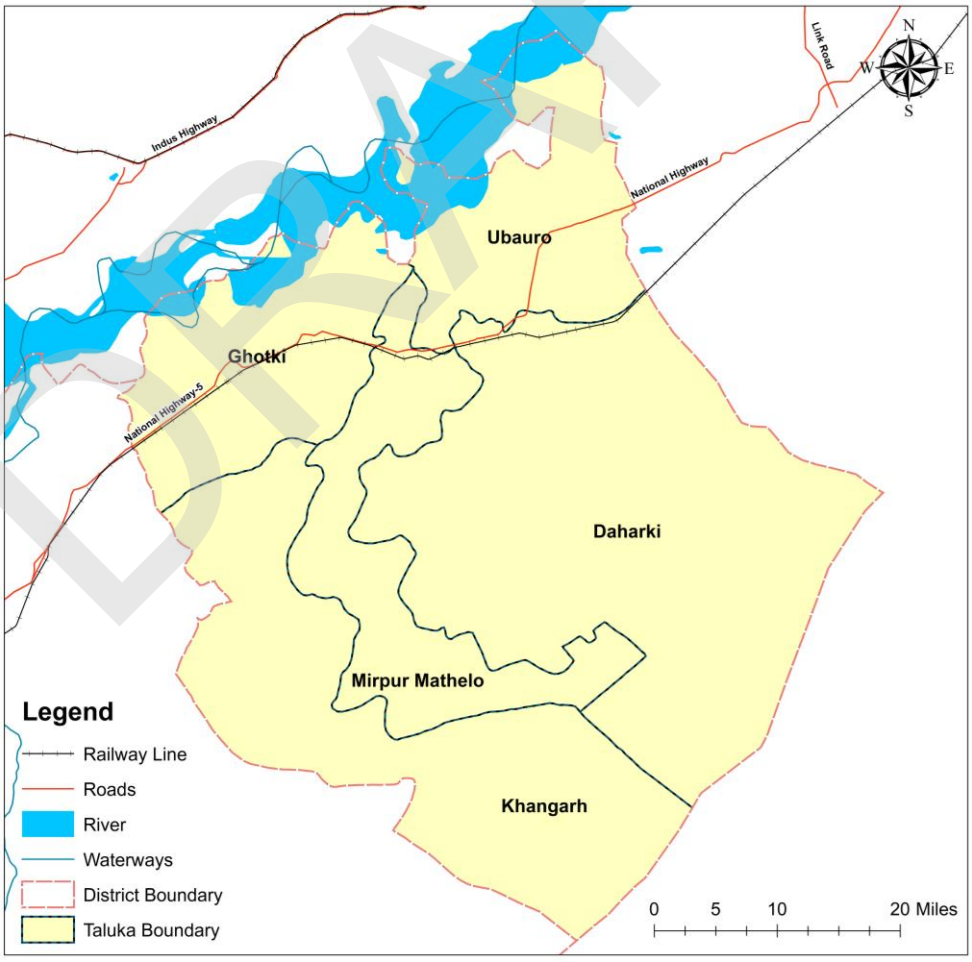


Figure 2-1, Location Map of Ghotki District

Source: *The Consultant Team*

2.2.1 Geographical Location

The Ghotki district is situated in the north-eastern part of Sindh provinve. It is located between 27° 19' 9" to 28° 18' 19" North latitudes and 69° 10' 12" to 70° 11' 20" East longitudes, with an elevation of 72 meters (239 ft) above sea level. The district shares its northern boundary with Rahim Yar Khan District of Punjab province, while to the south lies Sukkur District. On its eastern side, it borders Bahawalpur District of Punjab and India, while Kashmore District lies to its west. The district is strategically located along the western bank of the Indus River and primarily consists of fertile plains that are ideal for agriculture. As part of the Upper Sindh region, Ghotki is positioned approximately 500 kilometres north of Karachi. The district headquarters, Ghotki city, is located along the National Highway (N-5), which serves as a major transportation artery connecting Karachi to Peshawar.

2.2.2 Topography, Geology and Soils

The topography of Ghotki District is predominantly flat and plain, divided into three distinct geographical regions: Desert Area, Cultivable Area and Riverine Area (Katcho/Katcha). The Desert area, known as Achhro Thar (white desert), is part of the largest Thar Desert, with its northern part (Nara Desert) covering major portions of Ubauro, Mirpur Mathelo, Daharki, and Khangarh talukas. Between the desert and riverine areas lies the Cultivable area, separated from the desert by the Eastern Nara Canal, and irrigated by the Ghotki Feeder Canal of Guddu Barrage system. The third region comprises the Riverine areas (Katcho/Katcha), which fall within the natural flood plains of the Indus River[1].

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[1] *Pakistan Almanac*

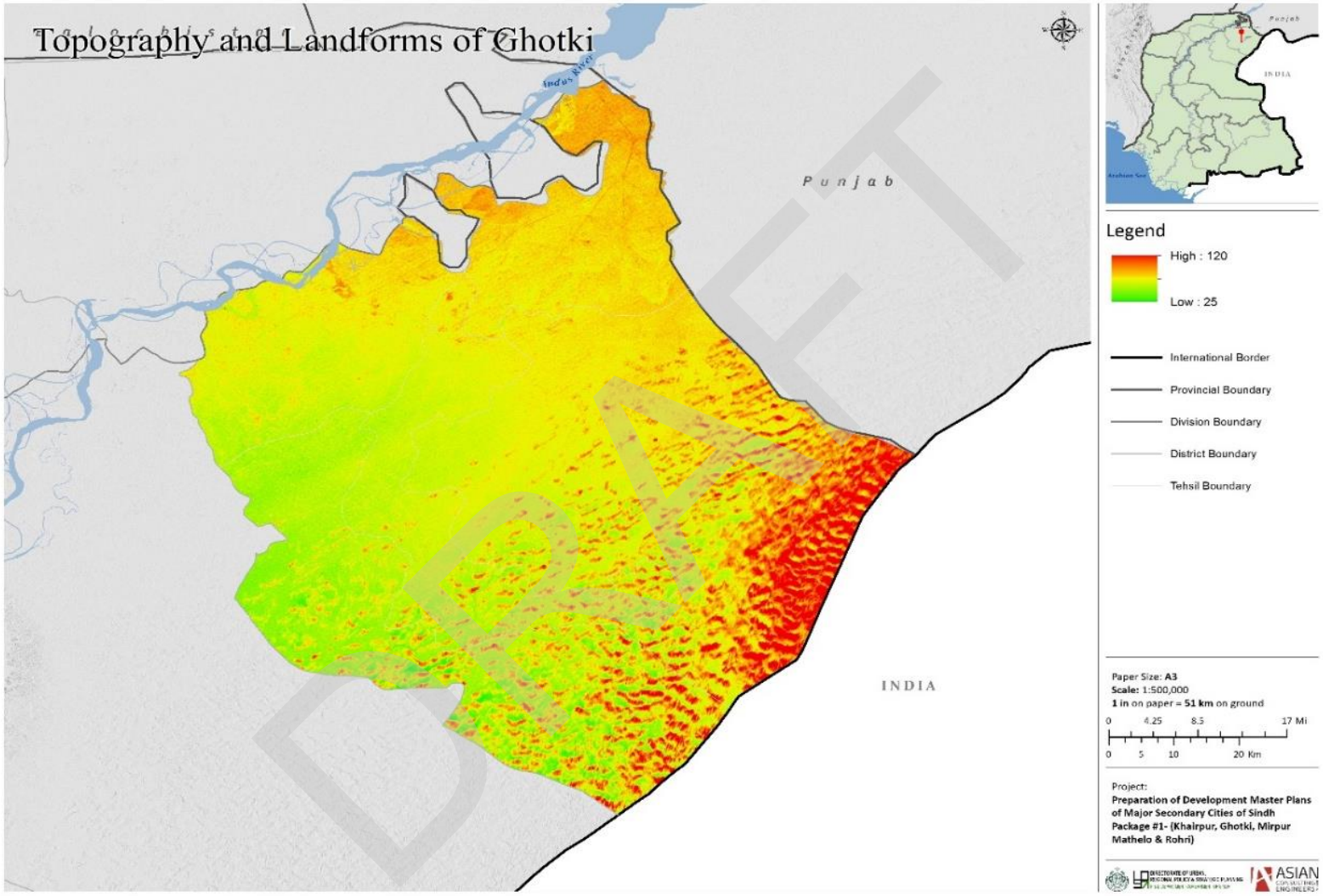


Figure 2-2, Topography and Landform of Ghotki District

Source: *The Consultant Team*

Geologically, Ghotki District is composed of sedimentary and volcanic rocks of quaternary type, divided into three broader zones: the Indus active floodplain area, the canal-irrigated region served by the Ghotki feeder, and the desert zone. The district's natural vegetation is diverse, featuring Rakh (tropical thorn) in the active and old flood plains of the Indus, desert and semi-desert vegetation in the desert zone, and thick riparian forest in 03 to 04 small pockets along with a sparse forest belt running partially along the Indus River[2].

While, the soils of the cultivable and riverine areas of Ghotki district are characterized by alluvial soils deposited by River Indus. The alluvium consists of a succession of layers of clay and sand. Deep below the alluvial deposits is a thick bed of sandstone with intercalations of clay and siltstone layers known as the Siwalik formation.

The Soils of District Ghotki are categorized as under:

Table 2-1, Soil based Zoning of District Ghotki

Category	Soil Type
Zone A	Loamy, Sandy striated soils of young good plains
Zone B	Loamy, Clayey soils of older riverplains
Zone C	Rolling to hilly sandy soils of Aeolian deserts.

Source: *DDMP District Ghotki, 2023*

[2] *DDMP District Ghotki, 2023*

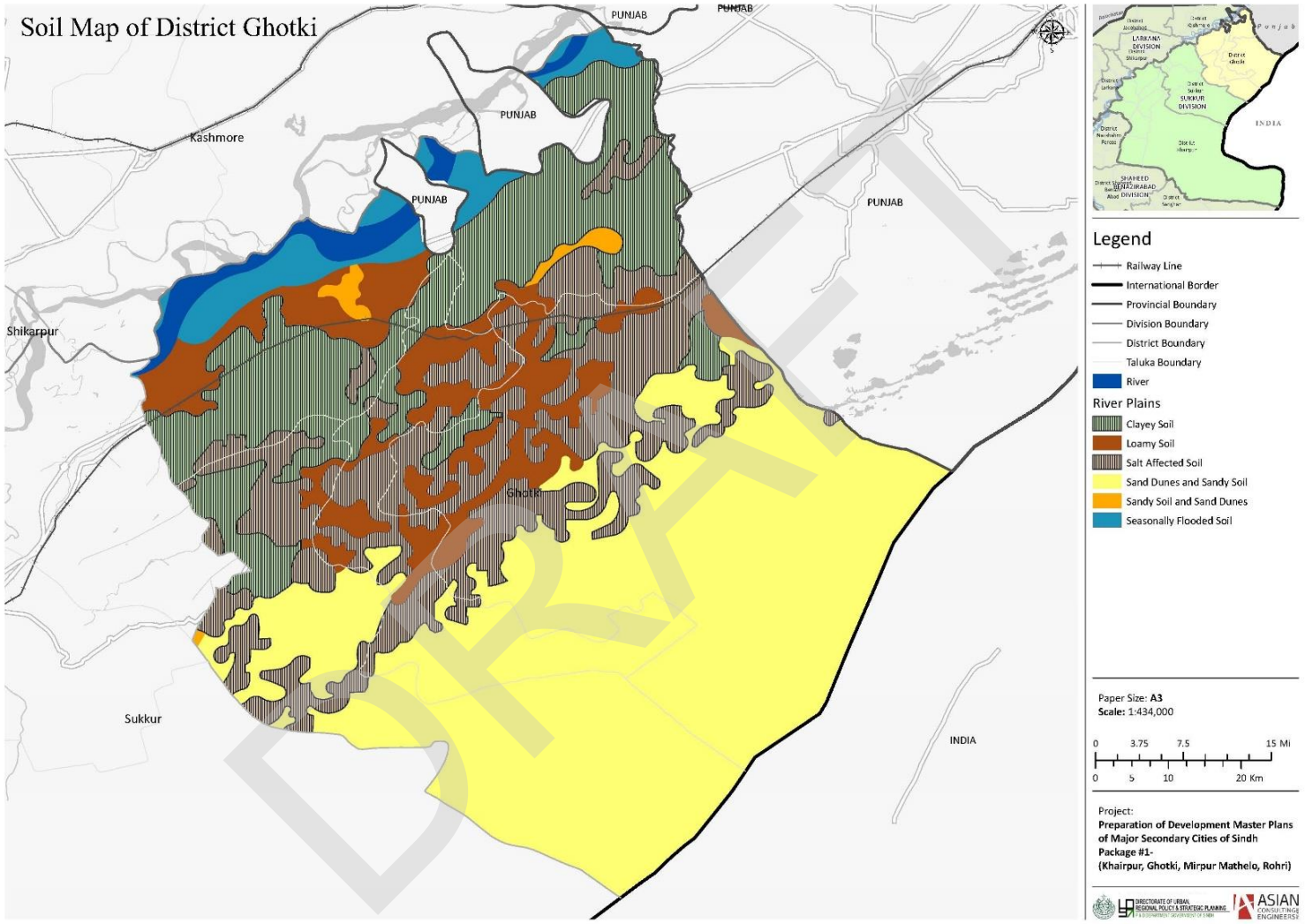


Figure 2-3, Soil Map of District Ghotki

Source: *The Consultant Team*

2.2.3 Climate

The climate of the Ghotki district is arid subtropical, characterized by hot summers and mild winters. May, June, and July are the hottest months. The winter months are December, January, and February.

The mean maximum temperature during summer is 44°C and the mean minimum is 29°C. During winter, the mean maximum temperature is about 23°C and the mean minimum is 9°C. August and September are hot, with high humidity. Severe hot winds blow, and occasional dust storms occur during May, June, and July.

The average annual rainfall of the area is 122 mm, with mean annual relative humidity of 52% and a wind speed of 80 km/ hr with a Northeast prevailing wind direction. Frost is common and occurs during December and January.

During the summer, the wind direction is mostly southeasterly and in winter it is northeasterly. Flood season starts in June and continues up to September; the flood discharges are at their peak flows during July and August[3].

2.2.4 Demography

Ghotki District covers approximately 6,083 sq. km and had a population of 1,772,609 persons in 2023, consisting of both rural and urban populations. The rural portion has a population density over thrice that of the urban portion (78.6% vs 21.4%) in 2023, reflecting the fact that the majority of the population lives in rural areas. The growth rates of the district, as observed in past census reports, indicate a continuous decline from 5.27% to 1.22%, reflecting an overall 77% decrease in the growth rate from 1961.

Table 2-2, Intercensal Population Distribution of District Ghotki

Year	Population	Average Annual Growth Rate
2023	1,772,609	1.22%
2017	1,648,708	2.83%
1998	968,797	3.26%
1981	558,058	4.03%
1972	401,318	5.27%
1961	221,243	2.1%
1951	179,186	-

Source: *Pakistan Bureau of Statistics*

Ghotki District is administratively divided into five talukas: Ghotki Taluka, Mirpur Mathelo Taluka, Daharki Taluka, Khangarh Taluka, and Ubauro Taluka. **Table 2-3** provides an overview of the population demographics in the different talukas within Ghotki District. Ghotki Taluka accounts for

[3] *Pakistan Almanac*

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approximately 30.5% of the population, making it the largest taluka among the five talukas in terms of population in 2023. The average annual growth rates range from 1.09% to 1.38%, with the lowest being in Ghotki Taluka and the highest in Ubauro Taluka with highest urban growth rate as well, over the period from 2017 to 2023.

Table 2-3, Taluka's Population Distribution of District Ghotki

Taluka	Area (sq.km)	Population (2023)	Average Household Size	Average Annual Growth Rate (1998-2017)	Average Annual Growth Rate (2017-2023)
Daharki	2,088	335,145	5.4	2.97%	1.27%
Ghotki	763	540,939	5.3	2.82%	1.09%
Khangarh	1,986	162,318	5.0	2.94%	1.37%
Mirpur Mathelo	593	350,647	5.1	2.67%	1.13%
Ubauro	653	383,560	5.6	2.84%	1.38%

Source: *Pakistan Bureau of Statistics*

2.2.5 Ethnicity and Culture

The population of Ghotki District comprises various ethnic groups, with Sindhi and Saraiki speakers forming the majority. The main tribes include Mahar, Shar, Chachar, Pitafi, Bhayo, Malik, Ghallu, Syed, Qureshi, Arain, and Rajput. The Hindu population also lives in the district. These tribes maintain their distinct cultural traditions while sharing common cultural elements of Sindhi heritage. Music and poetry, particularly Sindhi folk music and Sufi poetry, play a significant role in the local culture. The area is known for its numerous Sufi shrines which serve as important cultural and spiritual centers, notably the shrine of Syed Muhammad Shah Ghazi in Ghotki.

The district's cultural landscape is characterized by traditional crafts like Sindhi embroidery, pottery, and textile weaving. The local dress includes the traditional Sindhi Ajrak and Topi for men, while women wear Shalwar Kameez with Sindhi embroidery. Local festivals, particularly those associated with harvests and religious occasions, are celebrated with great enthusiasm throughout the district. The district has a strong oral tradition of folk tales and poetry, passed down through generations; while wrestling (Malakhra) and other traditional sports remain popular recreational activities.

2.2.6 Historical Places

In Ghotki District, there are several historical and famous places that hold cultural and religious significance. The most prominent among these are the numerous Sufi shrines scattered throughout the district, which serve as important spiritual centers and attract devotees from various parts of the

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country. Notable among these is the shrine of Syed Muhammad Shah Ghazi in Ghotki city, which is a significant pilgrimage site. Another important religious site is the shrine of Pir Syed Muhammad Shah located in Daharki taluka, which draws visitors throughout the year.

The district also features several historic mosques and architectural structures that reflect the rich Islamic heritage of the region. Historical Jamia Masjid/ Grand Mosque, Adalpur village, Ghotki was constructed by Syed Ghous Moosa Shah in 1732 AD, is one of the historical mosques of the district. The Katcho/Katcha area along the Indus River contains archaeological sites that provide insights into the ancient settlements of the region.

2.2.7 Major Connectivity

Ghotki District is strategically positioned with significant transport linkages that facilitate connectivity within the region and beyond. The district is served by a network of roads that connect it to major cities such as Sukkur and Rahim Yar Khan, enhancing trade and mobility for residents. The National Highway (N-5), which runs approximately 80 km through the district, serves as a vital corridor linking Ghotki to other major cities in Pakistan. Additionally, the Sukkur-Multan Motorway (M-5), located nearby, includes the Ghotki Interchange, facilitating efficient access to high-speed travel for both passengers and freight. The district is also served by a Mainline (ML-1) Railway network that connects it to the main line of Pakistan Railways, further supporting the movement of goods and people across regions. Overall, the combination of major roads, motorway access, and a robust railway network positions Ghotki as an important hub for trade and transportation in Sindh province.

2.3 Ghotki City

2.3.1 Historical Background

Ghotki town was founded by a general of Raja Ibne Selaj Birhman (a relative of Raja Dahar) of Sindh in 637 AD. He established an army camp in this area, which eventually became a village where people from different tribes resided. Mohammad Bin Qasim conquered Sindh, and one of Raja Dahar's grandsons accepted Islam, resulting in the formation of the "Ghota" tribe. They named this village "Dharwali" to honour their grandfather. The village's name changed from Dharwali to Loh-e-Sahiban (which means the land of purity or place of purified persons) in 1517 A.D. and later changed its name to "Ghotki" after 1817.

Administratively, the town was granted the status of a Town Committee as part of Sukkur District during the first census of Pakistan in 1951 when its population was in the thousands. Later, its Town Committee status was changed to Municipal Committee under the Sindh Local Government Ordinance of 1979, still under Sukkur District. In 1993, Ghotki was established as a separate district; before that, it was part of Sukkur District.

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Figure 2-4, Jamia Mosque, Ghotki

History suggests that Islam entered the subcontinent through Sindh, and the Jamia Mosque in Ghotki is over 300 years old, providing evidence of Sindh's role as a gateway for Islam in the subcontinent. It was constructed in the reign of Mian Noor Muhammad's son of Mian Yaar Muhammad Abbasi Kalhoro in the year 1148 hijra. Ghotki is specialized in making sweets named Perra which is made up of milk and Khoya. Along with the decoration of almonds and pistachio.

2.3.2 Existing Institutional Capacity and Administrative Gaps

A) Housing

The housing sector in Ghotki is governed by a multi-tiered institutional framework comprising provincial authorities, development agencies, and local administrative bodies. Each entity operates within defined legal mandates to address housing provision, urban planning, and infrastructure development.

1. Sindh Housing and Town Planning Department

The department serves as the apex policy-making body for urban development across Sindh. Its primary responsibilities include formulating provincial housing strategies, preparing regional master plans, and regulating land-use allocations. As the supervisory authority for development bodies like SDA and SKAA, it oversees the implementation of large-scale housing projects, including those funded through international partnerships. The department also plays a pivotal role in coordinating federal-provincial housing initiatives such as the Naya Pakistan Housing Programme (NPHP), ensuring alignment with national urban development goals.

Resource Allocation:

- Annual development allocations from Sindh Government
- Federal grants under programs like Naya Pakistan Housing Programme (NPHP)
- International funding (World Bank, UN-Habitat) for affordable housing initiatives

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Operational challenges include:

- Limited field offices in secondary cities like Ghotki, necessitating dependence on local administrations.
- Ineffective coordination with municipal committees and development authorities, resulting in project delays.
- Centralized decision-making processes that hinder timely approvals.
- Suboptimal utilization of geospatial technologies for urban monitoring.

2. Sindh Building Control Authority (SBCA)

SBCA functions as the regulatory body for construction standards and building safety across the province. Its operational purview includes technical review of architectural plans, issuance of construction permits (NOCs), and structural inspections during project execution. The authority maintains enforcement powers to demolish illegal constructions and penalize violations of building bylaws. In rapidly urbanizing areas like Ghotki, SBCA' s role in preventing unplanned vertical expansion and ensuring seismic compliance is particularly critical.

SBCA's organizational capacity is as follow;

Funding Sources:

- Processing fees for plan approvals and NOCs
- Penalties from regulatory violations

Technical Resources:

- Teams of qualified inspectors and structural engineers
- Legal support for enforcement actions

Performance limitations include;

- Insufficient field staff for effective monitoring of construction activities.
- Bureaucratic hurdles in enforcement against illegal buildings.
- Vulnerability to corrupt practices in approval processes.

3. Sindh Katchi Abadis Authority (SKAA)

SKAA specializes in the regularization and upgrading of informal settlements through a rights-based approach. Its work involves conducting cadastral surveys of Katchi Abadis, processing lease documentation to grant tenure security, and coordinating infrastructure upgrades in regularized areas. The authority serves as an intermediary between informal communities and line departments, facilitating access to water, sanitation, and social services post-regularization.

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Its resource profile is as follow,

Financial Basis:

- Provincial budget allocations
- Revenue from lease documentation fees

Implementation Structure:

- Field survey teams for settlement mapping
- Community engagement units

Institutional Weaknesses:

- Chronic underfunding for post-regularization infrastructure development.
- Outdated settlement data affecting policy formulation.
- Protracted lease processing timelines discouraging formalization.

B) Education

The education ecosystem in Ghotki involves coordinated efforts across provincial departments, district offices, and specialized foundations. While these entities possess distinct mandates and resources, systemic gaps in infrastructure, governance, and service delivery persist.

1. Sindh School Education and Literacy Department (SELD)

As the primary policymaker for K-12 education, SELD oversees curriculum development, teacher recruitment, and school infrastructure provisioning across Sindh. It administers provincial education budgets, distributes textbooks, and implements donor-funded programs (e.g., USAID literacy initiatives). Through SEMIS (Sindh Education Management Information System), the department monitors school performance metrics, teacher attendance, and enrolment trends.

Key Resources:

- Substantial teaching workforce across primary, secondary, and specialist educator tiers
- School leadership teams with trained administrators
- Network of public education facilities with dedicated girls' secondary institutions
- Technology-enabled systems for staff monitoring and resource distribution

Critical Limitations:

- Inadequate physical infrastructure in rural learning environments
- Persistent pedagogical gaps in instructional quality
- Systemic operational challenges in staff deployment protocols
- Uneven policy implementation across geographically isolated areas.

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2. District Education Office (DEO), Ghotki

The DEO serves as the implementation arm of SELD, conducting school inspections, managing teacher deployments, and coordinating with School Management Committees (SMCs). It compiles district-level education data for provincial reporting and oversees minor infrastructure repairs.

Operational Capacity:

- Staffing includes few education officers (male/female) and field supervisors.
- SEMIS-linked attendance dashboards, standardized inspection formats.

Institutional Constraints:

- Logistical gaps include only limited vehicles serving schools, hindering monitoring.
- Bureaucratic delays require SELD approval for expenditures
- Manual data aggregation results in reporting lags of 3-6 months.

3. Higher Education Department (HED), Sindh

HED governs tertiary education via only few public colleges in Ghotki, offering intermediate and bachelor's programs affiliated with Shah Abdul Latif University. It manages faculty recruitment through SPSC and allocates development funds for lab upgrades.

Existing Capacity:

- Significant gender disparity favouring males
- Insufficient number of functional science labs.

Critical Barriers:

- High vacancy rate in STEM subjects.
- Infrastructure deficit involves libraries lack reference materials.

4. Sindh Education Foundation (SEF)

SEF bridges access gaps through public-private partnerships, operating non-formal schools in Ghotki's underserved villages. It provides performance-linked grants to NGOs, administers annual learning assessments (ASAT), and supplies free uniforms/stationery.

Resource Base:

- Partnerships with 12 local NGOs managing community schools.
- Funding through annual budget (60% donor-dependent).

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Systemic Challenges:

- Serves only a few out-of-school children in Ghotki.
- Teacher attrition rates are high due to low wages
- Absence of secondary options forces graduates to discontinue their education.

C) Health

The healthcare system in Ghotki operates through a network of provincial and district-level institutions, each playing distinct but interconnected roles in service delivery. Despite existing infrastructure, the sector faces challenges in accessibility, quality, and governance. Below is a detailed analysis of key health institutions and their operational frameworks.

1. District Health Office (DHO), Ghotki

The DHO serves as the primary implementing body for health services in Ghotki, overseeing taluka hospitals, Basic Health Units (BHUs), and Rural Health Centers (RHCs). It manages immunization programs, maternal and child health services, and disease surveillance, reporting directly to the Sindh Health Department.

Key Resources:

- Limited number of medical staff (doctors, LHVs, vaccinators) across Ghotki
- District Health Information System (DHIS) for real-time disease tracking.

Critical Limitations:

- Most of the BHUs operate without a doctor, some lack female medical staff.
- Frequent stockouts of essential medicines due to centralized procurement.
- Most of the health facilities lack clean water and electricity.

2. People's Primary Healthcare Initiative (PPHI)

PPHI manages many BHUs in Ghotki under a public-private model, focusing on maternal health, vaccinations, and outpatient care. It employs community health workers for outreach.

Key Resources:

- Funding through annual budget (Sindh Government + World Bank).
- Android-based real-time monitoring of patient visits.

Critical Limitations:

- No emergency or surgical care, patients are referred to Sukkur.
- Excludes urban slums and katcha (riverine) communities

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D) Recreation

The management of parks, green belts, and recreational areas in Ghotki involves coordinated efforts between provincial authorities and local administrative bodies. Each institution operates within defined legal mandates to address urban greening, public space maintenance, and encroachment prevention. The following section elaborates on their core functions, resource allocations, and operational constraints.

1. Municipal Committee (MC) - Ghotki

MC Ghotki serves as the primary custodian of urban open spaces under the Sindh Local Government Act 2013. Its mandate includes park maintenance, landscaping, and enforcement against encroachments in municipal limits.

Resource Allocation:

- Allocate the annual budget to the recreation sector
- Allocate more budget for horticulture staff and sanitation workers
- Ensure necessary equipment for basic maintenance
- Authority to collect fines for bylaw violations

Operational challenges include:

- Only a few public parks are being maintained
- There are many documented cases of park land encroachment
- Most of the park benches and water taps are non-functional
- There are no qualified landscape architects on staff
- Grievance redressal takes months to address

E) Disaster Management

Disaster Risk Reduction (DRR) is a cross-cutting theme, requiring the active participation of all stakeholders. This approach is essential for establishing a well-coordinated mechanism to ensure effective preparedness and response in the face of disasters. Following are the roles and responsibilities of various institutional bodies including the District Disaster Management Authority (DDMA), Taluka Disaster Management Committees (TDMCs), and Union Council Disaster Management Committees (UCDMCs). These institutions are tasked with disaster mitigation and coordination, in alignment with directives from the National Disaster Management Authority (NDMA) and the Provincial Disaster Management Authority (PDMA), thereby ensuring coherence with both national strategies and local needs.

The roles, responsibilities, and functions of the authorities and committees outlined are derived from Chapter IV and V of the National Disaster Management Act, 2010, as well as the relevant provisions of the Sindh Local Government Act, 2013, which define the disaster management responsibilities of Union Councils.

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1. Provincial Disaster Management Authority (PDMA)

Established in 2010 after promulgation of National Disaster Management Act, the Provincial Disaster Management Authority function under Rehabilitation Department, Government of Sindh. A dedicated authority for disaster management was established in purview of smooth inter and intradepartmental coordination, early preparedness for disaster mitigation, prevention, swift response to disasters and early recovery, and rehabilitation on build back better principals.

Organizational Structure and Members of PDMA:

Following are the Provincial Disaster Management Commission composition representatives;

Table 2-4, Representatives of PDMA

Sr. No.	Representative	Role
1.	Minister Rehabilitation Department	Chairperson
2.	PDMA Board	Member
3.	Secretary Rehabilitation	Member
4.	Director General	Member
5.	PS to DG	Member
6.	Director F/A	Member
7.	Director Operations	Member
8.	Deputy Director F/A	Member
9.	Deputy Director Hyderabad/Skkur	Member
10.	Deputy Director OPS	Member
11.	Deputy Director HQ&COORD	Member
12.	Deputy Director Skkur	Member
13.	Assistant Director F/A	Member
14.	Assistant Director Civil	Member
15.	Assistant Director Procurement	Member
16.	Assistant Director Admin Finance	Member
17.	Assistant Director Hyderabad	Member
18.	Assistant Director (OPS-II)	Member
19.	Assistant Director (OPS-I)	Member
20.	Assistant Director Sukkur	Member
21.	Data Processing Assistant	Member

Source: *PDMA, Sindh*

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The following are the responsibilities of the Provincial Disaster Management Authority (PDMA):

- Develops and implements strategies for early preparedness, risk reduction, and disaster mitigation across Sindh.
- Coordinates swift response during disasters and oversees early recovery and rehabilitation based on "Build Back Better" principles.
- Formulates and executes disaster management plans at the provincial level.
- Ensures inter- and intra-departmental coordination among government agencies for effective disaster management.
- Supervises and coordinates with 30 District Disaster Management Authorities (DDMAs), led by respective Deputy Commissioners, for grassroots-level implementation.
- Undertakes reforms, capacity building, equipment procurement, and infrastructure enhancement to strengthen provincial disaster management capabilities.
- Successfully managed large-scale disasters, including the 2010 and 2022 floods.

2. District Disaster Management Authority (DDMA)

The National Disaster Management Act (NDM Act), promulgated in Pakistan in 2010, provides the legal framework for disaster management across the country. Under Chapter IV, Section 18 of the Act, the establishment of District Disaster Management Authorities (DDMAs) in all districts is mandated including Ghotki.

According to the NDM Act, 2010, the DDMA functions as the primary coordinating body for disaster management within a district. It works in collaboration with government departments and non-governmental organizations to implement disaster management plans and actions.

Organizational Structure and Members of DDMA:

The Deputy Commissioner of the district will be the chairperson of DDMA and Additional Deputy Commissioner shall be the District Disaster Management Officer (DDMO). Following is the list of members for DDMA committee;

Table 2-5, Committee Representatives of DDMA

Sr. No.	Committee Representative	Role
1	Deputy Commissioner	Chairperson
2	Additional Deputy Commissioner	DDMO
3	Senior Superintendent of Police	Member
4	Assistant Director Local Government	Member

Sr. No.	Committee Representative	Role
5	District Information Officer	Member
6	Cantonment Officer (Where Applicable)	Member
7	District Health Officer	Member
8	District Education Officer	Member
9.	District Food Controller	Member
10.	Deputy Director Civil Defense	Member
11.	District Officer Social Welfare	Member
12.	District Officer Livestock	Member
13.	District Chairman Zakat	Member
14.	Executive Engineer (Works and Services)	Member
15.	Executive Engineer Irrigation	Member
16.	Executive Engineer Public Health	Member
17.	Municipal Commissioners / CMOs / TMOs	Member(s)
18.	Representative Officer of Armed Forces	Member
19.	Two Elected Representatives nominated by the chair	Members
20.	Two Representatives of NGOs/Civil Society	Members
21.	Two Representatives of Business Community	Members
22.	Representative of Agriculture and Livestock Department	Member
23.	Representative of NHA	Member
24.	Representative of Electric Supply Corporation	Member
25.	Representative of SSGC	Member
26.	Representative of Red Crescent	Member
27.	Representative of Sindh Scouts	Member
28.	Representation of Volunteers from Communities at Risk	Member(s)

Source: *PDMA, Sindh*

The following are the responsibilities and functions of DDMA committee:

Responsibility of District Disaster Management Authority (DDMA)

- The DDMA shall work as a coordinating body of all government agencies and non-government organizations operating in the district and act as a focal authority in the conduction and implementation of plan and actions on disaster management.
- Additional Deputy Commissioner who is proposed as Disaster Management Officer shall also work as Secretary DDMA and will provide administrative support to DDMA.
- The DDMA shall ensure to take all possible disaster management measures in the district in accordance with the guidelines laid down by PDMA or NDMA.

- The DDMA shall provide leadership by taking initiative to achieve MHVRA Informed Disaster M2anagement Plan goals and objectives.
- The DDMA shall coordinate with PDMA Sindh in disaster preparedness, response and recovery.
- The DDMA shall provide guidance and support for the implementation of district response plans including management of the District Emergency Operation Centre.

Functions of DDMA

- To review district disaster management plan, including district response plan in-line with Provincial and National disaster management plans and policies.
- To ensure that risk maps are developed and updated and disaster-prone areas have been identified and prioritized in the district.
- To coordinate the efforts for prevention and mitigation measures that are undertaken by the government and local authorities in the identified vulnerable areas of the district.
- To organize and coordinate specialized disaster management training programs for different.
- levels of officers, employees, and volunteer rescue workers in the district.
- To facilitate community training and awareness programs with the support of local authorities, government and non-government organizations.
- To set up, maintain, review and upgrade the mechanism for early warning and dissemination of accurate information to concerned authorities and the general public.
- To review development plans prepared by the government departments, statutory or local authorities with a view that disaster management plan has been integrated into the development activities and projects of the plan
- To coordinate with, and give guidelines to, local authorities in the district to ensure that predisaster and post-disaster management activities in the district are carried out promptly and effectively
- To prepare, review and update district level response and contingency plans.
- To identify buildings and places which could, in the event of disaster situation be, used as relief centres and camps and make arrangements for water supply and sanitation in such buildings or places
- To distribute relief and facilitate rescue or ensure disaster preparedness and response

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- To ensure operationalization of District Emergency Operation Centre (DEOC) equipped with all necessary gadgets
- To activate the District Emergency Operations Centre (DEOC) and ensure its uninterrupted operation during and after disaster events
- To carry out rapid damage and needs assessment and develop a report for assisting PDMA and other relevant stakeholders
- To coordinate and monitor early recovery and rehabilitation activities with the support of PDMA or relevant local and international stakeholders
- To prepare and continuously update databases of external agency projects, future priority areas, funding framework, available resources, areas of operations/expertise etc.
- To perform other functions as deemed necessary by the provincial government or provincial authority for disaster management in the district.

2.3.3 Geography

Municipal Committee Ghotki, a historic city, is the Taluka Headquarter of Ghotki taluka, with a population of 119,879 according to the 2023 census. It is situated at 28° 0' 24" N and 69° 18' 54" E, with an altitude of 71 meters (233 feet). Ghotki is located 4.5 miles (7.4 km) on the eastern bank of the Indus River along the Grand Trunk (GT) Road and National Highway N-5, which originates from Torkham (Pakistan-Afghanistan border) and runs via Peshawar, Islamabad, Lahore, Multan, and Hyderabad on its way to Karachi as well as at an approximate distance of 80 kilometres to the northeast of Sukkur via N-5. Sukkur-Multan motorway (M-5) passes near the city with the nearest Ghotki interchange approximately 10 km away from the city center. These roads serve to connect the settlements in various directions of Ghotki District with the surrounding important urban centres of the area. Additionally, railway station also exists in the city on the Mainline (ML-1) providing the access routes of the city.

2.3.4 Demographic Analysis

The study of the human population size, composition, spatial distribution, and variations over time have all been examined in demographic analysis. In the case of Ghotki city, these analyses depict the impact of the high monsoon rains, floods that began in 2010 and onward, and urbanization.

The population, age of residents, gender, and population density provide the type of information needed to plan for the residents' diverse needs. Future estimates for service and resource demands, including the number of facilities and sites for new facilities, etc., will be made with the help of these analyses.

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A) Past Population Trends

The rapid population growth leads to rapid urbanization, along with all of its negative effects. There has been a steady increase in the rate of population growth in Ghotki. Records have been available since 1951, indicating that Ghotki had a population of only 5,882 people in 1951. This number has grown to 111,398 in 2017 over a period of seven decades. The **Figure 2-5** shows the past population trends of Ghotki city.

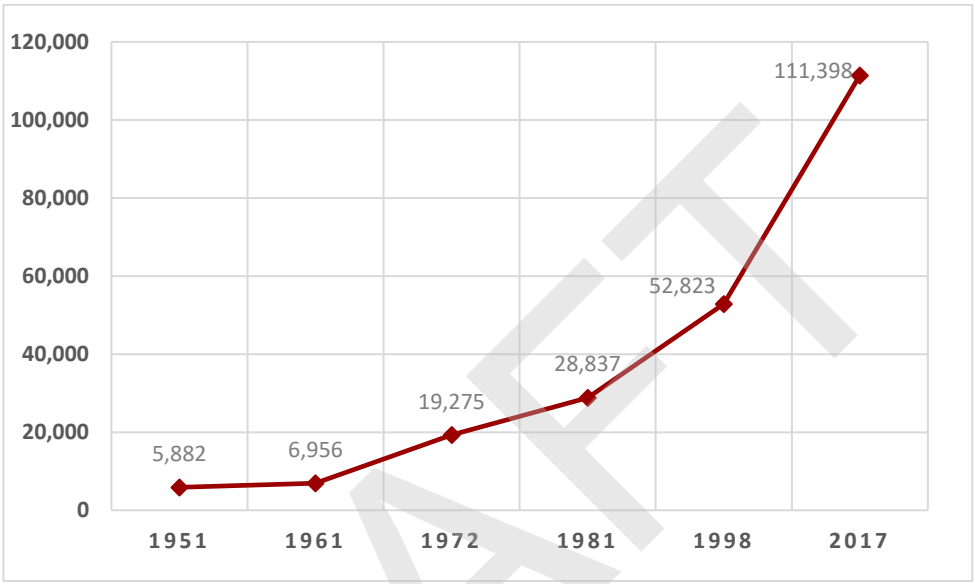
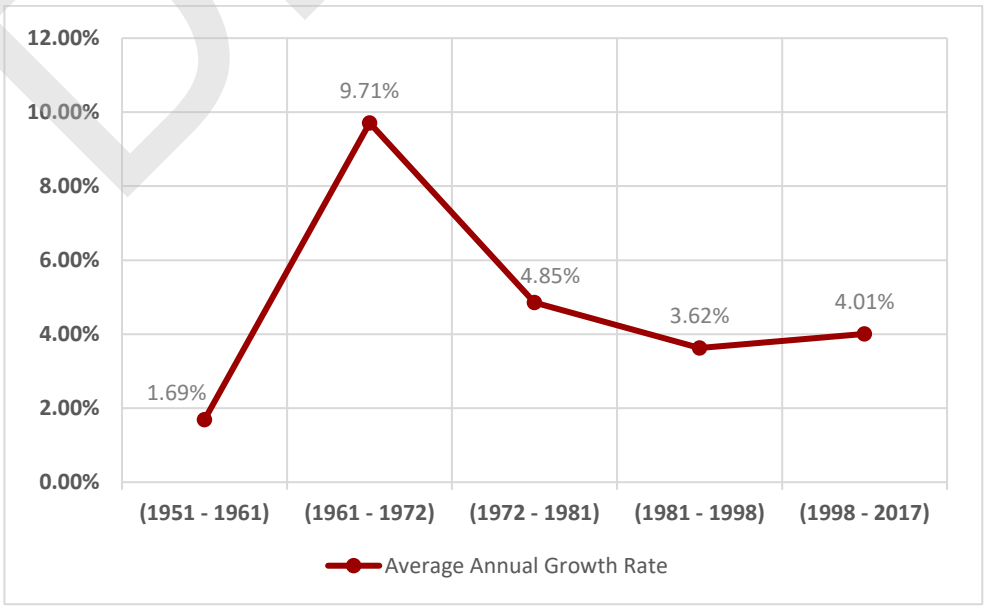


Figure 2-5, Intercensal Population Growth Trend of Ghotki City

Source: *Pakistan Bureau of Statistics*

Figure 2-6 shows intercensal population growth rate which depicts the change in population over a period up to year 2017. Between 1981 and 1998, the city's average growth rate rises before starting to fall. In 2017, the population growth rate slightly increased up to 4%.



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Figure 2-6, Intercensal Average Annual Growth Rate Trends of Ghotki City

Source: *Pakistan Bureau of Statistics (PBS) and The Consultant Team*

The **Table 2-6** represents the percentage of male and female populations using data from the census from 1961 to 2017. It can be seen from the table that initially there was a difference of almost 6% between the male and female populations, with males being the dominant factor in the city. This difference then decreased to 2% in 1998 before slightly increasing over time to 4% in 2017. This highlights the need for equal facilities and opportunities to be planned for both males and females in the future.

Table 2-6, Intercensal Population Distribution by Gender of Ghotki City

Years	Male Population (%)	Female Population (%)
1951	53%	47%
1961	53%	47%
1972	54%	46%
1981	52%	48%
1998	51%	49%
2017	52%	48%

Source: *Pakistan Bureau of Statistics*

B) Age Distribution

The age distribution trends were analysed from the data collected from the 2017 census [4] and the socio-economic survey conducted in 2023. The population aged 10 years and above was 56% according to the 2017 census, which decreased to 3% in the base year according to the socio-economic survey. Likewise, according to the 2017 census and the socio-economic survey of 2023, the adult population (i.e., 18 years and above) varied from 41% to 94% respectively. The dependent population (i.e., 60 years and above) decreased from 3% to 1% respectively according to the 2017 census and the socio-economic survey of 2023.

C) Population Projections

Population projection is a vital aspect of urban planning, helping cities anticipate future needs and plan resources accordingly. Previously, Ghotki has experienced significant population growth over the years. According to the 2023 census, the population of MC Ghotki is 119,879 with a growth rate of 1.23%, covering an area of 18 sq. km. However, this growth rate may not serve as a reliable indicator for future projections due to several interrelated factors.

Firstly, Ghotki's topography renders it particularly susceptible to urban flooding, a vulnerability that was starkly highlighted during the riverine floods of 2022, which significantly increased risks to both residents and infrastructure.

[4] 2017 age-wise distribution data is utilized because the 2023 census data for age distribution in urban localities is not yet available.

Secondly, the city is experiencing the broader global trend of declining population growth rates, which has further contributed to its local demographic stagnation. Additionally, the COVID-19 pandemic has had profound impacts on population dynamics, disrupting economic activities and migration patterns between 2017 and 2023, thus exacerbating the decline in growth rates.

Historical data reveal significant fluctuations in Ghotki's population growth, with growth rates decreasing from 4.00% in 2017 to 1.23% in 2023, an average growth rate of 4.00% has been used as a pivotal value for the future growth scenario to ensure a balanced and sustainable projection. For future planning, an existing compact built-up area with a contiguous urban boundary is marked that also includes a proportion of an area outside of notified MC boundary and the current population inhabiting these areas has also been considered in future population projections. This expansion has resulted in the total population of the city reaching 140,429 persons with growth rate of 4.00%, covering an area of 10.21 sq. km (1,021 ha), ultimately resulting in population of urban contiguous boundary being used for the population projections till 2043.

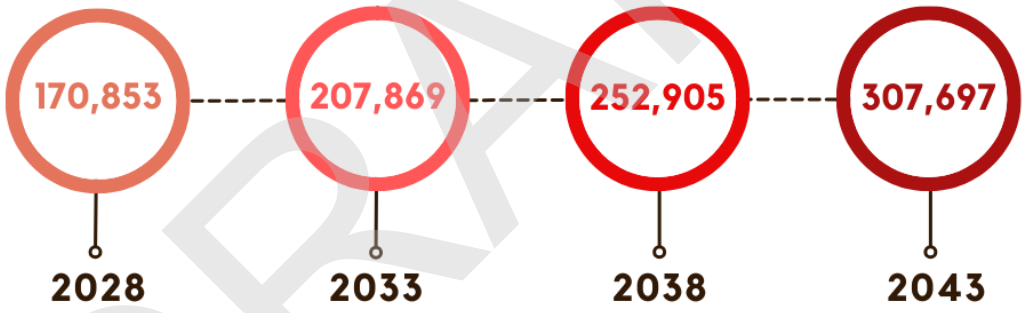


Figure 2-7, Population Projections of Ghotki City (2023 - 2043)

Source: *The Consultant Team*

Figure 2-7 shows the population projection of the city that has been calculated using the geometric growth model, providing a comprehensive understanding of future demographic changes. compares three growth scenarios.

D) Population Density

A dasymetric population density map has been developed for Ghotki city to provide a more precise representation of population distribution than traditional methods. Unlike standard choropleth maps that rely solely on administrative boundaries, this map uses additional data sources, such as land use, satellite imagery, and building footprint to focus on inhabited areas while excluding uninhabited spaces. Covering 1,021 hectares with a population of 140,429 in 2023, the city features 108 census blocks with densities ranging from 1 to 1,541 persons per hectare, averaging 103 persons

per hectare. The National Reference Manual categorizes the population into low density (30%, 70-160 persons/ha) observed throughout the periphery and suburban zones, medium density (35%, 161-396 persons/ha) along main roads, and high density (35%, above 396 persons/ha) is observed within the downtown area of Ghotki, along both sides of Ghotki – Mathelo Road, Hussain Beli Road, Canal Road, Municipal Road, Qadirpur Road and Bhagowah Road.

The dasymetric map (**Figure 2-8**) below shows population density based on census blocks, with darker colours indicating a higher population density

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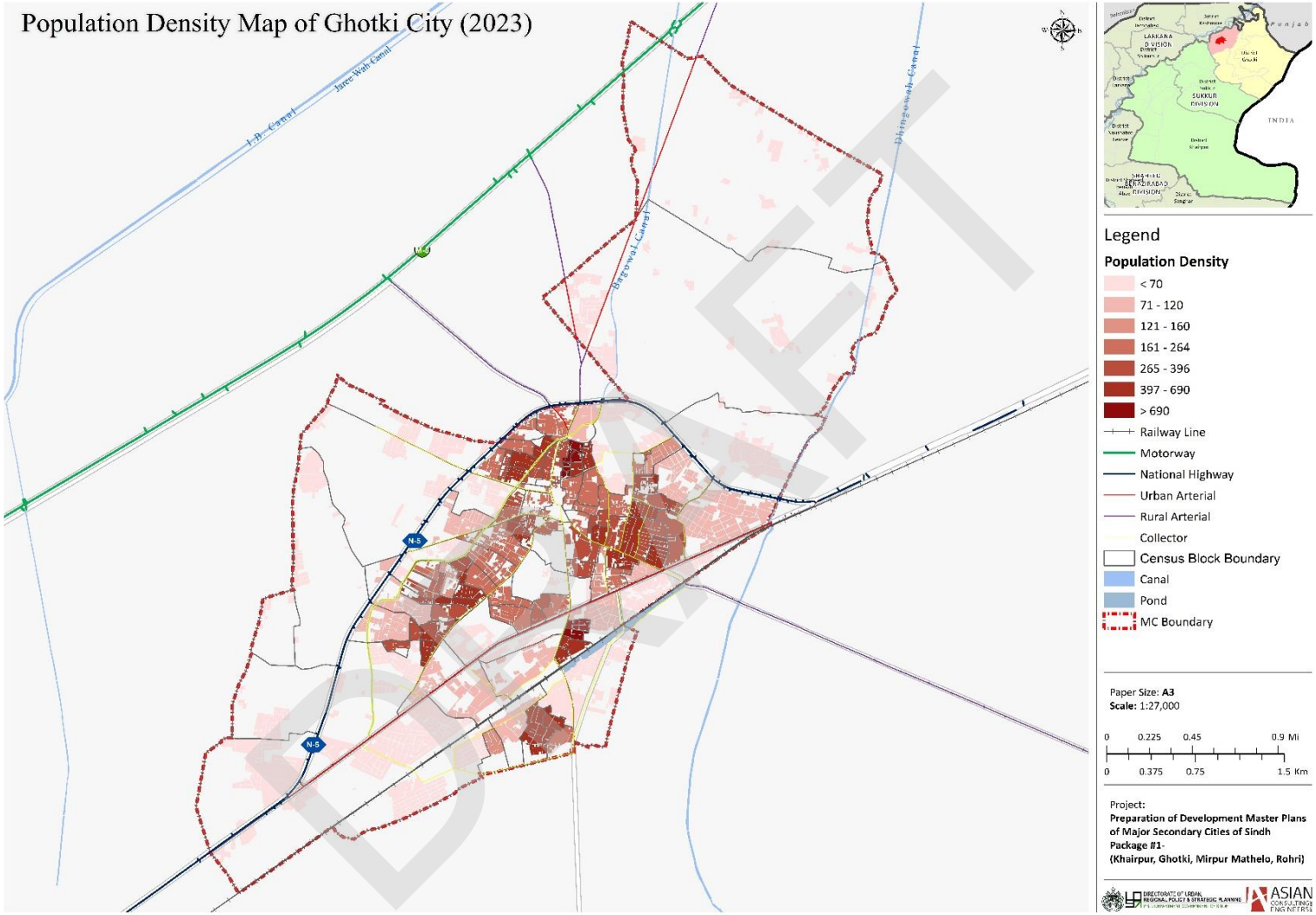


Figure 2-8, Population Density Map of Ghotki City

Source: *The Consultant Team*

2.4 Urban Morphology

Ghotki city has experienced compact urban development as shown in **Figure 2-9**, supplemented by mixed-use developments that incorporate a variety of land uses such as residential, commercial, institutional etc. These land uses are primarily located along major transportation corridors such as the National Highway (N-5) and Railway line which pass through the city. This type of development is common in cities with multiple access roads.

The existing developed land use pattern in Ghotki city consists of a city centre with development extending radially out in decreasing intensity in proximity to existing transportation corridors. The city follows a compact development pattern, strategically concentrating on major transportation corridors and pivotal nodes of Ghotki city, which include areas of varying densities (high-density inner areas, medium density outer-central areas, low-density outskirts), with a predominant mixed-use development. This type of urban layout is considered to optimize land use efficiency and sustainability. It promotes walkability, provides easy access to public transportation, and ensures basic public amenities are within close proximity, improving the urban fabric. However, the street network within the urban developed area displays some inconsistencies in street layout, such as unexpected turns, dead-end streets, or variations in road widths. These irregularities can pose difficulties in navigation, cause traffic congestion, and affect the overall functionality of the city. Furthermore, irregular street patterns can impact the aesthetic appeal of a city.

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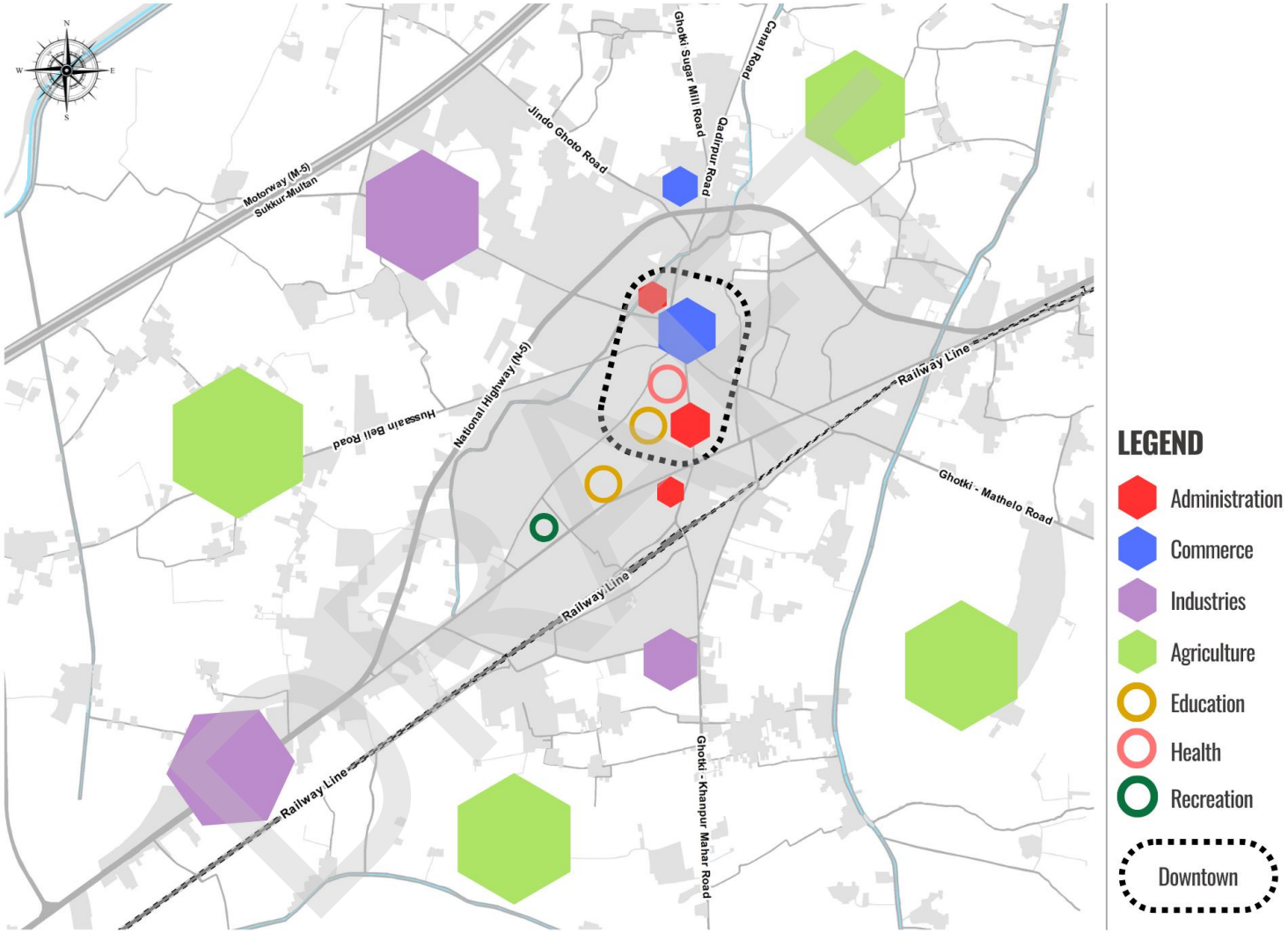


Figure 2-9, Existing Urban Form of Ghotki City (2023)

Source: *The Consultant Team*

2.5 Spatio-temporal Analysis

The spatio-temporal growth analysis of Ghotki city from 2008 to 2023, conducted using satellite imagery at five-year intervals, revealed significant urban expansion driven by population growth and rapid urbanization. The analysis showed that cropland and farmland were being increasingly converted into built-up areas to meet the needs of the growing population. The expansion occurred in all directions, particularly along major roads: agro-industrial development along the National Highway (N-5) in the southwest, mixed-use developments on Ghotki - Sugar Mill Road in the north, and industrial growth along Jindo - Ghoto Road and Devri Road in the northwest. However, residential development has happened largely without proper planning or development controls, raising concerns about infrastructure and service delivery in the city.

The total area of Ghotki city is 10.21 sq. km. Out of this, 5.9 sq. km has already been developed in 2008, which accounts for approximately 58% of the total city area. However, the developed area has increased significantly by 42% between 2008 and 2023 due to ongoing development growth. **Table 2-7** further shows the details of the percentage increase in area which can be visualized in **Figure 2-10**.

Table 2-7, Spatio-temporal Growth Trends – Ghotki City (2008-2023)

Year	Area (Sq. km)	Increase in area (Sq. km)	Percentage Increase (%)
2008	5.9	-	-
2013	6.6	0.7	11.9
2018	9.3	2.7	40.9
2023	10.21	0.9	9.8

Source: *The Consultant Team*

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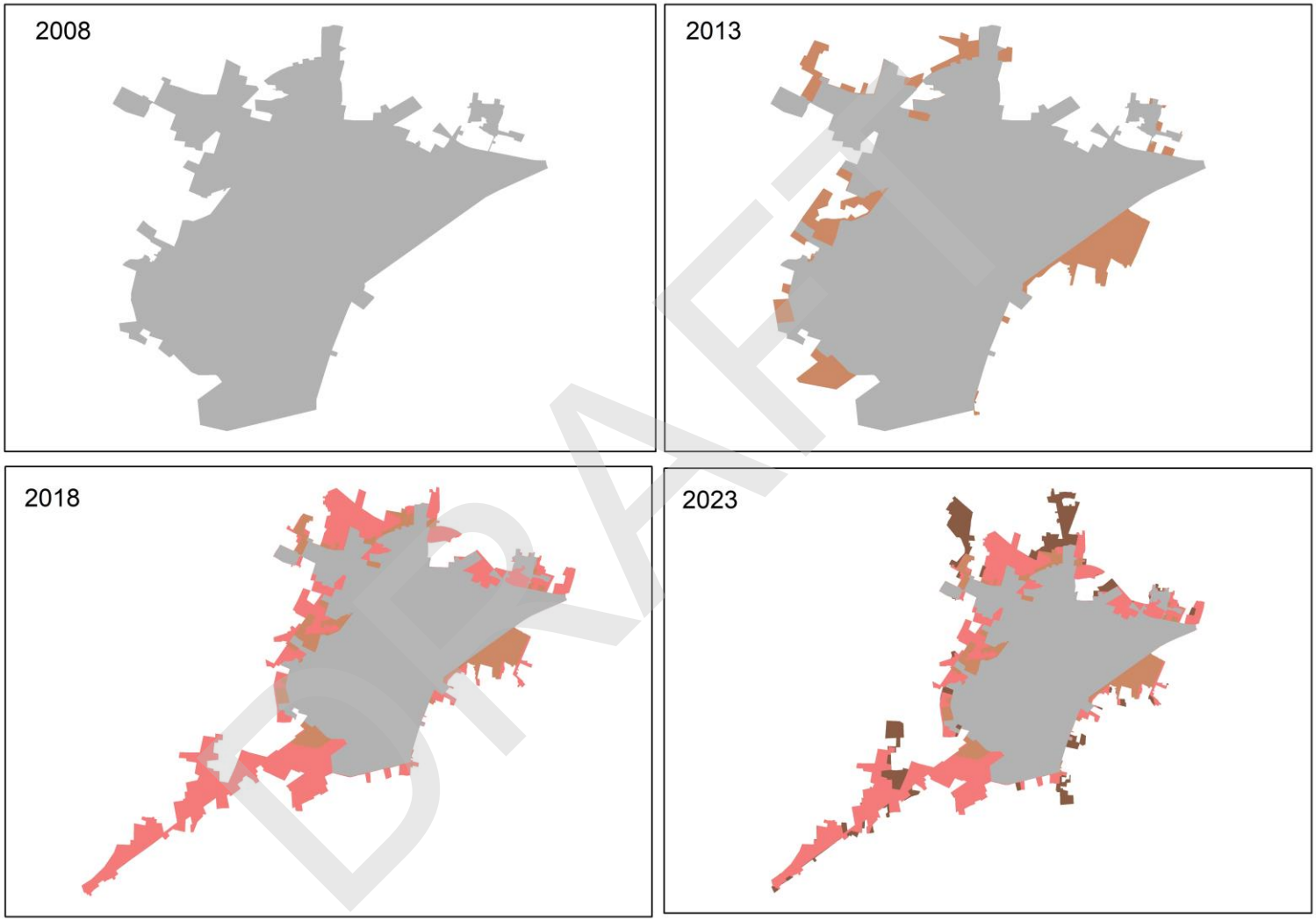


Figure 2-10, Spatio-Temporal Growth Map - Ghotki City (2008-2023)

Source: *The Consultant Team*

2.6 Existing Land Use (2023)

The land use analysis reveals that the city is expanding in the northern, northwestern, and southwestern directions without proper planning along primary roads (such as National Highway (N-5), Jindo Ghoto Road, Ghotki Sugar Mill Road, etc.). Approximately 94% of the designated built-up area of the city is utilized for urban land uses, which encompass residential, commercial, industrial, amenities, transportation, parks, playgrounds, and areas designated for residential schemes. The remaining area consists of non-urban land uses, such as agriculture, major canals, and water bodies, including areas of underutilized land parcels used for open defecation or ponding. The details are given in **Table** 2-8**.**

Table 2-8, Distribution of Major Land Uses in Ghotki (2023)

Urban/ non-urban	Land uses	Areas (Ha)	Percentage
Urban	Residential	516.74	50.59%
	Commercial	73.06	7.15%
	Parks and Playground	14.52	1.42%
	Institution	36.63	3.59%
	Utilities And Municipal Service Facilities	4.68	0.46%
	Religious	23.40	2.29%
	Industries	71.30	6.98%
	Special Use	76.34	7.47%
	Transportation	138.11	13.52%
	Sub Total	**954.78**	**93.48%**
Non-Urban	Agriculture and Forestry	28.91	2.83%
	Water Bodies	37.67	3.69%
	Sub Total	**66.58**	**6.52%**
Total		**1,021.37**	**100.00%**

Source: *The Consultant Team*

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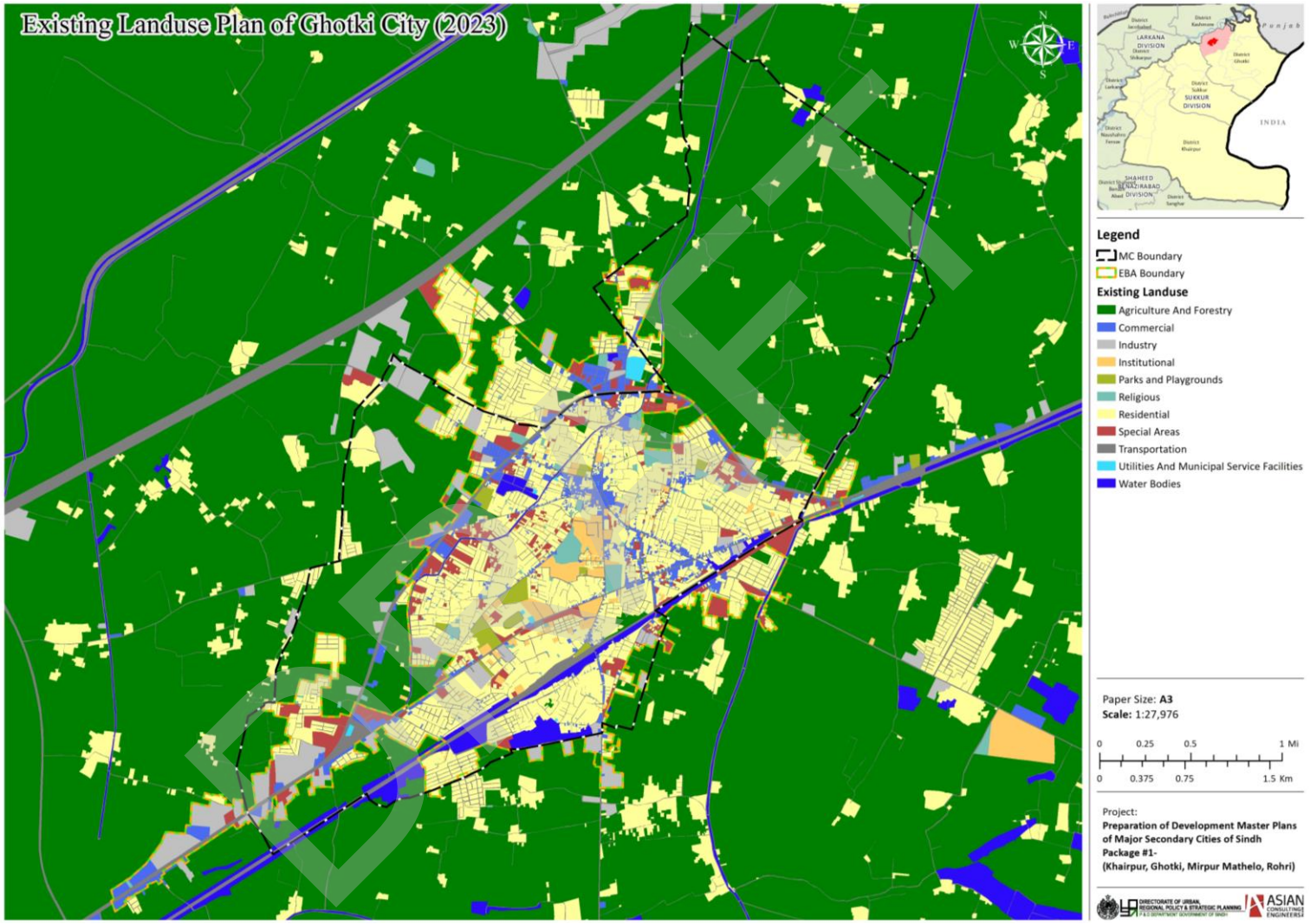


Figure 2-11, Existing Land Use Map of Ghotki City (2023)

Source: *The Consultant Team*

SECTION - 3: STRATEGIC DEVELOPMENT PLAN VISION

3.1 Introduction

This section presents the Strategic Development Plan Vision, outlining the long-term direction for sustainable, inclusive, and resilient growth. It explains how the vision aligns with community priorities, addresses key challenges, and guides future planning decisions. Serving as the foundation for the entire plan, this vision sets the course for balanced development, improved quality of life, and environmental stewardship.

3.2 Process of Vision Formulation

The vision formulation for Ghotki city is anchored in a participatory and structured approach aimed at aligning strategic development with the city's unique socio-economic, environmental, and cultural attributes. This visioning process will guide sustainable urban growth, resource allocation, and organizational decision-making over the coming years, with the ultimate goal of establishing Ghotki as a resilient, economically vibrant, and socially cohesive city.

The importance of vision development underscores the necessity for a forward-thinking framework that is responsive to Ghotki's current needs and adaptable to future demands. Through a holistic vision, the city aims to foster a healthy environment, stimulate economic development, and nurture strong community ties, ultimately enhancing quality of life. A vision development workshop was organized as a platform for stakeholders to collaborate and redefine priorities, address sectoral issues, and explore development opportunities.

Adopting the Oregon Model for Vision Development, the process engaged participants in a structured methodology across four fundamental stages:

City Profile: Profiling Ghotki's demographics, infrastructure, and environmental assets, capturing both strengths and areas of improvement.

Trend Statement: Projecting future scenarios based on ongoing trends, identifying possible outcomes, and considering alternative development trajectories.

Vision Statement: Articulating a shared vision for Ghotki's future, including goals in public health, education, cultural preservation, transportation, and economic growth.

Action Plan: Outlining actionable steps and partnerships to translate the vision into measurable progress, aligning policies and projects with the city's long-term aspirations.

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Figure 3-1, Oregon Model for Vision Development

Source: *Extracted by Consultant from Ames, 2010*

3.3 Vision Development Workshop

Vision development workshop provided participants the opportunity to contribute in-depth insights about Ghotki's current situation and prospective development. Organized into sessions, the workshop tackled key questions: identifying overlooked issues, defining what makes a city great, and mapping the desired future of Ghotki. Stakeholders highlighted concerns around limited departmental capacity, transparency, and infrastructure strain due to migration. They emphasized the need for parks, healthcare improvements, public transport facilities, water treatment facilities, and solutions for waste management and flood-prone areas.



Figure 3-2, Pictorial Evidence from Future Vision Development Workshop

Source: *The Consultant Team*

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3.4 Ghotki's Vision Statement

Stakeholders' inputs and focus group discussions were followed by the vision development exercise in line with the key findings and issues identified by the participants. During this exercise, consultants assisted the participants, first, in brainstorming the future goals and targets as keywords, and then preparing a vision statement for Ghotki using those keywords. By analysing the outcomes of the proceeding following vision statement is derived:

> ***"Promotion of smart growth through quality and innovative development ensuring inclusiveness"***

3.4.1 Strategic Goals and Objectives

The vision statement articulates strategic goals and objectives to guide Ghotki's sustainable long-term development, focusing on:

A) Smart Growth and Sustainable Urban Development

Goal: Transform Ghotki into a well-planned, efficient, and eco-friendly city.

Objectives includes:

- Implement compact, mixed-use urban design to reduce sprawl and enhance accessibility.
- Develop walkable neighbourhoods with green spaces and pedestrian-friendly infrastructure.
- Integrate public transit systems to reduce traffic congestion and pollution.
- Adopt climate-resilient infrastructure to mitigate environmental risks.

B) Quality Development and Eco-Friendly Practices

Goal: Ensure robust, sustainable, and people-centric infrastructure.

Objectives includes:

- Promote green building standards (energy-efficient materials, rainwater harvesting).
- Upgrade water, sanitation, and waste management systems for long-term sustainability.
- Encourage community-driven urban projects (e.g., parks, cultural centers).

C) Innovation and Economic Advancement

Goal: Position Ghotki as a hub for skilled labour, technology, and economic opportunities.

Objectives includes:

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- Establish vocational training centers aligned with industry demands (e.g., IT, agro-processing).
- Foster public-private partnerships (PPPs) for innovation in agriculture, logistics, and SMEs.
- Develop digital infrastructure (e.g., e-governance, smart city solutions).

D) Inclusive and Equitable Development

Goal: Ensure all residents benefit from Ghotki's development.

Objectives includes:

- Provide affordable housing schemes for low-income families.
- Improve access to healthcare, education, and social services in underserved areas.
- Promote gender-inclusive policies (e.g., women's entrepreneurship programs).

By integrating smart growth, quality development, and innovative practices, the vision aims to create a sustainable future for Ghotki. This involves preserving natural resources, reducing environmental impact, and meeting present needs without compromising the ability of future generations to meet their own needs.

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SECTION - 4: PROPOSED STRATEGIC DEVELOPMENT PLAN - 2043

4.1 Introduction

This section presents the proposed Strategic Development Master Plan 2043 for Ghotki city, outlining the comprehensive planning process undertaken to guide future growth and development. It explains the formulation of planning scenarios based on existing conditions, projected needs, and sustainable development goals. The section also details the proposed land use zones and designed to optimize urban functions.

4.2 Planning Process

The development master planning process is required to guide the orderly growth and sustainable development of urban areas, ensuring that all aspects of land use, infrastructure, and environmental considerations are taken into account. This process involves multiple stages, including assessment, analysis, design, and implementation, to create a well-balanced and efficient plan. The **Figure 4-2** illustrates the comprehensive planning process that is followed to achieve objectives of development master plan.

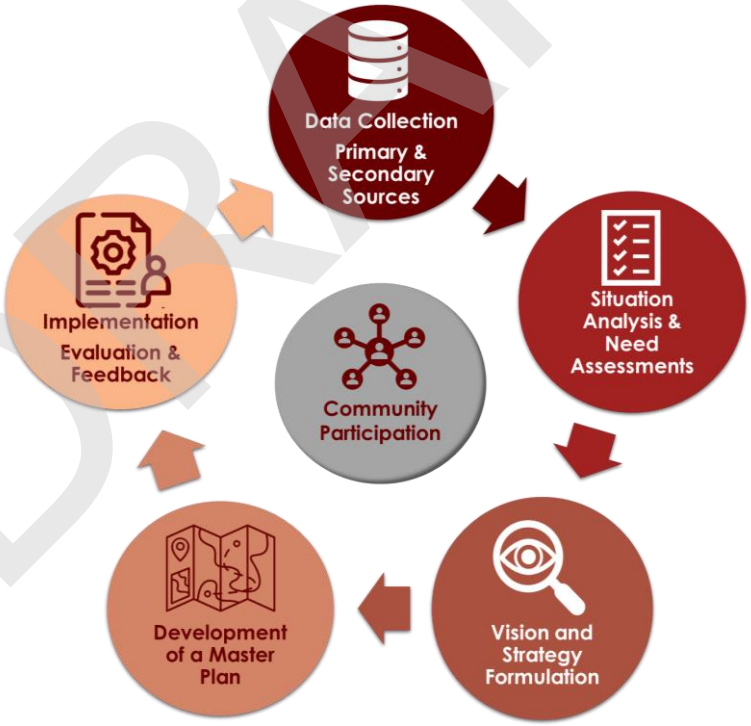


Figure 4-1, Planning Process of Strategic Development Plan

Source: *The Consultant Team*

4.3 Determinants for Planning Proposal

The main determinants of land use zoning ensure balanced and well-informed land use decisions. This inclusive approach helps in creating sustainable and liveable environments. The main determinants which are

considered while proposing the different land use zones in city are Physical/Geopolitical Barriers, Natural Barriers, Flood-Prone Zones (Hydrological Analysis), Existing Land Use/Infrastructure, Land Suitability Analysis, Growth Trend Analysis and Air and Wind Direction.



Figure 4-2, Key Determinants for Land Use Zoning

Source: *The Consultant Team*

4.3.1 Physical/Natural Barrier

Ghotki city's urban expansion is significantly influenced by physical and natural barriers. To the north, the Sukkur-Multan Motorway (M-5) acts as a major constraint, limiting development due to the presence of katcha areas, which pose security risks and accessibility challenges. Meanwhile, to the south, the railway line and Dhingro Wah Canal creates another obstacle, reducing available land and complicating development feasibility. As a result, the city's growth is primarily channelled along the north-south axis, closely following the National Highway (N-5), which serves as the primary corridor for connectivity and expansion.

4.3.2 Land Suitability Analysis

Land Suitability Analysis (LSA) is a systematic process that helps to identify appropriate areas for various land uses, including residential, commercial, industrial or agricultural developments. By integrating Geographic Information Systems (GIS) with multi-criteria decision-making (MCDM) techniques, LSA assesses land based on environmental, socio-economic, and

infrastructural factors. This method ensures that land-use decisions are well-informed, sustainable, and aligned with both developmental needs and ecological preservation.

The LSA process begins with comprehensive data collection, which includes topographical details such as slope and elevation, soil characteristics like type and fertility, climatic conditions including rainfall and flood susceptibility, and existing land use patterns. Additionally, proximity to infrastructure such as roads and utilities, as well as socio-economic factors like population density and economic activities, are considered. This diverse dataset provides a holistic understanding of the physical and human factors influencing land suitability.

Once the necessary data is gathered, the next step involves defining and weighting the criteria that determine land suitability. Each criterion is assigned a weight based on its relative importance, often determined through expert judgment or structured methods like the Analytical Hierarchy Process (AHP). This weighting ensures that critical factors have a greater influence on the final suitability assessment.

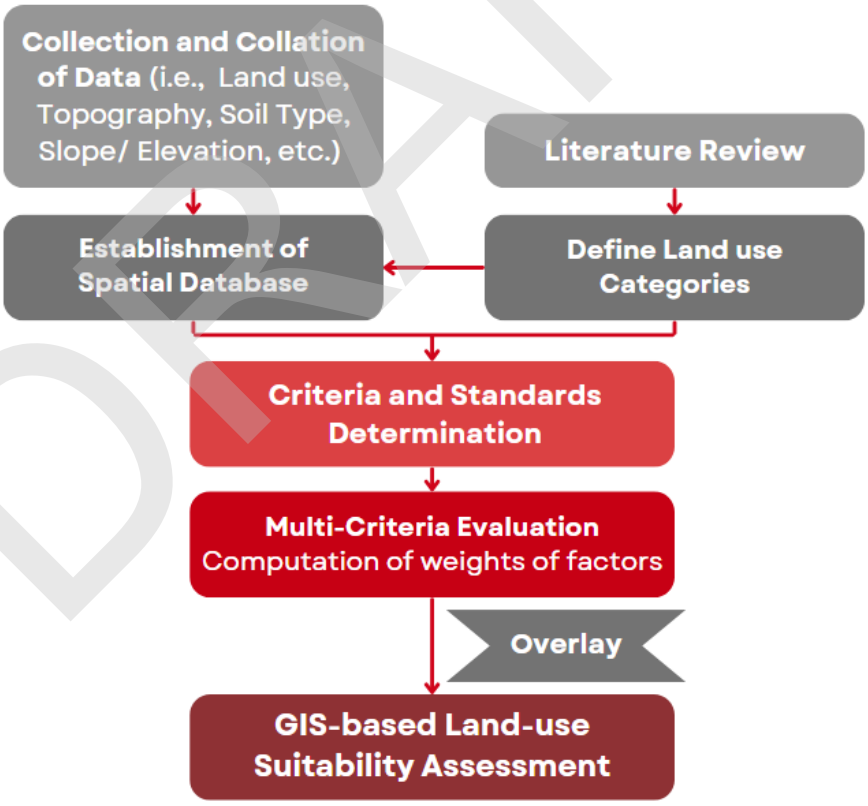


Figure 4-3, Flow Diagram of Land Suitability Analysis (LSA) Process

Source: *The Consultant Team*

GIS plays a pivotal role in processing and analysing the collected data. Techniques such as overlay analysis, weighted overlay analysis, and buffer analysis are employed to integrate multiple layers of information and

evaluate spatial relationships. Overlay analysis combines different maps to identify areas that meet specific conditions, while weighted overlay analysis aggregates the weighted criteria to produce a composite suitability score. Buffer analysis helps assess proximity-based factors, such as distance from roads or flood-prone zones.

The results of the analysis are classified into five suitability categories: most suitable, moderately suitable, less suitable, least suitable, and suitable but avoided. The most suitable areas exhibit optimal conditions with minimal constraints, making them ideal for the proposed land use. Moderately suitable zones may require minor adjustments or infrastructure improvements, while less suitable areas present significant challenges that need mitigation. Least suitable regions are marked by major limitations such as high flood risk or poor soil quality, rendering them unfavourable for development. Areas classified as suitable but avoided are typically protected or restricted due to ecological or regulatory reasons.

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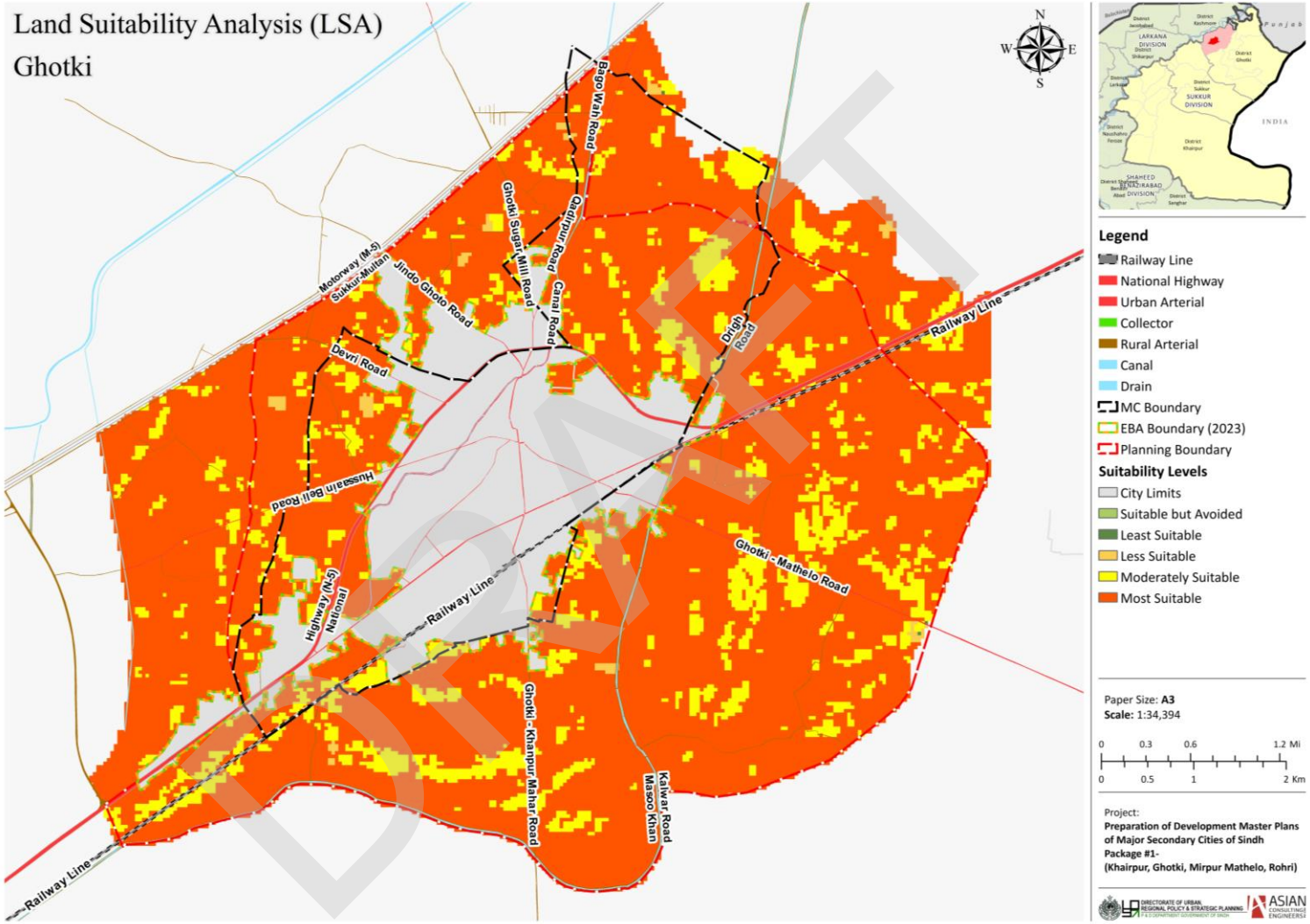


Figure 4-4, Land Suitability Analysis (LSA) - Ghotki

Source: *The Consultant Team*

The Land Suitability Analysis (LSA) map (**Figure 4-4**) of Ghotki city highlights variations in land suitability for urban development based on existing land use trends and infrastructural factors. The most suitable areas, marked as red, primarily concentrated in the north western and south eastern parts of the city, align with existing urban development and key transportation corridors like National Highway (N-5), Ghotki Mathelo Road, Hussain Beli Road and Railway Line, making them ideal for expansion. Moderately suitable and less suitable zones extend outward from the urban core, indicating areas that may require interventions such as infrastructure improvements.

4.3.3 Flood Prone Zone (Hydrological Analysis)

The hydrological analysis serves to evaluate flood impacts and guide disaster management efforts by identifying areas most affected by inundation and disrupted connectivity. This information is crucial for planning relief and rehabilitation measures. Additionally, it supports long-term urban and regional planning by identifying flood-prone zones that require mitigation strategies, contributing to the development of resilient land use and infrastructure plans.

The analysis was conducted using advanced 2D hydrodynamic modelling in HEC-RAS to accurately assess flood risks and impacts. The methodology incorporated high-resolution terrain data, with a 30-meter Digital Elevation Model (DEM) processed to capture subtle elevation changes critical for flood modelling. The study area was precisely defined using administrative boundaries of District Ghotki, ensuring the analysis aligned with jurisdictional planning needs. The model setup included creating a detailed 2D flow area with variable cell sizing, employing finer resolution in vulnerable urban centers and coarser grids in less critical areas to optimize computational efficiency.

The key hydraulic inputs included boundary conditions representing inflow/outflow points and gridded meteorological data, particularly for the August 2022 flood event that severely impacted the region. The model underwent rigorous calibration and validation against historical flood records and field observations where available. The simulation outputs provided comprehensive flood characteristics including extent, depth variations (from 0.05 feet to over 1 feet), flow velocities, and duration of inundation. These results (as shown in **Figure 4-5**) were visualized through detailed flood maps, with inundated areas clearly marked in blue gradients indicating depth variations, while critical infrastructure networks were overlaid to assess disruption impacts.

The analysis serves dual purposes for both immediate disaster response and long-term resilience planning. The detailed flood maps enable to identify priority areas for relief operations and evacuation planning. For long-term development, the results inform land-use zoning decisions, infrastructure design standards, and mitigation strategies, particularly for protecting vital

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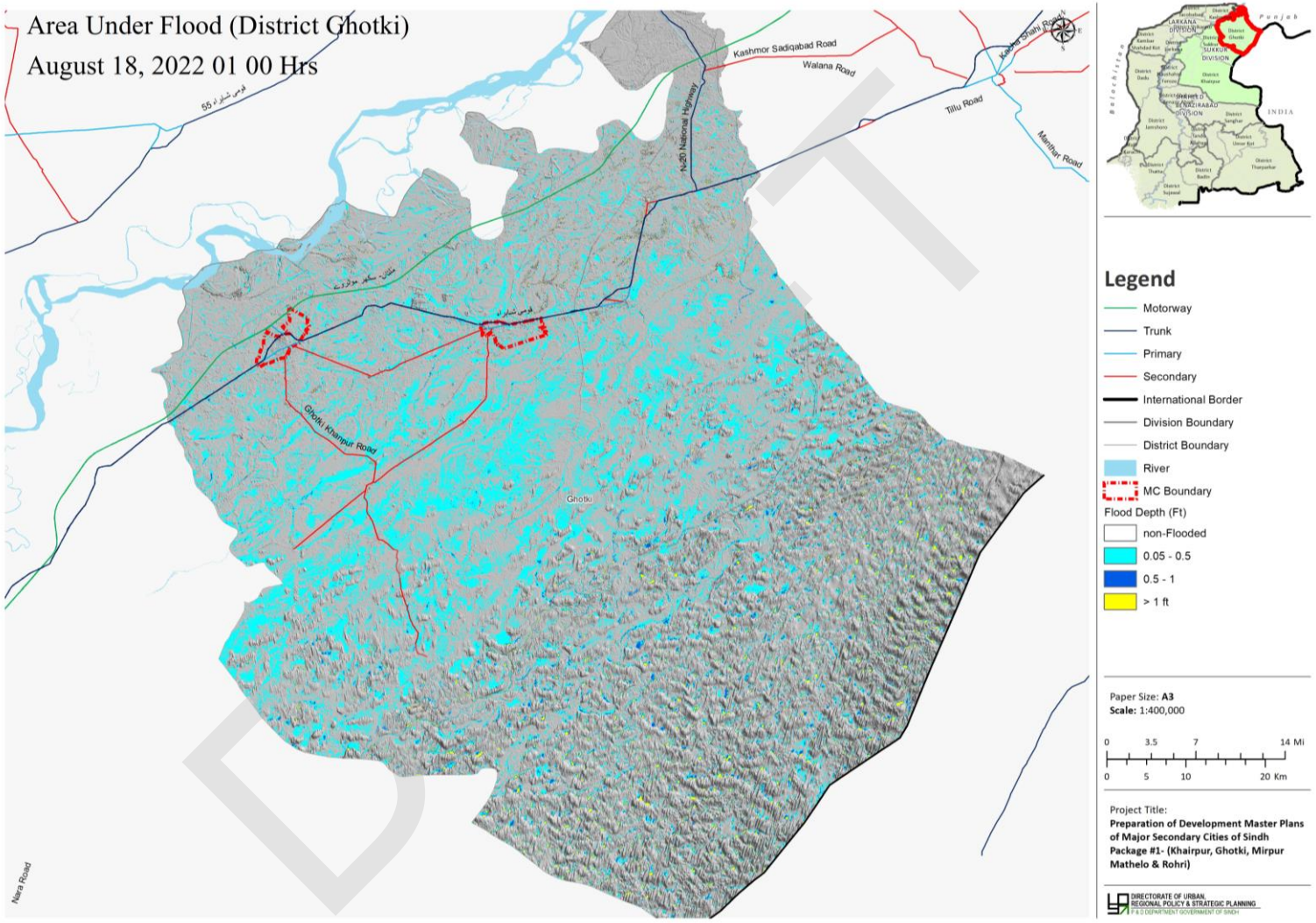


Figure 4-5, Hydrological Analysis – Ghotki District

Source: *The Consultant Team*

transportation routes like motorways and primary roads. By incorporating administrative boundaries, the analysis provides actionable insights tailored for both urban and rural planning contexts, supporting the development of comprehensive flood resilience strategies across District Ghotki.

4.3.4 Existing Land Use/ Land Cover

The analysis of existing land use/ land cover is crucial for Ghotki's sustainable urban development, as it provides a comprehensive assessment of how land is currently utilized, whether for residential, commercial, agricultural, industrial, or ecological purposes, while identifying inefficiencies, incompatible land uses, encroachment on roads, fertile agricultural land or flood-prone areas, and underused spaces that require intervention.

By evaluating the distribution of infrastructure, services, and natural resources, this analysis ensures future planning aligns with the city' s current skeleton, preventing haphazard expansion, environmental degradation, and resource mismanagement. The integration of land use/ land cover analysis into Ghotki's development plan will optimize land use, enhance resilience, and support coordinated development, ensuring the city's expansion is both economically viable and environmentally sustainable while improving quality of life for its residents.

4.3.5 Growth Trend Analysis

The spatio-temporal growth analysis of Ghotki city (2008–2023) provides vital insights for proposed zoning. It highlights urban expansion driven by population growth, with suburban areas transitioning into built-up zones along major roads. Key developments include agro-industrial projects along the National Highway (N-5), mixed-use developments on Ghotki-Sugar Mill Road, and industrial facilities on Jindo-Ghoto Road and Devri Road. However, residential growth has occurred without adequate planning, presenting challenges for sustainable urban development. These findings enable to allocate land use effectively, optimize infrastructure, and ensure sustainable urban development.

4.3.6 Air and Wind Direction

The wind rose for Ghotki city indicates that wind predominantly blows from the south to northeast. Understanding these airflow and wind patterns is essential for proposed zoning as it guides the optimal placement of industrial, commercial, and residential areas. Proper alignment reduces pollution exposure in sensitive zones, enhances ventilation, and promotes urban comfort, contributing to improved environmental quality and public health.

4.4 Planning Scenarios

To address city's urban growth and sustainable land use, three alternative development scenarios have been formulated:

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- Multi-Nuclei Model
- Corridor Development Model
- Living Land Conservation Model

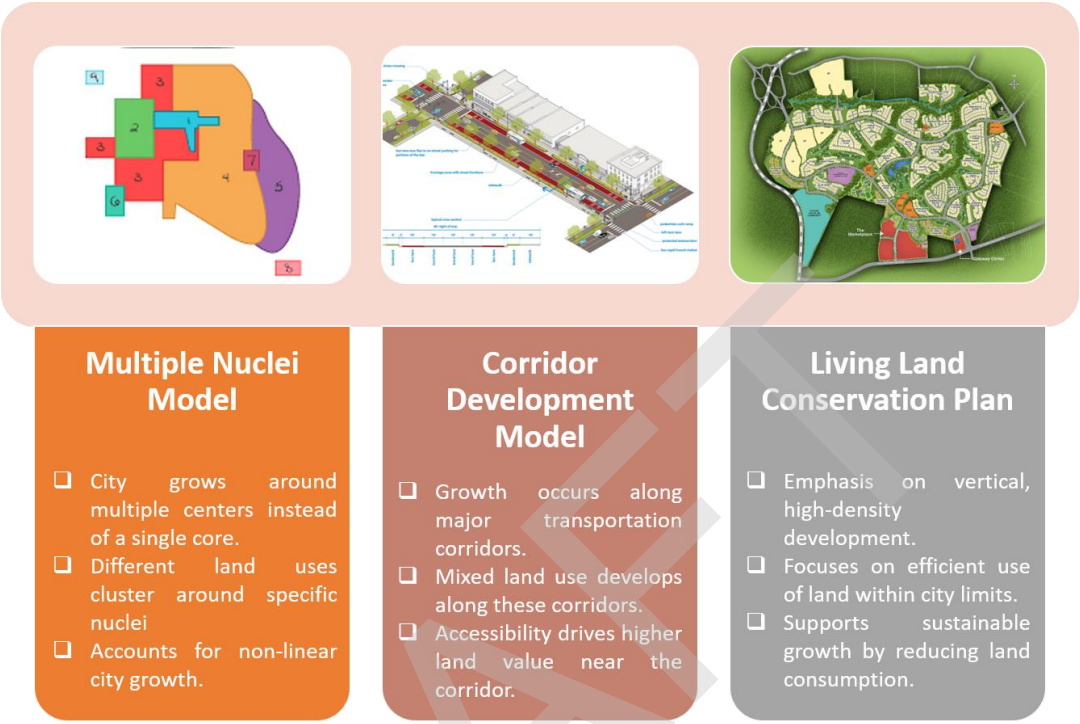


Figure 4-6, Proposed Development Scenarios for Ghotki City

Source: *The Consultant Team*

4.4.1 Multi Nuclei Model (Scenario 1)

The model advocates for decentralized urban development, distributing growth across multiple activity centers rather than concentrating it in a single core. This approach mitigates congestion in central areas while fostering specialized hubs that cater to diverse economic, social, and infrastructural needs. By allowing cities to expand organically through interconnected nuclei, the model supports balanced development and reduces dependency on a monolithic city center. **Table** 4-1 shows the primary advantages and disadvantages of multi nuclei model.

Table 4-1, Pros and Cons of Multi Nuclei Model

Pros	Cons
• City can grow naturally with the development of new nuclei in response to the city's expansion, preventing overcrowding in a single city center. • Encourages a mix of land uses, fostering community interaction	• Requires robust and extensive road/ transport network or infrastructure to connect these nuclei effectively. • Some nodes may develop rapidly while others stagnate, creating disparities in land value

Pros	Cons
and reducing the need for long-distance travel. • The model allows for a more organic growth pattern, enabling different areas to develop according to their unique characteristics and needs. • Different CBDs can cater to various economic activities, promoting local businesses and creating job opportunities across different sectors.	and quality of life across different parts of the city. • The establishment of multiple CBDs may lead to urban sprawl, consuming more land and potentially impacting agricultural or green spaces. • Managing and coordinating development across multiple centers can be more complex and require more sophisticated urban planning and governance.

Source: *The Consultant Team*

4.4.2 Corridor Development Model (Scenario 2)

The Corridor Development Model strategically directs high-density, mixed-use development along major transportation routes (e.g., highways, arterial roads, transit lines) to create vibrant, walkable urban spines. Unlike sprawl-based expansion, this model promotes compact, efficient land use by concentrating housing, offices, retail, and public services along key mobility corridors. **Table 4-2** shows the primary advantages and disadvantages of this model.

Table 4-2, Pros and Cons of Corridor Development Model

Pros	Cons
• By focusing development along transport corridors (e.g., highways, railways), the city can improve accessibility and reduce travel time between important areas, benefiting daily commuters and facilitating efficient movement of goods. • Corridors can encourage high-density, mixed-use development around transit stations, reducing reliance on cars and promoting walkable, sustainable neighbourhoods that are more environmentally friendly. • Rather than spreading resources thinly, government can concentrate infrastructure investments (like roads, utilities,	• If not implemented carefully, corridor development may encourage urban sprawl, leading to longer commute times, higher vehicle emissions, and the loss of green spaces or agricultural land around the city. • Large-scale corridor development can harm the environment, particularly when natural habitats, water resources, or farmland are disrupted by new infrastructure and increased human activity. • Rapid corridor development can cause congestion on major routes, especially if public transit options are inadequate. Additionally, infrastructure

Pros	Cons
and transit) along these corridors, leading to better quality services and reduced costs.	upgrades may be necessary to meet rising demand, straining municipal budgets and triggering sudden land price increases that reduce affordability.

Source: *The Consultant Team*

4.4.3 Living Land Conservation Model (Scenario 3)

This model promotes sustainable approach of urban development by strategically preserving agricultural and natural landscapes while accommodating controlled growth. Unlike conventional approaches that encourage unchecked sprawl, it prioritizes infill development while protecting vital farmland, forests, and watersheds. By balancing urban expansion with ecological conservation, the model offers a blueprint for sustainable growth, that maintains productive landscapes, strengthens local food systems, and enhances quality of life for both urban and rural communities. **Table 4-3** shows the primary advantages and disadvantages of this model.

Table 4-3, Pros and Cons of Living Land Conservation Model

Pros	Cons
• This model conserves valuable agricultural and natural landscapes around city, protecting biodiversity and supporting local food systems. • Reduces the need for extensive new infrastructure, making it easier and more cost-effective to maintain and upgrade existing services and facilities • Higher density urban areas can decrease dependency on vehicles, resulting in lower emissions and energy use.	• Building vertically or converting existing low-density areas into high-density housing requires substantial planning and investment. • A significant increase in density can lead to overcrowding if not carefully managed, potentially causing issues like higher noise levels, limited green space, and increased strain on infrastructure.

Source: *The Consultant Team*

Following consultations with the client and stakeholders, and in consideration of Ghotki city's existing development structure, the Living Land Conservation Model (Scenario 3) has been selected for the proposed land-use zoning. This model supports sustainable urban growth by prioritizing high-density development and discouraging horizontal expansion. Through compact urban forms, it minimizes the conversion of agricultural land for urbanization, preserving critical natural and agricultural landscapes. By integrating eco-friendly practices, the Living Land Conservation Model ensures a balanced development strategy that safeguards the city's green and productive resources for future generations.

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4.5 Conceptual Zoning Model

The conceptual zoning model for Ghotki city uses concentric planning circles to establish an organized yet flexible approach to urban expansion. **Figure 4-7** illustrate that the inner circle is marked as Established Built-up Area, the darker outer zones represent high-potential areas for development, and the radial segments within the circles allocate specific land uses to meet the city's diverse needs. This design not only accommodates growth but also promotes environmental sustainability, efficient land utilization, and enhanced urban connectivity, offering Ghotki city a comprehensive framework for balanced and orderly development.

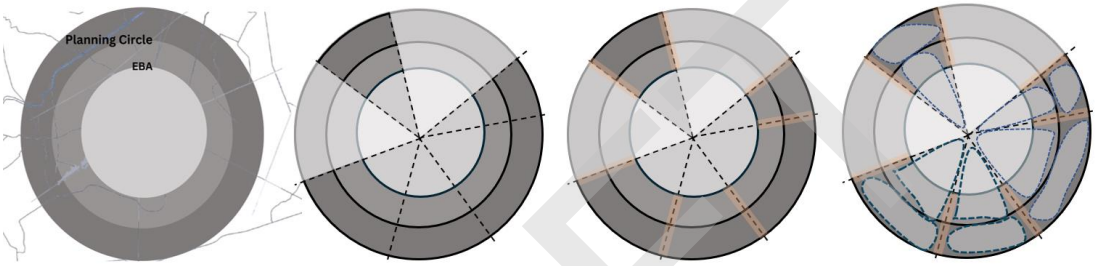


Figure 4-7, Conceptual Diagram for Planning Scenario - Ghotki

Source: *The Consultant Team*

4.6 Land Demand Calculation

To determine the future land demand for Ghotki city, a comprehensive assessment was conducted by considering the two main factors influencing land requirements: population and density. The density of Ghotki city has been increased by 50% in accordance with maximum achievable density to optimize land use. The population, which is the key driver of land demand, is derived from three primary sources:

- Existing urban population residing within the developed areas of Ghotki, who will require additional land over time to accommodate population growth and expanded urban services.
- Rural population within the designated urban expansion zone, which is expected to be integrated into the city's urban framework due to urban sprawl and natural engulfment, thereby necessitating additional urban land.
- Taluka rural population outside the planning boundary, of which 60% is considered for inclusion in the land demand calculations. This inclusion is justified as this portion of the population is expected to rely on Ghotki for higher-order urban facilities, while the remaining 40% will continue to fulfil their residential needs within their existing rural settlements.

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The calculation begins with the Current Population **(CP)** and the Current Area **(CA)** of Established Built-up Area[5] 2023, which gives the Current Population Density **(CPd)** by dividing **CP** by **CA**. To accommodate future growth, the Projected Population **(PP)** is determined based on demographic projections.

Current Population = **CP**

Current Population Density = **CPd**

A Desired Density **(DD)** is established[6] by increasing the Current Density by 50%, calculated as follows

Desired Density (50% increase) = DD = CPd + (CPd x 0.2)

Using this Desired Density, the Total Projected Area **(PA)** required for the projected population is calculated:

Total Projected Area = **PA = PP/DD**

New Area required = **PA – CA**

Table 4-4, Land Demand Calculation for Ghotki City (2023 – 2043)

Elements	Established Built-up Area (2023)	Rural Settlements inside UGB	Rural Settlements outside UGB
Population (2023)	119,879	23,206	386,808
Growth Rate (2023)	1.23	1.09	1.09
Estimated Population (2023)	140,429	23,206	386,808
Existing Area 2023 (ha)	1,021	183	-
Existing Density 2023 (pph)	137	137	-
Projected Population (2043)	307,697	28,824	480,463
Proposed Density (2023-2043)	206	206	206
60% of projected population	-	-	288,278
Cumulative population 2023-2043	**624,799**		
Total Population with 5% Contingency	**31,240**		
Total Population 2023-2043	**656,039**		
Cumulative Area 2023-2043 (ha)	**3,181**		
Additional Area 2023-2043 (ha)	**1,976**		

Source: *The Consultant Team*

[5] The "Established Built-up Area" is defined as an "Urban Contiguous Area" refers to a continuous, connected zone of a city that is fully developed with infrastructure, buildings, and urban services.

[6] A comparison conducted for medium-sized cities shows that the maximum achievable density is only 15-20% higher than the current density. Additionally, population growth within the same area results in an overall increase in density.

4.7 Proposed Land Use Zoning

The proposed land use zoning plan provides a strategic framework for the long-term development of Ghotki city, incorporating prevailing planning standards and guidelines. This comprehensive plan carefully integrates the unique contextual features of the city, including its topography, distinctive landscape, and historical elements, recognizing their direct influence on urban planning decisions. By addressing these critical factors, the zoning plan establishes a framework for balanced growth over the next 20 years.

The plan's fundamental strategy focuses on coordinating different land uses to achieve both physical expansion and economic development. It includes detailed allocations for residential, industrial, commercial, and community facilities, along with an integrated transportation network. Particular emphasis has been placed on optimizing locations for key infrastructure and services to ensure efficient urban functionality. This comprehensive approach ensures that all development aligns with Ghotki's vision for sustainable urbanization and improved quality of life for its residents.

Demographic projections form a crucial basis for the plan as the current projections indicate significant population growth, with density expected to increase from 139 persons per hectare to 166 persons per hectare. To accommodate this expansion, the plan allocates an additional 1,976 hectares for incremental population needs, bringing the total urban land requirement to 3,181 hectares. As Ghotki city enters a new phase of development, this zoning plan provides a clear roadmap for transformation with respect to its existing urban fabric. **Table 4-5** shows the distribution of proposed land use zones in Ghotki city.

Table 4-5, Proposed Land Use Distribution Percentage for Ghotki (2043)

Level 1 (Zoning)	Level 2 (Sub-Zoning)	Area (Acres)	Percentage Distribution
Residential	Existing Residential	2,434.29	47.58%
	Proposed Medium-High Density	2,108.65	
	Proposed Low-Medium Density	1,058.85	
Commercial	Existing Commercial	210.83	5.97%
	Proposed High-Density Mixed-Use Zone	301.11	
	Proposed Grain Market	59.12	
	Proposed Fruit and Vegetable Market	132.14	
Parks and Playgrounds	Existing Park/ Recreation	137.53	9.98%
	Proposed City Parks / Recreation	161.46	

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Level 1 (Zoning)	Level 2 (Sub-Zoning)	Area (Acres)	Percentage Distribution
	Urban Forestation	87.47	
	Proposed Recreational Neighborhoods	789.01	
Institutional	Existing Institutional	139.31	14.89%
	Proposed Education	556.96	
	Proposed Health and Welfare	537.63	
	Proposed Government/Public Administration	141.98	
	Science Park	377.29	
Utilities And Municipal Service Facilities	Utilities and Municipal Service Facilities	11.98	0.10%
	Proposed Grid Station	0.5	
	Proposed Fire Station	0.5	
Religious	Existing Religious	66.85	2.09%
	Proposed Community Centre	3.90	
	Proposed Graveyard Zone	175.90	
Industrial	Existing Industry	299.48	6.12%
	Proposed Industrial Zone	215.77	
	Proposed Special Economic Zone	205.11	
Transportation	Transportation	624.73	5.31%
Special Areas	Future Extension (Vacant)	394.22	3.35%
Agriculture and Forestry	Existing Agriculture and Forestry	121.44	4.06%
	Proposed Cattle Market	56.12	
	Proposed Dairy/Poultry Farming Zone	159.43	
	Urban Agriculture	140.06	
Water Bodies	Canals and Drains	64.57	0.55%
Total		**11,774.20**	**100.00%**

Source: *The Consultant Team*

4.7.1 Residential Zone

The proposed master plan emphasizes inclusive housing development by offering a diverse mix of residential options tailored to meet the needs of all income groups. In line with the National Reference Manual (NRM) standards for cities with populations ranging from 100,000 to 499,000, residential land use is expected to form the dominant component of future urban development.

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Based on projected population growth, the plan allocates 26% to 48% of the total area for residential purposes, as recommended by the NRM guidelines. The infill development approach fosters compact urban growth that enhances neighbourhood accessibility and walkability while creating more efficient, liveable communities. This strategy focuses on optimizing vacant and underutilized land parcels within contiguous city limits, particularly in core urban areas, to promote infill development rather than horizontal urban expansion. By concentrating growth within the existing urban boundary, the plan achieves multiple sustainable development objectives: preventing urban sprawl, maximizing the use of current infrastructure and road networks, reducing transportation demands, and maintaining close proximity between housing, employment centers, and social amenities. This approach is expected to partially address the immediate housing needs of incoming migrants seeking better living conditions.

However, the future residential developments are proposed to take place in the form of self-contained neighbourhoods with adequate provisions of streets, open spaces, commercial area, public buildings and other community facilities. The proposed residential areas are categorized into two main groups: Low to Medium Density Residential Zone (L-MDRZ) and Medium to High Density Residential Zone (M-HRDZ). The L-MDRZ is primarily situated at outskirts and/or peri- urban, preserving a low-density development pattern. In contrast, the M-HDRZ is located adjacent to existing built-up areas, aligning with traditional zoning regulations to facilitate development. This deliberate placement aims to minimize disruption to the surrounding areas and ensure compatibility with existing developments.

A) Zoning Regulations for Residential Zone

As per the rules, the residentiary density means the average number of persons residing on or occupying 1 acre of land. Following are the residential densities;

Density Type	Plot Area Sq. yds	Person per Acre	Density Type (consultant)
Density - 01	80	500	Very High Density
Density – 02	> 81 to 120	400	High Density
Density - 03	> 121 to 240	300	Medium Density
Density - 04	> 241 to 400	200	Low Density
Density - 05	>401 to 600	150	Very Low Density
Regional Interim Building and Town Planning, Regulations - 2018, Chapter 20, sub clause 20-3.2.1			

Flats Density as per the average number of persons residing on or occupying

1 acre of land are as follows;

Income Groups	Person per Acre	Density Type (consultant)
Low Income	650	Compact/High-Density Units
Medium Income	500	Moderate/Medium-Density Units
High Income	325	Spacious/Low-Density Units
Regional Interim Building and Town Planning, Regulations - 2018, Chapter 20, sub clause 20-3.2.2,3,4		

Allocations for various land uses for New Residential Schemes are as follows;

Sr. No	Land Allocation	Area Percentage of Total Land
1	Residential Uses	55%
2	Commercial Uses	5%
3	Roads/Streets	25%
4	Parks And Playground	8%
5	Public Uses (Religious Building and Health Centre)	4%
6	Educational Uses	3%

Source: *Regional Interim Building and Town Planning Regulations – 2018 (Chapter 20, sub clauses of 20-4.1)*

As per 25-B.2. Building Standards of residential within Sukkur Region shall observe the following standards;

Plot Size (sq. yds.)	Foot Print	No. of Floors (Max)	Minimum Front	Minimum Sides	Minimum Rear
Up to 119	90%	G+2	-	-	-
120-199	80%	G+2	3'-0	-	-
200-299	70%	G+2	3'-0	-	3'-0
300-399	65%	G+2	4'-0	one side-3'-0	3'-0
400-499	65%	G+2	5'-0	one side-3'-0	5'-0
500-999	65%	G+1	7'-0	5'-0	5'-0
1000 and above	60%	G+1	10'-0	5'-0	10'-0

The following guidelines are for residential zone development:

Permitted	Allied Permissible	Prohibited
• Residential Dwelling Units (Houses, Flats, Apartments) • Childcare • Clinics	• Accessory Buildings • Home Offices • Parks, Playgrounds • Small Scale	• Heavy industrial or polluting enterprises • Large-scale commercial and office complexes • Major transportation facilities (e.g., bus depots,

Permitted	Allied Permissible	Prohibited
• Small-Scale Education • Places of Worship	Commercial shops	highways) • Waste treatment/disposal sites, large utilities • Nuisance-creating land uses (e.g., livestock farming)

4.7.2 Commercial Zone

Ghotki's commercial zone presents both opportunities and challenges that this plan strategically addresses. The city currently exhibits vibrant but unplanned commercial growth, with retail activities heavily concentrated in the central urban core through traditional bazaars and shops that developed organically over time. This haphazard expansion has created significant urban challenges, including severe traffic congestion from mixed motorized and non-motorized traffic, vendor encroachments, and problematic on-street parking. To transform these conditions while preserving Ghotki's economic vitality, structured commercial zone is proposed as per the Sindh Building Control Act (SBCA) rules, approximately 5% across the city's total area.

High Density Mixed-Use Zone

The high-density mixed-use zones along key transportation corridors, including the western side of Ghotki Sugar Mill Road, northwestern Massoo Khan Kalwar Road, and National Highway (N-5) near the Ghotki bus terminal. These strategically positioned zones will feature vertical mixed-use buildings with commercial establishments on ground floors and residential units above, promoting walkability while reducing vehicular dependence.

Fruit and Vegetable Market

The proposed Fruit and Vegetable Market along Masoo Khan Kalwar Road in the southern side of city will serve as a modern wholesale and distribution hub strategically located with direct access to the proposed bypass road and Masoo Khan Kalwar Road to efficiently handle local and regional fresh produce. The facility will include cold storage, auction platforms, packaging units, and dedicated loading zones to minimize food waste, boost supply chain efficiency, and ensure food safety. By improving farmer access to markets and enabling transparent pricing, it will create jobs and strengthen connections between urban and rural economies. Its strategic location near farmland and major transport routes positions it as a key driver of local agricultural growth.

Grain Market

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A modern grain market will be established in eastern part of Ghotki along National Highway (N5), adjacent to the proposed education zone, creating an integrated agricultural trade hub. With direct access to the proposed bypass road and National Highway (N5), it will feature storage silos, auction halls, weighing bridges, and quality control systems to streamline cereal, pulse, and oilseed trade. This cluster will reduce costs, stabilize prices, and position Ghotki as northern Sindh's key agri-business center.

Cattle Market

To formalize Ghotki's vital livestock trade, a dedicated Cattle Market is proposed along Drigh Road and proposed bypass road, with modern auction platforms, veterinary facilities, and segregated zones for different animal types, strategically located near major transport routes for regional accessibility. This organized facility will replace informal roadside trading by providing proper sanitation controls, fodder storage, and loading bays, improving animal welfare while reducing traffic disruptions and public health risks associated with the current unregulated trade.

Neighbourhood Commercial

To ensure equitable access to commercial facilities, the plan introduces neighbourhood commercial centers distributed throughout proposed residential areas. These neighbourhood commercial centres will be integrated within residential neighbourhoods throughout the city to cater to daily retail needs, such as grocery stores, pharmacies, service shops, and other essential goods. These localized commercial areas will enhance accessibility and support walkable communities, improving convenience and quality of life for residents.

A) Zoning Regulations for Commercial Zone

As per 25-B.2. Building Standards of residential within Sukkur Region shall observe the following standards;

Plot Size (sq. yds.)	Foot Print	No. of Floors (Max)	Minimum Front	Minimum Sides	Minimum Rear
Up to 99	90%	G+4	-	Open duct one side of 30 Sq.ft.	-
100 and above	80%	G+5	-	Open duct one side of 30 Sq.ft.	Open duct of 30 Sq.ft.
Up to 149	90%	G+2	3'-0	-	3'-0
150-499	80%				
240-499	80%	G+2	4'-0	one side-3'-0	3'-0
*500-599	65%(GF) 70%(UF)	G+2	5'-0	one side-3'-0	5'-0
*600- 999	60%	G+1	7'-0	5'-0	5'-0

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Plot Size (sq. yds.)	Foot Print	No. of Floors (Max)	Minimum Front	Minimum Sides	Minimum Rear
*1000 and above	65%	G+1	10'-0	5'-0	10'-0

Source: *Regional Interim Building and Town Planning Regulations – 2018*

The following guidelines are for commercial zone development;

Permitted Uses	Allied Permissible Uses
• Corporate Head Office Buildings • Large Markets • Malls, Outlets • Large Public Squares and Parks • Dedicated Parking Lots / Spaces	• Pedestrian friendly streetscape • Mixed-used buildings • Medium to High Rise Apartments • Fuelling stations

4.7.3 Amenities

In accordance with the National Reference Manual (NRM) standards for populations ranging from 100,000 to 499,000, approximately 2% to 10% of land is proposed to be allocated for amenities in Ghotki. The proposed amenities include designated zones for education, health and welfare, public administration, a science park, community centers, and graveyards. The details of each proposed zone under the amenities land use category are as follows:

A) Educational Zone

Ghotki city faces significant educational challenges that demand urgent attention. With an overall literacy rate of just 63%, comprising 77% for males and 49% for females, city's education sector requires comprehensive improvement. The situation is exacerbated by inadequate infrastructure, where many schools lack basic facilities such as clean water, electricity, and functional toilets. Furthermore, overcrowded classrooms with student-teacher ratios as high as 62:1 in primary schools far exceed UNESCO standards. These systemic issues call for a transformative approach to education planning and development.

The educational zone is a critical component of the master plan. Its proposals include a dedicated educational zone along National Highway (N-5), eastern side of Ghotki-Khanpur Mahar Road, and the northern side of Dhingra Wah canal. Within this zone, 20% of the land is allocated for high-order educational facilities, including universities, degree colleges, research institutions, and vocational training centers.

The remaining 80% supports complementary land uses such as residential neighbourhood contains housing, green spaces, and community amenities, creating a balanced ecosystem that integrates learning with liability. Furthermore, the plan ensures universal access to school-level education within walking distance (i.e., 500m) of all neighbourhoods. Higher-order

institutions in the educational zone a\re strategically aligned with industry demands to bridge skill gaps and enhance employability. By harmonizing education with housing, technology, and environmental stewardship, the plan cultivates a future-ready, inclusive society equipped to tackle economic and social challenges.

1. Zoning Regulations for Educational Zone

As per 25-B.7. Building Standards of Amenity Plots within All Regions shall observe the following standards;

Sr. No	Plot Size Sq. Yds	Foot Print	Floor Area Ratio (F.A.R)	Minimum Front ft.	Minimum Sides ft.	Minimum Rear ft.
1	Less than 1.0 Acres	50%	1:1.5	10	10	10
2	1.0 Acre and above	50%	1:1.5	15	15	15

The following guidelines are for educational zone development;

Permitted Uses	Allied Permissible Uses	Prohibited Uses
• Large scale educational areas; • (Nursery Schools, Kindergartens, Primary Schools, Secondary Schools, High Schools, Colleges, Special Colleges, Technical Colleges, Universities, Research Institutes, Madrassah) • General Education Universities • Scientific Research Institutes • Engineering colleges / universities • Business and management schools • Finance and accountancy Institutes • IT and media Institutes • City level libraries, book banks, data and information centres	• Staff Residences (teaching and non-teaching) • Separate Hostels for Boys and Girls • Auditoriums, seminar halls, workshop spaces • Community facilities (parks, playgrounds, clinics, schools, neighbourhood commercial) • Support facilities (gym, health club, bus stops, taxi stand, banks, fuelling stations)	• Private Residential Housing Schemes • Large Commercial Activities

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Permitted Uses	Allied Permissible Uses	Prohibited Uses
As per SBCA Bylaws the education institutions must be duly charted by Govt. of Sindh and recognized by Higher Education Commission (HEC). The institutions must have a provision of ramp up to ground floor with a minimum width of 4 ft. (1.20m) and maximum gradient 1:12 with a railing at least on one side for disable people.		

B) Health and Welfare Zone

Ghotki city faces a severe healthcare crisis, with medical facilities covering just 0.63% (6.4 hectares) of urban land, far below recommended standards, to serve its population. The healthcare system of the city suffers from critical shortages of professional medical staff, inadequate equipment, and poor geographic distribution, leading to overwhelmed facilities and high disease rates. While there is only one Taluka Headquarter Hospital (THQ) provides essential healthcare services, the severe lack of clinics, dispensaries, and specialized care leaves residents struggling to access proper treatment. Urgent expansion, improved staffing, and public-private investments are needed to address these gaps and prepare for future growth, demanding a complete overhaul of healthcare planning and infrastructure development.

To address these challenges, Ghotki's proposed Health and Welfare Zone, a key component of the city's development master plan, aims to allocate urban land for healthcare, ensuring better access and improved public health outcomes. The zone is strategically located along southern side of Hussain Beli Road and Canal Road along National Highway (NH-5), and western side of Ghotki-Khanpur Mahar Road, to serve both urban and rural populations. 20% of the zone will be dedicated to high-order medical facilities, including upgraded hospitals, specialized care centers, and medical research institutes,

While the remaining 80% supports complementary land uses such as community centers, housing, green spaces like parks, gyms, and wellness centers. Hospitals, clinics, and pharmacies form the backbone of the zone, ensuring residents have access to essential medical care, while community centers and shelters provide critical support to vulnerable populations, including the elderly, disabled, and low-income families. By prioritizing health and welfare, this zone reduces health disparities, improves public health outcomes, and fosters a resilient, inclusive, and cohesive community.

1. Zoning Regulations for Health and Welfare Zone

As per 25-B.7. Building Standards of Amenity Plots within All Regions shall observe the following standards;

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Sr. No	Plot Size Sq. Yds	Foot Print	Floor Area Ratio (F.A.R)	Minimum Front ft.	Minimum Sides ft.	Minimum Rear ft.
1	Less than 1.0 Acres	50%	1:1.5	10	10	10
2	1.0 Acre and above	50%	1:1.5	15	15	15

The following guidelines are for Health and Welfare Zone development;

Permitted Uses	Allied Permissible Uses	Prohibited Uses
• Large Hospitals • Specialized treatment centers • Medical College • Dental College • Pharmaceutical College • Nursing College • Laboratories and Diagnostic Centers • Blood Banks • Health Research Institutes	• Staff Residences (medical and • paramedic) • Separate Hostels for Boys and Girls • Auditoriums, seminar halls, workshop spaces • Community facilities (parks, • playgrounds, schools, clinic, • neighbourhood commercial) • Support facilities (gym, health club, bus stops, taxi stand, banks, fuelling stations)	• Private Residential Housing Schemes • Large Commercial Activities
The institutions must have a provision of ramp up to ground floor with a minimum width of 4 ft. (1.20m) and maximum gradient 1:12 with a railing at least on one side for disable people.		

C) Public Administration Zone

Ghotki city's rapid urbanization and growing population necessitate the creation of a new, well-planned administrative zone to address current challenges in governance, service delivery, and urban sprawl. The existing administrative offices are concentrated in the congested city center, leading to accessibility issues, traffic bottlenecks, and inefficient public service delivery. The proposed public administration zone serves as the administrative and governance hub of the city, government offices, civic institutions, and public service facilities, designated along southern side of National Highway (N-5) for better accessibility.

The zone integrates municipal buildings, police stations, fire departments, post offices, and other critical institutions to ensure effective governance and

public service delivery. Civic spaces, including town halls and public squares, are designed to foster community engagement and participation in local governance, while the infrastructure is carefully planned to ensure smooth transportation, ample parking, and pedestrian-friendly pathways for easy accessibility. Additionally, dedicating space for private sector offices, such as banks, corporate services, and development firms, would foster economic activity and reduce the haphazard mixing of commercial and residential land uses seen in the old city. This zone plays a critical role in maintaining order, delivering public services, and fostering trust between the government and its citizens, ensuring a well-organized and responsive urban environment.

1. Zoning Regulations for Public Administration Zone

As per 25-B.7. Building Standards of Amenity Plots within All Regions shall observe the following standards;

Sr. No	Plot Size Sq. Yds	Foot Print	Floor Area Ratio (F.A.R)	Minimum Front ft.	Minimum Sides ft.	Minimum Rear ft.
1	Less than 1.0 Acres	50%	1:1.5	10	10	10
2	1.0 Acre and above	50%	1:1.5	15	15	15

The following guidelines are for Public Administration zone development;

Public Administration Zone		
Permitted Uses	**Allied Permissible Uses**	**Prohibited Uses**
• District Secretariat • Development Authority Town Committee Complex • Line Departments • Local Government Offices • Town Planning Department • Judiciary Complex • Circuit House	• Employees Residences (for all grades) • Auditoriums, seminar halls, workshop space • Community facilities (parks, playgrounds, clinics, schools, neighbourhood commercial) • Support facilities (gym, health club, bus stops, taxi stand, banks, fuelling stations)	• Private Residential Housing Schemes • Large Commercial Activities
The institutions must have a provision of ramp up to ground floor with a minimum width of 4 ft. (1.20m) and maximum gradient 1:12 with a railing at least on one side for disable people.		

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D) Science Park

The science park is envisioned as a dynamic and innovative hub within the master plan, designed to foster research, development, and technological advancement. This zone allocates 20% of its land to high-order facilities such as software houses, skill/ IT based research institutions, technology incubators, and innovation centers, while the remaining 80% supports complementary land uses like office spaces, green areas, and residential accommodations for researchers and professionals. It is strategically located near major transport corridor specifically along National Highway (N-5) on the western and eastern edges of the city. The science park promotes collaboration between academia, industry, and government, driving economic growth and technological innovation.

The zone will feature state-of-the-art laboratories, conference facilities, and co-working spaces, creating an ecosystem that encourages knowledge sharing and entrepreneurship. By attracting talent, investment, and cutting-edge projects, the science park aims to position the city as a leader in science and technology, fostering a culture of innovation and contributing to long-term economic and social development.

1. Zoning Regulations for Science Park

The following guidelines are for Science Park development;

Science Park		
Permitted Uses	**Allied Permissible Uses**	**Prohibited Uses**
• Educational and Research Institutions • Offices of Social and Cultural Organizations • Software houses and IT firms • Research and development institutions • Technology incubators and innovation centers • Skill development and training centers • Approved Parking Provisions • Research centers • Libraries	• Office spaces for technology-related businesses • Food courts • Petrol and gas filling Station Parks, Memorials and Monuments • Day Cares • Public Utilities and Buildings Taxi Stands, Bus Halts • Residential accommodations for researchers and professionals Co-working spaces	Other than permitted and permissible

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Science Park
The institutions must have a provision of ramp up to ground floor with a minimum width of 4 ft. (1.20m) and maximum gradient 1:12 with a railing at least on one side for disable people.

E) Community Center

As part of the proposed land use plan, the Community Center is envisioned as a dynamic, multi-purpose facility that addresses the divine, social, and developmental needs of residents. It will include dedicated spaces for religious practices, community events, and essential support services. In addition to serving as a venue for worship and celebrations, the center will also actively promote interfaith dialogue, cultural interaction, and lifelong learning. Strategically positioned along the southern side of Railway line on Masoo Khan Kalwar Road on the southern edge of the city, the center is designed to foster social cohesion and improve community well-being.

1. Zoning Regulations for Community Centre

The following guidelines are for Community center development;

Permitted Uses	Allied Permissible Uses	Prohibited Uses
• Spaces for religious practices (e.g., prayer areas) Community gatherings and events Educational and skill development programs Cultural and recreational activities	• Administrative offices Health and social support services Small-scale food kiosks or cafés Temporary shelters during emergencies	• Industrial or manufacturing activities Permanent residential units Commercial plazas or large-scale retail operations Entertainment venues unrelated to community welfare
The institutions must have a provision of ramp up to ground floor with a minimum width of 4 ft. (1.20m) and maximum gradient 1:12 with a railing at least on one side for disable people.		

F) Graveyards Zone

The graveyards in Ghotki city currently cover 15.14 hectares (1.48% of urban land), with major cemeteries concentrated around Station Road, Ali Akbar Shah Road, and southern Rahmowali Road. These sites face increasing pressure from urban growth, with limited expansion potential due to surrounding development. The city's multi-faith population maintains distinct burial spaces, Muslim cemeteries near Eid Gah, Hindu cremation grounds

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along Bhagowah Road, and Sikh smadhs by Gurdwara Guru Ram Das, each with specific spatial needs. Current challenges include overcrowding, poor access (particularly noticeable along the National Highway corridor which lacks any cemetery), and inconsistent maintenance.

To address these issues, a new graveyard zone is strategically designed to address both immediate and long-term needs for burial spaces in the city. It is proposed on the northeastern and southeastern sides of the city. This zone also follows a strategic framework of 80% residential use and 20% dedicated solely to graveyard purposes. This allocation not only optimizes land use but also integrates the graveyard zone within a broader residential context, making it accessible and respectful of community needs. By establishing this zone, the city aims to provide a long-term solution for burial space while enhancing the surrounding residential areas.

1. Zoning Regulations for Graveyards Zone

The following guidelines are for Graveyard zone development;

Graveyards Zone		
Permitted Uses	**Allied Permissible Uses**	**Prohibited Uses**
Graveyard Area	• Related commercial activities • Accommodation for caret	Other than permitted and permissible

4.7.4 Recreational Zone

Recreational spaces in Ghotki city are severely lacking in both numbers and location, as they are not adequately serving the entire city population, making up only 1.42% of the total urban area which is far below the 8% minimum recommended standard by SBCA. The existing parks, such as Rahmowali park, MC park, Ladies Park and Railway Park, are insufficient for the growing population. The proposed development master plan addresses the disappearance of open spaces and the lack of planned recreational zones in the existing city by prioritizing recreational land use to create a healthier and more sustainable urban environment.

Recreational zone includes a variety of green spaces such as city parks for both active and passive recreational facilities, urban forestry along major roads and canals, and preserved orchards (if any). Neighbourhood-level parks and open spaces are also incorporated to ensure accessibility for local communities. The main city park is strategically located on the northwestern side of Devri Road along N-5, while recreational neighbourhoods along Hussain Beli Road, Massoo Khan Kalwar Road, Ghotki Mathelo Road, Devri Road, or etc., are proposed to equitably fulfill the recreational requirements of the entire community throughout the city. In recreational neighbourhood zone, 80% of the area is designated for housing, while 20% is allocated for

recreational purposes, including mohalla and neighbourhood parks. Overall, 20% of the city's total area is reserved for recreational land use, underscoring its pivotal role in creating a balanced, vibrant, and liveable urban structure.

A) Zoning Regulations for Recreational Zone

The following guidelines are for Recreational zone development;

Permitted Uses	Allied Permissible Uses	Prohibited Uses
• City scale parks • Large public squares • Sports facilities • Cultural activities • Amusement area • Special theme parks • Regional level gardens like botanical, zoological	• Ancillary structures • Accommodation for caretakers / workers • Related commercial activities • Fuelling stations • Parking • Public washrooms	• Other than permitted and permissible

4.7.5 Industrial Zone

The existing industries (rice mills, flour mills, brick kilns, and warehouses) in Ghotki city is concentrated along Devri Road, Ghotki Khanpur Mahar Road and National Highway (N-5), forms the backbone of the local economy but suffers from haphazard development and infrastructure limitations. As per the NRM standards for Ghotki 3% to 8% land in Ghotki is proposed to be allocated for industrial use. New proposals include the development of a dedicated industrial zone and a Special Economic Zone (SEZ), are proposed, positioned along Hussain Beli Road and Devri Road aims to systematically address these challenges while capitalizing on current city's growth patterns. By strategically locating these zones along emerging development corridors, the plan will both upgrade traditional industries through modern facilities and clustering, while introducing higher-value sectors like food processing and renewable energy that complement Ghotki's agricultural strengths.

This integrated approach promises to transform the current pattern of industrial activity into an organized economic engine, creating thousands of formal jobs, attracting new investment, and improving linkages to transportation networks. The initiative represents a key opportunity to build upon Ghotki's established industrial base while steering its economic future toward more sustainable and diversified growth.

A) Zoning Regulations for Industrial Zone

As per 25-B.6. Building Standards of Industrial Plots within All Regions shall observe the following standards;

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Sr. No	Plot Size Sq. Yds	Foot Print	F.A.R.	Minimum Front ft.	Minimum Sides ft.	Minimum Rear ft.
1	Up to 1100	70%	1:2.5	8	5 one side	10
2	1101 to 2500	70%	1:2.5	10	10 each side	10
3	2501 to 20000	65%	1:2	20	15 each side	15
4	20001 to 30000	60%	1:2	20	15 each side	20
5	30001 to 45000	60%	1:1.5	30	15 each side	20
6	Above 45000	60%	1:1.5	30	15 each side	45
Plots below 1100 Sq. Yds. shall not be allowed for use of heavy Industry, except cottage industry. However, on plot less than 1100 Sq. Yds., the approval for medium industry shall be allowed subject to NOC of Industries Dept: GoS.						

Allocations for various land uses for new industrial towns and estates are as follows;

Sr. No.	Land Allocation	Area Percentage of Total Land
1	Industrial area	70%
2	Commercial area	1%
3	Roads/Streets	20%
4	Parks And Playground	3%
5	Public Uses (Religious Building and Health Centre)	6%
6	Educational Uses	3%

Source: *Regional Interim Building and Town Planning Regulations – 2018 (Chapter 20, sub clauses of 20-4.2.4)*

Industrial Plots (Regional Interim Building and Town Planning Regulations - 2018 (Chapter 20, sub clauses of 20-4.2.4 ,5)

On industrial plots of 5 acres and more, 8% of the total plot area in the rear shall be allowed for residential, local commercial, amenity, road etc. within the premises for labour and staff for which a separate approach shall have to be provided. The minimum distance between the factory and residential units shall be at least 40 ft. (12.18m.)

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In any industrial area, no road shall be less than 50 ft. (15.22m) in width for areas allocated for large and medium industries and no less than 40 ft. (12.18m) for area allocated for small industries.

The following guidelines are for Industrial Zone development;

Industrial Zone		
Permitted Uses	**Allied Permissible Uses**	**Prohibited Uses**
• Large-scale manufacturing/ heavy industry • Small-scale manufacturing/ light industry • Wholesale uses: warehousing, godowns, and wholesale markets	• Showrooms • Mixed-used buildings • Residences for workers • Fuelling stations	• Private Residential housing schemes • Large health and educational institution

4.7.6 Urban Forestation Zone

As part of the city's green infrastructure strategy, urban forestation is proposed along major corridors and canals. A 50 feet wide green buffer on both sides will be developed as dense urban forest belts, enhancing ecological value, improving air quality, and creating aesthetically pleasing urban landscapes. Additionally, increased tree cover is planned along Sukkur-Multan Motorway (M-5), contributing to climate resilience and boosting the overall greenery and environmental health of the city. This initiative aims to promote biodiversity, reduce urban heat island effects, and create a more liveable and sustainable urban environment. Engaging local communities in these planting initiatives can further enhance the success of such projects by fostering a sense of ownership and stewardship over these green spaces.

A) Zoning Regulations for Urban Forestation Zone

The following guidelines are for Urban Forestation Zone development;

Urban Forestation Zone		
Permitted Uses	**Allied Permissible Uses**	**Prohibited Uses**
• Horticulture • Landscaping • Plantation • Green belts • Urban	• Related land use and activities, while no land development or buildings • Temporary accommodation for labor	• Land development for commercial or residential purposes

forestation	and security persons • Specific parking area for any accident and unplanned incident.	• Construction of permanent buildings • Industrial or high-traffic activities

4.7.7 Dairy/ Poultry Farming Zone

A state-of-the-art Dairy/ Poultry Farming Zone is proposed along the Sukkur-Multan Motorway (M-5) on the northern side of city, integrating modern dairy (mechanized milking systems), poultry (climate-controlled sheds), and fish farming operations. The zone will implement sustainable practices like manure recycling and water reuse while featuring veterinary services, cold storage, and farmer training programs. Strategically located for market access, this initiative aims to boost regional production of milk, eggs, poultry, and fish, enhance food security, and promote eco-efficient farming techniques to strengthen Ghotki's agricultural economy.

A) Zoning Regulations for Dairy/ Poultry Farming Zone

The following guidelines are for Dairy/ Poultry Farming Zone development;

Dairy/ Poultry Farming Zone		
Permitted Uses	**Allied Permissible Uses**	**Prohibited Uses**
• Cattle Farms • Poultry Farms • Pasture and grazing lands • Slaughter Houses • Dairy production • Veterinary services • Veterinary education and training	• Low rise ancillary structures • Residences of caretakers • Related commercial activities • Fuelling stations • Godowns and • cold storage • Cattle market	• Other than permitted and permissible

4.7.8 Agricultural Zone

To manage urban expansion effectively, all areas beyond the designated planning boundary have been classified as agricultural zones. This strategic designation aims to contain the city's growth, preserving valuable farmland and promoting sustainable land use practices. By limiting urban development in these regions, the plan seeks to maintain the ecological balance and ensure that agricultural activities continue to thrive, ultimately supporting local food production and community resilience.

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A) Zoning Regulations for Agricultural Zone

The following guidelines are for agricultural zone development;

Agricultural Zone	
Permitted Uses	**Allied Permissible Uses**
• Land use for proposed agricultural and its necessities.	• Related land activities with respect to its rules and regulations • Accommodation for farmers and labour in associations with MC.

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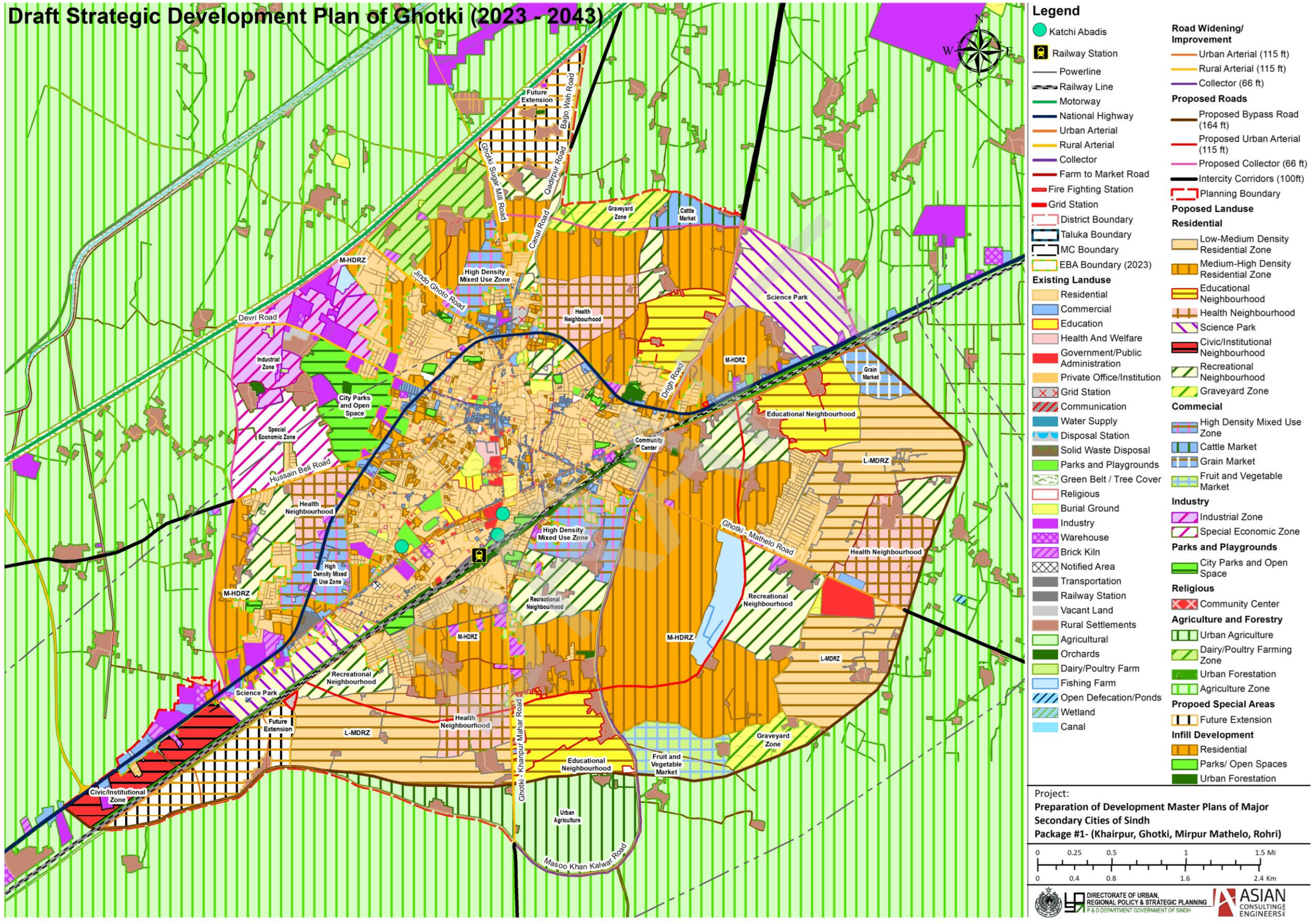


Figure 4-8, Draft Strategic Development Master Plan of Ghotki (2023-2043)

Source: *The Consultant Team*

SECTION - 5: HOUSING

5.1 Introduction

This section outlines a strategic approach to address the city's housing challenges, starting with an assessment of current conditions, including quality, distribution, and service access. A SWOT analysis identifies key sectoral strengths and gaps, while future housing needs are projected based on population growth. Land Suitability Analysis (LSA) supports the identification of areas for residential expansion. Based on these insights, policy recommendations and a Strategic Development Plan are proposed, along with priority projects and an Immediate Action Plan to meet urgent needs and promote sustainable, inclusive housing development.

5.2 Existing Situation

The current state of housing in Ghotki city is similar to the situation nationwide. Ghotki is a rapidly growing urban area. Along with the natural increase in the local population, a significant number of immigrants from nearby villages are also contributing to the city's population every year. Housing and other basic municipal services in Ghotki are often below standard. The situation has worsened as the urban population has grown. Despite an increase in the quantity of housing supply over the years, the condition of housing in Ghotki remains inadequate.

The majority of the surveyed houses were deemed to be in satisfactory condition. According to the socio-economic survey 2023, approximately 43% of the houses were constructed within the past 10 years, 27% within the past 20 years, 10% within the past 30 years, and 21% over 30 years ago. In addition, around 48% of the houses had plot sizes ranging from approximately 80 to 120 square yards.

Regarding household utility services, there is need for improvement in basic amenities. According to the socio-economic survey 2023, 50% of homes are equipped with drainage systems in their toilets, while the other 50% have toilets without drainage, necessitating manual cleaning.

5.3 Available Housing Stock

The quantity of existing housing stock in Ghotki city is an important consideration in evaluating the adequacy of the existing stock and predicting future housing requirements. The condition and age of residential units are two physical characteristics of the housing supply that reflect the quality of housing. Other variables, such as tenure, building height, plot size, number of rooms, and affordability, determine the overall status of the housing supply. The **Table 5-1** displays the existing housing stock for 2023,

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estimated from the 2017 housing census data[7] as the census data of 2023 is not available yet, and the quality of the existing housing stock is analysed using data collected from socio-economic survey.

Table 5-1, Existing Housing Stock and Backlog in Ghotki City

Population (2017)	111,398
Population (2023)	140,429
Housing Units (2017)	19,297
Household Size (2017)	5.48
Required Housing Units (2017)	20,328
Housing Backlog (2017)	1,031
Percentage of Backlog (2017)	5.34%
Household Size (2023)	5.47
Required Housing Units (2023)	25,673
Estimated Housing Backlog (2023)	1,372
Existing Estimated Housing Units (2023)	24,301

Source: *Pakistan Bureau of Statistics and Consultant Team*

5.4 Katchi Abadis of Ghotki

Ghotki city is grappling with significant challenges stemming from unplanned urban development. The inner core of the city has seen the rise of densely populated areas, notably Shamshabad Mohalla, Saien Chando Ram Colony, Scrap Colony, Benazir Colony, and Mohalla Pir Mehboob. These neighbourhoods are marked by chaotic construction and insufficient infrastructure, leading to rapid population growth without adequate urban planning measures. Residents face issues such as narrow, congested lanes, poor sanitation, and limited green spaces, which detrimentally affect their quality of life. To tackle these challenges, a comprehensive approach involving urban planning, infrastructure enhancement, and community engagement is essential.

In addition to these unplanned areas, Human Settlement Authority (HSA), formerly known as the Sindh Katchi Abadis Authority (SKAA), has identified several Katchi Abadis (informal settlements) in Ghotki city including Rahmowali, Ghota Bazar, and Garibabad. These settlements, characterized by densely packed housing and narrow alleys, exhibit resilience despite facing similar infrastructural deficiencies and a lack of basic amenities. The settlement of Rahmowali, near the railway station, also reflects this trend of informal community development amidst infrastructural challenges.

[7] *2017 housing census data is utilized because the 2023 census data for housing in MC is not yet available.*

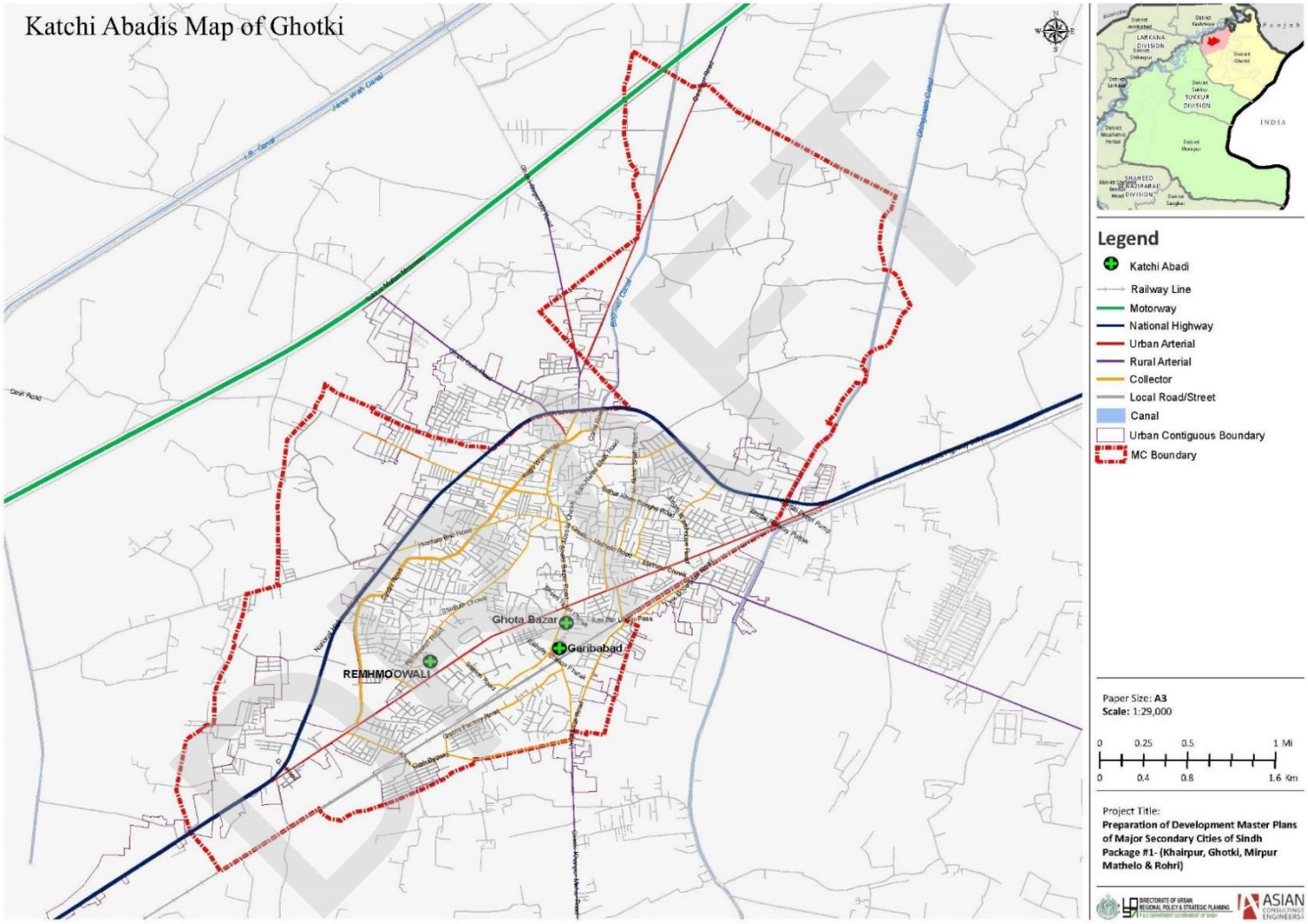


Figure 5-1, Location of Notified Katchi Abadis - Ghotki City

Source: *The Consultant Team*

Human Settlement Authority (HSA) formerly known as Sindh Katchi Abadis Authority (SKAA) has the power to implement policies formulated by government for the development or improvement of the areas of the Katchi Abadis and regularization of such Katchi Abadis.

5.5 SWOT Analysis

Strengths	Weaknesses
• Presence of planned layouts indicates for organized urban development	• Mushroom growth (unknown status of PHS) • Poor building topology
Opportunities	**Threats**
• Vacant land can be used for infill development to minimize horizontal expansions.	• Policy issues • Land speculation • Lack of implementation of building byelaws

5.6 Need Assessment

5.6.1 Housing Demand for the Project Period

Based on the estimated population data of 2023, the housing demand for Ghotki city (2023-2043) is estimated to be 27,275 dwelling units, assuming an average household size of 5.47 persons for the projected population of 307,697. The housing demand has been calculated by considering factors such as housing backlog, new demand generated due to increase in population and the availability of vacant housing stock in the city. The year wise housing demand is shown below in **Table** 5-2.

Table 5-2, Five Year Interval Wise Housing Demand (2023-2043)

Year	Incremental Population	Average Household Size (DCR-2023)	Housing Demand
2028	30,424	5.47	5,562
2033	37,016		6,767
2038	45,035		8,233
2043	54,793		10,017
Housing Demand based on population projections (2023-2043)			26,104
Housing Backlog 2023			1,171
Total Housing Demand (2023-2043)			**27,275**

Source: *PBS and The Consultant Team*

5.6.2 Residential Land Suitability Analysis

Land Suitability Analysis (LSA) for residential development in Ghotki city focuses on evaluating various factors such as topography, proximity to infrastructure, environmental conditions, and existing land use, etc., to

determine the best locations for housing, particularly emphasizing areas along major primary and secondary roads and existing settlements. Suitable residential areas (**Figure** 5-2) are often found near main networks such as National Highway, Ghotki Mathelo Road and Railway Line, which provide essential access to transportation, services, and amenities, enhancing the convenience for residents. Additionally, proximity to infrastructure such as utilities and social services is crucial, as it reduces development costs and improves overall liveability. Areas that are within a distance of 200 to 1000 meters from major roads such as Ghotki Khanpur Mahar Road, Ghotki Mathelo Road, Jindo Ghoto Road as well as other secondary roads, are generally considered optimal for residential use, balancing accessibility with the need to avoid excessive noise and pollution from traffic. Furthermore, the presence of existing residential neighbourhoods could indicate desirable locations for new developments. These neighbourhoods often reflect established community dynamics and have infrastructure support.

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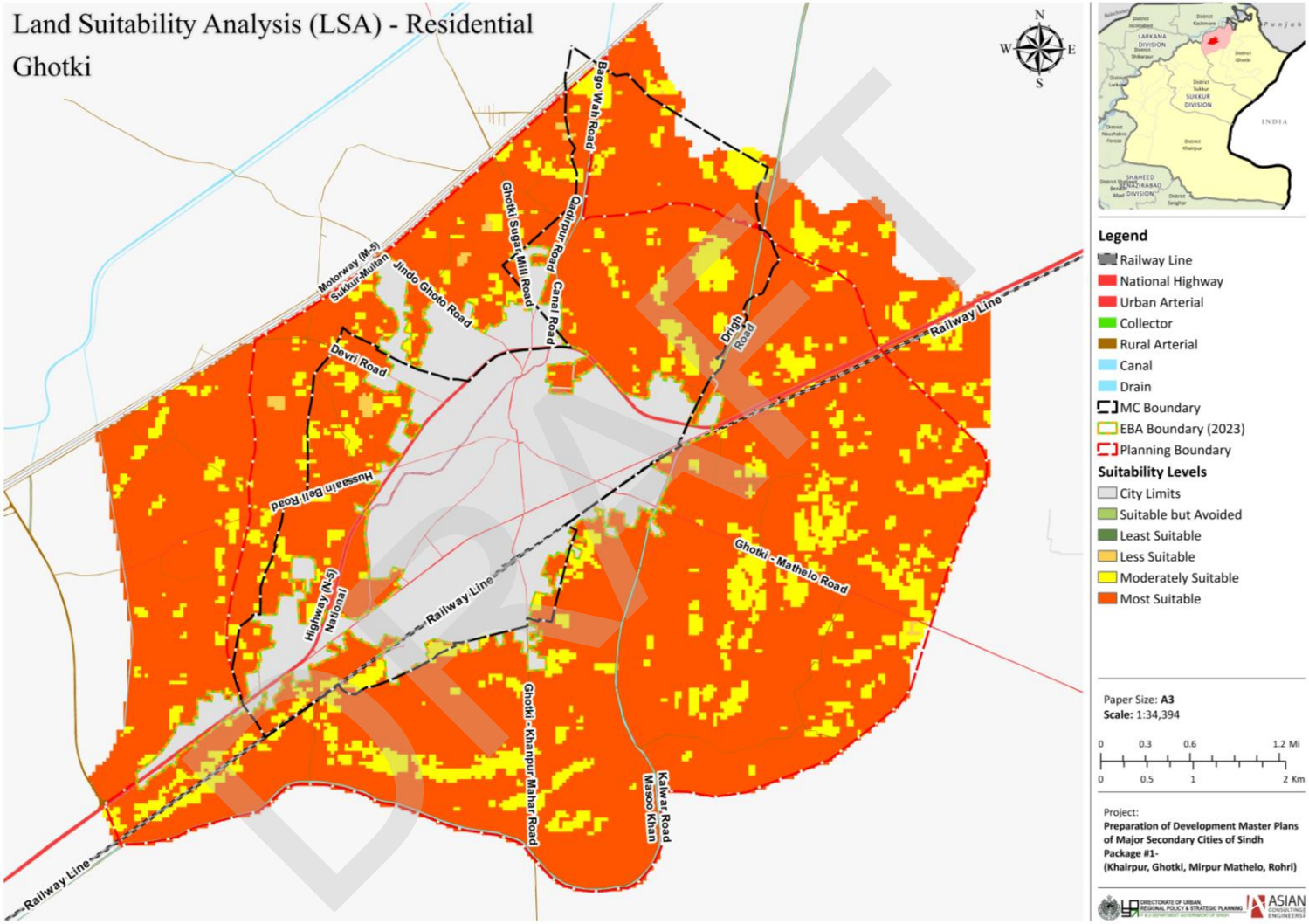


Figure 5-2, Land Suitability Analysis - Residential

Source: *The Consultant Team*

5.7 Policy Guidelines

The housing sector in Ghotki city must be developed in alignment with existing laws, policies, rules, and regulations at the federal, provincial, and local levels. The following policy guidelines are framed with respect to the available legal framework to ensure effective implementation and compliance:

5.7.1 Policy Measures for Land

Priority Identification of Land for Housing

Under the Sindh Land Revenue Act (1967), provincial and local authorities must identify state and private lands suitable for housing. Private developers shall be engaged in this process through public-private partnerships (PPPs) to ensure market-driven land allocation while preventing speculative hoarding. Priority will be given to urban areas with existing infrastructure to minimize development costs.

Land Acquisition

The Land Acquisition Act (1894) governs land acquisition for public housing schemes, ensuring fair compensation at market rates. For private housing schemes, developers must negotiate directly with landowners under Sindh Real Estate Regulatory Authority (SRERA) guidelines to prevent forced evictions and ensure transparency.

Land Information System

As mandated by the Sindh Land Revenue Act (1967), a GIS-based land information system shall be developed to maintain accurate records of land inventory, classification, and availability, with regular updates to reflect changes in ownership, land use, and settlement patterns.

Land Registration and Tenure System

Under the Sindh Land Revenue Act (1967) and Sindh Katchi Abadis Act (1987), informal and customary land tenure systems shall be rationalized into a formal, registered social contract, providing secure land titles to residents of Katchi Abadis and informal settlements.

5.7.2 Policy Measures for Housing Finance

Encouraging Financial Institutions

In line with the State Bank of Pakistan (SBP) regulations and the Mera Pakistan Mera Ghar (MPMG) program (initiated in 2020), financial institutions shall be encouraged to provide low-interest mortgage loans to low- and middle-income groups, while microfinance institutions shall offer small loans for housing construction and improvements.

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Subsidized Housing

Under federal and provincial housing policies, subsidies will prioritize urban housing schemes. A cross-subsidy model will be implemented, where revenue from high-value commercial plots in private developments funds low-income housing units. Additionally, subsidized loan facilities will support rural housing construction and improvements through microfinance institutions such as Khushhali Bank and Zakat funds.

5.7.3 Policy Measures for Katchi Abadis, Squatter Settlements, and Slums

Regularization and Upgradation

Under the Sindh Katchi Abadis Act (1987), prior to 23rd March 1985, Katchi Abadis shall be regularized, providing residents with legal ownership rights, while infrastructure upgrades, including water supply, sanitation, and electricity, shall be implemented to improve living conditions.

Relocation of Hazardous Settlements

In compliance with the Sindh Katchi Abadis Act (1987) and National Disaster Management Authority (NDMA) Guidelines, Katchi Abadis located in hazardous zones, such as flood-prone areas, near railway tracks, or under high-tension power lines, shall be relocated to safer areas with proper compensation and resettlement support.

5.7.4 Policy Measures for Low-Income Housing

Reservation of Plots for Low-Income Groups

In all government and private housing schemes, 20% of plots shall be reserved for low-income groups and offered at affordable prices, as per the Sindh Local Government Act (2013). Private developers shall be incentivized to develop low-cost housing schemes through tax breaks and land subsidies.

Incremental Housing Plans

Under the Sindh Building Control Ordinance (1979) and Sindh Local Government Act (2013), building bylaws and planning standards shall be revised to permit incremental development, making housing more affordable for low-income groups, and local governments shall prepare housing plans to address current and future housing needs.

Infrastructure Provision

As per the Sindh Local Government Act 2013 (amended in 2021), all approved housing schemes will be provided with fundamental amenities such as piped water, sewerage, electricity, and gas connections, in collaboration with the appropriate authorities to ensure prompt infrastructure development. According to SRERA regulations, private developers are

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required to offer water, sewerage, electricity, and roads before selling plots. Failure to comply will result in project blacklisting and financial penalties.

5.7.5 Policy Measures for Disaster-Resilient Housing

Flood-Resilient Designs

Under the Sindh Building Control Ordinance (1979) and NDMA Guidelines, flood-resistant materials and elevated housing designs shall be promoted in flood-prone areas, and local builders and contractors shall be trained in disaster-resilient construction techniques.

Insurance Schemes

Affordable housing insurance schemes shall be introduced under the Sindh Insurance Ordinance (2000) to protect homeowners from losses due to natural disasters.

5.7.6 Policy Measures for Monitoring and Evaluation

Anti-Speculation Measures

The Sindh Prohibition of Housing Schemes and Land Subdivision (Unregulated) Act (2021) bans unauthorized housing schemes. Developers must complete construction within 5 years of land acquisition, or plots shall be auctioned to prevent artificial shortages.

Regular Audits

In compliance with the Sindh Transparency and Right to Information Act (2016), regular audits of housing projects shall be conducted to ensure compliance with policies and standards, promoting transparency and accountability.

Performance Metrics

As per the Sindh Local Government Act (2013), performance metrics shall be developed to evaluate the success of housing initiatives, enabling data-driven improvements and ensuring effective resource allocation.

Feedback Mechanisms

Under the Sindh Transparency and Right to Information Act (2016), feedback mechanisms shall be established to gather input from residents, ensuring that housing policies and projects are responsive to community needs and expectations.

5.8 Strategic Development Plan

By 2043, the city's population is projected to grow by 307,697. To accommodate this, a structured plan will guide development within existing urban areas and expansion zones, ensuring sustainable growth. A 773

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hectares residential zone is proposed in the northern, northeastern, and southern side of city, strategically located near arterial roads for easy access to key urban centers and employment hubs. The aim of this Strategic Development Plan is to facilitate the provision of housing, infrastructure, and urban amenities, particularly for the poor and deprived population in Ghotki city. The following strategies need to be focused on:

A) Long-Term Plan

- Develop new planned residential expansions (near Ghotki-Mathelo Road, Railway Station, and Khanpur Road) to reduce urban congestion.
- Mandate 60% of new housing schemes to allocate 80–120 sq. yd. plots for low-income families.
- Reduce construction costs by 30% using local materials.
  - Training programs for masons on stabilized mud blocks and ferrocement roofing.
  - Provide subsidy on locally made bricks for low-income builders.
- Establish a Housing Regulatory Cell under SDA to monitor illegal land grabs and approve ethical housing schemes.
- Digitize land records to reduce fraudulent transactions (linked with Sindh Land Revenue Dept.).
- Establishing a dedicated housing fund modelled on the Akhuwat Foundation in Pakistan, which provides interest-free microfinance to low-income individuals for affordable housing and community development in Ghotki.
- Engaging private developers in affordable housing projects through government-backed incentives and land subsidies.

B) Short-Term Plan

- Legalizing informal settlements after implementing an infrastructure improvement package to enhance residents' living conditions.
- Retrofit 20% (as per socio-economic survey, 2023) vulnerable homes throughout city with raised plinths and bamboo-reinforced walls.
- Relocate families from railway-side slums to proposed new low-cost housing developments.
- Ensuring the provision of tap water connections to every house in the core urban area.
- Replace open drains with underground pipes in Pir Mehboob Mohalla and Scrap Colony.
- Developing green medians along major roads and promoting rooftop gardens to mitigate pollution and improve urban ecology.

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- Upgrading streets specially in core urban areas with concrete slabs, hard tiles, or brick pavement to create safe, pedestrian-friendly pathways, particularly for children and vulnerable users.
- Installing smart LED street lighting with motion sensors and solar power integration in all residential and commercial areas, along with vertical gardens on light poles for aesthetic and environmental enhancement.

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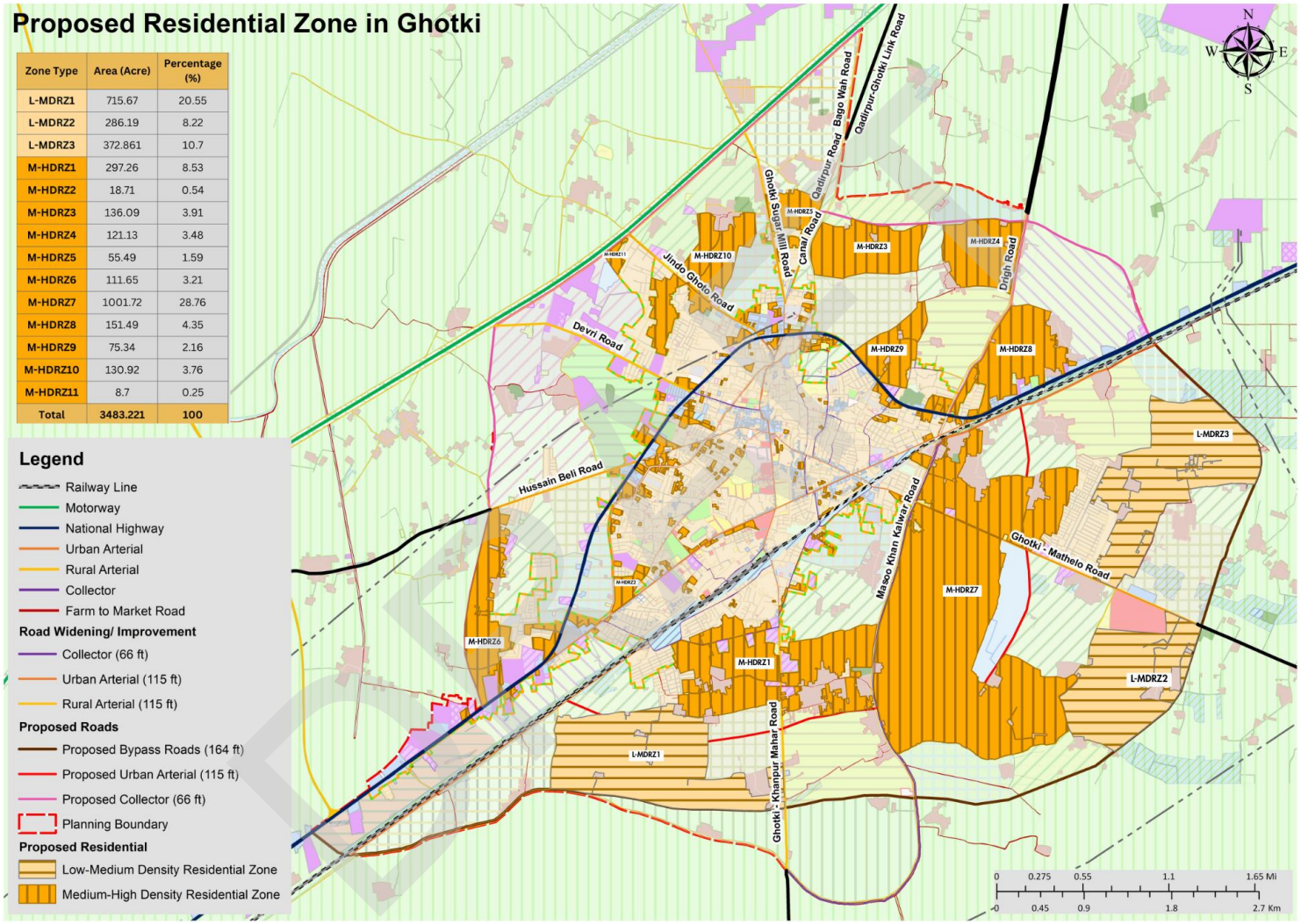


Figure 5-3, Proposed Residential Zones in Ghotki

Source: *The Consultant Team*

5.9 Priority Project

5.9.1 Development of a Housing Site for Low-Income Communities in Ghotki City

A) Project Justification

Ghotki city is experiencing a growing housing shortage, with low-income groups being the most affected. A significant portion of residents live in substandard conditions, lacking basic infrastructure such as potable water, electricity, and sanitation. A socio-economic survey (2023) reveals that 68% of families own their homes, 32% rely on rented or government-subsidized housing. However, even among homeowners, many dwellings are unsafe and overcrowded due to financial constraints. Unplanned urban sprawl and encroachments have further exacerbated the issue, leading to environmental degradation and inefficient land use.

1. Site and Services Model

This project proposes the implementation of a "Site and Services Model", a sustainable, proven solution where the project authority provides developed plots equipped with essential infrastructure (roads, water, sanitation, and electricity) to beneficiary families. This model allows households to construct homes incrementally according to their financial capacity, ensuring affordability, reducing the proliferation of informal settlements, and promoting planned urban expansion. Building on the successful precedent of the Khuda-Ki-Basti (KKB) in cities like Karachi and Hyderabad, this project will leverage an established model to efficiently address Ghotki's housing deficit, benefiting approximately 2,500 plots in the short term while ensuring urban growth is inclusive and sustainable.

B) Project Scope

The scope is designed to create a holistic and sustainable neighbourhood rather than merely a collection of plots. This project aims to develop a planned community in Ghotki to address the housing crisis by:

- Developing a fully serviced site with core infrastructure including roads, potable water, sanitation, electricity, and waste management for a minimum of 2,500 plots.
- Allocating serviced plots with secure land tenure to pre-qualified low-income families, providing a legal and affordable foundation for housing.
- Integrating essential social infrastructure such as reserved land for a school, health clinic, green spaces, and community facilities to create a holistic community.

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- Implementing a progressive housing model by providing technical support and facilitating access to microfinance, enabling families to build their homes incrementally.
- Promoting sustainable urban growth by offering a planned alternative to slums, reducing informal settlements, and ensuring efficient land use.

C) Project Details

The project will cover a total site area of approximately 50 hectares, accommodating 2,500 housing units, each measuring 120 square yards. The estimated development cost is PKR 30 million per hectare, amounting to a total project cost of PKR 2.6 billion. The target beneficiaries are low-income families earning less than PKR 50,000 per month. The housing model consists of core housing system where the beneficiaries will acquire secure housing tenure and have access to serviced plot with core housing.

The site and service model emphasize incremental housing development. This approach is financially viable as it states working under core unit housing where basic services critical infrastructure including wall, sewerage, waste disposal point, kitchen, toilet and water connection will be provided to the beneficiaries.

Table 5-3, Cost Estimation for Low Income Housing

Cost Estimation for Development of a Low-Income Housing under Site and Service Model for Low-Income Communities in Ghotki City	
Land acquisition cost (per hectare)	19.76 million
Site development cost (per hectare)	30 million
Total Land Cost per Hectare	**49.76 million**
Cost for 50 Hectares (50 ha * 49.76 million)	2.49 billion
Miscellaneous (5% of Land and Development cost)	124.4 million
Total Cost	**2.6 billion**

Source: *The Consultant Team*

Facilities and Infrastructure

To create a sustainable and self-sufficient residential community, the project will incorporate several essential facilities and infrastructure.

Basic Utilities

The project will ensure a reliable piped water supply with a filtration plant, establish electricity infrastructure for a 24/7 power supply (integrating renewable energy where feasible), and implement a well-planned sewage and solid waste management system.

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Community Facilities

The proposed site will be equipped with educational institutions (primary and secondary schools), healthcare centres (clinics and dispensaries), and recreational spaces (parks, playgrounds, and green zones) to enhance the quality of life.

Commercial and Economic Activities

Designated retail and commercial areas will cater to daily needs, while small business zones will encourage entrepreneurship and create local employment opportunities for residents.

Transport and Road Network

The project will feature a network of paved, well-lit roads internally and improve public transport accessibility by establishing dedicated bus stops and enhancing linkages to major city routes.

D) Expected Benefits

The project will enhance the quality of life for low-income families. It will also help in the reduction of slum areas, leading to better urban management and increased security, fostering improved social cohesion. This approach will allow gradual improvement in housing quality through household-driven incremental development, enabling families to construct their homes step by step according to their financial capacity. The construction phase will generate employment opportunities, both directly and indirectly. Revenue will be generated through the sale and leasing of commercial plots.

Additionally, the planned commercial zones will lead to an increase in local economic activities. Proper land utilization will help reduce urban encroachments. The development of green spaces will enhance environmental sustainability, while the implementation of eco-friendly waste management and water conservation systems will contribute to a healthier urban environment.

E) Implementation Strategy

The project will be executed in a phased manner to ensure efficient development and timely completion.

Phase 1 (Year 1-2)

The initial phase will focus on land acquisition and legal formalities. Infrastructure development, including roads, utilities, and sewerage systems, will be carried out during this phase.

Phase 2 (Year 3)

The second phase will involve the demarcation and allocation of plots to beneficiaries followed by the construction of core housing components. Core housing will include construction of house wall and basic structures i.e.,

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washroom, kitchen and a roof structure within each unit. The overall construction should follow a planned pattern to make it cohesive to its surrounding and don't disturb the urban morphology of the area. In parallel, essential community facilities i.e. commercial spaces will also be allocated to encourage economic activities and make the site sustainable.

Phase 3 (Year 5)

In the final phase, progressive construction will begin depending upon household's financial capacities under site and service framework. Community services will be fully operationalized, and ongoing monitoring will ensure the sustainability of the project.

F) Implementing Authority

The project will be spearheaded by the Government of Sindh with District Administration Ghotki as lead implementing bodies. Municipal Committee Ghotki, Sindh Building Control Authority (SBCA) and other private contractors will provide technical support. Partnerships will be established with microfinance institutions to facilitate access to credit, enabling households to gradually build safe and durable homes on allocated serviced plots.

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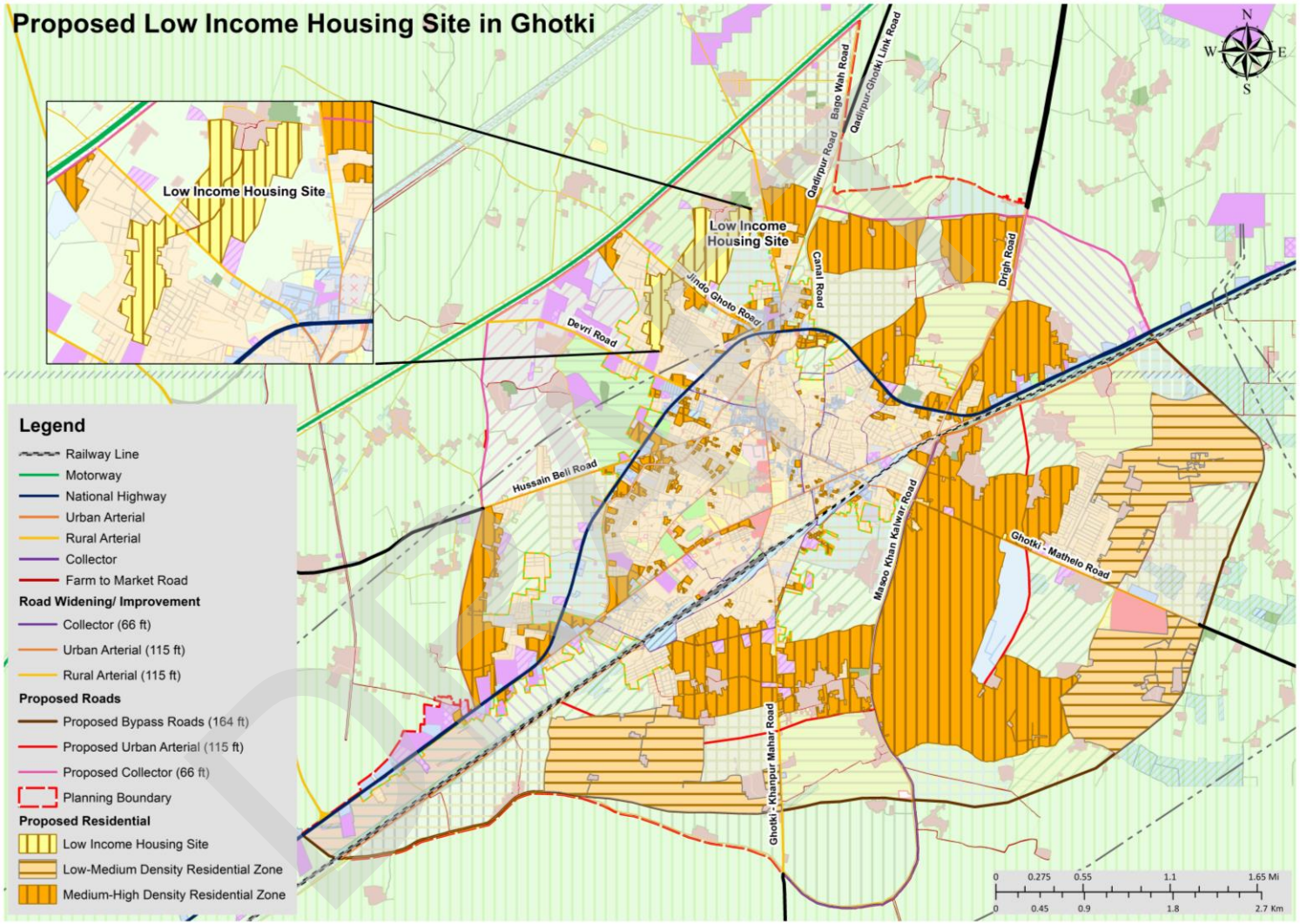


Figure 5-4, Proposed Low Income Housing Site in Ghotki

Source: *The Consultant Team*

5.10 Immediate Action Plan for Core Urban Area

To address Ghotki's urban challenges, the immediate action plan combines infill development for optimized land use and Katchi Abadi upgradation to improve living conditions.

5.10.1 Infill Development Strategy for Residential Areas

Objective: *Maximize underutilized existing vacant spaces while preserving neighbourhood character.*

- Identify vacant/underused plots in Ghotki's core using GIS mapping, prioritizing areas near existing infrastructure (e.g., roads, water lines).
- Adopt narrow lot housing models (80 sq yard) with lane access, to increase density without compromising walkability.
- Launch infill project with mixed housing (e.g., low-rise apartments) in collaboration with private developers, ensuring 30% affordability quotas.
- Conduct design charrettes with residents to address concerns about parking, heritage, and traffic key issues flagged in Saskatoon's infill program[8].

5.10.2 Katchi Abadi Upgradation Strategy

Objective: Transform Katchi Abadis into liveable and secure communities.

To address the pressing need for sustainable urban development in Ghotki, the following model prioritize community-centric, low-cost solutions tailored to the city's unique challenges-particularly for notified Katchi Abadis like Rahmowali colony. This approach balance in-situ improvements with structured relocation, ensuring affordability, tenure security, and climate resilience while leveraging local resources and policies.

A) In-Situ Upgradation Model for Katchi Abadi

Ghotki's notified Katchi Abadi, Rahmowali colony, suffers from overcrowding, inadequate sanitation, and tenure insecurity despite being legally recognized. This model focuses on improving living conditions without relocating residents, aligning with the Sindh Katchi Abadis Act (1987).

Key Interventions includes:

- Expedite the formalization of tenure through property deeds for households that existed before 1987, using GIS mapping (to resolve disputes).
- Housing Resilience:

[8] *https://www.saskatoon.ca/business-development/development-regulation/developers-homebuilders/neighbourhood-infill-development*

- Raised plinths using local bricks to combat flooding.
- Incremental loans (via Khushhali Bank) for home upgrades.

- Core Infrastructure:
  - Install community-managed RO plants (addressing Ghotki's saline groundwater).
  - Replace open drains with covered sewers linked to municipal systems.
  - Paved pathways with permeable materials (e.g., interlocking bricks) to reduce flooding.
  - Slope-Adjusted drainage channels to prevent water stagnation.
  - Plant native, flood-resistant vegetation along drainage lines.
  - Skills training (masonry, plumbing) to enable local labor employment in upgradation projects.

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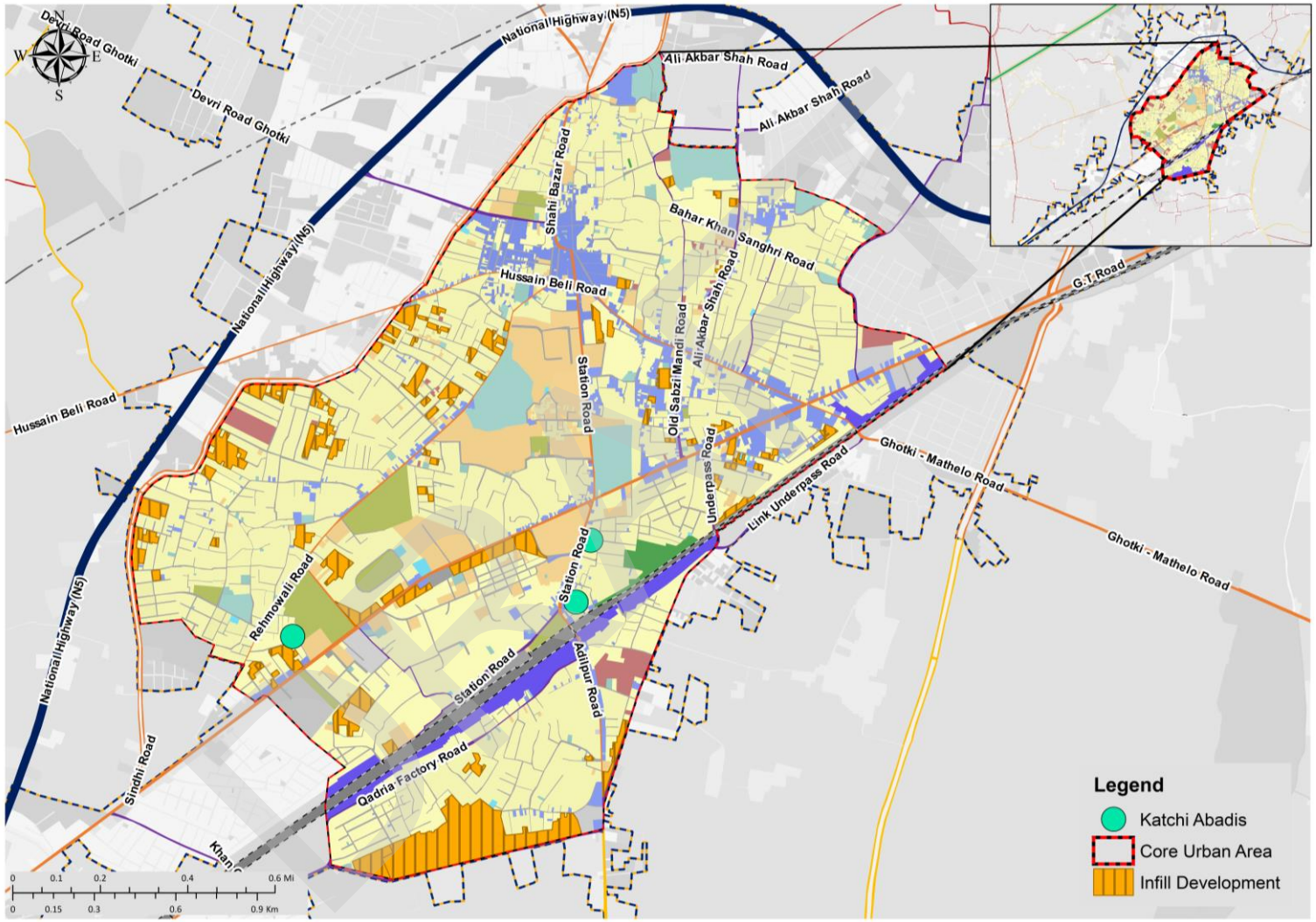


Figure 5-5, Priority Areas for Residential Development - Ghotki

Source: *The Consultant Team*

SECTION - 6: SOCIAL INFRASTRUCTURE

6.1 Introduction

This section outlines a strategic framework for enhancing social infrastructure, starting with an assessment of the existing situation. It includes a SWOT analysis to evaluate strengths, weaknesses, opportunities, and threats, followed by a need assessment using demand projections and Land Suitability Analysis (LSA). Based on these findings, policy guidelines and a Strategic Development Plan are proposed to address gaps and ensure sustainable growth. Additionally, priority projects and an Immediate Action Plan (IAP) for the core urban area are detailed to tackle urgent needs and improve social infrastructure access and quality.

6.2 Education

6.2.1 Existing Situation

A) District Level Educational Facilities

The education sector of Ghotki district boasts an extensive network of schools spanning across the entire district, however, the quality of education and inclusivity is compromising. This network comprises approximately 2,231 schools, encompassing Primary, Middle, Secondary, and Higher Secondary Government schools. Among these, 453 are exclusively for boys, 289 for girls, and 1,489 are mixed-gender schools. Additionally, there exist private sector schools operating under government registration. The male literacy rate (aged 15-49 years) in Ghotki district stands at 45.9%, while the female literacy rate is recorded at 46.4% as per census 2023. The **Table** 6-1 illustrates the distribution of schools based on their respective levels.

Table 6-1, Number of Schools in Ghotki District

Level	Total	Male	Female	Mixed
Primary	2,051	424	245	1,382
Middle	89	11	22	56
Elementary	49	12	16	21
Secondary	34	5	4	25
Higher Secondary	8	1	2	5
Grand Total	**2,231**	**453**	**289**	**1,489**

Source: *RSU - Sindh Education Management Information System (SEMIS) 2018-2019*

In Ghotki district, there exists a significant gap in enrolment rates between boys and girls, with boys constituting 69% of the total enrolment, while girls only make up 31%. This stark contrast in enrolment figures warrants a closer examination of the underlying causes and reasons contributing to this

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disparity. One primary factor contributing to the enrolment gap is deeply rooted socio-cultural norms and traditions that prioritize boys' education over girls. In some areas of Ghotki district, the lack of accessible educational infrastructure, particularly for girls, acts as a significant barrier to enrolment. The **Figure** 6-1 depicts enrolment rate of students respective to education level.

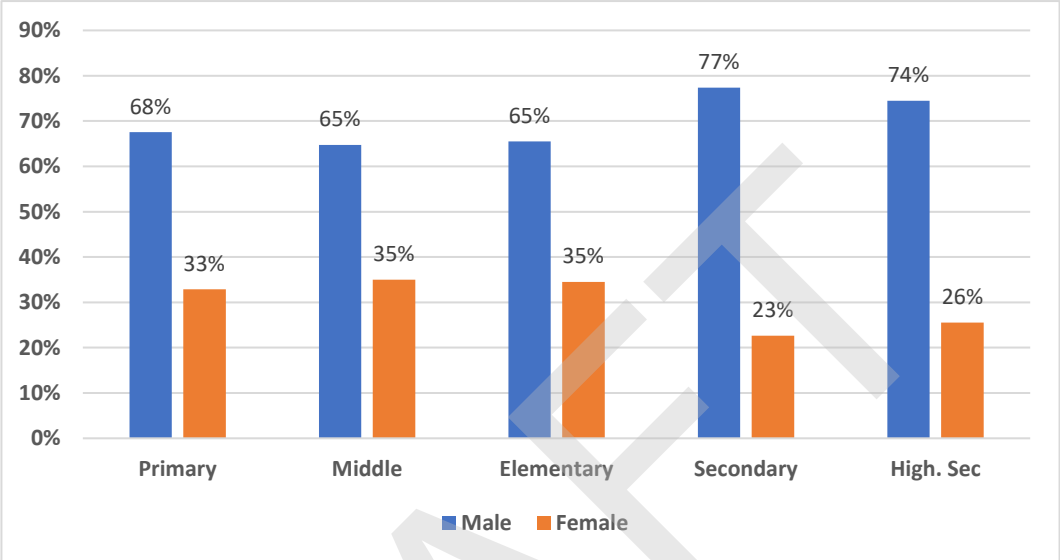


Figure 6-1, Enrolment Rate of Students in Schools

Source: *RSU -Sindh Education Management Information System (SEMIS) 2018-2019*

The student-teacher ratio in Ghotki district, as derived from current data, stands at approximately 43 students per teacher. With a total of 4,705 teachers catering to an enrolment of 202,884 students, this ratio reflects the distribution of educational resources within the district. Analysing this figure sheds light on the classroom dynamics and the challenges educators might face in ensuring personalized attention and quality instruction for each student. A student-teacher ratio of 43 indicates a considerable workload for teachers, potentially impacting their ability to provide individualized support and feedback to students. Moreover, it underscores the importance of effective classroom management strategies and academic approaches that can accommodate diverse learning needs within larger class sizes.

In Ghotki district, the educational landscape is characterized by a significant student-to-classroom ratio, indicative of both the challenges and opportunities within the local educational system. With a total student population reaching 202,884 individuals and only 4,089 classrooms available. A ratio of 49.6 students per classroom suggests that classrooms are often crowded, potentially limiting individualized attention, and inhibiting interactive learning experiences.

Colleges in Ghotki district are contributing their efforts to increase the educational level in this area by offering demanding courses and programs.

Among the list there are only 08 non- professional colleges which includes degree colleges. The **Figure** 6-2 below illustrates the overall enrolment rate of students in colleges.

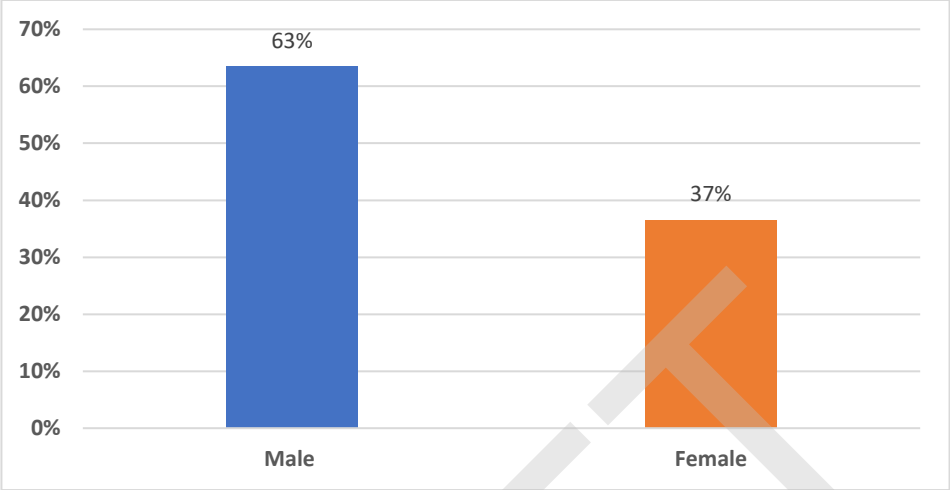


Figure 6-2, Enrolment Rate of Students in Colleges

Source: *RSU -Sindh Education Management Information System (SEMIS) 2018-2019*

The primary emphasis of vocational education lies in developing technical skills rather than focusing solely on academic knowledge. Across the province, there exists a network of vocational institutions, ranging from polytechnics to monotechnic and commercial education centres, encompassing both governmental and private sectors. The Government of Sindh is deeply invested in skill development programs targeted specifically towards youth aged 18 to 35. In the district there are a total of 04 vocational institutes. Details of technical institutes are depicting below in the **Table** 6-2.

Table 6-2, Enrolment in Technical Institutes Ghotki District

Technical Institutes	Total	Male	Female
Polytechnic Institutions	573	573	-
Monotechnic Institutions	289	289	-
Commercial Institutions	20	20	-
Vocational Institutions and Vocational Schools	36	-	36

Source: *RSU -Sindh Education Management Information System (SEMIS) 2018-2019*

B) City Level Education Facilities

The education status of Ghotki, as indicated by the 2017 census[9], is average overall literacy rate of 63%, with 77% for males, 49% for females, and 23% for transgenders. The following **Table** 6-3 shows educational attainment at different level of education.

[9] *2017 literacy rate is utilized because the 2023 census data for literacy in urban localities is not yet available.*

Table 6-3, Educational Attainment Level in Ghotki

Educational Attainment Percentage			
Education Level	**Male**	**Female**	**Transgender**
Primary but Below Matric	12%	8%	0.004%
Matric but Below Degree and Other	9%	5%	0.002%
Degree and above	4%	1%	-

Source: *Pakistan Bureau of Statistics (PBS) and The Consultant Team*

The **Table** 6-3 above illustrates the educational attainment levels within the population of Ghotki city. It is evident that a significant number of both male and female residents have achieved educational qualifications ranging from primary education to below degree and above. This data reflects that the educational attainment reflects a pattern where a majority of the population has educational qualifications below matric level and below degree. Conversely, there is a smaller proportion of individuals who have attained a degree or higher education level, indicating that a smaller percentage of the population in Ghotki city has advanced educational qualifications.

According to the socio-economic survey 2023, approximately 84% of households in the city have access to and can afford up to higher secondary level educational facilities. However, **Figure** 6-3 shows a contrasting decline in accessibility at the university level compared to the college level, indicating a decrease in affordability or availability of accessible higher education options. This correlation highlights a positive trend in accessibility across educational levels. However, there is a significant challenge in ensuring widespread accessibility to higher education due to potential financial constraints or limited availability of affordable institutions at the higher education level.

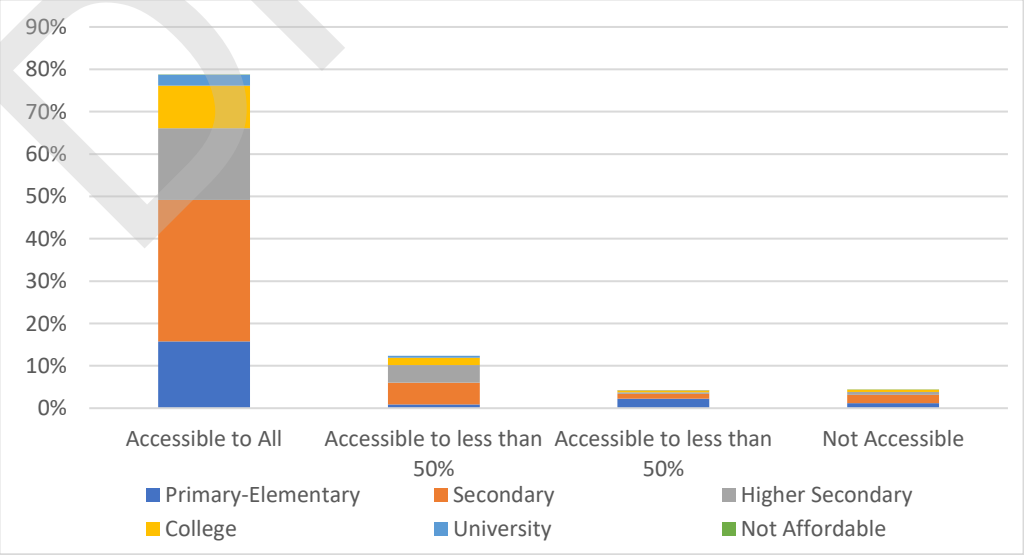


Figure 6-3, Correlation between Affordability and Accessibility to Educational Facilities

Source: *The Consultant Team*

From the secondary data, average student-teacher ratio and student-classroom ratio of schools for Ghotki city has been analysed which is shown in the **Table** 6-4**.** Average student-teacher ratio for schools of Ghotki city comes out to be comparable to UNESCO standards which suggests the average student-teacher ratio 40:1 in primary education and 35:1 (2014 estimates) in secondary education – far higher than the global average of 18:1. In case of Ghotki city, student-teacher ratio in primary education level is comparatively higher as compared to UNESCO standards, which indicates the lack of educational institutions at this level.

Table 6-4, Average Student Teacher and Student Classroom Ratio of Ghotki City

Educational Facilities	Average Student Teacher Ratio	Average Student Classroom Ratio
Primary/Elementary School	62:1	61:1
Middle School	41:1	72:1
Secondary School	16:1	27:1

Source: *GIS MAP | RSU[10] | School Education and Literacy Department*

According to the land use survey 2023, the number of different levels of educational facilities are shown in the **Table** 6-5 and their spatial distribution is shown in the **Figure** 6-4**.** The city has a good number of higher institutes, and primary schools also lag behind. There is a significant need for more primary, secondary and high schools. Basic education services are lacking here, even though the city caters to the entire country with nationally prestigious institutes.

Table 6-5, Number of Educational Facilities in Ghotki City

Educational Facilities	Count
Primary School	11
Elementary School	2
Higher Secondary School	1
High School	3
Private Institutes	69
Colleges	10
University	2
Library	1
Training and Coaching Institutes	3

Source: *The Consultant Team*

Education facilities' proximity is a critical factor in ensuring accessible and quality education for students. To assess the proximity of educational institutions NRM and planning standards stipulate a minimum distance of 500

[10] *https://rsu-sindh.gov.pk/programs/onlineGIS.php?district=Ghotki*

meters for primary schools, 1.5 km for middle school and 5 kilometres for higher secondary schools. Proximity is especially important in urban areas like Ghotki city, where population density can impact accessibility. As shown in the **Figure** 6-4 below that the primary school in Ghotki city plays a crucial role in providing foundational education to various neighbourhoods. The city faces a significant gap in the middle and higher secondary education sector which don't serves some parts of the city. Addressing this gap through the establishment of a dedicated primary school or by expanding existing middle and secondary institutions are essential to ensure that the youth of Ghotki receive the education they deserve and contribute to the city's growth and development.

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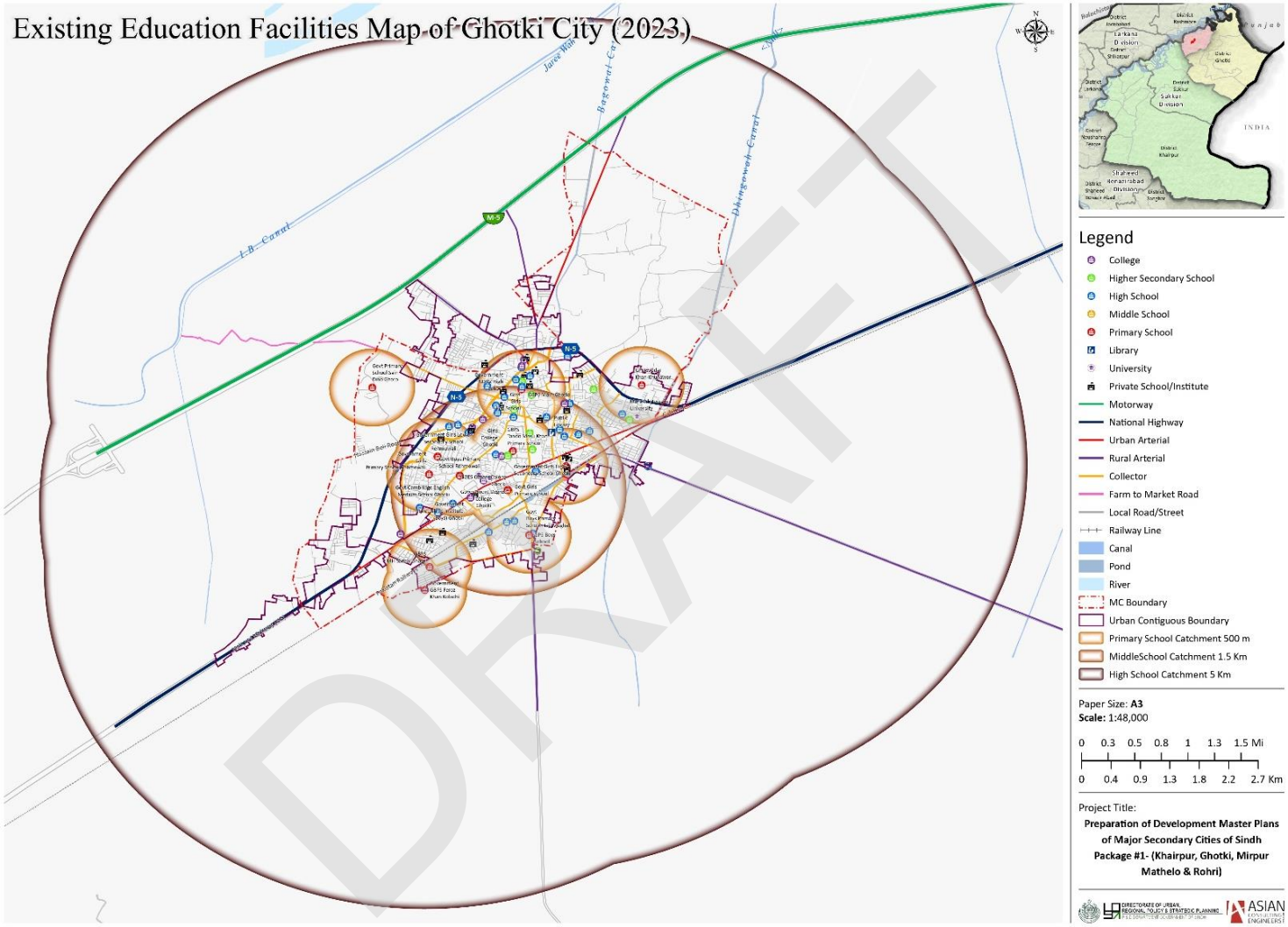


Figure 6-4, Spatial Distribution of Existing Education Facilities of Ghotki City

Source: *The Consultant Team*

6.2.2 SWOT Analysis

Strengths	Weaknesses
• Hierarchy of education institution exist. • There exists large number of private sector educational institutes as well.	• No quality check and maintenance of infrastructure. • Institution to meet the demand of skilled labour are missing.
Opportunities	**Threats**
• Develop vocational training and skill development programs that align with local job market needs, enhancing employability for graduates. • The rise of digital education tools presents an opportunity to improve learning experiences.	• Policy issues • Poverty and unemployment. • Economic downturns may lead to budget cuts in public education funding.

6.2.3 Need Assessment

The student-teacher ratio in primary schools (62:1) and student-classroom ratio remains significantly high (61:1) as per UNESCO standard, leading to overcrowded classrooms that hinder personalized attention and interactive learning. While the city hosts a reasonable number of higher education institutions, a shortage of primary and middle schools creates an imbalance in the educational infrastructure. Although prestigious national-level institutions serve a broader population, the need for accessible basic education within the city remains unfulfilled.

Proximity to educational facilities is another key concern. While densely populated areas like Mohallah Rahmowali and Irrigation Colony have access to primary schools, while Mohallah Anwarabad and its vicinity areas face educational gaps due to their distance from existing institutions. Some of the key educational needs for the city are follow below:

- Targeted interventions are essential to bridge the gender gap in literacy rates.
- Efforts should focus on improving the availability and affordability of higher education.
- Investment in school infrastructure is crucial to lower student-classroom ratios and enhance learning conditions.
- Addressing the shortage of primary and middle schools will help create a more equitable education system.
- Ensuring all areas, particularly underserved neighbourhoods, have adequate access to primary education facilities.

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- Implementing financial aid programs can alleviate affordability barriers and promote equitable access to education.

A) Land Suitability Analysis of Education

Land Suitability Analysis (LSA) for educational facilities in Ghotki city (**Figure** 6-5) is crucial in determining the best locations for schools, particularly emphasizing areas that are easily accessible and strategically positioned. Suitable sites are often found along main roads such as National Highway (N-5), Qadirpur Road, Masoo Khan Kalwar Road and Drigh Road, which enhance accessibility for students and facilitate transportation options such as school buses, bicycles, and pedestrian access. Proximity to existing residential neighbourhoods/ settlements is also important, as it ensures that schools are within a reasonable distance for families, ideally within 500 meters to encourage walking and reduce traffic congestion. Existing educational facilities within 500 meters are constraints, indicating saturation in those zones. Meanwhile, locations further than this distance are more favourable. Proximity to parks and open spaces enhances the suitability of sites, making them more attractive for educational purposes. Additionally, the analysis considers environmental factors, ensuring that schools are not located near hazardous land uses like industrial areas that could pose health risks to students. Overall, effective land suitability analysis helps identify optimal locations for educational facilities that promote safety, accessibility, and community integration.

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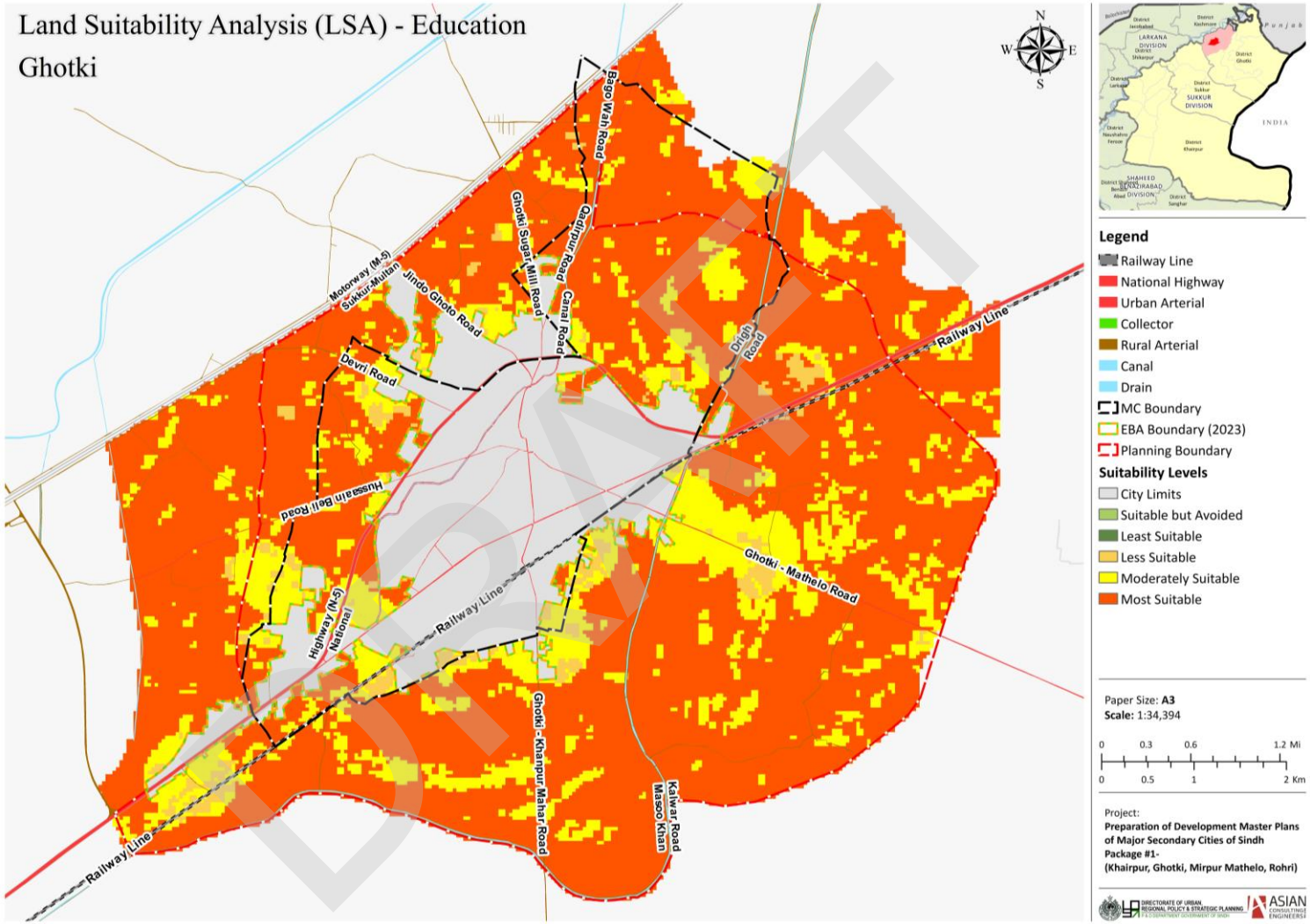


Figure 6-5, Land Suitability Analysis – Education

Source: *The Consultant Team*

6.2.4 Policy Guidelines

The education sector in Ghotki city must be developed in alignment with existing laws, policies, rules, and regulations at the federal, provincial, and local levels. The following policy guidelines are framed with respect to the available legal framework to ensure effective implementation and compliance.

A) Policy Measures for Infrastructure Development

Construction and Upgradation of Schools

Under the Sindh Right to Free and Compulsory Education Act (2013), the provincial and local authorities shall prioritize the construction and upgradation of schools in Ghotki District, ensuring that all schools have adequate classrooms, furniture, and basic facilities such as clean water, sanitation, and electricity.

Disaster-Resilient School Buildings

In compliance with the Sindh Building Control Ordinance (1979) and National Disaster Management Authority (NDMA) Guidelines, all new school buildings shall be constructed using disaster-resilient designs, especially in flood-prone areas. Existing schools in hazardous zones shall be retrofitted to withstand natural disasters.

B) Policy Measures for Access to Education

Enrolment Drives

Under the Sindh Right to Free and Compulsory Education Act (2013), enrolment drives shall be conducted to ensure that all children aged 5–16 years are enrolled in schools. Special attention shall be given to marginalized communities, including girls, children with disabilities, and those from low-income families.

C) Policy Measures for Quality Education

Teacher Training and Recruitment

Under the Sindh Teachers Education Development Authority Act (2014), a comprehensive teacher training program shall be implemented to improve the quality of teaching. Vacant teaching positions shall be filled through transparent recruitment processes, ensuring that only qualified and trained teachers are hired.

Curriculum Reforms

The Sindh Curriculum Framework shall be revised to align with modern educational standards and local needs. Emphasis shall be placed on STEM (Science, Technology, Engineering, and Mathematics) education, digital literacy, and vocational training to prepare students for future challenges.

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D) Policy Measures for Inclusive Education

Special Education Programs

Under the Sindh Empowerment of Persons with Disabilities Act (2018), special education programs shall be introduced to cater to the needs of children with disabilities. Schools shall be equipped with assistive technologies and trained staff to provide inclusive education.

Girls' Education

To promote girls' education, the Sindh Right to Free and Compulsory Education Act (2013) shall be enforced to ensure that all girls have access to quality education. Scholarships and stipends shall be provided to girls from low-income families to encourage enrolment and retention.

E) Policy Measures for Community Participation

Parent-Teacher Associations (PTAs)

Under the Sindh Local Government Act (2013), Parent-Teacher Associations (PTAs) shall be established in all schools to foster community involvement in education. PTAs shall play an active role in monitoring school performance, addressing grievances, and supporting school improvement initiatives.

Awareness Campaigns

Awareness campaigns shall be conducted under the Sindh Transparency and Right to Information Act (2016) to educate parents and communities about the importance of education and their rights under the law.

F) Policy Measures for Vocational and Technical Education

Skill Development Programs

Under the Sindh Technical Education and Vocational Training Authority (STEVTA) Act (2012), vocational and technical education programs shall be introduced in Ghotki District. These programs shall focus on skill development and job readiness, providing students with opportunities for gainful employment.

Partnerships with Industry

Partnerships with local industries and businesses shall be established to provide internships, apprenticeships, and job placements for students. This will ensure that vocational training programs are aligned with market needs.

G) Policy Measures for Digital Education

E-Learning Platforms

Under the Sindh ICT Education Policy, e-learning platforms shall be introduced to provide students with access to digital resources and online learning opportunities. Schools shall be equipped with computers, internet connectivity, and digital tools to facilitate blended learning.

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Teacher Training in ICT

Teachers shall be trained in information and communication technology (ICT) to effectively integrate digital tools into their teaching practices. This will enhance the quality of education and prepare students for the digital age.

H) Policy Measures for Monitoring and Evaluation

Regular Inspections

Under the Sindh Education Management Information System (SEMIS), regular inspections shall be conducted to monitor school performance, infrastructure, and compliance with educational standards. Inspection reports shall be made publicly available to ensure transparency.

Performance Metrics

Performance metrics shall be developed to evaluate the effectiveness of educational policies and programs. Data-driven improvements shall be made to address gaps and ensure continuous progress.

Feedback Mechanisms

Feedback mechanisms shall be established to gather input from students, parents, teachers, and community members. This feedback shall be used to make necessary adjustments to educational policies and practices.

6.2.5 Strategic Development Plan

Ghotki city faces educational challenges such as inadequate schools, poor infrastructure, untrained teachers, and an outdated curriculum. Strengthening education through reforms, better facilities, and capacity-building is essential. Key improvements include enhancing teaching methods, merit-based teacher recruitment, accountability, and student-centered learning. Governance can be improved through standard-setting, IT-based accountability, school consolidation, public-private partnerships, and stronger district management. Equitable resource allocation and fiscal sustainability will ensure transparency and accountability, fostering long-term educational progress.

A) Long-Term Plan

- Build new primary/middle schools to meet the gap of 5 primary and 1 middle school in underserved zones.
- Upgrading the infrastructure of existing school buildings to provide a conducive learning environment.
- Investing in human capital by improving teacher training programs and professional development opportunities.

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- Establishing new educational institutions, particularly in urban centers and growing settlements, to accommodate increasing student populations.
- Encouraging private sector participation in education through direct investments or public-private partnerships.
- Expanding vocational training programs for both male and female students to align education with contemporary job market demands.

B) Short-Term Plan

- Adding classrooms to existing school and college buildings along with allied facilities such as libraries, laboratories, and IT centers.
- Enhancing the quality of education by updating the curriculum to meet modern academic and professional standards.
- Implementing comprehensive teacher training programs to enhance pedagogical skills and student engagement.
- Establishing vocational and skill training centers in collaboration with industries to address market-driven employment needs.
- Introducing digital learning platforms and smart classroom initiatives to integrate technology into the education system.
- Providing basic utilities such as clean drinking water, sanitation, and reliable electricity in all educational institutions.

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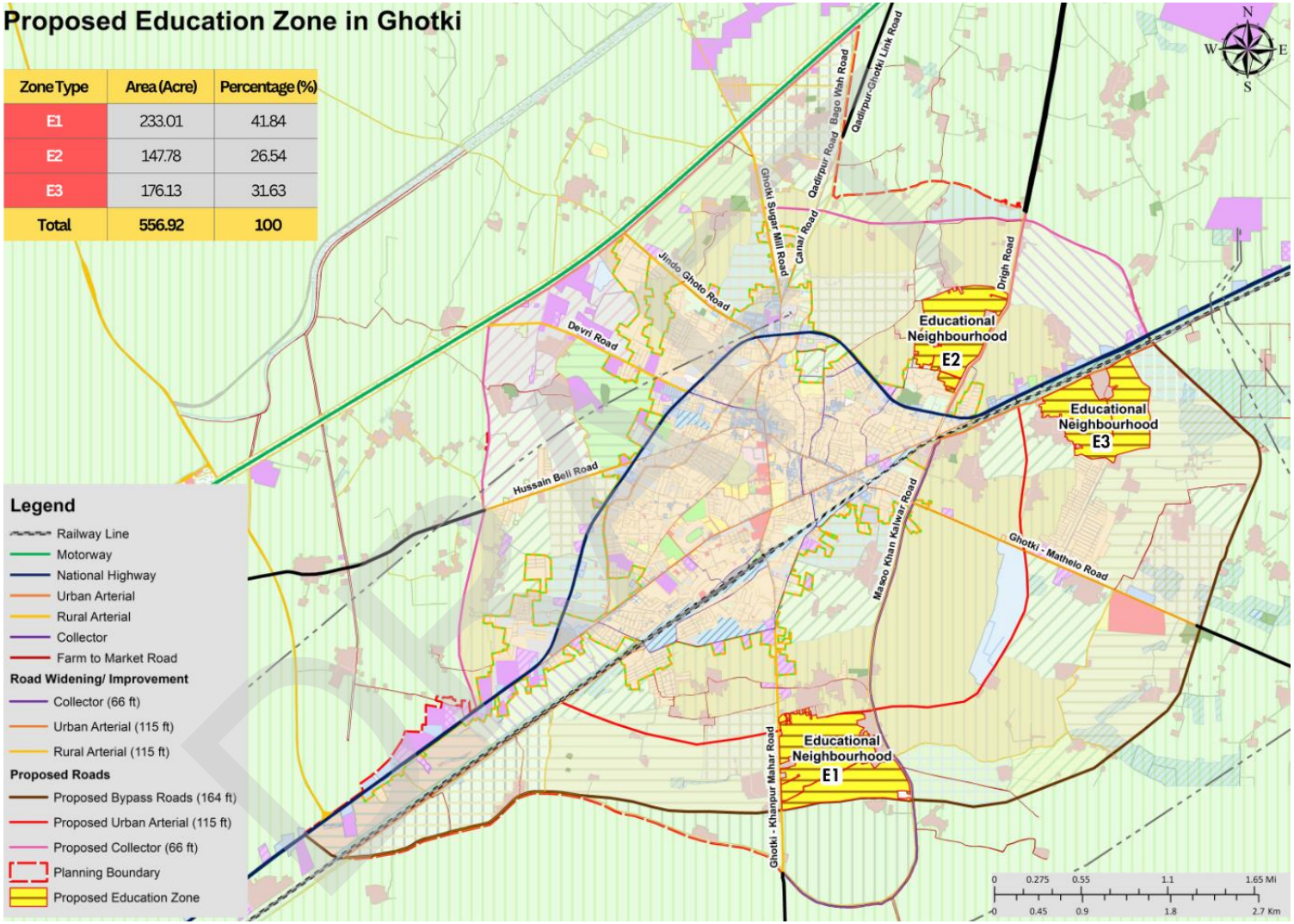


Figure 6-6, Proposed Educational Zones in Ghotki

Source: *The Consultant Team*

6.2.6 Priority Projects

Education is the cornerstone of any prosperous urban strategy. In Ghotki city, the current state of primary and secondary education infrastructure is suboptimal, with many schools lacking essential facilities such as clean water, electricity, functional toilets, and playgrounds. This not only hampers the quality of education but also discourages enrollment, particularly among girls and marginalized communities. To address these challenges, priority projects will focus on the repair, rehabilitation, and upgrading of existing schools, ensuring they meet modern educational standards and provide a safe, inclusive, and conducive learning environment for all students.

A) Repair, Rehabilitation, and Upgradation of Schools with Allied Infrastructure (Excluding IAP projects)

1. Project Justification

The education sector in Ghotki city is in urgent need of intervention. The dilapidated and unsafe conditions of government schools pose a critical barrier to education, resulting in low enrollment, high absenteeism, and elevated dropout rates. Many schools lack basic amenities like clean water, functional toilets, and reliable electricity, creating an environment that is not conducive to learning.

This project is essential for providing a safe, functional, and inclusive learning environment that protects students, motivates attendance, and ensures equitable access to quality education for all children, including those with disabilities.

2. Project Scope

This project will involve the comprehensive repair, rehabilitation, and upgrading of identified school buildings and their surroundings. The detailed scope of works includes:

- Execute comprehensive structural repairs, including roof replacement, plastering, repainting, and the installation of new floors, doors, and windows to ensure building safety and functionality.
- Provide essential utilities by installing solar-powered electrical systems, water filtration plants, and new blocks of gender-segregated toilets with running water in each school.
- Enhance the learning environment through the modernization of classrooms with new furniture and smart boards, and the establishment of dedicated computer and science laboratories.
- Ensure student safety and inclusion by constructing secure boundary walls, developing playgrounds, and installing wheelchair ramps and disabled-friendly toilets for full accessibility.

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The following schools have been identified as priority institutions for immediate intervention based on their current condition and the number of students they serve:

Sr. No.	Institute Name	Institute Hierarchy	Area (Ha)
1	Govt. Primary School, Sobdar Khan Khuhawar	Government Primary School	0.08
2	Govt. Boys Primary School, MH Sachal Bhayo	Government Primary School	0.04
Total Area			**0.12**

3. Project Benefits

- **Enhanced Learning Environment:** Improved infrastructure will create a safe, comfortable, and stimulating environment for students, fostering better academic performance.
- **Increased Enrolment:** The provision of basic facilities and upgraded infrastructure will attract more students, particularly girls, reducing the gender gap in education.
- **Improved Literacy Rate:** By addressing the current deficiencies in school infrastructure, the project will contribute to raising literacy rates in Ghotki city.
- **Community Empowerment:** Better educational facilities will uplift the socio-economic status of the community, enabling families to break the cycle of poverty.
- **Inclusive Education:** Upgraded facilities will ensure accessibility for students with disabilities, promoting inclusivity and equal opportunities for all.

4. Implementation Strategy

Phase 1: Assessment and Planning

- Conduct a detailed assessment of the selected schools to identify specific needs.
- Develop a comprehensive rehabilitation plan, including cost estimates and timelines.

Phase 2: Infrastructure Development

- Repair and rehabilitate school buildings, ensuring structural safety and functionality.
- Install basic facilities such as water supply systems, electricity, and gender-segregated toilets.
- Construct playgrounds and boundary walls to ensure safety and recreational opportunities.

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Phase 3: Capacity Building

- Train teachers and staff on maintaining the new facilities and creating an inclusive learning environment.
- Engage the community to foster ownership and ensure the sustainability of the project.

Phase 4: Monitoring and Evaluation

- Establish a monitoring mechanism to track progress and ensure quality standards.
- Conduct regular evaluations to assess the impact of the project on student enrolment and performance.

5. Implementing Authority

- District Education Works and Services Department, Government of Sindh
- Collaborating Partners: Local NGOs, community organizations, and private sector stakeholders.

6. Estimated Cost

Total Estimated Cost: Rs. 123.3 million (approx.)

6.2.7 Immediate Action Plan for Core Urban Area

A) Repair, Rehabilitation, and Provision of Missing Facilities to School Buildings

The core urban area of Ghotki city is home to several government schools that are in dire need of repair and rehabilitation. Many of these schools lack basic facilities such as clean water, electricity, functional toilets, and safe infrastructure, which severely impacts the quality of education and student enrolment. This immediate action plan focuses on addressing these critical gaps by repairing and rehabilitating school buildings, providing missing facilities, and ensuring a safe and conducive learning environment for all students.

The following schools in the core urban area have been prioritized for immediate intervention:

- Govt. Girls Elementary School, Officer Colony
- Govt. Boys Primary School, Haji Mughal
- Govt. Boys Primary School, Rahmowali
- Govt. Girls Primary School, Rahmowali
- Govt. Boys Primary School, Main Ghotki
- Govt. Boys Primary School, Tando Masu Khan
- Govt. Girls Lower Secondary School, Rahmowali
- Govt. Girls High School

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- Govt. NDAV High School
- Govt. Cambridge English Medium School
- Govt. Girls High Secondary School, Ghotki

1. Immediate Action Plan

The immediate action plan will focus on the following key areas for each school:

Structural Repairs and Stability:

- Address cracks, roof leaks, and other structural issues to ensure the safety of students and staff.
- Reinforce weak structures and repair damaged walls, floors, and ceilings.

Access to Basic Utilities:

- Provide electricity connections and install energy-efficient lighting systems.
- Ensure a clean and reliable water supply by installing water tanks and filtration systems.
- Construct gender-segregated toilets with proper sanitation facilities.

Provision of Essential Facilities:

- Replace old and broken furniture with new desks, chairs, and benches.
- Build playgrounds and recreational areas to promote physical activity and holistic development.
- Equip classrooms with modern teaching aids such as whiteboards, projectors, and computers.

Security Measures:

- Install boundary walls and secure gates to ensure the safety of students and school property.
- Set up CCTV cameras and hire security personnel to monitor school premises.

Staffing and Capacity Building:

- Ensure the presence of adequate teaching and non-teaching staff.
- Provide training for teachers on modern teaching methodologies and classroom management.

2. Cost Estimation for Rehabilitation and Provision of Facilities

This **Table** 6-6 provides a clear and structured breakdown of the rehabilitation costs for each school, ensuring transparency and facilitating effective planning and implementation.

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3. Implementing Authority

- District Education Works and Services Department, Government of Sindh
- Collaborating Partners: Local NGOs, community organizations, and private sector stakeholders

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Table 6-6, List of Schools for Rehabilitation in Core Urban Area – Ghotki

Sr. No.	Institute Name	Area (Ha)	Rehabilitation Required - Area wise or Job wise Cost (PKR) (In millions)						
			Street / Road / Parking	Utility Facilities			Play grounds	School Building/ Classrooms Repair/ Renovation	Security
				Electricity	Water Supply	Sewerage			
1	Govt. Girls Elementary School, Officer Colony	0.06	-	191.09	9.30	6.20	-	258.22	15.49
2	Govt. Boys Primary School, Haji Mughal	0.12	-	382.17	18.59	12.39	-	516.45	30.99
3	Govt. Boys Primary School, Rahmowali	0.41	5.76	636.95	30.99	20.66	1.58	860.75	51.64
4	Govt. Girls Primary School, Rahmowali	0.03	-	95.54	4.65	3.10	-	129.11	7.75
5	Govt. Boys Primary School, Main Ghotki	0.30	-	955.43	46.48	30.99	-	1,291.12	77.47
6	Govt. Boys Primary School, Tando Masu Khan	0.15	-	477.71	23.24	15.49	-	645.56	38.73
7	Govt. Girls Lower Secondary School, Rahmowali	0.03	-	95.54	4.65	3.10	-	129.11	7.75
8	Govt. Girls High School	0.20	-	636.95	30.99	20.66	-	860.75	51.64
9	Govt. NDAV High School	0.39	2.74	923.58	44.93	29.95	0.75	1,248.08	74.88
10	Govt. Cambridge English Medium School	0.72	11.52	955.43	46.48	30.99	3.16	1,291.12	77.47
11	Govt. Girls High Secondary School, Ghotki	1.67	33.20	1,464.99	71.27	47.51	9.11	1,979.71	118.78
Total		**4.07**	**53.23**	**6,815.38**	**3,31.56**	**221.04**	**14.61**	**9,209.98**	**552.60**
Total Cost (PKR)		***17,198.4 million***							

Source: *The Consultant Team*

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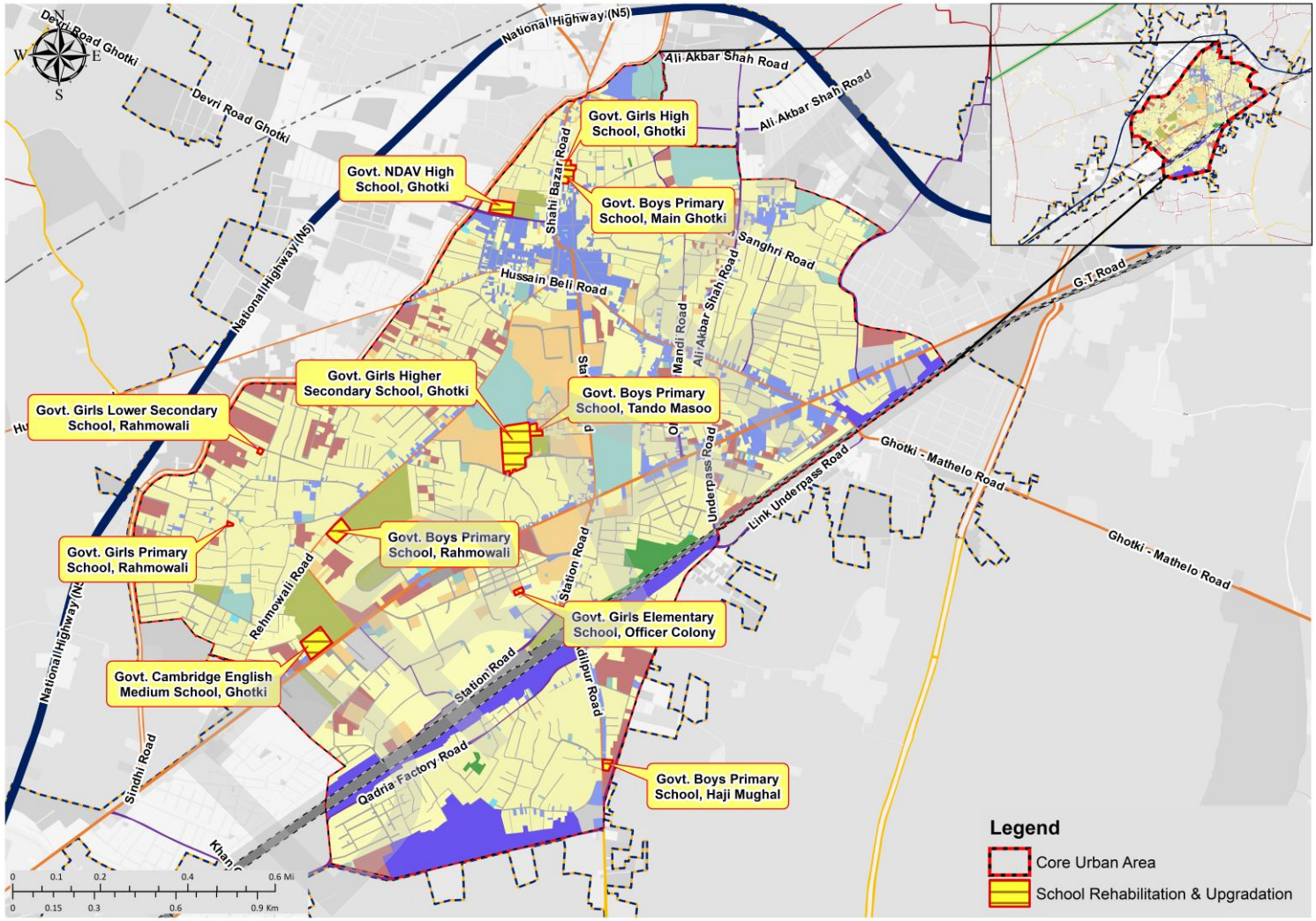


Figure 6-7, Education Institutes in Core Urban Area - Ghotki

Source: *The Consultant Team*

6.3 Health

6.3.1 Existing Situation

A) District Level Healthcare Facilities

Rapid population expansion has created significant strain on healthcare services and infrastructure. The existing facilities in District Ghotki are inadequate and poorly distributed geographically. The prevalence of inadequate personal hygiene practices, inadequate community sanitation, contaminated and limited water resources, and ineffective waste disposal systems has resulted in elevated rates of illness and death.

A hierarchical structure for healthcare facilities exists nationwide, yet it lacks comprehensiveness, with rural regions largely dependent on urban centres for both general and specialized healthcare. Nonetheless, there is an urgent requirement to transition from this centralized model towards establishing localized healthcare facilities, particularly for general health services tailored to the needs of each area. The overall number of health facilities and number of medical and para medical staff present in Ghotki district are mentioned below in the **Table** 6-7.

Table 6-7, Number of Healthcare Facilities in Ghotki District

Health Facilities	Medical Centres	Beds
Basic Health Units (BHUs)	34	68
Rural Health Centres (RHCs)	3	60
Dispensaries	36	4
Government	13	0
Semi Government	5	0
Local Bodies	15	0
Private	3	4
Tb Clinics	9	2
Government	8	0
Private	1	2
Mother and Child Health Centres (MCHC)	4	44
Government	3	40
Semi-Government	1	4

Source: *Sindh District Profile 2021*

The **Table** 6-8 below shows total number of medical professionals and para-medical staff, encompasses doctors, specialists, surgeons, nurses, midwives, pharmacists, laboratory technicians, radiographers, and other allied healthcare professionals. It includes both government-employed and private practitioners operating in the district.

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Table 6-8, Number of Medical and Para Medical Staff in Ghotki District

Staff	Numbers
Doctors/ GMO	363
Dentists	7
Surgeons	4
Physician	4
Gynaecologist	5
Paediatricians	7
Nurses	48
Paramedical Staff	470

Source: *Sindh District Profile 2021*

In Ghotki district, the population served by health facilities faces notable challenges in terms of patient-to-healthcare-provider ratios. With a staggering patient-per-bed ratio of 3,262 persons, healthcare infrastructure seems overburdened and potentially strained. This ratio suggests a significant scarcity of hospital beds relative to the population's healthcare needs, potentially leading to overcrowding and compromised quality of care. Moreover, the patient-per-doctor ratio stands at 4,514, indicating a substantial demand for medical attention compared to available physician resources. This imbalance could potentially lead to longer waiting times, reduced consultation durations, and compromised patient outcomes. Similarly, with a patient-per-nurse ratio of 36,012, there is a pronounced shortage of nursing staff to adequately address the healthcare needs of the community. This scarcity may result in diminished patient care quality, increased workload for nurses, and potential burnout.

The coronavirus disease 2019 (COVID-19) has received various distinct perspectives and responses at the local as well as global levels. **Table** 6-9 represents COVID-19 prevalence in Ghotki district with total cases, case fatality rate, and recovery rate.

Table 6-9, COVID-19 Statistics in Ghotki District, 2020

Total cases	Deaths	Prevalence%[11]	CFR%[12]	CRR%[13]
3,533	42	0.2	1.2	98.8

Source: *Umer A., 2021*

[11] *The total number of individuals in a population who have a disease or health condition at a specific period, usually expressed as a percentage of the population.*
[12] *CFR is defined as the ratio between the total number of deaths due to pandemic COVID-19 and total infected individuals from pandemic COVID-19.*
[13] *CRR is the proportion of recovered or discharged individuals with a specified health condition compared to total infected cases.*

B) City Level Healthcare Facilities

The overall condition of public health care is concerning, as indicated by data gathered from the Land Use Survey 2023, as shown in **Table** 2-8. The rapid increase in population has significantly strained health services and facilities. The existing infrastructure is inadequate and poorly distributed spatially. Elevated morbidity and mortality rates are attributed to factors such as limited awareness of personal hygiene, inadequate community sanitation practices, impure and insufficient water supply, and deficient refuse disposal systems.

The quality and availability of public healthcare facilities in Ghotki city is insufficient and not adequately serving the entire city area. However, the city lacks sufficient clinics and dispensaries, despite the presence of THQ and Hospitals. Additionally, a few private practitioners offer health care services to the population. The **Table** 6-10 provides details of these health facilities.

Table 6-10, Number of Healthcare Facilities in Ghotki City

Healthcare Facilities	Count
Taluka Head Quarter Hospital (THQ)	1
Hospitals	14
Clinics	35

Source: *The Consultant Team*

Land use analysis reveals that healthcare facilities occupy only 6.4 hectares. (0.63%), falling below the recommended planning standard of 2-3%. In addition to the limited land coverage, Ghotki city is experiencing a shortage of health units, highlighting crucial need for the development of healthcare facilities in the area.

According to the 2023 socio-economic survey, there is a clear trend indicating that government healthcare services are more widely available compared to private services in Ghotki city. Approximately 39% of government facilities have regular availability of doctors, while only 3% of private healthcare services fall into the same category. Additionally, a significant portion of government services (28%) have partial availability of doctors within a hospital, in contrast to private services shown in the **Figure** 6-8.

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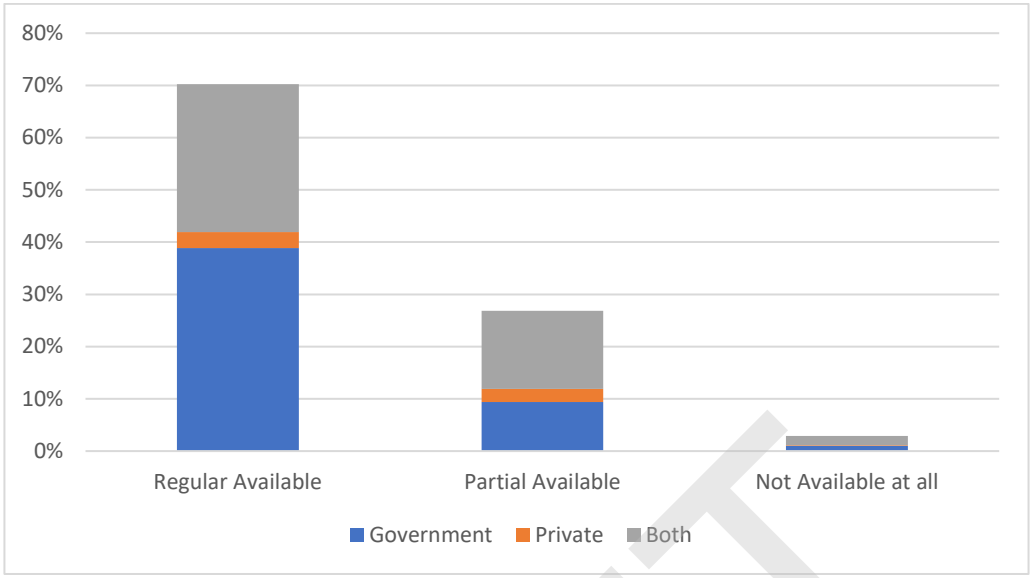


Figure 6-8, Correlation between Health Facilities and Doctor Availability

Source: *The Consultant Team*

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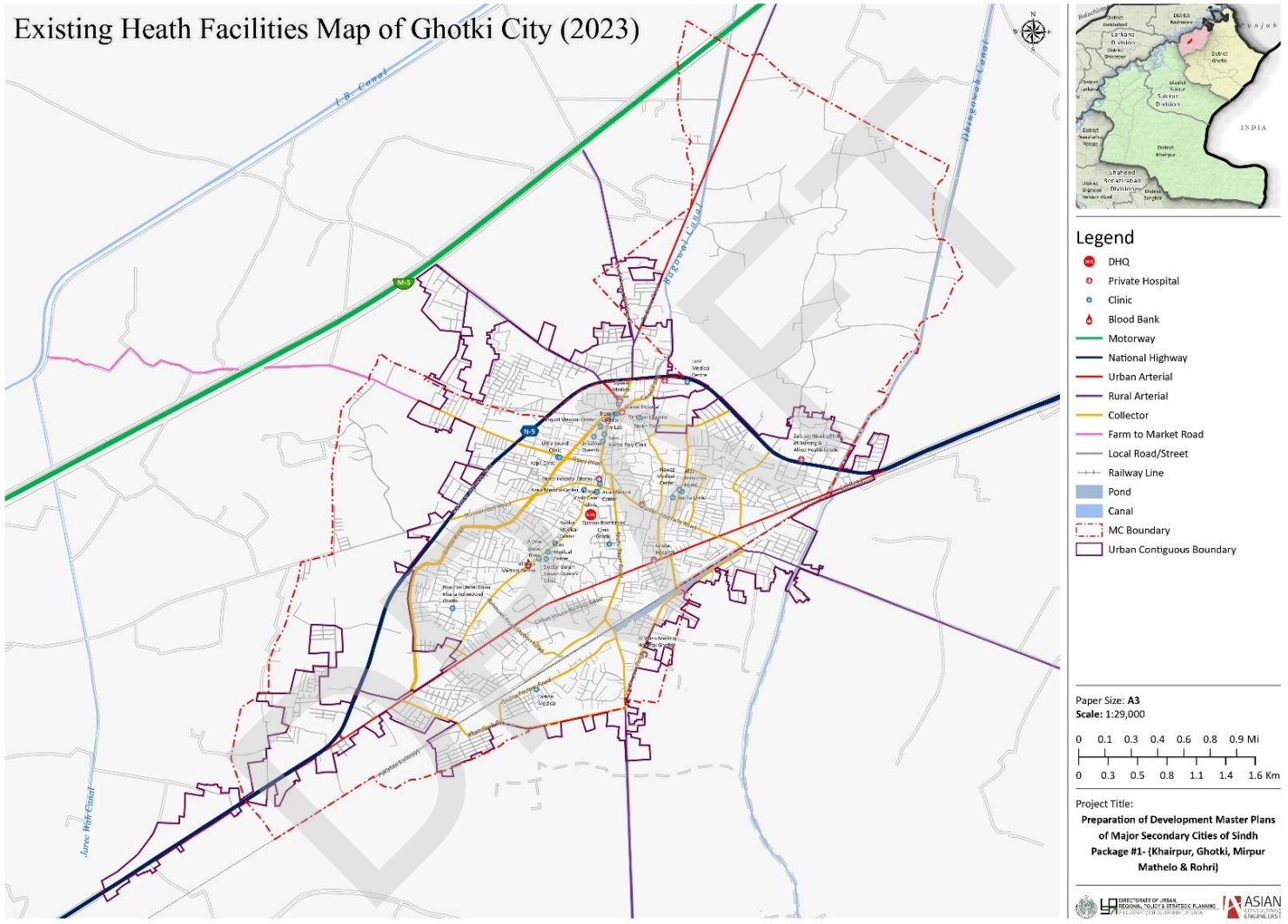


Figure 6-9, Spatial Distribution of Existing Health Facilities of Ghotki City

Source: *The Consultant Team*

6.3.2 SWOT Analysis

Strengths	Weaknesses
• There is one specialized hospital in city. • The presence of THQ (Tehsil Headquarters) hospital provides basic healthcare services to the population.	• The current number of beds and medical facilities does not meet the demand of the current population. • Existing healthcare facilities are often inadequate and lack essential medical equipment and resources necessary for effective treatment.
Opportunities	**Threats**
• Potential to attract investment in specialized healthcare facilities due to increasing demand. • Investments can be made through public-private partnerships to enhance service delivery	• Population growth in Ghotki may exacerbate existing healthcare challenges, if infrastructure does not keep pace with demand.

6.3.3 Need Assessment

To bridge the existing gaps and improve healthcare outcomes for the population, there is a need to increase human resources by recruiting more doctors, nurses, midwives, and paramedical staff is crucial to meet recommended patient-to-provider ratios. Elevating the level of medical service delivery by investing in training initiatives for healthcare staff and establishing oversight mechanisms for accountability remains indispensable. Furthermore, strengthening public health measures by implementing community-based programs focusing on hygiene education, clean water supply projects, and waste management systems will help address preventable diseases. Leveraging technology by introducing telemedicine services and electronic medical records systems can also improve healthcare delivery. Lastly, increasing land allocation for healthcare facilities in Ghotki city to meet the recommended standard of 2-3% is vital for accommodating future healthcare needs.

A) Land Suitability Analysis of Health

Land Suitability Analysis (LSA) for healthcare facilities in Ghotki city (**Figure** 6-10) is crucial in identifying optimal locations that enhance accessibility and meet community health needs. Key considerations include proximity to major roads such as National Highway (N-5), Ghotki Khanpur Mahar Road, and Ghotki Mathelo Road, as these roads facilitates easy access to patients and emergency services. Ideally, sites within 500 meters are considered highly suitable to ensure rapid response times, while those beyond 2,000 meters are

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deemed unsuitable. Sites should also be located near residential areas to ensure that communities can conveniently reach healthcare services, with a recommended distance of no more than 500 meters.

Additionally, the analysis must take into account environmental factors, avoiding locations near hazardous sites (northern and northwestern side of city) such as industrial areas or flood-prone zones to ensure patient safety. Sites should instead be close to parks and open spaces, which enhance the environment for healthcare services. Accessibility to essential services, such as pharmacies and laboratories, is also important as it enhances the overall healthcare experience. By focusing on these criteria, land suitability analysis helps ensure that healthcare facilities are strategically placed to serve the population effectively and equitably.

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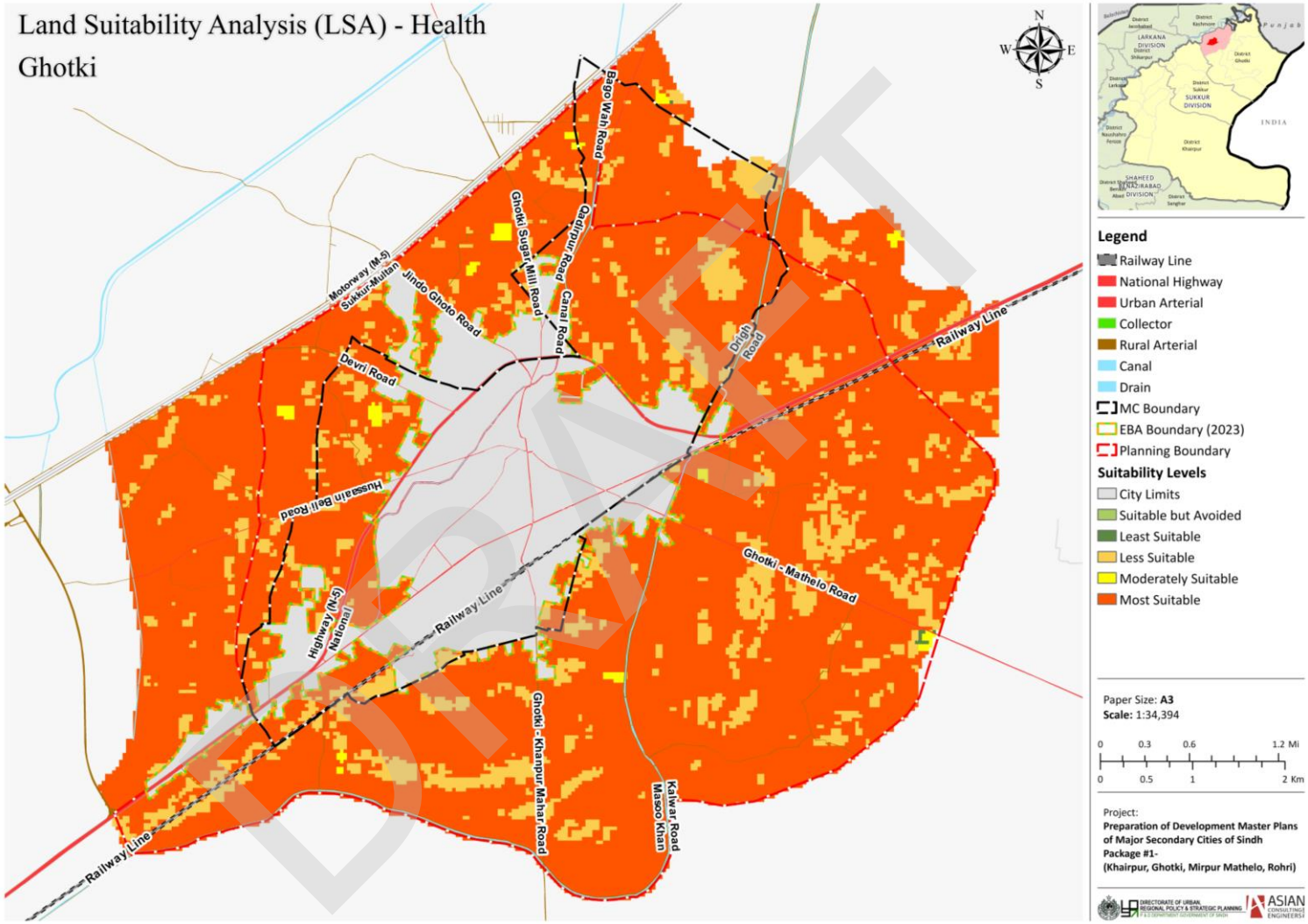


Figure 6-10, Land Suitability Analysis – Health

Source: *The Consultant Team*

6.3.4 Policy Guidelines

The health sector in Ghotki city must be developed in alignment with existing laws, policies, rules, and regulations at the federal, provincial, and local levels. The following policy guidelines are framed with respect to the available legal framework to ensure effective implementation and compliance.

A) Policy Measures for Healthcare Infrastructure

Construction and Upgradation of Healthcare Facilities

Under the Sindh Local Government Act (2013), the provincial and local authorities shall prioritize the construction and upgradation of healthcare facilities, including hospitals, clinics, and basic health units (BHUs), in Ghotki District. These facilities shall be equipped with essential medical equipment, medicines, and trained staff.

Disaster-Resilient Healthcare Facilities

In compliance with the Sindh Building Control Ordinance (1979) and National Disaster Management Authority (NDMA) Guidelines, all new healthcare facilities shall be constructed using disaster-resilient designs, especially in flood-prone areas. Existing facilities in hazardous zones shall be retrofitted to withstand natural disasters.

B) Policy Measures for Access to Healthcare

Mobile Health Units

Under the Sindh Local Government Act (2013), mobile health units shall be deployed to provide healthcare services in remote and underserved areas of Ghotki District. These units shall offer basic medical care, vaccinations, and maternal and child health services.

Ambulance Services

To improve access to emergency healthcare, the Sindh Local Government Act (2013) shall be utilized to establish a network of ambulance services. These services shall be equipped with basic life support systems and staffed by trained paramedics.

C) Policy Measures for Quality Healthcare

Training and Recruitment of Healthcare Professionals

Under the Pakistan Medical and Dental Council Act (2022), a comprehensive training program shall be implemented to improve the skills of healthcare professionals. Vacant positions in healthcare facilities shall be filled through transparent recruitment processes, ensuring that only qualified and trained professionals are hired.

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Standard Treatment Protocols

The Sindh Healthcare Commission Act (2013) shall be enforced to ensure that all healthcare facilities follow standard treatment protocols. Regular audits shall be conducted to monitor compliance and improve the quality of care.

D) Policy Measures for Maternal and Child Health

Maternal and Child Health Clinics

Under the Sindh Local Government Act (2013), maternal and child health clinics shall be established in all healthcare facilities. These clinics shall provide antenatal and postnatal care, immunizations, and nutritional support to mothers and children.

Awareness Campaigns

Awareness campaigns shall be conducted under the Sindh Transparency and Right to Information Act (2016) to educate communities about the importance of maternal and child health. These campaigns shall focus on promoting safe childbirth practices, breastfeeding, and immunization.

E) Policy Measures for Disease Prevention and Control

Vaccination Programs

Under the Sindh Immunization and Epidemics Control Act (2023), vaccination programs shall be implemented to prevent the spread of infectious diseases. Special attention shall be given to polio, measles, and hepatitis vaccination campaigns.

Vector Control Programs

To combat vector-borne diseases such as malaria and dengue, the Sindh Local Government Act (2013) shall be utilized to implement vector control programs. These programs shall include community education, insecticide spraying, and environmental management.

F) Policy Measures for Mental Health

Mental Health Services

Under the Sindh Mental Health Act (2013), mental health services shall be integrated into primary healthcare facilities. Trained mental health professionals shall be deployed to provide counselling and treatment for mental health conditions.

Awareness and Stigma Reduction

Awareness campaigns shall be conducted to reduce the stigma associated with mental health issues. These campaigns shall be supported by the Sindh Transparency and Right to Information Act (2016) to ensure widespread dissemination of information.

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G) Policy Measures for Monitoring and Evaluation

Regular Inspections

Under the Sindh Health Care Commission Act (2013), regular inspections shall be conducted to monitor the performance of healthcare facilities. Inspection reports shall be made publicly available to ensure transparency.

Performance Metrics

Performance metrics shall be developed to evaluate the effectiveness of healthcare policies and programs. Data-driven improvements shall be made to address gaps and ensure continuous progress.

Feedback Mechanisms

Feedback mechanisms shall be established to gather input from patients, healthcare providers, and community members. This feedback shall be used to make necessary adjustments to healthcare policies and practices.

6.3.5 Strategic Development Plan

Ghotki city faces substantial healthcare challenges, including inadequate infrastructure, a lack of tertiary care facilities, poorly equipped hospitals, and insufficient access to quality healthcare services. Strengthening the healthcare system through infrastructure development, improved service delivery, and capacity-building is essential. Key improvements include enhancing healthcare facilities, ensuring the availability of modern equipment, and promoting accountability in health departments. Governance can be improved through public-private partnerships, IT-based monitoring systems, and equitable resource allocation. A focus on preventive care, awareness campaigns, and skilled workforce development will ensure long-term progress in public health.

A) Long-Term Plan

- Establish specialized hospitals with advanced medical services, including trauma care, cardiology, and oncology, to reduce the need for patients to travel to other cities for treatment.
- Expand mobile health units to provide healthcare services to remote and underserved areas, ensuring equitable access for all residents.
- Create a comprehensive ambulance network, especially for nearby rural areas, to ensure timely medical assistance and reduce preventable deaths.
- Build residential facilities for doctors and paramedic staff to attract and retain skilled healthcare professionals in Ghotki city.
- Establish new Basic Health Units (BHUs) and Maternal and Child Health Centers (MCHCs) to improve primary healthcare access.

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- Conduct workshops, seminars, and community meetings to raise awareness about hygiene, sanitation, and communicable diseases.
- Strengthen coordination with government health departments to ensure vaccination programs and healthcare services reach remote areas.
- Implement health insurance schemes to reduce catastrophic health expenditures and make healthcare affordable for low-income communities.

B) Short-Term Plan

- Reduce travel distances to healthcare facilities by strategically locating BHUs, and dispensaries based on both population and geographic distance.
- Develop an "Edhi-type" ambulance network funded by local charities and supported by local government bodies to provide emergency medical transport.
- Ensure the availability of skilled healthcare professionals and modern medical equipment to improve service delivery.
- Strengthen immunization programs to protect against preventable diseases, particularly in rural and underserved areas.
- Upgrade hospital equipment and ensure the consistent availability of quality medicines.
- Provide additional facilities such as furnished accommodation, discounted utility bills, and transportation allowances to attract healthcare professionals to work in rural areas.
- Advocate for an increase in the health sector budget to support infrastructure development and service improvements.
- Introduce IT-based monitoring systems to improve accountability and efficiency in healthcare delivery.

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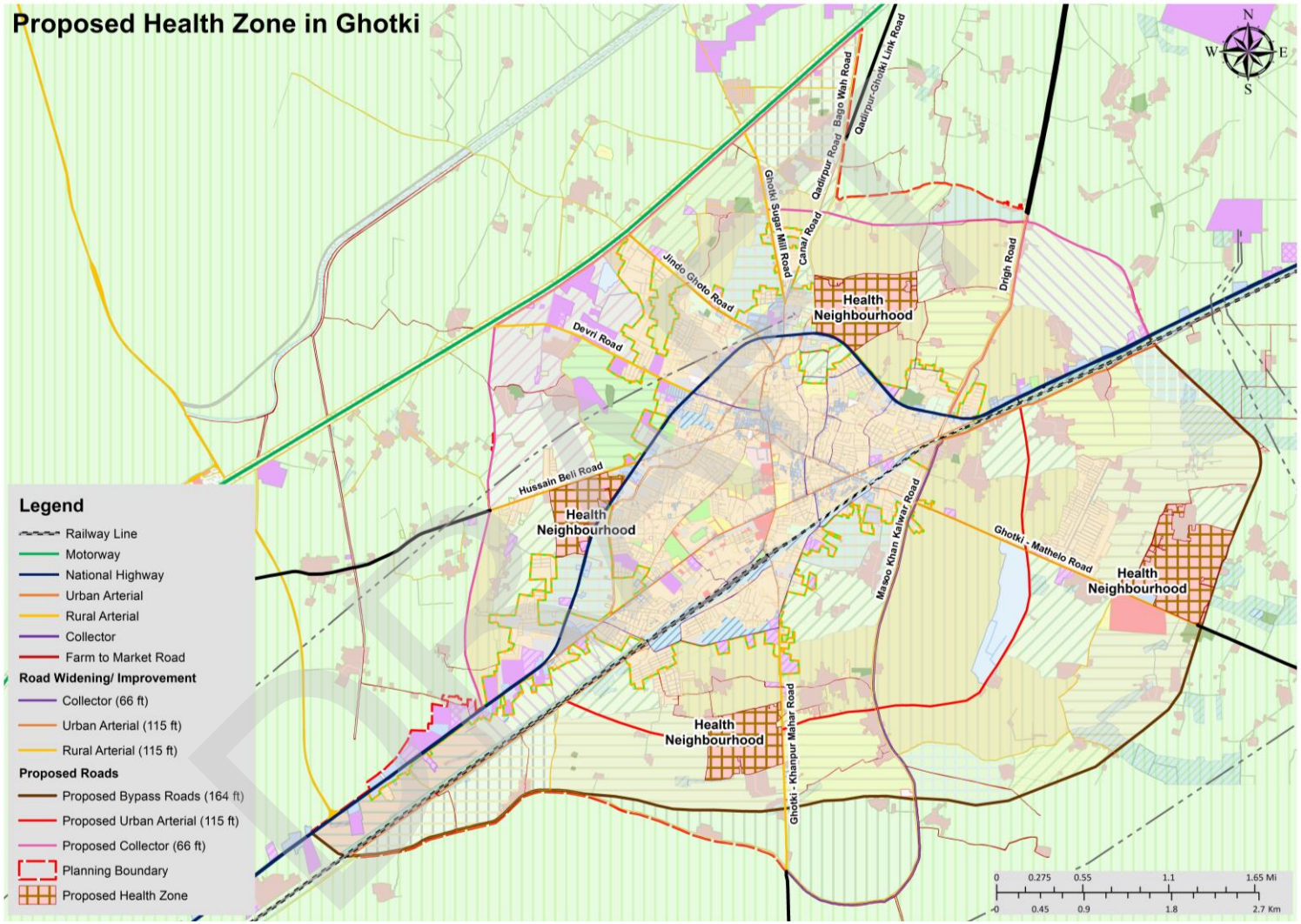


Figure 6-11, Proposed Health Zones in Ghotki

Source: *The Consultant Team*

6.3.6 Priority Projects

Healthcare is a foundation of urban development and a fundamental right of every citizen. In Ghotki city, the current state of public healthcare is alarming, with inadequate infrastructure, insufficient facilities, and a severe shortage of medical professionals. The rapid population growth has further strained the already overburdened healthcare system, leading to elevated morbidity and mortality rates. To address these challenges, priority projects will focus on expanding healthcare infrastructure, improving service delivery, and ensuring equitable access to quality healthcare for all residents.

A) Repair, Rehabilitation and Upgradation of Medical Facilities in Taluka Headquarter (THQ) Hospital, Ghotki

1. Project Justification

The existing healthcare infrastructure in Ghotki city is critically frail, with only 1 Taluka Headquarter (THQ) Hospital, 14 private hospitals, and 35 clinics serving a population of 119,879. Healthcare facilities occupy a mere 6.4 hectares (0.63%) of land, significantly below the recommended planning standard of 2-3%. The THQ Hospital, a vital public health provider, lacks essential specialized units and modern equipment. This severe shortage and uneven distribution create a healthcare crisis, forcing residents to travel long distances for basic specialized care and overburdening private facilities.

This project is essential to transform the THQ Hospital into a robust, well-equipped medical hub that provides equitable, accessible, and quality healthcare to reduce patient burden and improve community health outcomes.

2. Project Scope

This project will comprehensively rehabilitate, upgrade, and expand the THQ Hospital to meet provincial standards for a Taluka Headquarter facility. The scope of work is detailed below:

- Execute structural repairs to the main building, including concrete crack injection and complete weatherproof re-roofing. Fully refurbish interiors with repainting, replacement of all doors and windows, and upgrading patient toilets with modern, accessible sanitary ware.
- Equip the hospital with essential diagnostic and treatment technology, including a Digital X-Ray machine, an Ultrasound system, and modern laboratory analysers for haematology and biochemistry to enable accurate and timely diagnosis.
- Provision of modern medical equipment for diagnostics, monitoring, and treatment across key departments. Upgrades to essential systems like reliable power backup (generators/UPS), oxygen supply, and water sanitation.

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- Improve the hospital's functionality and patient experience by rehabilitating internal roads and parking, creating a covered waiting area, and upgrading the waste management system with color-coded bins and a sharps disposal unit for safety and hygiene.
- Lay the foundation for digital healthcare management by implementing structured LAN cabling and providing computers with software for a Hospital Management Information System (HMIS) to streamline patient records and hospital administration.

3. Project Benefits

- **Improved Healthcare Delivery:** The rehabilitation and upgradation of medical facilities will enable the THQ Hospital to deliver quality healthcare services, reducing the burden on other facilities.
- **Enhanced Patient Care:** Specialized units and modern equipment will ensure comprehensive care for trauma, maternal health, paediatrics, and emergencies.
- **Increased Capacity:** Expanded bed capacity and improved infrastructure will allow the hospital to serve more patients effectively.
- **Better Public Health Outcomes:** Access to quality healthcare will reduce morbidity and mortality rates, improving overall public health in the district.
- **Strengthened Healthcare System:** The project will contribute to a more resilient and efficient healthcare system in Ghotki city.

4. Implementation Strategy

Phase 1: Assessment and Detailed

- Conduct a comprehensive structural and engineering assessment of the THQ Hospital to finalize technical specifications.
- Complete detailed architectural and engineering designs for the new annex and upgraded facilities.
- Finalize tender documents and initiate a transparent procurement process for contractors and equipment.

Phase 2: Infrastructure and Civil Works

- Execute structural repairs, including crack injection, re-roofing, and interior refurbishment.
- Carry out upgrades to critical utility systems, including electrical, water, and sanitation infrastructure.

Phase 3: Equipment Installation and System Integration

- Procure, deliver, and install all medical and non-medical equipment (e.g., X-ray, ultrasound, laboratory analyzers, HMIS).

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- Install and commission the power backup generators, central oxygen system, and water filtration plant.
- Conduct rigorous testing and calibration of all new systems and equipment.

Phase 4: Staff Training and Operationalization

- Conduct specialized training programs for medical, nursing, and technical staff on the use of new equipment and protocols.
- Develop and implement new operational and maintenance procedures for the upgraded facilities.

Phase 5: Monitoring and Evaluation

- Establish a monitoring mechanism to track hospital performance indicators (e.g., patient load, service delivery).
- Conduct a post-project evaluation to assess impact on patient outcomes, staff efficiency, and community satisfaction.
- Ensure the implementing authority has a long-term maintenance plan in place.

5. Implementing Authority

- District Health Department, Government of Sindh
- Public Health Engineering Department
- Local Government and Rural Development Department

6. Estimated Cost

Total Estimated Cost: PKR 2.46 million (approx.)

6.3.7 Immediate Action Plan for Core Urban Area

A) Provision of Missing Facilities to Taluka Headquarter (THQ) Hospital, Ghotki

The THQ Hospital in Ghotki city is a critical healthcare facility serving a population of 119,879, yet it lacks essential facilities, severely impacting its ability to deliver quality healthcare services. This immediate action plan focuses on addressing these critical gaps by repairing and rehabilitating the hospital infrastructure, providing missing facilities, and ensuring a safe and functional healthcare environment for patients and staff.

The following key areas of the THQ Hospital have been prioritized for immediate intervention:

- Ophthalmology Department
- ENT Department
- Urology Department
- Cardiology Department
- Radiology Department

- Neurology Department

1. Immediate Action Plan

The immediate action plan will focus on the following key areas for the THQ Hospital:

Structural Repairs and Stability

- Address structural issues such as cracks, roof leaks, and damaged walls to ensure the safety of patients and staff.
- Reinforce weak structures and repair damaged floors, ceilings, and operational areas.

Access to Basic Utilities

- Provide a reliable water supply by installing water storage tanks and filtration systems.
- Ensure uninterrupted electricity by setting up generators or solar power systems.
- Construct proper sanitation facilities and establish a waste disposal system.

Provision of Essential Facilities

- Procure and install essential medical equipment, including ventilators, ECG machines, ultrasound devices, and laboratory tools.
- Establish a fully equipped diagnostic laboratory for basic and advanced diagnostic tests.
- Set up a dedicated emergency and trauma care unit with modern equipment and trained staff.
- Create a fully functional maternity ward for safe deliveries and postnatal care.
- Develop a paediatric care unit with child-friendly facilities and specialized equipment.
- Ensure a fully stocked pharmacy with essential medicines and supplies.

Security Measures

- Reconstruct and rehabilitation of boundary walls and secure gates to ensure the safety of patients, staff, and hospital property.
- Set up CCTV cameras and hire security personnel to monitor hospital premises.

Staff Accommodation and Capacity Building

- Provide temporary accommodation for doctors and paramedics to attract and retain skilled healthcare professionals.

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- Organize training sessions for hospital staff on the use of new equipment and emergency care protocols.

2. Cost Estimation

Sr. No.	Department/ Facility	Components	Estimated Cost* (In millions)
1	Diagnostic Wing	CT, MRI, X-ray, Ultrasound	7.215
2	Specialist Equipment	Cardiology, Neurology, etc. equipment	199.6
3	Training and Housing	Staff development and accommodations	0.8
Total			**207.6**

Source: *The Consultant Team*

**Equipment cost doesn't include in it.*

3. Implementing Authority

- District Health Department, Government of Sindh
- Public Health Engineering Department
- Local Government and Rural Development Department
- Collaborating Partners: Local NGOs, private sector stakeholders, and community organizations.

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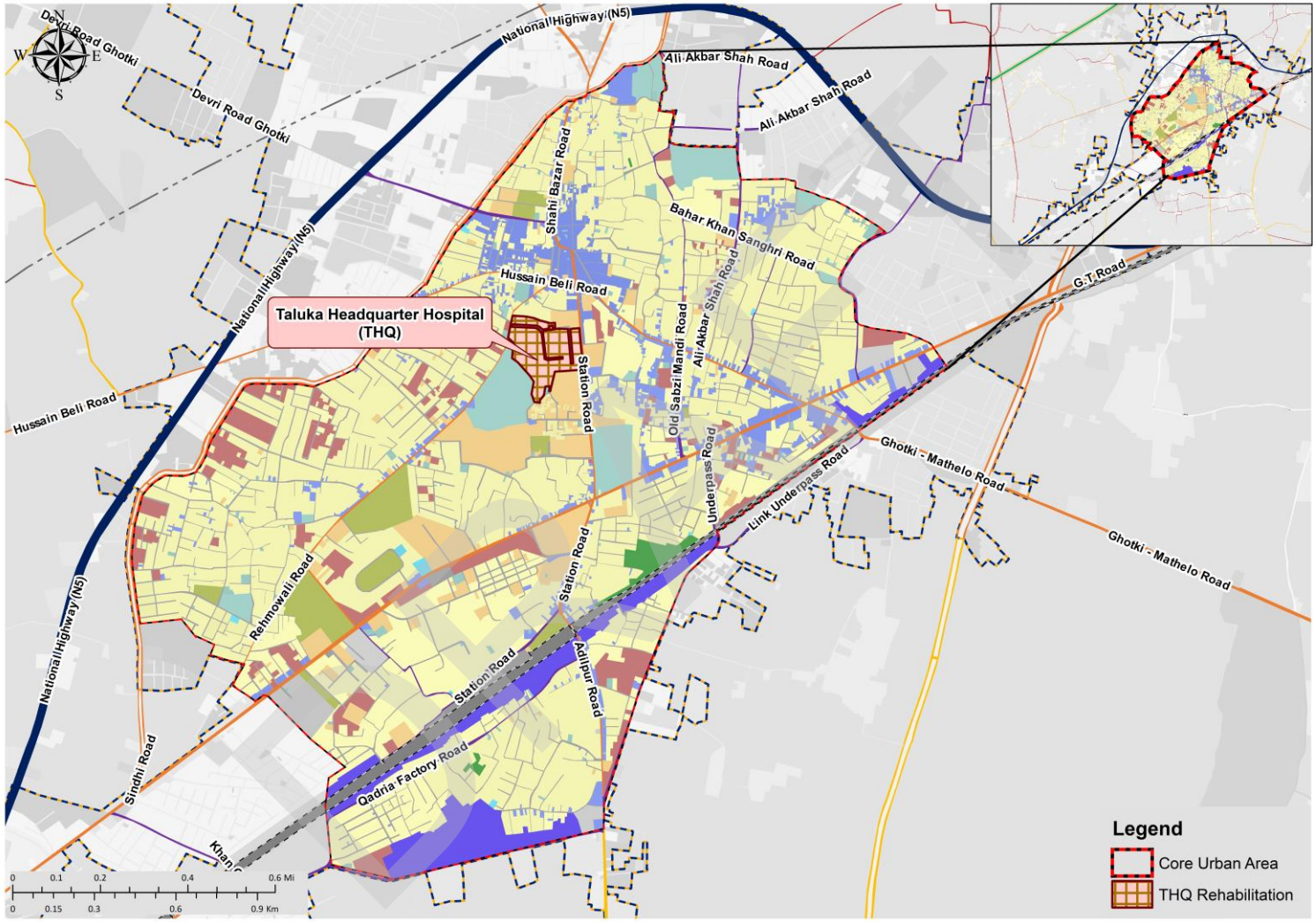


Figure 6-12, Healthcare Facility in Core Urban Area - Ghotki

Source: *The Consultant Team*

6.4 Recreation

6.4.1 Existing Situation

Ghotki city currently faces significant deficiencies in its parks and recreational infrastructure, which negatively impact residents' quality of life. The city has only a handful of public parks, including Rahmowali Park, Railway Park, and Ladies Park, along with a few neighbourhoods open spaces. The distribution of recreational spaces (as shown in **Figure** 6-13) across Ghotki is highly uneven, creating accessibility challenges for many residents. While some central areas have park facilities, the northwestern sectors of the city are particularly underserved, with no proper recreational spaces available. This inequitable distribution forces residents in these areas to either travel long distances to access parks or go without such facilities entirely. The number of available open spaces is mentioned in the **Table** 6-11.

Table 6-11, Number of Open Space Facilities in Ghotki City

Open Space Facilities	Count
Community Level Park	1
Neighbourhood Park	3
Mohalla Park	6
Playgrounds	2

Source: *The Consultant Team*

There are certain standards set by World Health Organization (WHO) that is 9 km^2 per person within 15-minute walking distance and UN-Habitat for open spaces should be accessible within 800 meters[14], these standards can be utilized for the provision of open spaces in the future for the provision of adequate open spaces and park.

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[14] *https://www.bip.org.bd/admin/uploads/bip-publication/publication-24/paper/20201002102922.pdf*

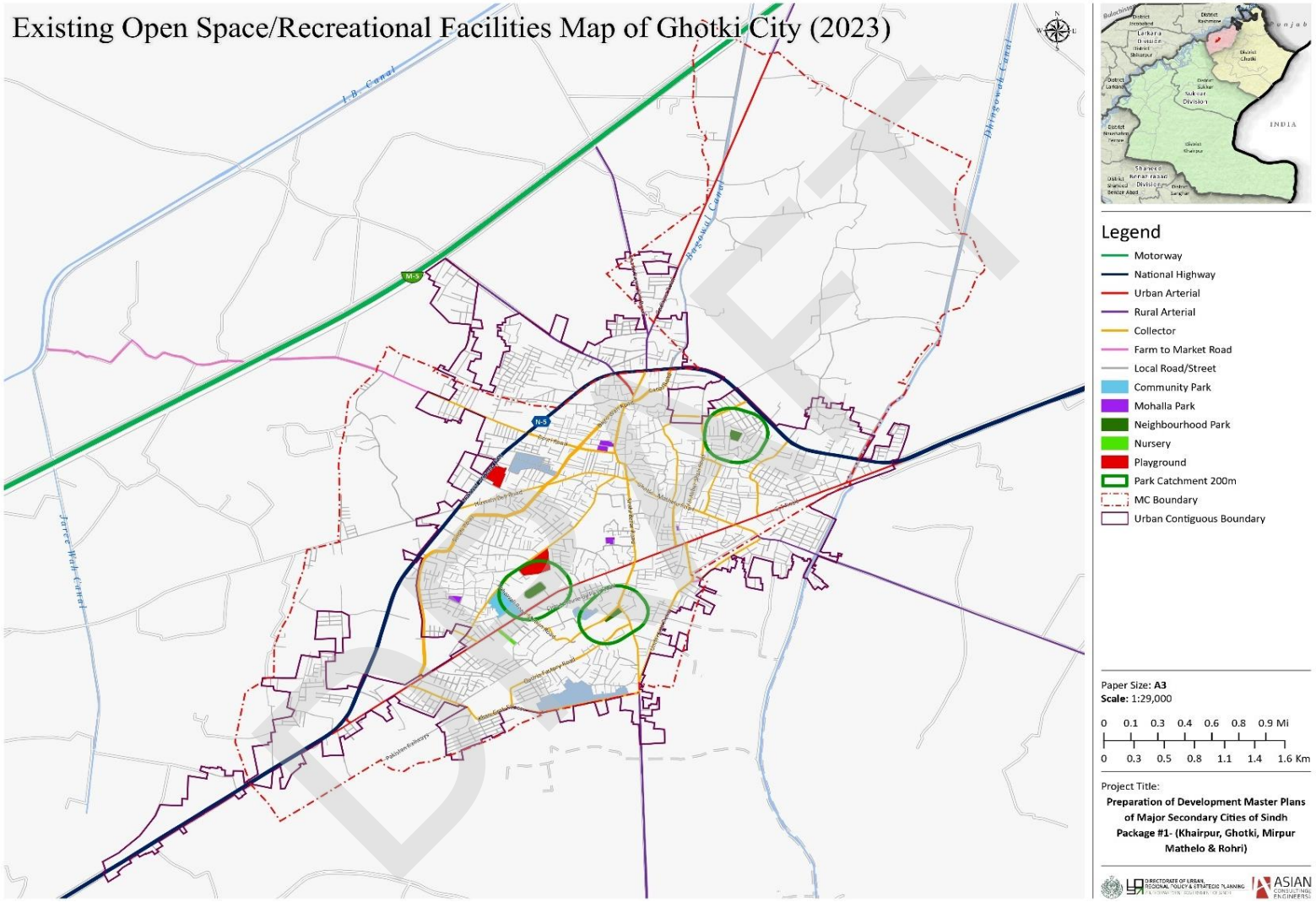


Figure 6-13, Spatial Distribution of Existing Parks/ Open Spaces - Ghotki City

Source: *The Consultant Team*

6.4.2 SWOT Analysis

Strengths	Weaknesses
• The city features various recreational facilities, including the Rahmowali park and a sports complex, catering to different community needs for leisure and physical activities.	• There is an uneven distribution of parks, particularly a lack of adequate recreational spaces limiting access for residents in those areas. • Existing parks may suffer from deferred maintenance or inadequate resources, impacting their usability and attractiveness.
Opportunities	**Threats**
• Vacant spaces can be transformed into parks or green spaces, providing residents with accessible recreational areas.	• Rapid urbanization may threaten existing recreational spaces if not properly managed, leading to potential loss of open areas.

6.4.3 Need Assessment

Currently, the city has a mix of recreational spaces, including Mohalla parks, neighbourhood parks, community-level parks, open spaces, and playgrounds. However, there is a notable disparity in the distribution of these spaces throughout the city. This disparity needs to be addressed to enhance the quality of life for residents and contribute to the city's vision of fostering a healthy and active community. According to international standards, such as those set by the World Health Organization (WHO) and UN-Habitat, cities should aim to provide accessible open spaces within walking distances. The WHO recommends at least 9 square meters of open space per person, while UN-Habitat suggests that open spaces should be accessible within 800 meters.

To address the current shortcomings and meet future demands, there is need to focus on increasing its open space area by developing new parks and open spaces. Improving accessibility is also crucial, ensuring that open spaces are within 800 meters for most residents. Diversifying open space types to include both active and passive spaces will cater to different recreational needs. Enhancing existing parks and playgrounds to improve their quality and functionality is also essential. Lastly, involving local communities in planning and maintaining open spaces will ensure they meet residents' needs and preferences.

A) Land Suitability Analysis of Recreation Areas

Land suitability analysis (LSA) for parks and open spaces is essential for effective urban planning, focusing on identifying optimal locations that enhance community well-being and environmental quality. Key factors influencing suitability include proximity to residential areas, accessibility via

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major roads (within 500 meters), and the presence of existing green spaces. Ideal sites are typically located in flat areas, away from industrial zones and flood-prone regions, ensuring safety and accessibility for the public. Additionally, proximity to water access, particularly within 100 meters, are deemed most suitable for parks. This analysis aims to provide communities with accessible green spaces that promote physical activity, social interaction, and ecological benefits, ultimately contributing to a healthier urban environment.

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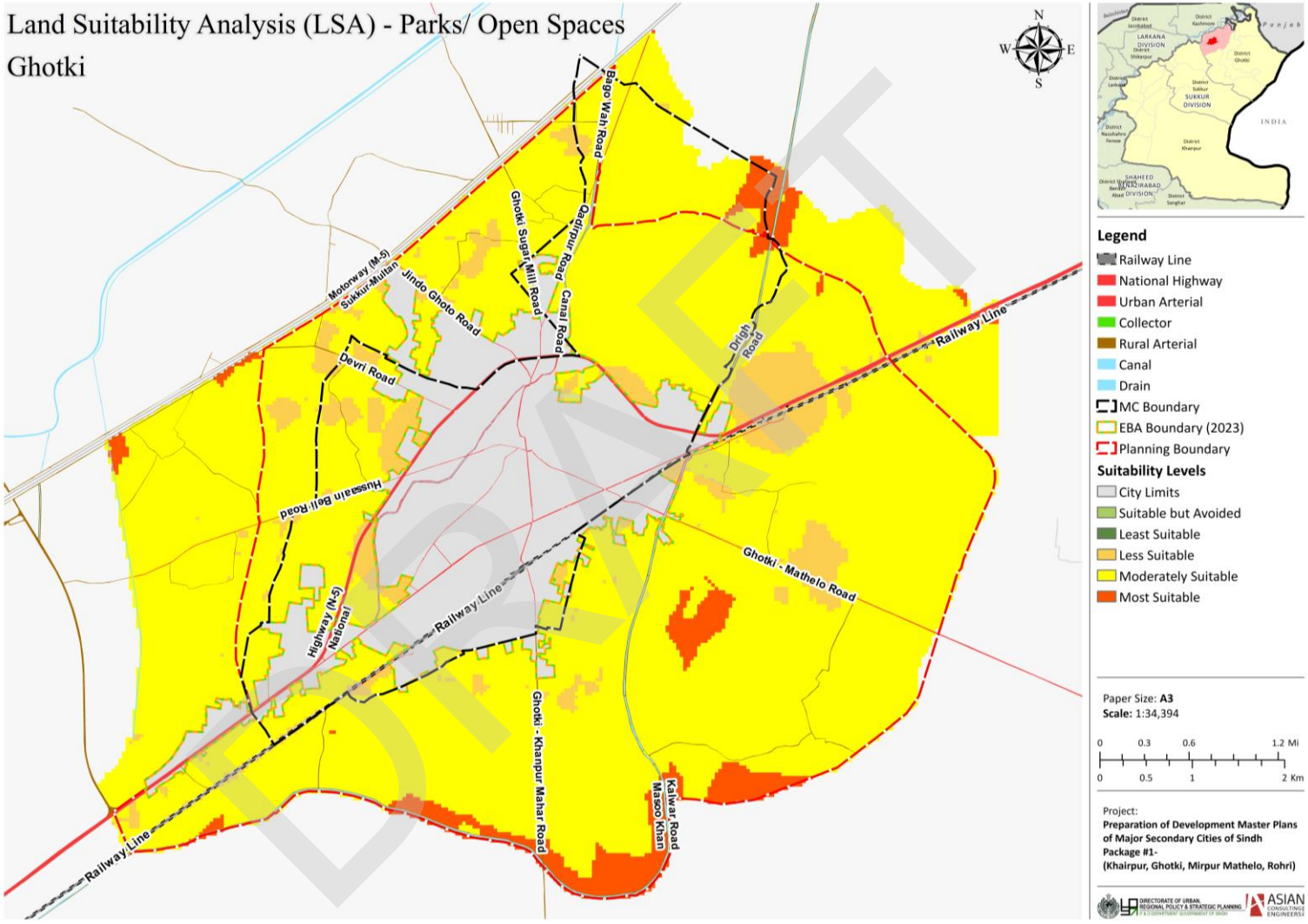


Figure 6-14, Land Suitability Analysis - Parks/ Open Spaces

Source: *The Consultant Team*

6.4.4 Policy Guidelines

The development of parks, recreation, and sports facilities in Ghotki city must align with the broader goals of urban planning, community well-being, and sustainable development. These policy guidelines are framed within the context of the Sindh Local Government Act (2013) Sindh Environmental Protection Act (2014) and other relevant laws and regulations to ensure effective implementation and compliance.

A) Policy Measures for Parks and Green Spaces

Development of Public Parks

Under the Sindh Local Government Act (2013), the local government shall allocate land for the development of public parks in Ghotki city. These parks shall be designed to provide recreational spaces for all age groups, with features such as walking paths, playgrounds, and seating areas.

Green Spaces and Urban Forestry

In compliance with the Sindh Environmental Protection Act (2014), green spaces shall be integrated to improve air quality and provide environmental benefits. Urban forestry initiatives shall be promoted to increase tree cover and create shaded areas in parks and public spaces.

Maintenance and Upkeep

A dedicated budget shall be allocated under the Sindh Local Government Act (2013) for the maintenance and upkeep of parks and green spaces. Regular cleaning, landscaping, and repair of facilities shall be ensured to keep these areas safe and attractive for public use.

B) Policy Measures for Recreational Facilities

Community Centers

Under the Sindh Local Government Act (2013), community centers shall be established in Ghotki city to provide spaces for recreational activities, cultural events, and social gatherings. These centers shall be equipped with facilities such as libraries, auditoriums, and multipurpose halls.

Children's Play Areas

Play areas for children shall be developed in residential neighbourhoods and public parks. These areas shall include safe and age-appropriate play equipment, ensuring accessibility for children with disabilities.

Walking and Cycling Tracks

Walking and cycling tracks shall be developed in parks to promote healthy lifestyles. These tracks shall be designed to ensure safety and connectivity within recreational facilities.

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C) Policy Measures for Sports Facilities

Development of Sports Complexes

Under the Sindh Sports Board Ordinance of (1980), sports complexes shall be developed in Ghotki city to provide facilities for various sports, including cricket, football, basketball, and athletics. These complexes shall include playing fields, gymnasiums, and seating for spectators.

Community Sports Facilities

Smaller sports facilities, such as community gyms and multipurpose courts, shall be established in residential areas to encourage local participation in sports and physical activities.

Promotion of Traditional Sports

Traditional sports and games, such as cricket, futsal, volleyball, hockey, and throwball, as well as kodiko, shall be promoted to preserve cultural heritage and encourage community participation. Local tournaments and events shall be organized to foster a sense of community and healthy competition.

D) Policy Measures for Accessibility and Inclusivity

Universal Design Principles

All parks, recreational facilities, and sports complexes shall be designed in accordance with universal design principles to ensure accessibility for persons with disabilities, the elderly, and children. Ramps, accessible pathways, and inclusive play equipment shall be incorporated.

Gender-Sensitive Facilities

Separate spaces and facilities for women and girls shall be provided in parks and sports complexes to encourage their participation in recreational and sports activities. These spaces shall ensure privacy and safety.

E) Policy Measures for Monitoring and Evaluation

Regular Inspections

Under the Sindh Local Government Act (2013), regular inspections shall be conducted to monitor the condition and usage of parks, recreational facilities, and sports complexes. Inspection reports shall be made publicly available to ensure transparency.

Performance Metrics

Performance metrics shall be developed to evaluate the effectiveness of policies and programs related to parks, recreation, and sports. Data-driven improvements shall be made to address gaps and ensure continuous progress.

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Feedback Mechanisms

Feedback mechanisms shall be established to gather input from users and community members. This feedback shall be used to make necessary adjustments to policies and practices.

6.4.5 Strategic Development Plan

Ghotki city faces considerable challenges in providing adequate recreational spaces, including a lack of parks, poorly maintained facilities, and disparities in park distribution. Strengthening the city's recreational infrastructure through the development of new parks, rehabilitation of existing facilities, and equitable resource allocation is essential. Key improvements include enhancing the quality and accessibility of parks, ensuring the availability of modern recreational amenities, and promoting community engagement. Governance can be improved through public-private partnerships, and community involvement. A focus on environmental sustainability, cultural preservation, and youth development will ensure long-term progress in creating a healthy and vibrant urban environment.

A) Long-Term Plan

- Develop city level parks with advanced amenities such as sports complexes, jogging tracks, and cultural hubs to reduce the need for residents to travel to other cities for recreational activities.
- Create urban forests, green belts, and buffer zones along Bago Wah and Dhingra Wah canal and railway line to enhance the city's green cover and environmental sustainability.
- Ensure equitable access to parks by establishing new recreational spaces in underserved areas, particularly in the north-western part of the city.
- Establish multi-purpose community centers with indoor sports facilities, community centers, and cultural spaces to promote social interaction and youth development.
- Organize workshops, seminars, and community meetings to raise awareness about the importance of parks, environmental conservation, and healthy lifestyles.
- Collaborate with government departments and NGOs to ensure the ensure the maintenance and sustainability of recreational facilities.
- Use technology to monitor park usage, maintenance, and resource allocation for improved governance and accountability.

B) Short-Term Plan

- Repair and upgrade existing parks such as Rahmowali Park, Railway Park, and Ladies Park by improving infrastructure, adding amenities, and enhancing landscaping.

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- Develop Mohallah parks in residential areas by converting unused or dilapidated spaces, ensuring accessibility within 800 meters as per UN-Habitat standards.
- Transform canals into recreational spots by constructing footpaths, walkways, and green belts, and installing benches and lighting.
- Develop synthetic playing turfs for football, hockey, and cricket to encourage sports participation among youth.
- Ensure the availability of clean drinking water, public toilets, and shaded seating areas in all parks.
- Involve local communities in the planning, development, and maintenance of parks to foster a sense of ownership and responsibility.
- Install modern recreational equipment such as fitness zones, children's play areas, and outdoor gyms to enhance usability.
- Lobby for increased funding for the development and maintenance of recreational facilities to support infrastructure improvements.

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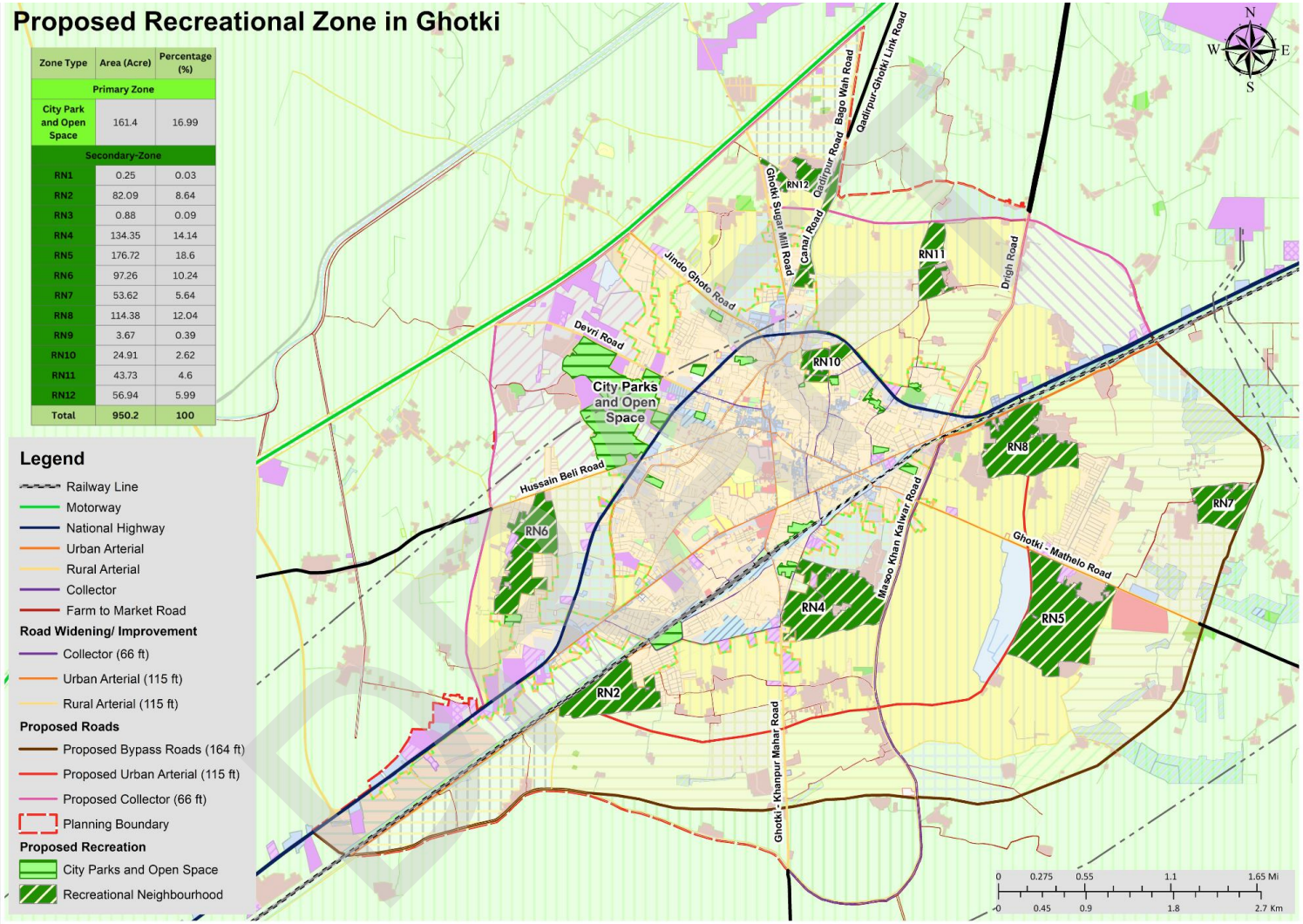


Figure 6-15, Proposed Recreational Zones in Ghotki

Source: *The Consultant Team*

6.4.6 Priority Projects

The development and rehabilitation of parks in Ghotki city are essential to addressing the growing need for accessible, safe, and well-maintained recreational spaces. The following priority projects aim to enhance the quality of life for residents by providing inclusive environments for physical activity, social interaction, and relaxation. By repairing and upgrading existing parks like Rahmowali Park, Municipal Park, Anwarabad Park and Ladies Park, the city will restore their functionality and appeal, ensuring they meet the needs of all age groups.

A) Enhancement of Recreational Facilities in Ghotki City

1. Project Justification

Ghotki city's existing recreational spaces are unevenly distributed and have fallen into disrepair. While the city has made strides in developing recreational spaces such as Anwarabad Park, Municipal Park, Ladies Park, or etc., there is a need to address the disparities in park distribution, particularly in the north-western part of the city. Additionally, existing parks require repair, rehabilitation, and provision of missing facilities to meet international standards and cater to the growing needs of the population.

This project is essential to rectify spatial inequities and transform dilapidated parks into safe, inclusive, and vibrant community hubs that promote public health and elevate the city's quality of life.

2. Project Scope

This project will address the recreational deficit through targeted rehabilitation of existing facilities. The scope of work is detailed below:

- Repair and upgrade of selected parks, including landscaping, pathway repairs, and installation of modern, safe play equipment.
- Installation of essential facilities across all project sites, including functional water fountains, gender-segregated public toilets, shaded seating areas, and adequate lighting for evening safety.
- Construction of walking/jogging tracks and the incorporation of universal access features like ramps to ensure the facilities are inclusive for children, the elderly, and persons with disabilities.

The following recreational facilities have been identified as priority projects:

Sr. No.	Name	Area (Ha)
1	Anwarabad Public Park	0.71
2	Ghotki Ball Field	2.04
Total		**2.75**

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3. Project Benefits

- **Social Benefits:** Improved recreational spaces will promote positive social change, particularly for youth, by providing safe spaces for leisure and physical activities.
- **Health Benefits:** Enhanced parks will encourage a healthy and active lifestyle, reducing the prevalence of lifestyle-related diseases.
- **Economic Benefits:** The project will boost local economic potential, create employment opportunities, and enhance the city's landscape, making it more attractive for tourism and investment.
- **Environmental Benefits:** Properly managed parks and open spaces will improve drainage, preserve natural areas, and mitigate the impact of floods.

4. Implementation Strategy

Phase 1: Site-Specific Assessment and Community Consultation

- Conduct detailed topographical and condition surveys of Anwarabad Public Park and Ghotki Ball Field.
- Hold community consultation workshops to gather input on desired facilities and design preferences.
- Finalize master plans and designs for each park, incorporating universal accessibility features.

Phase 2: Procurement and Site Preparation

- Finalize tender documents and award contracts for civil works and equipment supply.
- Clear sites, secure perimeters, and begin earthworks and grading.

Phase 3: Core Infrastructure Development

- Construct walking/jogging tracks, install underground utilities (water, electricity, drainage).
- Build and repair structural amenities such as public toilet blocks, shaded seating areas, and boundary walls.
- Install the foundational infrastructure for lighting and irrigation systems.

Phase 4: Installation of Amenities and Landscaping

- Install playground equipment, outdoor fitness stations, water fountains, and benches.
- Execute landscaping, including turfing, planting of trees and shrubs, and creation of green zones.
- Complete the installation of solar-powered LED lighting and security features (e.g., CCTV).

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Phase 5: Community Handover and Inauguration

- Develop and sign over maintenance plans to the local government and community groups.
- Train municipal staff on the operation and maintenance of new equipment and systems.
- Officially inaugurate the parks and initiate community engagement programs and activities.

Phase 6: Post-Completion Monitoring

- Monitor Park usage, facility conditions, and public satisfaction through surveys.
- Identify any necessary adjustments or corrective maintenance required.

5. Implementing Authority

- Sindh Government
- Local Government
- Private Investors

6. Estimated Cost

Total Estimated Cost: PKR 543 million (approx.)

6.4.7 Immediate Action Plan for Core Urban Area

Ghotki city currently faces a lack of well-maintained public spaces, sports facilities, and preserved heritage sites. To address these challenges, an immediate action plan has been developed, focusing on three key projects: transforming vacant spaces into green areas to improve the urban environment, rehabilitating the Ghotki Gymkhana to promote health and wellness of the residents and upgradation of the Rahmowali, Ladies and Municipal Park to improve recreational and community well-being. The following sections outline the objectives, scope, and immediate actions for each project.

A) Infill of Vacant Spaces for Green Spaces

Objective: *To convert underutilized vacant spaces into green areas, enhancing the city's environment, promoting biodiversity, and providing residents with accessible recreational areas*.

- Identify strategic vacant spaces within the urban fabric of Ghotki city that can be converted into green spaces.
- Implement landscaping, tree plantation, and installation of seating and recreational amenities.
- Ensure accessibility and connectivity of green spaces with pedestrian pathways and cycle tracks.

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- Initiate plantation drives with community participation.
- Install benches, shaded areas, and public amenities
- Develop an irrigation plan using sustainable water sources such as rainwater harvesting or recycled water.
- Install fencing, lighting, and surveillance systems for security.
- Coordinate with municipal authorities, landowners, and local communities to secure permissions and support for the project.

B) Upgradation of Rahmowali, Ladies and Municipal Park, Ghotki

Objective: *Transform the Rahmowali, Ladies and Municipal Park into a vibrant community hub with improved recreational facilities and cultural activities.*

- Repair and widen walking tracks using eco-friendly materials.
- Install modern play equipment, outdoor gym stations, and clean public toilets.
- Upgrade lighting (solar LEDs) and security (CCTV + patrols).
- Introduce themed sections (medicinal plant garden, picnic zones).
- Construct a small amphitheatre for cultural events and public gatherings.
- Organize weekly activities (yoga classes, storytelling sessions, environmental workshops).
- Partner with schools for "Park Clean-Up Days" and tree-planting drives.

C) Rehabilitation of Ghotki Gymkhana

Objective: *To rehabilitate and modernize Ghotki Gymkhana's fitness facilities with upgraded infrastructure, ensuring a safe, functional, and motivating environment for health and wellness.*

- Upgrade ventilation and cooling systems for a comfortable workout environment.
- Install proper flooring (rubberized/rubber mats) to reduce injury risks and noise.
- Renovate changing rooms, showers, and lockers with improved hygiene standards.
- Redesign the gym floor for optimal space utilization and user-friendly zoning (cardio, weights, functional training).
- Ensure clean drinking water access with water dispensers.
- Implement regular equipment servicing and facility maintenance schedules.

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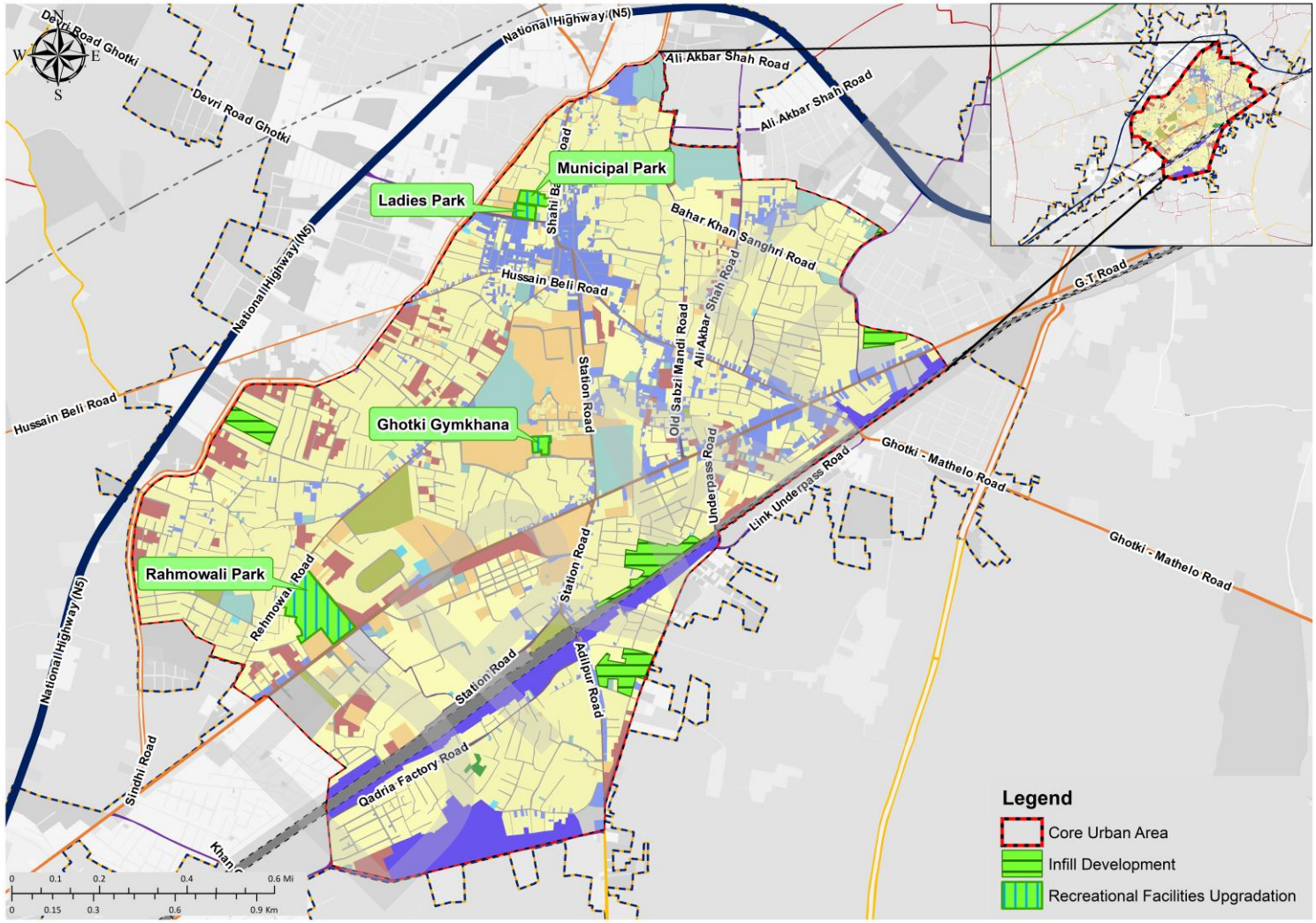


Figure 6-16, Recreational Facility in Core Urban Area - Ghotki

Source: *The Consultant Team*

SECTION - 7: ECONOMIC DEVELOPMENT PLAN

7.1 Introduction

Ghotki city's economic growth hinges on the sustainable development of its key sectors includes agriculture, livestock, fisheries, industries, and commerce, which form the backbone of local livelihoods and regional trade. This section evaluates the current economic landscape, identifies constraints such as limited infrastructure, market access, and technological gaps, and proposes strategic interventions to enhance productivity, diversify the economy, and foster inclusive growth, positioning Ghotki as a thriving economic hub.

7.2 Agriculture

7.2.1 Existing Situation

The economy of Ghotki is mainly based on cultivation due to its fertile soil and the Indus Basin Irrigation System. Major crops of the district include wheat, rice, sugarcane and cotton. But these days, sugarcane has been spreading at an unprecedented pace, from just over 2,400 hectares in 2010-11 to almost 59,000 hectares in 2019-20, converting Ghotki into one of the 10 largest sugarcane producing areas. Part of this growth has also been at the cost of cotton at the expense of rural employment in general, and employment for women in particular. Ghotki is also famous for its bananas, mangoes, citrus, dates, onions, and chilies.

7.2.2 Key Issues and Challenges

The key challenges include water stress, soil salinity, inefficient irrigation, limited crop diversity, and declining cotton-related employment. Traditional farming practices dominate, with poor access to quality seeds, mechanization, and agro-services. Climate-related threats such as heatwaves and pest infestations further reduce yields. A lack of post-harvest infrastructure and value chains leads to income loss and inefficiencies for farmers.

7.2.3 SWOT Analysis

Strengths	Weaknesses
• Fertile soil • Good irrigation foundation • Growing sugarcane output and crop diversification.	• Over-reliance on a handful of crops • Outdated farming methods • Water inefficiency and lack of value addition.
Opportunities	**Threats**
• High value crops, agro processing • Export-oriented horticulture and contract farming schemes.	• Water scarcity • Climate shocks, loss of biodiversity • Unemployment from monoculture

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7.2.4 Need Assessment

Enhancing productivity also needs decent quality seeds, fertilizers and irrigation instruments. Many areas in need of improved irrigation efficiency through drip, rehabilitated canals, and lining watercourses. There is a need to focus more on diversifying the farm sector into horticulture crops and fruits and vegetables, particularly exportable items including mango and onions. And that's where the agro-processing units, cold chains, and modern storage facilities comes in. There is need to support women and smallholders in the area of kitchen gardening and local marketing.

7.2.5 Strategic Development Plan

The strategy focuses on increasing farm production through farmer training, mechanization, and better inputs. Showcase plots will demonstrate increased yield. Water saving devices (drip/sprinkler) and good drainage will be in place. Diversification of crops will focus on bananas, dates, onions and off-season vegetables, and agro-processing will be facilitated by units of rice milling, cotton ginning and fruit pulp extraction. One of the anchor-projects is the Agro Export Processing Zone at Ruk Farm. Food security and income stabilization will be enhanced through village grain silos, crop insurance and collective marketing.

7.2.6 Priority Projects

Immediate priorities include:

- Repair and rehabilitation of watering channels and irrigation canals
- Farmer Field Schools and Pest Management Training
- Setting up of agro-processing and cold storage units
- Mango / Date gardens Expansion and supply of hybrid saplings
- Redevelop Ghotki's grain mandi in line with digital pricing system
- Pilot crop insurance and disseminate climate-smart seeds
- Opening of the Ruk Agro Export Zone

7.3 Livestock

7.3.1 Existing Situation

Livestock is an essential component of the rural economy of Ghotki and is an important source of income, nutritional relief and gaining livelihood security along with crops agriculture. The district is home to large numbers of buffaloes, cows, goats, and sheep. Some of the most common indigenous breeds are Red Sindhi cattle and Kundi buffalo. Dairy and beef are largely for local use and commercial poultry is also coming up, with more than 300 poultry farms in the district. Livestock activity is burdened by women and is more intense around the backyards. However, the subsector is informal, low-

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productive and widely outside value chain and formal marketplace.

7.3.2 Key Issues and Challenges

The main livestock constraints are the low milk and meat productivity due to low quality breeds and feed, reduced capacity of veterinary services to control diseases and limited availability of feed, notably in the dry season. There is limited availability of artificial insemination and modern animal management practices. There are investment needs in the infrastructure for milk collection, chilling and processing. There are no certified slaughterhouses either, and meat quality is affected. The absence of structured marketing system, inadequate access to credit also limits the proliferation for smallholders and women livestock owners.

7.3.3 SWOT Analysis

Strengths	Weaknesses
• Large livestock base • Traditional knowledge • Established role of women in care and management.	• Low productivity, traditional practices • Weak veterinary infrastructure • Absence of processing units
Opportunities	**Threats**
• Commercial dairy and meat farming, • Breed improvement, • Fodder cultivation, and value chain development.	• Disease outbreaks • Feed shortages • Climate-related stress, and continued informal • Unregulated market practices

7.3.4 Need Assessment

Livestock production must be commercialized by improving genetic quality of animals, increasing availability of feed and fodder, and access to veterinary and breeding services. There is need to develop dairy and meat processing infrastructure as well as capacity in order to connect producers with markets. There should be support for fattening farms, chilling centers, and poultry hatcheries. The involvement of women should be much better than it, through their training. We also need to enhance and encourage fish farming, especially in saline and water-logged areas as an alternative source of income.

7.3.5 Strategic Development Plan

The scheme envisions taking the city from backyard to commercial animal production programs, with large dairy farms, artificial insemination campaigns, and organized fodder production. Veterinary hospitals and mobile clinics will be expanded. A milk processing plant will be established for producing of packed milk (or) milk products. For meat, we'll need feedlots

and an up-to-date slaughterhouse. Better hatcheries and feed for poultry value chains. The district will also attempt to take up farming of fish on uneconomical lands with canal water and initiate pilot projects for cage aquaculture. It also seeks to support institutions through cooperatives and producer groups led by women. The following figure shows the spatial distribution of proposed land uses related to livestock.

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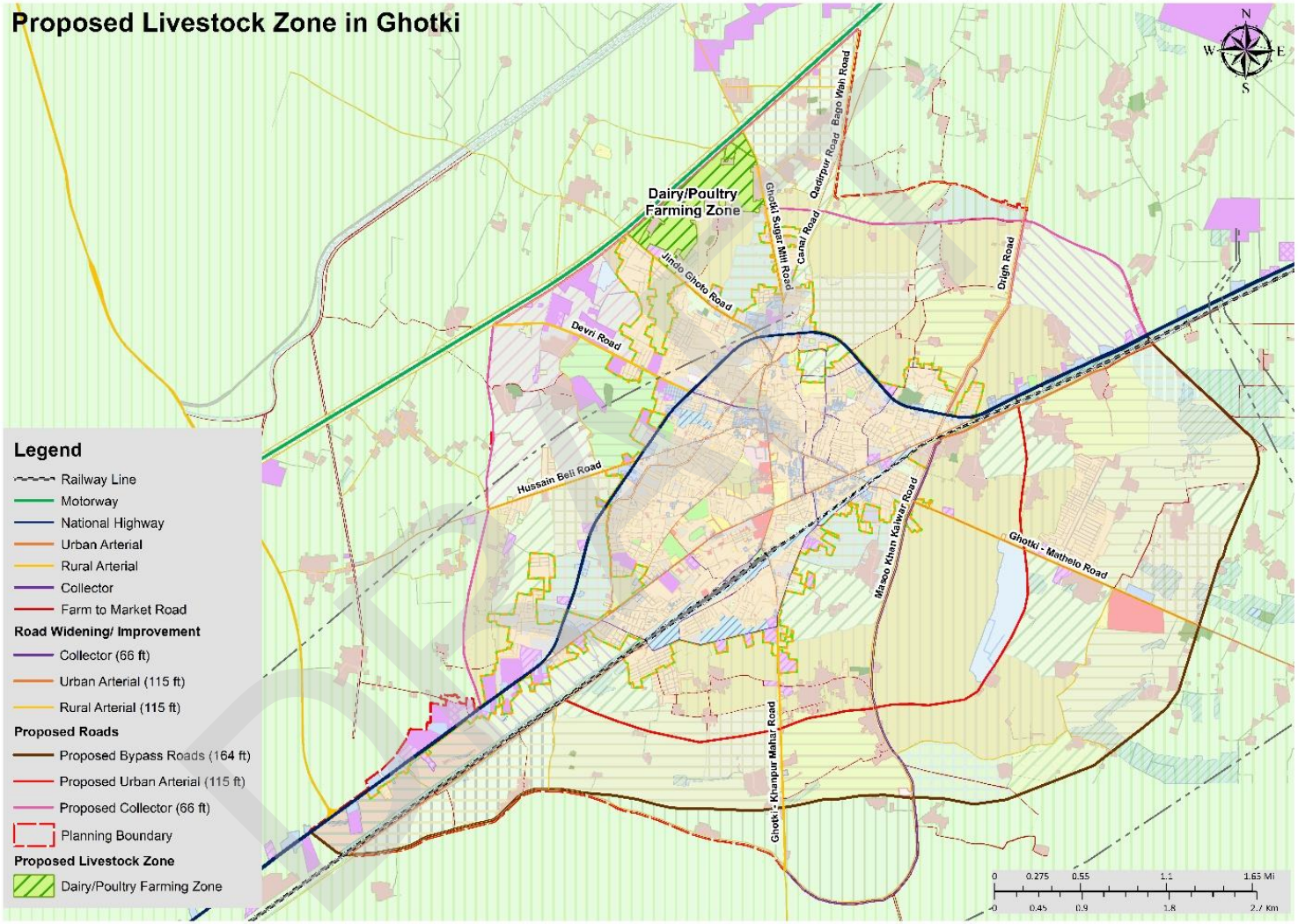


Figure 7-1, Proposed Dairy/ Poultry Farming Zone in Ghotki

Source: *The Consultant Team*

7.3.6 Priority Projects

Key projects include:

- Establishment of a milk processing plant and cold chain network
- Creation of feed mills and demonstration fodder plots
- Veterinary hospital upgrades and mobile vet services
- Launch of meat fattening farms and slaughterhouse infrastructure
- Development of poultry hatcheries and smallholder poultry kits
- Fish hatchery setup and aquaculture pilots in saline lands
- Capacity building for women in livestock and backyard poultry These initiatives aim to double livestock productivity, improve food quality, and generate new employment across rural Ghotki.

7.4 Fisheries

7.4.1 Existing Situation

Ghotki is not a well-known fisheries district in general it has great scope for in-land culture fisheries because of its canal system, waterlogged areas, brackish and unproductive soils. At present, fisheries are low level and informal with some single type fish culture based on canals or ponds. Although fresh and dried fish is in high demand at local markets, there is limited investment in aquaculture improvement nor in ponderable facilities. But with enough land and water, it is a potentially lucrative area for expansion.

7.4.2 Key Issues and Challenges

There are also several constraints hampering fish farming in Ghotki: no fish hatcheries are available in the district for fingerlings' supply; feed is not produced locally; farmers have low technical knowhow; and veterinary or extension support is not provided for aquaculture. Farmers are unaware of fish pond management, disease, and commercial species. There are not even fish markets, processing systems or cold storage facilities. Without government handholding, demonstration or training, the acceptability is relatively low when its potential in salt-affected area was a necessity.

7.4.3 SWOT Analysis

Strengths	Weaknesses
• Canal access to water • Underutilized land and more interest in diversifying income.	• Absence of hatcheries • Limited technical skill in tilapia culture • No feed or input supply chain little market access

Opportunities	Threats
• Pond and cage aquaculture • Integrated agriculture (e.g., rice…fish systems) • Community fish ponds and market establishments.	• Bad water administration, • Risks of disease, • Initial farmer resistance and lack of policy focus or continued support. •

7.4.4 Need Assessment

For the development of the sector, FISH requires a dedicated fish hatchery, training programs, extension services, and a fingerlings and feed supply chain. Farmers should be encouraged through demo ponds and by showing successful models of aquaculture to be profitable. Any waterlogged or saline lands need to be brought under mapping and offered for fish farming under public-private or community models. Local marketing infrastructure, such as fish markets and small processing or drying plants, would also be necessary to establish markets.

7.4.5 Strategic Development Plan

The plan centers on promoting inland aquaculture through transforming underproductive land into fish farms as well as trying cage aquaculture in canals. Species such as common carp, and tilapia, which grow more quickly, will be marketing. This approach will help in having a steady supply of fingerlings and will be a central hatchery (district level). Pond making, water quality, feeding and harvesting practices will be trained to the farmers. Community groups and cooperatives will be encouraged to operate collective fish ponds, particularly in situations where private investment is restricted. It also suggests to include fish farming in the existing farming systems so as to derive more from less.

7.4.6 Priority Projects

Priority initiatives include:

- Establishment of a fish hatchery to supply fingerlings locally
- Pilot cage farming and fish pond projects in saline or waterlogged zones
- Capacity-building for farmers on aquaculture best practices
- Support for integrated farming models (e.g., rice, fish or agro, fish systems)
- Introduction of feed supply chains and disease management tools
- Development of a local fish market and feasibility for small-scale processing

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- Inclusion of women and youth in aquaculture programs for inclusive growth
- These initiatives aim to lay the foundation for a viable fisheries sector in Ghotki, expanding livelihoods and enhancing nutrition.

7.5 Industries

7.5.1 Existing Situation

Ghotki is one of the important industrial districts of Sindh based on Big industrial units. It is home to the two largest fertilizer plans in Pakistan. Engro and Fauji Fertilizer, as well as the Liberty Power and Mari Petroleum units. Furthermore agro-based industries as sugar mills (like JDW and other private mills), over 28 rice mills, 20 oil mills and 15 flour mills are there. But such industries are heavily concentrated in the vicinity of highways and cities, with few spillover effects to rural regions or SMEs. There is a Small Industries Estate however it is under-utilized and not equipped with modern facilities.

7.5.2 Key Issues and Challenges

There is significant industrial support, but the ecosystem lacks depth beyond big fertilizer and sugar. The constraints comprise of: obsolete machinery in agro-processing industries, irregular supply of electricity and gas to SMEs, low level of access to finance, inadequate industrial infrastructure and low skill mismatch. The Small Industries Estate has rather a bad name as it is devoid of facilities such as single utility feeders, internal roads and investor facilitation mechanism. Local entrepreneurship is also very low, while women's involvement in industrial enterprises is negligible.

7.5.3 SWOT Analysis

Strengths	Weaknesses
• Presence of prominent anchor industries, location on n-5 and main railway of the country • Developed agro-industrial base	• Non-development of SME • Ill-equipped industrial estates • Scarcity of skilled workers • Inadequate backward linkages
Opportunities	**Threats**
• Diversification into textiles, packaging, engineering goods • Agro-processing • New industrial zones • Public-private partnerships	• Investor concerns about red tape • Competition with established SEZS • Potential environmental problems with insufficient safeguards.

7.5.4 Need Assessment

Ghotki's industrialization needs improved infrastructure, facilitation for investors and skill development programmes according to local industry

requirements. - A new or a higher-end industrial estate around Mirpur Mathelo-Ruk with adequate power, gas and administrative assistance is required. Modernization measures for agro-industry (especially rice, flour and oil mills) are called for very clearly. Local supply chains for plastic packaging, tools making, food processing and cloth stitching can be promoted by supporting SMEs. There is a requirement for a single window investment facilitation to prevent bureaucratic holdups.

7.5.5 Strategic Development Plan

It offers an industrial diversification plan emphasizing the growth of small and medium enterprises. The Small Industries Estate will be given a new look including all the modern facilities of utilities security and administration. Agro Export Processing Zones, especially at Ruk Farm would assist in value addition for rice and produce value added sugar (ethanol and bagasse) from sugarcane and fruits, vegetables and cotton. Garment stitching and equipment manufacturing new industrial units will get packaging and textile stitching incentives. We will introduce industrial upgrading loans, as well as training centers that follow the needs of the factory (for example for welding, the maintenance of machinery, food safety etc) The approach also advances inclusive industrialization through assistance for women-owned businesses and youth entrepreneurship. The following figure shows the spatial distribution of proposed land uses related to Industry.

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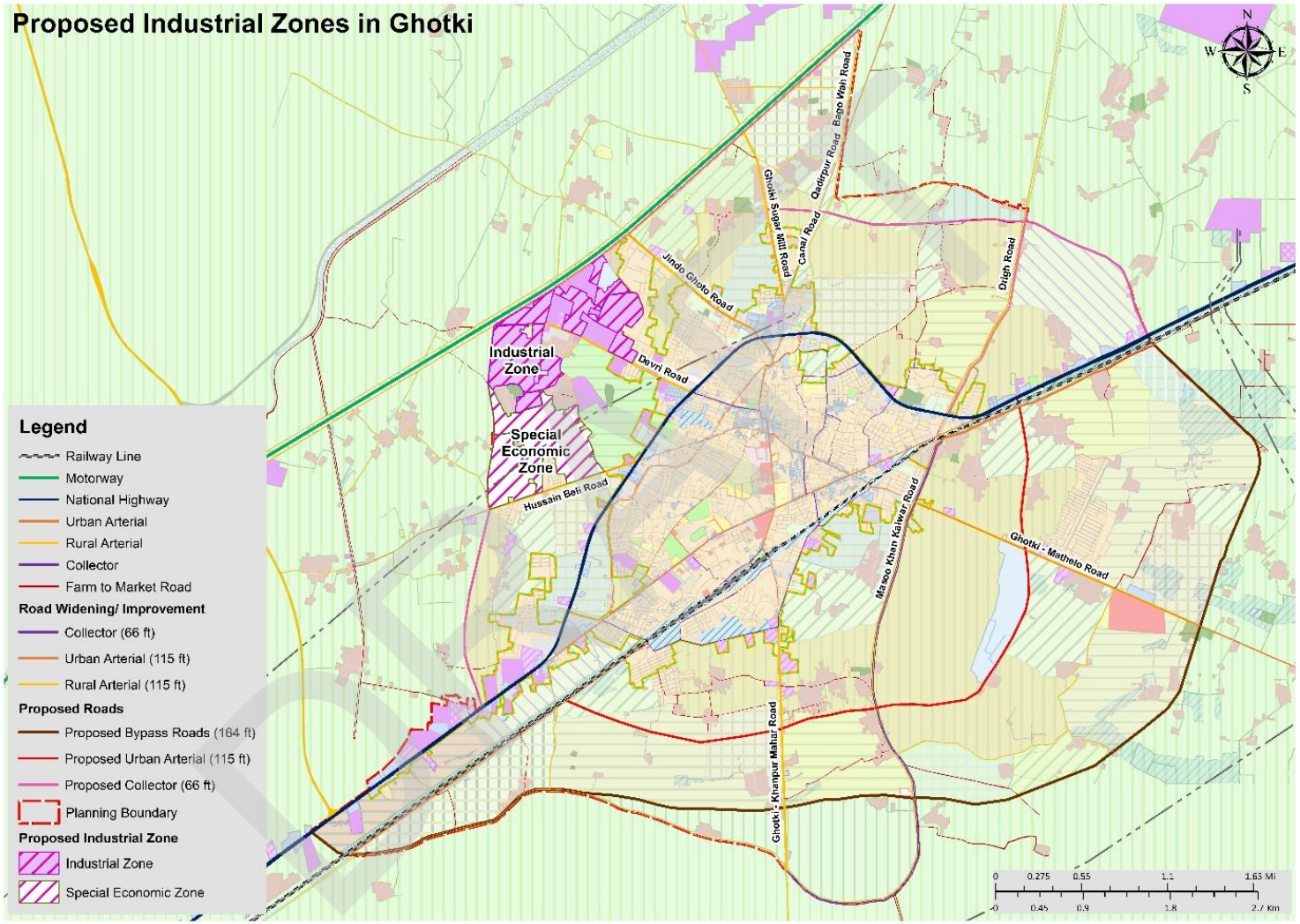


Figure 7-2, Proposed Industrial Zone in Ghotki

Source: *The Consultant Team*

7.5.6 Priority Projects

Key industrial projects include:

- Expansion and modernization of the Ghotki Small Industries Estate
- Fast-tracking the Agro Export Processing Zone at Ruk for fruit and vegetable processing
- Modernization fund for rice mills, sugar mills, and flour mills
- Feasibility and setup of textile and garment stitching units
- Establishment of training centers for industrial skills (e.g., electrical, mechanical, food processing)
- Creation of an Investment Facilitation Desk and digital investor support system
- Promoting industrial innovation partnerships with anchor industries like Engro and FFC

These projects aim to enhance industrial employment, diversify the economy, and improve competitiveness for local and export markets.

7.6 Trade and Commerce

7.6.1 Existing Situation

It is strategically situated at the intersection of Pakistan's numerous transportation arteries: the National Highway (N-5) and the Sukkur to Quetta main railway line between Sindh and Punjab. The district is an important transit and trade route for agricultural and industrial commodities. The backbone of local trade consists of its agricultural produce, including rice, sugarcane, wheat, cotton, and fruits. Primary markets are at Daharki, Mirpur Mathelo and Ghotki town. But the trade infrastructure, grain markets, storage and logistics, is outdated and underdeveloped, which limits the district's potential to serve a new-age trade hub.

7.6.2 Key Issues and Challenges

Some of the big challenges include absence of mandi (market) infrastructure, lack of organized logistics services, inadequate storage and grading facilities, and weak digital connectivity. Farm-to-market roads are bad and lead to post-harvest losses and delays. No proper export facilitation and warehousing hub, it has no dry port even after being a transportation corridor, he pointed out. Small companies are frustrated by bureaucratic hurdles, and there's not much help on offer to improve e-commerce or packaging. Formal markets are not easily accessible to women and smallholder traders.

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7.6.3 SWOT Analysis

Strengths	Weaknesses
• Prime location on national trade corridors • Successful agriculture and commercial towns	• Aging physical infrastructure • Limited cold chains and warehousing • Inadequate policy support for traders
Opportunities	**Threats**
• Modernizing Mandi, adoption of e-commerce • Formation of trade facilitation centers and connectivity to CPEC logistics corridors.	• Saturation of primary produce markets • Regional competition • Price fluctuations of transport • Climate change disruption of supply chains.

7.6.4 Need Assessment

Ghotki is an untapped market in need of market-centred intervention in upgrading its grain, fruit mandis, grading centres, warehousing and cold storage. Upgraded Link roads, loading points are absolutely necessary for better rural urban connectivity. There is also requirement for Export Facilitation Cell to ensure that local producers meet the standards of labeling, packing and branding. The development of digital platforms for local trade and onboarding small traders on to digital payment tools will improve market access and efficiency.

7.6.5 Strategic Development Plan

Under it, markets for grains such as wheat and produce will be modernized with concrete platforms, auction yards, electronic auctions as well as display boards of prices, and sanitation facilities. Cold storage cum grading facilities would be created mostly near AEPZ at Ruk. A district-level logistics center with storage, sorting, and dispatching facilities would be established adjacent to the N-5 corridor. This includes rolling out a locally led digital commerce program to link farmers and small-scale producers with buyers from local and national markets. Export promotion would be tilted towards value-added products like mango pulp, dry onions, and by-products of cotton. An appropriate enabling regulatory environment will be created by streamlining the registration and licensing process. The following figure shows the spatial distribution of proposed land uses related to commerce.

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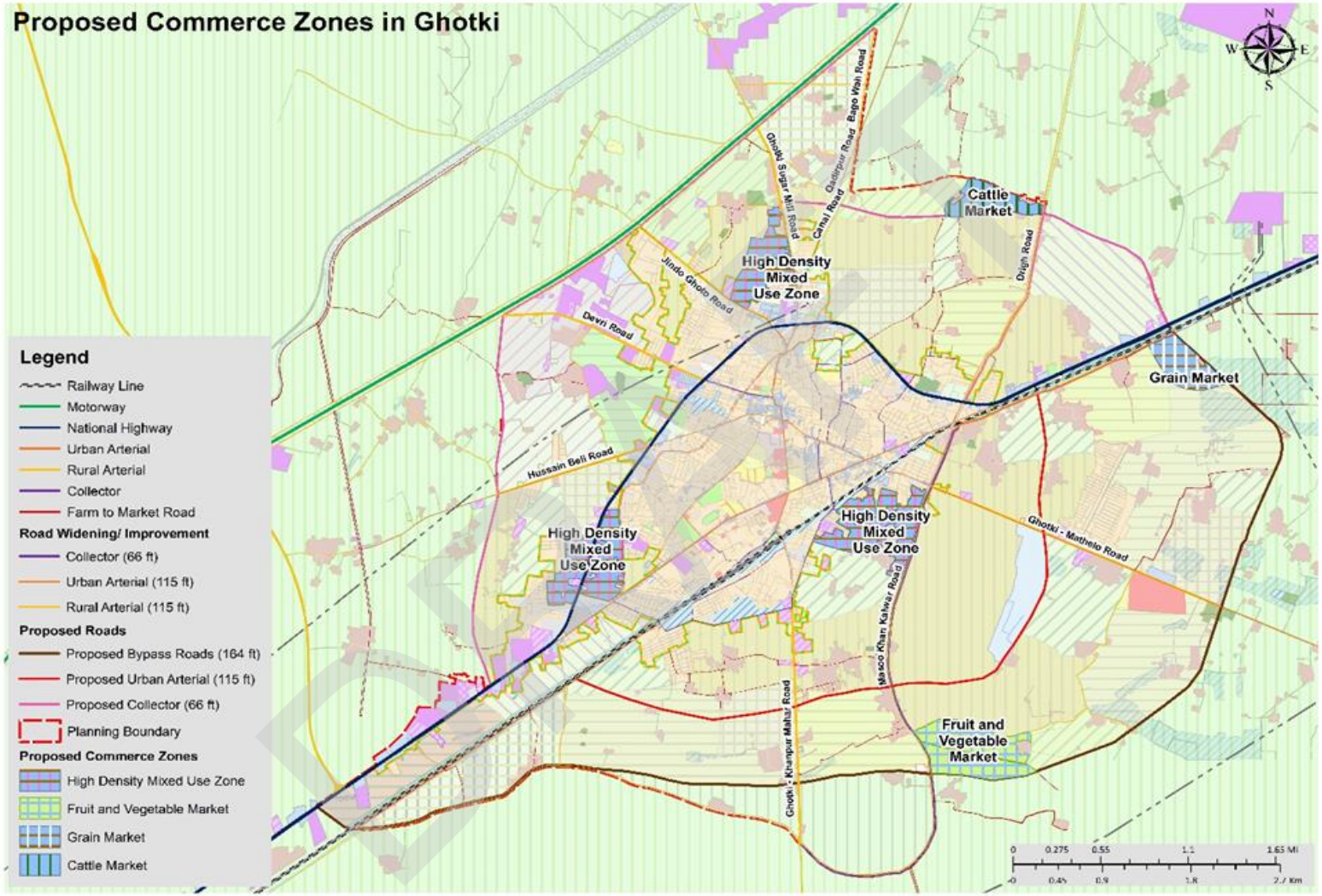


Figure 7-3, Proposed Commerce Zone in Ghotki

Source: *The Consultant Team*

7.6.6 Priority Projects

Key initiatives include:

- Modernization of grain and fruit mandis with digital pricing system and auction platform
- Construction of a cold room and grading/packing facility
- Develop sai dungarpur and mansarowar area as a logistics park and dry port in addition and adjacent to the industrial corridor on genesee road.
- Establishment of an Export Facilitation Center (EFC) in collaboration with TDAP
- Website development for e-commerce and training for local traders
- Farm to Market Road development in Important production zones
- Mobile markets and digital payment systems for women traders as a pilot effort.

The following figure shows the spatial distribution of proposed land uses related to science park which will act as capacity building center.

7.7 Employment and Skills Development

7.7.1 Existing Situation

After data analysis of the socio-economic survey, it was observed that the economic condition of the residents of Ghotki is on the edge. The Income Groups have been developed to segment the population per income patterns. These groups were used to distinguish the population according to their welfare, poorest households are grouped together into the 1st and 2nd Income Group, those with higher consumption into the 3rd group, and so on. Seven Income Groups rank the population from the poorest to the richest. These include 1st (Up to 25,000/month), 2nd (25,0001-50,000), 3rd (50,001-75,000), 4th (75,001-100,000) and 5th (100,001-150,000 and so on. The main aim of these income groups is to analyse how social and economic indicators vary in relation to people's welfare. Monthly income pattern of Ghotki according to socio economic survey conducted by the consultant are summarized in **Table** 7-1**.** It shows that the 80% of the respondents are on the poverty line and they are living a hand to mouth life.

Table 7-1, Monthly Income of Ghotki

Sr. No.	Monthly Income in PKR	Percentage
1	Up to 25,000	45.59%
2	25,001- 50,000	34.49%
3	50,001-75,000	11.56%
4	75,001-100,000	5.46%

Sr. No.	Monthly Income in PKR	Percentage
5	100,001-150,000	2.09%
6	150,0001-200,000	0.64%
7	Above 200,000	0.18%

Source: *Socio-Economic Survey, 2023*

7.7.2 Occupation

Occupational data of the respondents has been given in **Table** 7-2

Category	Count	Percentage
Professionals (Engineers, Doctors, Bankers, Lawyers)	99	9.01%
Teachers	92	8.37%
Others	908	82.62%

Table 7-2, Occupational Details

Category	Count	Percentage
Skilled Labor	500	45.50%
Agriculture	107	9.74%
Professional	99	9.01%
Private	92	8.37%
Retail	92	8.37%
Teacher	92	8.37%
Unemployed	38	3.46%
Business	33	3.00%
Armed Forces	19	1.73%
Government Job	12	1.09%
Retired	12	1.09%
Fishery	2	0.18%
Student	1	0.09%

Source: *Socio-Economic Survey, 2023*

7.7.3 Development Plan

Creating plenty of job opportunities and giving locals the skills they need to take advantage of them is one of the key planks of this development plan. A predominantly young population and low overall literacy mean a sizeable cross-section of residents are either unemployed or working low productivity jobs. Women's participation in the formal economy is especially constrained (female literacy only 20% and culturally a lot of women stay out wage labor).

Traditional agriculture has been a labor magnet, but mechanisation and other developments such as the transition from cotton to sugarcane, a crop that needs little manual work, threatens workers with dismissal. That is why plan focuses on vocational training, entrepreneurship and create jobs and

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ensure the benefit of the growth to the people live there and mainly targeted youth and women. Key initiatives include:

7.7.4 Vocational and Technical Training Centres

Establishment of VTCs for imparting market-relevant skills We will develop and upgrade existing vocational training centers in the district (currently, there are few technical institutes and vocational centers in Ghotki, as documented in the profile with improved infrastructure, updated curricula, and qualified instructors. New Vocational Training Institutes (VTIs) focusing trades needed in local industries will be opened in industrial towns Mirpur Mathelo and Daharki.

Electrician and electric mechanic training (in a bid to have support for industries and infrastructure to be maintained), welding and metalwork (vital experience needed for engineering workshops and OGDCL operations) automotive mechanics (given the amount of heavy transport in usage), agro-techniques (for service providers in agriculture) and basic IT skills (office software, accounting) to get youth ready for clerical and support roles. Such partnerships with firms such as Engro and FFC will help develop apprenticeship programs – for example, trained apprentices receiving on-the-job experience as mechanical and instrument technicians at the fertilizer plant, etc.

One way we do this is by matching our training to industry demand, resulting in high job placement rates for our graduates. The objective is to train minimum 5,000 Youth (Male & Female) in different tech trades, over next 5 years, which will be certified by Sindh Technical Education authority.

7.7.5 Entrepreneurship & Micro, Small & Medium Enterprises (MSME)

Not everyone is going to be wage employed, so creating incentives for entrepreneurship is important. The plan will create a Business Incubation Center in Mirpur Mathelo for startups and small businesses. You would have this center set up at a local college or standalone that provides mentoring, business development services and access to microcredit. New businesses are encouraged in areas such as agri-business (small-scale food processing, cold chain logistics), services (rural transport, appliance repair, mobile mechanics) and handicrafts. Special help will be given to each of these categories of women – for example, women who can embroider, women who can sew, and women who can do traditional crafts (like Sindhi caps and the embroidery in Ghotki's cottage industry (Sindh-Ghotki - will) be arranged into cooperatives or small businesses.

Among other projects, the plan could make possible a "Women's Handicraft Center" to provide training, design improvement, and marketing support so that local embroidery and textile crafts can be brought to larger urban markets. Microfinance providers and SME banks functioning in the region (for

example Khushhali Bank, Sindh Microfinance) will be coordinated so that entrepreneurs easily obtain small loans on easy terms to open or expand a business. A local Youth Innovation Fund (with public-private funding) could provide seed grants to eager young people wishing to pursue business ideas in technology, agritech or any field stimulating a culture of innovation.

7.7.6 Job Placement and Employment Programs

In order to directly address unemployment, particularly among educated youth, initiating job placement and employment programs is part of the plan. Employment offices will maintain a database of job-seekers and job openings, both inside the district and in nearby districts. Job fairs will be routinely arranged in Mirpur Mathelo during which companies belonging to Ghotki and larger cities as Sukkur or Rahim Yar Khan can interview local candidates.

Public works programs can simultaneously provide temporary employment in infrastructure-related projects for a less-skilled work force – for instance, local labour can be engaged to maintain roads, improve canals, carry out tree plantation drives and municipal works, thereby creating jobs while at the same time improving infrastructure.) The idea is that people in need of a job (cash-for-work programs in off-seasons) are obtained in the short run, and industries and services' expansion in the long run ensures the growing labour force is productively employed.

7.7.7 Job Training for Women

The piece de resistance in economic empowerment of women has a high payoff in Ghotki itself in terms of family welfare and social development. The plan promotes initiatives, especially ones that are culturally acceptable, that bring women into the labour force. Except handicraft cooperatives and tailoring centers, however, we will help establish home-based or community-based work units for women such as handmade embroidered products, assembling handicrafts, and processing foods (pickle making, etc.) which can ultimately sell out through local markets or e-commerce.

The government will support NGOs or social enterprises that will skill women in business skills and provide them raw materials and market linkages. In addition, large employers (industries, agri-processing units) will be incentivised to employ women in relevant positions – i.e. will be guided to take women as lab technicians, packaging employees, or extension workers. We want to maximize the number of women in the workforce by either providing safe working conditions (daycare at workplaces, women-only training batches, etc) and also breakage of stereotypes about women working.

Cotton picking is already declining and was primarily women's work, so you could feasibly reassign many of those women with a bit of retraining to new

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opportunities in food processing or garment stitching centers (Pakistan abandoning cotton for sugarcane | Dialogue Earth).

7.7.8 Youth Engagement and Active Transition to Work

The plan invests in youth engagement, aware that a large youth population can be an asset when used well. All secondary schools and colleges in the district will be incentivised to introduce career counselling and vocational streams so that not all students with go for scarce government jobs while they can also take up skilled trades and entrepreneurship. We shall work with educational institutions to enhance the quality of education (particularly in science and technology) in also introduce computer labs and digital skills for students will prepare them to obtain modern jobs.

Another one is to launch after-school skills programs, such as coding boot camps for educated young people, or mobile device repair training ; that make use of school facilities during non-school hours. Mobile technical training units can go to the villages and teach basic skills (such as motorbike repairs, carpentry, or farm machinery operation) to rural youth who might have dropped out of school. When youth are engaged in constructive skills development, it will not only prepare them for future employment but will also mitigate the innumerable issues that can arise from being a jobless youth.

7.7.9 Inclusive Job Growth

The plan encourages inclusive work through targeted efforts:

A) Agricultural Service Enterprises

Train and support youth to form custom service teams (for tractor rental, spraying services, harvesting services). This formalizes farm work into businesses and creates jobs in rural areas that are beyond own-farm employment.

B) Tourism and Heritage Jobs

Ghotki carries few cultural sites (shrines, Shadani Darbar temple) for which it's not a big sector but some people still visit here. Guides can be trained from among youth while women can be trained to make souvenirs which will provide small-scale tourism-related employment opportunities for people in Mirpur Mathelo and its suburbs.

C) Public Sector Hiring and Services

Try to ensure that the district gets its share of hiring in essential public services (teachers, health workers, technicians). If trained, locals can fill professional jobs in, say, local public services that improving these services creates. For example, when new health clinics are opened, local youth (particularly women) can be trained as lady health workers or nurses to staff these clinics, thus serving two purposes: delivery of services as well as providing

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employment.

The plan aims to address economic inequality by investing in people and their training in the skills needed for jobs in the future and reducing unemployment in the district by investing in training, bridging the skills gap. The targets include reducing youth unemployment by half in five years, and increasing the number of skilled workers in industries and services substantially. While numbers tell us one story, the qualitative target is to empower the people of Ghotki – creating farmers turned agribusiness entrepreneurs, labourers turned skilled tradesmen, and home-bound women turned earning members of the

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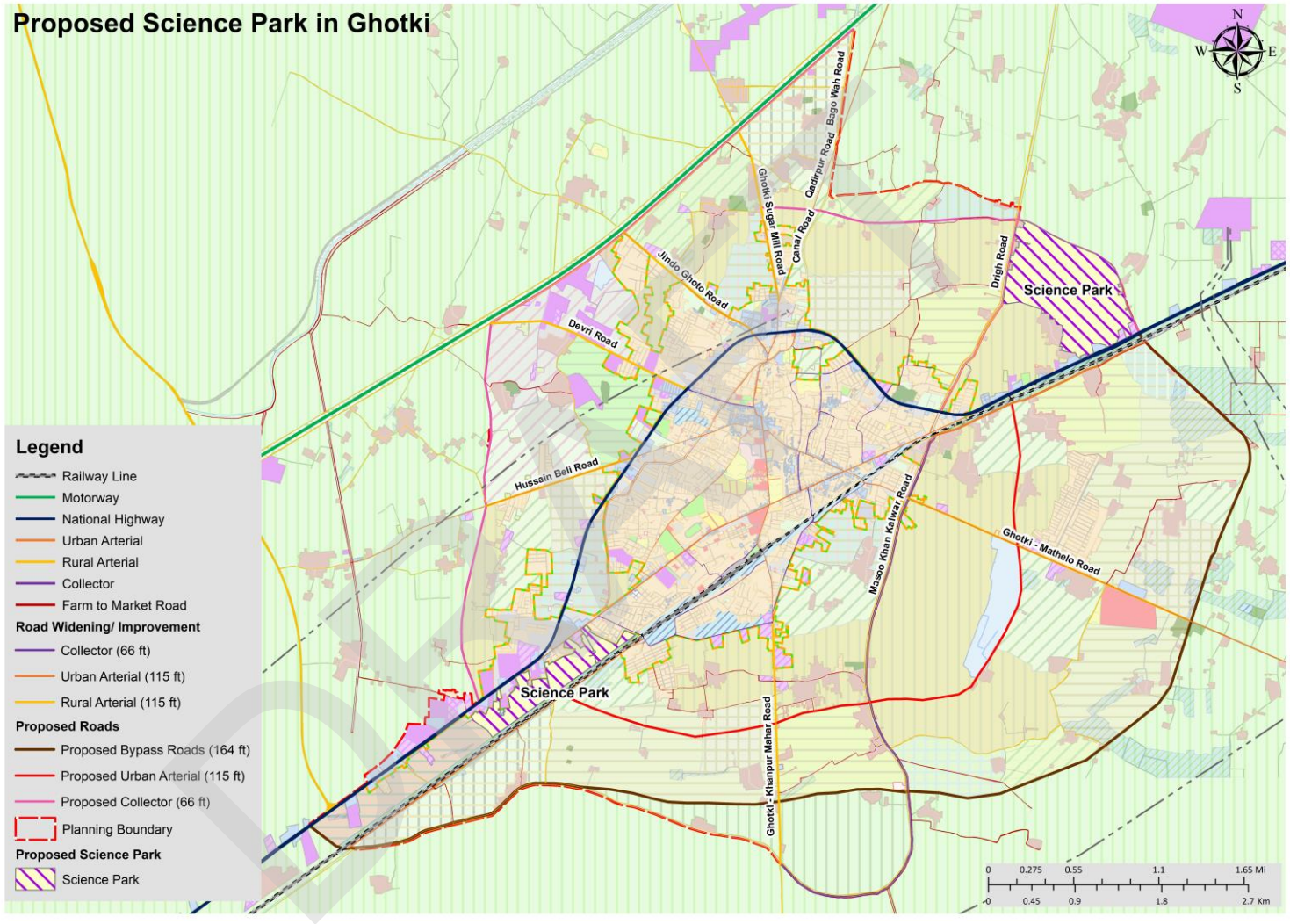


Figure 7-4, Proposed Science Park in Ghotki

Source: *The Consultant Team*

society. Human development constitutes the integral part of this plan and the human capital of Ghotki will be untapped to drive and sustain the economic growth of the district through education, training and enterprise support.

7.8 Social Inclusion and Equity Strategy

The EDP places inclusive growth at its core by prioritizing the economic and social empowerment of marginalized groups, especially women, youth, persons with disabilities (PWDs), and low-income communities. Equity-focused development ensures that the benefits of growth reach the most vulnerable segments of society.

7.8.1 Strategic Actions for Inclusion:

A) Women's Economic Empowerment

- Establish women-only vocational centers offering training in tailoring, embroidery, IT, and food processing.
- Create 10 women self-help groups (SHGs) in Phase 1 for collective enterprise and micro-loans.
- Prioritize women-led enterprises for SME loans under BISP, SEDF, and microfinance.
- Ensure at least 30% female participation in all training and employment programs.
- Improve safety in public spaces (e.g., streetlighting, women-friendly transport) to enable access to work.

B) Youth Engagement and Employment

- Train over 1,000 youth (40% women) in trades like solar repair, construction, IT, and agro-processing.
- Establish youth business incubator hubs in partnership with SMEDA and private firms.
- Facilitate apprenticeships and internships with local industries and municipal departments.
- Promote youth leadership in EDP oversight through representation in community monitoring groups.

C) Support for Low-Income Households and PWDs

- Ensure geographic equity by targeting underserved neighbourhoods for early infrastructure upgrades (water, roads, parks).
- Provide free or subsidized vocational training for BISP and Zakat-eligible families.
- Design public buildings and infrastructure to be disability-friendly (ramps, signage).

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- Partner with NGOs to deliver targeted services for PWDs and out-of-school youth.

D) Gender and Inclusion Governance

- Assign a Gender & Inclusion Focal Point within the EDP Implementation Committee.
- Conduct annual audits on equity outcomes (e.g., % of women/youth beneficiaries).
- Involve local women's organizations and youth councils in project design and feedback.

7.9 Financing Strategy and Resource Mobilization

The Economic Development Plan (EDP) recognizes that successful implementation hinges on the availability of financial resources. To that end, the following resource mobilization strategy will guide investments:

7.9.1 Public Sector Funding

- **Annual Development Program (ADP):** Core government funding via Sindh ADP, covering infrastructure, vocational training, agriculture, and urban services.
- **Federal Programs:** Targeted projects through federal PSDP (e.g., roads, M-6 linkage, SEZ support).
- **Line Department Budgets:** Each lead agency will align EDP targets with their annual allocations.

7.9.2 Donor and Development Partner Support

- Mobilize funding from multilateral agencies like World Bank, Asian Development Bank, USAID, and UNDP for sectors like water, sanitation, climate resilience, skills, and SME support.
- Propose PPP-based infrastructure and service delivery pilots through donor-supported grants (e.g., solid waste, renewable energy, vocational training).

7.9.3 Public-Private Partnerships (PPP)

Leverage Sindh PPP Unit to structure:

- Industrial Estate development
- Dairy and agro-processing plants
- Cold chains and logistics hubs
- Wastewater treatment

Offer fiscal incentives and long-term land leases to attract private investors to these PPPs.

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7.9.4 SME and Startup Finance

- Partner with SMEDA, SEDF, and commercial banks to expand SME loan schemes.
- Link youth and women entrepreneurs with Kamyab Jawan, BISP entrepreneurship program, and Akhuwat microfinance.

7.9.5 Municipal Revenues

Strengthen local revenue through:

- Improved property tax collection (in coordination with Excise Dept.)
- Market fees and user charges (grain market, parks, etc.)
- Lease/sale of industrial plots within designated zones

7.9.6 Investment Promotion Mechanisms

The Investment Promotion Cell will:

- Package bankable investment projects for pitching to investors
- Maintain a pipeline of priority projects
- Facilitate investor licensing, approvals, and aftercare

7.9.7 Way Forward

To maintain progress, the EDP recommends developing a Vision 2050 strategy by the end of Phase 3. This future strategy will align with evolving opportunities, including greater integration with the Sukkur metropolitan area.

This phased, inclusive, and data-informed approach ensures that the EDP is implemented in a structured, accountable manner. Through sustained political support and community engagement, Ghotki can emerge as a leading example of integrated urban-rural development in Sindh.

7.10 Monitoring and Evaluation Framework

The success of the EDP depends on consistent tracking, review, and learning. The M&E framework is designed to ensure transparency, drive performance, and enable adaptive implementation across all phases.

7.10.1 Core Principles

- **Results-Based:** Focused on measuring outcomes, not just activities
- **Inclusive:** Disaggregated data collection (gender, age, income level)
- **Transparent:** Public access to periodic performance reports
- **Adaptive:** Course corrections based on evidence and feedback

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7.10.2 Key Performance Indicators (KPIs)

Thematic Area	Sample KPIs by Year 5 & 10
Agriculture	+20–30% increase in crop yields, 5,000 acres under drip irrigation, 500 farmers trained annually
Industry & Investment	Full occupancy of industrial estate, 50% SME survival rate after 3 years
Skills & Jobs	1,000+ youth trained, unemployment reduced below 15%, 30% female participation
Water & Sanitation	90% water supply coverage, wastewater treatment facility operational
Urban Services	80% waste collection coverage, all major roads resurfaced
Education & Health	75%+ literacy rate, female enrollment up 20%, maternal wing operational
Social Inclusion	Gender parity in training programs, 10+ women SHGs functional
Governance	EDP Committee meets quarterly, citizen dashboard live by Year 3

7.10.3 Monitoring Mechanism

A) Lead Entity:

M&E Cell within the District Administration, with technical support from the Sindh Bureau of Statistics.

B) Tools & Processes:

- **Annual Progress Reports:** Submitted by each lead department using standardized formats.
- **Mid-Term Review (Year 5):** Conducted by an independent third-party evaluator; used to recalibrate targets.
- **Final Evaluation (Year 10):** Assesses effectiveness, impact, and sustainability.
- **GIS & Digital Dashboards:** Spatially monitor infrastructure upgrades and service coverage.

- **1.15.4 Citizen Feedback & Transparency**
  - **Community Oversight Groups** in each ward to provide implementation feedback.
  - **Grievance Redress Portal** linked to municipal website and WhatsApp helpline.
  - **Annual Townhall Meetings** to share results, gather suggestions, and foster co-ownership.

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- **1.15.5 Learning & Adaptive Management**
    - Quarterly EDP Committee Meetings to review KPIs, resolve delays, and shift priorities if needed.
    - Integration of real-time data from mobile-based field monitoring apps.

  Capacity-building of line departments in M&E, data management, and reporting

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SECTION - 8: BASIC UTILITIES

8.1 Introduction

Basic utilities, including water supply, sewerage and drainage, and solid waste management, are fundamental to ensuring public health, environmental sustainability, and liability in Ghotki city. This section assesses the current state of these utilities, identifies key challenges such as inadequate infrastructure and service gaps, and proposes strategic interventions to enhance service delivery, improve sustainability, and support Ghotki's long-term urban development strategy.

8.2 Water Supply

8.2.1 Existing Situation

This section describes the detailed design of different components of water supply system till year 2043. Detailed design of water supply system includes:

- Planning concept
- Water sources
- Detailed design of water supply pipe network
- Computer aided hydraulic modelling and analysis of water supply system
- Design of tubewells
- Design of Over Head Reservoirs (OHRs)
- Priority Projects

8.2.2 SWOT Analysis

	Internal Factors	External Factors
Positive Impacts	**STRENGTHS** Water Supply System: • Master planning initiated. • Availability of fresh groundwater as resource. • Water supply infrastructure is present. • Experienced staff available with the organization related to water supply system.	**OPPORTUNITIES** Water Supply • Adequate resources of water available for water supply system. • Public private partnership in service delivery.
Negative Impacts	**WEAKNESSES** Water Supply and Sewerage: • No consumer and bulk metering. • Aged infrastructure nearing end of lifecycle.	**THREATS** Water Supply, Sewerage and Drainage System: • Resistance to pay for water and sewerage services. • Depletion of water quality due to

	Internal Factors	External Factors
	• No stable pressure/head maintained in the water distribution network. • 100% MC boundary is not covered by piped supply. • The animals do contaminate the surface water source during grazing near the source and drinking water at the source. • Minimal water tariff is unable to sustain operation and maintenance.	draw down. • System inefficiency and reduced delivery of services. • Contaminated water consumption resulting in the health problems for the residents of the Ghotki.

8.2.3 Feasibility Analysis

The proposed water supply projects are designed to meet the immediate water demand outlined in the action plans. A detailed analysis has been conducted for the placement and number of tube wells, as well as the required pipeline lengths, to ensure efficiency and effectiveness. The pipe materials and tube well capacities have been selected carefully, keeping in mind both technical requirements and cost considerations. This ensures that the system performs reliably without exceeding budgetary constraints. The overall design maintains a balance between performance and economic viability. In the case of the sewerage system, the pollution load to be managed by the trunk sewers has been thoroughly studied. Routes for the trunk sewers have been selected to avoid excessive excavation depths, which helps reduce construction challenges and costs. The alignment of sewer lines ensures minimal disruption to existing infrastructure and natural terrain. These design decisions contribute to the overall feasibility and sustainability of the project. The proposed systems are practical, efficient, and ready for timely implementation.

8.2.4 Strategic Development Plan

A) Zoning Criteria

The zoning criteria adopted for water supply is in accordance with the landuse plan provided for all the four cities. The extent of zoning is based on the following factors:

- Topography of the project area.
- Location of the existing water supply network and the transmission mains.
- Location and elevations of the existing and proposed ground and elevated reservoirs.

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- Location/use of existing tube wells.
- Present and future population.

The detailed zoning maps corresponding to the exact master planning for the city is provided below.

B) Planning Concept for Planning Boundary

According to the Detailed Design of Water Supply of Ghotki City, whole city has been divided into 5 zones to make the water supply operation easy. Each zone has its own serving area. In order to handle water supply maintenance issues, each zone is connected to other. The total projected population of year 2043 is 6,60,295 of Ghotki City and total average demand is 48 cusecs. The required maximum daily demand is 72 cusecs.

Population of each zone is presented in the

Table 8-1. Detail of these zones is given below.

1. Zone-1

The total projected population of Zone 1 for year 2043 is 131,436. The total average demand of Zone 1 is 10 cusecs. The required maximum daily demand for 24 working hours and 16 working hours is 14 cusecs and 22 cusecs, respectively. The diameters use in this zone range from 82.5 mm to 459.7 mm. The length of pipe of diameter 82.5 mm, 101 mm, 128.5 mm, 146.8, 165.4 mm, 165.4 mm, 183.7 mm, 367.7 mm and 459.7 mm is 161,450 ft, 613 ft, 1,895 ft, 281 ft, 1,342 ft, 721 ft, 108,998 ft and 37,589 ft respectively. An economical velocity must therefore be chosen for each zone is less than 5 ft/sec.

2. Zone-2

The total projected population of Zone 2 for year 2043 is 95,464. The total average demand of Zone 2 is 7 cusecs. The required maximum daily demand for 24 working hours and 16 working hours is 11 cusecs and 16 cusecs, respectively. The diameters use in this zone range from 82.5 mm to 413.7 mm. The length of pipe of diameter 82.5 mm, 128.5 mm, 183.7 mm, 326.3 mm and 413.7 mm is 124,814 ft, 694 ft, 12,192 ft, 78,132 ft, 19,540 ft and 569 ft respectively.

3. Zone-3

The total projected population of Zone 3 for year 2043 is 62,045. The total average demand of Zone 3 is 5 cusecs. The required maximum daily demand for 24 working hours and 16 working hours is 7 cusecs and 10 cusecs, respectively. The diameters use in this zone range from 82.5 mm to 413.7 mm. The length of pipe of diameter 82.5 mm, 114.8 mm, 183.7 mm, 229.7 mm, 257.4 mm, 367.7 mm and 413.7 mm is 158,432 ft, 1900 ft, 12,511 ft, 12,010 ft, 96 ft, 28,289 ft, and 7,303 ft respectively.

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4. Zone-4

The total projected population of Zone 4 for year 2043 is 189,829. The total average demand of Zone 4 is 14 cusecs. The required maximum daily demand for 24 working hours and 16 working hours is 21 cusecs and 31 cusecs, respectively. The diameters use in this zone range from 82.5 mm to 413.7 mm. The length of pipe of diameter 82.5 mm, 101 mm, 114.8 mm, 289.4 mm, 326.3 mm, 367.7 mm and 413.7 mm is 172,241 ft, 6,801 ft, 2,207 ft, 42,559 ft, 16,762 ft, 39,204 ft and 34,939 ft respectively.

5. Zone-5

The total projected population of Zone 5 for year 2043 is 181,521. The total average demand of Zone 5 is 13 cusecs. The required maximum daily demand for 24 working hours and 16 working hours is 20 cusecs and 30 cusecs, respectively. The diameters use in this zone range from 82.5 mm to 652.7 mm. The length of pipe of diameter 82.5 mm, 101 mm, 114.8 mm, 146.8 mm, 165.4 mm, 183.7 mm, 206.8 mm, 229.7 mm, 289.4 mm, 459.7 mm, 514.9 mm and 652.7 mm is 67,942 ft, 5,338 ft, 1,339 ft, 936 ft, 12,700 ft, 17,265 ft, 1,336 ft, 16,076 ft, 19,017 ft, 48,792 ft, 52,802 ft and 120 ft respectively.

The layout of zone wise water supply network in planning boundary has been shown in **Figure** 8-1.

Table 8-1, Population of Each Zone

Zone	Projected Population
	2043
Zone-1	131,436
Zone-2	95,464
Zone-3	62,045
Zone-4	189,829
Zone-5	181,521
Total Population	**660,295**

C) Water Demand

Total water demand for the project area is calculated on the basis of design criteria as discussed in **Immediate Action Plan (IAP)** Report; Section 3. Non-domestic demand includes commercial and institutional demands. Based on the agreed criteria, water demand of the city is estimated in table below:

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Table 8-2, Total Average Demand of 2043

Zones	Projected Population	Domestic Water Demand	Non-Domestic Water Demand (20% of Domestic)	UFW 10% of (Col. 2+3)	Total Average Water Demand (Col 2+3+4)
Column No.	1	2	3	4	5
	2043	(GPD)	(GPD)	(GPD)	(GPD)
Zone-1	131,436	3,903,649	780,730	468,438	5,152,817
Zone-2	95,464	2,835,281	567,056	340,234	3,742,571
Zone-3	62,045	1,842,737	368,547	221,128	2,432,412
Zone-4	189,829	5,637,921	1,127,584	676,551	7,442,056
Zone-5	181,521	5,391,174	1,078,235	646,941	7,116,349
Total	**660,295**	**19,610,762**	**3,922,152**	**2,353,292**	**25,886,205**

Based on the above calculations;

Average Water Demand = 25,886,205 GPD
= 48 Cusec

Maximum Day Demand = 48 * 1.5
= 72 Cusec

Peak Demand = 72 * 1.5
= 108 Cusec

D) Quality of Water Source

The tube well (Ground water source) is adopted in the Ghotki City. So, the ERS and Water quality studies of the areas reflect that the Fresh water zone must be chosen for tube well design and lesser values of TDS and Chemical parameters should be encountered in the planning. Chlorinators should be installed at the proposed and existing tube wells for the safe delivery of water.

E) Bore Log Test

Bore log points are being identified and tests are being performed. The detailed bore log report is annexed in the Draft Strategic Planning Report.

F) Population Projection

Population density method is used to calculate total number of persons in one zone.

Percentage of area occupied by one zone is calculated then multiplied by total population to get number of persons in that specific zone.

The methodology for Population projection is added in the report. Further

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population projection is corresponding to the land use and master planning concept. Similar values and population density is adopted for calculation of population up to the draft strategic planning horizon, priority planning and immediate action plan for calculating the loads and demands of the utilities proposed on the master planning.

G) Tubewells

On the basis of above recommendation, recharge water along the canals will be used for future demand of the city.

As per total demand of water, calculation for the tubewells is shown in **Table** 8-3 and layout of TW's location is shown in **Figure** 8-1

Table 8-3, Calculation of Tubewells

Parameter	Unit	Design Value				
		Zone 1	Zone-2	Zone-3	Zone-4	Zone-5
Projected Population	Persons	131,436	95,464	62,045	189,829	181,521
Average Day Water Demand	GPD	5,152,817	3,742,571	2,432,412	7,442,056	7,116,349
	Cusecs	9.53	6.92	4.50	13.77	13.17
Max Day Demand	Cusecs	14.30	10.39	6.75	20.65	19.75
Tubewell Pumping Duration (Adopted)	hrs	16	16	16	16	16
Total Pumps Discharge Capacity	Cusecs	21.45	15.58	10.12	30.98	29.62
Capacity of Each Tubewell	Cusecs	3	3	3	3	3
No. of Tubewell Required	No.	7	5	4	10	10

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H) Overhead Water Reservoir

Overhead Reservoirs (OHRs) are also key component of water distribution system. In water supply system OHRs serve the following functions:

- Store water for use during electric load-shedding and during maintenance works of tube-wells/ pumps.
- Provide balancing of flow and pressure during peak hours.

Storage Capacity of Overhead reservoirs should be based on around **1/10th** of average day demand.

Based on average water demand of the project area, required storage is calculated in **Table** 8-4 and layout for Location of OHR's is shown in **Figure** 8-1.

Table 8-4, Calculation of OHRs

Parameter	Unit	Design Value									
		Zone 1		Zone-2		Zone-3		Zone-4	Zone-5		Total
Projected Population (2043)	Persons	131,436		95,464		62,045		189,829	181,521		6,60,295
Total Average Day Water Demand	GPD	5,152,817		3,742,571		2,432,412		7,442,056	7,116,349		2,58,86,205
Existing OHR (Outside the Urban Boundary)	-	-		-		-		-	-		
Proposed Capacity of OHR (1/10th of Average day water demand)	Gallons	515,282		374,257		243,241		744,206	711,635		2,588,621
Adopted	Gallons	550,000		400,000		300,000		800,000	750,000		2,800,000
Storage Capacity of Each OHR	Gallons	200,000	150,000	200,000	100,000	200,000	100,000	200000	200000	150000	
No. of OHR's Required	No.	2	1	1	2	1	1	4	3	1	16

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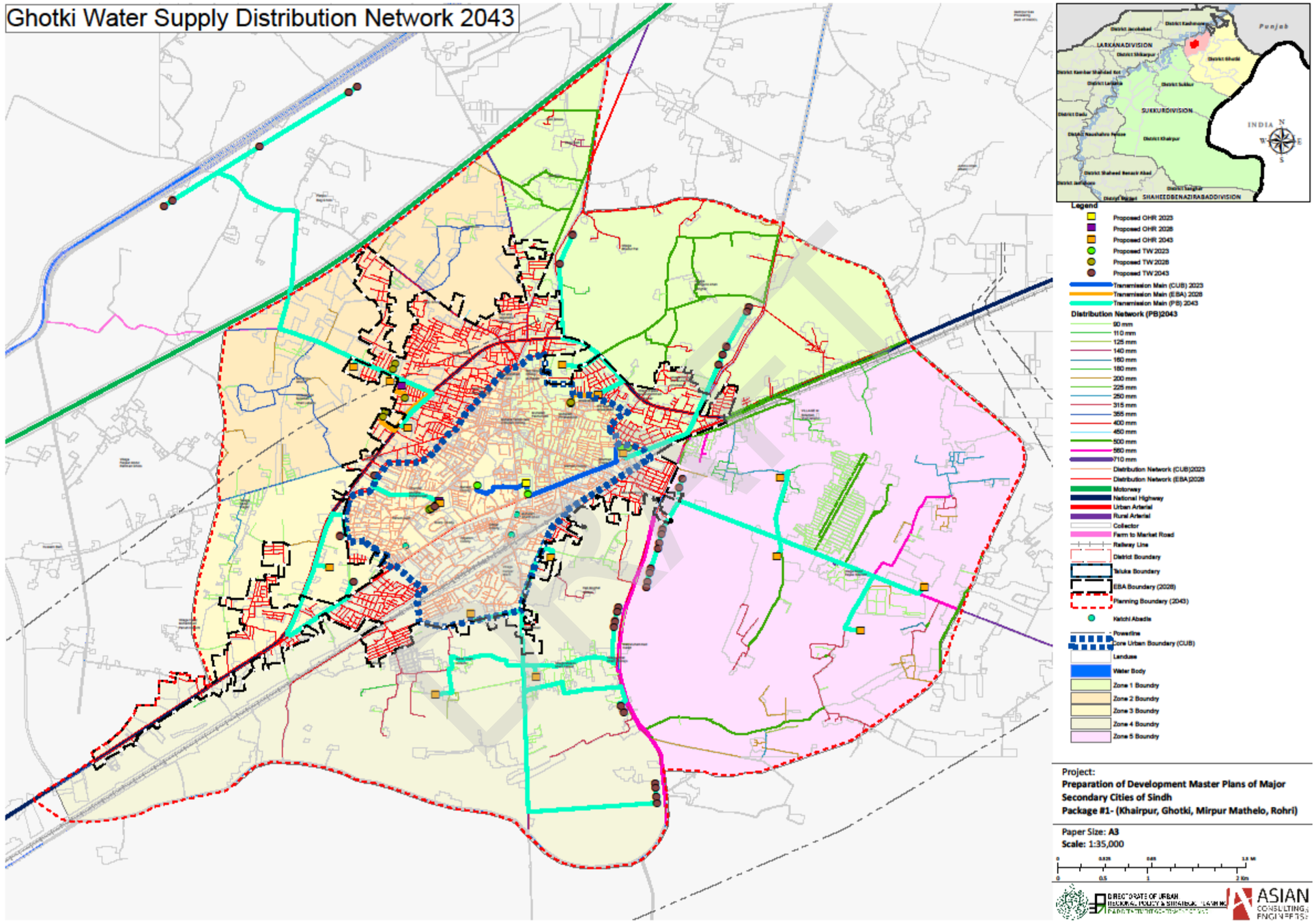


Figure 8-1, Strategic Development Master Plan (SDMP) - Distribution Network for Water Supply of Ghotki

Source: *The Consultant Team*

8.2.5 Proposed Planning for Water Supply Network

Considering the proposed water supply network, water demand for each pipe is calculated based on the feeding/ serving area of the pipe, population and per capita water demand. The water demand of the pipe is primarily based on feeding area. Afterwards, each feeding area is multiplied with respective population resulting in the served population on that pipe. Subsequently, the served population is multiplied with per capita demand to calculate the water demand of each pipe. Water Distribution network is designed to carry the peak water demand of the project area.

Each zone has its independent OHRs to work efficiently but all zones are interconnected with each other through main grid line, which will be used in case of water shortage in any zone or maintenance tenure of OHRs.

Based on the peak hour demand, hydraulic modelling is done in computer software, WATER GEMS.

A) Type of Network

There are two types of system that can be used for the designing of water supply network:

- Looped Water Supply System
- Isolated or branched Water Supply System

Looped Water Supply System	Isolated or branched Water Supply System
In this type of system there are several pathways that the water can flow from the source to the consumer. In this system multiple pipes would provide water supply to consumers even if one source is disturbed, water from other pipe would provide the requisite water supply	In isolated system is similar to that of a tree branch, in which smaller pipes branch off larger pipes throughout the service area, such that the water can take only one pathway from the source to the consumer. In this system only one pipe would provide water supply to consumer. In case of any disturbance in source, water supply will be stopped
It is the most widely used configuration in large municipal areas.	This type of system is most frequently used in rural areas.
This system provides a high degree of reliability Whenever a damage to line occurs the damaged line can be isolated with little impact on consumers outside the immediate area	Damage to main line at the start can result in disturbance of whole area
Looping in this system reduces some of the problems associated with water stagnation, such as adverse reactions with the pipe walls, and it increases fire-fighting capability	In this case when tube well will be switched off water will get stagnant in water pipes. Moreover, water hammer can occur due to abrupt change in pressure will occur when tube well will be switched on again.

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Looped Water Supply System	Isolated or branched Water Supply System
In integrated system all the lines in network along with OHRs are interconnected	In isolated system one network of lines having one or more OHRs are disconnected with other networks.
Pressure can be balance	Pressure balance is difficult

On the basis of above comparison, looped system is considered for design of water distribution network. In this system, better pressure can be maintained and repair and Maintenance will be easy.

B) Computer Aided Hydraulic Modelling and Analysis of Water Supply System

In order to analyse and evaluate the proposed water supply network, computer aided hydraulic modelling has been carried out using Water GEMS.

Total Planning Area is divided into different zones to efficiently manage the water supply.

As per design criteria, computer model is run to cater the peak flow. Advantages of this scenario is:

- The system is evaluated against peak flows. Therefore, pipes are sized to cater the peak demand in the system.
- The pressures in the system are adjusted for the peak hours.

In this model, the water supply system is analysed for peak hour demand. Key features of model are;

- 16 Nos. OHRs are used for modelling.
- Minimum diameter for distribution network is kept as 82.5mm (03 inch) while maximum diameter comes out 652.7 mm (26 Inch).

8.2.6 Operation and Maintenance (O&M) Staff for Water Supply

The proposed O&M staffing for year **2043** has been estimated based on the projected population and service requirements for water supply in the following table;

Table 8-5, O&M Staff Detail

Category	Position	No. of Staff	Key Responsibilities
Management & Supervision	O&M Manager / Executive Engineer	2	Overall management of water supply & sewerage system, planning and reporting.
	Assistant Engineer / Deputy Manager	2	Supervision of operations, maintenance planning, staff monitoring.

Category	Position	No. of Staff	Key Responsibilities
	Sub-Engineer / Inspector	2	Field inspections, fault reporting, coordination of repair works.
Water Supply System	Pump / Tubewell Operators	18	Operation of tubewells and pumping stations (shift-based coverage).
	OHR Operators / Caretakers	8	Operation and monitoring of overhead reservoirs.
	Plumbers / Line Men	1	Leakage repair, pipeline maintenance, house connections.
	Electricians / Electrical Technicians	1	Maintenance of motors, panels, wiring and generators.
	Mechanical Fitters / Technicians	1	Maintenance of pumps, valves, mechanical equipment.
Support Staff	Drivers (General)	1	Transport for maintenance teams
	Sweepers / Cleaners	1	Cleaning of offices and facilities

8.2.7 Priority Projects

A) Water Supply Network Provision for Urban Boundary

Provision of new water supply network for urban boundary (Approx. 2026.3 Acres) beyond the core urban area of Ghotki MC.

Project Justification

According to socio economic survey results, about 100% population of Ghotki city has no water supply infrastructure network / potable water & dependent on hand pump & community wells. People purchase their potable water through tankers due to unavailability of water supply network. This project will help to make possible supply of water in those areas where the network is not available and existing network is discontinued. Provision of New Water Supply Network in urban boundary outside of Core urban Boundary will cover main components i.e. Excavation, Pipe cost, gate valve/ Washout valve/ Air release valve, Joints repairs, Balancing slopes at all network, Checking of pipe life with rupture checker and Valves for area wise pressure maintenance.

Project Size	
Population of Ghotki **Urban Boundary**	170,853
MC Area of City in Acres	4,448
Urban Boundary Area within MC in Acres	2,026.3

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Project Size	
Installation of New water supply scheme for 100% (2026 Acres) of Ghotki city @ Rate of 1.2 million Per Acre	2432

- **Project Benefits:** As already discussed above that 100% of Ghotki MC has not a proper supply of clean Water. So, after implementing this project, the Potable water will easily supply to the rest of the residents of the city.
- **Implementing Authority:** Government of Sindh- PHE Department Ghotki MC.
- **Estimated Cost:** 2432.00 million PKR Approx. (Short Term)

Provision of Water Supply Network for Urban Boundary (Approx. 2026.3 Acres) outside of Core Urban Boundary in Ghotki.

Table 8-6, Proposed Priority Projects – Ghotki City

S. No.	Project Name	Estimated Cost In Millions	Status	
			Short Term	Long Term
Water Supply				
1	Provision of New water supply network for Urban Boundary (2026.3 Acres) except core urban area.	2,432		

1. Planning Concept for Urban Boundary (2028)

The total projected population of Urban Boundary for year 2028 is 170,853. This is the area in which new water supply network is being proposed as **Priority Project.** The total average demand is 12.85 cusec. The required maximum daily demand is 19.28 cusecs. The diameters use in this zone range from 82.5 mm to 514.9 mm. The length of pipe of diameter 82.5 mm, 101 mm, 114.8, 128.5, 146.8 mm, 183.7, 206.8 mm, 229.7, 257.4 mm, 289.4 mm, 326.3, 367.7, 413.7, 459.7 and 514.9 mm is 544,605 ft, 5,091 ft, 694 ft, 281 ft, 13,518 ft, 1,336 ft, 5,716 ft, 96 ft, 5,698 ft, 51,562 ft, 128,595 ft, 42,408 ft, 9,729 ft, 4,857 ft and 815,649 ft respectively. An economical velocity must therefore be chosen for each zone is less than 5 ft/sec. The layout for water supply network of Urban Boundary has been shown in **Figure** 8-2.

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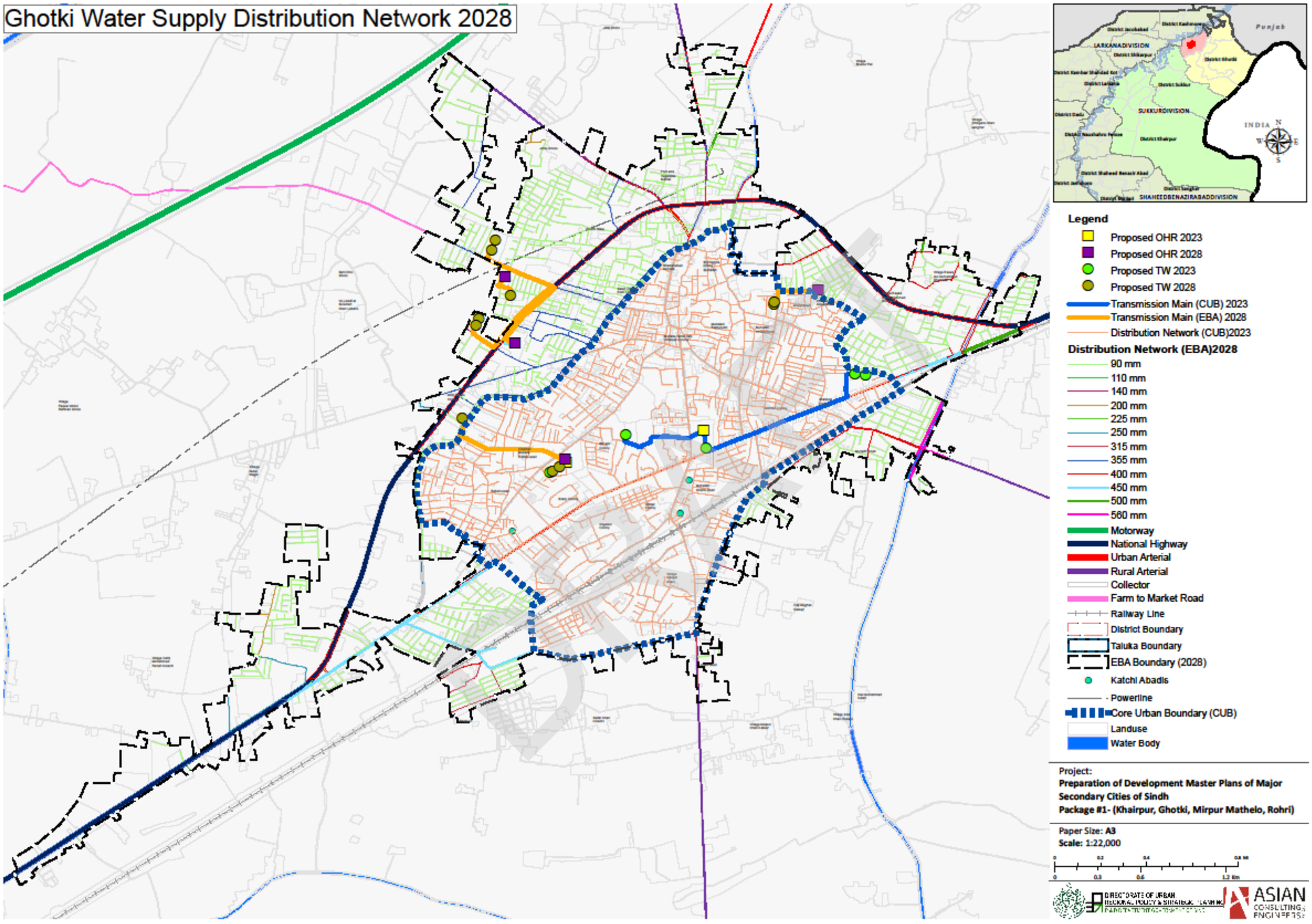


Figure 8-2, Priority Project Map-Distribution Network for Water Supply of Ghotki

Source: *The Consultant Team*

Table 8-7, Population of Urban Boundary (2028)

Urban Boundary	Population
	2028
Total Population	170,853

2. Water Demand

Total water demand for the project area is calculated on the basis of design criteria as discussed in **Immediate Action Plan (IAP)** Report Section 3. Based on the criteria, water demand of the city is estimated in **Table** 8-8**.**

Table 8-8, Total Average Demand of 2028

Parameter	Unit	Value
Projected Population (2028)	Persons	170,853
Average Domestic Water Demand @ 30 GPCD	GPD	5,125,590
Average non-domestic water demand @ 20% of domestic water demand	GPD	1,025,118
Domestic and Non-Domestic Average Water Demand	GPD	6,150,708
Unaccounted Water Demand	GPD	615,071
Total Average Water Demand	GPD	6,765,779
	Cusecs	12.85
Max Day Demand @ 1.5 of Avg. Day demand	Cusecs	19.28
Peak Hour Demand @ 1.5 of max day demand	Cusecs	28.92

Source: *The Consultant Team*

3. Tubewells

On the basis of above recommendation, recharge water along the canals will be used for future demand of the city.

As per total demand of water, calculation for the tubewells is shown in **Table** 8-9 and layout of TW's location is shown in **Figure** 8-2.

Table 8-9, Calculation of Tubewells

Parameter	Unit	Design Value
Projected Population (2028)	Persons	170,853
Average Day Water Demand	GPD	6,765,779
	Cusecs	12.85
Max Day Demand	Cusecs	19.28
Tubewell Pumping Duration (Adopted)	hrs	16
Total Pumps Discharge Capacity (Calculated)	Cusecs	28.92
Total Pumps Discharge Capacity (Adopted)	Cusecs	30

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Parameter	Unit	Design Value
Capacity of Each Tubewell	Cusecs	3
No. of Tubewell Required	No.	10

4. Overhead Water Reservoir

Overhead Reservoirs (OHRs) are also key component of water distribution system. In water supply system OHRs serve the following functions:

- Store water for use during electric load-shedding and during maintenance works of tube-wells/ pumps.
- Provide balancing of flow and pressure during peak hours.

Storage Capacity of Overhead reservoirs should be based on around 1/10th of average day demand.

Based on average water demand of the project area, required storage is calculated in **Table** 8-10 and layout of OHR's location is shown in **Figure** 8-2.

Table 8-10, Calculation of OHRs

Parameter	Unit	Design Value	
Projected Population (2028)	Persons	170,853	
Total Average Day Water Demand	GPD	6,765,779	
Existing OHR in Urban Boundary beyond Core Urban Boundary	-	-	
Proposed Capacity of OHR (1/10th of Avg. Day Water Demand)	Gallons	676,578	
Adopted	Gallons	7,00,000	
Storage Capacity of Each OHR	Gallons	2,00,000	1,00,000
No. of OHR's Required	No.	03	01

8.2.8 Immediate Action Plan for Core Urban Area

A) Provision of New Water Supply Network for 100% of Ghotki MC (Approx. 1,115 Acres)

1. Project Justification

According to socio economic survey results, about 100% population of Ghotki city has no water supply network & dependent on hand pump & community wells. People purchase their potable water through tankers due to unavailability of water supply network. This project will help to make possible supply of water in those areas where the network is not available and existing network is discontinued. Provision of New Water Supply Network in core urban area will cover main components i.e. Excavation, Pipe cost, gate valve/ Washout valve/ Air release valve, Joints repairs, Balancing slopes at all network, Checking of pipe life with rupture checker and Valves for area wise pressure maintenance.

Project Size	
Population of Ghotki for Core Urban Boundary	94,264
MC Area of City in Acres	4,448
Core-Urban Boundary Area within MC in Acres	1,114.65
Installation of New water supply scheme for 100% (1115 Acres) of Ghotki city @ Rate of 1.2 million Per Acre	1,338

2. Project Benefits

As already discussed above that 100% of Ghotki MC has not a proper supply of clean Water. So, after implementing this project, the Potable water will easily supply to the rest of the residents of the city.

3. Implementing Authority

Government of Sindh - PHE Department Ghotki MC.

4. Estimated Cost

1,338.00 million PKR Approx. (Short Term)

Table 8-11, Proposed New Water Supply Network for Core Urban Area (Ghotki City)

Sr. No.	Project Name	Estimated Cost Millions	Status	
			In-Short Term	Long Term
Water Supply				
1	Provision of 100% New water supply network for Core Urban Area (1114.65 Acres)	1,338		

B) Planning Concept of Core Urban Area

The total projected population of Core Urban area for year 2023 is 94,264. This is the existing area in which new water supply network is being proposed as **Immediate Action Plan (IAP).** The total average demand is 7 cusecs. The required maximum daily demand is 10 cusecs. The diameters use in this zone range from 82.5 mm to 459.7 mm. The length of pipe of diameter 82.5 mm, 101.0 mm, 114.8 mm, 146.8 mm, 152.4 mm, 183.7 mm, 289.4 mm, 367.7 mm, 413.7 mm, and 459.7 mm is 259,884 ft, 3,947 ft, 1,463 ft, 197 ft, 806 ft, 8,577 ft, 43 ft, 41,421 ft, 23,331 ft, 1,695 ft and 341,364 ft respectively. An economical velocity must therefore be chosen for each zone is less than 6 ft/sec. The layout for water supply network of Core Urban Boundary has been shown in

Figure 8-3.

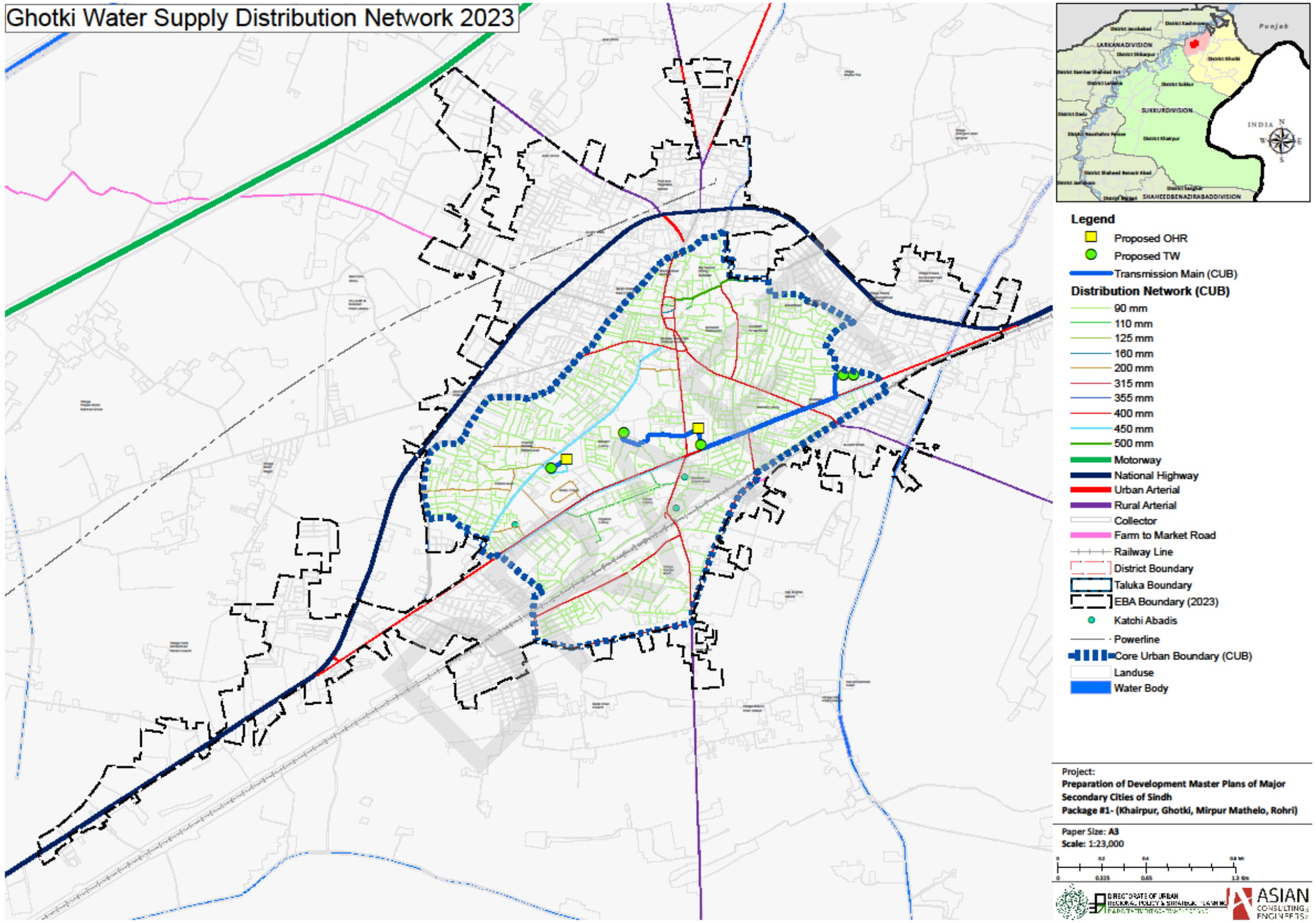


Figure 8-3, Immediate Action Plan Map-Distribution Network of Ghotki for Water Supply

Source: *The Consultant Team*

Table 8-12, Population of Core Urban Boundary

Core Urban	Population
	2023
Total Population	94,264

C) Water Demand

Total water demand for the project area is calculated on the basis of design criteria as discussed in **Immediate Action Plan (IAP)** Report Section 3. Based on the criteria, water demand of the city is estimated in **Table** 8-13.

Table 8-13, Total Average Demand of 2023

Parameter	Unit	Value
Core Urban Boundary		
Projected Population (2023)	Persons	94,264
Average Domestic Water Demand @ 30 GPCD	GPD	2,827,920
Average non-domestic water demand @ 20% of domestic water demand	GPD	5,65,584
Domestic and Non-Domestic Average Water Demand	GPD	33,93,504
Unaccounted Water Demand	GPD	339350.4
Total Average Water Demand	GPD	37,32,854
	Cusecs	7
Max Day Demand @ 1.5 of Avg. Day demand	Cusecs	10.5
Peak Hour Demand @ 1.5 of max day demand	Cusecs	15.75

Source: *The Consultant Team*

D) Tubewells

On the basis of above recommendation, recharge water along the canals will be used for future demand of the city.

As per total demand of water, calculation for the tubewells is shown in **Table** 8-14. and layout of TW's location is shown in

Figure 8-3.

Table 8-14, Calculation of Tubewells

Parameter	Unit	Design Value
Projected Population (2023)	Persons	94,264
Average Day Water Demand	GPD	37,32,854
	Cusecs	7
Max Day Demand	Cusecs	10.5
Tubewell Pumping Duration (Adopted)	hrs	16
Total Pumps Discharge Capacity	Cusecs	15.75
Capacity of Each Tubewell	Cusecs	3
No. of Tubewell Required	No.	5

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E) Overhead Water Reservoir

Overhead Reservoirs (OHRs) are also key component of water distribution system. In water supply system OHRs serve the following functions:

- Store water for use during electric load-shedding and during maintenance works of tube-wells/ pumps.
- Provide balancing of flow and pressure during peak hours.

Storage Capacity of Overhead reservoirs should be based on around 1/10th of average day demand.

Based on average water demand of the project area, required storage is calculated in

Figure 8-3 and layout of OHR's location is shown in

Figure 8-3.

Table 8-15, Calculation of OHRs

Parameter	Unit	Design Value
Projected Population (2023)	Persons	94,264
Total Average Day Water Demand	GPD	37,32,854
Existing OHR	-	-
Proposed Capacity of OHR (1/10th of Average day water demand)	Gallons	3,73,285
Adopted	Gallons	4,00,000
Storage Capacity of Each OHR	Gallons	2,00,000
No. of OHR's Required	No.	2

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8.3 Sewerage and Drainage

8.3.1 Existing Situation

Sewage is collected and catered by both open/covered drains and piped network. Piped sewerage network has been laid in few streets but mostly sewage is being collected through drains. The flow from these sewers is collected in main sewerage line which ultimately dispose of the collected sewage in a disposal station. The ultimate disposal of sewage is the open/agricultural, Dhingrowah and Bhagowah canal without any treatment.

A) Problems in Existing Sewerage System

Analysis of the existing municipal services infrastructure and the quality-of-service delivery was done. Site visits to actual problematic areas in the Ghotki city are conducted to identify the problems, bottlenecks and shortcomings in the infrastructure itself and its operation and maintenance for each municipal service along with the correction/updating of descriptive maps.

There is an inadequate, under capacity and outlived network of sewers as well as Surface Drains and lack of facilities for disposal so under capacity existing sewer needs to be replaced and rehabilitation of disposal stations are needed. Ghareebabad, Somro Colony and Kaholra Phatac disposal stations, need rehabilitation and ongoing maintenance to ensure they can operate to design capacity with appropriate screening.

Diameter (Inches)	Length (ft)
9	7,157
12	7,414

1. MC Officials/Stakeholder Consultation

The city was visited to,

- Verify and correct the data provided by the Municipal Committee/Public Health Engineering Department (PHED).
- Update the descriptive maps of all the services by consultation with MC staff and Public Health Engineering staff.
- The access condition of existing disposal stations (design capacity, number and capacity of wet wells, pumps and capacity, generators) and existing treatment facilities.
- Identify the required improvements and extension of the municipal services infrastructure.

2. Meeting/Discussion with MC's Official

The consultant team, visited Ghotki city for the purpose of detailed Reconnaissance/Technical survey. Firstly, the consultant team met MC

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administration where detailed discussion was carried out regarding provided maps of sewerage system.



3. Detail Reconnaissance Survey

To study the sewerage and drainage facilities in project area, a team comprising Water and Sanitation Engineers along with MC representatives visited the existing disposal station sites and developed the inventory of existing disposal stations. The visit was carried out from 13-02-2025 to 21-02-2025. The study of existing 06 disposal stations was made.

Furthermore, point of ultimate disposal of different disposal stations were visited. Also made sure the main sewer lines diameters, materials and their routes after confirmation from MC Officials. The Consultant Team, also visited the flooded and unserved areas where surveys from different people were conducted to gather information about sewerage/drainage issues.

Some pictorial view of reconnaissance Survey is shown in above pictures.

4. Existing Features of Sewerage System in Ghotki City

Existing sewerage system in Ghotki is a combination of the following assets;

- Sewer lines
- Open/Covered Drains
- Disposal Stations
- Force Main

5. Sewer Lines

In Ghotki, sewerage system has been laid in the few areas, however the same is facing multiple problems throughout the city that ranges from under capacity sewers to over aging and choking of sewer. This can result in crown failure and ponding in different parts of the city. The sewerage system in the city is mostly planned and constructed by Public Health Engineering Department (PHED) and subsequently handed over to MC for operation and maintenance.

At present, MC is operating and maintaining sewer lines of 9'' to 24'' laid in various phases and sub projects connected with disposal stations. Total length of sewer network in Ghotki City is approximately 4.5 Km.

6. Open/Covered Drains

Most of the area is covered by open/covered drains. Total length of drains in Ghotki City is approximately 36 Km. Open and covered drains are there to cater the domestic sewage flow as well as stormwater flow of that area. These small drains dispose of their sewage to main drains of larger size ranging from 2.0' x 3.0', 2' x 4.0', 2.0' x 5.0' and 4.0' x 4.0'. These drains ultimately disposing their flow to disposal stations. All these drains are clogged with a lot of solid waste and sediments thus has significantly reduced their carrying capacity.

Presently, there exist Three (03) disposal/lift stations in Ghotki city. These are used for pumping of the sewage/storm water to the final disposal points. All disposal stations are functional and dispose-off the raw sewage into nearby water bodies like Dhingrowah and Bhagowah canal without any treatment.

7. No. of Operational and Non-Operational Disposal Stations

The existing disposal stations generally consists of screening chamber, wet wells, dry wells and force main. These are made of brick walls. The pumps are either horizontal centrifugal, vertical centrifugal or Cardon shaft. Screening chambers and wet wells in few disposal stations have been choked.

Wastewater from disposal stations is being carried through force main. Brief summary of disposal stations is as follows:

Table 8-16, Brief Summary of Disposal Stations

Sr. No.	Name of Disposal Station	Year of Construction	Designed Capacity (Cusec)	Status	Discharge Point
1	Sadaf Cinema	1982	16	Functional	Bhagowah Canal
2	Rahmowali	1982	18	Functional	Bhagowah Canal
3	Anwar Abad	1983	12	Functional	Dhingowah

Sr. No.	Name of Disposal Station	Year of Construction	Designed Capacity (Cusec)	Status	Discharge Point
					Canal

Table 8-17, Summary of Sewerage System

Sr. No.	Component	Quantity
1	Sewer lines	4.5 km
2	Open drains	36 km
3	Disposal Stations	10 nos.

Source: *Data obtained from digitized map and field surveys*

8. Force Mains

Diameter (inch)	Material
4	PVC
6	AC, PVC
8	AC, PVC
10	AC, PVC
12	AC

9. Unserved Areas

The following areas were found un served areas.

- Bhatiyun
- Village Raees Gul M. Khuhawar
- Village Bahadur Pat
- Dhingano Khan Sanghar

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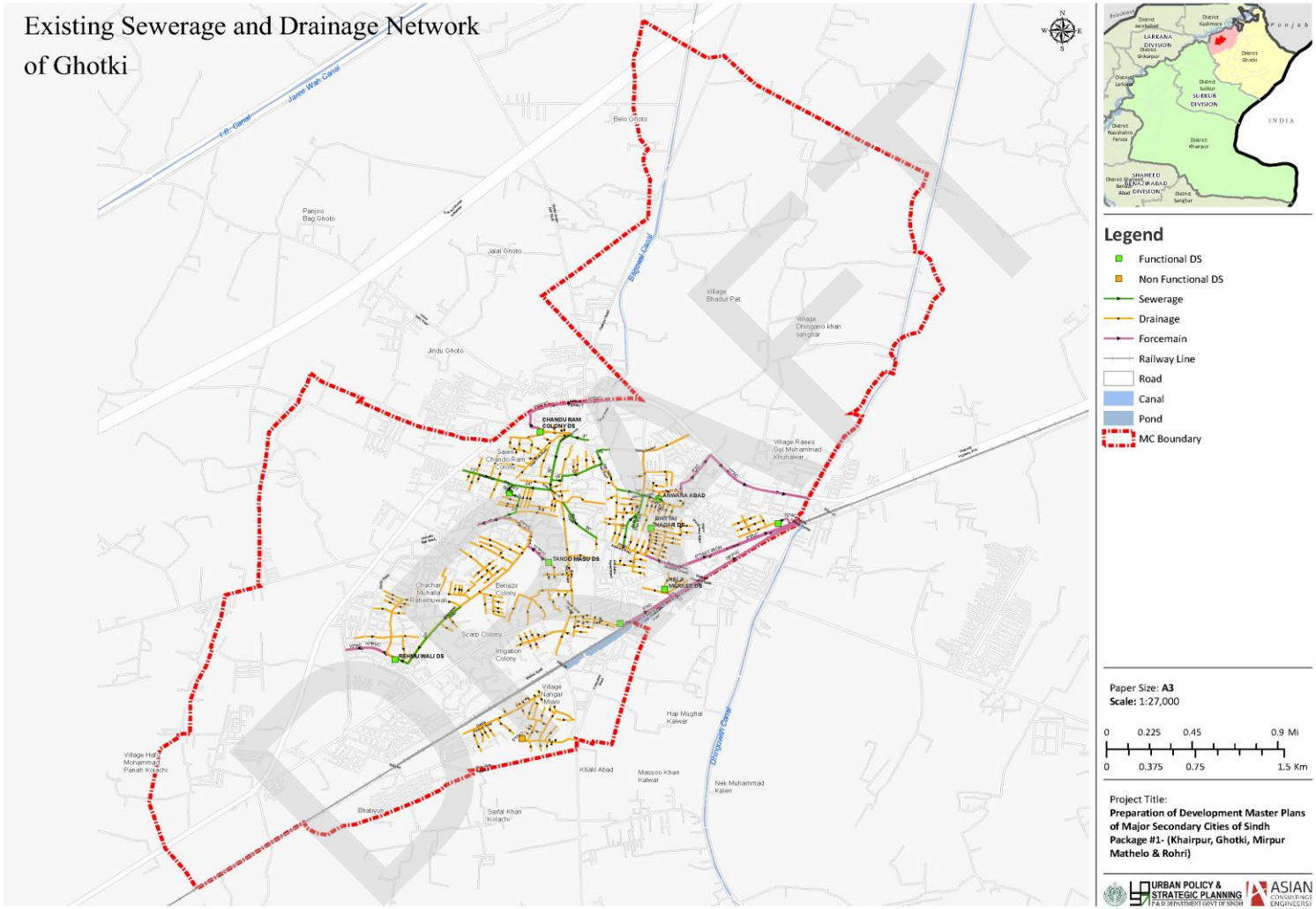


Figure 8-4, Layout of Exisisting Drainage Network Ghotki

Source: *The Consultant Team*

8.3.2 SWOT Analysis

	Internal Factors	External Factors
Positive Impacts	**STRENGTHS** **Sewerage and Drainage System:** • The existing Sewerage/Drainage System facilitates the city. • Experienced staff available with the organization related to sewerage and drainage system.	**OPPORTUNITIES** **Sewerage and Drainage System:** • Replacement and Rehabilitation of existing disposal stations and their machinery. • Improvement of general hygiene/ public health by cleaning sewerage/drainage system. • Revenue can be generated by charging services for cleaning. • Job opportunities for skilled staff for proper maintenance. • Treatment of wastewater for safe disposal of wastewater to water bodies. • Development of legislation, regulation and updating of existing rules / standards.
Negative Impacts	**WEAKNESSES** **Sewerage and Drainage System:** • No systematic updating of GIS mapping and asset inventory. • No sewerage tariffs are being collected. • Capacity development and training mechanism is not in place. • No SOPs and O&M manuals. • Due to poor maintenance condition; garbage (solid waste) enters into sewers/drains. • 64% Urban area is not connected to sewerage/drainage system. • There is no sewerage treatment plant, water bodies getting polluting due to raw sewage discharges.	**THREATS** **Water Supply, Sewerage and Drainage System:** • Resistance to pay for water and sewerage services. • System inefficiency and reduced delivery of services. • Negative health impact on community due to improper sewerage and waste disposal. • Spreading of epidemic / pandemic, pollution of water bodies due to untreated sewerage. • Stormwater flooding or overflow of sewers/drains due to extreme weather events, such as excessive rainfalls.

8.3.3 Detailed Sewerage and Drainage System

A) Existing and Projected Population for Sewage Calculation

The existing Population of Planning Boundary of Ghotki for the year 2023 is 140,429 The population for the years 2028, 2033, 2038 and 2043 is projected as (170,853), (207,869), (252,905) and (307,697) respectively.

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The population for the year 2043 (307,697) is considered for the strategic planning of the Ghotki City for the year 2043.

8.3.4 Feasibility Analysis

The proposed projects of sewer are designed to meet the immediate water demand outlined in the action plans. A detailed analysis has been conducted for the placement and number of tube wells, as well as the required pipeline lengths, to ensure efficiency and effectiveness. The pipe materials and tube well capacities have been selected carefully, keeping in mind both technical requirements and cost considerations. This ensures that the system performs reliably without exceeding budgetary constraints. The overall design maintains a balance between performance and economic viability. In the case of the sewerage system, the pollution load to be managed by the trunk sewers has been thoroughly studied. Routes for the trunk sewers have been selected to avoid excessive excavation depths, which helps reduce construction challenges and costs. The alignment of sewer lines ensures minimal disruption to existing infrastructure and natural terrain. These design decisions contribute to the overall feasibility and sustainability of the project. The proposed systems are practical, efficient, and ready for timely implementation.

8.3.5 Proposed Sewerage System

This section describes the detailed design of different components of sewerage system till year 2043.

A) Population Projection

Population density method is used to calculate total number of persons in one zone.

Percentage of area occupied by one zone is calculated then multiplied by total population to get number of persons in that specific zone.

The methodology for Population projection is added in the report. Further population projection is corresponding to the land use and master planning concept. Similar values and population density is adopted for calculation of population up to the draft strategic planning horizon, priority planning and immediate action plan for calculating the loads and demands of the utilities proposed on the master planning.

B) Zoning Criteria

The zoning criteria adopted for sewerage system is in accordance with the landuse plan provided for the city. The extent of zoning is based on the following factors:

- Topographic levels and terrain following the disposal pattern into the water bodies after treatment.

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- Landuse available for proposing the Wastewater treatment plants.
- Pollution load contributing to the existing and proposed disposal stations is aligned with the zoning criteria.

The detailed zoning maps corresponding to the exact master planning for the city is provided below.

C) Planning Concept for Trunk Sewer – Ghotki City (2043)

According to the Detailed Design of combined sewerage system of Ghotki City, whole city has been divided into 3 zones to make the sewerage and drainage system easy. The total projected population of year 2043 is 307,697 of Ghotki City. The daily flow is 54.23 cusec according to 85% of water supply.

The layout of these zones has been shown

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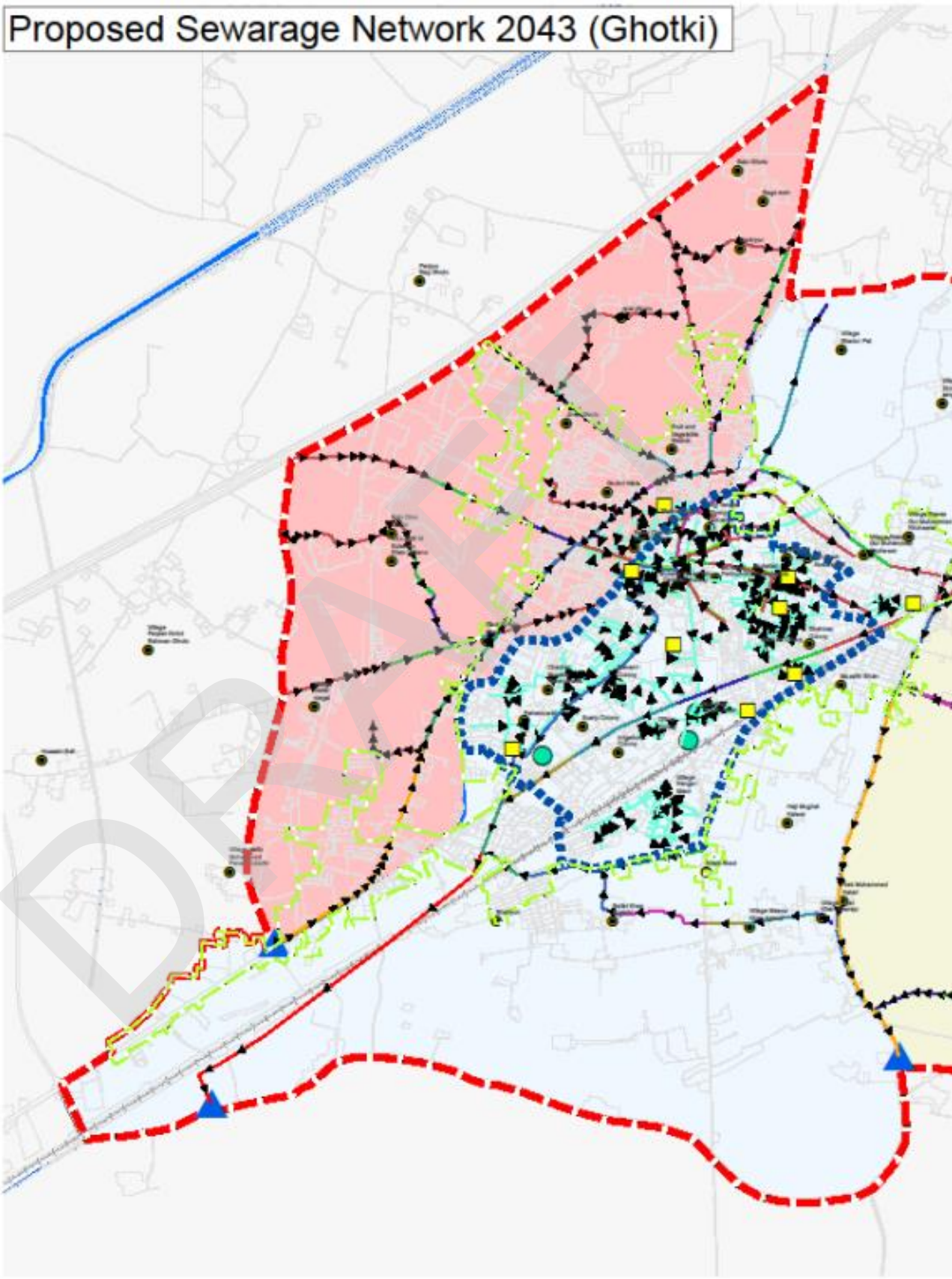


Figure 8-5. Population and design flow of each zone is presented in the Table 8-18 and Table 8-19. Detail of these zones is given below.

1. Zone-1

The total projected population of Zone 1 is 106,540. The daily flow of zone is 18.7 cusec according to 85% of water supply. The diameters use in this zone range from 9 inches to 48 inches. Below is table provided including lengths in accordance with diameters.

Pipe Diameters	Lengths (ft)
9.0 in	15,119.6
10.0 in	2,749.9
12.0 in	6,221.6
15.0 in	4,459.6
18.0 in	9,980.7
21.0 in	3039.8
24.0 in	5,446.7
30.0 in	13,270.6
36.0 in	2,717.4
48.0 in	9,759.7
Total Length	**72,765.5**

2. Zone-2

The total projected population of Zone 2 is 132,619. The daily flow of zone 1 is 23.27 cusec according to 85% of water supply. The diameters use in this zone range from 9 inches to 42 inches. Below is table provided including lengths in accordance with diameters.

Pipe Diameters	Lengths (ft)
9.0 in	49,504.6
12.0 in	25151.3
15.0 in	11,369.2
18.0 in	4,195.3
21.0 in	2,312.4
24.0 in	7,851.8
30.0 in	5,710
36.0 in	149
42.0 in	10,287.1
Total Length	**116,530.7**

3. Zone-3

The total projected population of Future Zone is 68,538. The daily flow of zone is 12 cusecs according to 85% of water supply. The diameters use in this zone

range from 9 inches to 42 inches. Below is table provided including lengths in accordance with diameters.

Pipe Diameters	Lengths (ft)
9.0 in	34,939
12.0 in	7346.3
15.0 in	8,358.9
18.0 in	4,747.1
24.0 in	952.5
30.0 in	5,025
36.0 in	3,623
42.0 in	6,452.9
Total Length	**71,444.6**

The layout of zone wise proposed sewerage network is shown in

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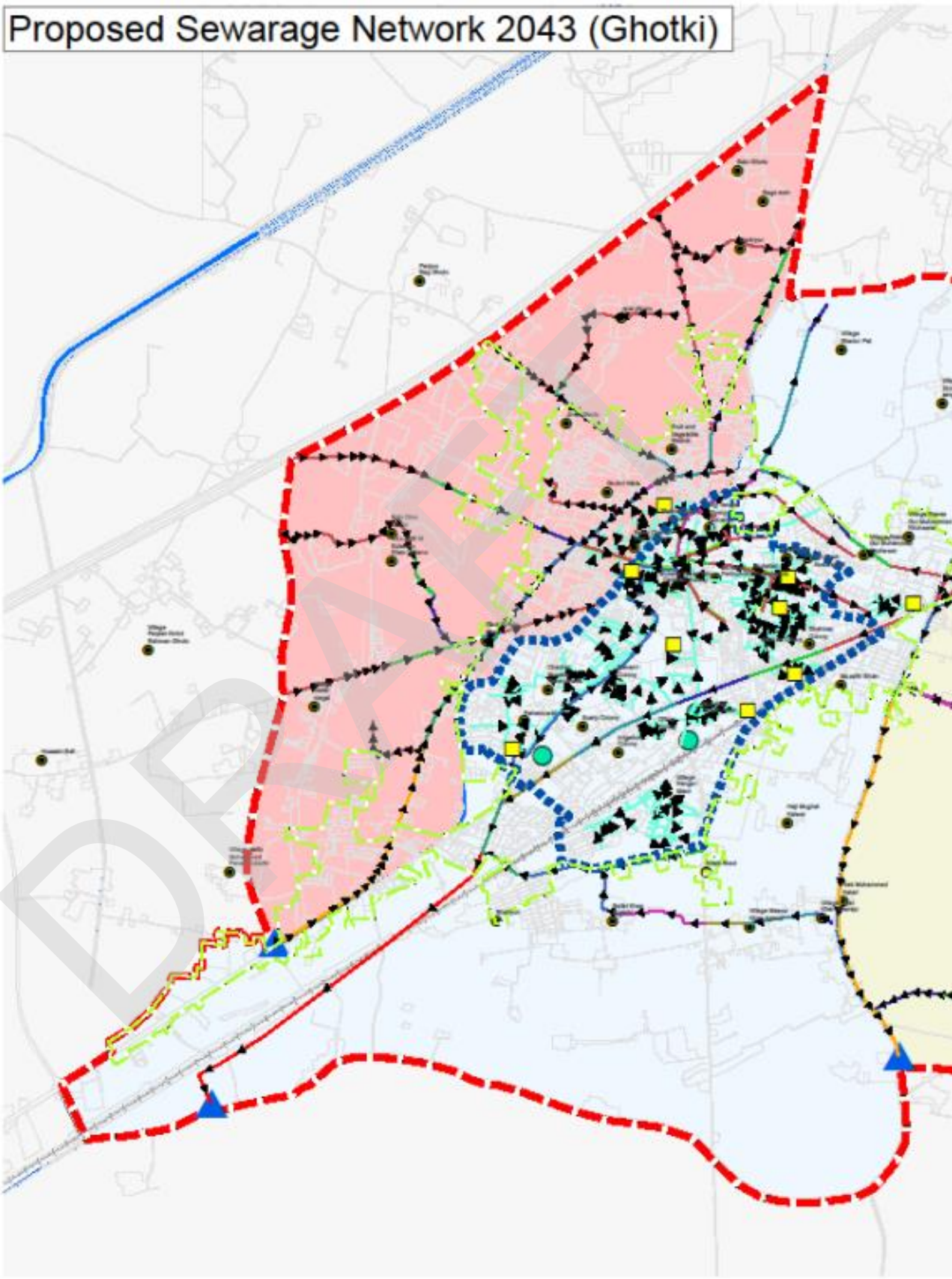


Figure 8-5 .

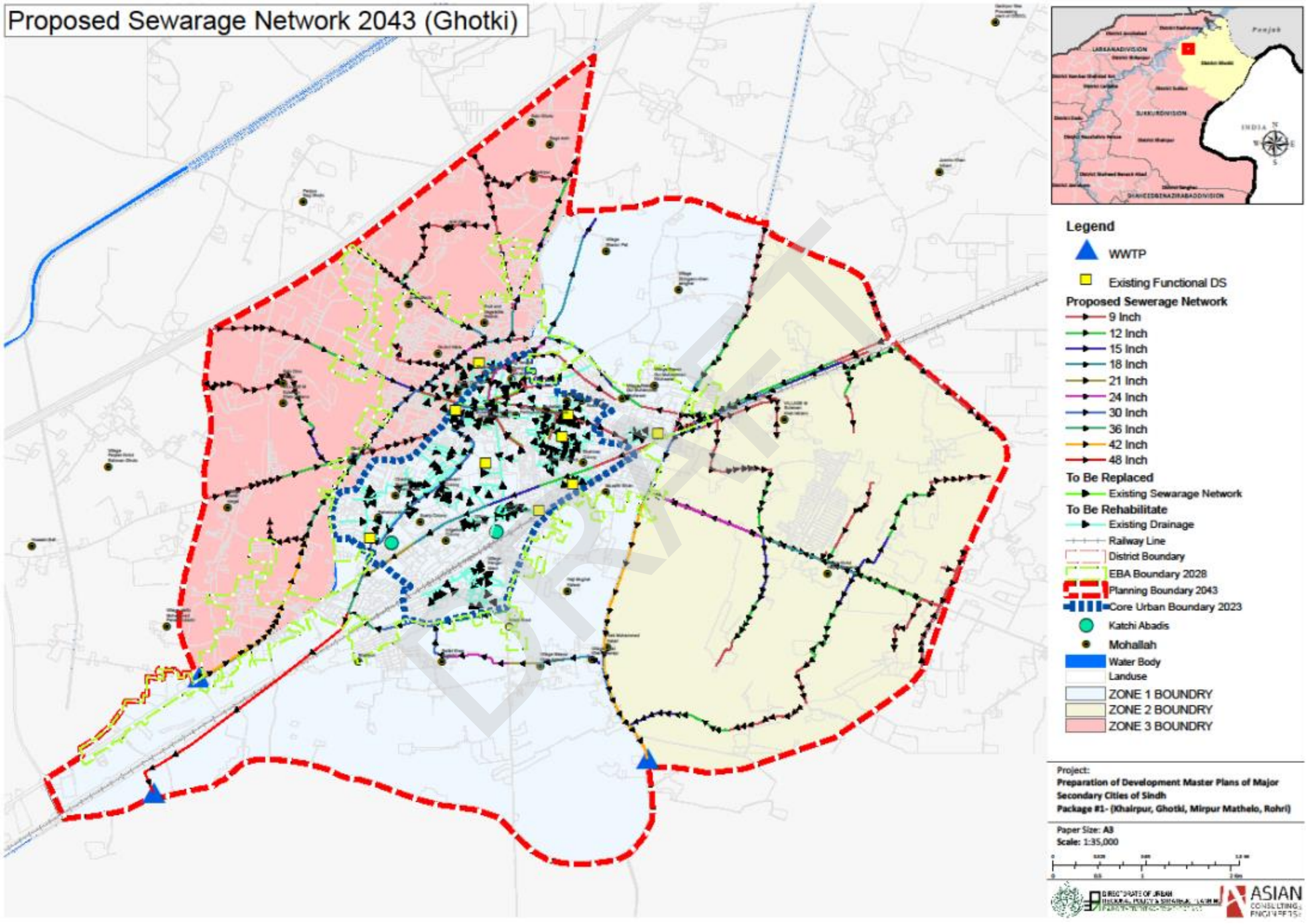


Figure 8-5, Proposed Sewerage Network of Ghotki City

Source: *The Consultant Team*

D) Population Projection

Table 8-18, Population Projection -2043

Urban Boundary	Population
	2043
Total Population	307,697

E) Design Flow

Total design flow for the project area is calculated on the basis of design criteria mentioned in Section 3 of **Immediate Action Plan (IAP)** Report. Based on the criteria, design flow of the city is estimated in **Table** 8-19**.**

Table 8-19, Design Flow Calculation of 2043

Parameter	Unit	Design Value		
		Zone 1	Zone-2	Zone-3
Projected Population (2043)	Persons	106,540	132,619	68,538
Total Average Day Water Demand	GPD	3,196,200	3,978,570	2,056,140
Average Domestic Sewage Flow @85% of avg. water demand	GPD	2,716,770	3,381,785	1,747,719
Average Non-Domestic Sewage Flow @ 20% of domestic sewage flow	GPD	543,354	676,357	349,544
Average Sewage Flow	GPD	3,260,124	4,058,141	2,097,263
	Cusecs	6.03	7.51	3.88
Infiltration @ 10% of average sewage flow	Cusecs	0.60	0.75	0.39
Peak Sewage Flow	Cusecs	12	15	8
Storm water Allowance @50% of peak sewage flow	Cusecs	6.03	7.51	3.88
Total Design Flow	Cusecs	18.70	23.27	12.03

F) Wastewater Treatment Plant

The treatment and ultimate disposal of municipal wastewater/sewage of Ghotki city is a major concern. Currently, no treatment plant is available for treatment of sewage in the project area of Ghotki city. The raw sewage is being directly disposed into the nearby water bodies (Dhingrowah and Bhagowah canal) or used for agricultural purposes.

It is recommended to construct three wastewater treatment plants in zone 1, zone 2 and Zone 3 of capacity of 3.3, 4.1 and 2.1 MGD respectively with waste stabilization pond for Ghotki City. The treated wastewater from the proposed wastewater treatment plants will discharge

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into the nearby water bodies (Dhingrowah and Bhagowah canal).

Note: *All industries shall install and operate their own wastewater treatment plants (WWTPs), and only treated effluent complying with applicable discharge standards shall be allowed to connect to the city trunk sewer system.*

The comparison for wastewater technology is given below:

Parameter	Activated Sludge	Trickling Filters	Aerated Lagoons	Waste Stabilization Pond
Plant Area Requirement	Minimum		High	Very High
Operation and Maintenance Cost	High	Moderate	Very High	Minimum
Process Energy Requirement	High	Moderate	Very High	Nil
Operational Supervision & Control	High	High	Moderate	Minimum
Construction Cost	High	High	Very High	Moderate
Capital Cost	High	High	Very High	High
Process Mechanical Equipment	Yes	Yes	Yes	No
Quantities of Sludge Produced	High	High	High	Minimum
Daily Waste Sludge Disposal	Yes	Yes	Yes	No

The Waste Stabilization Pond (WSP) system is a natural and low-cost wastewater treatment option that relies on biological processes driven by sunlight, algae, and microorganisms. It requires large land area but offers significant advantages such as no energy requirement, minimal operation and maintenance, and no need for complex mechanical equipment. The system produces very little sludge, eliminating the need for daily sludge handling or disposal. Due to its simplicity, reliability, and low operational cost, WSPs are particularly well-suited for cities where skilled staff is not available, they cannot meet high operational cost of other treatment technologies and warm climatic conditions like those in Pakistan.

1. Design Capacity

- **Plant 1**: 3.3 million Gallons per Day (MGD)
- **Plant 2**: 4.1 million Gallons per Day (MGD)
- **Plant 3**: 2.1 million Gallons per Day (MGD)

2. Components of Treatment Technology

Anaerobic Ponds

- **Function:** Initial treatment to settle solids and reduce organic load.
- **Depth:** 3–5 meters
- **Retention Time:** 1–5 days

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Facultative Ponds

- **Function:** Biological treatment using aerobic and anaerobic bacteria and algae.
- **Depth:** 1–2.5 meters
- **Retention Time:** 5–30 days

Maturation Ponds

- **Function:** Final polishing to remove pathogens.
- **Depth:** 0.5–1.5 meters
- **Retention Time:** 5–10 days

Treatment Efficiency

- BOD Removal: 80–95%
- Pathogen Removal: 90–99%
- TSS Removal: 80–90%

Treated effluent is suitable for restricted irrigation or safe discharge to surface waters.

3. Area Estimation for Treatment Plant

Area needs depend on flow rate, design parameters, and retention times. The following are typical estimates based on standard WSP design:

3.3 MGD WSP

- **Flow Rate:** ~ 14,997 m³/day
- **Total Area Required:** 22.5 Hectare
- (Assuming 1.5 hectares per 1,000 m³/day for full WSP train)

4.1 MGD WSP

- **Flow Rate:** ~ 18,633 m³/day
- **Total Area Required:** 28 Hectare

2.1 MGD WSP

- **Flow Rate:** ~ 9,544 m³/day
- **Total Area Required:** 14.3 Hectare

Effluent of all treatment plants should be compiling with NEQS standards before discharge.

Critical Parameter	Standard As per NEQS (mg/L unless noted)
pH	6-10
Biochemical Oxygen Demand (BOD5) at 20∘C	80
Chemical Oxygen Demand (COD)	150
Total Suspended Solids (TSS)	150
Total Dissolved Solids (TDS)	3500

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Critical Parameter	Standard As per NEQS (mg/L unless noted)
Oil and grease	10
Phenolic compounds (as phenol)	0.1
Cyanide (as CN) total	2
Total toxic metals	2

4. Suitability of Treatment Technology Adopted for Ghotki City

For Ghotki City, it is recommended to:

- Identify land plots on the outskirts for all treatment plants.
- Use a phased construction plan, prioritizing one plant and expanding as demand grows.
- Explore integration with constructed wetlands for final polishing and reuse.

G) Operation and Maintenance (O&M) staff for Sewerage System

The proposed O&M staffing for year 2043 has been estimated based on the projected population and service requirements for sewerage systems in the following table;

Table 8-20, O& M Staff Detail for Sewerage System

Category	Position	No. of Staff	Key Responsibilities
Management & Supervision	O&M Manager / Executive Engineer	1	Overall management, planning, monitoring, reporting
	Assistant Engineer / Deputy Manager	1	Supervision of operations & maintenance works
	Sub Engineer / Inspector	1	Field inspection, fault reporting, coordination
Sewerage & Drainage System	WWTP Operators	2	Operation & maintenance of 3 wastewater treatment plants (shift-based)
	Disposal Station Operators	13	Operation of lift/disposal stations
	Sewerage Electricians / Fitters	2	Electrical + mechanical maintenance of sewer pumps
	Drivers	5	Operation of suction/jetting and maintenance vehicles
	Watchmen	1	Security of disposal stations
Support Staff	Drivers (General)	1	Transport for O&M teams
	Sweepers / Cleaners	1	Cleaning of office and installations

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8.3.6 Priority Projects

A) Provision of New Sewerage and Drainage Network for 67% of Ghotki Urban Boundary (Approx. 1,297 Acres)

1. Project Scope and Justification

According to socio economic survey results, about 67% population of Ghotki city is unserved due to unavailability of sewerage and drainage network.

2. Project Size

Therefore, it is proposed to install new drainage scheme for unserved 67% area of Ghotki City on priority basis, covering an area of 1297 acres. The remaining area of the Ghotki City Urban Boundary needs to be provided a proper drainage and sewerage network in the city. This project will help the inhabitants of the city for easy disposal of storm water drainage and sewage water in to main drainage system.

Table 8-21, Project Size

Population of Ghotki Urban Boundary	170,853
MC Area of City in Acres	4,448
Urban Boundary Area within MC in Acres	2,026.3
Total Coverage of Sewerage and Drainage in Acres	729.5
Installation of New Sewerage and drainage network for 67% (1296.8 Acres) of Ghotki city Urban Boundary @ Rate of 1.5 million Per Acre	1,946

3. Project Benefits

As already discussed above that 67% of Ghotki Urban Boundary is the area of the city which is missing the facility of the drainage network will be served.

4. Implementing Authority

Government of Sindh - PHE Department Ghotki MC.

5. Estimated Cost

PKR 1,946.00 million Approx.

B) Repair and Rehabilitation of Existing Sewerage and drainage Network for 33% Ghotki Urban Boundary (Approx. 729.5 Acres)

1. Project Scope and Justification

In Ghotki City Sewage is mainly disposed of in covered or open drains, and untreated sewage collects in ponds. The drainage system and structures are in poor condition with open smelly drains and sewers. Drains are in poor condition almost in all the city and need to be repaired.

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2. Project Size

According to socio economic survey results 33% (729.5 Acres) of city area is served with drainage system. Almost 90% of respondents from the town are dissatisfied with the current sewerage system. Therefore, it is proposed to repair and rehabilitate existing drainage scheme for Ghotki Urban Boundary on priority basis covering. Repair and Rehabilitation of Primary and Secondary Drains will include the following components;

- Repair of Walls, bed and Top slab of drains, manholes and chambers
- Reconstruction of drains, chambers and manholes were found completely damage
- Cleaning of pipes, chambers, drains and inlet gratings
- Laying of news pipes after replacement of old damage pipes

Table 8-22, Project Size

MC Area of City in Acres	4,448
Urban Boundary Area within MC in Acres	2,026.3
Total Coverage of Sewerage & Drainage in Acres	729.5
Rehabilitation of drainage network for 33% (729.5 Acres) of Ghotki City @ Rate of 0.165 million Per Acre	120.36
MC Area of City in Acres	4,448

3. Project Benefits

After implementing of this project, the overall surface drainage network of Ghotki City with easy disposal to river/canals after the treatment.

4. Implementing Authority

Government of Sindh - PHE Department Ghotki MC.

5. Estimated Cost

120.36 million PKR Approx.

C) Construction of Waste water Treatment Works

1. Project Scope and Justification

Currently, there is no wastewater treatment plant present in Ghotki city. It is recommended to construct at least two wastewater treatment plants with waste stabilization pound for Ghotki City urban boundary 2028.

Waste stabilization pond (WSP) is natural technology which can be installed in centralized or semi-centralized sewerage systems for treatment of domestic and industrial wastewater, septage and sludge, etc. WSPs are highly efficient, simple to construct, low cost and easy to operate.

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2. Project Size

Initially, construction of 3 WWTPs having capacity of 2.25, 2 and 1.15 MGD in zone 1, zone 2 and zone 3 respectively is proposed on priority basis due to be completed in phase wise distribution.

3. Project Benefits

After the implementation of the plan, wastewater will be used for landscaping or maybe for other use.

4. Implementing Authority

Government of Sindh - PHE Department Ghotki MC.

5. Estimated Cost:

708 million PKR Approx.

Table 8-23, Proposed Priority Projects - Ghotki City

S. No.	Project Name	Estimated Cost (in Millions)
Sewerage and Drainage		
1	Installation of New Sewerage network for 67% (2632 Acres) of Ghotki city Urban Boundary @ Rate of 1.5 million Per Acre.	1946
2	Rehabilitation of Existing Drainage Network for 33% (1312 Acres) of Ghotki City @ Rate of 0.165 million Per Acre.	120.36
3	Construction of 3 Wastewater Treatment Works – Phase wise Construction	708

D) Planning Concept for Urban Boundary (2028)

The total projected population of Urban Boundary for year 2028 is 170,853. The total design flow is 30.11 cusec. The diameters use in this urban boundary of 2028 range from 9 Inch diameter RCC pipe to 36 inches diameter RCC Pipe.

Table 8-24, Population of Urban Boundary (2028)

Urban Boundary	Population
	2028
Total Population	170,853

1. Design Flow

Total design flow for the project area is calculated on the basis of design criteria mentioned in Section 3 of **Immediate Action Plan (IAP)** Report. Based on the criteria, design flow of the city is estimated in

Table 8-25.

Table 8-25, Design Flow of 2028

Parameter	Unit	Value
Projected Population	Persons	170,853
Average Water Demand @ 30 GPD	GPD	5,125,590
Average Domestic Sewage Flow @85% of avg. water demand	GPD	4,356,752
Average Non-Domestic Sewage Flow @ 20% of domestic sewage flow	GPD	871,350
Average Sewage Flow	GPD	5,228,102
	Cusecs	10
Infiltration @ 10% of average sewage flow	Cusecs	0.97
Peak Sewage Flow	Cusecs	19.34
Storm water Allowance @50% of peak sewage flow	Cusecs	9.67
Total Design Flow	Cusecs	29.98

2. Disposal Stations

Presently, there exist Three (03) disposal/lift stations in Ghotki city urban boundary. These are used for pumping of the sewage/storm water to the final disposal points. These Disposal stations disposing off the raw sewage into nearby water bodies like Dhingrowah and Bhagowah canal. Disposal Stations is given in **Table** 8-26**.**

Table 8-26, Disposal Stations

S. No.	Name of Disposal Station	Designed Capacity (cusecs)	Rehabilitation/ Non-Functional/ Under Construction
1	Rahmowali	18	Rehabilitation
2	Sadaf Cinema	16	Rehabilitation
3	Anwar Abad	12	Rehabilitation

E) Wastewater Treatment Plant

The treatment and ultimate disposal of municipal wastewater/sewage of Ghotki city is a major concern. Currently, no treatment plant is available for treatment of sewage in the project area of Ghotki city. The raw sewage is being directly disposed into the nearby water bodies (Dhingrowah and Bhagowah canal) or used for agricultural purposes. Three wastewater Treatment Plants (WWTPs) have been proposed for zone 1, zone 2 and zone 3 of capacity of 2.25, 2 and 1.15 MGD respectively. The treated wastewater from the proposed wastewater treatment plants will discharge into the nearby water bodies (Dhingrowah and Bhagowah canal).

Note: *All industries shall install and operate their own wastewater treatment plants (WWTPs), and only treated effluent complying with applicable discharge standards shall be allowed to connect to the city trunk sewer system.*

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Design Capacity

- WWTP 1: 2.25 million Gallons per Day (MGD)
- WWTP 2: 2 million Gallons per Day (MGD)
- WWTP 3: 1.15 million Gallons per Day (MGD)

Components of Treatment Technology

Anaerobic Ponds

- Function: Initial treatment to settle solids and reduce organic load.
- Depth: 3–5 meters
- Retention Time: 1–5 days

Facultative Ponds

- Function: Biological treatment using aerobic and anaerobic bacteria and algae.
- Depth: 1–2.5 meters
- Retention Time: 5–30 days

Maturation Ponds

- Function: Final polishing to remove pathogens.
- Depth: 0.5–1.5 meters
- Retention Time: 5–10 days

Treatment Efficiency

- BOD Removal: 80–95%
- COD Removal 80-85%
- Pathogen Removal: 90–99%
- TSS Removal: 80–90%

Treated effluent is suitable for restricted irrigation or safe discharge to surface waters.

Area Estimation for Treatment Plant

Area needs depend on flow rate, design parameters, and retention times. The following are typical estimates based on standard WSP design:

2.25 MGD WSP

- Flow Rate: ~ 10,225 m^3/day
- Total Area Required: 15.3 Hectare

(Assuming 1.5 hectare per 1,000 m^3 /day for full WSP train)

2 MGD WSP

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- Flow Rate: ~ 8,180 m^3/day
- Total Area Required: 12.27 Hectares

1.15 MGD WSP

- Flow Rate: ~ 5,226 m^3/day
- Total Area Required: 7.84 Hectares

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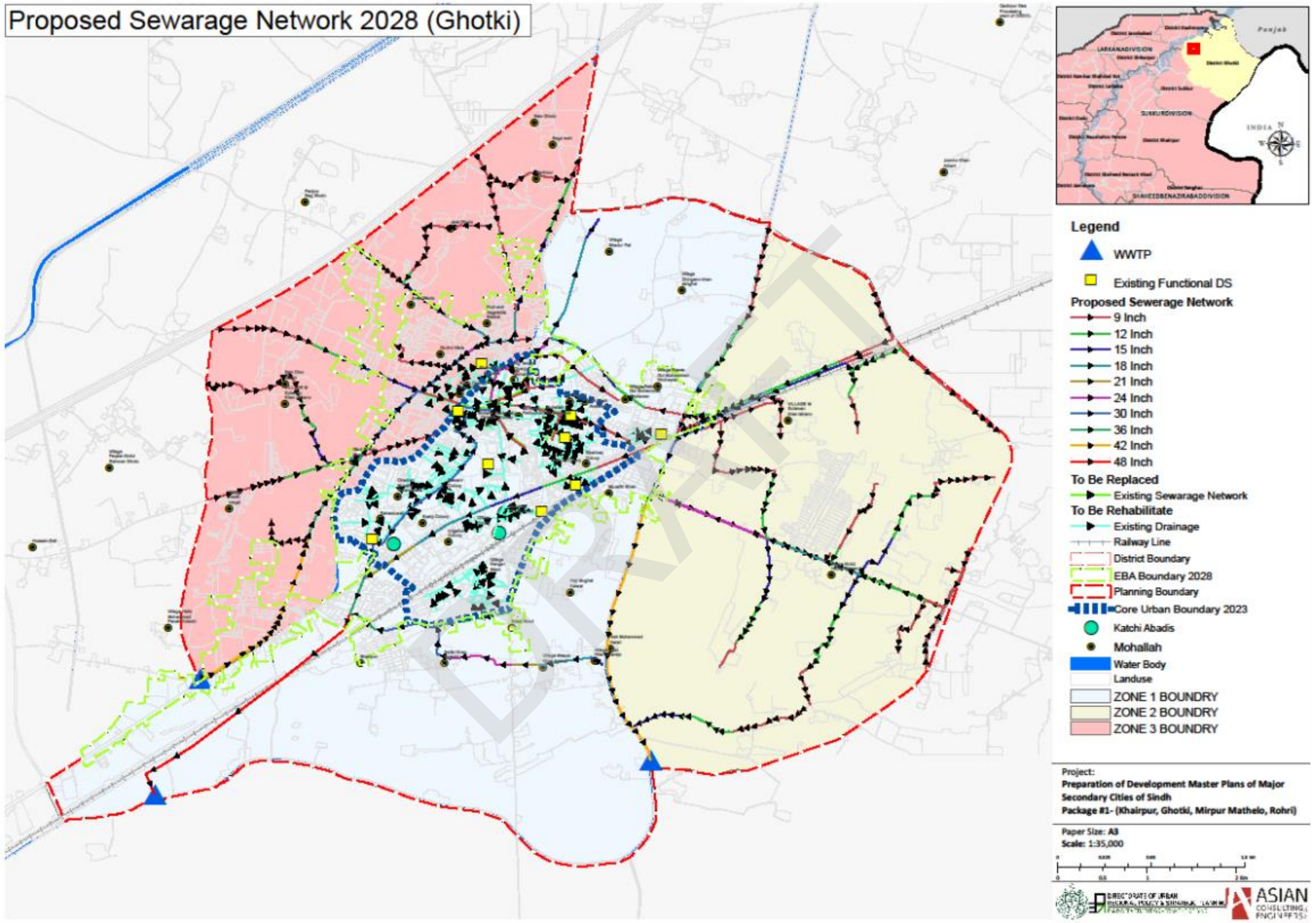


Figure 8-6, Proposed Sewerage System of Ghotki - 2028

Source: *The Consultant Team*

8.3.7 Immediate Action Plan for Core Urban Area

According to the information provided by the Municipal Committee and consultant survey the sewerage and drainage system of Ghotki city consist of underground pipe sewers constructed in various phases. The sewerage/wastewater gravitates to the covered or open surface drains.

Table 8-27, Table of demand and flow for Ghotki Core Urban Boundary

	Description	2025
Ghotki city	Population (Persons)	101,956
	Water Demand (Cusecs)	5.8
	Design Sewage Flow (Cusecs)	18.38

Source: *Consultant's Estimation*

A) Repair and Rehabilitation of Sewerage and Drainage Network Core Area

During the survey the residents complained that, the design of existing drainage network is not fulfilling the present demand. And old sewerage line had burst several times. So therefore, it is proposed to repair and rehabilitate existing sewerage and Drainage network of core city area.

Sr. No.	Name	Total Core Urban Area (acre)	Per acre cost (PKR) million	Cost (PKR) million
1	Sewerage System	1115	0.165	183.98
Total Cost (PKR). Million				183.98

Note: *Sewerage system includes all urban core area network system with all related machinery and equipment.*

Table 8-28, Break Up Plan for Rehabilitation of Sewerage Pipes

Sr. No.	Priority Project List for Sewerage in Core Urban Area of Ghotki	Length (Rft)
G-P-1	Rehabilitation of Sadaf Cinema Disposal Station (Repair of 1 pump)	-
G-P-2	Rehabilitation of Tando Masu Disposal Station (Repair of 2 pumps and 1 Diesel Engine)	-
G-P-3	Replacement of under capacity 18 Inch Sewer TO 21 Inch at Rahmowali road	2,378
G-P-4	Replacement of under capacity 9 Inch Sewer to 12 INCH AT Sain Nahro Shah road	1,384
G-P-5	Replacement of under capacity 12 Inch Sewer to 15 Inch at Sain Nahro Shah Road	531
G-P-6	Replacement of under capacity 18 Inch Sewer to 21 Inch at Sain Nahro Shah Road	256
G-P-7	Replacement of under capacity 9 Inch Sewer to 15 Inch at Qadirpur road	656
G-P-8	Replacement of under capacity 15Inch Sewer to 18 Inch at Qadirpur road	1,218
G-P-9	Replacement of under capacity 18 Inch Sewer to 21 Inch	1,344

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Sr. No.	Priority Project List for Sewerage in Core Urban Area of Ghotki	Length (Rft)
	at Ghotki-Mathelo road	
G-P-10	Replacement of under capacity 12 Inch Sewer to 15 Inch at Ghotki-Mathelo road	1,030
G-P-11	Replacement of under capacity 12 Inch Sewer to 15 Inch at Bago Wah Road	1,280
G-P-12	Replacement of under capacity 18 Inch Sewer to 21 Inch at Bahar Khan Sanghri and Ali Akbar Shah Road	3,784

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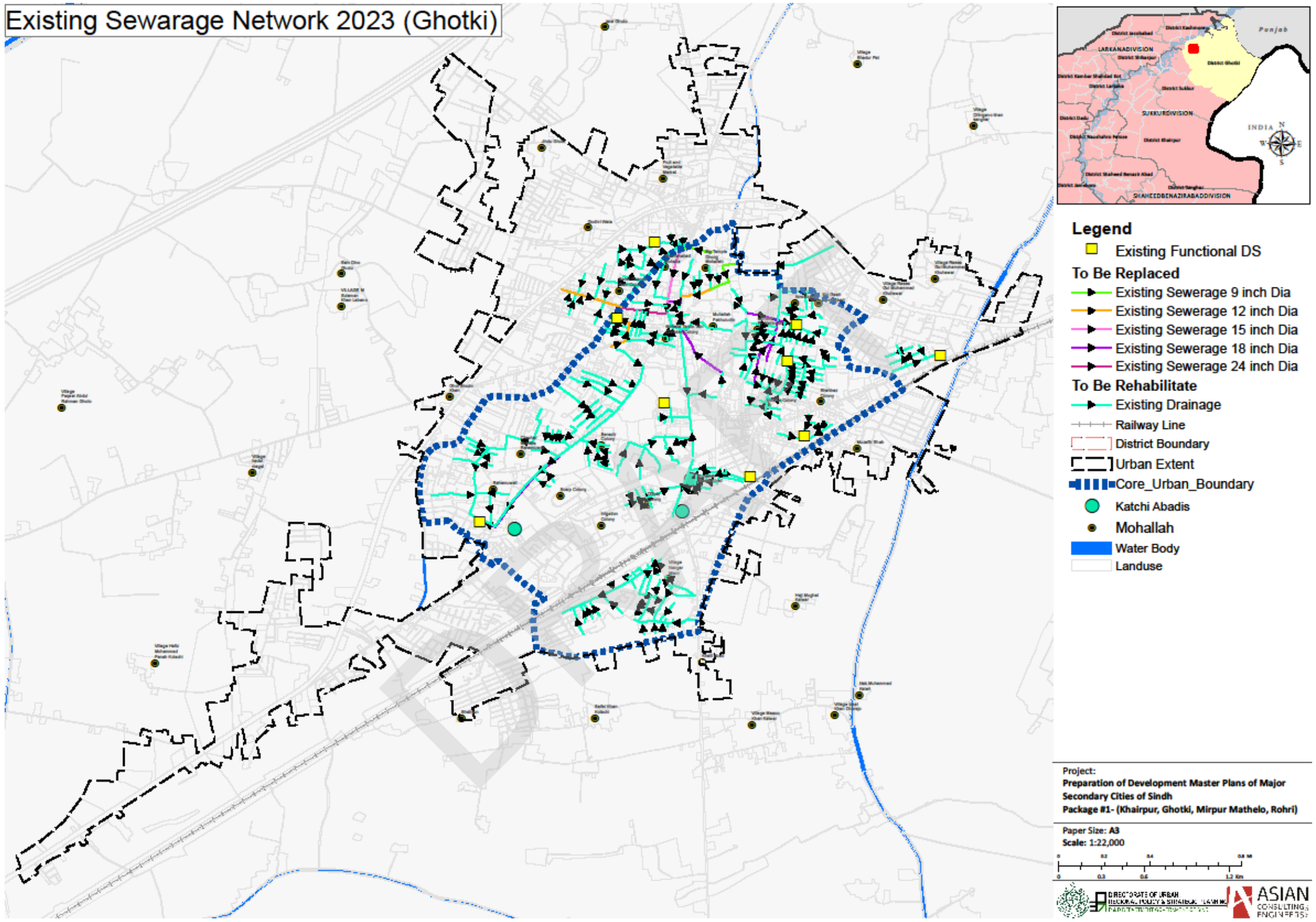


Figure 8-7, Replacement of Major Priority – Sewer Lines Core Urban Area of Ghotki

Source: *The Consultant Team*

B) Planning Concept of Core Urban Area

The total projected population of Core Urban for year 2025 is 101,956. The design flow is 8.87 cusec. The diameters use in this zone range from 82.5 mm to 567.7 mm. The length of pipe of diameter 459.7 mm and 514.9 mm is 1218 ft and 7,762 ft respectively.

Table 8-29, Population of Core Urban Boundary

Core Urban	Population
	2025
Total Population	101,956

1. Design Flow

Total design flow for the project area is calculated on the basis of design criteria. Based on the criteria, design flow of the city is estimated in **Table** 8-30.

Table 8-30, Design Flow of 2025

Parameter	Unit	Value
Projected Population	Persons	101,956
Average Water Demand @ 30 GPD	GPD	3,058,680
Average Domestic Sewage Flow @85% of avg. water demand	GPD	2,599,878
Average Non-Domestic Sewage Flow @ 20% of domestic sewage flow	GPD	519,976
Average Sewage Flow	GPD	3,119,854
	Cusecs	5.93
Infiltration @ 10% of average sewage flow	Cusecs	0.59
Peak Sewage Flow	Cusecs	11.86
Storm water Allowance @50% of peak sewage flow	Cusecs	5.93
Total Design Flow	Cusecs	18.38

2. Disposal Stations

Presently, there are 3 disposal/lift stations in Ghotki city core urban boundary. These are used for pumping of the sewage/storm water to the final disposal points. These Disposal stations disposing off the raw sewage into nearby water bodies like Mirpur Minor Canal.

Disposal Stations is given in **Table** 8-31.

Table 8-31, Disposal Stations

S. No.	Name of Disposal Station	Designed Capacity (cusecs)	Proposed
1	Sadaf Cinema	16	Rehabilitation
2	Rahmowali	18	Rehabilitation
3	Anwar Abad	12	Rehabilitation

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8.4 Solid Waste Management

8.4.1 Existing Situation

A comprehensive situational analysis of Ghotki City has been conducted to assess the current circumstances, identify key challenges, and evaluate the effectiveness of existing systems in place. This analysis provides a clear understanding of the city's waste management issues, infrastructure limitations, and operational inefficiencies, offering valuable insights for the development of targeted solutions and strategic interventions.

Based on the current waste management scenario, several critical gaps have been identified that necessitate the formulation of a Strategic Development Plan. The city generates approximately 66 tons of waste daily from diverse sources, including residential, commercial, industrial, and construction sectors. However, only 38% of this waste is efficiently collected due to inadequate equipment efficiency, high operating costs, and insufficient manpower. Transportation challenges exacerbate the issue, with outdated and inefficient machinery consuming excessive fuel and time while offering minimal service efficiency. Furthermore, the shortage of sanitation manpower and vehicle operators has severely limited the city's ability to achieve targeted waste management outcomes. Open dumping sites within city limits further compound the problem, posing significant health hazards, environmental degradation, and mental stress for residents. Addressing these critical gaps requires a well-structured and sustainable strategic development plan to enhance waste management operations and improve the quality of life for the city's inhabitants.

A) Summary of Existing Resources

The following human resources, tools and equipment, and machinery resources are already available in the city to conduct regular solid waste management operations.

1. Machinery, Tools, Equipment, and Dump Site Machinery

Table 8-32, List of Existing Machinery, Tools, Equipment, and Dump Site Machinery

Equipment/machinery	2023	
	Operational	Gap
Hand carts (0.25 m3)	11	19
Mini Tipper (01 m3)	0	10
Containers (0.8 m3)	6	10
Mobile Compactor (8.0 m3)	0	02
Front blade tractors	0	01
Tractor trolleys	06	30

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Equipment/machinery	2023	
	Operational	Gap
Arm roll truck (5.0 m3)	01	01
Front end loaders	02	01
Water bowser with tractor	01	01

2. Human Resources

Table 8-33, Existing Human Resources

Year		Sanitary workers	Vehicle Drivers	Supervisors	Sanitary Inspectors	Clerks	Other Staff
2023	Available	172	05	00	00	01	00
	Gap	40	07	07	02	01	03

B) Solid Waste Generation as per Population Projection

To calculate the future equipment and machinery demands, it is required to calculate annual solid waste generation for the given years. The waste generation estimations are based on the population for each respective year.

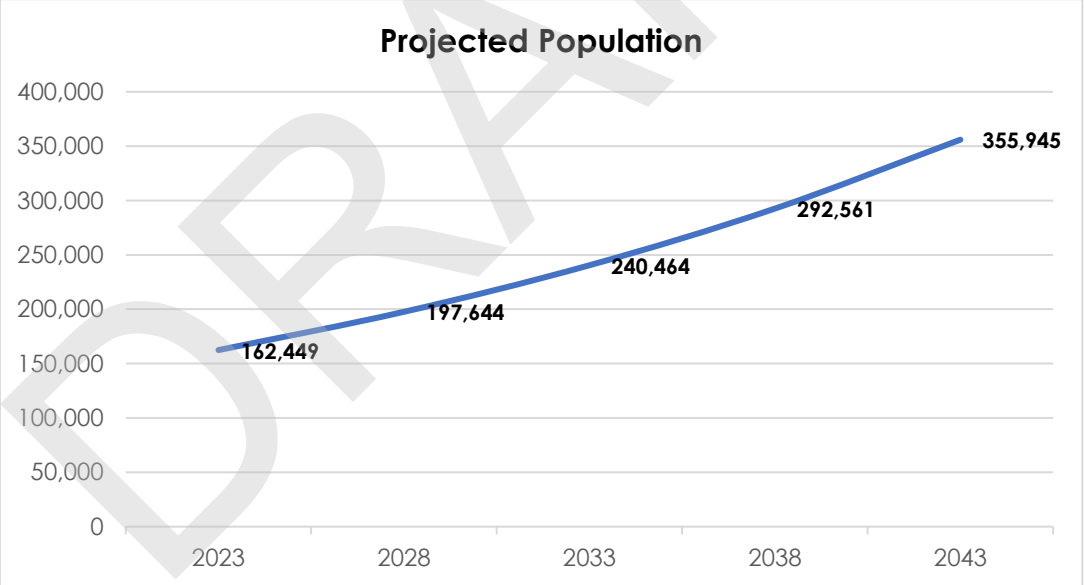


Figure 8-8, Population Projection

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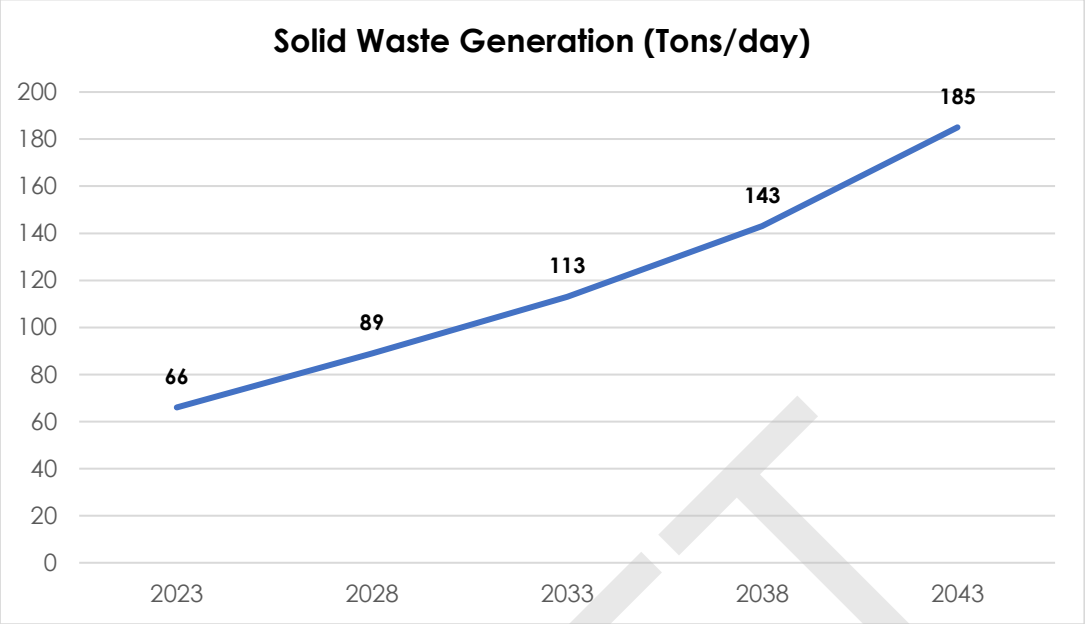


Figure 8-9, Solid Waste Generation

8.4.2 Issues and Gap Analysis

Table 8-34, Issues/Gap Analysis

Areas	Gaps/Issues Identified
Waste Generation	According to 2023, 66 tons/day waste is being generated. This huge amount of waste is generated either from residential, commercial, industrial areas as well as from construction and demolition waste.
Collection	According to 2023 solid waste generation, the total waste collection efficiency is 38%. Municipal solid waste collection lacks 62% of waste collection efficiency due to Poor efficiency of equipment and machinery Large operating cost Insufficient man power
Transportation (Equipment and Machinery)	The existing equipment and machinery are being operated at its full capacity but still it is not possible to attain full-service efficiency due to low efficiency of equipment consuming larger time and money in its operation. The tractors trolleys are slow moving and consuming large fuel & time but carry only one third of the waste to dumping sites as compared to the compactor trucks. Similarly, the container carriers haul only one container carrying 3.0 m3 of waste to the dumping site. These carriers are also hauled by tractors having slow speed, high fuel consumption and very low efficiency. The proposition of continued use of this equipment with enhanced number of manpower will not cure the problem. Rather it will increase the operation and maintenance cost with very little improvement of the service delivery level.

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Areas	Gaps/Issues Identified
	Both of these secondary collection systems are having poor efficiency and also require larger manpower as compared to the existing.
Manpower	MC Ghotki is facing sanitation manpower shortage for rendering services to the entire city. For accruing the targeted benefits from the project. Vehicle drivers and other allied staff need to be recruited by MC for which sanction of the competent authority is required. Present ban on the recruitment needs to be filled for this recruitment.
Disposal	The present open dumping sites are located in the city and are big health hazards for the inhabitants as these are breeding vectors, producing obnoxious smell, deteriorating and degrading the city environment and producing large mental frustration. MC will continue to dump the waste in the present dumping sites.

8.4.3 SWOT Analysis

To effectively cope with the challenges of providing municipal services of the city, a detailed analysis on strengths, weaknesses, opportunities, and threats (SWOT) was carried out to assess possible weaknesses and potential threats in the execution of service provision, so as to devise a plan of action to overcome these, utilising present strengths and available opportunities. These are explained below:

Strength	Weaknesses
Institutional and Financial • Management – An organizational structure for SWM of the city is available • Health and Safety – Provisions in the Manuals to safeguard employees • Capability – Available vacant positions for sanitary workers, vehicle driver and sanitary inspectors and clerk • Motivation- Compliant cell is available to ensure SWM operations in proper legal and ethical way • Financial Management – Financial Systems in place • Monitoring – Monitoring is carried out by Local Government and District Administration **Solid Waste Operations**	**Institutional and Financial** • Management: -Insufficient strategic approach for SWM & Political influence at the organizational level • Staff –Insufficient sanitation workers to cover the entire city • Health and Safety – Disposal sites are not too far from the city (05 & 04 km approximately), causing health implications • Capability - Lack of staff capability • Motivation- no proper disposal of complaints • Financial Management – No financial resources available for environmental management system and cleaner production

• Coverage – 38% door to door collection and Street Sweeping is carried out on main roads and bazar • Data- Systems available and real-time system adopted by SWMC • Parking and Storage – Sufficient number of available machinery and equipment • Workshop – Can maintain a vehicle for minor repairs • Fleet Capacity –Sanitation workers of the city work in two shifts • Waste Containers – Street Sweeping is carried out on main roads and bazar • Disposal Facility-Sharing of a single solid waste storage area i.e., dumping sites • Route Planning-Proper Route planning	• Monitoring – Monitoring without KPIs **Solid Waste Operations** • Data-Lack of data base for tracing of vehicles • Parking and Storage facility – one disposal site almost filled and closed • Workshop – Need maintenance/repair of tractor trolleys, containers, front end loaders and dumper • Fleet Capacity – Lack of sanitation manpower to cover the entire city (collection efficiency is 38%) • Waste Containers - No 3-bin system is installed • Transfer Stations – Not available nor Time and motion study conducted • Disposal Facility – No engineering-controlled landfill site is available in the city • Taxation-Lack of Solid Waste taxation • Treatment – Un-availability of solid waste treatment technologies • Route Planning-Lack of route optimization
Opportunities	**Threats**
Institutional and Financial • Management – To fill the positions and make use of the available tiers • Staff – Increase in employment opportunities • Health and Safety – Reduce health risks (water borne diseases) & Maintaining cleanliness for creating a positive ambiance and promoting good health • Capability - Can be enhanced by filling the vacant posts • Motivation- Improvement in country's economy • Financial Management – Regularized and implementing terrif	**Institutional and Financial** • Management: Decision not given due consideration due to lack of qualified staff • Staff – Work overladed to nontechnical staff • Health and Safety – Staff exposed to a range of hazards thus vulnerable • Capability – Insufficient awareness of the public regarding solid waste management • Motivation- Poor corporation from residents (specially entrepreneurs)

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• Monitoring – Proper KPIs for monitoring can increase efficiency **Solid Waste Operations** • Data- Systems available and real-time system adopted by SWMC • Parking and Storage – Places marked and budget for construction • Workshop – By Upgrading vehicles can be maintained for all purposes • Fleet Capacity – Adequate for next 7 years • Waste Containers – Workshop may include manufacturing and repairing containers • Transfer Stations – Promoting resource recovery and composting for sustainable waste management • Disposal Facility –Engineered Landfill Site can be established • Treatment – Implementing circular economy principles to reduce solid waste and promote recycling &Installation of a biogas plant in a solid waste management center • Route Planning – Upgradation of Routes can increase efficiency	• Financial Management – Overbilling, under billing and nonproductive results • Monitoring – Satisfaction without due consideration leading to no improvement **Solid Waste Operations** • Data- No backups • Parking and Storage – Vehicle parts theft and cleanliness • Workshop – Cost of repairs rising • Fleet Capacity – Low amounts of On-road vehicles • Waste Containers - Theft /Non-maintenance causing a decrease in collection capacity • Transfer Stations. – The increasing cost of waste transportation • Treatment – Low value of recyclable solid waste • Disposal Facility – Lack of control over disposal sites operations • Route Planning - High cost for Waste Collection • Extreme weather events due to climate change can disrupt solid waste management systems and create additional challenges

8.4.4 Need Assessment and Policy Guidelines

Need Assessment	Relevant Policy Guidelines
Need for effective waste management strategies to handle 66 tons/day of waste	**Sindh Solid Waste Management Board Act, 2014:** Empowers the collection and disposal of solid waste, supports and promotes waste management schemes, and regulates waste generation and disposal.
Improve waste collection efficiency	**Sindh Local Government Ordinance, 2013:** Endorses the management, operation, and maintenance of sanitation disposal and solid, liquid, industrial, and hospital waste collection.
Upgrade inefficient collection equipment and machinery	**Sindh Solid Waste Management Board Act, 2014:** Allows for the improvement, maintenance, and construction of

Need Assessment	Relevant Policy Guidelines
	machinery and related infrastructure for waste management.
Increase manpower for waste collection and enhance their safety	**Sindh Occupational Safety and Health Act, 2017:** Provides a framework for safe working conditions, which supports the recruitment and safety of sanitation workers.
Modernize or replace low-efficiency transportation equipment	**Sindh Solid Waste Management Board Act, 2014:** Authorizes the improvement and maintenance of machinery, enhancing transportation efficiency for waste management.
Explore cost-effective and fuel-efficient transportation solutions	**Sindh Solid Waste Management Board Act, 2014:** Supports the implementation of efficient waste management schemes, including transportation.
Redesign secondary collection systems to reduce manpower needs	**Sindh Local Government Ordinance, 2013:** Encourages the improvement of waste collection systems under local government regulation.
Recruit additional sanitation workers	**Sindh Occupational Safety and Health Act, 2017:** Establishes a framework for recruitment and safety in workplaces, relevant for expanding the sanitation workforce.
Lift recruitment ban to address manpower shortages	**Sindh Occupational Safety and Health Act, 2017:** Supports consultations between workers, employers, and government, which can influence decisions on lifting recruitment bans for necessary staffing.
Relocate dumping sites away from residential areas	**Sindh Environmental Protection Act, 2014 (SEPA 2014):** Provides the legislative framework for environmental protection, including the location and management of dumping sites.
Implement safe and environmentally friendly waste disposal methods	**The Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2014:** For landfill/leachate/MRF, include an EIA/IEE pathway, EMP with monitoring, and budget for environmental controls; tie construction start to NOC issuance in the phasing plan.
Implement safe disposal methods for	**Sindh Hospital Waste Management**

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Need Assessment	Relevant Policy Guidelines
hospital waste	**Rules, 2014:** Mandates hospitals to manage waste using internationally or nationally recognized practices, ensuring safe disposal.
Handling and disposal of hazardous substances	**Hazardous Substance Rules, 2014**: Provides regulations for handling, storage, and disposal of hazardous substances, including waste management plans and safety precautions.

8.4.5 Strategic Development Plan

The initial assessment has already been conducted through stakeholder engagement, as presented in **Section 1.1** of this report. The subsequent steps of the strategic plan are outlined below:

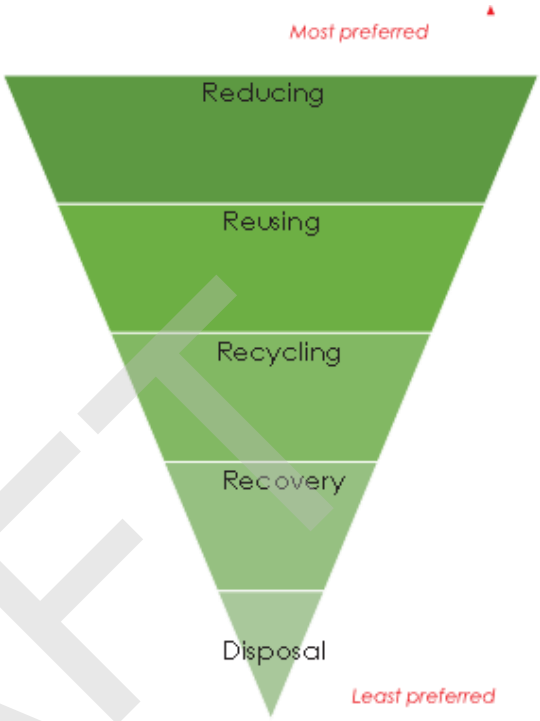
A) Vision and Goal Setting

In order to address the weaknesses and threats as mentioned in the SWOT analysis, MC has developed a SSWMP 2023-2043 for the city in order to establish, a resource recycling, financially sustainable and environmentally sound waste management system in the city. SSWMP includes a comprehensive list of priority projects including actions and implementation based on the existing situational analysis conducted through quick study and series of workshops and meetings on strategy development.

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B) Waste Management Hierarchy

The waste management hierarchy as shown, is widely referred to in promoting the 3Rs concept, or Reduce – Reuse – Recycle. Accordingly, the most preferred option in the waste hierarchy is to prevent the waste being generated at the outset, and the next preferred option is to reduce amounts generated. Likewise, the least preferred option is the final disposal, which should be practiced only after attempting to implement the other preferred strategies.



The first step of the SSWMP is to establish the priorities whereas the next step of the plan is to provide broad guidelines to suggest measures to manage the growing solid waste of the city. This has been determined after assessing the potentials and constraints in the existing solid waste management of the city. The plan is prepared with 20 years perspective from year 2023 to year 2043. This section of the report deals with an outline of proposals regarding;

- Action plans to cater for needs of present and future population in municipal services.
- Capacity building for O&M of the municipal services is also proposed in these Action Plans.

According to the developed vision, the following strategic objectives are to be achieved:

- Attain the required institutional and human capacity and reduction in the amount of waste to achieve 100% waste collection efficiency in coordinated, integrated and transparent manner.
- A comprehensive and sustainable approach towards improving waste collection, storage, transfer, disposal and treatment, including hazardous waste must be implemented in the shape of an action Plan.
- Installation of additional and appropriate tools and vehicles to regularized and equitable house-to-house waste collection, community storage, transfer and disposal.
- Availability of financial resource for environmental management system and cleaner production.

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C) Timeframe and Phased Implementation

The strategy will be rolled out in five sequential phases, each of five years, scaled to the realities of Ghotki. A deliberate spatial break-up anchors works where they deliver the greatest early gains, eases management and contractor oversight, and creates clear hand-offs into the next phase. This staging also enables proactive financial planning—with predictable capital and O&M needs defined ahead of each tranche—while progressively upgrading to higher, technically enhanced service levels. Each phase will remain adaptive, allowing design and implementation to evolve with on-ground conditions, demand growth, institutional capacity, and lessons learned from the preceding phase.

D) Proposed Management Structure

A clear management structure keeps city solid-waste services coordinated, accountable, and safe. It defines:

- Who plans, operates, regulates, and pays; preventing gaps and enabling performance-based contracting and safe informal-sector integration.
- Rapid decisions and emergency response, ensures legal compliance (Sindh EPA/SSWMB), and protects workers and communities.
- It centralizes community engagement and GRM, improves data flow and audits, and drives continuous improvement from segregation to final disposal.

A structured management plan, roles/responsibilities, and coordination between various sectors is shown below:

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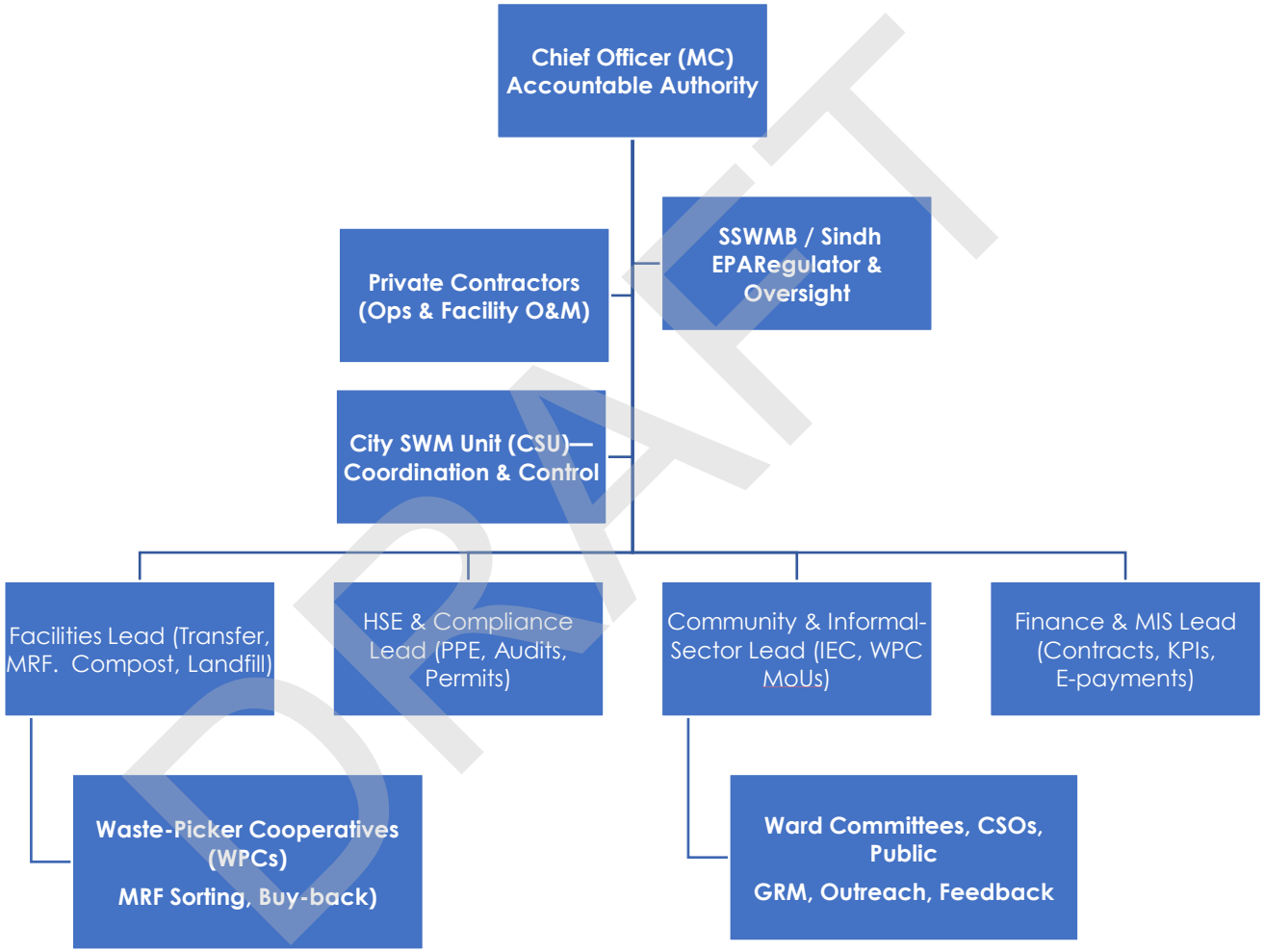


Figure 8-10, Proposed Management Structure - SWM

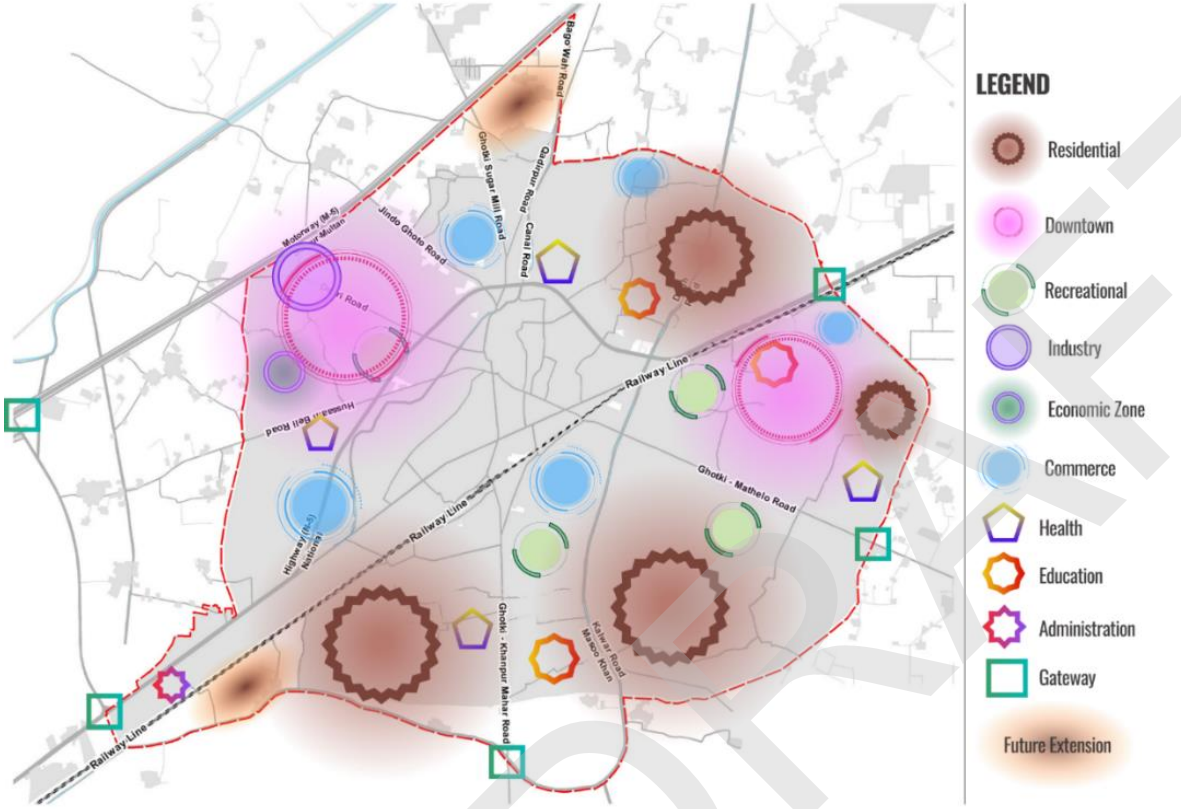
Source: *The Consultant Team*

Under the Chief Officer (MC), the City SWM Unit (CSU) coordinates all services while SSWMB/Sindh EPA provide regulatory oversight. Private contractors handle collection, transport, and facility O&M (transfer/MRF/compost/landfill) under performance-based SLAs, reporting to CSU Ops/Facilities; HSE & Compliance lead joint inspections and incidents. The Community & Informal-Sector Lead formalizes WPCs and manages IEC/GRM; Finance & MIS aggregates GPS/weighbridge/e-manifest data for KPI dashboards and payment certification. Weekly O&M huddles, monthly reviews, and CSU→Chief Officer escalation keep field work, compliance, community input, and finance aligned for end-to-end accountability.

E) Provision of Solid Waste Management Resources for Future Solid Waste Management

To calculate the future equipment & machinery and manpower, it is required to calculate annual solid waste generation for the given years based on population projection and land use. The proposed urban structure of the city and population projection are given below:

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Land uses	Existing Percentage Distribution	Proposed Percentage Distribution
Residential	51%	40%
Commercial	8%	8%
Parks and Playgrounds	1.42%	20%
Amenities	6.3%	10%
Industrial	7%	7%
Transportation	13.5%	15%
Other	12.8%	-
Total	**100%**	**100%**

Figure 8-11, Proposed Urban Structure of the City

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The waste generation estimations are based on the population for each respective year.

- Conversion of daily waste generation to annual waste generation.
- Estimation of the number of each type of equipment needed based on their average capacity.

Table 8-35, Population Growth in Different Census Periods and Estimated Solid Waste Generation

Year	Projected Population	Population Increase	Waste generation (Tons/day)
2023	162,449	-	66 (as per existing baseline)
2028	197,644	35,195	89
2033	240,464	42,820	113
2038	292,561	43,002	143
2043	355,945	63,384	185

**0.42 kg/capita/day*

***0.45 kg/capita/day*

****0.47 kg/capita/day*

*****0.49 kg/capita/day*

******0.52 kg/capita/day*

(Assuming a nominal per capita increase in MSW generation of 01 percent per annum or two)

8.4.6 Equipment and Machinery

With the increase in solid waste generation, it is essential to scale up our machinery and equipment as well as the maintenance of the available resources. This expansion will ensure we can efficiently handle the rising waste volume and maintain effective waste management practices.

Assuming each equipment operates 300 days a year for calculation purposes:

$$\textbf{Number of Equipment} = \frac{\textbf{Annual Waste Volume}}{\text{Capacity/ equipment *trips/year}}$$

Table 8-36, Total Estimated Machinery Requirement for the City with 20 Years Interval throughout the Project Life i.e., 2043

	Additional Requirement					
Equipment/machinery	**2023**		**2028**	**2033**	**2038**	**2043**
	Operational	**Gap**				
Hand carts (0.25 m³)	11	19	44	71	109	170
Mini Tipper (01 m³)	0	10	22	36	55	85
Containers (0.8 m^3)	6	10	37	60	91	141

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Equipment/machinery	Additional Requirement					
	2023		2028	2033	2038	2043
	Operational	Gap				
Mobile Compactor (8.0 m³)	0	02	06	09	14	21
Front blade tractors	0	01	03	04	05	06
Tractor trolleys	06	30	48	61	77	100
Arm roll truck (5.0 m³)	01	01	03	13	04	04
Front end loaders	02	01	04	06	07	08
Water bowser with tractor	01	01	03	05	07	09

A) Mechanical Sweeping and Washing

1. Mechanical Sweeping

The Mechanical Sweeper will operate on the major roads for 6 hours daily, covering a minimum distance of 20 kilometres daily. This operation must ensure that the main roads remain clean and debris-free, contributing to a cleaner urban environment. The sweeper will follow a scheduled route, focusing on high-traffic areas and key locations within the municipality to maximize efficiency and effectiveness.

2. Mechanical Washing

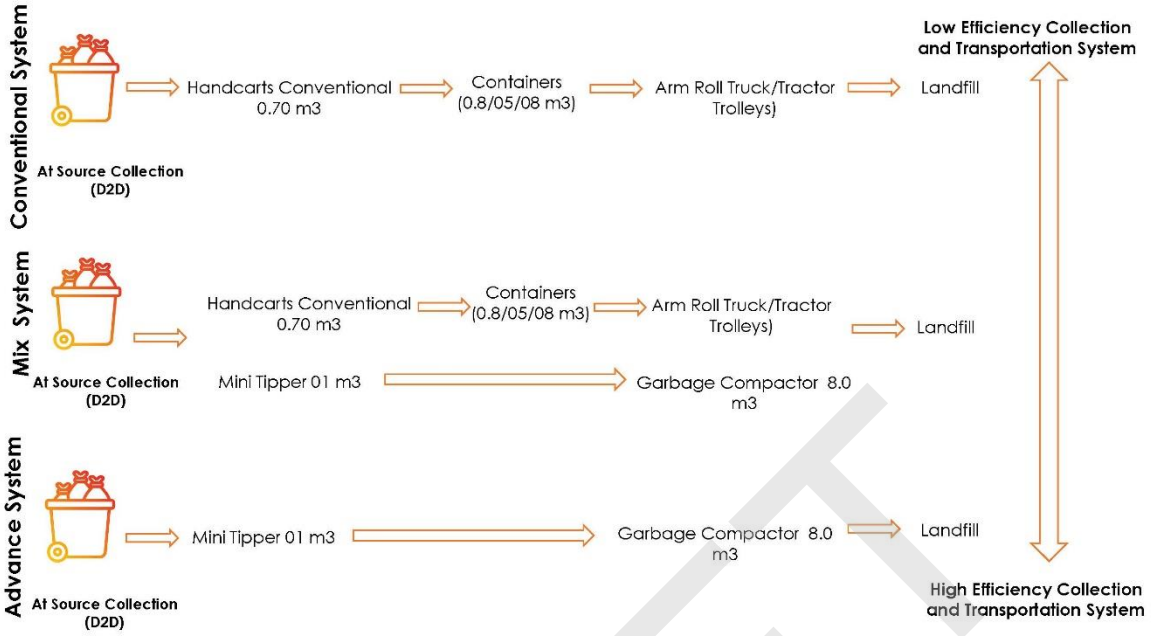
Mechanical washing is another important component of a waste management system. Public places, major roads, dividers, and walkways will be washed to improve their cleanliness. It is proposed to wash/sprinkle the major roads as specified below (min. 05 KM daily per 01 tractor-mounted water bowser/washer) and the walkways of the tehsil through washers to improve their working efficiency and cleanliness standards.

3. Manual Sweeping & Drain Desilting Operations

A dedicated team of sanitary workers equipped with necessary operational tools will manually sweep the area and de-silt the tertiary drains. One drain cleaner will also be deployed separately in urban and rural areas.

- Manual sweeping in the first shift is carried out from 6 AM to 2 PM.
- The tertiary drains will be de-silted and opened 2 feet wide, and one drain cleaner will be deployed separately for urban and rural areas.
- Personal protective equipment includes uniforms, Gloves, Shoes, and Jackets for the winter season.
- Operational Requirements for Sanitary Workers include a Broom, Shovel, Scrapper, Hand Cart, and De-silting tools.

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Transitioning Toward an Efficient Solid Waste Management System

The flowchart illustrates the progression from conventional to advanced solid waste management systems, highlighting a shift in efficiency and operational capacity. Beginning with basic handcart-based collection and transportation methods, the system evolves through intermediate mixed approaches to advanced high-efficiency collection and disposal practices. This structured transition underscores the importance of integrating improved technologies, such as garbage compactors, mini tippers, and arm roll trucks, coupled with at-source collection initiatives, to achieve sustainable and effective waste management solutions.

B) Manpower Calculation

To calculate the manpower needed for solid waste management by categorizing the staff into sanitary workers, vehicle drivers, supervisors, sanitary inspectors, clerks, and other support staff, the number of each type of staff required for each year based on the equipment and tasks needs to be estimated.

1. Assumptions for Staff Categories

- **Sanitary Workers:** Handle waste collection, operate hand carts, and assist with containers.
- **Vehicle Drivers:** Drive and operate tractor trolleys, arm roll trucks, container carriers, front blade tractors, front end loaders, and dumper trucks.
- **Supervisors:** Oversee operations; assume 01 supervisor per 50 workers.

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- **Sanitary Inspectors:** Monitor sanitary conditions; assume 01 inspector per 100 workers.
- **Clerks:** Handle administrative tasks; assume 01 clerk per 200 workers.
- **Other Staff:** Includes mechanics, cleaners, and support staff; assume 01 per 50 workers.

The estimated proposed staff/manpower is given below:

Year		Sanitary workers	Vehicle Drivers	Supervisors	Sanitary Inspectors	Clerks	Other Staff
2023	Available	172	05	00	00	01	00
	Gap	40	07	07	02	01	03
2028		227	28	09	04	02	06
2033		276	45	11	06	03	09
2038		335	68	13	08	04	12
2043		408	106	16	10	05	15

C) Planning and Management for Fleet

Collection, operation and maintenance should be observed and monitored by:

- Planning collection routes
- O & M of collection vehicles (preventive maintenance)
- Management of the workforce
- Communication
- Monitoring (IT based monitoring system)

1. Planning Collection Routes

Planned and designed carefully to cover all areas including:

- Planned in respect to least distance and minimum fleet
- Take into account traffic conditions
- Take care of any local legislations for example, weight limits on roads or bridges
- Avoid turns across traffic (difficult U turns will and should be avoided)
- The designation for collection routes for vehicles requires an intelligent common-sense approach rather than high technology
- Study the operation

2. Operation and maintenance (O & M) of vehicles

- Vehicle washing before and transfer of waste

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- Fully gauged with safety equipment and limitations system (e.g., signals, alarm, light, cautions etc.)
- Enabled vehicle monitoring system
- Comprehensive and accurate data collection and good planning
- Computer programs for planning vehicles routes
- Knowledge and awareness
- Modern mode of communication and smart planning

3. Management of the Workforce

- Planning
- Allocation of duties
- Defining tasks
- Timings
- Number of trips
- Task and Finish system

4. Communication

There are three levels of communication: at the parking yard, at the beginning of the shift and at the end of shift.

- Equipe supervisors and team with a means of communication
- Mobile phone or two-way radio

5. Monitoring

Collection of data: Routine basis, from time to time and representative of the normal situation.

Analysis: Comparison of current performance with previous performance comparison of, comparison of performance in two locations, comparing the performance of loading crew, comparing drivers, anticipating the effects of possible changes in management, estimating the cost of alternative collection system, comparing actual productivities and unit cost with those expected while system designing or at planning stage.

Smart/IT Monitoring System

Vehicle trip counting system covers:

- Real time monitoring of trips & weight, real time monitoring of waste disposed-off in dumping through radio frequency-based device, internal protocol camera (IP cameras) and weighbridge, digital database of each trip and monitoring of town zone and UC wise tonnage.

Live monitoring of SWM fleet

This monitoring system covers:

- Trackers to be installed in all SWM vehicles, all the movements of vehicle are continuously monitored through this system, is case of violation of route /plan or over speeding will be recorded & fined and stooped time report of all SWM vehicles is prepared on daily basis for their performance monitoring.

8.4.7 Intermediate Treatment Options

Once full collection coverage and environmentally sound disposal practices are established, and where financially feasible, institutional-level waste separation and recycling should be prioritized as the next step in improving the waste management sector. Policies that promote waste reuse, recycling, and resource recovery offer significant environmental benefits and should be integral to waste management strategies. Currently, a substantial portion of recycling and resource recovery is carried out by the informal sector. Establishing citywide biogas generation and composting plants, especially in larger cities with economies of scale in mind, can help move waste management systems further up the waste hierarchy. This approach becomes even more viable if regional waste treatment and disposal facilities are adopted at the provincial or regional level.

Large-scale composting and refuse-derived fuel (RDF) facilities have been established in some areas under public-private partnerships (PPP). However, these facilities often operate at reduced capacity or have shut down due to operational challenges. With focused attention and support from local and provincial governments, these facilities can be revived and brought back to full operational capacity.

Siting of waste disposal facilities	Design of waste disposal facilities	Operation and Management
• Policy framework • Guidance criteria for locating disposal facilities	• Survey • Key infrastructure components • Types of design standards	• KPIs for operation • KPIs for management • Outcomes of poor operation and management

A notable example of innovative waste treatment is the development of biogas plants to support urban transit systems. For instance, waste from livestock or other organic sources can be converted into bio-compressed natural gas (bioCNG) to fuel public transportation systems, while also producing valuable by-products such as compost, liquefied carbon dioxide (CO2), and treated water for non-potable uses. Such initiatives demonstrate how integrated waste management can contribute to environmental sustainability, energy generation, and resource recovery.

This gradual approach, combining institutional support, technological solutions, and community engagement, can significantly improve waste management outcomes and contribute to a circular economy.

Table 8-37, Landfill Requirement Over 2043

Year	Population	Generation		Impact of 4Rs: reduction, reuse, recycling and recovery (20%)	Collection			Disposal		Landfill site requirement in acres
		Per Capita (Kg)	Total (Kgs)		Collection Efficiency %	Total Weight kg (W_T)	Total Volume, m3	Yearly volume m3	Accumulative volume m3	
2023	186169	0.42	78190.86	62552.68	38	23770	47.54	17352.11	17352.11	0.43
2028	226503	0.45	101926.21	81540.97	54	55040	110.08	40179.31	181312.69	4.47
2033	275575	0.47	129520.32	103616.26	69	89369	178.74	65239.39	455519.67	11.24
2038	335279	0.49	164286.87	131429.49	83	136358	272.72	99541.41	884389.29	21.83
2043	407919	0.52	212117.65	169694.12	100	212118	424.24	154845.88	1546908.59	38.18

Assumptions

- Looe waste density assumed to be 300 kg/m³ and compacted waste assume to be 600 kg/m³
- Landfill Depth: Set at 10 feet (approximately 3 meters).
- Area Conversion Factor: Converts volume to acres: 1 acre=4046.86 m²
- 4Rs Impact: Assumes a 20% reduction in waste through recycling, reuse, and recovery.
- Collection Efficiency: Gradually improves from existing to future.

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8.4.8 Disposal and Landfill Requirements

Effective disposal and landfill management are essential components of a sustainable solid waste management system. In Ghotki City, the increasing volume of waste, projected to reach 185 tons per day by 2043, necessitates the establishment of well-designed and environmentally compliant landfill facilities. Current disposal practices, which rely on open dumping sites located within city limits, pose significant health hazards, environmental degradation, and community distress. This section outlines the strategic measures required to address these challenges, including waste reduction through the 4Rs (Reduce, Reuse, Recycle, and Recovery), improved waste collection efficiency, and the development of engineered landfill sites. By transitioning to modern landfill practices, Ghotki City can mitigate environmental risks and enhance the overall quality of life for its residents.

A) Proposed Solid Waste Landfill Site – Ghotki City

1. Site Location

The proposed landfill site for Ghotki City is located at **27° 57'1.62"N, 69° 17'11.37"E,** as indicated on the map below (Figure 2-2). The site lies on the outskirts of the city, south of the main urban settlement, with access from nearby secondary roads, facilitating collection and transportation of municipal solid waste. The proposed location has been identified after careful consideration of environmental, social, technical, and regulatory factors to ensure safe and efficient waste disposal up to the year 2043.

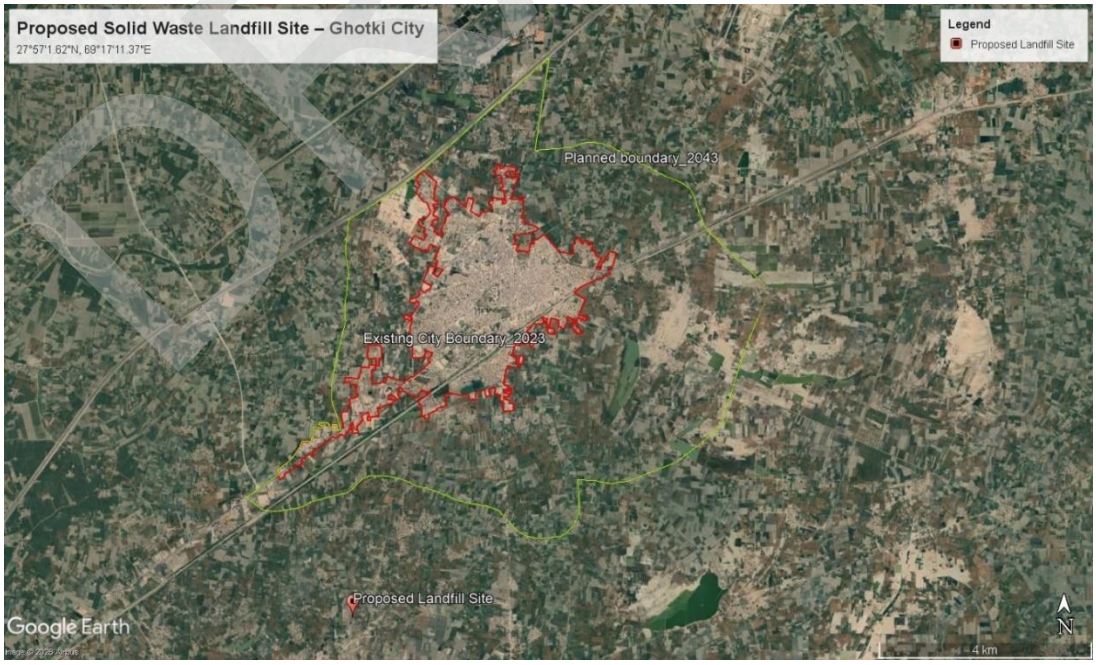


Figure 8-12, Proposed Solid Waste Landfill Site – Ghotki City

The image shows the city boundary in red, planned boundary of 2043 in green and the proposed landfill site marked with a red pin. Surrounding areas

consist of agricultural land and minor settlements, while the site is sufficiently distanced from major water bodies and sensitive receptors. The overall site criteria is given below:

Criteria	Requirement / Standard	Site Assessment (27°57'1.62"N, 69°17'11.37"E)	Remarks / Notes
Distance from water bodies	≥250–500 m	~1–2 km from nearest canal/river	Acceptable; buffer sufficient
Groundwater depth	Preferably >2–3 m	Likely 3–5 m	Moderate; groundwater monitoring recommended
Soil type / permeability	Low permeability (clay preferred)	Predominantly alluvial sandy-loam	Engineered liner required
Flood risk / floodplain	Avoid flood-prone areas	Slightly elevated terrain	Acceptable; minor grading may be needed
Distance from settlements	≥500–1000 m	~1–2 km from nearest village	Acceptable; buffer adequate for odors/noise
Distance from sensitive sites	Schools, hospitals, public areas	≥1 km	Acceptable
Proximity to roads / access	Good road access	Near secondary road network	Good; minor upgrades may be needed
Topography / slope	2–5% gentle slope	Gently sloping land	Ideal for drainage
Land use / protected areas	Avoid agricultural/protected land	Adjacent minor cultivation	Minor conflict; compensation may be needed
Land area available	≥38.18 acres	TBD – current site may need expansion	Ensure total area meets projected waste till 2043
Availability of cover material	Soil or alternative daily cover	Local clay/sandy soil available	Sufficient
Slope stability	Stable, no landslide risk	Flat to gently sloping	Acceptable

The proposed site at 27° 57'1.62"N, 69° 17'11.37"E meets the essential criteria for solid waste landfill siting, including environmental safety, social acceptability, technical feasibility, and regulatory compliance. With proper engineering design, phased development, and operational planning, this site is suitable to serve the city's solid waste management needs until 2043.

B) Key Safeguards Issues

Scope: Landfill leachate management, air pollution from any future waste-to-energy (WtE) facility, and safeguards for informal waste pickers.

Impact	Mitigation
Liquid leaking from waste entering soil or underground water and creating bad smells.	Keep the base liner and collection system in good condition, pump and treat the liquid,

Impact	Mitigation
	and apply daily soil cover on waste.
Bad smells affecting nearby people.	Reduce the open working face, apply daily soil cover, collect and treat gas, and manage odorous loads quickly.
Pests and birds spreading disease or litter.	Cover waste daily, use bird control measures, keep fencing secure, and maintain site cleanliness.
Wind-blown litter leaving the site.	Install high litter fences near the working area, increase clean-up rounds, and ensure trucks and containers are covered.
Underground gas build-up increasing fire or explosion risk.	Install and maintain gas wells and pipes, monitor gas levels, and keep fire breaks and firefighting equipment ready.
Storm water mixing with waste and becoming dirty water.	Keep clean storm water separate with drains and berms, repair damaged drains, and keep the working face small.
Truck accidents and unsafe movement inside the site.	Use one-way traffic where possible, set clear signs and speed limits, use trained spotters, and require reflective clothing.
Unsafe handling of ash and air cleaning residues causing health and environmental risks.	Cool, separate, and store residues in closed containers, test the material, and send to approved disposal or reuse routes.
Smoke and gases from energy recovery plant stacks worsening outdoor air.	Run the air cleaning system at all times, maintain it well, and keep continuous emission monitors working and calibrated.
Fine dust and harmful compounds escaping during operations.	Use effective filters, schedule regular testing, fix defects immediately, and keep doors and hatches closed.
High noise from machinery, turbines, fans, and trucks disturbing neighbors and workers.	Use acoustic insulation and barriers, maintain equipment, and schedule loud activities during daytime.
High use of water reducing local availability.	Install water-saving devices, fix leaks quickly, collect rainwater from roofs, and reuse treated water for cleaning and landscaping.
High energy use increasing air pollution and costs.	Use energy-efficient motors and lighting, recover heat where possible, and track energy use monthly to drive reductions.
Injuries and poor health of workers and waste pickers.	Provide protective clothing and equipment, vaccinations, safe work training, and clean washing areas.
Unhygienic conditions and spread of disease at sorting or composting areas.	Keep floors clean, provide covered storage, control pests, and separate medical waste and sharp items.
Complaints from neighbors about smells, dust, or traffic.	Keep a public complaint phone or desk, log all cases, respond within thirty days, and

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Impact	Mitigation
	share actions taken with the community.
Risks to nearby schools, clinics, and homes from site operations.	Place clear signs and boundaries, manage traffic, limit night work near sensitive places, and hold regular community meetings.
Security risks and unauthorized entry to the site.	Install secure fencing, lighting, and trained guards; keep visitor sign-in records and conduct patrols.
Fires, explosions, or major spills causing injuries and environmental harm.	Keep an emergency plan, conduct regular drills, maintain firefighting equipment, store chemicals safely, and report incidents promptly.

8.4.9 Strengthening Estimates of Annual GHG Emissions from the Solid Waste Sector

The Intergovernmental Panel on Climate Change (IPCC) guidelines classify greenhouse gas (GHG) emissions from the solid waste sector into distinct categories, each requiring specific data inputs to develop emission estimates using the Tier 1 methodology:

A) Solid Waste Disposal (IPCC Code 4A)

1. Required Data

- Annual amount of municipal solid waste (MSW) disposed of in managed anaerobic or semi-aerobic landfills, as well as unmanaged deep or shallow landfill sites.
- Waste composition.
- Amount of scavenging at landfill sites, focusing on the remaining waste and its composition.
- Separate GHG emission estimates for urban and rural areas (current estimates focus only on urban areas).

B) Biological Treatment of Solid Waste (IPCC Code 4B)

1. Relevance

- This category is a relatively small source of GHG emissions in Pakistan. Only a few pilot projects for organic waste recycling are operational.

C) Incineration and Open Burning of Waste (IPCC Code 4C)

1. Required Data

- Annual quantity of waste burned openly and its composition.
- Emission estimates from open burning, which is not currently included in Pakistan's inventories.
- Note: Municipal solid waste (MSW) incineration is not practiced in Pakistan.

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D) Current Challenges and Improvements

Pakistan's waste sector GHG estimates are part of its National Communications and Nationally Determined Contribution (NDC). However, uncertainties in activity data affect the accuracy of these estimates. To enhance accuracy:

- Establish data flows using data supply agreements (DSAs) or memorandums of understanding (MOUs) between waste management companies (WMCs), local government departments, and the Ministry of Climate Change (MOCC).
- Ensure timely provision of high-quality data to support sustainable waste management initiatives.

E) Developing GHG Emission Projections

Accurate historical GHG emission estimates will enable improved projections. Waste sector projections should consider the following aspects:

1. **Future Waste Generation Trends:** Projected changes in the quantity and type of waste generated nationally.
2. **Evolving Waste Treatment and Disposal Systems:** Anticipate shifts in the utilization of treatment, disposal, and recycling systems over time.
3. **Technological Advances and Retrofits:** Potential changes in waste parameters and emission factors due to advancements in waste treatment technologies or the adoption of abatement systems.
4. **Optimization of Waste Collection:** Efforts by WMCs and municipalities to reduce fuel consumption through optimized collection systems.

F) Mitigation and Co-Dependencies in Waste Management

Mitigation measures can impact waste generation, treatment, and disposal in various ways, highlighting the need to understand interdependencies across treatment pathways. Projections should consider:

- The mass flow of waste through different stages of the treatment process.
- How mitigation actions, such as waste separation, recycling, or energy recovery, might influence emissions in one or more areas.

G) Energy Recovery from Waste

If energy generation from waste is implemented, emissions resulting from this process must be accounted for in the energy sector to avoid double-counting.

By addressing these factors, Pakistan can develop more robust and precise GHG emission projections, laying the foundation for more effective mitigation strategies within the solid waste sector.

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8.4.10 Financial Planning and Cost Estimates

This section presents indicative financial estimates for the key solid waste management infrastructure and systems proposed under the Strategic Development Plan. The costing covers essential equipment and machinery, landfill development requirements, workshops and training provisions, and selected advanced facilities, providing a high-level financial basis to support planning, prioritization and phased implementation at the city level.

A) Equipment and Machinery

Sr. No.	Equipment / Machinery	Additional Units (2023–2043)	Unit Cost (PKR million)	Total Cost (PKR million)
1	Hand Carts (0.25 m³)	159	0.04	6.36
2	Mini Tipper (≈1 m³)	85	2.50	212.50
3	Containers (0.8 m³)	135	0.07	9.45
4	Mobile Compactor (8 m³)	21	18.00	378.00
5	Front Blade Tractor	6	4.00	24.00
6	Tractor Trolley	94	4.50	423.00
7	Arm-Roll Truck (5 m³)	3	12.00	36.00
8	Front-End Loader	6	18.00	108.00
9	Water Bowser	8	6.00	48.00
Subtotal				**1,245.31**

B) Landfill Requirement Over 2043

Item	Value
Total Landfill Area (to 2043)	38.18 Acres
Unit Development Cost (Engineering Only)	PKR 30 million / Acre
Total Development Cost (Excl. Land Cost)	≈ PKR 1,145.40 million
Unit Land Cost (Sindh Rate)	~PKR 4.5 million / Acre*
Total Land Cost (38.18 Acres)	≈ PKR 171.81 million
Total Project Cost (Incl. Land Cost)	≈ PKR 1,317.21 million

*****Land cost is assumed based on average rural/agricultural land valuation rates notified by the Board of Revenue, Government of Sindh (DC Rates), prevailing during FY 2024–25.*

C) Indicative Fuel Cost for Waste Haulage to Landfill (O&M)

Parameter	Value
Waste delivered to landfill (2043)	185 tons/day
Average payload per trip	10 tons/trip
Estimated trips per day	19 trips/day
Average haulage distance (one way)	7 km

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Parameter	Value
Average round-trip distance	14 km
Average fuel efficiency (loaded)	2.5 km/litre
Estimated fuel consumption per day	106 litres/day
Estimated fuel consumption per year	38,700 litres/year
Indicative diesel price	PKR 300 / litre
Estimated annual fuel cost	≈ PKR 11.6 million / year

D) Workshop, Parking Sheds & Training

1. Workshop & Parking Sheds

Sr. No.	Component	Qty	Unit Cost (PKR Million)	Total (PKR million)
1	Central Maintenance Workshop	1	40.00	40.00
2	Parking / Service Sheds	2	20.00	40.00
—	Subtotal	—	—	80.00

2. Training & Capacity Building

Cost Element	Basis	Cost (PKR million)
Training Modules (Ops + HSE + Mechanical + Fleet)	Lump Sum	10.00
PPE / Manuals / Toolkits	Lump Sum	5.00
Certifications / External Trainers	Lump Sum	5.00
Total Training	—	20.00

3. Advanced Facilities

Sr. No.	Facility	Description	Lump-Sum Cost (PKR Million)
1	Material Recovery Facility (MRF)	Sorting line, balers, storage, handling	300.00
2	Composting / AD Facility	Organic processing & composting	150.00
3	Environmental Monitoring + LFG System	Groundwater wells, ambient air, LFG flare/utilization	100.00
—	Subtotal – Advanced Facilities	—	550.00

Note: *This figure is conservative and suitable for master planning stage — will be adjusted during feasibility / PC-I.*

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8.4.11 Priority Projects

The priority projects to improve the collection efficiency of solid waste will focus on following key initiatives:

Priority Section	Code	Project / Initiative
Collection	C1	Procurement of Collection Machinery
	C2	Short-Term Collection Optimization
	C3	Hiring & Training of Crew
	C4	Construction of Parking/Service Sheds
	C5	Source Segregation
	C6	Primary Storage & Street Infrastructure
	C7	Digital Service & Feedback
	C8	Worker PPE & Hygiene
		Community Awareness & Engagement (Collection)
Transfer & Transport	T1	Segregated Transfer Stations
	T2	Fleet Procurement
	T3	Maintenance Workshops
	T4	GPS & Fleet Management
	T5	Route Optimization & Scheduling
	T6	Material Recovery Corners
		Community Awareness & Engagement (T&T)
Disposal & Resource Recovery	D1	Expand Engineered Landfill
	D2	Waste-to-Energy (Rejects Only)
	D3	Advanced Sorting & Recycling Hubs (MRF)
	D4	Composting & Anaerobic Digestion
	D5	Legacy Site Upgrading
	D6	Long-Term Staffing & Training
	D7	Environmental Monitoring Systems
	D8	LFG Utilization & Energy
	D9	Producer Responsibility & Markets
		Community Awareness & Engagement (Disposal/Recovery)

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8.4.12 Immediate Action Plan for Core Urban Area

Phase	Year	Priority Project	Objective	Actions
01	0-2 Years	Procurement of Collection Machinery	Establish a baseline for waste management practices and infrastructure.	Conduct detailed assessments of waste generation, collection efficiency, and existing facilities by gradually increasing tractor trolleys and containers (05 m³) rising from **48 tons to 100 tons**, and hand carts expanding from **722 tons to 1500 tons**. This indicates a significant escalation in waste management requirements over the next **20 years**.
		Short-Term Waste Collection Optimization	Enhance current waste collection practices.	Re-assess and optimize collection routes, schedules, and frequencies based on collected data.
		Hiring of Human Resources	Strengthen the workforce to support waste management initiatives.	Recruit additional staff for waste collection, transportation, and management. The cumulative staffing requirement over the period totals **6,373 positions**, with significant increases in sanitary workers, vehicle drivers, and other roles reflecting growing operational demands
		Construction of Parking Sheds for Machinery	Provide adequate infrastructure for the storage and maintenance of machinery.	Design and construct parking sheds to house and protect waste management vehicles and equipment.
02	2028-2032	Development of Transfer Stations	Facilitate efficient waste transportation and processing.	Identify locations and construct transfer stations to streamline the waste transfer process.

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Phase	Year	Priority Project	Objective	Actions
		Procurement of Transportation Vehicles	Improve the efficiency and capacity of waste transportation.	Acquire new, fuel-efficient vehicles tailored to waste transportation needs. Transportation vehicle needs will rise from 2023 to 2043, with arm roll trucks increasing from **10 to 21 tons**, and dumper trucks from **18 to 38 tons**.
		Construction of Maintenance Workshops	Ensure proper maintenance of waste management machinery and vehicles.	Establish workshops for the routine servicing and repair of waste management equipment.
		Implementation of GPS and Fleet Management Systems capacity building of staff	Enhance monitoring and management of waste collection and transportation fleets.	Install GPS systems on all vehicles, develop a fleet management system, and provide staff training.
03	**Upto 5 Years**	Expansion of Landfill Capacity	Accommodate increasing volumes of waste and improve disposal efficiency.	Plan, design, and expand existing landfill sites, ensuring compliance with environmental standards. Landfill site needs will grow from **0.43 acres in 2023 to 38.18 acres by 2043,** reflecting rising waste generation and population.
		Development of Waste-to-Energy Facilities	Convert waste into usable energy and reduce landfill dependence.	Research, design, and construct waste-to-energy facilities; integrate with existing waste systems.
		Implementation of Advanced Waste Sorting and Recycling Systems	Increase recycling rates and reduce landfill waste.	Introduce advanced sorting technologies, establish recycling centers, and promote recycling programs.

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Phase	Year	Priority Project	Objective	Actions
04	Up to 2043	Construction of Composting Facilities	Promote organic waste recycling and reduce landfill pressure.	Design and build composting facilities; establish organic waste collection programs.
		Upgrading of Hazardous Waste Disposal Facilities	Safely manage and dispose of hazardous waste materials.	Upgrade existing facilities or construct new ones to handle hazardous waste in compliance with regulations.
05	2043 onward	Long-Term Staffing and Training	Ensure a skilled workforce for sustainable waste management.	Implement ongoing recruitment, training, and development programs for waste management staff.
		Establishment of Environmental Monitoring Systems	Monitor and ensure environmental compliance and performance.	Install monitoring systems for air, water, and soil quality; regularly review and report findings.

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SECTION - 9: INFRASTRUCTURE

9.1 Introduction

The infrastructure section forms the backbone of Ghotki city's sustainable growth, encompassing transportation, telecommunication, power, and gas networks, all of which are vital for economic development and improved quality of life. This section evaluates existing infrastructure gaps, outlines strategic interventions, and proposes actionable solutions to modernize and expand these sectors, ensuring Ghotki's alignment with regional development goals and enhancing its competitiveness as a key urban center.

9.2 Transportation

A development master plan for Roads is a detailed long-term plan that guides how roads will be developed, maintained, and managed to meet the current and future needs of the area. It represents a clear practical vision to ensure the functionality of roads network for every stake holder not merely a list of road projects. It also enables a city to develop a coordinated, institutional framework to make the most of the opportunities with a sustainable development approach.

Roads are the lifeline of any region, similarly, people depend heavily on road transport for daily commuting, business, and social activities in Pakistan. Roads connect cities, towns, and villages, helping people reach schools, hospitals, markets, workplaces and transporting good, which is a basic need for any community to grow socially and economically.

Without proper planning, roads can become overcrowded, unsafe, and expensive to maintain. Many areas face problems like traffic jams, frequent accidents, and roads that get damaged quickly during the monsoon season. A development masterplan strategically addresses these issues by looking at the whole road network and planning for growth, safety, and durability.

The masterplan usually looks ahead 10 to 20 years or more, taking into account population growth, urban expansion, increasing vehicle numbers, and changes in travel patterns. It also considers how roads fit into the environment and the lives of all users, including pedestrians, cyclists, and public transport.

This report will be the continuation of the previous reports which were highlighting the baselines of the city. All the primary and secondary data which was collected from the city in the form of different surveys and consultations was presented in the Situation Analysis Report (SAR), on the basis of which a SWOT analysis was performed. In this report we will be focusing on analysing the collected data to utilize it in forming a well-formed and practical masterplan. An immediate action plan (0-2 years), a short-term

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plan for next 05 years and long-term plan for next 20 years of the city shall be discussed in this report. A priority criterion will be set in this report and existing road infrastructure will be evaluated through the set criteria, and the roads that need rehabilitation the most will be highlighted respectively.

A) Conceptual Framework of the Development Masterplan

The masterplan acts as a roadmap that helps authorities and planners make the calculated and timely decisions about certain roads. It lays down a clear vision for how the road network should develop over time and sets priorities for where to construct new roads, which roads need upgradation and how to maintain them properly.

It integrates technical, social, and economic factors to ensure the network is efficient, safe, and sustainable. This includes considering different types of roads such as national highways, provincial roads, urban streets, and rural access roads. Each has a specific role but all need to work together smoothly.

The plan also aligns road development with other important aspects of regional planning such as housing, industry, and environmental protection. This coordination avoids problems like roads cutting through sensitive areas or new developments creating traffic bottlenecks.

B) Uses of a Development Masterplan for Roads

The Development Masterplan for Roads is a practical tool used by government departments, planners, engineers, and other stakeholders to manage road infrastructure in a balanced and sustainable way. The main uses include:

1. Prioritizing Road Construction and Upgrades

One of the most important uses of the masterplan is to help decide where new roads should be built or existing roads need to be widened or upgraded. This decision is based on understanding current traffic patterns, population trends, economic activities, and future growth areas.

For example, if a certain highway is heavily congested during peak hours, the masterplan may recommend widening it or constructing an alternative bypass. Similarly, if a rural area is developing quickly due to agriculture or industry, new access roads might be planned to connect farms or factories to main highways.

By prioritizing these projects, the plan ensures that money and resources are used where they can have the biggest positive impact. This avoids random or unplanned road works that do not solve real problems or that cause new issues.

2. Guiding Maintenance and Asset Management

Roads are expensive to build, but they also need regular care to stay in good condition. The masterplan helps by providing a schedule and framework for

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maintaining roads based on their condition and importance.

This means identifying which roads need urgent repairs like pothole filling or resurfacing, and which require long-term rehabilitation. It also helps plan routine activities like cleaning drainage channels, fixing road signs, and maintaining road markings, all of which contribute to safer and smoother travel.

Good maintenance planning helps prevent costly repairs later and reduces accidents caused by poor road conditions. It also ensures that limited budgets are used efficiently, focusing on roads that serve the most people or carry the heaviest traffic.

3. Managing Traffic Flow and Improving Safety

Traffic congestion and road accidents are major challenges in many parts of Pakistan. The masterplan helps address these by recommending solutions based on careful study of traffic patterns in the study area.

Safety is also a key focus. The masterplan includes proposals for better road signs, speed control measures, pedestrian crossings, and improved street lighting. These steps reduce accidents and make roads safer for drivers, pedestrians, cyclists, and motorcyclists.

Additionally, the plan encourages providing safe access to schools, hospitals, and markets, ensuring that vulnerable road users such as children and elderly people are protected.

4. Supporting Economic Growth and Social Development

Well-planned roads boost the economy by improving the movement of goods and people. The masterplan helps identify routes that connect important economic centres such as industrial zones, ports, agricultural markets, and urban business areas. Improved road access reduces travel time and transportation costs, helping businesses operate more efficiently and encouraging investment in the region. This, in turn, creates jobs and improves living standards.

On the social side, the masterplan promotes equitable access to roads for all communities, including remote rural areas. This helps connect people to education, healthcare, and other social services, reducing isolation and promoting balanced regional development.

9.2.2 Methodology and Scope

This section outlines the approach and boundaries of the study carried out for the Development Masterplan of road infrastructure in the core urban area of Ghotki, Sindh. It covers the approach taken to collect information, analyse data.

A) Objectives of the Study

The study aims to:

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- Understand the current condition of roads in Ghotki's urban area.
- Identify which roads need repair or improvement most urgently.
- Suggest a plan for building new roads and expanding the network in future.
- Support better traffic flow and safer travel in the city.

B) Methodology Overview

To ensure clear understanding of the existing road network and to help identify practical steps for improvement a systematic approach was established. The process cantered on gathering reliable information, analysing it carefully, and involving key stakeholders to make sure the results truly reflect the situation on the ground in Ghotki.

The study combined both quantitative data (like traffic volumes, road conditions, and network coverage) and qualitative inputs (such as Household surveys). This combination helps create a balanced picture of the road network's strengths and weaknesses.

1. Data Collection Methods

To get a good picture of the roads, the team used different ways to collect information:

- Socio Economic Survey
- Manual Classified Counts (MCCs)
- Roadside Interviews (RSI)
- Journey Time Surveys (JTS)
- Inventory and Condition Survey (landCS)
- Pictorial Survey

2. Assessment Criteria

To decide the roads that need immediate attention, and how future projects will be listed, following criteria has been used in listed order:

- Conditions of the existing roads
- Volume/Capacity ratio of the existing roads
- Importance of roads within the city based on adjacent land use

3. Tools and Techniques Used

- Situation Analysis
- Digital Base Maps
- SWOT Analysis
- Prioritization System

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- Making sure road plans fit with other services like water and drainage.

First 3 steps have already been covered and respective reports have been submitted. This report is in continuation to these studies and development of prioritization criteria in liaison with other departments ongoing city development plans to make sure all efforts work together smoothly.

C) Scope of the Study

This study focuses only on roads of Ghotki city. It covers all types of roads from bypass to collectors to streets.

9.2.3 Baseline Analysis and Prioritization of Road Network

This section presents the baseline analysis of the road network in Ghotki' s urban area and outlines the process used to prioritize roads for rehabilitation and future development. The chapter begins by reviewing relevant information from earlier reports prepared for the project. It then describes the surveys conducted to collect the information of the existing roads, followed by an assessment of their condition. Finally, it explains how priority roads were identified based on clear criteria, and suggests future road development plans to support the city's growth.

A) Previous Submissions

1. Inception Report

The Inception Report defined the initial scope, methodology, and engagement strategy for the preparation of the development master plans for Ghotki and other cities under Package-I. It set the tone for systematic data collection, GIS mapping, and stakeholder inclusion, ensuring that the plan would be grounded in both empirical evidence and community inputs.

2. Situation Analysis Report (SAR)

The SAR provided a detailed assessment of Ghotki's current situation. It revealed that the built-up area had expanded from 7% in 2008 to 32% in 2023, with significant pressure on land along major roads. Rapid growth has contributed to the decline of green areas by 43%. The infrastructure analysis highlighted critical gaps in water supply, sanitation, healthcare, education, and solid waste management. Economic assessment identified an industrial base with limited diversification. Environmental risks, particularly floods, were underscored as a major challenge.

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3. Digital Base Map and Explanatory Report

The Digital Base Map produced high-resolution spatial data visualizing land use patterns, infrastructure, and environmental assets. It highlighted high-density corridors, urban sprawl directions, and critical infrastructure bottlenecks. This provided the spatial basis for future planning decisions and zoning reforms.

4. SWOT Analysis

Through participatory workshops, the SWOT analysis emphasized Ghotki's strengths in industrial activity and connectivity, while pointing out weaknesses such as service deficits and governance issues. Opportunities for SEZ establishment, smart growth, and environmental conservation were noted, while threats from climate change and unplanned expansion were acknowledged. The vision statement developed promotes Ghotki as a smart, inclusive, and resilient industrial city.

B) Surveys Conducted:

Identification of the existing road network is a foundational step in transportation planning. A clear and comprehensive understanding of the current network is essential for effective planning, forecasting, and decision-making. Due to a limitation of secondary data from the MC, the consultant has conducted multiple surveys e.g. Inventory, condition, and Pictorial survey etc. to identify the gaps in the existing road network. Surveys like traffic surveys, roadside interviews, etc have already been discussed in Situation Analysis Report previously.

1. Inventory and Condition Survey

Inventory and Condition Survey (IandCS) was conducted in the month of August in 2023. The Proformas for IandCS were submitted to the Client along with the Inception report. The data collected from the proformas encompassed all details related to road cross-sections, including the carriageway, shoulder, walkway, roadside drain, services corridor, road furniture, land use type, and encroachment.

Inventory and Condition survey was carried out on almost all links/roads having ROW more than 18-20' within the MC boundaries despite of their pavement type. Table 1 shows the IandCS results recorded from the study area. This list will be rearranged according to the set prioritisation criteria which will be defined in the next section of this chapter.

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Table 9-1, landCS Results

Sr No.	Road Name	Start	End	Length (km)	Carriageway			Shoulder		Roadside Drain			Not Exist				Land Use Type
					Total Metaled Width (ft)	Pavement Type	Pavement Condition	Width (ft)	Condition	Type	Width (ft)	Condition	Road Signs	Street Light Pole	Electric Pole	Telephone Pole	
GHT-01	Devri road	0	2	2	16	Asphalt	Bad	3	Bad	-	-	-	Not Exist	Not Exist	Exist	Not Exist	Agricultural
GHT-02	Jindu Ghoto Road (N-5 to M-5)	0	0.4	1.7	22	Asphalt	Good	3	Fair	-	-	-	Exist	Exist	Exist	Not Exist	Mixuse
		0.4	1.7		19	Asphalt	Good	3	Fair	-	-	-	Exist	Exist	Exist	Not Exist	Mixuse
GHT-03	Ghotki Sugar mill Road	0	0.7	2.1	22	Asphalt	Fair	5	Fair	Brick/Covered	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Commercial
		0.7	1.5		25	Asphalt	Fair	5	Fair	-	-	-	Not Exist	Not Exist	Exist	Not Exist	Residential
		1.5	2.1		28	Asphalt	Good	5	Fair	-	-	-	Not Exist	Not Exist	Exist	Not Exist	Agricultural
GHT-04 A	Bus Stop Link Road	0	0.2	0.2	24	Asphalt	Poor	-	-	-	-	-	Not Exist	Exist	Not Exist	Not Exist	Commercial
GHT-05	Sindhri-Bagowa Road	0	1.3	4.4	18	Asphalt	Poor	3	Fair	Brick/Open	8	Fair	Not Exist	Not Exist	Exist	Not Exist	Mixuse
		1.3	2.4		12	Asphalt	Fair	3	Fair	-	-	-	Not Exist	Exist	Exist	Not Exist	Mixuse
		2.4	2.9		12	Asphalt	Poor	2	Poor	-	-	-	Not Exist	Not Exist	Not Exist	Not Exist	Residential
		2.9	3.1		12	Paver	Fair	2	Poor	-	-	-	Not Exist	Not Exist	Not Exist	Not Exist	Mixuse
		3.1	3.4		16	Paver	Fair	-	-	-	-	-	Not Exist	Not Exist	Not Exist	Not Exist	Mixuse
		3.4	4.4		28	Paver	Good	-	-	Brick/Covered	3	Bad	Not Exist	Not Exist	Exist	Not Exist	Commercial
GHT-06	Benazir Colony Road	0	0.2	2.1	18	Earthen	Poor	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
		0.2	0.4		15	Paver	Bad	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
		0.4	0.7		18	Asphalt	Fair	-	-	Brick/Covered	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
		0.7	1.4		18	Asphalt	Bad	-	-	Brick/Covered	2	Bad	Not Exist	Exist	Exist	Not Exist	Mixuse
		1.4	1.7		20	Asphalt	Bad	-	-	Brick/Open	2	Bad	Not Exist	Exist	Exist	Not Exist	Mixuse
		1.7	2.1		18	Asphalt	Bad	-	-	Brick/Open	2	Bad	Not Exist	Exist	Exist	Not Exist	Commercial
GHT-07	Rahmowali park	0	0.3	0.3	24	Asphalt	Fair	3	Bad	-	-	-	Exist	Exist	Not Exist	Not Exist	Mixuse
GHT-08	Dawa Khana street Rahmowali	0	0.2	0.2	14	Paver	Poor	-	-	Brick/Open	2	Bad	Not Exist	Exist	Exist	Not Exist	-
GHT-09	Chacher Mohalla Rahmowali Road	0	0.4	0.8	18	Paver	Poor	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Mixuse
		0.4	0.8		36	Asphalt	Poor	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
GHT-10	Mohallah Street Tando Buland Khan Road	0	0.1	0.2	13	Paver	Bad	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
		0.1	0.2		14	Paver	Poor	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
GHT-11	Hussain Beli Road	0	1.4	1.4	18	Asphalt	-	-	-	Brick/Covered	2	Bad	Not Exist	Exist	Exist	Exist	Commercial
GHT-12	Devri Road	0	0.5	0.7	18	Paver	Bad	-	-	Brick/Open	3	Fair	Not Exist	Exist	Exist	Not Exist	Commercial
		0.5	0.7		12	Paver	Bad	-	-	Brick/Covered	3	Fair	Not Exist	Exist	Exist	Not Exist	Commercial
GHT-13	Municipal Park Road	0	0.5	0.7	17	Paver	Good	-	-	Brick/Open	2	Good	Not Exist	Not Exist	Not Exist	Not Exist	Mixuse
		0.5	0.7		13	Paver	Good	-	-	Brick/Open	2	Good	Not Exist	Not Exist	Not Exist	Not Exist	Residential
GHT-14	Jindu Ghoto Road (Canal Road-N-5)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Sr No.	Road Name	Start	End	Length (km)	Carriageway			Shoulder		Roadside Drain			Not Exist				Land Use Type
					Total Metaled Width (ft)	Pavement Type	Pavement Condition	Width (ft)	Condition	Type	Width (ft)	Condition	Road Signs	Street Light Pole	Electric Pole	Telephone Pole	
GHT-15	Mahar Bazar Road (Shahi Bazar Road)	0	0.1	2.3	30	Paver	Bad	-	-	-	-	-	Not Exist	Exist	Exist	Exist	Commercial
		0.1	0.7		33	Paver	Good	-	-	-	-	-	Not Exist	Exist	Exist	Exist	Commercial
		0.7	1		40	Asphalt	Good	-	-	Brick/Open	2	Fair	Not Exist	Exist	Exist	Exist	Commercial
		1	1.5		40	Paver	Good	-	-	Brick/Open	2	Fair	Not Exist	Exist	Exist	Exist	Commercial
		1.5	1.6		28	Paver	Good	-	-	Brick/Covered	2	Fair	Not Exist	Exist	Exist	Exist	Commercial
		1.6	2		40	Asphalt	Fair	-	-	Brick/Covered	2	Fair	Not Exist	Exist	Exist	Exist	Commercial
		2	2.3		22	Paver	Good	-	-	Brick/Covered	2	Fair	Not Exist	Exist	Exist	Exist	Commercial
GHT-16	Sain Nahro Shah Road	0	0.5	0.5	12	Paver	Good	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Exist	Residential
GHT-17	Ali Akber Shah Road	0	0.3	0.3	-	-	-	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Mixuse
GHT-18	Ali Akber Shah Road (Kalma Chowk)	0	0.5	1.2	18	Asphalt	Good	3	Fair	-	-	-	Not Exist	Exist	Not Exist	Not Exist	Residential
		0.5	0.9		24	Asphalt	Good	-	-	Brick/Open	2	Fair	Not Exist	Exist	Exist	Exist	Residential
		0.9	1.2		15	Paver	Good	-	-	Brick/Open	2	Fair	Not Exist	Not Exist	Exist	Not Exist	Residential
GHT-19	Bahar Khan Sanghar Road	-	-	-	20	Paver	Good	-	-	Brick/Open	2	Bad	Not Exist	Exist	Exist	Exist	Residential
GHT-20	Engro Warehouse Road	0	0.3	0.9	15	Asphalt	Bad	3	Bad	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Exist	Residential
		0.3	0.9		12	Earthen	Poor	3	Bad	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
GHT-21	Jilani Model School Road	-	-	-	15	Paver	Good	-	-	Brick/Open	3	Fair	Not Exist	Exist	Exist	Not Exist	Residential
		-	-	-	12	Paver	Good	-	-	Brick/Open	3	Fair	Not Exist	Exist	Exist	Not Exist	Residential
		-	-	-	12	Earthen	Poor	-	-	Brick/Open	3	Poor	Not Exist	Not Exist	Exist	Not Exist	Residential
		-	-	-	14	Earthen	Poor	-	-	Brick/Open	3	Poor	Not Exist	Not Exist	Exist	Not Exist	Residential
GHT-22	Ghotki-Mathelo Road (Pakistan Chowk-G.T Road)	0	0.7	1	42	Paver	Good	-	-	Brick/Covered	3	Fair	Not Exist	Exist	Exist	Exist	Commercial
		0.7	1		25	Asphalt	Good	-	-	Brick/Covered	3	Fair	Not Exist	Exist	Exist	Exist	Commercial
GHT-23	Ghotki-Mathelo Road (G.T Road-Mathelo)	0	0.1	1.4	35	Paver	Good	4	Bad	-	-	-	Not Exist	Exist	Exist	Not Exist	Commercial
		0.1	1.4		18	Asphalt	Good	4	Bad	-	-	-	Exist	Not Exist	Not Exist	Not Exist	Mixuse
GHT-24	Sabzi Mandi Road	0	0.2	0.3	24	Asphalt	Poor	-	-	Brick/Open	3	Bad	Not Exist	Exist	Exist	Exist	Commercial
		0.2	0.3		35	Paver	Good	-	-	Brick/Open	3	Bad	Not Exist	Exist	Exist	Exist	Commercial
GHT-25	Madarsa Nashir Road	0	0.8	0.8	15	Asphalt	Poor	3	Fair	-	-	-	Not Exist	Not Exist	Exist	Not Exist	-
GHT-26	Underpass Road	0	1	1.2	18	Asphalt	Fair	4	Fair	-	-	-	Not Exist	Exist	Exist	Not Exist	Commercial
		1	1.2		32	Paver	Good	-	-	Brick/Open	2	Bad	Not Exist	Exist	Exist	Not Exist	Commercial
GHT-27	G.T Road	0	5	5	24	Asphalt	Good	-	Fair	-	-	-	Not Exist	Not Exist	Exist	Exist	Commercial
GHT-28	Station Road	0	0.2	0.4	30	Asphalt	Bad	-	-	Brick/Covered	4	Fair	Not Exist	Exist	Exist	Not Exist	Mixuse
		0.2	0.4		13	Asphalt	Bad	3	Bad	-	-	-	Not Exist	Not Exist	Exist	Not Exist	-
GHT-29	Qadira Factory Road	0	0.4	2.7	18	Asphalt	Good	3	Bad	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Exist	Residential

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Sr No.	Road Name	Start	End	Length (km)	Carriageway			Shoulder		Roadside Drain			Not Exist				Land Use Type
					Total Metaled Width (ft)	Pavement Type	Pavement Condition	Width (ft)	Condition	Type	Width (ft)	Condition	Road Signs	Street Light Pole	Electric Pole	Telephone Pole	
		0.4	1.1		24	Asphalt	Good	3	Bad	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Exist	Residential
		1.1	2.7		18	Asphalt	Good	3	Bad	Brick/Covered	3	-	Not Exist	Not Exist	Exist	Exist	Residential
GHT-30	Link Road (Adilpur-Underpass Road)	0	3.4	3.4	18	Asphalt	Good	3	Bad	-	-	-	Not Exist	Not Exist	Not Exist	Not Exist	-
GHT-31	Nagar Miani Road	0	0.1	0.8	16	Asphalt	Bad	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
		0.1	0.3		18	Paver	Good	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
		0.3	0.6		13	Paver	Good	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
		0.6	0.8		12	Paver	Good	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
GHT-32	Khan Garh Bypass	0	0.3	2.2	20	Asphalt	Good	2	Fair	-	-	-	Not Exist	Not Exist	Not Exist	Not Exist	Mixuse
		0.3	1.4		24	Asphalt	Good	2	Fair	-	-	-	Not Exist	Not Exist	Not Exist	Not Exist	Mixuse
		1.4	2.2		24	Asphalt	Poor	4	Bad	-	2	Poor	Not Exist	Not Exist	Not Exist	Not Exist	Residential
GHT-33	Opposite Stadium Street	0	0.5	0.5	13	Paver	Poor	-	-	Brick/Open	2	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
GHT-34	Station Road	-	-	-	15	Asphalt	Fair	-	-	Brick/Open	4	Poor	Not Exist	Not Exist	Exist	Not Exist	Mixuse
		-	-	-	15	-	-	-	-	Brick/Covered	4	Fair	Not Exist	Not Exist	Exist	Not Exist	Residential
GHT-35	Sheikh Mohallah Street	0	0.2	0.5	14	Asphalt	Bad	-	-	Brick/Open	3	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
		0.2	0.3		15	Paver	Bad	-	-	Brick/Open	3	Bad	Not Exist	Exist	Exist	Not Exist	Residential
		0.3	0.5		15	Paver	Fair	-	-	Brick/Open	3	Bad	Not Exist	Not Exist	Exist	Exist	Residential
GHT-36	SRSO Office Street	0	0.2	0.5	20	Asphalt	Bad	-	-	Brick/Open	3	Bad	Not Exist	Exist	Exist	Not Exist	Residential
		0.2	0.5		20	Paver	Fair	-	-	Brick/Open	3	Bad	Not Exist	Exist	Exist	Not Exist	Residential
GHT-37	Kalma Chowk Road-Sain Nahro Shah Road	0	0.4	0.9	18	Asphalt	Good	3	Bad	Brick/Open	3	Bad	Not Exist	Exist	Exist	Not Exist	Agricultural
		0.4	0.7		13	Asphalt	Poor	-	-	Brick/Open	3	Bad	Not Exist	Not Exist	Exist	Not Exist	Residential
		0.7	0.9		14	Paver	Bad	-	-	Brick/Open	3	Bad	Not Exist	Not Exist	Exist	Exist	Residential
GHT-38	Ghazillian Ave	0	0.2	0.2	18	Paver	Good	-	-	Brick/Open	3	Bad	Not Exist	Not Exist	Exist	Exist	Residential
GHT-39	Defence Colony Road	0	0.1	0.2	20	Asphalt	Poor	-	-	Brick/Open	4	Bad	Not Exist	Not Exist	Exist	Exist	Residential
		0.1	0.2		16	Asphalt	Poor	-	-	Brick/Open	5	Bad	Not Exist	Not Exist	Exist	Exist	Residential
GHT-40	Village Raees Gul M.Khuhawar	0	0.2	0.3	20	Paver	Fair	-	-	Brick/Open	6	Bad	Not Exist	Not Exist	Exist	Exist	Residential
		0.2	0.3		18	Earthen	Poor	-	-	Brick/Open	7	Bad	Not Exist	Not Exist	Exist	Exist	Residential
GHT-41	Adilpur Road	0	0.4	4.4	40	paver	Good	-	-	Brick/Open	2	Fair	Not Exist	Not Exist	Exist	Exist	Commercial
		0.4	4.4		22	Asphalt	Good	-	-	Brick/Open	2	Fair	Not Exist	Not Exist	Exist	Exist	Commercial
GHT-42	N-5	0	6.8	13.6	35	Asphalt	Good	Asphalt	good	-	-	-	Not Exist	Not Exist	Exist	Exist	Commercial
		6.8	13.6		40	Asphalt	Good	Asphalt	good	-	-	-	Not Exist	Not Exist	Exist	Exist	Commercial

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Ghotki City has mostly two-lane roads with 45% of total roads in the city having an average lane width of approximately 11 feet. The pavement condition is not good, with approximately 52% of roads identified as bad. No road signs, pavement markings, and street lights are provided on the roads.

2. Pictorial Survey

A detailed pictorial survey was also carried out to capture the true picture of the existing condition of the subject study area. The pictorial survey was done parallel with landCS as shown in and all notable conditions were captured with the point of view of recognisance for planning and detail design. Some of the images are attached below in **Figure** 9-1.











Figure 9-1, Pictorial Survey of Ghotki

C) Strategic Development Master Plan

Situation Analysis of the project city necessitated surveys which were carried out based on Traffic operation and present Infrastructure and is explained in detail in the SAR report of the city.

Consequently, inventory, condition, and pictorial survey etc. were carried out to identify the gaps in the existing road network. Strategic development plan was then carved out in a way that the road infrastructure projects are

categorized in 3 classes namely core urban area projects, intermediate projects and future projects, in line with the TORs of the project.

Core urban area projects and intermediate projects have been prioritized based on the criteria mentioned in the next section and on the basis of utility rehabilitation projects e.g., sewer rehabilitation, etc. These projects are listed combinedly in **Table** 9-2 below and are bifurcated in the subsequent Immediate Action Plan and Priority Projects Reports. Similarly, future planned road projects are identified and prioritized based on future master planning aspects and are listed in **Table** 9-3 below.

D) Prioritization Criteria and Priority Roads

Based on the findings from the Situation Analysis Report, SWOT Report and surveys like Inventory and Condition Survey (IandCS), this chapter outlines a phased action plan to improve Ghotki' s road network. The plan is divided into immediate, short-term, and long-term actions, depending on the current conditions, usage patterns, and future development needs of the city.

To ensure that road improvements bring maximum benefit, a clear prioritization framework is followed. This helps determine which roads should be upgraded first, whether they are inside the existing urban area or in regions expected to grow. Roads are prioritized not only based on how badly they are deteriorated, but also on how important they are in terms of local land use and traffic movement.

By using this approach, Ghotki can address its most urgent infrastructure needs while also laying the groundwork for better mobility and connectivity in the future. This chapter presents the following specific criteria used for prioritization:

- Improvement of roads within the city based on adjacent land use
- Volume/Capacity ratio of the existing roads
- Conditions of the existing roads
- Identification of new or under-connected areas that require road access or rehabilitation

Based on the above criteria, a priority list (for both immediate and early action plan) of the existing roads has been established in **Table** 9-2 and shown in **Figure** 9-2 and list of proposed future roads (for long term action plan) has been given in **Table** 9-3 and shown in **Figure** 9-3. Further the tentative scope of works of immediate/early action plan and long-term action plan is described below the tables.

Table 9-2, List of Priority Roads

No.	Name of Road	Adjacent Landuse
GHT-P-01	Sindhri-Baght-Pwa Road	Residential/Commercial

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No.	Name of Road	Adjacent Landuse
GHT-P-02	Dawa Khana street Rahmowali	Residential/Commercial
GHT-P-03	Hussain Beli Road	Commercial
GHT-P-04	*Devri Road	Commercial
GHT-P-05	Sabzi Mandi Road	commercial
GHT-P-06	Chacher Muhala Rahmowali Road	Residential
GHT-P-07	Mohallah Street Tando Buland Khan Road	Residential
GHT-P-08	*Jilani Model School Road	Residential
GHT-P-09	Opposite Stadium Street	Residential
GHT-P-10	Kalma Chowk Road-Sain Nahro Shah Road	Mix Use
GHT-P-11	*Benazir Colony Road	Residential
GHT-P-12	*Ali Akber Shah Road	Residential
GHT-P-13	Engro Warehouse Road	Residential
GHT-P-14	Station Road	Residential
GHT-P-15	Sheikh Mohallah Street	Residential
GHT-P-16	SRSO Office Street	Residential
GHT-P-17	*Sadaf Cinema Disposal Station	Residential
GHT-P-18	*Qadirpur Road	Residential
GHT-P-19	*Ghotki-Mathelo Road	Mix Use
GHT-P-20	Jindu Ghoto Road (Canal Road-N-5)	Commercial
GHT-P-21	Bus Stop Link Road	Residential
GHT-P-22	Madarsa Nashir Road	Residential
GHT-P-23	Defence Colony Road	Residential

The proposed initiative focuses on the rehabilitation of road infrastructure. The scope may include:

- Reconstruction of roads in poor condition
- Resurfacing and/or structural overlay of roads suffering from surface cracking
- Construction of side shoulders and installation of roadside drainage, if & where needed
- Clearance of encroachments and geometric corrections where feasible
- Provision of footpaths, particularly in high pedestrian traffic zones
- Improvement of road-side infrastructure

All improvements will be aligned with sustainable road engineering practices and coordinated with utility service departments to prevent post-construction disturbances.

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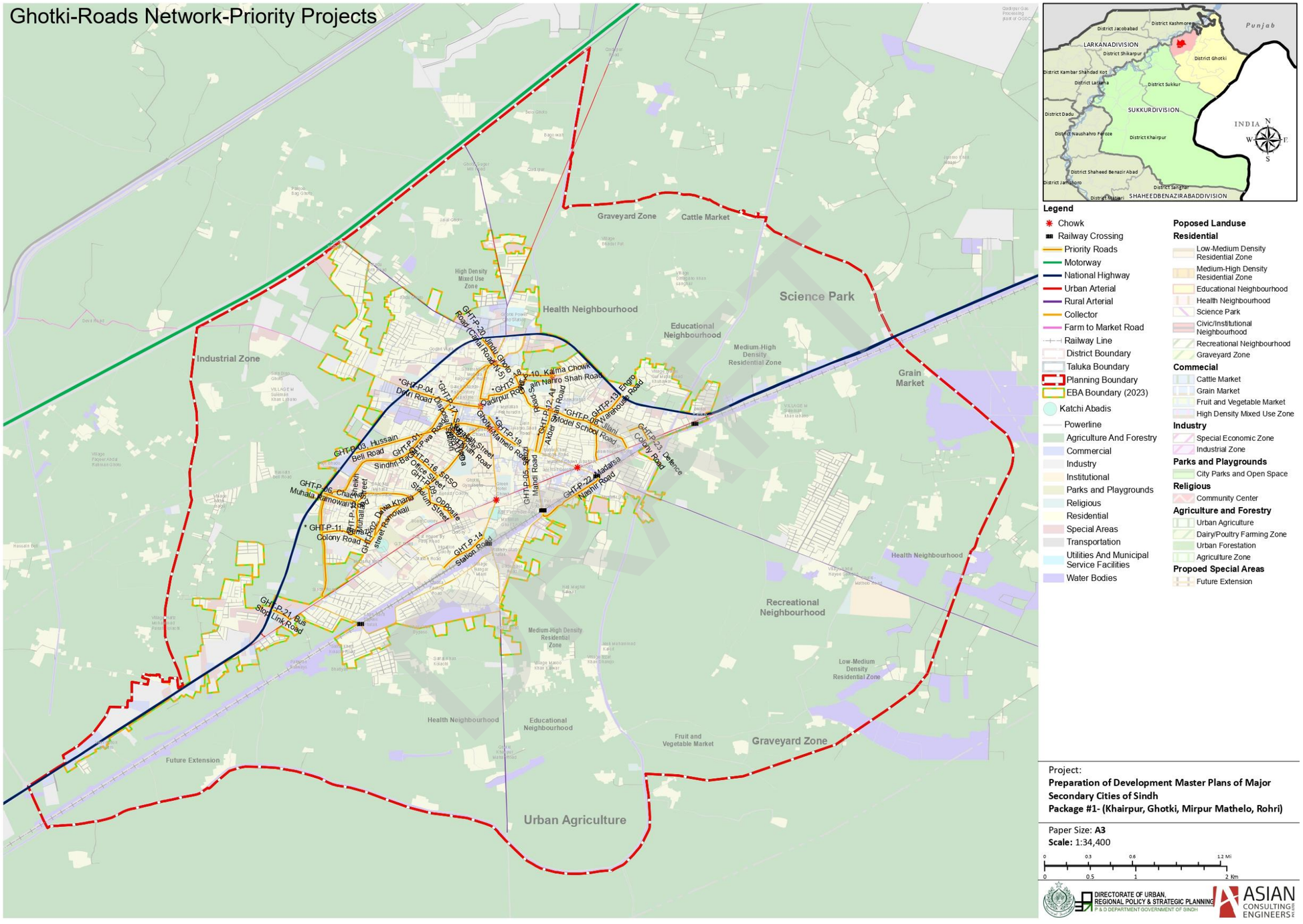


Figure 9-2, Priority Roads Network Map of Ghotki

Source: *The Consultant Team*

1. Priority Roads Project

This section highlights the priority projects for the upgradation and expansion of Ghotki's road network, focusing on improving connectivity, safety, and accessibility to support the city's growing socio-economic needs. Given Ghotki's strategic location within Sindh and its role as a regional hub, enhancing the existing road infrastructure including major provincial highways and new link roads is essential to facilitate efficient transportation of goods and people.

The proposed priority projects aim to upgrade key routes to standard widths with proper drainage and safety features, reduce travel times, and connect rural areas with urban centers, thereby promoting regional development and integration. These improvements will not only address current deficiencies in road quality and capacity but also lay the foundation for sustained economic growth and improved quality of life for residents.

Road Network Upgradation and New Link Road

The road network in Ghotki is facing significant challenges due to continued neglect, inadequate drainage systems, ad hoc utility installations and overloading of heavy vehicles. The deterioration has become a major concern, directly affecting mobility, safety, and the regional economy.

Road segments of collectors and arterials, present in critical locations, including agricultural and industrial zones, have experienced varying degrees of structural failure. Many roads suffer from surface cracking, base erosion, edge breaking, and water-related damage. Additionally, encroachments, poor geometric design, and lack of pedestrian facilities further reduce the functionality and safety of the network.

This situation demands a systematic rehabilitation and improvement program, prioritizing the most critical sections based on condition, traffic load, economic importance, and connectivity value.

List of Priority Projects (Excluding Core Urban Areas)

Sr. No.	Name of Road	Adjacent Land Use	Length (km)	Tentative Cost (Million PKR)
GHT-P-20	Jindo Ghoto Road (Canal Road-N-5)	Commercial	0.23	27.96
GHT-P-21	Bus Stop Link Road	Residential	0.20	33.71
GHT-P-22	Madarsa Nashir Road	Residential	0.70	59.70
GHT-P-23	Defence Colony Road	Residential	0.28	25.87

Scope of Proposed Work

The proposed initiative focuses on the rehabilitation of road infrastructure. The scope may include:

- Reconstruction of roads in poor condition

- Resurfacing and/or structural overlay of roads suffering from surface cracking
- Construction of side shoulders and installation of roadside drainage, if & where needed
- Clearance of encroachments and geometric corrections where feasible
- Provision of footpaths, particularly in high pedestrian traffic zones
- Improvement of road-side infrastructure

All improvements will be aligned with sustainable road engineering practices and coordinated with utility service departments to prevent post-construction disturbances.

Project Benefits

- Improved Regional Connectivity.
- Reduced Transportation Costs.
- Increased Road Safety
- Support to Economic Activities

Institutional Responsibility

The implementation of the proposed works will be led by the Works and Services Department, Government of Sindh, in coordination with local Municipality. Technical assessments, prioritization, and supervision shall follow departmental standards and provincial infrastructure planning frameworks.

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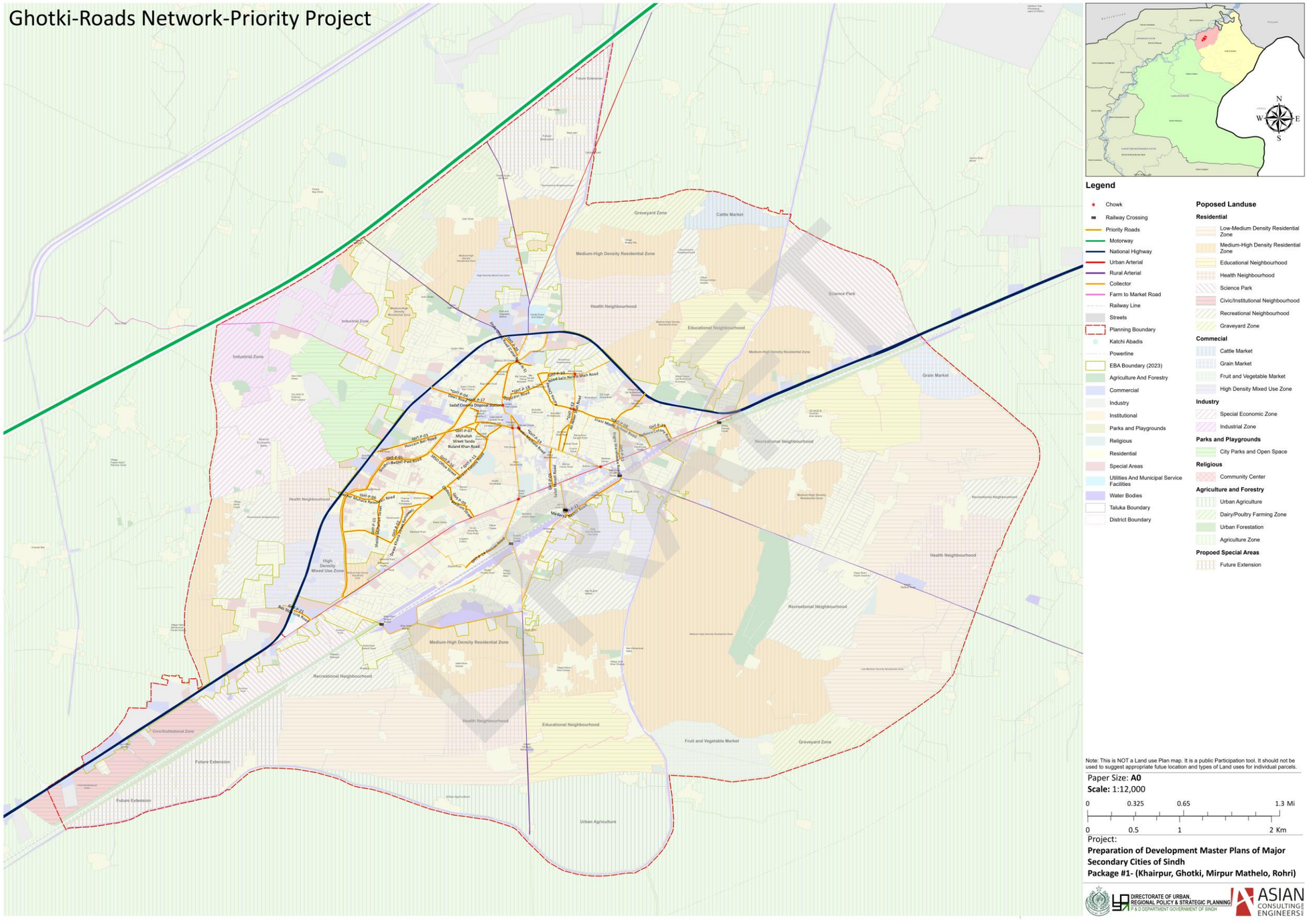


Figure 9-4, Priority Roads for Ghotki

Source: *The Consultant Team*

2. Immediate Action Plan for Core Urban Area

The condition of several roads in Ghotki's central urban area has significantly declined over recent years. Key commercial routes and residential link roads now suffer from broken surfaces, irregular widths, poor drainage, and widespread encroachments. These issues are not only affecting mobility but also contributing to traffic congestion and safety risks. This plan prioritizes the immediate rehabilitation of key roads that play a critical role in daily movement within the town. These include:

- Sindhri–Baghwa Road – A high-traffic residential-commercial corridor
- Hussain Beli Road and Devri Road – Serving busy commercial areas
- Sabzi Mandi Road – A key route for market logistics
- Kalma Chowk to Sain Nahro Shah Road – Connecting mixed-use areas
- Station Road – A vital access route to the central railway station
- Benazir Colony Road and Ali Akber Shah Road – Connecting dense residential clusters
- Ghotki–Mathelo Road and Qadirpur Road – Secondary connectors with regional significance

The rehabilitation scope includes:

- Repair and resurfacing of worn-out pavements
- Clearly marking road boundaries and restoring the right-of-way
- Introducing green medians, lane markings, and traffic signs
- Providing safe pedestrian crossings at key intersections

A key aspect of this work will be addressing encroachments. Instead of forceful removals, the plan encourages a community-driven approach involving local residents and businesses to agree on realignments. With public cooperation, we can improve road access while minimizing disruption and building a sense of ownership among the community.

Encroachments on Central Business District (CBD) roads, particularly those obstructing road width and pedestrian movement, will be removed with the support of the local administration. All rehabilitated roads will be upgraded with proper surface treatment and drainage, designed to support both vehicular and foot traffic.

Sr. No.	Name of Road	Adjacent Land use	Length (Km)	Tentative Cost (Million PKR)
GHT-P-01	Sindhri-BaGHT-Pwa Road	Residential/commercial	3.44	409.06
GHT-P-02	Dawa Khana street Rahmowali	Residential/commercial	0.52	15.8937

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Sr. No.	Name of Road	Adjacent Land use	Length (Km)	Tentative Cost (Million PKR)
GHT-P-03	Hussain Beli Road	Commercial	1.37	154.3872
GHT-P-04	*Devri Road	Commercial	0.72	66.0297
GHT-P-05	Sabzi Mandi Road	commercial	0.42	70.0167
GHT-P-06	Chacher Mohalla Rahmowali Road	Residential	0.92	83.7371
GHT-P-07	Mohallah Street Tando Buland Khan Road	Residential	0.51	15.12
GHT-P-08	*Jilani Model School Road	Residential	1.08	77.5917
GHT-P-09	Opposite Stadium Street	Residential	0.50	35.7627
GHT-P-10	Kalma Chowk Road-Sain Nahro Shah Road	Mix Use	0.66	61.5186
GHT-P-11	*Benazir Colony Road	Residential	2.19	199.0799
GHT-P-12	*Ali Akber Shah Road	Residential	0.79	74.36
GHT-P-13	Engro Warehouse Road	Residential	0.87	81.4242
GHT-P-14	Station Road	Residential	0.51	50.8592
GHT-P-15	Sheikh Mohallah Street	Residential	0.37	12.5736
GHT-P-16	SRSO Office Street	Residential	0.39	13.2912
GHT-P-17	*GHT-P-21, Sadaf Cinema Disposal Station	Residential	0.22	7.54
GHT-P-18	*GHT-P-22, Qadirpur Road	Residential	1.25	125.0928
GHT-P-19	*GHT-P-23, Ghotki-Mathelo Road	Mix Use	0.48	38.688

**These roads are to be rehabilitated after sewerage rehabilitation.*

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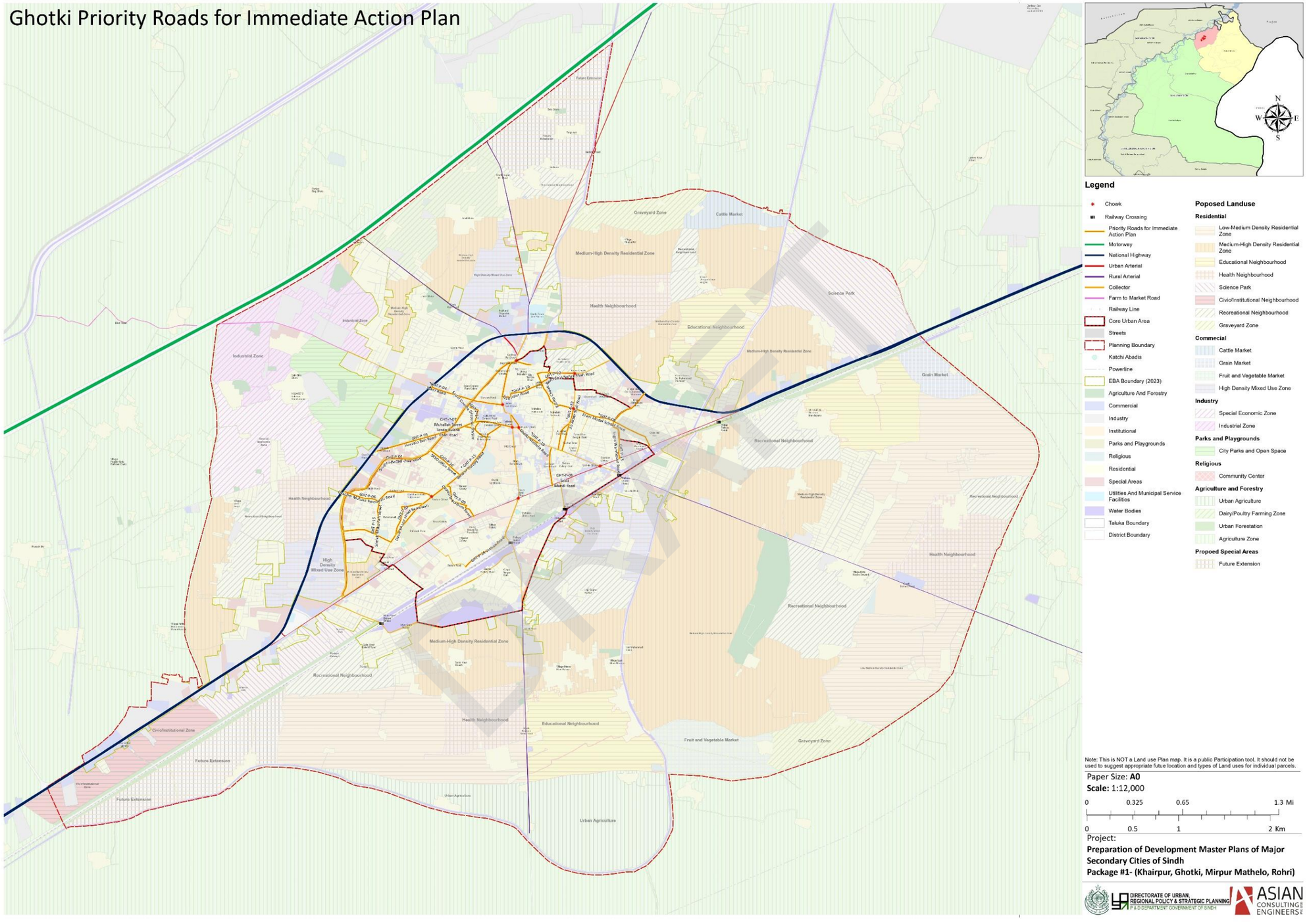


Figure 9-3, Repair & Rehabilitation & Improvement in Transport Facilities for Core Urban Area

Source: *The Consultant Team*

E) Future Roads

The future development plan for secondary cities in Sindh prioritizes a well-structured road network to enhance connectivity, accessibility, and urban expansion. The proposed road infrastructure is strategically aligned with the planned land use framework to support mobility, economic growth, and sustainable urbanization.

Additionally, existing small earthen roads and informal pathways have been identified for formal marking and potential upgrades to improve local accessibility and integrate them into the broader transportation network. This initiative ensures the preservation of vital local routes while facilitating their transition into durable, all-weather roads.

The road development strategy emphasizes sustainability, climate resilience, and efficient traffic management to accommodate future urban growth. By integrating planned and existing roads, this initiative aims to create a well-connected and future-ready urban landscape, promotion of economic and social development across secondary cities in Sindh.

Collector: These roads penetrate localities within districts and feed traffic down from the primary and secondary networks.

Arterial: Arterial roads are high-capacity roads that ensure efficient traffic flow over medium to long distances, connecting urban centres, commercial areas, and transport hubs while limiting direct property access.

Bypass: Bypass roads are roads built to divert traffic around congested or urban areas, reducing congestion, improving traffic flow, and enhancing safety by minimizing through-traffic in city centres.

The table shows the future existing and proposed roads for Ghotki city, the table describes the name/category, start end points coordinates, length, existing pavement type and the proposed ROW. The ROWs of the future roads are proposed on the basis of the NRM[15] and their categorization in the SAR report. The ROWs for the collectors are defined of 20 meters, arterials 35 meters and for the bypass roads ROWs are defined as 50 meters according to Standard Right of Ways for Urban Roads table-7.8 NRM-1986. These roads are proposed considering all the services under the berms.

The existing roads carriageway shall be remained same through the length till the city extend the ideally the proposed ROW shall be attained in the unbuilt area.

[15] *National Reference Manual on Planning and Infrastructure standards-1986, MoP Housing and Works*

Table 9-3, Long Term Action Plan Roads

Sr. No.	Road Name/Category		Start Point	End Point	Length	Existing Pavement Type	Proposed ROW
1	Proposed Collector		528197.36, 3099071.48	531949.92, 3102119.86	4.85	Asphalt	20
2	Proposed Collector		532879.39, 3098165.4	533676.97, 3100186.21	2.25	Earthen	20
3	Collector Masso Khan Road	Collector	532800.84, 3097914.9	531199.77, 3093460.19	6.2	Earthen	20
4	Proposed Collector		528068.03, 3095151.81	528189.75, 3099071.56	3.95	-	20
5	Proposed Collector		534923.58, 3099000.58	531003.85, 3100271.87	4.53	-	20
6	Ghotki Sugar Mill Road	Rural Arterial	531183.40, 3099302.83	530765.41, 3101058.57	1.82	Asphalt	35
7	Jindu Ghoto Road	Rural Arterial	530914.85, 3098958.34	529575.43, 3100008.56	1.72	Asphalt	35
8	Devri Road	Rural Arterial	530215.62, 3098395.18	528201.96, 3099071.80	2.15	TST	35
9	Hussain Beli Road	Rural Arterial	529659.37, 3097666.23	528149.11, 3097177.12	1.58	TST	35
10	Ghotki Khanpur Road	Rural Arterial	531127.52, 3095973.29	531199.27, 3093461.99	2.51	Asphalt	35
11	Ghotki Mathelo Road	Rural Arterial	532532.59, 3097254.25	535470.71, 3095976.70	3.2	Asphalt	35
12	Railway Road-1	Urban Arterial	532800.78, 3097897.16	534990.73, 3098869.87	2.44	Earthen	35
13	Railway Road-2	Urban Arterial	529774.88, 3095793.48	526713.31, 3093615.19	3.75	Earthen	35
14	Proposed Urban Arterial	Urban Arterial	533605.02, 3098206.33	528950.71, 3095212.01	7.58	-	35
15	Proposed Bypass	Bypass	534937.06, 3098951.84	526330.22, 3093840.26	14.2	-	50

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Collector: These roads penetrate localities within districts and feed traffic down from the primary and secondary networks.

Arterial: Arterial roads are high-capacity roads that ensure efficient traffic flow over medium to long distances, connecting urban centers, commercial areas, and transport hubs while limiting direct property access.

Bypass: Bypass roads are roads built to divert traffic around congested or urban areas, reducing congestion, improving traffic flow, and enhancing safety by minimizing through-traffic in city centers.

The proposed initiative focuses on the rehabilitation and construction of new roads infrastructure. The scope may include:

- Widening or rehabilitation of existing links.
- Construction of new links.
- Construction of structure (if any) like culverts, bridges etc.
- Reconstruction of roads in poor condition
- Construction of side shoulders and installation of roadside drainage, if & where needed

Provision of footpaths, particularly in high pedestrian traffic zones, and utility corridors

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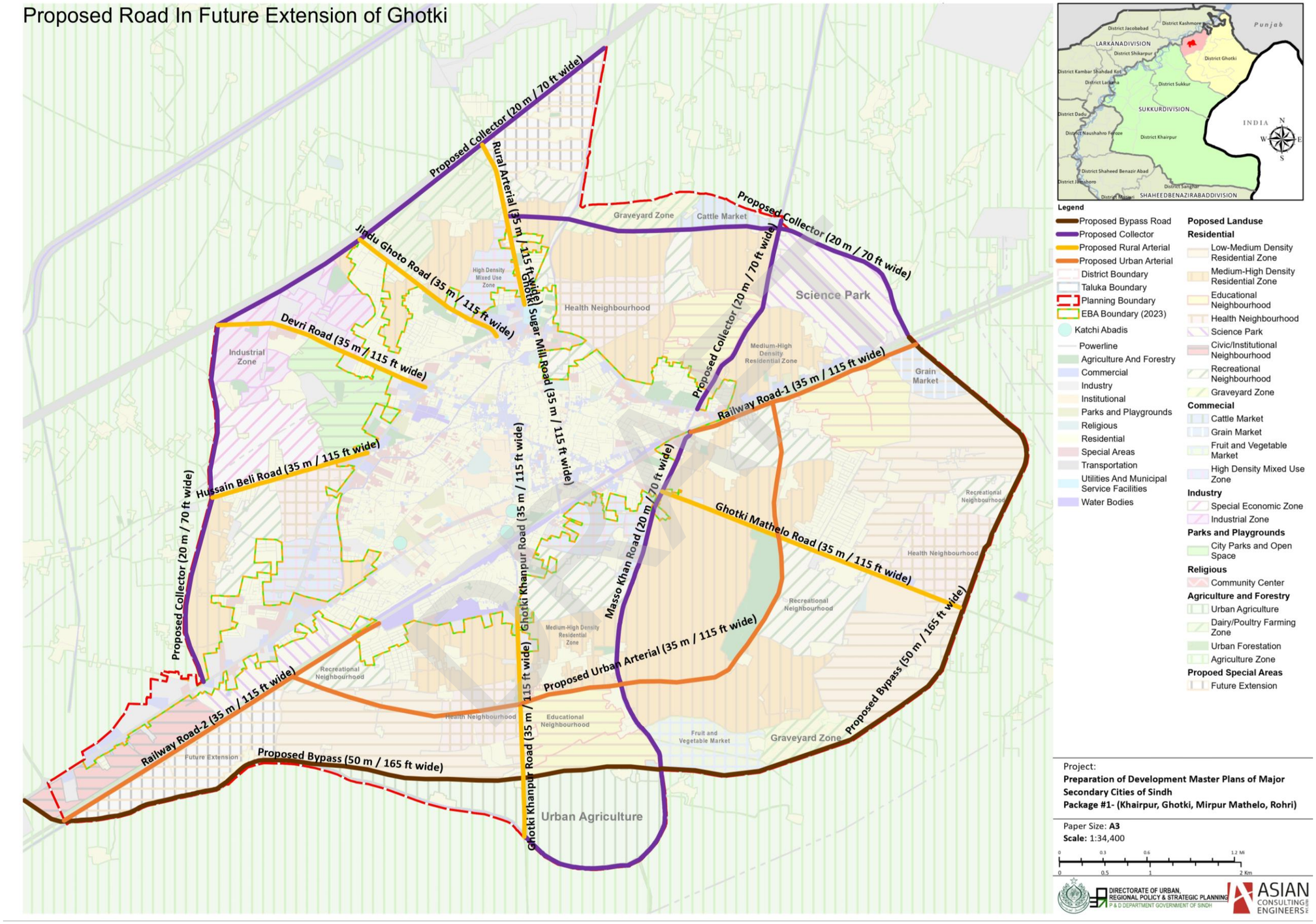


Figure 9-3, Future Roads Network Map of Ghotki

Source: *The Consultant Team*

9.3 Telecommunication

9.3.1 Existing Situation

Telecommunication services in District Ghotki remain limited, with inconsistent mobile and internet coverage across the region. Field surveys and network coverage maps indicate that while major providers such as Jazz, Ufone, Zong and Telenor offer 2G, 3G, and 4G services, the quality and availability of these services vary significantly. Many areas still lack reliable access to high-speed internet and stable mobile signals, highlighting a significant digital connectivity gap in the district.

9.3.2 Key Issues and Challenges

Field Survey provides us the data regarding the availability or non-availability of PTCL landline in respective areas of Ghotki.

There are still many houses where there is no connection of Landline. Data Collection from survey also provided us the information regarding the connections of landline in different areas of the Ghotki. The Table mentioned below shows details above the connections.

Table 9-4, Availability of Telecom in Ghotki City

Parameters	Details
Total No. of Houses	1,099
No. of Houses with Landline	53
Cellular Connection	1,046

Source: *The Consultant Team*

9.3.3 SWOT Analysis

Strengths	Weaknesses
• Widespread GSM mobile coverage (2G, 3G, 4G) by all major providers. • High mobile phone penetration as alternative to landlines.	• Nearly 95% of households lack PTCL landline access. • Low PTCL internet coverage (only 53 households). • Telecom infrastructure lacks disaster resilient design and redundancy.
Opportunities	**Threats**
• Expand broadband infrastructure (fiber and wireless). • Promote affordable home internet and landline bundles. • High reliability telecom services for commercial and industrial zones.	• Overreliance on mobile data networks. • Lack of digital literacy limits internet adoption.

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9.3.4 Need Assessment

A detailed need assessment highlights the specific requirements for improving Ghotki's communication infrastructure:

Extension of Landline Connectivity:

- A significant portion of households (1046) still lack PTCL landline connections.
- There is an urgent need to lay down additional copper and fibre-optic cables to expand reach.

Broadband Internet Expansion:

- Internet access is limited to almost all households, indicating low broadband penetration.
- Increasing fibre-optic and wireless broadband infrastructure is essential to bridge the digital divide.

Community Digital Awareness and Training:

- Digital literacy remains a barrier to full utilization of communication tools.
- Workshops and campaigns are required to educate residents on safe and productive internet usage, online services, and digital tools.

Disaster-Resilient Telecom Infrastructure:

- Need for redundant network routes, elevated equipment, and protected telecom installations.
- Backup power solutions (solar system and generators) for critical telecom sites.

Early Warning and Emergency Communication Integration:

- Telecom networks must support mass alert dissemination through SMS, cell broadcast, and data services.
- Integration with Disaster Management Authorities and emergency services is required.

Industrial and Commercial Telecom Requirements

Reliable, low latency telecom services are essential for banking, logistics, trading and other industries

9.3.5 Policy Guidelines

To promote equitable and efficient communication services, the following policy directions are proposed:

Service Obligations:

Ensure that all residents, regardless of location, have access to affordable

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and reliable landline and internet services.

Incentivized Infrastructure Development:

Offer tax reliefs or public funding support to telecom providers willing to invest in underserved areas.

Public Internet Access Policy:

Establish and regulate public Wi-Fi zones in urban spaces, especially for educational and emergency use.

Digital Literacy Enhancement:

Collaborate with educational institutions and NGOs to run continuous awareness programs focused on internet safety, online transactions, and e-governance.

Performance Monitoring:

Introduce monitoring systems to ensure telecom providers maintain quality standards for coverage, speed, and customer service.

Disaster-Resilient Infrastructure Standards:

Enforce resilient design standards for telecom towers, exchanges, and data facilities.

Early Warning System Integration:

Mandate coordination between telecom operators and disaster management authorities for emergency alerts.

Industrial and Commercial Connectivity Policy:

Ensure enhanced telecom reliability and redundancy in industrial and commercial zones

9.3.6 Strategic Development Plan

Phase I (2025–2026): Infrastructure Mapping and Pilot Expansion

- Conduct a detailed GIS-based mapping of current PTCL and mobile infrastructure.
- Identification of vulnerable telecom assets.
- Begin expansion of landline services in areas with the highest communication gaps.
- Launch pilot digital literacy sessions in schools and community centers.
- Pilot integration of emergency alert systems with telecom operators.

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Phase II (2027–2029): Broadband Rollout and Public Wi-Fi

- Collaborate with telecom providers to lay resilient fibre-optic networks in high-density zones with backup power solutions.
- Deploy at least 10 public Wi-Fi hotspots in central business areas and public buildings.
- Promote low-cost broadband packages for low-income households.

Phase III (2030–2032): Full Connectivity and Smart City Integration

- Aim for 100% landline and broadband coverage.
- Integrate smart communication systems into urban planning (e.g., smart poles, IoT networks).
- Digitize public services and promote e-governance through reliable connectivity.

9.3.7 Priority Projects

Landline Connectivity Expansion Project

- **Goal:** Provide PTCL landline connections to currently unserved households.
- **Estimated Budget:** PKR 180 million
- **Timeline:** 12 months

Broadband Resilient Infrastructure Upgrade Project

- **Goal:** Expand fibre-optic and DSL internet coverage with redundancy, backup power and flood protection to at least 80% of the city.
- **Estimated Budget:** PKR 424 million
- **Timeline:** 18 - 24 months

Public Wi-Fi Deployment Initiative

- **Goal:** Set up 10 free Wi-Fi hotspots in key public areas.
- **Estimated Budget:** PKR 15 million
- **Timeline:** 6 - 8 months

Industrial Connectivity & Early Warning Integration Project

- **Goal:** Enable SMS and cell broadcast alerts linked with disaster management authorities and provide high bandwidth, reliable telecom services for industrial and commercial areas.
- **Estimated Budget:** PKR 25 million
- **Timeline:** 3 - 5 months

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Digital Literacy and Outreach Program

- **Goal:** Conduct 100+ training sessions across Ghotki city to promote digital awareness.
- **Estimated Budget:** PKR 10 million
- **Timeline:** 12 months (recurring)

9.3.8 Immediate Action Plan for Core Urban Area

Action	Timeline	Responsible Entity	Expected Outcome
Survey unserved areas for landline & internet	1 month	PTCL & Municipal Committee	Precise targeting of connectivity expansion
Provide PTCL landline connections to 500 homes	3 - 6 months	PTCL	50% reduction in landline gaps
Extend PTCL broadband coverage	6 months	PTCL & ISPs	200 new households connected
Install 3 public Wi-Fi hotspots (trial phase)	3 months	IT Department	Free internet access in public markets

9.4 Energy

This section scrutinizes the city's essential services in the domains of power networks to gain an in-depth understanding of their current status. Electricity is pivotal for the city's development, growth, and the quality of life for its residents. The report assesses the state of these networks, identifies opportunities and challenges, and outlines some recommendations for improvement of the power sector.

9.4.1 Existing Situation

The capacity of the Ghotki grid station is 52 MVA, there is still provision for the installation of two more 132/11 kV transformers to cater the overload condition of the grid station and to short the duration of load sheading in the area.

9.4.2 Key Issues and Challenges

Field Survey provides us the data regarding the availability or non-availability and load sheading of electricity in respective areas of Ghotki.

There are still many houses without electricity supply. The primary data collected from the city provides some insight of electricity consumptions in Units from individual sampled houses and also, it depicts the pattern of load sheading hours in different areas of the Ghotki city. The **Table 9-5** shows the availability / non-availability of electricity, load shedding hours, as well as the alternative source of power, which people have privately installed and the total consumptions of energy by each sample household.

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Table 9-5, Availability of Electricity in Ghotki City

Sr. No.	Parameters	Details
1	Total No. of Sample Houses	1,099
2	No. of Houses with Electricity	943
3	No. of Houses without Electricity	156
4	Average Load Sheading (Hours)	5-6 hours daily
5	Alternative Source of Supply	Solar Installed on 402 houses as alternative source of supply
6	Average Energy Consumptions per house (Units) (in summer, as the surveys were conducted in August)	0-50 (140 houses) 51-100 (510 houses) 101-200 (211 houses) 201-300 (81 houses) Above 300 units (15 houses)

Source: *The Consultant Team*

9.4.3 SWOT Analysis

Strengths	Weaknesses
• 132/11 kV Grid Station is installed to meet the power requirements of the city. • Overhead electrification is installed to distribute the power from grid station to the residences. • Infrastructure for electricity is established for efficient distribution to the consumers.	• The generation of electricity is expensive. • There is demand and supply gap in power consumption. • The power transmission and distribution system are inefficient. • Line losses in transmission and distribution. • Infrastructure development is poor. • There is recurring issue of electricity theft. • High per unit cost of electricity to the consumers.
Opportunities	**Threats**
• To increase the power capacity, new transformers can be installed at the existing grid station. • New Grid Station can be proposed to cater for the future demand load. • Electricity can be generated by coal and hydel to reduce the cost of generation. • Create top of the line transmission and distribution network for increased efficiency.	• Most of the areas lack in the general requirement of electricity. • Lack of resources to meet the supply and demand gap for electricity and gas. • Poor infrastructure can damage the equipment installed in the grid station as well as in transmission network. • Lack of awareness regarding electricity.

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• Minimize embezzlement of fuel to decrease the cost of generation with fuel. • Increase the efficiency of the system to decrease the transmission and distribution losses. • Spread awareness to the consumers about the importance of electricity. • Create marketing campaigns to entice consumers. • Infrastructure development with the latest technologies and standards.	

9.4.4 Need Assessment

A comprehensive need assessment for Ghotki's energy sector focuses on addressing both the immediate and long-term challenges of power generation, distribution, and consumption. Given the current state of the power infrastructure, the following aspects are crucial for ensuring sustainable and reliable electricity access for all residents:

Expanding Power Generation Capacity:

- To bridge the existing gap between demand and supply, it is essential to increase power generation capacity. This could include both conventional power generation methods (e.g., coal, gas, fuel) and renewable sources (e.g., solar). The city's grid station is currently at 52 MVA which will require additional generation capacity to reduce the duration of load shedding.

Upgrading the Existing Grid Station and Transmission Infrastructure:

- The existing transmission and distribution systems are outdated and inefficient, leading to significant power losses and unreliability. Upgrading the grid infrastructure is vital for improving the delivery of electricity, reducing line losses, and enhancing system stability.

Reducing Transmission and Distribution Losses:

- Transmission and distribution losses reduce the overall efficiency of the power supply, impacting both the cost and quality of electricity available to consumers. These losses result from inefficiencies in the grid and theft.

Addressing Electricity Theft and Improving Grid Security:

- Electricity theft is a recurring issue that puts the strain on the power grid which leads to additional financial losses and higher electricity

prices for consumers. Addressing this issue will improve both the economic sustainability of the power supply and the quality of service for consumers.

Providing Power to Underserved Areas of the City

- A significant portion of Ghotki's population is still without access to electricity. This disparity creates significant challenges for both residents and the city's overall development.

Educating Consumers on Efficient Energy Use and the Importance of Sustainable Power Consumption

- Promoting energy efficiency and sustainability among residents can help reduce the overall demand on the power grid and encourage more responsible use of electricity.

By addressing these needs, Ghotki can enhance its electricity infrastructure, reduce power outages, and create a more sustainable energy environment for its residents. This approach will also contribute to the broader goal of ensuring that all residents have access to affordable, reliable, and clean energy.

9.4.5 Policy Guidelines

To ensure a reliable, sustainable, and affordable energy supply for the residents of Ghotki, the energy policy focuses on several key areas. The policy addresses both short-term and long-term objectives to strengthen the energy infrastructure, promote energy alternatives, improve grid efficiency, and ensure electricity access.

Below are the essential policy guidelines for the city's energy sector:

Strengthening the Existing Infrastructure

- **Objective**: The existing power grid and transmission infrastructure must be reinforced to cope with the increasing demand for electricity. This will help reduce outages, improve the quality of service, and enhance the resilience of the power system.
- **Policy Actions**:
  - **Upgrade and Expansion:** Investments to modernize and expand the grid, including transformers, substations, transmission lines, and distribution networks, especially in underserved and growing areas.
  - **Infrastructure Maintenance:** Implement regular maintenance schedules for upkeep of existing infrastructure to prevent sudden breakdowns and system inefficiencies.

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Encouraging Renewable Energy Adoption:

- **Objective**: To diversify the energy mix and reduce dependence on expensive fuel-based generation, the policy should promote the use of renewable energy, particularly solar power, given its abundance and cost-effectiveness.
- **Policy Actions**:
  - **Incentives for Solar Adoption**: Provide financial incentives, tax rebates, and subsidies to households and businesses that install solar panels. These measures will help reduce initial installation costs and encourage the widespread use of solar energy.
  - **Government-Backed Solar Projects**: Facilitate large-scale solar power projects, such as solar farms, to supplement the grid with clean, renewable energy. This can help meet the growing electricity demand and reduce reliance on conventional power plants.
  - **Promote Solar for Off-Grid Areas**: In areas that are not connected to the main grid, solar power should be promoted as a viable alternative, with micro-grid solutions being explored for rural or remote communities.
  - **Awareness Campaigns**: Run public awareness programs to educate residents about the benefits of solar energy and other renewable technologies, aiming to increase adoption rates.

Enhancing the Efficiency of the Grid and Reducing Losses:

- **Objective**: Grid efficiency must be significantly improved to reduce power losses during transmission and distribution, which not only wastes energy but also increases costs for consumers. Modernization of the grid is essential for meeting these goals.
- **Policy Actions**:
  - **Upgrade Transmission and Distribution Networks**: Replace outdated infrastructure and invest in higher-quality materials to reduce line losses. Install more efficient transformers, circuit breakers, and conductors to improve overall grid performance.
  - **Reduce Electricity Theft**: Establish stricter regulations and law enforcement to combat electricity theft, which is a significant contributor to losses. This includes surveillance, audits, and the use of tamper-resistant equipment.

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- **Demand-Side Management**: Encourage consumers to adopt energy efficient practices through time of use tariffs that reward lower consumption during peak hours.

Ensuring Access to Electricity Across All Areas of the City

- **Objective**: The energy policy must ensure that all residents of Ghotki, including those in underserved or remote areas, have equal access to reliable and affordable electricity. This will ensure greater social equity and support economic development in all parts of the city.
- **Policy Actions**:
  - **Grid Expansion to Underserved Areas**: Expand electricity distribution networks to reach areas that are currently without power, focusing on communities with limited access to the grid. This may involve constructing new substations or building additional transmission lines.
  - **Subsidized Access for Low-Income Households**: Provide subsidized electricity rates or financial assistance programs for low-income households to ensure that energy costs do not become a barrier to essential services.

By adopting these policy guidelines, Ghotki can move toward a more sustainable, efficient, and equitable energy future. Strengthening the grid infrastructure, promoting renewable energy adoption, improving grid efficiency, and ensuring access to electricity will address both current challenges and future needs. These policies will not only enhance the reliability and affordability of energy but also contribute to the city's overall development and quality of life for its residents.

9.4.6 Strategic Development Plan

The Strategic Development Plan for the energy sector of Ghotki focuses on a comprehensive approach to address both the immediate and long-term energy needs of the city. This plan prioritizes infrastructure expansion, renewable energy development, modernization of the grid, and the adoption of advanced technologies to enhance grid efficiency and ensure reliable electricity supply.

Below are the key components of the Strategic Development Plan:

A) Investment in Infrastructure Expansion and Installation of New Power Transformers:

- **Objective**: To meet the growing demand for electricity and improve system reliability, Ghotki must invest in expanding its electrical infrastructure, especially the capacity of existing grid stations.
- **Strategic Actions**:
  - **Installation of New Transformers**: Prioritize the installation of two additional 132/11 kV transformers at the Ghotki grid

station to alleviate overload conditions and reduce load shedding. These transformers should be strategically placed to handle high-demand areas and support future growth.

- **Substation Expansion (New Grid Station)**: Expand the number and capacity of grid stations throughout the city to ensure that power is efficiently distributed to all areas, particularly underserved or high-demand zones.
- **Strengthening Transmission Lines**: Upgrade and expand transmission lines to increase the overall capacity of the grid, reduce transmission losses, and ensure reliable power supply across all parts of the city.
- **Grid Monitoring and Control**: Implement control systems that allow for better load management and grid stability to prevent overloads and optimize energy distribution.

Development of Alternative Power Sources:

- **Objective**: To reduce dependency on costly conventional energy sources and minimize the environmental impact of power generation, it is essential to invest in alternative power sources, particularly solar.
- **Strategic Actions**:

  Promote Solar Energy:

  - **Household Solar Programs**: Encourage the installation of rooftop solar panels in both residential and commercial buildings by providing subsidies or tax incentives. This decentralized energy solution will reduce pressure on the grid and lower overall electricity costs for consumers.

B) Improving the Power Distribution Network to Minimize Losses and Reduce Load Shedding

- **Objective**: Enhancing the efficiency of the power distribution network will not only reduce energy losses but also help alleviate frequent load shedding and improve the reliability of the electricity supply.
- **Strategic Actions**:
  - **Upgrade Distribution Infrastructure**: Replace outdated cables, transformers, and other equipment with more efficient and durable technology to improve the quality of electricity supply.
  - **Reduce Losses through Maintenance and Monitoring**: Implement real-time monitoring systems to track electricity consumption and pinpoint areas with high losses, ensuring urgent repairs and better load management.

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- **Address System Vulnerabilities**: Strengthen the distribution network in areas with frequent power outages and enhance the resilience of infrastructure against environmental factors (e.g., storms, flooding) that can cause service interruptions.
- **Focus on Load Management**: Implement strategic load management techniques, such as shifting non-essential loads to off-peak hours, to reduce peak demand on the grid and minimize load shedding during high-demand periods.

Implementation Timeline and Phases:

The Strategic Development Plan should be implemented in phases, with short, medium, and long-term objectives to ensure that progress is measurable and achievable.

Short-Term (1-3 Years)

- Begin the installation of additional transformers at key locations.
- Launch pilot projects for solar energy adoption in residential areas.
- Initiate the installation of smart meters and develop basic monitoring systems for grid management.

Medium-Term (5-10 Years)

- Expand the solar power program and build a utility-scale solar farm.
- Upgrade critical portions of the transmission and distribution networks to reduce losses.
- Implement full-scale deployment of smart grid technologies and energy storage solutions.

Long-Term (10-16 Years)

- Fully integrate renewable energy sources.
- Installation of new 132/11 kV Grid Station.
- Installation of new transmission lines along with the associated infrastructure.
- Achieve a fully modernized grid with advanced automation and real time monitoring.
- Ensure that electricity access is extended to all underserved areas of the city, and the grid is protected against environmental disruptions.

By implementing this Strategic Development Plan, Ghotki City will be able to strengthen its energy infrastructure, diversify its energy sources, reduce power losses, and improve grid reliability. These actions will not only enhance the overall quality of electricity service but also contribute to the city's sustainable development and the well-being of its residents.

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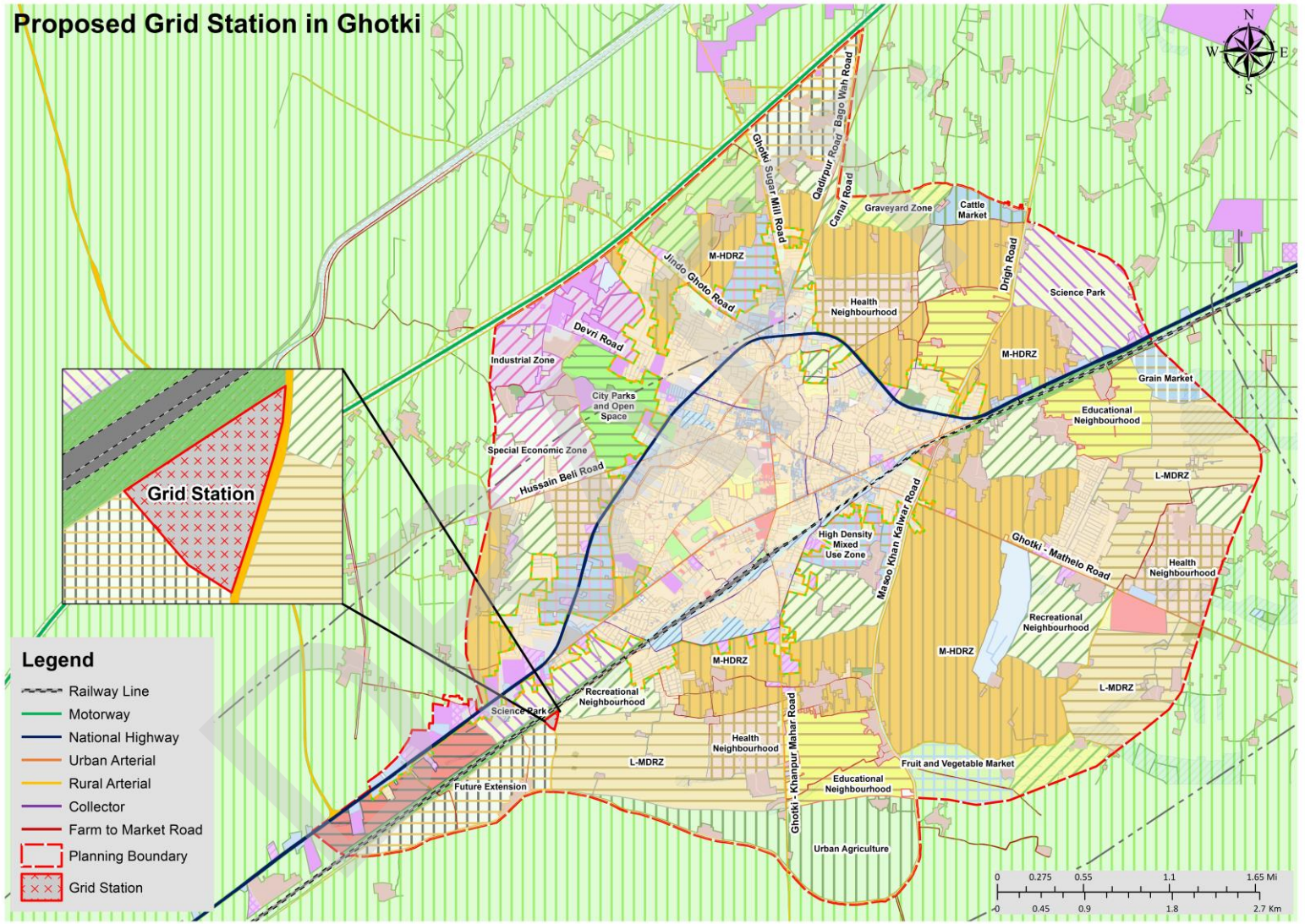


Figure 9-4, Proposed Grid Station in Ghotki

Source: *The Consultant Team*

9.4.7 Priority Projects

The Priority Projects for the power sector of Ghotki focuses on addressing the most pressing issues in the electricity supply chain, from generation to distribution. These projects are designed to ensure improved reliability, reduced load shedding and enhanced efficiency. Below are the key priority projects that should be undertaken immediately:

Installation of Additional Transformers at the Ghotki Grid Station:

- **Objective**: To address the overload condition of the current grid and reduce the duration of load shedding.
  - **Installation of Transformers**: Install two additional 132/11 kV transformers at the Ghotki grid station to enhance its capacity and support increased demand.
  - **Grid Capacity Expansion**: Ensure the new transformers are strategically placed to balance the load distribution across the city and accommodate future growth.
  - **Outcome**: The installation will reduce strain on the existing grid, lower load shedding hours, and improve overall grid stability.

9.4.8 Immediate Action Plan for Core Urban Area

The Immediate Action Plan for the core urban area of Ghotki focuses on addressing the pressing issues related to power shortages, load shedding, and energy efficiency. This structured approach aims to provide relief to residents, improve grid reliability, and promote sustainable energy practices.

- Install temporary power backup systems to reduce load shedding in critical areas.
- Begin the installation of additional transformers and network improvements.
- Promote small-scale renewable energy installations for households, such as solar panels.

9.5 Gas Supply

This section scrutinizes the city's essential services in the domains of gas networks to gain an in-depth understanding of their current status. Gas is pivotal for the city's development, growth, and the quality of life for its residents. The report assesses the state of these networks, identifies opportunities and challenges, and outlines some recommendations for improvement of the gas sector.

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9.5.1 Existing Situation

Field Survey provides us the data regarding the availability or non-availability and load sheading of gas in respective areas of Ghotki. The Table mentioned below shows the availability /non availability load shedding hours including alternative source of gas supply.

Table 9-6, Availability of Gas in Ghotki City

Sr. No.	Parameters	Details
1	Total No. of Houses	1,099
2	No. of Houses with Sui gas	819
3	No. of Houses with no connection of Sui gas	280
4	Average Load Sheading (Hours)	5-6 hours daily
5	Alternative Source of Supply	Wood and Gas Cylinders are used as an alternative source.

Source: *The Consultant Team*

9.5.2 Key Issues and Challenges

There are still many houses without supply of sui gas. Data Collection from survey also provided the information regarding the load sheading hours in different areas of the Ghotki city.

9.5.3 SWOT Analysis

Strengths	Weaknesses
• Gas network is established and provides gas to the residents of the city. • Gas network has helped the users to complete everyday tasks pertaining to cooking, heating etc.	• Gas is not available to all the consumers in the city. • Gas is widely unavailable due to the poor infrastructure network.
Opportunities	**Threats**
• Installation of TBS (Town Build Station) for better distribution of gas for existing as well as new consumers. • Improvement of infrastructure gas network.	• Lack of strategic planning to implement the latest systems for gas. • Lack of advertisement to educate consumers.

9.5.4 Need Assessment

A comprehensive Need Assessment for Ghotki's gas supply network is essential to identify the specific interventions necessary to address current gaps and future challenges. Based on the existing data and issues faced by residents, the following key needs have been identified:

A) Expanding the Gas Supply to Underserved Areas

A significant portion of Ghotki's population still lacks access to Sui gas, which affects their ability to meet basic energy needs for cooking and heating. The first priority is to expand the gas network to underserved and remote areas to ensure that all households in the city have reliable access to Sui gas.

B) Upgrading the Gas Infrastructure and Flood Resilience

Gas supply issues like load shedding are a direct result of inefficient infrastructure. Areas facing supply problems or low gas pressure require immediate infrastructure upgrades, including the replacement of outdated pipes, valves, and other critical components. Additionally, installation of Town Build Stations (TBS) and other necessary infrastructure is essential to improve the distribution network, which will help to reduce load shedding and improve overall service delivery.

Underground gas pipelines are at risk of corrosion, soil erosion, joint displacement and physical damage caused by water pressure or debris movement. To enhance resilience, aging pipelines should be replaced with corrosion-resistant and high-pressure-rated materials capable of withstanding prolonged water exposure. In flood prone zones, pipelines should either be elevated where feasible or structurally reinforced with protective casing and proper anchoring to prevent displacement.

C) Raising Awareness Among Residents

A significant challenge faced by Ghotki's gas network is the lack of awareness about the availability of gas services and the benefits of direct connections. Many households still rely on wood and gas cylinders for cooking, which are less efficient and harmful to health. There is a need for a comprehensive public education campaign that informs residents about the advantages of using Sui gas, the process of obtaining gas connections, and the safety precautions necessary for handling and using gas efficiently. Educating residents will help increase demand for connections and improve the overall safety and sustainability of the gas supply system.

D) Emergency Management & Industrial Safety Protocol

An Emergency Management and Industrial Safety Protocol is essential to minimize risks associated with gas leakages, fires and industrial accidents. This includes the development of a formal Gas Emergency Response Plan outlining standard operating procedures for incident reporting, evacuation, containment and coordination with relevant emergency services. A 24/7 Gas Emergency Control Room should be established to ensure immediate response and centralized communication during emergencies. In addition, automatic shut-off valves should be installed in high-risk and industrial areas to prevent large-scale damage in case of pipeline rupture.

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E) Alternate/Contingency Planning for Industries

To ensure supply reliability and operational continuity, adoption of an N+1 redundancy system in gas supply lines is recommended. This approach will provide backup capacity in case of primary line failure, thereby minimizing the risk of production disruption and enhancing overall system reliability.

By addressing these key needs through targeted interventions, Ghotki can improve the reliability and reach of its gas supply, ensuring access for all residents while laying the foundation for a more efficient and sustainable energy system in the future.

9.5.5 Policy Guidelines

To address the gas supply issues effectively in Ghotki, a set of clear and actionable policy guidelines is essential. These guidelines will form the basis for sustainable development, equitable access, and operational efficiency within the gas distribution system:

- **Access Policy**

  Ensure 100% coverage of Sui gas in all urban and other areas of Ghotki by 2030.

- **Infrastructure Resilience Policy**

  Develop and implement standards for infrastructure upgrades, with a focus on durability, safety, and scalability.

- **Equity and Affordability**

  Introduce subsidized connection schemes for low-income households to ensure equitable access.

- **Safety and Compliance Regulations**

  Enforce strict compliance with gas safety standards through regular inspections and community outreach programs.

- **Public-Private Partnership (PPP)**

  Encourage investment from the private sector in expanding and maintaining the gas infrastructure under regulatory oversight.

- **Consumer Awareness and Support**

  Establish permanent outreach units under the utility provider to engage residents, increase awareness, and support users in accessing services.

9.5.6 Strategic Development Plan

The strategic plan for the gas supply sector in Ghotki revolves around phased interventions, infrastructure expansion, and sustainable service delivery:

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Phase I (Short-Term: 1 to 3 years)

- Complete technical assessment of current gas infrastructure.
- Begin expansion in areas with no Sui gas coverage
- Install at least 2 Town Build Stations (TBS) to improve distribution efficiency.
- Initiate awareness campaign in 3 underserved areas.

Phase II (Mid-Term: 5 to 10 Years)

- Full network coverage across suburban areas.
- Integrate smart metering and pressure monitoring systems.
- Launch mobile service units for gas safety education and connection support.
- Begin phased replacement of aging pipelines and valves.

Phase III (Long-Term: 10 to 16 Years)

- Achieve seamless service with minimal load shedding in winter (<1 hour/day).
- Implement digitized network monitoring for predictive maintenance.
- Complete replacement of aging pipelines and associated material.

9.5.7 Priority Projects

Based on the identified needs and development strategy, the following projects are recommended for immediate prioritization:

Ghotki City Gas Network Expansion Project

- Objective: Connect all 344 unserved households.
- Budget Estimate: PKR 150 million
- Timeline: 12 months

TBS Installation and Pipeline Upgrade Initiative

- Objective: Install 2 new TBS units and upgrade 15 km of gas pipelines.
- Budget Estimate: PKR 300 million
- Timeline: 18 months

Gas Awareness and Education Campaign

- Objective: Educate 10,000+ residents through community sessions, pamphlets, and local media.
- Budget Estimate: PKR 10 million
- Timeline: Ongoing (initial 6-month rollout)

Emergency Repair and Maintenance Program

- Objective: Establish a rapid-response team with 24/7 capability for gas-related emergencies.

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- Budget Estimate: PKR 25 million
- Timeline: 6 months

9.5.8 Immediate Action Plan for Core Urban Area

To alleviate the most urgent gas-related issues in Ghotki's core urban areas, the following action plan will be implemented within the next 6–12 months:

Action	Timeline	Responsible Agency	Expected Outcome
Survey and map all households lacking gas access	1 month	Gas Utility Dept.	Accurate data for targeted expansion
Begin installation of new service lines in high-priority zones	3–6 months	Contractor + Utility	Gas access to at least 200 additional households
Deploy one TBS unit near high-load-shedding zone	6 months	Infrastructure Division	30% reduction in daily load shedding
Establish 24/7 customer support and emergency line	1 month	Gas Utility	Increased response efficiency and public trust

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SECTION - 10: ENVIRONMENT

10.1 Existing Situation

Ghotki is strategically located near the Indus River in northern Sindh and serves as the headquarters of Ghotki Taluka. The city lies in a predominantly flat terrain, making it vulnerable to frequent flooding during heavy rainfall or river overflow. Despite its advantageous location along the N-5 highway and proximity to the Sukkur-Multan Motorway (M-5), the city suffers from unplanned urban growth, lacking systematic master planning or zoning regulations. Environmental degradation has gradually worsened due to uncontrolled expansion, overexploitation of natural resources, and absence of integrated waste and drainage systems. The city is also exposed to natural hazards such as floods, droughts, dust storms, urban flooding, and heatwaves, making environmental resilience a key concern for future development planning.

The soil characteristics of Ghotki are variable, ranging from alluvial to saline patches, which influence agricultural productivity. Soil samples taken across the region indicate moderate to poor fertility in certain zones due to salinization and waterlogging, particularly in low-lying areas. The surface water sources include the Indus River and canals such as the Dingro Wah and Ghotki Feeder. These water bodies are critical for irrigation and domestic purposes but are heavily contaminated by untreated sewage and industrial effluents.

Groundwater quality remains a significant concern. Testing conducted across various city locations shows that groundwater is non-compliant with SEQS in many areas. Parameters such as Total Dissolved Solids (TDS), hardness, and chloride levels exceed acceptable limits, making the water unfit for drinking and many domestic uses. Excessive pumping of groundwater, especially in eastern parts of the city, is further depleting aquifers and deteriorating water quality.

Ghotki lacks a wastewater treatment facility, and all domestic and industrial wastewater is discharged untreated into open fields, agricultural lands, or surface drains such as the Dingro Wah and Bhagowah canals. The existing sewerage network consists of a combination of open and covered drains. The city has a total of 36 km of drainage lines and only around 4.5 km of sewerage pipelines. Ten disposal stations are currently operational and help manage the outflow of wastewater. However, the ultimate disposal method relies entirely on direct discharge into natural watercourses without any treatment, leading to severe water pollution and health hazards.

The sewer infrastructure uses outdated materials such as Asbestos Cement (AC) and PVC pipes. No stormwater drainage system exists, resulting in frequent ponding during rainfall, especially in depression areas. This poses a

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significant risk of vector-borne diseases and contributes to the spread of waterborne infections.

The ambient air quality in Ghotki's rural and agricultural areas remains relatively acceptable, with lower levels of pollutants due to limited vehicular and industrial activities. However, in urban and industrial zones, increased emissions from vehicles and factories have contributed to elevated levels of particulate matter (PM2.5 and PM10). These pollutants are primarily the result of poor vehicle maintenance, lack of emission controls, and use of diesel-fueled generators.

Noise pollution is another emerging concern, particularly in commercial areas and transport corridors. The lack of traffic regulation, use of old and noisy vehicles, and proximity of residential zones to busy roads contribute to high noise levels during both day and night. These conditions have adverse impacts on public health, especially for vulnerable populations such as children and the elderly.

Solid waste management in Ghotki is largely traditional and underdeveloped. The city does not have a formal waste segregation system, and recycling is carried out informally by scavengers who collect valuable materials from street containers and dumping sites. The formal system managed by the Municipal Committee covers only a portion of the urban area and lacks adequate vehicles, personnel, and designated waste transfer stations. Hospital waste is not treated as independent hazardous waste stream and mixed with municipal solid waste at source, in collection, transportation and disposal. No incinerator is operational in the project areas for proper scientific disposal.

Currently, there are only two dumping sites within the city, both lacking sanitary landfill features. Open dumping of waste is common, leading to severe environmental and public health issues. Accumulated waste clogs drain, causes foul odor, and becomes a breeding ground for disease vectors such as flies and rodents.

Ghotki city faces serious challenges in water supply and sanitation. The city does not have a municipal piped water supply system. Residents rely heavily on hand pumps, motor pumps, and private water tanker services to meet their daily needs. This decentralized and unregulated water supply system poses major risks to public health due to the potential for contamination, especially in areas with poor groundwater quality.

Sanitation services are similarly limited. In many neighborhoods, open defecation is still practiced, particularly in low-income and peripheral areas. Poorly maintained and inadequate drainage infrastructure, along with the absence of wastewater treatment, exacerbate sanitation-related problems, increasing the risk of outbreaks of waterborne diseases such as diarrhea, hepatitis, and cholera.

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Energy access in Ghotki is unreliable and insufficient to meet residential and commercial demand. Only one 132/11 kV grid station with a 52 MVA capacity exists, which leads to frequent load shedding and power outages. The situation is worsened by limited access to alternative sources like gas and telecommunication networks. Approximately 14.2% of households lack access to electricity, 25.5% are without natural gas connections, and 58.8% have no telecommunication services.

This lack of basic infrastructure has a cascading impact on environmental management, especially in terms of waste treatment, water pumping, and industrial operations that rely on stable power supply.

The natural ecosystem of Ghotki is under pressure due to rapid urban expansion and lack of environmental oversight. Though specific biodiversity data is limited, existing green spaces such as agricultural lands and riverine vegetation are shrinking. NDVI analysis (2023) shows declining vegetation cover, particularly in peri-urban areas. Encroachments on natural waterways and agricultural conversion for housing and industrial use are causing habitat loss and reducing biodiversity in both terrestrial and aquatic environments.

10.1.1 Key Environmental Issues

- The Dingro Wah Canal, flowing adjacent to both residential and industrial areas of Ghotki city, exhibits elevated Biological Oxygen Demand (BOD) levels, indicating a substantial organic pollution load due to untreated domestic and industrial wastewater along with microbial contamination.
- Groundwater assessment identified Total Dissolved Solids (TDS), total hardness, and chlorides as the principal contaminants affecting water quality in Ghotki city.
- The wastewater samples collected from the waste drain did not meet SEQS standards due to untreated disposal of industrial and residential wastewater.
- The results from air quality monitoring in Ghotki city show that the values for PM2.5 and PM10 did not meet the SEQS standards (PM2.5: 75, PM10: 150) in commercial and residential area.
- Elevated noise levels were recorded in several locations, mainly due to heavy vehicular traffic, commercial activity, and industrial operations.
- Un-managed solid waste mechanism and improper disposal.
- High vulnerability to natural disasters like floods and heatwaves.

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10.2 SWOT Analysis

	Internal Factors	External Factors
Positive Impact	**STRENGTHS** • Abundant surface water resources in the city the Indus River, Ghotki Feeder Canal, and Dingro Wah Canal. The availability of these resources can be utilized by farmers for irrigation purposes to enhance crop cultivation and increase agricultural productivity and economic development. • The availability of groundwater in the northern and eastern areas are compliance with SEQS. • Designated green space allocated for riverine forests along the banks of River Indus and irrigated plantations. • The Blind Indus Dolphin are found in Indus River. Some fish species was found which is used as an extractable resource for human consumption. • Agricultural areas in Ghotki maintain good ambient air quality, benefiting residents and agriculture. • Acceptable daytime noise levels in agricultural areas promote a peaceful environment.	**OPPORTUNITIES** • Surface Water, after treatment, can be used as an alternative to ground water to reduce the pressure on ground water source. • Develop and improve water supply and sanitation facilities where needed. • Promote sustainable tourism, minimize harmful impacts on habitats, and educate tourists on conservation. Address threats to biodiversity like habitat destruction, pollution, and overexploitation through awareness and measures to mitigate these impacts in communities, schools, and businesses. • Improving public infrastructure, such as transportation networks and facilities, encourages decreased reliance on private vehicles. This shift contributes significantly to the reduction of both air and noise pollution levels within the community. • The Ghotki Feeder canal flows through industrial areas in the city, particularly near JDW Sugar Mills Unit-03. It is important to consider investing in extensive sustainable energy infrastructure and to provide incentives for industries to utilize renewable energy sources for their operations instead of relying heavily on fossil fuels. This can be supported by promoting research, policy backing, and partnerships aimed at facilitating the widespread implementation of sustainable energy technologies within industrial environments. • Develop and adopt eco-friendly vehicles, alongside greener manufacturing processes within

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	Internal Factors	External Factors
		industries, utilizing cleaner energy sources and implementing carbon capture technologies to reduce emissions significantly. • Encourage innovation, regulatory measures, and investment in sustainable technologies to mitigate pollution from transportation and industries.
Negative Impact	**WEAKNESSES** • Untreated industrial and residential wastewater contaminates the Indus River and canals, leading to a decline in water quality and harming aquatic life as well as agriculture. • Flood-prone Katcha areas near the Indus River suffer frequent flooding due to flat terrain and waterlogging. • The groundwater quality on eastern side found to be in non-compliance according to SEQS mainly due to high levels of TDS, hardness, and chlorides leading to contamination. • Over-pumping on eastern side of city deteriorates groundwater quality, unsuitable for various uses. • High levels of PM2.5 and PM10 are a result of traffic and industrial activities in commercial, industrial, and residential zones, leading to poor air quality. • High noise levels persist due to constant vehicular traffic and industrial operations. • Poorly maintained old vehicles significantly contribute to heightened noise pollution. • A small number of species, such as the Indian Wild Ass, are classified as near threatened, while the Asian Leopard is considered endangered, and the Houbara Bustard is a rare	**THREATS** • The disposal of untreated wastewater in the Indus River and canals adversely affects ecosystems, water quality, and agricultural viability, endangering both aquatic life and crop productivity. • Continuous flooding in flat terrains threatens lives, displaces communities, and damages property near the Indus River. • Excessive or extensive use of groundwater can lead to a lowered water table. • Traffic and industrial emissions contribute to high levels of particulate matter, causing respiratory problems and impacting overall health. • Increase of private vehicles causing more air emissions, impacting air quality and public health. • Implement sound barriers and green buffers around industrial areas, utilizing noise-reducing technologies and zoning regulations to minimize the impact of industrial noise on nearby communities. Encourage industries to adopt quieter machinery, comply with noise emission standards, and engage in community discussions to address concerns and find solutions collaboratively. • Reduction in green areas like forests and grasslands due to urbanization,

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	Internal Factors	External Factors
	species found in this area. • Decrease in green areas causes decrease in biodiversity value and disruption of ecosystem balance. • Decrease in aquatic and terrestrial biodiversity is primarily due to habitat destruction caused by human activities such as deforestation, urbanization, pollution, overfishing, and climate change. These actions disrupt ecosystems, reduce available habitats, and threaten the survival of numerous species, leading to a decline in biodiversity across both land and water environments	deforestation, or agricultural expansion leads to the loss of habitats for various species. • Unplanned urban development diminishes green spaces, leading to disruptions in carbon sequestration, water purification, and soil stabilization. This significantly impacts the overall balance and health of ecosystems. • Industrial waste, agricultural runoff, and other pollutants impact water bodies and terrestrial environments, causing harm to various species and ecosystem in future.

10.3 Policy Guidelines

10.3.1 Compliance with Sindh Environmental Protection Act, 2014

The Sindh Environmental Protection Act, 2014 (SEPA 2014) is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The SEPA 2014 is broadly applicable to air, water, soil, marine and noise pollution. Penalties have been prescribed for those contravening the provisions of the Act. The two primary deliberations of the Act are the conduct of projects only after approval of environmental assessments from the SEPA and adherence with Sindh Environmental Quality Standards (SEQS).

10.3.2 Hazardous Substance Rules, 2014

The Sindh Hazardous Substances Rules, 2014 are a set of rules derived from the Sindh Environmental Act, 2014 and are first of the very specific hazardous substances regulations brought into force in 2014 after the initial draft set of rules devised in 2003. They represent specific regulations with aspect of handling, storage and disposal of hazardous substances and issuing an approving license to the user or facility. The Schedule-I of the Rules enlists the hazardous substances that are under the scrutiny of the Sindh-EPA.

Under its licensing terms, the Rules highlight particular components as follows:

- Employment of Qualified technical personnel
- Packing and labelling
- Conditions of Premises

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- Safety precautions
- Trainings
- A comprehensive safety plan
- Waste management Plan and
- Transporting of hazardous substances

10.3.3 Enforce SEQS Compliance

All wastewater discharges (municipal and industrial) must comply with Sindh Environmental Quality Standards. Regular monitoring by SEPA and local MC is essential. All wastewater discharges monitoring will be followed as per The Sindh Environmental Quality Standards (Self-Monitoring and Reporting by Industries) Rules, 2014. In compliance to stated rules, the submission of Environmental Monitoring Reports to the concerned EPA should be enforced by SEPA officials as per the categories mentioned.

10.3.4 Mandatory EIAs for Projects

Every major infrastructure, industrial, or urban expansion project must undergo Environmental Impact Assessment (EIA) or Initial Environmental Examination (IEE) as per review of IEE and EIA regulations, 2014.

10.3.5 Issuance of Environmental Protection Order

If any environmental non-compliance including discharge or emissions of any effluent waste, air pollutant or noise or to disposal of waste or the handling of hazardous substance or any other act or omission is occurred or likely to be occurred, SEPA has the authority to take actions to immediate stoppage, preventing, lessening or controlling the discharges or emissions. If any entity contravenes to comply the provisions of SEPA, 2014, shall be punishable with a fine as mentioned under section 22 of SEPA, 2014 through Environmental Tribunals.

10.3.6 Enforcement Coordination with other departments

Under the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency has regulatory authority to inspect, issue notices, and enforce compliance, and it may seek assistance from local administrations and public authorities for implementation. Practically, environmental officers routinely coordinate with Municipal Committees, PHED, Industries Department, Labour/OSH authorities, and district administration to ensure that violations are corrected and orders are enforced on ground.

10.3.7 Enforcement through EPA District Incharge

To strengthen environmental compliance and ensure effective implementation of provincial environmental regulations at the local level,

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enforcement responsibilities shall be supported through the office of the District Incharge of the Sindh Environmental Protection Agency (SEPA). While SEPA operates as the principal regulatory authority under the Sindh Environmental Protection Act, 2014, the presence of designated district-level officers enables decentralized monitoring, faster response to violations, and closer coordination with municipal and line departments.

10.3.8 Awareness & Community Involvement

The implementation of environmental projects cannot be achieved without public awareness and community involvement. Current issues being faced at Ghotki city like sanitation, solid waste improper disposal, littering and illegal dumping are because of unfamiliarity and unawareness of environmentally sustainable practices. For this purpose, community involvement sessions are an integral part of implementation of safe environmental practices. The Master plan adopts a community centered approach to improve community behaviour towards environmental initiatives. Structured awareness campaigns will be undertaken through local media, community forums, and public outreach initiatives to educate residents on waste segregation, proper disposal practices, sanitation, water conservation, and the health and environmental risks associated with poor practices.

A) Collaboration with Educational Institutes

Engage educational institutions as key partners through school based environmental programs, clean up drives and plantation initiatives to foster long-term behavioural change among youth. Involve community groups, local leaders and civil society organizations in neighbourhood monitoring, reporting of illegal dumping or drain obstruction and supporting maintenance of green spaces.

Arrange awareness seminars for colleges for solid waste segregation practices, introducing concept for circular economy and water recycling initiatives.

B) Collaboration with Industries

Set up engagement companies with industries, markets and business to further promote environmental compliance and resource recovery practices.

These initiatives will be implemented in a phased manner, with initial awareness and pilot programs in the short term, citywide roll-out and institutionalization in the medium term, and integration into routine municipal operations over the long term. By embedding community participation within all environmental interventions, the Plan ensures improved service efficiency, reduced operation and maintenance costs, enhanced climate resilience, and long-term sustainability of infrastructure investments.

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10.4 Strategic Development Plan

The Environmental Strategy under the Sindh Master Plan for Ghotki City is intentionally framed at a policy and strategic level, rather than as a set of stand-alone infrastructure projects. The approach recognizes that environmental sustainability depends on system integration, institutional capacity, phased implementation, and climate resilience

10.4.1 Priority Projects (Upto 5 Years)

A) Sewerage and Drainage

To prevent untreated wastewater discharge into Dingro Wah and Ghotki Feeder canals under Basic utilities section of this report following projects are proposed.

Sr. No.	Environmental Intervention	Link to Basic Utilities	Key Environmental Outcome
1	Control discharge of untreated sewage into Dingro Wah & Ghotki Feeder canals	Expansion of sewer network in 64–67% unserved areas	Reduction in BOD, COD, and pathogen levels in surface water
2	Prevent sewer overflows and leakages	Rehabilitation of 33–36% existing network	Protection of groundwater from contamination
3	Initiate wastewater treatment	Phase-1 WWTPs (1–2 MGD)	Initial compliance with SEQS and pollution load reduction
4	Improve flood and stormwater management	Drain rehabilitation and cleaning	Reduced urban flooding and stagnation
5	Strengthen disposal station efficiency	Rehabilitation of lift stations	Reliable sewage conveyance and reduced backflow
6	Establish environmental monitoring program	Linked to WWTP & discharge points	Continuous tracking of water quality improvements

Objective

The priority phase focuses on immediate pollution abatement, rehabilitation of deteriorated infrastructure, and initiation of wastewater treatment to mitigate public health risks and reduce contamination of surface and groundwater resources.

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B) Improving Water Supply

Sr. No.	Linked Utility Intervention	Environmental Action	Environmental Outcome
1	New water supply network (2026 acres)	Achieve 100% piped water coverage in MC boundary	Improved sanitation & hygiene
2	10 additional tube wells	Expand safe groundwater abstraction	Controlled withdrawal planning
3	4 OHRs for 2028 demand	Ensure adequate storage capacity	Supply reliability during peak hours

Objective

Improve drinking water reliability and reduce environmental stress caused by informal extraction methods.

C) Solid Waste Management

The following priority projects are proposed to strengthen the solid waste management system of Ghotki City during the short-term planning horizon, focusing on improving collection efficiency, controlled disposal, and environmental compliance

Sr. No.	Linked SWM Intervention	Environmental Action	Environmental Outcome
1	Phase-1 landfill development	Replace open dumping with engineered disposal	Protection of groundwater
2	Material Recovery Facility (MRF)	Reduce landfill burden through recycling	Waste diversion & resource recovery
3	Transfer stations & transport vehicles	Improve transport efficiency	Reduced fuel consumption & emissions
4	Community awareness programs	Introduce waste segregation at source	Improved recyclables recovery
5	Landfill monitoring system	Establish environmental monitoring at disposal sites	Compliance with SEQS

Objective

Shift from uncontrolled dumping to environmentally managed waste disposal system.

D) Air Quality Management

To address the increasing environmental pressures resulting from urbanization and industrial activities, a phased approach toward strengthening municipal environmental governance is proposed

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1. Municipal Environmental Management & Monitoring Unit

As a priority intervention, a Municipal Environmental Management & Monitoring Unit shall be established within the Municipal Committee to institutionalize environmental oversight. The unit will be responsible for monitoring ambient air, water, soil, and noise levels in accordance with SEQS and WHO guidelines. It will conduct periodic sampling, maintain environmental databases, analyze trends, and coordinate with Sindh EPA for enforcement actions.

Objective

Establishment of monitoring unit will provide the institutional backbone required for regulatory compliance and evidence-based environmental planning.

Governing Body

MC Ghotki with coordination of District Incharge, SEPA.

2. Implementation of Air Quality Management System

Following institutional strengthening, an integrated Air Quality Management System (AQMS) shall be developed. This will include installation of real-time ambient air monitoring stations at strategic residential, commercial, and industrial locations. The monitoring data will be integrated into a centralized municipal dashboard to track pollution trends, identify hotspots, and inform urban planning decisions.

Objective

Public disclosure of air quality indices will also enhance transparency and community awareness

Governing Body

MC Ghotki with coordination of District Incharge, SEPA.

3. Urban Green Spots

Plantation of native trees along major roads, drains and open spaces. Convert vacant plots and roadside margins into community green spaces.

Objective

Plantation of native species will reduce $PM_{2.5}$ and PM_{10} in air, increase climate resilience, urban heat resilience and habitat development and restoration

Governing Body

MC Ghotki with coordination of District Incharge, SEPA

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10.4.2 Long-Term Plan (Upto 2043)

A) Improvement of Sewerage and Drainage:

Sr. No.	Link to Basic Utilities	Environmental Intervention	Key Environmental Outcome
1	Construction of 15 MGD & 10 MGD WWTPs	Eliminate direct sewage discharge into canals	Full compliance with environmental standards
2	Complete trunk sewer network (Zone 1–3)	Achieve universal sanitation coverage	Citywide public health protection
3	Effluent reuse system	Implement treated wastewater reuse	Reduced freshwater demand & circular water management
4	Pump station expansion & storm upgrades	Improve climate resilience of drainage system	Protection from extreme rainfall events
5	Sewer asset management system	Develop GIS-based asset & monitoring system	Sustainable O&M and performance tracking
6	Pollution load reduction from full treatment	Restore receiving water bodies ecosystem	Improved aquatic health and biodiversity

B) Water Supply

Sr. No.	Link to Basic Utility	Environmental Action	Environmental Outcome
1	36 tube wells (planned)	Develop aquifer sustainability plan	Prevent over-extraction
2	Zonal abstraction system	Implement groundwater monitoring program	Long-term water security
3	5-zone integrated system	Establish citywide interconnected grid	Resilience against supply shocks
4	15–16 OHRs	Optimize storage for future demand	Drought resilience
5	Demand management	Promote water conservation measures	Reduced per capita demand
6	Canal recharge strategy	Integrate recharge protection zones	Aquifer recharge protection

C) Integrated Solid waste Management

Sr. No.	Linked SWM Intervention	Environmental Action	Environmental Outcome
1	38.18-acre engineered landfill	Develop full sanitary landfill system	Long-term containment of waste
2	LFG collection system	Implement landfill gas capture	Methane reduction & climate mitigation
3	Composting / Anaerobic digestion	Promote organic waste processing	Reduced organic landfill load

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4	Reject fraction utilization	Introduce waste-to-energy feasibility	Reduced landfill dependency
5	Capacity building & PPP models	Strengthen institutional & regulatory framework	Sustainable service delivery
6	Recycling expansion	Implement circular economy framework	Resource efficiency

D) Industrial Air Pollution Control Incentive Framework

Based on monitoring evidence and regulatory assessments, a financial incentive framework shall be introduced to support industries in installing approved air pollution control systems such as bag filters, electrostatic precipitators, and scrubbers. Subsidies or soft-loan mechanisms may be developed in coordination with provincial authorities to facilitate compliance.

Objective

This intervention will reduce particulate matter and gaseous emissions, contributing to sustained improvement in ambient air quality.

E) Climate-Resilient Urban Forestry System

Establishment of urban development zone, ecological corridors connecting green areas and adaptation of carbon sequestration strategy with strategic planning of year 2043.

10.5 Institutional & Financial Sustainability

Effective environmental governance requires continuous monitoring, transparent reporting, and corrective action.

Sindh Environment Protection Agency	SEPA will retain its mandate as the primary regulatory authority responsible for environmental approvals, monitoring, and enforcement, including inspections and compliance actions under the Sindh Environmental Protection Act, 2014
EPA District Incharge	At the district level, the EPA District Incharge will facilitate routine oversight, field inspections, and coordination with local departments to ensure timely implementation of environmental safeguards.
Environmental Management Unit	Environmental Management Unit within the local government structure is recommended to oversee environmental planning, data management, reporting, and liaison with SEPA in terms of solid waste management, drainage, wastewater systems, parks and green spaces.

- The Master Plan adopts a phased and diversified financing approach to ensure that investments remain affordable and financially viable. Basic public service functions such as drainage improvement, green infrastructure, and environmental monitoring

will be supported through provincial and municipal development budgets.

- To control long-term costs, environmental systems will prioritize energy-efficient technologies, decentralized and modular solutions, and preventive maintenance practices that reduce operational expenses and extend asset life

10.6 Financial Planning and Cost Estimates

This section presents indicative financial estimates for priority projects proposed under Strategic Development Plan.

Sr. No.	Project Title	Coverage / Capacity	Estimated Cost (Million PKR)
Drainage and Sewerage Management			
1	Installation of New Sewerage & Drainage Network	1,297 Acres (≈64–67% unserved area)	2,091.36
2	Rehabilitation of Existing Sewerage Network	729.5 Acres (≈33–36% area)	
3	Construction of Phase-1 Wastewater Treatment Plants	1–2 MGD (Zone 1 & 2)	
Water Supply Management			
1	Provision of New Water Supply Network (Urban Boundary except Core Area)	2,026.3 Acres	2,432
Solid Waste Management			
1	Procurement of Transport Fleet (Compactors, Arm Roll, Trolleys etc.)	From Equipment Table (portion of 1,245.31M allocated to Phase-2 expansion)	1,320
2	Development of Transfer Stations	Lump-sum estimate	
3	Construction of Maintenance Workshop	As per workshop costing	
4	GPS & Fleet Management System	Included in monitoring & digital systems	
5	Phase-1 Engineered Landfill Development	38.18 acres total; phased initial cell (~10 acres equivalent)	
6	Material Recovery Facility (MRF)	From advanced facilities	
Air Quality Management			

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Sr. No.	Project Title	Coverage / Capacity	Estimated Cost (Million PKR)
1	**Municipal Environmental Management & Monitoring Unit** Lab setup (furniture, systems, workstation)	Lump sum	
	Water Sampling and Analysis equipment	Lump sum	
	Ambient Air Monitoring Station	1	
	Noise Meter	1	
	Sampling Vehicle	1	
	O & M Cost* (Lab staff salaries, calibration, maintenance and lab consumables)	Lumpsum	
2	AQMS Procurement	2	
Plantation of Native Species			
1	Plantation of native species along boundary of canal, open spaces	5000	14.5

10.7 Immediate Action Plan (0-2 years)

Project Name	Description	Cost (PKR) Million
Municipal Environmental Management & Monitoring Unit	Low-cost environmental testing lab to support SEPA and MC in routine analysis and compliance.	50
Provision of New Water Supply for 100 % Ghotki City	Development of a comprehensive piped water supply network to ensure safe, reliable, and equitable drinking water access for the entire population of Ghotki City.	1,338
Repair and Rehabilitate Existing Drainage System	Desilt, reconstruct, and extend broken and undersized drains in urban Ghotki.	183.98
Elimination of open waste dumping, improvement of collection coverage	Increase in collection machinery and workforce, designated temporary storage points and route optimization for collection and handling of solid waste.	425
Plantation	Plantation of native species along canal boundary, open spaces	14.5

10.8 Projects Integration

The proposed environmental projects under the Strategic Development Plan are designed as an integrated framework that collectively addresses water pollution, groundwater depletion, solid waste mismanagement, air quality deterioration, and institutional gaps in environmental governance.

The expansion of sewerage networks and phased development of wastewater treatment facilities will significantly reduce untreated discharge into surface water bodies, thereby lowering organic pollution loads and protecting aquatic ecosystems. Simultaneously, universal water supply coverage and groundwater monitoring strategies will reduce dependence on unsafe informal extraction methods and promote sustainable aquifer management. Improved solid waste collection, transfer systems, and engineered landfill development will prevent open dumping, reduce leachate contamination, and minimize drain blockages and urban flooding.

The establishment of a Municipal Environmental Management & Monitoring Unit along with a real-time Air Quality Management System will strengthen regulatory enforcement, ensure SEQS compliance, and support evidence-based planning. Together, these coordinated interventions shift Ghotki's environmental management approach from reactive control to proactive, sustainable urban environmental governance aligned with the 2043 development vision.

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SECTION - 11: DISASTER MANAGEMENT PLAN

11.1 Introduction

This section provides an overview of Ghotki's existing situation and its district disaster risk context. It highlights natural hazards such as floods, droughts, heatwaves, and earthquakes, along with man-made risks including fires, terrorism, and accidents. The section further identifies key challenges in mitigating these disaster threats and outlines the disaster management framework, emphasizing the roles of local authorities, emergency services, and coordination with agencies like NACTA. Additionally, it presents policy guidelines and strategic priorities aimed at effective disaster risk reduction and building resilience.

11.2 Existing Situation

Ghotki District, including the Ghotki city, is highly vulnerable to both natural and man-made hazards. Its proximity to the Indus River, combined with climatic variability and inadequate infrastructure, exposes the district to frequent floods, droughts, and extreme heatwaves. Additionally, the district faces significant risks from large-scale accident events, including terrorism and social unrest. Rapid urbanization has further exacerbated these vulnerabilities, particularly increasing the frequency of urban flooding and water scarcity. The following section details the specific disasters and risks affecting Ghotki city and district at large.

11.2.1 Disaster Risk and Vulnerability

A) Demographic Overview and Vulnerable Population

The demographic overview of an area provides a snapshot of its population characteristics. This includes information on the total population size, ethnic composition, language spoken, religious affiliation. Demographic data is essential for understanding the social and cultural diversity of a region, as well as the socioeconomic factors that shape its communities. It serves as a vital resource for government planning, resource allocation, and policy development, helping to address the unique needs and challenges of the area's residents. The demographic overview paints a dynamic picture of the area's past, present, and future, providing a foundation for informed decision-making and effective community development initiatives.[16]

1. Vulnerable Groups

Vulnerable groups in Taluka Ghotki extend to economically disadvantaged families, who face poverty-related issues, and minority communities, who

[16] *(A GIS-based technique analysis of land use and land cover change detection in taluka Ghotki: A case study in district Ghotki, 2021)*

may experience discrimination and reduced access to services.[17] As in many rural areas, people with disabilities, especially those living in underprivileged circumstances, face challenges related to accessibility and social inclusion. Further, vulnerability can also be referred as vulnerable age groups which include elder and younger population of community. Understanding the unique needs of this vulnerable age groups is essential for developing targeted interventions and policies that enhance the overall well-being of Taluka Ghotki's residents.

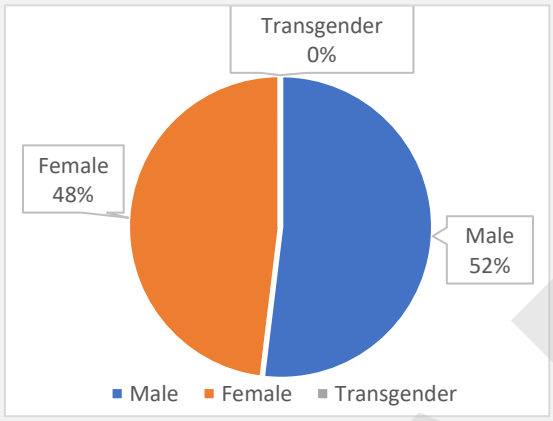


Figure 11-1, Gender Distribution

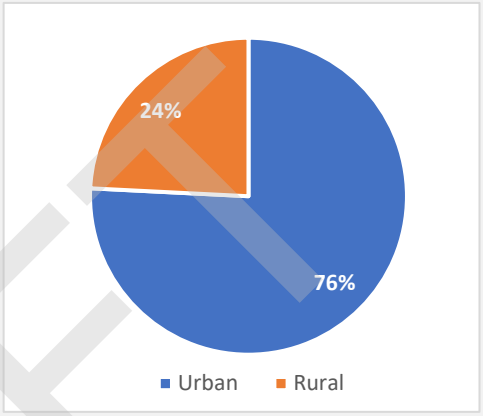


Figure 11-2, Urbanization - 2023

Source: *Pakistan Bureau of Statistics (PBS), 2023*

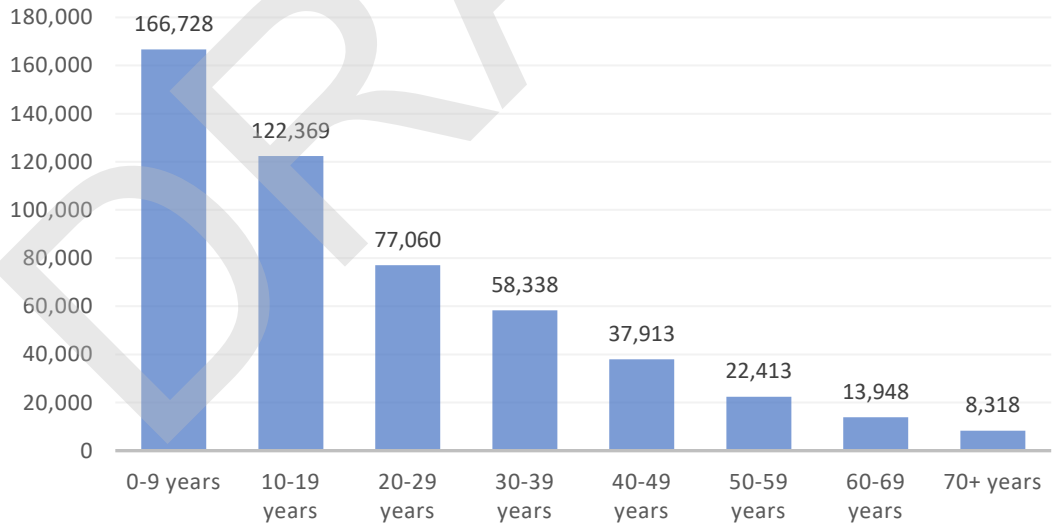


Figure 11-3, Age Group Distribution

Source: *Pakistan Bureau of Statistics (PBS)*

**2017 age-wise distribution data is utilized because the 2023 census data for age distribution is not yet available.*

Women, children, people of old age, and People with Disabilities are always considered as the most vulnerable elements and normally suffer more than

[17] (Https://Placeandsee.Com/Wiki/Ghotki, *n.d.)*

others during any kind of disaster. Their involvement is vital for effective disaster risk management. In a disaster situation, there is need to particularly focus on gender equality and the specific needs of females, children, people of old age, and PWDs before, during, and after the disaster events. [18]

2. Migration and Mobility

Ghotki, like much of rural Sindh, is predominantly an agricultural area. Over the years, labour migration has been common, with people from Ghotki seeking work in cities or other countries to support their families. They often find employment in construction, manufacturing, and other sectors. Like many rural areas, Ghotki has witnessed urbanization. People from the surrounding rural areas have migrated to the town in search of better economic opportunities and access to services and education. Apart from international migration, there's been a significant internal migration within Pakistan. People from rural Sindh, including Ghotki, often move to cities like Karachi, Lahore, and Islamabad in search of better economic prospects. The development of transportation infrastructure, including roads and railways, has also played a role in the mobility of people in and out of Ghotki. Improved connectivity has facilitated trade, tourism, and labour migration. [19]

B) Critical Infrastructure under Flood (2022), MC Ghotki

Figure 11-4 shows the critical infrastructure in Taluka Ghotki, located in the Sindh province of Pakistan, is prone to flooding while the risk varies for different infrastructures at different locations. The intercity linkages that connect MC Ghotki with other cities are mainly at risk at the time of flooding and there is a risk of fragmented connectivity. The below map gives a visualization that flood water has not caused any infrastructure damage within MC Ghotki.

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[18] *(DDMP District Ghotki (July 2018 - June 2023), 2018)*
[19] *(Family Advancement for Life and Health, 2010)*

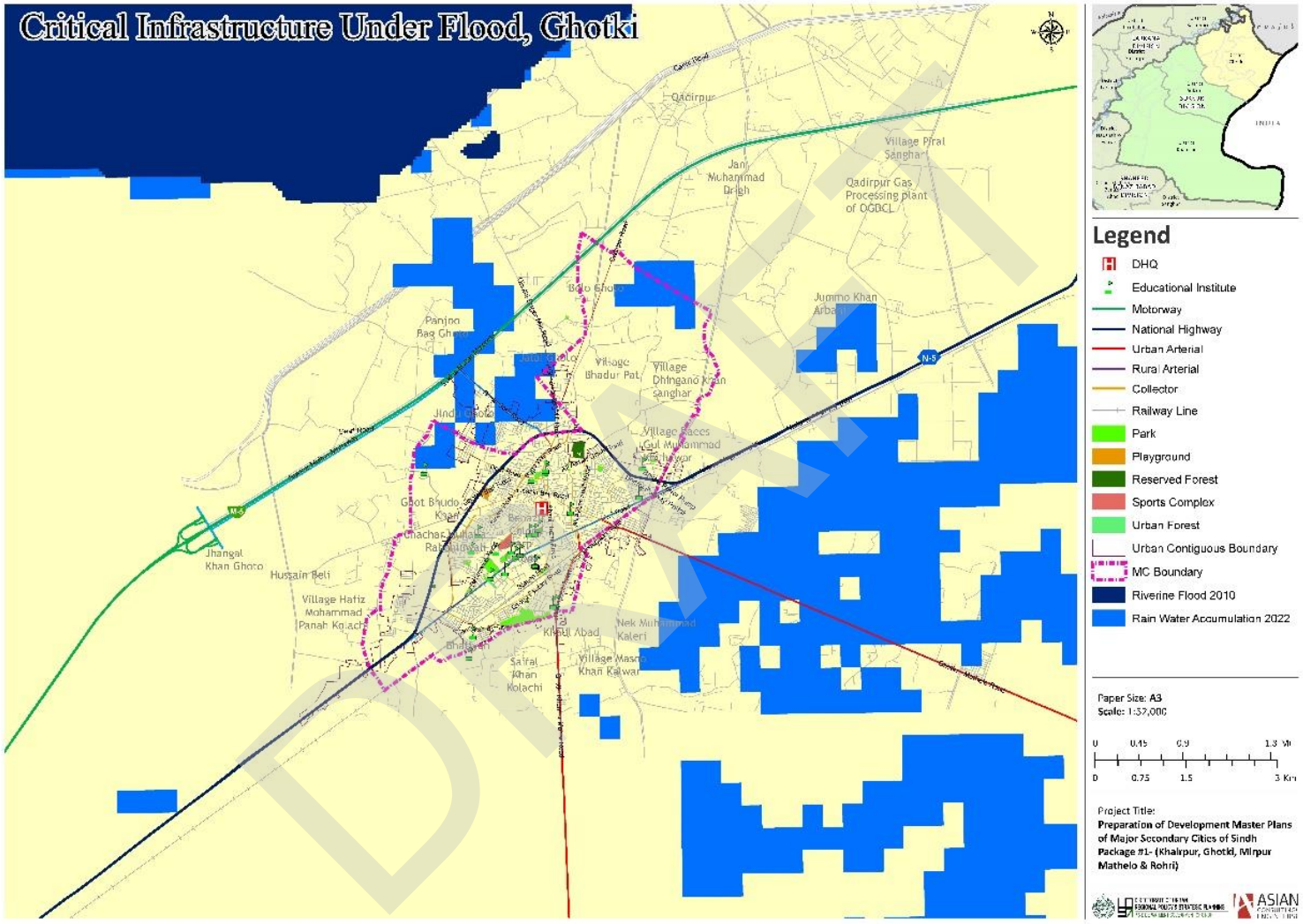


Figure 11-4, Critical Infrastructure Under Flood, Ghotki

Source: *The Consultant Team, 2023*

1. Population under Flood (2022), MC Ghotki

Figure 11-5 gives a visual representation of the population affected by the floodwater in MC Ghotki. It highlights the low, medium, and highly affected zones depending on the population density. The map illustrates the spatial distribution of communities and settlements as well as overlays the floodwater extent identifying the severely affected areas. **Figure 11-5** describes that in MC Ghotki, major area affected by the flood water is with low density, on the second number area with medium density and at last the area with high population density. Area affected with high population density is more critical for those handling disaster management.

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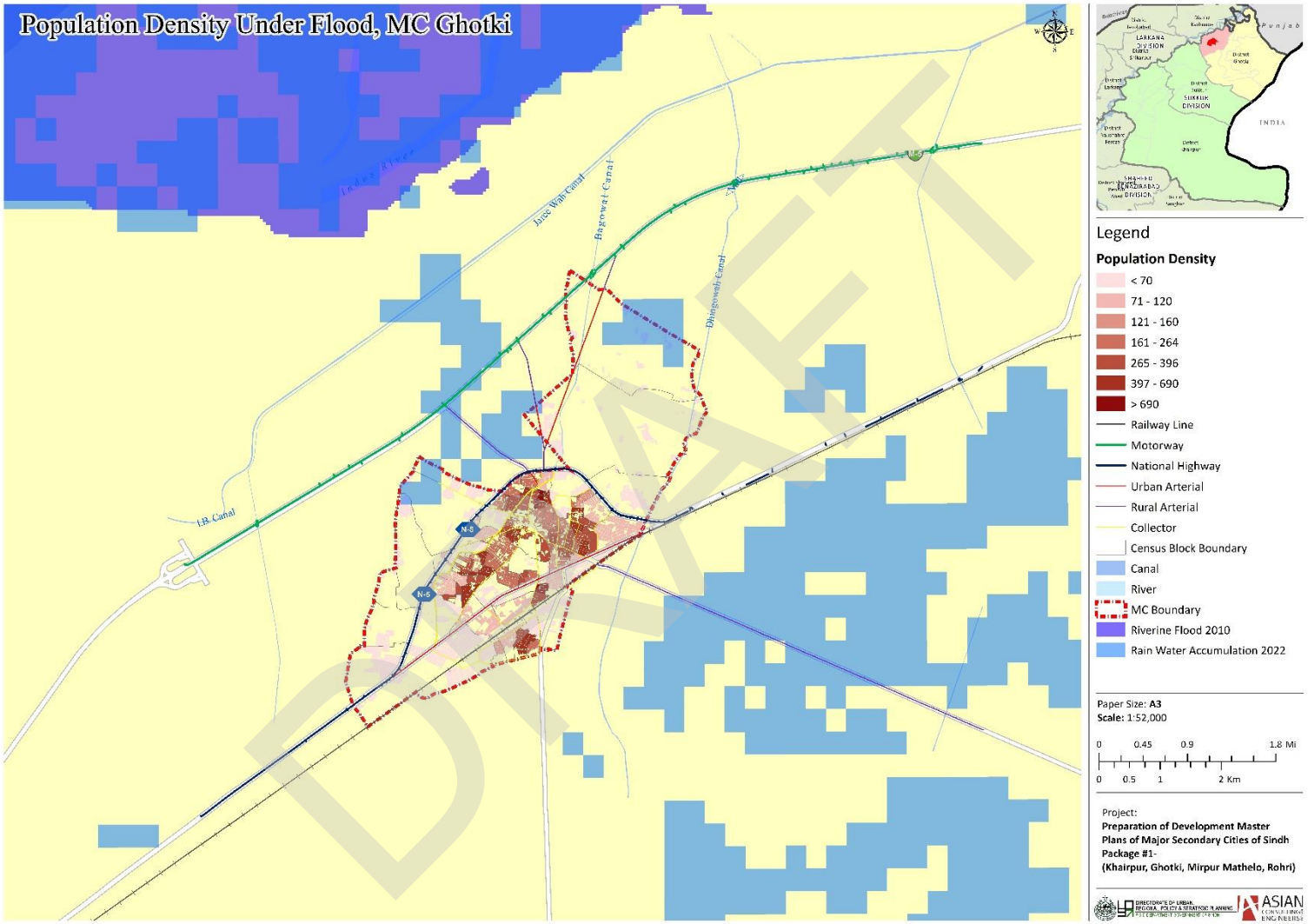


Figure 11-5, Population Density V/s Flood Extent, MC Ghotki

Source: *The Consultant Team, 2023*

11.3 Hazard Profile

Ghotki District, situated on the western bank of the Indus River in Sindh province, is geographically positioned in a region highly susceptible to a range of natural hazards. These include recurrent floods, extended droughts, intense heatwaves, and occasional earthquakes. The convergence of climatic vulnerabilities, an overburdened infrastructure system, and high population density amplifies the disaster risk profile of the city. As urbanization continues and climate change intensifies, the frequency and severity of such hazards are expected to increase, making disaster preparedness a critical component of the planning framework.

11.3.1 Flood

A) Provincial Profile

Flood 2022 in Pakistan is a historic event. Sindh has been among the most affected areas while a record-breaking precipitation was observed in most parts of the province. Due to various human and natural causes dewatering process in province is slow. The rainwater accumulation was further aggravated due to coincided water flows from Baluchistan and flooding in river Indus. Overloaded irrigation and drainage networks breached and dewatering process became more difficult. Cumulative effects caused large tract of most populated lands of the province to go under water and the population and livestock in millions and crops in thousands of acres got affected. The situation during flood 2010 was much alike but in 2022 both right and left banks of Indus were simultaneously affected which resulted in large scale disturbance. Resources of government were stretched to the limits and the international community came to assist the government and the affected community.[20]

Consecutive and continuous heavy rain spells flooded almost entire populated area of the province. Map below shows flood inundation as of August 28, 2022. As a result, huge number of homes were damaged leaving thousands of families dispersed in camps and other safe places. Secondary problems like malaria, cholera, diarrhoea, dengue, and other infectious diseases were raised due to abundance of water around human settlements.

Table 11-1, Losses and Damages in Sindh caused by Flood 2022[21]

Losses and Damages in Sindh caused by Flood 2022		
Deaths and Injuries	Deaths	823
	Injuries	8,422
	Livestock	436,435

[20] *(Flood 2022 in Sindh PREPARED BY PDMA, 2022)*
[21] *(Flood 2022 in Sindh PREPARED BY PDMA, 2022)*

Losses and Damages in Sindh caused by Flood 2022		
Infrastructure Damages	Houses (Count)	2,087,186
	Roads (Km)	8,463
	Bridges (Count)	165
	Causeways (Running	2,125
Population Affected	Affected Population	12,356,860
	Displaced Population	7,383,023
Crop Damages	Acres	3,777,272

Source: *PDMA Sindh, 2022*

- **Flood Extent: Past Trends in Sindh Province**

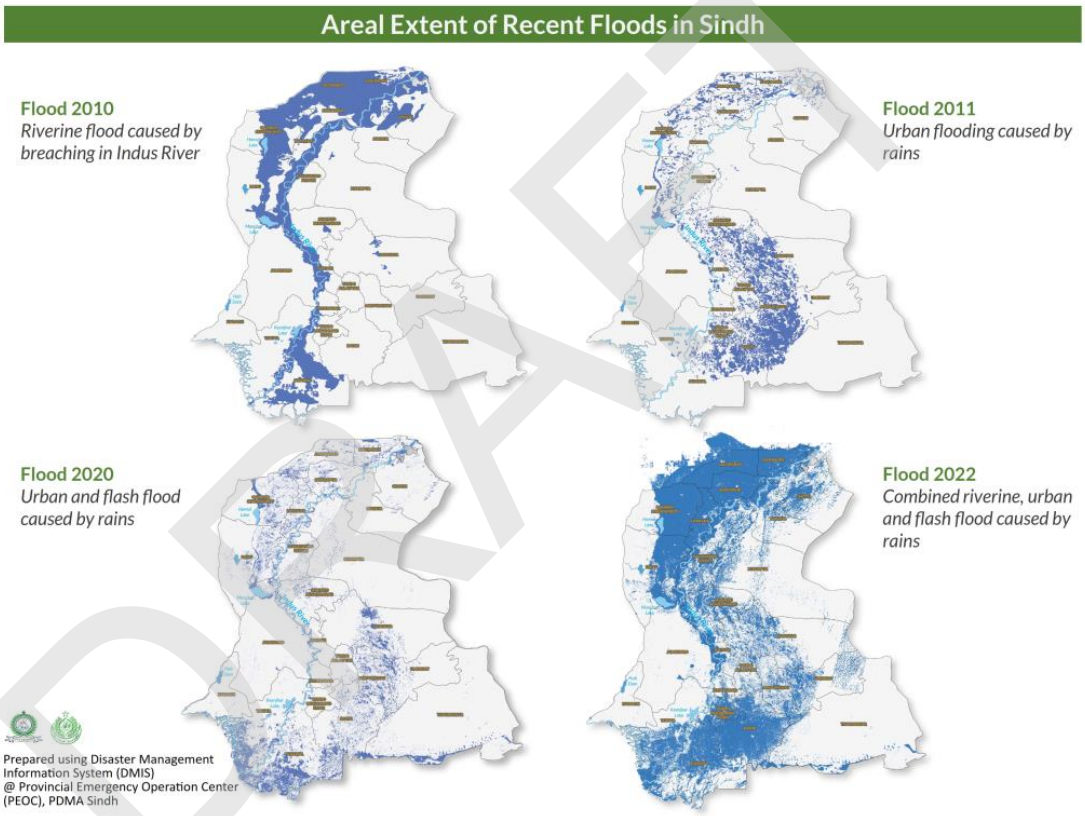


Figure 11-6, Comparison of Flood Water in Sindh Each Year: 2010, 2011, 2020, 2022[22]

Source: *PDMA Sindh, 2022*

Above figure depicts the area of flood water in Sindh for the years 2010, 2011, 2020, and 2022. In 2010, a breach in the Indus River caused flooding in the province, and the following year, high rains caused urban flooding, which became the cause of floods, leading to significant damages to human life, livestock, and infrastructure. After 9 years, significant rains brought floods

22 (Flood 2022 in Sindh PREPARED BY PDMA, 2022)

again in 2020, and in 2022, causing urban, flash, and riverine flooding throughout the region.

It can be seen from the extent maps that compared to previous floods of 2010, 2011 and 2020, the spatial extent of recent flood of 2022 is multifield while the damages have been devastating. This kind of extent has become a major concern for those responsible for disaster management in the area.

B) District Profile

Flooding is arguably the most prevalent and destructive hazard in Ghotki. Its location near the Indus River and the extensive irrigation system, exposes the city to seasonal floods, especially during the monsoon period. In 2010, a breach in the Indus River caused flooding in the province, and the following year, high rains caused urban flooding, which became the cause of floods, leading to significant damages to human life, livestock, and infrastructure. After 9 years, significant rains brought floods again in 2020, and in 2022, causing urban, flash, and riverine flooding throughout the region.

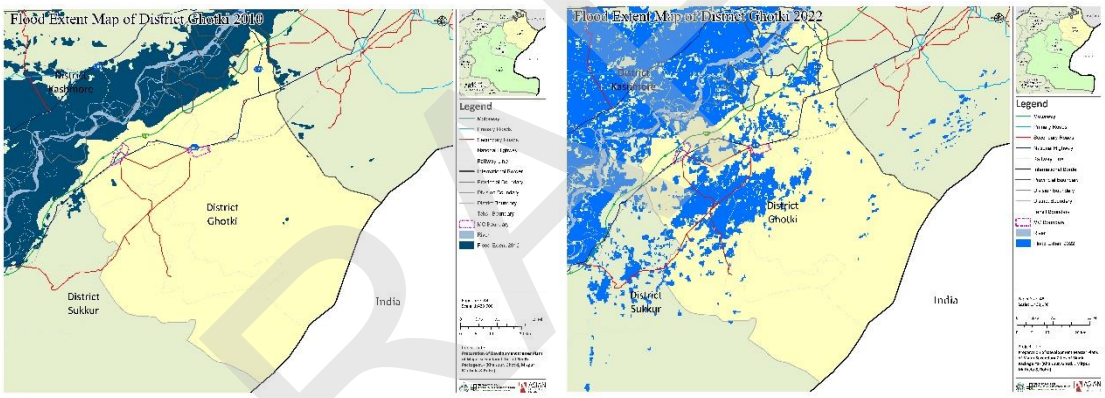


Figure 11-7, Flood Extent Map of District Ghotki with MC Boundaries, 2010 & 2022

Source: *The Consultant Team*

It can be seen (**Figure** 11-7) that in the Ghotki district, flood water was extended along with Indus River. 2010 Flood water extent can be seen in the northwest of the Ghotki district while the boundary area of MC Ghotki and MC Mirpur Mathelo was at risk during the disaster. In 2022, the sprawl of flood water was more in comparison to the year 2010. Multiple areas of the district were underwater and affected with the disaster. The maps indicate that the flood in 2022 caused a big calamity in the district compared to the flood in 2010. Floods in 2010 and 2022 were especially destructive, with the 2022 event surpassing previous ones in both scale and damage.

In between August 15th to September 15th, 2022 -, District Ghotki observed the first monsoon, the recorded rainfall in northern and southern regions of Ghotki ranges from 150-200 mm (from the **Figure** 11-8) while in the second month rainfall is comparatively low ranging from 100-150 mm and 75-100 mm in the southeast region. During the third month, northern, southern and central belts

of Ghotki faces 75-150 mm, while the western belt receives up to 100 mm and the eastern belt receives up to 100 mm of rainfall. This recorded pattern of rainfall, combined with the hydrological analysis and low-lying areas can lead to identify the flood prone areas of the region.

1. Assessment and Comparison of Damages under Flood (2022 and 2010)

The devastating floods of 2010 and 2022 were among the most severe in Pakistan's history. They were triggered by exceptionally heavy monsoon rains and the overflow of the Indus River and its tributaries. These floods affected a large portion of Sindh province, including Ghotki. Thousands of people were displaced, and extensive damage was caused to homes, crops, and infrastructure. Ghotki, like many parts of Sindh, is susceptible to flooding during the monsoon season, which typically occurs from July to September. **Table** 11-2 shows the damages that occurred in the Ghotki district due to the flood.

Table 11-2, Flood Damages in District Ghotki[23]

Flood (2010)	Counts	Flood (2022)	Counts
People died	05	People died	446
People injured	662	People injured	9
People Affected	49,950	No of Migrated Households	14,512
Villages Affected	133	No of Livestock affected	3,191
People Evacuated	52,933	No of Livestock Deaths	1,047
Area Affected (acres)	105,157	No of Houses Affected	20,102
Health (Treated)	63,937	No of Households Affected	56,279
Houses fully damaged	1,700	No of Villages Affected	1,466
Houses partially damaged	525	No of UCs Affected	62
Cattle head perished	250	No of Talukas Affected	5

Source: *DDMP 2018*

[23] *(DDMP District Ghotki (July 2018 - June 2023), 2018)*

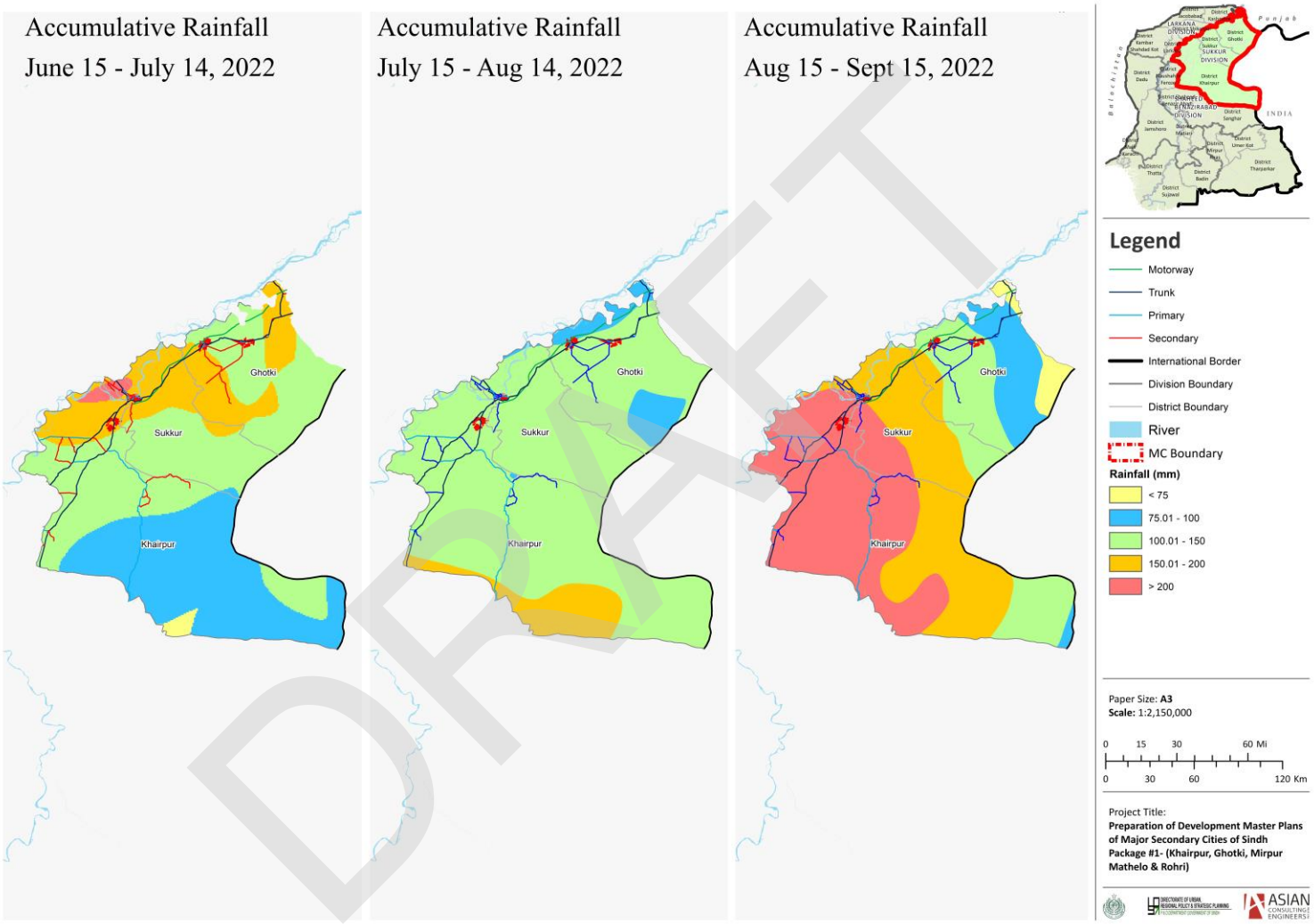


Figure 11-8, Accumulative Rainfall Assessment Map of Sukkur Division

Source: *The Consultant Team*

The recurring nature of these floods, compounded by siltation of riverbeds, poor maintenance of embankments, and unregulated urban expansion into floodplains, increases the exposure of the population. Informal settlements along water channels are particularly vulnerable, with inadequate housing structures, limited evacuation options, and no insurance coverage against natural calamities.

2. Hydrological Analysis of Flood Risk

The hydrological analysis serves to evaluate flood impacts and guide disaster management efforts by identifying areas most affected by inundation and disrupted connectivity. This information is crucial for planning relief and rehabilitation measures. Additionally, it supports long-term urban and regional planning by identifying flood-prone zones that require mitigation strategies, contributing to the development of resilient land use and infrastructure plans.

The analysis was conducted using advanced 2D hydrodynamic modelling in HEC-RAS to accurately assess flood risks and impacts. The methodology incorporated high-resolution terrain data, with a 30-meter Digital Elevation Model (DEM) processed to capture subtle elevation changes critical for flood modelling. The study area was precisely defined using administrative boundaries of District Ghotki, ensuring the analysis aligned with jurisdictional planning needs. The model setup included creating a detailed 2D flow area with variable cell sizing, employing finer resolution in vulnerable urban centers and coarser grids in less critical areas to optimize computational efficiency.

The key hydraulic inputs included boundary conditions representing inflow/outflow points and gridded meteorological data, particularly for the August 2022 flood event that severely impacted the region. The model underwent rigorous calibration and validation against historical flood records and field observations where available. The simulation outputs provided comprehensive flood characteristics including extent, depth variations (from 0.05 feet to over 1 feet), flow velocities, and duration of inundation. These results were visualized through detailed flood maps, with inundated areas clearly marked in blue gradients indicating depth variations, while critical infrastructure networks were overlaid to assess disruption impacts. The analysis serves dual purposes for both immediate disaster response and long-term resilience planning. The detailed flood maps enable to identify priority areas for relief operations and evacuation planning. For long-term development, the results inform land-use zoning decisions, infrastructure design standards, and mitigation strategies, particularly for protecting vital transportation routes like motorways and primary roads. By incorporating administrative boundaries, the analysis provides actionable insights tailored for both urban and rural planning contexts, supporting the development of comprehensive flood resilience strategies across District Ghotki.

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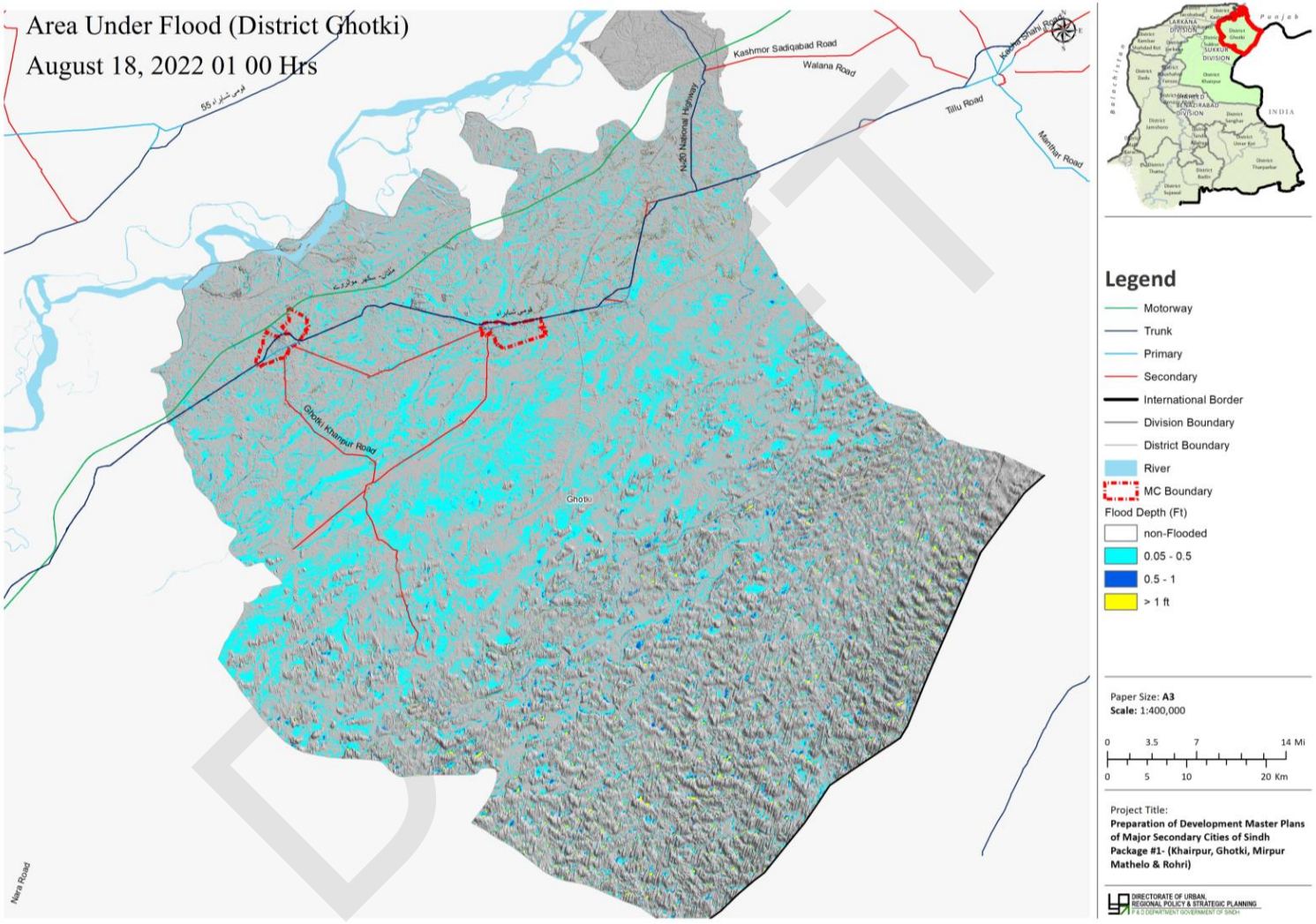


Figure 11-9, Hydrological Analysis – Ghotki District

Source: *The Consultant Team*

11.3.2 Droughts

Droughts represent a chronic challenge, especially in northern parts of the district including Khanpur Mahar and Daharki. Drought conditions are characterized by rainfall deficits of less than 100mm annually and severe groundwater depletion, with about 50% of wells drying up during the 2022 drought. These water shortages have crippling effects on agriculture, which forms the backbone of Ghotki's economy, and create serious public health concerns through water-borne diseases and malnutrition.

Over the past 5 - 10 years, Ghotki District has experienced two interrelated types of droughts Meteorological and Agricultural posing significant challenges, especially in northern areas like Khanpur Mahar and Daharki. Such types of droughts are exacerbated by low rainfall, groundwater depletion, and inefficient irrigation practices. Meteorological droughts are marked by consistent rainfall deficits (less than 100mm annually) and have led to moderate drought conditions, particularly near Jacobabad and Shikarpur, where rising temperatures and erratic monsoon patterns have exacerbated dry spells. However, Agricultural droughts have had a more severe impact, especially in canal-dependent zones such as Ubauro and Mirpur Mathelo, where soil moisture depletion and inefficient irrigation practices have caused chronic crop failures. Even in years with near-normal rainfall, these areas suffer due to groundwater overuse and unequal canal water distribution. Collectively, these droughts have crippled agriculture the district's economic backbone and triggered public health issues related to water scarcity and malnutrition. The following maps (**Figure 11-10**) highlights the Meteorological and Agricultural Hazard of district Ghotki for the last 5 years.

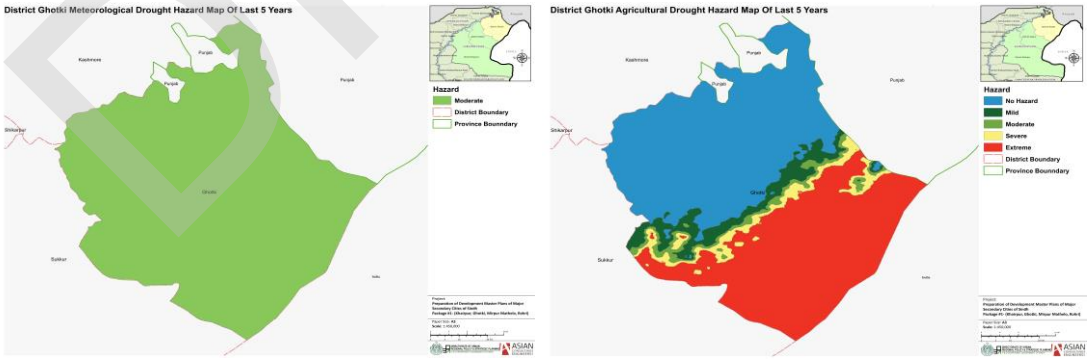


Figure 11-10, Meteorological and Agricultural Drought Hazard Maps of District Ghotki of Last 5 Years

Source: *The Consultant Team*

11.3.3 Heatwaves

Ghotki District has been facing increasingly intense heatwaves, with temperatures rising 6 – 8° C above normal, reaching up to 48° C in April 2025. These extreme conditions, part of a broader regional trend, have

occurred frequently since 2015, severely impacting public health, especially for outdoor workers, children, and the elderly, and straining infrastructure due to recurring power outages. In response, the Sindh government set up relief camps in Ghotki to provide shaded areas, water, and first aid. The growing frequency and severity of heatwaves highlight the urgent need for adaptive measures, improved infrastructure, and public awareness to protect vulnerable populations. **Figure 11-11** highlights the areas within Ghotki District most affected by heatwave strokes over the past decade, highlighting northern and central hotspots.

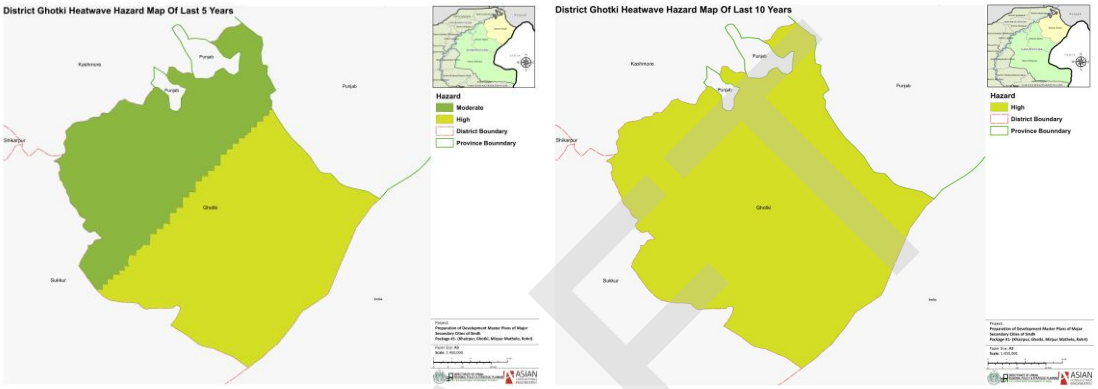


Figure 11-11, Heatwave Hazard Maps of District Ghotki of Last 5-10 Years

Source: *The Consultant Team*

11.3.4 Earthquakes

Over the last 100 years, District Ghotki, has experienced very low seismic activity as compared to other regions of the country. Based on data from the Pakistan Meteorological Department (PMD) and seismic hazard assessments by NDMA and UNDP, Ghotki falls within the "Zone 2A" or "Very Light Hazard Zone" of the Pakistan Seismic Map which means that there will be "moderate to low damage" by earthquakes.

However, the region has experienced occasional mild tremors, mostly originating from adjacent regions such as Kashmore, Jacobabad, and Balochistan, but these tremors typically measured below Magnitude 4.5 on the Richter scale and caused no significant damage. The below map illustrates the seismic vulnerability of District Ghotki over the past 95 years, indicating no major earthquakes have occurred in the area.

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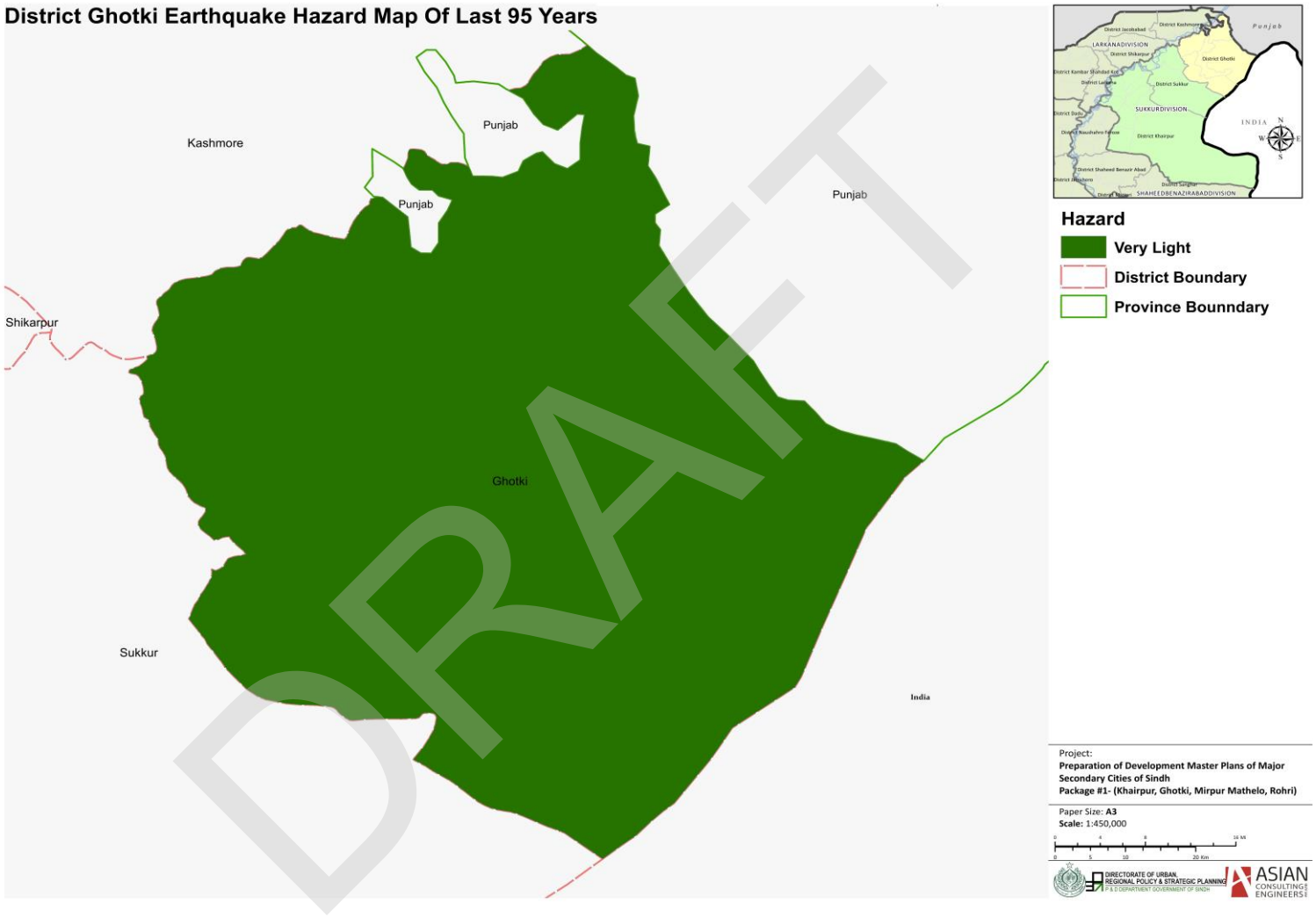


Figure 11-12, District Ghotki Earthquake Hazard Map of Last 95 Years

Source: *The Consultant Team*

11.4 Vulnerability Profile

Vulnerability refers to the magnitude by which communities, infrastructure, services, or specific geographic areas are prone to damage or disruption from the impact of a particular hazard. Vulnerability profiling involves assessing the exposure and sensitivity of these 'elements at risk' to various natural and man-made hazards. It is essential for identifying areas of concern, prioritizing interventions, and formulating effective disaster risk reduction strategies. Key vulnerability factors of disasters include the following and are not limited to these only. These vulnerability factors not only amplify the immediate impacts of disasters but also complicate long-term recovery and resilience-building efforts.

- Social Vulnerability
- Physical and Environmental Vulnerability
- Institutional and Behavioural Vulnerability

11.4.1 Social Vulnerability

The district's social fabric significantly influences its resilience. Specific population groups are disproportionately vulnerable due to factors like age, health, socioeconomic status, and geographic location. These groups require targeted strategies in early warning, evacuation, and relief distribution.

A) Vulnerable Population

In the context of disaster risk whether earthquakes, floods, or heatwaves certain population groups in Ghotki are especially vulnerable due to limited mobility, access to resources, or heightened exposure. These individuals often face greater challenges in both responding to and recovering from disasters. Preparedness and response plans must be inclusive and prioritize these groups through targeted awareness, accessible infrastructure, and equitable relief support. The vulnerable populations include:

- Elderly persons
- Persons with disabilities
- Women, especially pregnant and lactating women
- Children, particularly those without guardians
- Low-income households
- Daily-wage labourers and informal sector workers
- Residents of informal settlements or flood-prone areas

These groups should be at the centre of community-based disaster risk reduction efforts to ensure equity, safety, and resilience for all.

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11.4.2 Physical and Environmental Vulnerability

The interaction between human settlements, infrastructure, and the natural environment creates significant physical vulnerabilities.

A) Encroachments in Katcha Areas

Katcha areas in two Taluka of Ubauro and Ghotki have an approximate population of 400,000, and are extremely vulnerable due to the ever-present threat of river flooding. The unchecked expansion of settlements and agricultural activities along riverbanks has been a major contributor to the severity of recent floods, as seen in Pakistan's 2022 flood disaster. As the encroachment in Katcha Riverine areas significantly reduces river channel capacity and heightens flood risks. Some of the peculiar features of this area are nomadic living style, poverty, low literacy rates and tribal setup, all of which add to the threat to the lives and properties of these people.

B) Illegal Zamindari Bunds (Unauthorized Embankments)

Zamindari bunds are illegally constructed embankments by influential individuals or groups to protect private land from flooding. These unauthorized structures disrupt the natural flow of floodwaters, placing excess pressure on official flood protection bunds. The Irrigation Department is legally mandated to dismantle such structures, but enforcement remains inconsistent.

C) Vulnerable Points on Bunds

Certain locations along protective bunds have been identified as structurally weak or high-risk based on past flood behaviour. These points require reinforced monitoring, timely maintenance, and emergency preparedness to prevent breaches during high-flow conditions.

Some of the vulnerable points along the Bunds of Ghotki Feeder Canal Area are mentioned below in table.

Table 11-3, Vulnerable Points Along the River in District Ghotki

Sr. No.	Vulnerable Points	Division
1.	Qadirpur Loop Bund Mile 5/0 to 8/4	Mirpur Division
2.	Qadirpur Shank Bund Mile 0/5 to 2/6	Mirpur Division
3.	Qadirpur Bund Mile 10/4 to 11/4	Ghotki Division
4.	Baiji Bund Mile 7/5 to 7/6	Ghotki Division

11.4.3 Institutional and Behavioural Vulnerability

Governance capacity and community behaviour are critical determinants of disaster resilience.

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A) Reluctance to Evacuate from Affected Areas

Reluctance to evacuate from affected areas remains a persistent challenge. Social and economic factors, such as attachment to property and lack of trust in authorities along with ongoing tribal rivalries in the district often lead to resistance in evacuation efforts. Residents are hesitant to leave their homes due to fear of property loss and intertribal tensions. Many prefer to relocate only within their tribal groups, complicating camp management and creating logistical challenges during displacement. Additionally, livestock dependency discourages relocation, increasing casualties and complicating emergency response efforts.

B) Insufficient Disaster Management Funds

Insufficient disaster management funds hinder the ability to prepare for, respond to, and recover from disasters. After the replacement of Local Governments with Commissionerate System in the district, limited financial resources restrict investment in resilient infrastructure, community preparedness programs, and effective emergency response systems, leaving vulnerable populations at greater risk. In case of any disaster, the districts have to take urgent rescue and relief measures including immediate provision of dry and cooked ration, dewatering of the areas, provision of immediate shelter, provision of earthen ways to the low-lying villages etc. All this has to be done before the Provincial Government and other stakeholders actually come into play. Immediate provision of "Disaster Management Funds" on disposal of Deputy Commissioners is the need of the hour.

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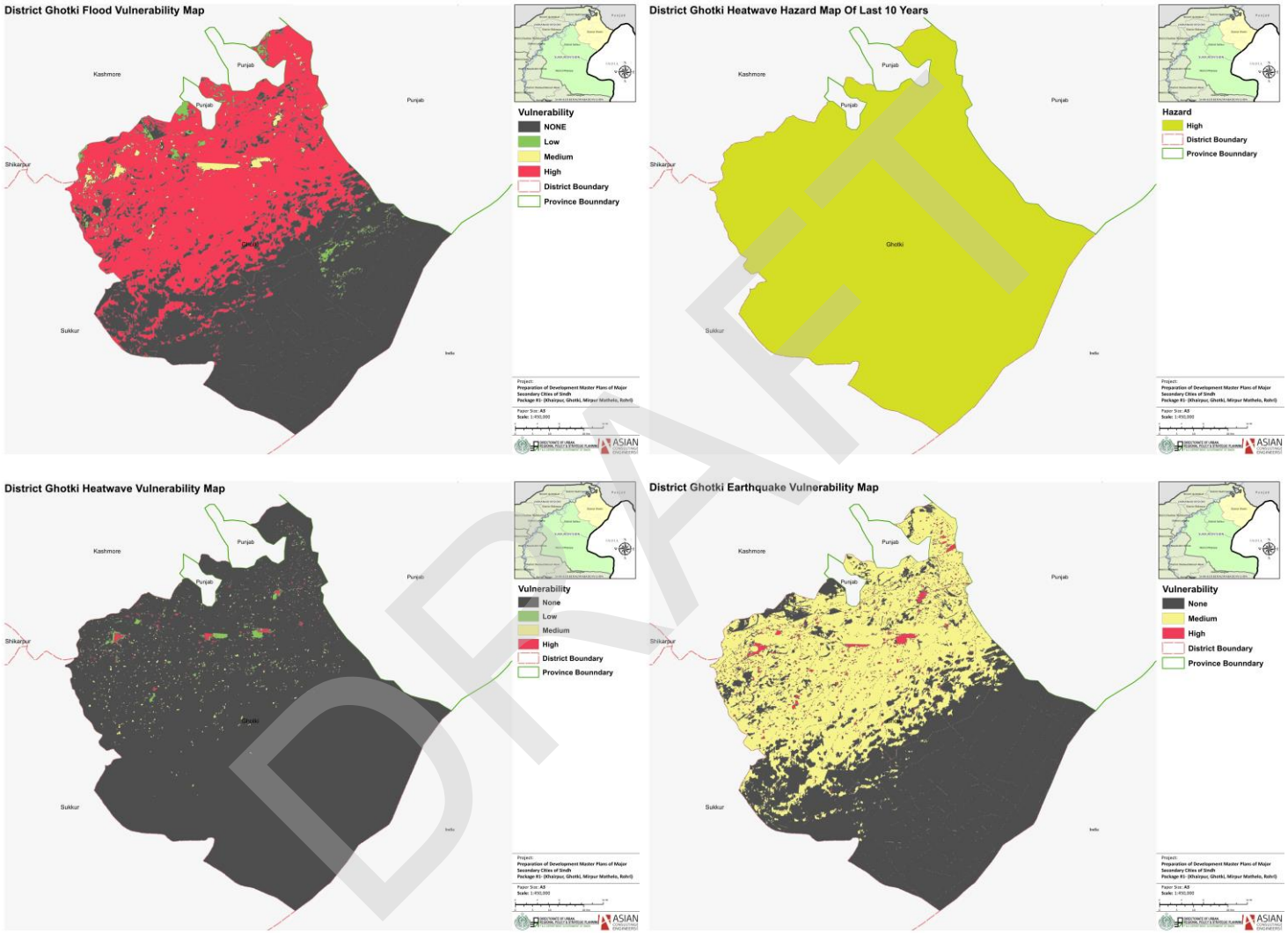


Figure 11-13, Vulnerability Map of District Ghotki

Source: *The Consultant Team*

11.5 Risk Profile

The following table provides a summary of various natural hazards affecting District Ghotki, highlighting the risk levels, brief descriptions, and key contributing factors for each hazard. Riverine flooding is identified as a significant threat, especially in the low-lying Katcha areas of Ghotki and Ubauro, with risk levels ranging from low to extreme. The key factors influencing this hazard include proximity to the Indus River, inadequate embankment structures, and the heavy flow of floodwaters. Urban flooding is also a concern, although to a lesser extent, caused by heavy rainfall combined with poor urban drainage systems, which are worsened by rapid, unplanned urban expansion.

Other hazards include meteorological and agricultural droughts, both of which pose risks from low to extreme levels, primarily due to low rainfall, reliance on agriculture, and poor water storage infrastructure. Heatwaves are becoming increasingly common, with temperatures rising up to 44°C, posing serious health risks due to limited public awareness and insufficient cooling facilities. Earthquakes, while assessed as low risk, remain a threat due to the presence of old, vulnerable structures and a general lack of earthquake resistant infrastructure and preparedness. Overall, risk Profile of Ghotki District is as follows;

Table 11-4 Risk Profile of Ghotki District

Hazard Type	Risk Level	Description	Key Risk Factors
Riverine Flood	Low to Extreme	Flooding is a major threat to the people living especially in Katcha areas of two Talukas namely Ghotki and Ubauro	Proximity to the Indus River, inadequate embankments, and high flow of floodwater.
Urban Flooding	Medium to Low	Localized flooding in urban areas due to heavy rainfall and poor drainage.	Inadequate urban planning, clogged drainage systems, and rapid urbanization.
Meteorological Drought	Medium to Extreme	Prolonged periods of low rainfall affecting agriculture and water supply.	Semi-arid climate, dependence on rainfall for agriculture, and limited water storage infrastructure.
Agricultural Drought	Low to Extreme		
Heatwave	Low to High	Extended periods of extreme heat impacting health and livelihoods.	Rising temperature reaches up to 44°C, lack of public awareness, and insufficient cooling centers.
Earthquake	Low	Seismic activity causing structural damage and potential loss of life.	Old and weak buildings, lack of earthquake-resistant infrastructure, and limited public preparedness.

Source: *The Consultant Team*

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11.6 Man-made Hazards

11.6.1 Fire Fighting System

A) Existing Situation and Gaps

Ghotki city currently lacks any firefighting infrastructure, i.e., fire stations, equipment, and trained personnel, posing a significant risk to public safety. This deficiency severely limits the city's capacity to respond promptly to fire emergencies, increasing the risk of extensive property loss and endangering the population.

Spatial analysis and population density mapping have identified several high-risk neighborhoods with unplanned layouts, narrow streets, and poor accessibility, which further hinder emergency response and evacuation. Although no major fire incidents have occurred in recent years, the absence of critical infrastructure leaves Ghotki dangerously unprepared for potential fire prone disaster. Urgent intervention is required to address this infrastructural gap and enhance urban resilience.

B) Need Assessment

According to the National Reference Manual (NRM) standards one fire station is required for 100,000 people, having a site area of approximately 2,025 sq. m. or about 4 Kanals. In regards to firefighting station coverage, Disaster Risk Reduction (UNDRR), Sendai Framework for Disaster Risk Reduction (2015 – 2030) and its Words into Action, guidelines states that ideally fire stations should maintain a response coverage radius that enables response times of 3 to 5 minutes in densely populated urban areas and no more than 7 to10 kilometres in broader municipal or rural regions.

In regards to preparedness of multi hazard emergencies, as per UNDRR, there should be at least 2 fire tenders with one at least have a high-capacity unit capable of carrying minimum of 1,500 litters water. Supporting firefighting equipment such as portable pumps, foam units, breathing apparatus, hose lines, and first aid kits must also be readily accessible. Reliable water sources are critical, and thus, the presence of a well-maintained hydrant network is essential, with hydrants ideally located within 500 meters of high-risk facilities. Where hydrants are not available or are unreliable, alternative sources such as water bowsers, storage tanks or water tanks with pumps should be provided to ensure continuity during fire emergencies. The staffing model should support 24/7 operations with shift-based deployments, and staff must be trained not only in firefighting but also in community engagement, emergency evacuation, and hazard-specific response.

In the context of Ghotki, the need assessment for firefighting stations is calculated as follows;

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Table 11-5, Firefighting Station Requirements: A Need-Based Assessment for 2043

Year	Projected Population	Proposed High Density 2043		National Reference Manual (NRM)			
		High Density Residential (%)	Vulnerable Population	Number of Firefighting Station	Number of Fire Engine	Number of Tankers with Pumps	Fire Fighting Station Area (sq. m.)
2043	307,697	15%	46,155	1	1	9	2,025

Source: *The Consultant Team & National Reference Manual (1986)*

The firefighting infrastructure requirement, upgradation and capacity building of Ghotki for 2043 have been projected based on the anticipated population growth and high-density development patterns. As the projected population is estimated to reach 307,697 by 2043 with approximately 15% of this population around 46,155 individuals expected to reside in high-density zones and considered particularly vulnerable during fire emergencies.

According to National Reference Manual (NRM), one firefighting station is recommended per 100,000 population. Applying this standard to the vulnerable population yields a requirement of approximately 1 firefighting station with full-fledged facilities to adequately serve the area.

Further, as per the NRM standards:

- One fire engine is required for every 25,000 - 75,000 population, calculating the threshold i.e., 1/25,000 population resulting in a need for approximately 1.85 ~ 1 fire engines.
- One water tanker equipped with a pump is needed for every 5,000 - 25,000 population, calculating the threshold i.e., 1/5,000, translating to a requirement of 9 such units to be installed in areas where water is sufficiently available.

In terms of land allocation, a minimum of 2,025 square meters (approximately 4 Kanals) is proposed along the National Highway, on the eastern side adjacent to the Medium to High Density Residential Zone. It is recommended that the proposed firefighting facility be equipped with essential operational resources to ensure effective fire safety measures within Ghotki's evolving urban landscape.

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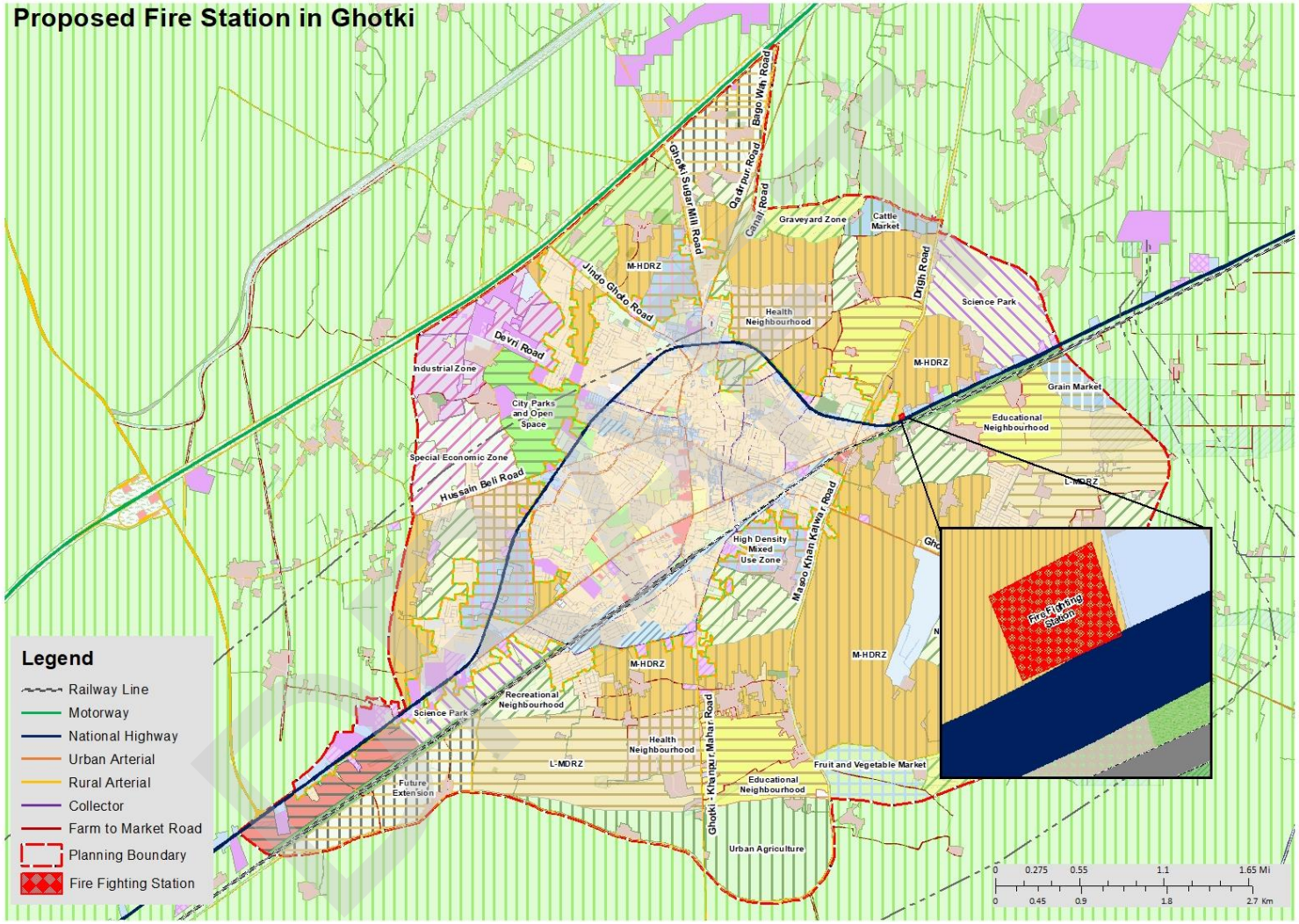


Figure 11-14, Proposed Fire Station in Ghotki

Source: *The Consultant Team*

11.6.2 Assessment of Crowded Places

Soft Targets and Crowded Places (ST-CPs) are locations that are easily accessible to large numbers of people and that have limited security or protective measures in place making them vulnerable to attack. ST-CPs can include, but are not limited to, schools, sports venues, transportation systems or hubs, shopping venues, restaurants, hotels, places of worship, tourist attractions, theatres, and civic spaces. These places do not have to be buildings and can include open spaces such as parks and pedestrian malls. ST-CPs will not necessarily be crowded at all times crowd densities may vary between day and night, by season, and may be temporary, as in the case of sporting events, festivals, or other special events.

A) Crowded Places in Ghotki

Among the sensitive places in Ghotki city are religious sites, such as Main Jamia Mosque Ghotki, Eidgah, Imam Bargahs, Temples, Shrines, and Gurdwara. Other areas that require special security measures for public safety may include transportation terminals. Areas with significant Shi'a and Hindu populations often have religious processions and other commemorations. These processions typically follow traditional routes to and from Shi'a Imam Bargarh's and may pass through crowded commercial areas. Larger processions may cause localized disruptions to traffic and business. Incidents mainly occur due to tribal conflicts between Hindu and Muslim populations, resulting in closures of shops, offices, and commercial areas. To maintain control in such situations, a heavy deployment of rangers and police is often observed. Security is expected to be particularly high near Hindu temples and Shi'a religious procession routes.

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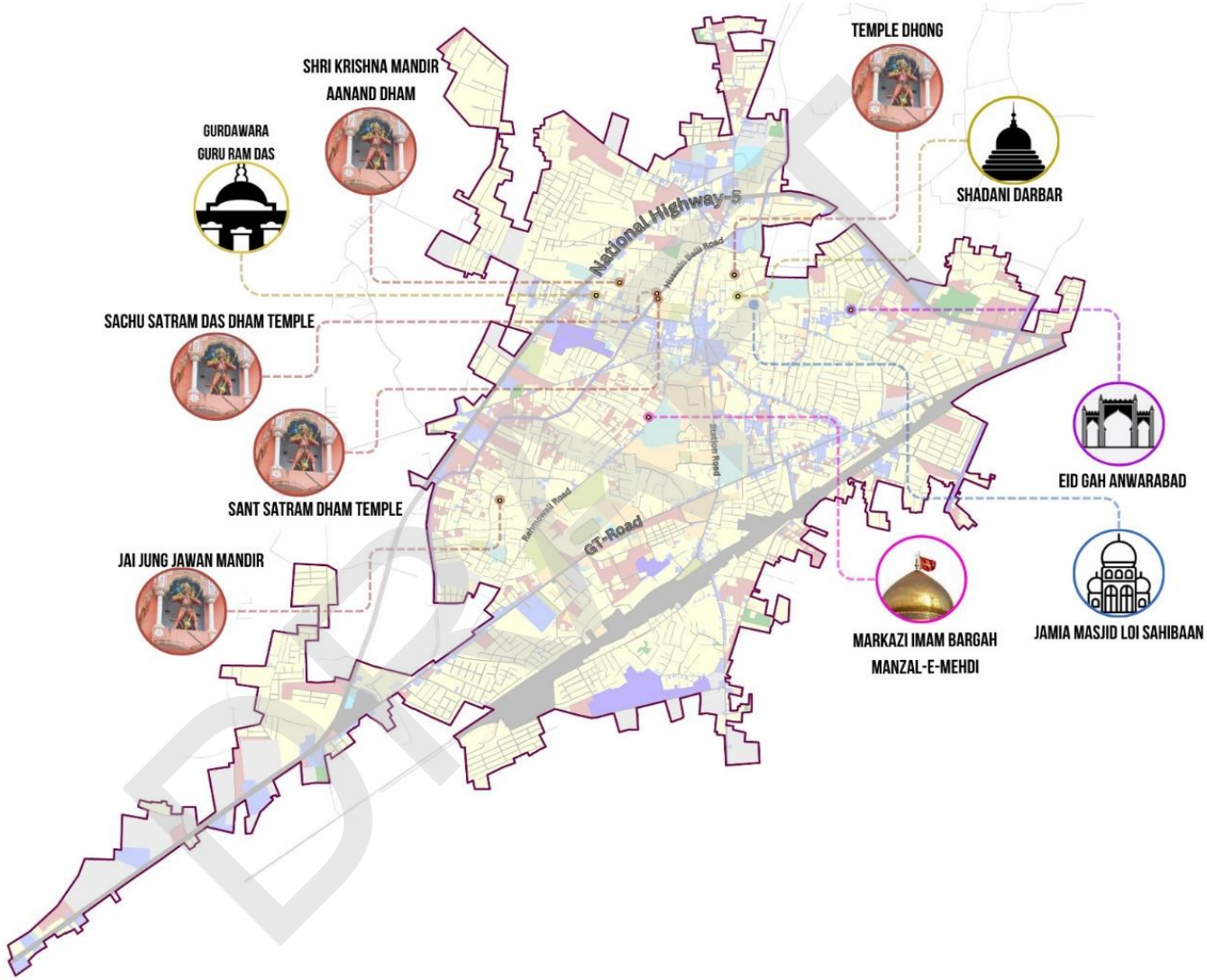


Figure 11-15, Identification of Major Crowded Places

Source: *Land use Survey*

Further, the possible terrorist Intensity places has been identified in Ghotki City on the basis of Crowd and most visiting places by the Public. The places are classified according to the land uses which are potential crowd pulling places.

Sr. No.	Land Use	Terrorist Threat
1	Education	Secondary Schools/College/ University
2	Health	BHU/Hospitals/Medical Collages
3	Commercial	CBD/Mandi/shopping mall
4	Religious	Eid Gah / Shrines/Minority Religious Places/Imam Barghas
5	Government Offices	District Court/DCO Office/SSP Office/District Jail/Police Head Quarter/LEA
6	Recreational	Tourism Places
7	Transportation	Bus Stop/Railway Station/Airport

Source: *The Consultant Team*

B) Identification of Potential Stakeholders

Preventing attacks against ST-CPs and reducing impacts of attacks that do occur is a shared mission among many stakeholders. Law enforcement agencies, National Counter Terrorism Authority (NACTA), venue owners, facility managers and general public are key stakeholders in implementing security measures. Federal Ministries/Departments, Federal Law Enforcement/Intelligence Agencies, Provincial Ministries/Departments, Social Welfare Departments/Ministries, Police, Criminal Investigation Department, Counter Terrorism Department, Bomb Disposal Units and healthcare providers are crucial departments in responding to emergencies in crowded spaces.

Government agencies, regulatory bodies, and community organizations collaborate to establish safety regulations, conduct risk assessments, and promote public awareness campaigns. Effective collaboration and coordination among these stakeholders are essential for ensuring the safety and security of individuals in crowded spaces.

C) Responsibilities of Stakeholders

Implementation of protective security measures and reducing the vulnerability of crowded places to terrorist attack was not just a job for the Government (Federal / Provincial / Division / District) and the police alone. To be most effective, this work requires engagement from a range of local partners, including local authorities and businesses, in order to identify vulnerable sites and prioritize work to reduce those vulnerabilities.

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D) NACTA's Specific Coordination Measures for Enhancing National Efficiency Against Terrorism/Extremism

NACTA has played a role in designing and executing SOPs, security plans and programs to enhance the security of ST-CPs which is elaborated in **Figure 11-16**. Recent changes in the threat landscape and trends in global and domestic incidents call for a renewed level of focus on this problem.



Figure 11-16, Sensitive Areas Security Primary Planning Phases

Source: *The Consultant Team*

11.7 Institutional Framework and Key Challenges

Disaster Risk Reduction (DRR) is a cross-cutting theme that requires the active participation of all stakeholders. A well-coordinated institutional mechanism is essential for effective disaster preparedness and response. This framework, established under the National Disaster Management Act (2010) and Sindh Local Government Act (2013), outlines a hierarchical structure from the provincial to the community level, ensuring alignment with national strategy and local needs.

11.7.1 Hierarchical Institutional Structure

The disaster management system in Ghotki operates on a four-tiered model for seamless policy-making, coordination, and implementation:

Authority Level	Chairperson / Lead	Primary Role & Function
Provincial Disaster Management Commission (PDMC)	Chief Minister	**Policy-Making Body** • Lays down provincial DRM policy • Approves plans • Oversees integration of DRR into development planning
Provincial Disaster Management Authority (PDMA)	Minister, Rehabilitation Dept.	**Provincial Implementing & Coordinating Agency** • Develops strategies and coordinates response • Mobilizes resources • Supervises all DDMAs in Sindh • Manages large-scale disasters
District Disaster Management Authority (DDMA)	Deputy Commissioner	**District-Level Coordination & Implementation Focal Point** • Prepares and implements the District Disaster Management Plan • Leads emergency response • Manages the District Emergency Operation Centre (DEOC)
Taluka Disaster Management Committee (TDMC)	Assistant Commissioner	**Frontline Implementation at Taluka Level** • Bridges DDMA and communities • Ensures local implementation of plans • Conducts local risk assessments • Manages shelter and evacuation
Union Council Disaster Management Committee (UCDMC)	UC Administrator	**First Responder & Community Mobilization** • Acts as the first point of contact during a disaster • Mobilizes community volunteers • Reports ground situations • Assists in relief distribution

Source: *PDMA, Sindh*

11.7.2 Institutional Framework and Coordination Mechanisms

An effective disaster management response hinges on seamless coordination between all stakeholders. While the National Disaster Management Act (2010) and Sindh Local Government Act (2013) outline the roles of various institutions, a clear operational protocol is essential to avoid duplication of efforts, ensure accountability, and facilitate a swift, unified response.

The following matrix details the coordination protocols for critical phases of disaster management. The structure ensures that for every action, one entity is clearly in charge (Lead Agency), other entities know their specific support duties, and a pathway exists for resolving issues or acquiring additional resources (Escalation Mechanism).

Table 11-6, Disaster Management Coordination Protocols

Phase / Activity	Lead Agency	Key Support Agencies	Support Functions	Escalation Mechanism
Pre-Disaster (Preparedness & Planning)				
Risk Assessment & Early Warning	Pakistan Meteorological Department (PMD) / Irrigation Dept (for flood levels)	▪ DDMA ▪ PDMA ▪ Local Governments	▪ DDMA disseminates warnings to TDMCs/UCDMCs and public. ▪ Local Govt. activate local alert systems (sirens, mosque speakers).	If warning indicates a major disaster (e.g., Very High Flood), DDMA immediately escalates to PDMA to activate provincial resources.
Community Preparedness & Drills	District Disaster Management Authority (DDMA)	▪ TDMCs/UCDMCs ▪ Police Dept ▪ Health Dept ▪ NGOs (e.g., Red Crescent)	▪ TDMCs/UCDMCs mobilize community volunteers and identify evacuation routes. ▪ Health department provide first aid training. ▪ Police manage traffic and security during drills.	If community participation is low, UCDMC -> TDMC -> DDMA will organize awareness campaigns with support from Social Welfare.
Pre-positioning of Relief Stocks	Provincial Disaster Management Authority (PDMA)	▪ DDMA ▪ Red Crescent	▪ DDMA identifies secure storage locations at taluka level.	If stocks are insufficient, DDMA submits a formal request to PDMA for replenishment.
During-Disaster (Response)				
Activation of Emergency Operations	District Disaster Management Authority (DDMA)	▪ All DDMA member departments ▪ Armed Forces (if required)	▪ DDMO chairs the District Emergency Operation Centre (DEOC). ▪ Police ensures law and order. ▪ Health department sets up medical camps. ▪ Irrigation department provides real-time river	If the disaster scale exceeds district capacity, the DDMA Chairperson (Deputy Commissioner) formally requests PDMA and NDMA for immediate assistance, including armed forces.

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Phase / Activity	Lead Agency	Key Support Agencies	Support Functions	Escalation Mechanism
			data.	
Search and Rescue	Police / Rescue 1122	▪ Fire Brigade ▪ Community Volunteers (via UCDMC) ▪ Armed Forces Engineers	▪ Fire Brigade provides technical rescue from collapsed structures. ▪ Community volunteers guide rescuers to affected areas. ▪ Armed forces provide boats and helicopters for flood rescue.	If specialized equipment or manpower is needed, Police/ Rescue 1122 -> DDMA -> PDMA to mobilize provincial/federal resources.
Evacuation	District Administration (Revenue Dept)	▪ Police ▪ Transport Dept ▪ TDMCs/UCDMCs ▪ Health Dept	▪ Police department secures evacuation routes and manages traffic. ▪ Transport department arranges buses and trucks. ▪ UCDMCs guide people to assembly points. ▪ The health department is conducting screenings for evacuees at shelters.	If populations are reluctant to evacuate, local elders and UCDMC members lead persuasion efforts, supported by Police.
Shelter Management	Local Government Department	▪ Social Welfare Dept ▪ Health Dept ▪ Education Dept (for school buildings) ▪ NGOs (e.g., UNHCR, SRSP)	▪ Social Welfare department register affected individuals and manages distribution of non-food items. ▪ Health department ensures sanitation, vaccination, and medical care in camps. ▪ NGOs supplement	If shelter conditions deteriorate (disease outbreak, overcrowding), Camp Manager -> DDMA -> PDMA for additional resources and intervention.

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Phase / Activity	Lead Agency	Key Support Agencies	Support Functions	Escalation Mechanism
			government efforts in camp management.	
Post-Disaster (Recovery & Rehabilitation)				
Damage and Needs Assessment (DANA)	District Disaster Management Authority (DDMA)	▪ All Line Departments (PHE, Irrigation, Education, Health, etc.) ▪ Revenue Dept	▪ Each line department assesses damage to its own infrastructure (schools, clinics, roads). ▪ Revenue Dept assesses crop and private property damage.	DDMA consolidates all reports and submits a unified DANA to PDMA within 72 hours for resource allocation and funding.
Restoration of Critical Infrastructure	Respective Line Department (e.g., PHE for water, Works & Services for roads)	▪ Local Government ▪ DDMA	▪ All line departments execute repairs. ▪ DDMA coordinates and prioritizes based on damages and needs. ▪ Local Govt provides local labor and support.	If a department lacks capacity/funds, it reports to DDMA, which escalates the issue to the relevant Provincial Secretary via PDMA.
Livelihoods Recovery	Agriculture / Livestock Dept	▪ Social Welfare ▪ Fisheries Dept ▪ Banks (for soft loans)	▪ Agriculture department distributes seeds and fertilizers. ▪ Livestock department provides veterinary services and fodder. ▪ Social Welfare department implements cash-for-work programs.	If recovery is slow, DDMA coordinates with PDMA to link programs with federal/UN agency initiatives.

Source: *PDMA, Sindh*

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11.7.3 Key Challenges in addressing Natural and Man-Made Disasters

- Weak embankments and illegal Zamindari bunds worsen flood risks.
- Limited cooling centres, urban form and green plantation to reduce heatwave impacts in the city
- Weak enforcement of zoning laws for flood-prone areas
- Reluctance of community to evacuate due to socio-economic factors.
- Absence of sustainable groundwater recharge strategies and water reuse systems.
- Clogged drains due to garbage disposal exacerbate urban flooding.
- Poor Rainwater Harvesting Infrastructure; Minimal use of rooftop or community-based harvesting systems in urban planning.
- Insufficient disaster management funds and coordination.
- Lack of enforcement of building codes and fire safety regulations in residential and commercial areas.
- Inadequate fire-fighting infrastructure (fire stations, hydrants, extinguishers, alarms).
- Poor emergency access due to narrow roads, encroachments, and unplanned urban development.
- Shortage of trained fire personnel and delayed response times during emergencies.
- Minimal security measures at public spaces such as markets, religious sites, and transport hubs.
- Limited surveillance systems (e.g., CCTV coverage, monitoring)
- Unregulated gatherings and lack of crowd management protocols during events.
- Inadequate coordination between law enforcement and emergency services.

11.7.4 Key Stakeholders and their Role in Disaster Management

Following are the significant disaster management activities that the lined department, local administration, institution and other district stakeholders are expected to execute at three different stages known as pre, during and post disaster management. Following table depicts the overall role of various stakeholders including Provincial Disaster Management Authority (PDMA), District Disaster Management Authority (DDMA), civil defense, education department, finance department, health department, irrigation department, information department, Pakistan Meteorological Department (PMD), police department, revenue department, armed forces, social welfare and community development and NGOs / INGOs in different stages for disaster management:

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Table 11-7, Proposed Key Roles of Stakeholders for Disaster Management in District Ghotki

Pre-Disaster	During-Disaster	Post-Disaster
Provincial Disaster Management Authority (PDMA)		
Develop preparedness plans, conduct risk assessments, and coordinate early warning systems.	Lead emergency response operations, coordinate rescue and relief efforts, and mobilize resources.	Oversee recovery, rehabilitation, and reconstruction while assessing lessons learned for future preparedness.
District Disaster Management Authority (DDMA)		
Close coordination with PDMA and other relevant stakeholders	Mobilization of man and material resources	Coordination with TDMC and line departments for need and damage assessment
Risk assessment and identification of disaster-prone areas	For rescue and evacuation of people, provide and manage temporary shelter and life restoration equipment in disaster affected regions	Need and damage assessment reporting to PDMA
Aware and sensitize public and private departments on main streaming disaster risk reduction in developing planning	Coordinate with TDMC and line departments	Ensure rehabilitation on Build Back Better principle
Coordinate meeting and engage TDMC for preparation of anticipated disasters	The DDMA shall lead the evacuation of people to safer places with the assistance of PDMA.	

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Pre-Disaster	During-Disaster	Post-Disaster
	DDMA shall also ensure safety, security, supply chain, life commodities and management of relief camps	
Ensure readiness of equipment and inventory	Only authorized officials of DDMA shall brief media on disaster situation and the response activities.	
Disseminate disaster alerts to concerned TDMC with action plans for forecastable disasters		
Ensure availability of relevant staff before anticipated disaster		
Advise concerned departments on removal of congestion from water ways before monsoon and flooding period		
Ensure availability and functioning of district emergency operation center		
Arrange emergency response exercises and drills along with volunteer groups, social welfare and civil defense on various disaster scenarios		
Civil Defense		

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Pre-Disaster	During-Disaster	Post-Disaster
Assign representatives for DDMA to participate in meetings	Fire fighting	Assist in rehabilitation process if required
Information sharing regarding capacities and needs of Civil Defense department regarding disaster risk management	Rescue and evacuation	
Capacity building of Civil Defense department regarding disaster risk management	Assign volunteers in coordination with PDMA and DDMA	
Information sharing regarding technical and personnel expertise with DDMA	Communicate to DEOC about details of all activities	
Conduct trainings for Volunteers regarding Rescue and other relevant expertise in collaboration with Health department and PDMA	Communicate to DEOC any additional resources required for performing the above tasks	
Create awareness regarding rescue, evacuation and first aid	Facilitate line departments as per demand in disaster response	
Effectively establish, train and systemize volunteer's initiatives in collaboration with education department / institutions		
Education Department		

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Pre-Disaster	During-Disaster	Post-Disaster
Assign representatives for DDMA and participate in meetings	Mobilize human resources for intervention during disaster	Assessment of damages occurred to educational institutes
Information sharing regarding capacities and needs of Education department regarding disaster risk management	Inform schools situated in high-risk areas about hazard and hazard forecast	Provide assistance to teachers, students and other staff who are victimized by disasters (lack of food, shelter, etc.)
Teachers and students are informed about the disaster-prone areas of the district	Assist in arrangement of relief and shelter camps in educational institutes for the disaster	Rehabilitation and reconstruction of affected educational facilities
Teachers and students are informed of their responsibilities to take care of materials and documents to safe places during disaster	Facilitate Health department and other relevant entities in arranging medical camps, blood donations and provision of medical aid during disaster and emergencies	Facilitate institutions / NGOs / INGOs which focus on rehabilitation of educational facilities
Facilitate and collaborate with PDMA in preparation of disaster management curriculum		
Collaborate with PDMA and DDMA in synergizing volunteers		
Finance Department		
Regular coordination with PDMA	Provide funds to PDMA and other line departments for procurement of material and equipment required for emergency response	Get statistical data regarding actual damage and recovery needs from all line departments

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Pre-Disaster	During-Disaster	Post-Disaster
Allocate budget on contingency basis, to handle any emergency situations		Provide funds for execution of rehabilitation process
Facilitate other departments in planning and meeting their financial needs		
Health Department		
Assign representatives for DDMA, and participate in meetings	Provide emergency treatment for the seriously injured	Conduct disaster impact assessment on health situation
Information sharing regarding capacities and needs of Health department regarding disaster risk management	Ensure emergency supplies of medicines and first-aid	Prepare plan for the following year along with reports and submit to PDMA and concerned department.
Build capacity of health department regarding disaster risk management and preventive health care especially in disaster prone areas	Supervise food, water supplies, sanitation and disposal of waste	Medical camps and vaccination
Monitor the general health situation, e.g., monitor outbreak of diseases	Assess and co-ordinate provision of ambulances and hospitals where they could be sent (public and private);	Rehabilitation of health infrastructure affected during disaster
Provide specific information required regarding precautions for epidemics	Provide special information required regarding precautions for epidemics	Preparation of impact assessment surveys covering strengths and weaknesses of interventions

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Pre-Disaster	During-Disaster	Post-Disaster
Establish a health mobile team in district and taluka headquarter hospital	Set-up an information Centre to organize sharing of information for public information purposes	
Set-up an information Centre to organize sharing of information for public information purposes	Conduct disaster impact assessment on health	
Prepare first aid kits, medicines, water test kits, chloramines and anti-snake venom serum.		
Collaboration with relevant organizations / partner NGOs for participation and support through technical resources		
Up-gradation and smooth functioning of hospitals, BHUs, equipped with required staff, medicines and equipment		
Database and linkages with ambulance services/blood banks		
Health and hygiene awareness and education		
Ensure proper disposal of hospital waste		
Irrigation Department		

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Pre-Disaster	During-Disaster	Post-Disaster
Inspection and identification of vulnerable embankments	Ensure 24/7 vigilance of vulnerable embankments	Conduct assessment of damages and needs and report to PDMA through DEOC
Monitoring and dissemination of river water levels	Measure and report flood water inundation levels to DDMA and PDMA	Restore and repair damaged irrigation systems
Implementation of SOPs defined by Bund Manual	Ensure to drain/de-water from agriculture fields and its safe conveyance to minimize losses	Prepare overall report of the department regarding intervention and disseminate to PDMA
Ensure readiness of equipment and machinery before monsoon and flooding season	Coordinate with PDMA and DDMA during entire disaster event for execution of on-demand action plans	
Monitor and disseminate flood level information to DDMA and PDMA		
Initiate necessary embankments reinforcing interventions for vulnerable embankments		
Initiate interventions for river training where necessary		
Introduce and ensure water harvesting and modern water management interventions in likely drought affected areas		
Ensure safety and compactness of irrigation channels, canals, branches, etc. before start of		

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Pre-Disaster	During-Disaster	Post-Disaster
monsoon season to avoid breaches in irrigation system during heavy rains		
Ensure removal of congestion from storm water and draining channels before monsoon		
Information Department		
Close coordination and liaison with PDMA and DDMA	Coordination with PDMA and DDMA for announcement of warnings and updates on disasters	Focus on problems being faced by the people of the affected area
During monsoon, flooding season and forecastable hazards issuance of press releases regarding hazards and preparedness plans of the government	Publication of bulletins on government actions, facilities, relief and rescue efforts	Publish, broadcast /telecast programs highlighting strengths, weaknesses and scams in disaster response activities
Issue and publish disaster alerts on appropriate media forums	Publication of camp management and relief distribution announcements	Publish, broadcast /telecast programs highlighting government initiatives and collective response of NGOs, INGOs and other departments for relief and rehabilitation
Coverage and publication of government initiatives on disaster risk reduction and management	Publication of safety measures during disasters to minimize disaster domino effects	

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Pre-Disaster	During-Disaster	Post-Disaster
Ensure media coverage and publication of PDMA and DDMA meetings for pre disaster preparations	Communicate voice of affectees to concerned departments	
Pakistan Meteorological Department (PMD)		
Update and upgrade forecast equipment	Monitoring of flood waters, river flows and sharing of information with PDMA	Technical assistance in rescue and rehabilitation process
Timely and authentic forecast of rains, windstorms and other forecastable hazards	Forecasting for any confluencing disaster	
Timely transfer of information regarding abnormal weather conditions to PDMA	Issuance of precautionary measures to avoid domino effects of disaster	
Police Department		
Coordinate with the DDMA in the pre-disaster planning	Co-ordinate with DEOC	Assist in relief and rehabilitation process
Participate in DDMA meetings	Assistance in shifting of rescued/affected people to relief camps and hospitals	
Capacity building of Police department regarding disaster risk management	Provide protection and easy access to rescue and relief personnel/vehicles	
Information dissemination through 15 helpline service to local residents	Maintain law and order	

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Pre-Disaster	During-Disaster	Post-Disaster
Prepare team for emergency intervention	Provide warning / instruction to travelers	
	Divert traffic on alternate routes as and when necessary	
	Ensure security to workers of NGOs and INGOS who perform duties for disaster response	
	Ensure safety and security of relief goods and maintain discipline during relief distribution process	
	Provide security in Relief Camps	
Revenue Department		
Assign representatives for DDMA, and participate in meetings	Coordination with the DEOC	Allocation of funds for recovery and rehabilitation process
Information sharing regarding capacities and needs of Revenue department regarding disaster risk management	Establish relief distribution centers	Assessment of damage of industry/business, crops and livestock and settlement of applicable
Capacity building of Revenue department regarding disaster risk management	Accept relief donations and relief support	
Assessment of high prone areas and estimation of possible damage and needs for recovery in case of emergency	Timely release of funds	

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Pre-Disaster	During-Disaster	Post-Disaster
Arrangement of financial resources		
Facilitate getting tax exemptions to institutions/NGOs/INGOs focus on disaster risk		
Armed Forces		
Coordinate with the DDMA in the pre-disaster planning	Maintain liaison with the DEOC for vital inputs during response	Cooperate and coordinate with district authorities
Prepare necessary equipment, labor, transportation and other materials for emergency interventions	Collect information and warn appropriate Army units for engagement in safety, rescue and evacuation activities	Assist in rehabilitation process if required
Provide training to soldiers and determine the role of soldiers who are stationed in flood	Establish communication infrastructure and supplement the civil communication set-up if required	
Assist in evacuation of people to safe places	Coordinate all military activity required by the civil administration	
	Provision of medical care with the help of the medical teams, including treatment at the nearest armed forces hospital	
	Transportation of relief material	
	Provision of logistic back-up (aircrafts, helicopters, boats)	

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Pre-Disaster	During-Disaster	Post-Disaster
	Assist in establishment of Relief Camps	
	Assist in evacuation of people to safe places during the disaster	
	Installation of temporary Bridges, Bunds	
	Maintain liaison with the DEOC for vital inputs during response	
	Collect information and warn appropriate Army units for engagement in safety, rescue and evacuation activities	
	Establish communication infrastructure and supplement the civil communication set-up if required	
	Coordinate all military activity required by the civil administration	
Social Welfare and Community Development		
Coordination with NGOs and civil society organizations working for disaster risk management	Provide information on the situation of the disaster to the DEOC	Monitor and follow up the status of the extremely vulnerable people

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Pre-Disaster	During-Disaster	Post-Disaster
Empower the extremely vulnerable people emphasizing women and children through public	Coordinate all NGOs / INGOs and civil society organizations working during the emergency response	Assist and facilitate Damage and Needs Assessment teams from NGOs
Awareness involving respective departments for various fields such as Education, Health etc.	Monitor progress of relief operations in the affected areas	Conduct impact assessment studies and analysis of strengths and weaknesses of stakeholders and disseminate learning to PDMA, DDMA and other concerned institutions
	In coordination with PDMA, Health, Revenue and other line departments, ensure delivery of relief to most vulnerable segments of society such as children, orphans, widows, destitute	Facilitate institutions / NGOs/ INGOs which focus on rehabilitation activities
	Assist and facilitate Damage and Needs Assessment teams from NGOs	
	Share human resources with DDMA	
NGOs / INGOs		
Facilitate PDMA and DDMA for capacity building regarding disaster risk management	Collaborate and facilitate in relief operations	Collaborate and facilitate in rehabilitation activities
Capacity building of community groups regarding disaster risk management	Incorporate local and international expertise in disaster response	Incorporate local and international expertise in rehabilitation activities

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Pre-Disaster	During-Disaster	Post-Disaster
Linkages with concerned departments and institutions for providing technical and financial resources regarding diverse sectors related to disaster management	Facilitate establishment of temporary shelters and camps	Facilitate overall rehabilitation in collaboration with concerned departments
Resource mobilization at local and international level	Facilitate in overall disaster response in collaboration with concerned departments	Impact assessment studies and sharing findings with PDMA, DDMA, local and international partners
	Regular updates and alerts to local and international partners	Linkages with partners for sustainable resources mobilization
	Utilization of existing resources and further mobilization at local and international level	
	Assessment of losses using sphere standards	

Source: *NDMA*

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11.8 Disaster Management Plan

The comprehensive Disaster Management Plan (DMP) for Ghotki District, grounded in the findings of the Multi-Hazard Vulnerability and Risk Assessment (MHVRA) and, critically, the lessons learned from the 2022 Floods. The plan moves from general guidelines to a specific, actionable framework with clearly assigned roles. It addresses identified weaknesses in coordination, community preparedness, and reconstruction by providing detailed protocols for early warning, evacuation, and resilient recovery, ensuring a cohesive and accountable approach to disaster risk management.

Multi-hazard Vulnerability Risk Assessment of Ghotki district reveals that the district is relatively safe in terms of natural disasters. The pertinent hazards to district are hydro-meteorological hazards including drought and riverine flood with the potential to cause urban flooding. The risk of geophysical hazards is low in the district. In modern technological era, hydro-meteorological hazards can be precisely forecasted and action can be taken well in time to minimize damages and losses. In other words, the vulnerabilities and risks are manageable and losses and damages can be minimized through adoption of best management practices and mobilization of resources.

These guidelines introduce best practices which can be adopted to manage risk of natural disasters in the district.

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Table 11-8, Best Practices to Manage Risk of Natural Disasters in District Ghotki

Disaster	Mitigation Measures	Responsible Agency
Riverine Flood	▪ Identify and reinforce vulnerable sections of river embankments based on pre-monsoon surveys.	DDMA, Irrigation Department
	▪ Conduct pre-monsoon clearance of stormwater drains and natural waterways to prevent urban flooding.	Local Government Department, Municipal Authorities
	▪ Activate a multi-channel public early warning system (SMS, FM Radio, Mosque announcements) for communities in low-lying areas.	DDMA, Information Department, Pakistan Meteorological Department (PMD)
	▪ Pre-position emergency stocks (tents, boats, medical kits) at the Taluka level.	PDMA, DDMA / Social Welfare Department
Earthquake	▪ Identify and retrofit old and vulnerable public buildings (e.g., schools, hospitals).	Local Government, Works & Services Department / Health Department
	▪ Enforce building codes for all new construction projects.	Sindh Building Control Authority (SBCA) and Local Government
	▪ Conduct annual earthquake safety drills in all schools and major public institutions.	DDMA, Civil Defense, Education Department
Heatwave	▪ Issue public health warnings and precautionary advisories via SMS and local media when temperatures exceed 45°C.	Health Department, Information Department, PMD
	▪ Establish temporary cooling centers in public buildings (e.g., schools, community halls) in urban areas.	Local Government / Municipal Committee, Health Department
	▪ Launch public awareness campaigns on heatstroke prevention and water conservation.	Health Department, Information Department, NGOs

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Disaster	Mitigation Measures	Responsible Agency
Drought	▪ Promote and distribute drought-resistant seed varieties to farmers.	Agriculture Department, Research Institutions
	▪ Monitor groundwater levels and promote efficient irrigation systems (e.g., drip irrigation).	Irrigation Department / Agriculture Department, P&D Department
	▪ Establish and manage community seed banks to ensure food security.	Agriculture Department, Social Welfare, Community Organizations

Source: *MHVRA Informed Disaster Management Plan, Ghotki District (2023–2032)*

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11.8.1 Urban Resilience and Sectoral Roles

Building on the disaster management guidelines, it outlines a strategic framework for embedding resilience into the urban fabric and development planning of Ghotki District. The objective is to shift from reactive disaster response to proactive risk reduction by addressing sectoral vulnerabilities through clearly defined roles and accountable actions. The following table presents the core objectives for adaptation and urban resilience, each linked to specific, actionable measures and the primary stakeholders responsible for implementation. This ensures that disaster risk reduction is not a standalone activity but is mainstreamed into the core functions of all relevant government departments and community institutions.

Table 11-9, Objectives and Action Plan for Adaptation & Urban Resilience

Objective	Actionable Measure	Responsible Stakeholders
Infrastructure	Climate-adaptive public and critical infrastructure	MC, PHED, SID
	Stormwater drainage to reduce urban flooding	
	Erosion protection of waterfronts and canal banks	
	Low-carbon transport systems with redundancy for post-disaster mobility	
	Cooler walkways and public spaces to mitigate heatwaves	
Water, Sanitation, and Waste	Functional sanitation and drainage to prevent disease outbreaks after floods	MC, SIDA
	Safe waste disposal to avoid contamination	
	Reverse osmosis & sustainable groundwater use to combat water logging & drought	
	Plastics recycling and sewage treatment to reduce environmental hazards	
Agriculture, Irrigation, Livestock & Fisheries	Promote drought- and flood-tolerant crops	AGED, SIDA, Fisheries Dept.
	Improve irrigation efficiency & protect from salinity/waterlogging	
	Research climate-resilient seeds and fishery techniques	
	Market linkages to restore livelihoods after disaster shocks	
Human Health & Well-Being	Health facilities resilient to floods	HLD, MC, MoCC
	Awareness campaigns on heatstroke & vector-borne disease	

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Objective	Actionable Measure	Responsible Stakeholders
	Reduced disaster mortality and disease spread	
Governance & Partnerships	Community-based disaster committees (CBDRM)	DDMA, GOS, MC, NGOs
	Enhanced inter-agency coordination	
	Women, youth & vulnerable group empowerment in response teams	
Food Security	Flood and salinity control projects	Food Dept., MC, NGOs
	Emergency food distribution points	
	Livelihood diversification to reduce disaster vulnerability	
Communication, Awareness & Education	School safety clubs, mock drills, and community volunteers.	DDMA, MoCC, Schools, NGOs
	Climate and disaster risk education campaigns	
	Early warning dissemination systems	
Disaster Preparedness & Response	Regularly updated local disaster action plans	DDMA, PMD
	Early warning systems & community communication	
	Provision of shelters and safe evacuation routes	
Urban Planning & Land Development	Enforce zoning regulations to restrict new settlements in high-risk floodplain areas.	P&DD, SIDA, MC
	Relocation of high-risk households	
	Land use policies to protect catchment and easements	
Housing	Flood-proof housing and earthquake-resistant designs	SBCA, BOR
	Climate-resilient building construction codes	
	Secure land tenure for housing relocation	

Source: *The Consultant Team, aligned with MHVRA Informed Disaster Management Plan, Ghotki District (2023–2032)*

The successful implementation of this framework hinges on the proactive coordination led by the District Disaster Management Authority (DDMA), which will facilitate regular inter-departmental meetings and monitor progress against the stated timelines and indicators. The Planning & Development Department (P&DD) plays a critical role in ensuring these resilience measures are integrated into the annual development plans and projects for Ghotki District. This sector-based approach ensures that resilience is not an add-on but a fundamental principle of urban and regional development, directly addressing the vulnerabilities identified in the MHVRA and the lessons from the 2022 floods.

11.8.2 Early Warning System (EWS)

An effective Early Warning System (EWS) is a critical lifeline for Ghotki District, enabling a transition from disaster response to proactive risk reduction. The system's effectiveness hinges on its ability to generate timely alerts and ensure they reach every at-risk individual, who must understand the message and know how to act. Based on the MHVRA findings and lessons from the 2022 floods, Ghotki's EWS will leverage a multi-channel approach to guarantee "last-mile" connectivity, especially for vulnerable and remote communities.

The system will be activated based on triggers from the Pakistan Meteorological Department (PMD) and the Sindh Irrigation Department regarding river levels and weather forecasts. The dissemination protocol is outlined below, detailing the escalation from alert to immediate action.

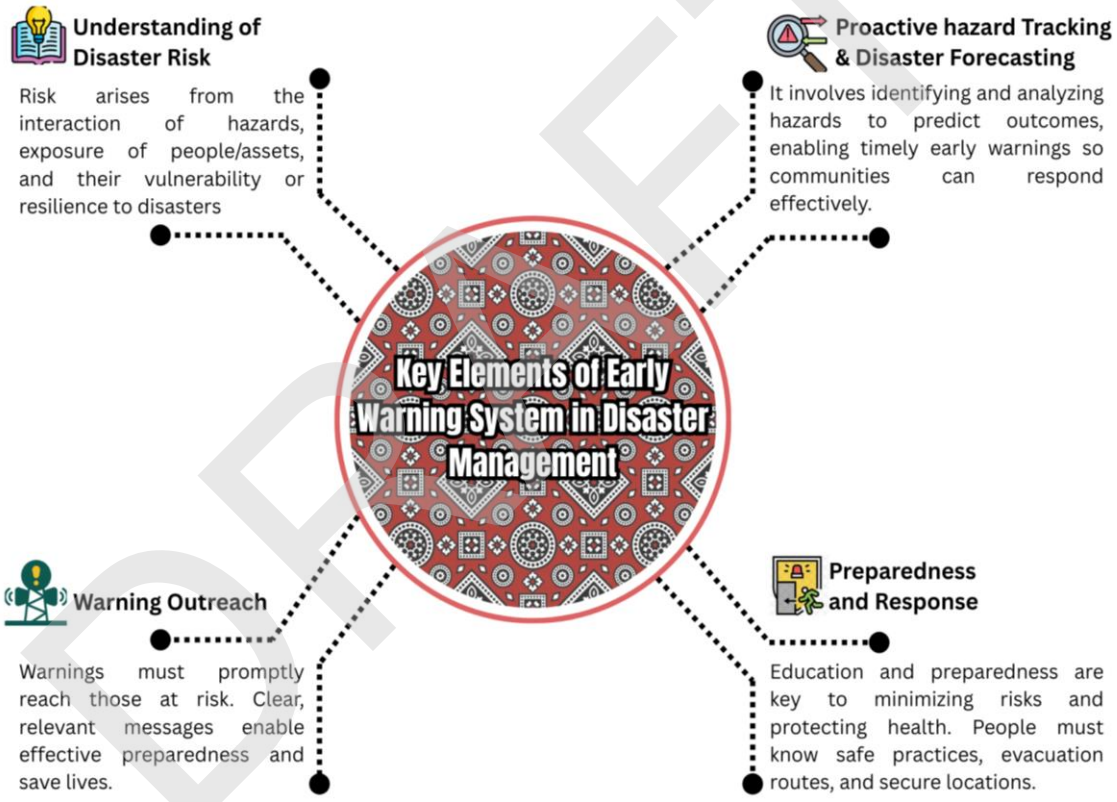


Figure 4-1, Key Elements of Early Warning System in Disaster Management

Source: *The Consultant Team*

Table 11-10, Early Warning Dissemination Protocol for District Ghotki

Warning Level & Trigger	Dissemination Channels	Required Actions by Authorities & Communities
ALERT (72-48 hours before event) • PMD forecast of heavy rainfall in	▪ SMS Blasts to registered community contacts. ▪ Initial FM Radio broadcasts on local stations.	▪ DDMA/Irrigation department is intensifying monitoring. ▪ Communities/CDVs are

Warning Level & Trigger	Dissemination Channels	Required Actions by Authorities & Communities
catchment areas. • Rising river levels at upstream barrages.	▪ Issuance of Alert to DDMA and line departments via official channels.	reviewing evacuation plans and checking emergency supplies. ▪ Information Dept. prepares public awareness messages.
WARNING (24 hours before event) • Confirmed forecast of severe weather. • River flow reaching predetermined danger levels.	▪ Repeated SMS/FM Radio broadcasts with specific details. ▪ Mosque Loudspeaker announcements in vulnerable UCs. ▪ Mobile Vans with megaphones deployed in high-risk areas. ▪ Activation of UC-level WhatsApp groups by administrators.	▪ DDMA/Police department finalizes evacuation routes and resource deployment. ▪ Communities are secure livestock, assets and preparing to evacuate. ▪ Shelter Management (Revenue Dept.) pre-activate designated shelters.
IMMEDIATE ACTION (Evacuate) • Imminent breach warning or rapid rise in water levels. • Direct order from PDMA/DDMA	▪ Continuous sirens in installed locations (if available). ▪ Door-to-door alerts by Police and Community Disaster Volunteers (CDVs). ▪ Direct calls to UC Chairpersons and key community leaders.	▪ DDMA/Transport Dept. coordinates evacuation vehicles. ▪ Police department manages traffic and ensure safe passage. ▪ Communities should evacuate immediately to pre-identified shelters.

Source: *The Consultant Team*

11.8.3 Community Based Disaster Risk Management (CBDRM)

Community-Based Disaster Risk Management (CBDRM) emphasizes local community participation in disaster preparedness, mitigation, and response. While the government holds the main responsibility for disaster services, community involvement is essential for long-term success. Projects that ignore local needs and culture risk failure, so effective disaster management must be people-centered and built on partnerships with communities.

CBDRM offers key advantages includes reduces vulnerability, strengthens resilience, fosters hope and self-reliance, supports resilient local and national economies, and allows testing of risk reduction strategies at the community level.

In Ghotki district, where floods, droughts, and climate change hazards are frequent, CBDRM is especially critical. By raising awareness, building

capacity, valuing indigenous knowledge, and forming local disaster committees, the framework aims to create resilient communities capable of minimizing risks and effectively responding to emergencies.

Core Community Structures: From Planning to Action

To operationalize CBDRM, the following structures will be established in each Union Council, with clear linkages to the District and Taluka disaster management authorities:

- Union Council Disaster Management Committees (UCDMCs) will be the cornerstone of local action, chaired by the UC Administrator and including members from local NGOs, CBOs, mosque leaders, and representatives from vulnerable groups.
- Each UCDMC will facilitate the formation of a Community Disaster Volunteer (CDV) Teams comprising 20-30 local volunteers. These teams will be trained in first aid, light search and rescue, and early warning dissemination.
- All secondary schools in the district will establish Safety Clubs to conduct regular drills and raise awareness among students, who act as powerful messengers within their families.

A) Phased Implementation of Community-Based Disaster Risk Management (CBDRM)

The following framework outlines a practical, phased approach to establishing and sustaining CBDRM in Ghotki District. This process transforms community engagement from a one-time consultation into a continuous cycle of planning, action, and improvement, directly managed by the communities with support from the DDMA and local authorities.

Table 11-11, Phased CBDRM Implementation Framework

Phase	Key Components	Specific Activities & Outputs
Phase 1: Foundation & Assessment (Months 1-3)	1. Community Mobilization & Mapping 2. Vulnerability & Capacity Assessment (VCA)	▪ **Demarcate the community boundary** for the CBDRM unit (e.g., a village or mohalla). ▪ Map local leaders, schools, businesses, mosques, CBOs, and representatives of women, elderly, and persons with disabilities. ▪ Use community mapping, transect walks, and discussions to identify local hazards, vulnerable groups, and existing resources (e.g., community buildings, boats, skilled individuals).
Phase 2: Planning &	3. Formulate the UC Disaster Management Plan	▪ Define clear goals for disaster risk reduction specific to the community. ▪ Create a list of prioritized actions (e.g.,

Phase	Key Components	Specific Activities & Outputs
Institutionalization (Months 4-6)	4. Establish Governance Structure	clear drainage channel X, mark evacuation route to school Y). ▪ Formally appoint a Leader, Sub-Leaders, and teams for specific tasks (Early Warning, Evacuation, First Aid, Shelter Management).
Phase 3: Implementation & Capacity Building (Months 7-12)	5. Resource Mobilization & Training 6. Implementation of Actions	▪ Identify and leverage local resources (volunteers, equipment) and seek external support (training, materials) from DDMA/NGOs where needed. ▪ Train Community Disaster Volunteers (CDVs) in first aid, light search and rescue, and early warning dissemination. ▪ Begin implementing the prioritized actions from the community disaster plan, starting with the most viable projects.
Phase 4: Monitoring, Evaluation & Sustainability (Ongoing)	7. Drills & Simulation Exercises 8. Review and Update 9. Coordination with Authorities	▪ Test the community's plan through simulation exercises and document lessons learned. ▪ Revise the community disaster plan based on drill outcomes, new hazards, or changes in community structure. ▪ The UCDMC will regularly report activities and needs to the Taluka and District Disaster Management Authorities (TDMC/DDMA) to ensure integration into the wider disaster management system.

Source: *The Consultant Team*

11.8.4 Evacuation Plan

The evacuation plan for Ghotki District is designed to ensure the safe, orderly, and timely relocation of populations from hazard-prone areas. The plan is activated for two primary scenarios:

- Riverine Floods: Relocating populations from the 171 identified settlements within the riverine flood plain.
- Earthquakes: Relocating populations from areas with vulnerable infrastructure and collapsed buildings.

Evacuation will be to the network of designated shelters identified in the district.

A) Pre-Evacuation Preparedness

- Shelter identification involves the 7 primary shelter locations, as geo-referenced in the plan, will be clearly mapped and marked with

signage. Their proximity to major roads and basic facilities (health centers, education, police stations) is a key feature for accessibility.

- Route planning involves evacuation routes will primarily utilize the Sukkur-Multan Motorway (M-5) and the National Highway (N-5) network for high-volume traffic. Secondary and link roads will be identified for access to vulnerable neighbourhoods, as illustrated in the shelter location map.
- Regular awareness campaigns will be conducted in at-risk Union Councils (UCs) to inform communities about evacuation procedures, shelter locations, and routes. Evacuation drills will be organized in collaboration with Union Council Disaster Management Committees (UCDMCs) to ensure community readiness.
- A pre-planned emergency traffic management protocol will be prepared by the relevant departments (e.g., Police, NHA) to ensure efficient mobility and prevent congestion on evacuation routes.

B) Activation and Execution

- Activation trigger for:
  - Flood: Evacuation orders will be triggered based on early warnings disseminated by the Provincial Disaster Management Authority (PDMA) via the District Emergency Operation Center (DEOC).
  - Earthquake: Evacuation will be immediate and based on rapid damage assessments conducted by the DDMA and frontline responders following the seismic event.
- Upon activation, the District Disaster Management Authority (DDMA) will lead the effort, mobilizing police (from the 17 police stations identified) for security and traffic control. The Taluka Disaster Management Committees (TDMCs) and UCDMCs will act as frontline responders, guiding people from their communities.
- Specific arrangements, including dedicated transport, will be made for the safe evacuation of vulnerable groups (elderly, persons with disabilities, women, children). Coordination with nearby 88 health facilities will be critical for medical support during transit, especially in an earthquake scenario.

C) Shelter Management

- Designated shelters, which have the capacity to accommodate approximately 25,200 and 37,950 tents for flood and earthquake respectively, will be equipped with essential facilities managed by the DDMA in coordination with relevant line departments and NGOs. This includes provisions for water, sanitation, food, and basic healthcare.

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- Trained personnel, including volunteers from Social Welfare and community-based groups, will manage shelter registration, crowd control, and the distribution of relief goods.

D) Return and Rehabilitation

- Once the disaster threat has passed and conditions are declared safe by the relevant authorities, organized transportation will be arranged for evacuees to return to their communities.
- Rehabilitation efforts, guided by the "Build Back Better" principle, will be coordinated by the PDMA and DDMA. This includes support for temporary housing, restoration of livelihoods, and healthcare services in collaboration with government departments and partner organizations.

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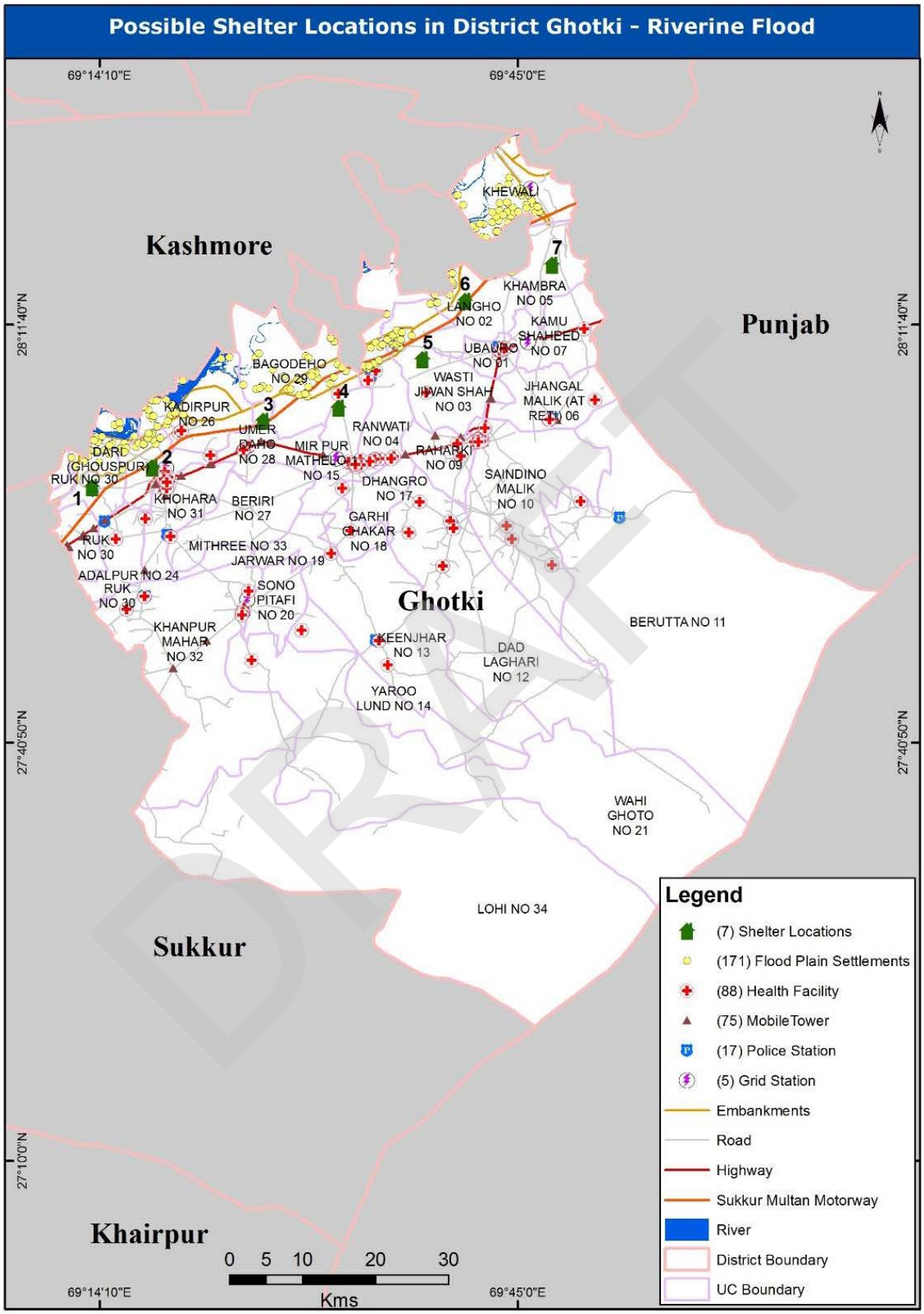


Figure 11-17, Shelter Locations in District Ghotki – Riverine Flood

Source: *MHVRA Ghotki District, 2023-2032*

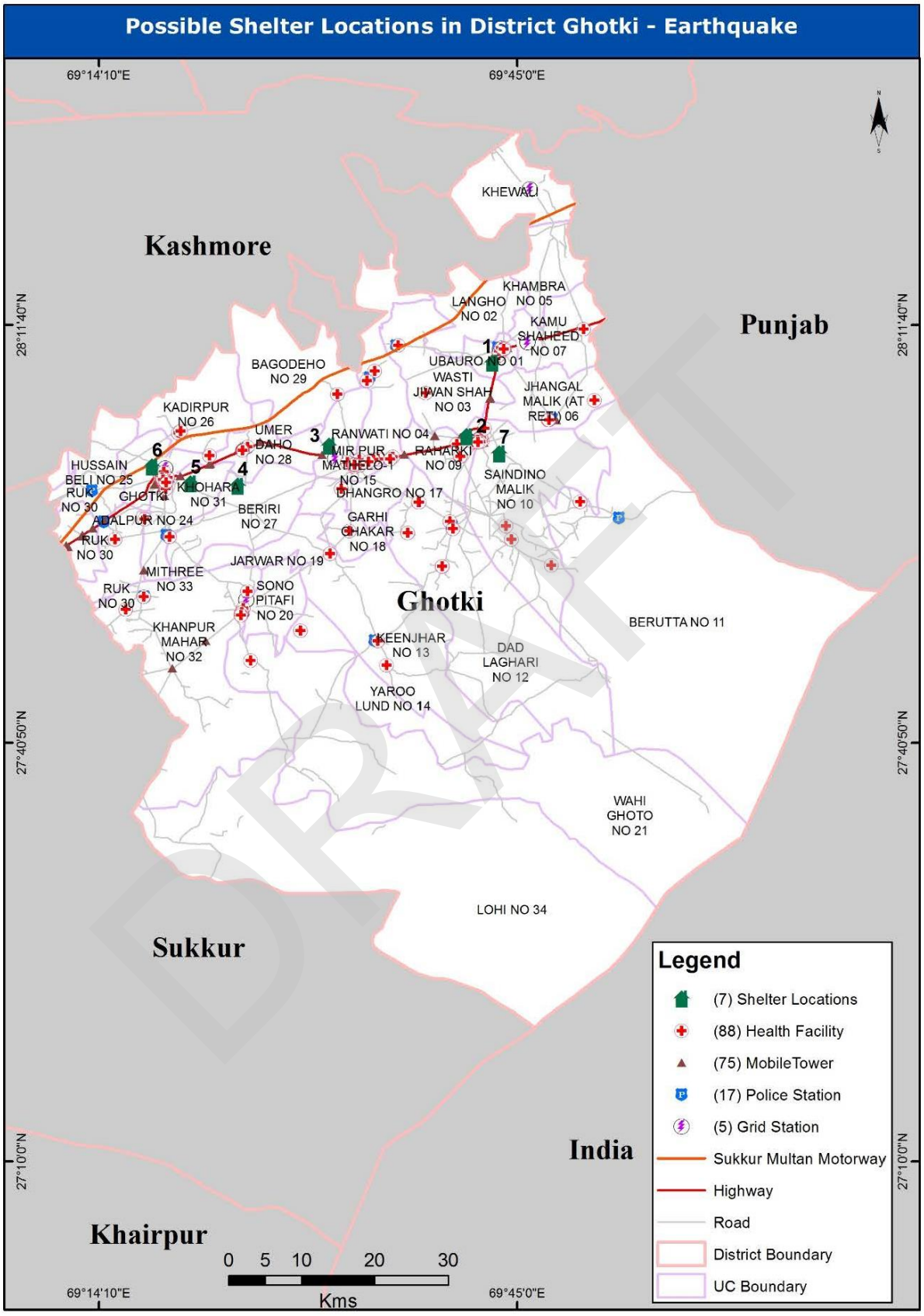


Figure 11-18, Shelter Locations in District Ghotki – Earthquake

Source: *MHVRA Ghotki District, 2023-2032*

11.9 Strategic Framework for Disaster Risk Reduction

11.9.1 Policy Guidelines

A) Integrate Disaster Risk Reduction (DRR) into Urban Planning

- Incorporate hazard and vulnerability assessments into all stages of urban development.
- Ensure infrastructure, housing, and land use decisions are based on risk data.
- Reduce exposure to hazards by avoiding high-risk zones (e.g., floodplains, fault lines).
- Support resilient city growth to minimize future disaster impacts.

B) Regulate Encroachments in Floodplains and Illegal Bunds

- Enforce laws to prevent construction in flood-prone or environmentally sensitive areas.
- Demolish unauthorized bunds and structures that obstruct natural drainage.
- Monitor land use regularly to deter further encroachments.
- Protect water flow and flood mitigation zones to reduce disaster risk.

C) Promote Green Infrastructure and Resilient Agriculture

- Increase urban greenery (e.g., parks, tree belts) to combat heat and absorb rainwater.
- Implement nature-based solutions like rain gardens, green roofs, and permeable pavements.
- Support climate-resilient farming through drought-tolerant crops and improved irrigation.
- Encourage sustainable practices to reduce long-term vulnerability

D) Increase Urban Greenery (e.g., Parks, Tree Belts) To Combat Heat and Absorb Rainwater

- Implement nature-based solutions like rain gardens, green roofs, and permeable pavements.
- Support climate-resilient farming through drought-tolerant crops and improved irrigation.
- Encourage sustainable practices to reduce long-term vulnerability.

E) Strengthen Community-Based Disaster Risk Management (CBDRM) Programs and Local Capacity Building

- Involve communities in identifying local hazards and planning risk-reduction activities.

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- Provide training and resources to improve disaster preparedness at the grassroots level.
- Empower local leaders and volunteers to act as first responders.
- Enhance public awareness campaigns and mock drills through inclusive participation in DRM efforts.

F) Mainstream Fire Safety in Urban Development

To ensure comprehensive disaster resilience, fire safety must be integrated as a key policy priority in Ghotki's urban management framework.

- Ensure full compliance with the Building Code of Pakistan – Fire Safety Provisions 2016 (BCP-FSP 2016) for all building types.
- Enforce routine audits of industrial, commercial, and high-rise buildings, applying penalties for non-compliance.
- Maintain adequate separation between industrial and residential areas and ensure dedicated emergency access routes.
- Include fire safety modules in school and university curricula to build long-term awareness.
- Define evacuation routes, assembly points, and conduct regular fire drills in schools, markets, and neighborhoods.
- Upgrade training facilities and collaborate with the *National Institute of Fire Technology* for advanced courses.
- Create a centralized database to record and analyze fire incidents for proactive planning.

G) Enhance Security and Risk Management for Crowded Places

- Identify, map, and periodically review crowded places such as transport hubs, religious institutions, commercial centers, and public venues to assess security risks.
- Ensure installation of CCTV, controlled access points, and emergency evacuation procedures in high-footfall zones.
- Engage law enforcement agencies (Police, CTD, NACTA), local authorities, and private facility managers to jointly plan and implement protective measures.
- Conduct awareness campaigns and mock drills in markets, schools, and religious areas to enhance public readiness during emergencies.

H) Risk Based Planning Through Vulnerability and Hazard Assessments

- Collect data to identify vulnerable groups (e.g., women, elderly, low-income communities).
- Analyse geographical and systemic risks for targeted planning.
- Prioritize high-risk areas for resource allocation and intervention.

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- Design evidence-based, technically sound DRM strategies tailored to specific needs.

I) Build on Existing Community Structures and Coping Mechanisms

- Utilize established community organizations and local leadership.
- Leverage traditional practices and local knowledge in DRM planning.
- Increase community trust and support by involving familiar structures.
- Ensure long-term sustainability by embedding interventions in local systems.

J) Include Women as Key Stakeholders in DRM

- Recognize women's vital roles in families and communities during disasters.
- Address gender-specific vulnerabilities and inequalities in DRM planning.
- Involve women in decision-making and early warning systems.
- Strengthen resilience by leveraging women's unique skills and perspectives.

K) Define Roles and Responsibilities Across Government Levels

- Clearly allocate DRM roles among local, provincial, and national authorities.
- Avoid duplication and gaps through well-defined responsibilities.
- Ensure smooth communication and coordination during emergencies.
- Enable faster, more efficient response through structured governance.

11.9.2 Strategic Development Plan

The Strategic Development Plan aims to build a resilient Ghotki through integrated disaster risk management, reducing vulnerabilities to natural and man-made hazards, including fire-related emergencies. The plan emphasizes preparedness, institutional coordination, and infrastructure enhancement.

A) Long Term Plan

National risk assessment would identify highly vulnerable districts and be complemented by higher resolution work at local level to diagnose the underlying causes of risk, explore concrete risk reduction options and inform development planning and prioritization exercises and/ or disaster preparedness planning.

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- Assessments should be conducted using a uniform methodology and process for multi-hazard vulnerability and risk assessment so they can help to refine the national/ provincial data-bases.
- DRR needs to address and involve local level actors in high-risk communities to be effective
- and produce sustainable results. Provide disaster relief centres is high risk areas for shelter is higher. Places with medical facilities and food distribution centres.
- There is a need to have clear arrangements that allow the system to switch into emergency mode and mobilize necessary resources in a timely and effective manner.
- Establish multi-hazard disaster relief centers in high-risk zones.
- There is need to clarify mutual roles and responsibilities (horizontal and vertical) and coordination arrangements in an updated, multi-hazard national response plan that is based upon current legislation.
- Integrate fire services infrastructure within urban development plans by:
  - Upgrade existing fire stations as per *NRM* and *BCP-FSP 2016* standards.
  - Allocate a minimum of **2,025 sq. m (~4 kanals)** for each firefighting station with adequate training and storage facilities.
  - Expand hydrant networks and ensure water availability in high-risk areas.
  - Establish a centralized fire incident database and integrate it with the city's emergency response system.
  - Integrate safety measures for soft targets into master plans, including transport terminals, religious centers, and public venues.
  - Strengthen inter-agency coordination for threat assessment and response.
  - Promote continuous risk monitoring and stakeholder engagement.

B) Short Term Plan

- Provision of the right to timely emergency care by providing quality
- emergency service as per international standards.
- Creating an integrated District and provincial level capacity to identify and Monitor vulnerability and hazard trends including potential climate change impact.

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- Strengthening an integrated disaster preparedness and response capacity from the local to the national level.
- Promoting development planning that considers and addresses disaster risks alongside environmental and climate change concerns.
- Strengthening capacity at national and provincial levels to facilitate and
- provide support to the implementation of DRM policies, plans and programs across sectors and in high-risk areas
- Strengthening Local Level Risk Reduction capacity focusing upon communities, and supportive linkages with Union Councils, tehsils and districts.
- Strengthening the structural and non-structural resilience of key infrastructure and lifelines in Pakistan.
- Rapid Response Fire Services: Establish compact fire sub-stations with specialized vehicles for congested neighborhoods.
- Emergency Preparedness: Identify and mark emergency access routes, fire lanes, and safe assembly points.
- Firefighting Capacity Building: Procure firefighting tools (breathing apparatus, foam units, rescue kits) and train staff in coordination with the National Institute of Fire Technology.
- Crowded Places Safety Measures:
  - Develop a GIS-based inventory of crowded places with risk profiling.
  - Install CCTV, communication systems, and controlled entry points at major public areas.
  - Conduct joint training for police, emergency services, and facility managers on crowd management and threat response.
  - Integrate public awareness programs on fire safety, evacuation drills, and emergency behavior.

11.9.3 Priority Projects

- **Establish a Risk Assessment Framework**
  - Develop clear criteria for declaring disaster-affected areas to ensure transparent and timely response.
  - Base disaster risk management (DRM) strategies on comprehensive hazard and vulnerability assessments, combining both quantitative and qualitative analyses of potential losses and geographic exposure.

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- **Develop an Integrated Multi-Hazard Data and Monitoring System**
  - Create a centralized digital database to record, analyze, and monitor all disaster events, including floods, fires, and security-related incidents in public areas.
  - Enable evidence-based planning, informed decision-making, and continuous risk monitoring through GIS integration and real-time reporting mechanisms.
- **Strengthen Flood Risk Mitigation and Response Mechanisms**
  - Implement structural and non-structural measures to reduce flood impacts, such as strengthening embankments, improving drainage systems, and establishing community-based early warning and evacuation plans.
  - Designate and equip safe shelters with essential services to ensure the protection of vulnerable populations during flood emergencies.
- **Enhance Fire Safety and Public Space Security**
  - Upgrade existing fire stations, establish new ones at strategic locations, and deploy additional fire engines, water tankers, and mobile units for rapid response.
  - Implement moderate safety enhancement measures in crowded areas through surveillance systems, controlled access, and coordinated response among law enforcement and local authorities.
  - Promote community-level fire safety education, awareness campaigns, and regular evacuation drills.
- **Build Capacity and Strengthen Emergency Response Preparedness**
  - Establish certified training programs for first responders in partnership with relevant national institutions.
  - Equip response teams with modern tools, communication systems, and medical supplies.
  - Conduct multi-agency simulation exercises involving police, firefighters, and health departments to ensure efficient coordination and operational readiness.

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SECTION - 12: CLIMATE CHANGE, RESILIENCE AND ADAPTABILITY PLAN

12.1 Introduction

This section highlights the existing and projected climate hazards affecting Ghotki. Located along the Indus River, Ghotki's landscape and agriculture are shaped by its semi-arid climate, with extreme temperatures and limited rainfall increasing its risk of droughts and heatwaves. Rising temperatures and erratic precipitation highlight growing climate stress. Limited access to healthcare, education, water, and sanitation further heightens community vulnerability. With a growing population largely dependent on agriculture, Ghotki remains highly sensitive to environmental and socio-economic shocks.

12.1.1 Climatology of Pakistan

A) Temperature Trends

Pakistan has experienced an increase in average temperatures over the past century, with a rise of approximately 0.57°C. The warming has been more pronounced in southern areas, including Sindh, where winter temperatures have increased by 0.91°C to 1.12°C. This warming trend accelerates during winter and post-monsoon months. The highest temperatures are recorded in June, while the lowest occur in January, reflecting distinct seasonal temperature variations across the country.

B) Precipitation Patterns

Historically, rainfall in Pakistan has been inconsistent. While the northern regions see higher rainfall, the southern plains, including Sindh, have seen a decrease in rainfall. The country is also experiencing increased heavy rainfall events, contributing to both floods and droughts. The monsoon season, which peaks in July and August, accounts for most of Pakistan's annual precipitation. The trends indicate a shift in rainfall distribution, with more frequent intense rainfalls and extended dry periods.

12.1.2 Overview of Climate Change in Pakistan & Sindh

A) National Vulnerability

Pakistan is ranked among the top 10 countries most vulnerable to climate change impacts, despite its low contribution to global greenhouse gas emissions. Climate change in Pakistan has led to extreme weather events like floods, droughts, heatwaves, and unpredictable rainfall. This is exacerbated by Pakistan's dependency on agriculture, which is highly sensitive to climate fluctuations. Additionally, population growth, poverty, and limited resources make the country even more susceptible to climate impacts.

B) Climate Change Impact in Sindh

Sindh is one of the most climate-vulnerable provinces in Pakistan. It faces

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multiple climate hazards:

- Flooding: Sindh, particularly districts along the Indus River, faces significant flood risks due to glacial melt in the upper catchment and increasing rainfall in the lower catchment areas. The province has witnessed severe floods in 2010 and 2013, displacing thousands and causing extensive damage to infrastructure, agriculture, and livelihoods. In 2022, floods covered nearly one-third of Sindh, with the northern districts being the most affected.
- Heatwaves: Heatwaves in Sindh are becoming more frequent and intense. From 1961 to 2011, the frequency of heatwaves, particularly those above 45°C, has significantly increased. In June 2015, over 1,200 deaths were attributed to a heatwave in Sindh. With global warming, heatwaves are expected to become more severe, with rising health risks, particularly to vulnerable populations.
- Coastal Zone Vulnerability: The Sindh coastline is particularly susceptible to sea-level rise. Areas like the Indus Delta are already seeing the effects of saline intrusion, causing land degradation and impacting agriculture and local communities. The coast is also vulnerable to erosion, with some areas experiencing erosion rates of up to 176 meters per year.
- Water Scarcity: Sindh's water resources are under severe stress. The province depends on the Indus River for irrigation, but irregular river flows, combined with reduced rainfall and increased evaporation, are exacerbating water scarcity. Groundwater levels are rising due to extensive irrigation, contributing to salinity and waterlogging, which further reduce agricultural productivity.

12.1.3 National and Provincial Climate Change Governance Framework

A) National Policies

At the national level, Pakistan has established climate policies, including the National Climate Change Policy (NCCP) of 2012, which provides the framework for addressing climate impacts. The Nationally Determined Contributions (NDCs) under the Paris Agreement commit Pakistan to reducing greenhouse gas emissions by 50% by 2030, with a 35% reduction conditional on international support.

B) Sindh's Climate Change Policy

In response to the growing climate challenges, the Sindh Climate Change Policy was formulated in 2022. This policy is designed to complement national efforts while addressing Sindh's specific climate vulnerabilities. It emphasizes a localized approach to climate change mitigation and adaptation, integrating resilience-building measures tailored to the province's unique environmental, social, and economic conditions.

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C) Governance Mechanisms

The provincial climate governance is led by the Environment Climate Change and Coastal Development Department (ECC&CDD), which oversees the implementation of climate change actions. Key bodies such as the Sindh Environmental Protection Agency (SEPA), the Sindh Coastal Development Authority (SCDA), and the Sindh Irrigation Development Authority (SIDA) play critical roles in implementing climate policies, focusing on environmental protection, coastal resilience, water management, and sustainable agriculture.

12.2 Potential Existing and Future Hazards

District Ghotki has been increasingly affected by various indicators of climate change over the past five decades. Key observed trends include:

12.2.1 Rising Temperatures

District Ghotki has experienced a gradual rise in average temperatures over the past five decades, with 2004 being the warmest year at 27.9°C. Summer months show intensified heat stress, impacting urban and agricultural areas.

12.2.2 Variability in Precipitation Patterns

Rainfall in Ghotki has become increasingly erratic, with alternating dry spells and intense downpours. While the district was less impacted by the 2022 Sindh floods, disrupted monsoon patterns are affecting water availability and recharge.

12.2.3 Intensification of Heatwaves

Rising temperatures are driving more frequent and intense heatwaves, leading to water stress, health risks, and agricultural impacts, especially during pre-monsoon and summer seasons.

12.2.4 Increased Flood Risk

Comparative analysis of 2010 and 2022 floods shows a significant increase in flood extent and intensity in Ghotki, with nearly one-third of the district affected in 2022, primarily due to changing climatic patterns.

12.3 Potential Future Hazards

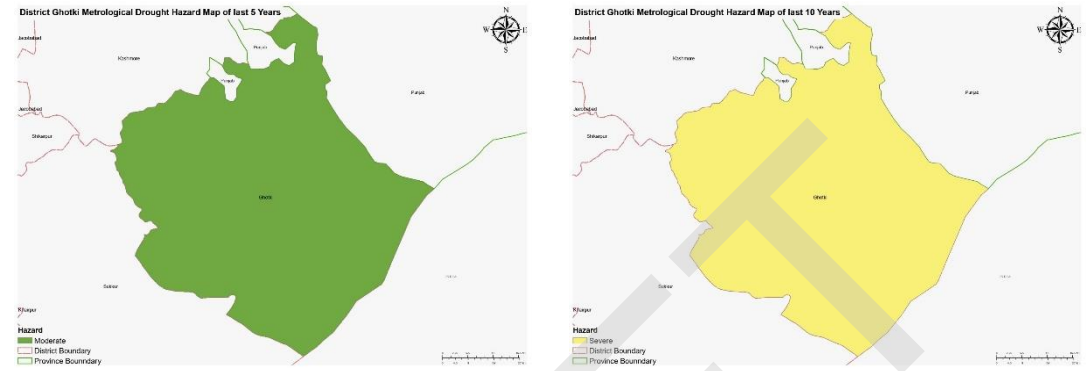
12.3.1 Flood

Ghotki experienced notable floods in 2010 and 2022, exposing vulnerabilities in low-lying areas near the Indus River. While the Sindh Hazard and Risk Atlas classifies the district's overall flood hazard as none too low for five- and ten-year periods, especially in central and southern regions, climate change and shifting rainfall patterns may increase flood risk in the coming years.

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12.3.2 Meteorological Drought

Persistent dry conditions from below-average rainfall have placed District Ghotki under increasing meteorological drought stress. Hazard maps (a) & (b) in Figure 1-1 indicate a "Moderate" risk over 5 years, escalating to "Severe" over 10 years, signaling prolonged dryness. This trend threatens agriculture, water security, and regional stability.



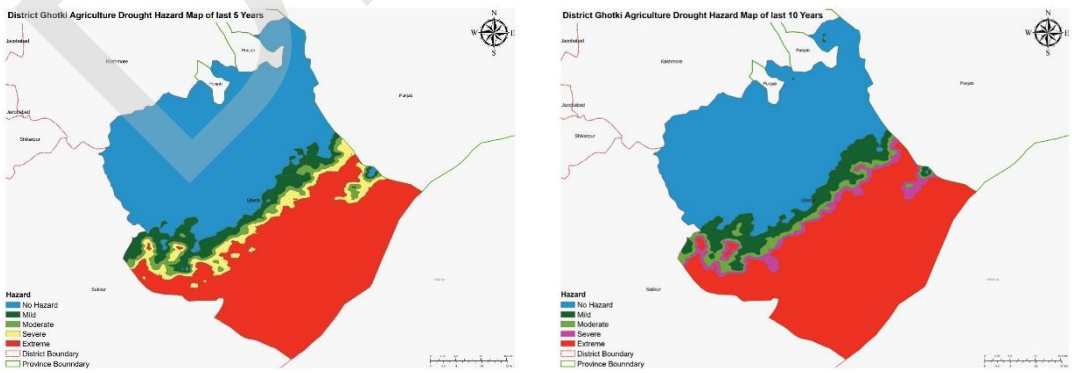
(a) Hazard Map of 05 Years *(b) Hazard Map of 10 Years*

Figure 12-1, Meteorological Drought Hazard Maps of District Ghotki

Source: The Consultant Team, 2025

12.3.3 Agricultural Drought

With declining soil moisture and unreliable rainfall, agricultural drought is becoming a serious concern. Hazard maps from the past 5 and 10 years in Figure 1-2 (a) & (b) show clear spatial variation in drought severity across Ghotki. While the north and northwest face little to no risk, the south and southeast consistently fall under extreme hazard zones, indicating persistent water shortages and growing pressure on agriculture.



(a) Hazard Map of Last 05 Years *(b) Hazard Map of Last 10 Years*

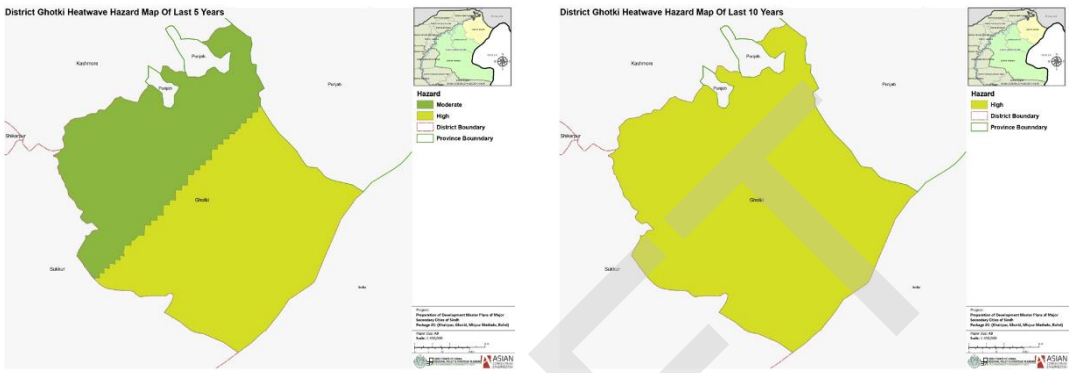
Figure 12-2, Agricultural Drought Hazard Map of District Ghotki

Source: The Consultant Team, 2025

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12.3.4 Heatwave

The frequency and intensity of heatwaves have grown, impacting health, agriculture, and infrastructure. The 5-year hazard map in Figure 1-3 (a) shows high-risk zones in central and southern areas, while Figure 1-3 (b), the 10-year projection identifies most of the district at high risk, attributed to arid conditions, sparse vegetation, and urban heat island effects. Greener peripheral areas experience relatively moderate risk.



(a) Hazard Map of 05 Years *(b) Hazard Map of 10 Years*

Figure 12-3, Heatwaves Hazard Maps of District Ghotki

Source: *The Consultant Team, 2025*

12.4 Climate Resilience and Emergency Contingency Plan

District Ghotki, located in northern Sindh, is highly vulnerable to climate-induced hazards, including riverine and flash floods, agricultural and meteorological droughts, extreme heatwaves, and public health-related emergencies. This Climate Resilience and Emergency Contingency Plan forms a core component of Ghotki's CCRAP, aiming to minimize the loss of lives, protect livelihoods, and ensure effective recovery through a structured and locally adapted disaster response framework. The plan integrates early warning, institutional preparedness, community engagement, and multi-sectoral coordination to ensure climate resilience at the district level. This district-level plan will also be implemented in Ghotki City to enhance local preparedness and adaptive capacity.

12.4.1 Climate-Responsive Disaster Management Strategy

A) Early Warning System and Forecasting

- Pakistan Meteorological Department (PMD) will provide timely weather forecasts, heavy rainfall alerts, and heatwave notifications.
- Flood Forecasting Division (FFD) will issue river flow and flood risk bulletins.

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- SUPARCO will support impact forecasting through satellite imaging for high-risk areas.
- District Disaster Management Authority (DDMA) will ensure localized early warnings reach vulnerable communities through radio, loudspeakers, SMS, and CBO networks.

B) Risk-Based Evacuation Planning

- High-risk zones near canals and floodplains to be pre-identified and marked for early evacuation.
- Evacuation routes and safe shelters mapped and disseminated to communities.
- Persons with disabilities, elderly, women, and children to be prioritized during relocation.

C) Emergency Response Coordination

- DDMA Ghotki will operate the District Emergency Operations Center (DEOC) and serve as the central hub for real-time information and deployment.
- Rescue, medical, food, and shelter units will be coordinated with Health Department, Municipal Committee, Civil Defense, and Police.
- Emergency stockpiles (food, water, tents, medicines) to be pre-positioned by PDMA/NDMA.

12.4.2 Priority Projects for Climate Resilience

The priority projects have been identified as high-impact interventions that address the most urgent climate risks faced by the city, particularly in the areas of housing, water and sanitation, health, education, and the environment. The budgets provided show the scale of investment required to make Ghotki more resilient, while the timelines reflect whether the actions can be achieved in the short term (1–5 years) or will require medium-term implementation (3–6 years).

Table 12-1, Priority Projects for Climate Resilience & Adaptation

Sector	Priority Action	Priority	Timeline	Estimated Budget (PKR bn)
Housing / Urban Planning	Development of Low-Income Housing Site (2,500 units on 50 ha)	High	Short-term (1–5 yrs)	2.60
Water, Sanitation & Waste (WASH)	New Water Supply Network (100% coverage, ~2026 acres)	High	Short-term (1–5 yrs)	2.43

Sector	Priority Action	Priority	Timeline	Estimated Budget (PKR bn)
	Sewerage & Drainage Network Expansion (~1297 acres)	High	Short-term (1–5 yrs)	1.95
	Rehabilitation of Existing Sewerage (~730 acres)	Medium	Short-term (1–3 yrs)	0.12
	Construction of Wastewater Treatment Works (2 plants, phased)	High	Medium-term (3–6 yrs)	0.03
Health	Rehabilitation & Upgradation of THQ Hospital, Ghotki	High	Short-term (1–5 yrs)	2.46
Education	Rehabilitation & Upgradation of Schools (Sobdar Khan Khuhawar, Sachal Bhayo, others)	High	Short-term (1–5 yrs)	0.12
Environment & Ecosystem	Green Buffer Plantation along Dingro Wah & Indus Canal	Medium	Short-term (1–3 yrs)	likely <0.05
Environment & Ecosystem	Rainwater Harvesting & Recharge Pits (in schools)	Medium	Short-term (1–3 yrs)	likely <0.05

12.4.3 Sectoral Preparedness & Response

A) Health Sector

- Pre-deployment of mobile health units and emergency stockpiles.
- Establishment of medical camps in relief sites.
- Disease surveillance and post-disaster vaccination drives.

B) Water, Sanitation & Waste

- Provision of safe drinking water via filtration units.
- Sanitation and hygiene kits for flood-affected households.
- Mobile waste collection in relief areas.

C) Education Sector

- Disaster education in school curricula.
- Schools as temporary shelters.

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- Provision of learning materials and psychosocial support post-disaster.

D) Agriculture & Livestock

- Pre-disaster community seed banks and fodder storage.
- Monitoring of water availability and early disease warning for crops/livestock.
- Post-flood crop loss assessments and farmer compensation schemes.

E) Police and Civil Defense

- Law and order in camps and affected areas.
- Coordination for emergency traffic control and relief security.
- Volunteer mobilization and rescue training.

F) Community Engagement & Awareness

- Active community engagement is a cornerstone of effective disaster resilience and emergency response in District Ghotki. Ensuring that local populations are informed, prepared, and empowered enhances the overall success of climate adaptation measures.
- Formation of City level disaster risk committees to coordinate local preparedness and response actions.
- Implementation of regular community-based drills and simulation exercises to build preparedness capacity.
- Development and dissemination of user-friendly early warning materials in local languages using visual tools, posters, and audio broadcasts.
- Inclusion of women, youth, persons with disabilities, and minority groups in planning and decision-making processes to ensure equity and representation.
- Engagement of faith-based organizations, schools, and community-based organizations (CBOs) to act as knowledge multipliers.
- Support for local volunteer groups through training in first aid, evacuation procedures, and camp management.
- Integration of climate literacy and disaster risk awareness into school and adult education programs to build long-term community resilience.

12.4.4 Institutional Roles and Standard Operating Procedures (SOPs)

- This section outlines clear responsibilities and standard operating procedures (SOPs) for key institutions involved in disaster preparedness, response, and recovery in District Ghotki.

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A) Departmental Roles Overview

Figure 12-4, Departmental Roles Overview

Department	Pre-Disaster	During Disaster	Post-Disaster
District Disaster Management Authority	Risk mapping, early warning prep	DEOC operation, relief coordination	Damage assessment, rehab planning
Health	Stockpiling meds, mobile teams	Treatment, disease control	Camps, vaccinations
Agriculture	Seed/fodder banks, alerts	Crop surveillance	Recovery, compensation
Police	Security planning	Evacuation support	Security for NGOs, camps
Civil Defense	Volunteer training	Rescue & firefighting	Rehab support
Education	Climate change education	Shelter space	Educational continuity
Livestock	Livestock vaccination	Transport & feeding	Loss compensation

B) Key SOPs Across Departments

- **Early Warning Activation:** PMD and FFD to issue timely alerts; DDMA to localize and disseminate warnings to community members.
- **Evacuation and Shelter:** DDMA to identify and manage evacuation routes and temporary shelters; Education Department to allocate schools as shelters.
- **Search and Rescue:** Civil Defense and Police to coordinate rescue missions and ensure safety at relief sites.
- **Medical Services:** Health Department to provide emergency treatment, water testing kits, and disease prevention measures.
- **Livestock & Agriculture:** Livestock and Agriculture Departments to ensure protection of animals and standing crops, including food stock and vaccination.
- **Camp Management:** DDMA and Social Welfare agencies to maintain order, ensure equitable distribution of aid, and oversee basic needs.
- **Information Flow:** All departments to share real-time updates with DDMA for coordinated reporting to PDMA and NDMA.

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- **Post-Disaster Rehabilitation:** Departments to assess damage, plan rehabilitation activities, and restore services based on sectoral mandate.

C) Recovery, Rehabilitation, and Climate Resilience Building

The recovery and rehabilitation phase are critical for building long-term climate resilience and ensuring that affected communities can resume normal life safely and sustainably. The following strategies will guide post-disaster recovery efforts:

- **Restoration of Basic Services:** Immediate reactivation of healthcare facilities, schools, transport systems, and essential utilities.
- **Financial and Livelihood Support:** Compensation for affected households, restoration of agricultural productivity, and employment programs.
- **Climate-Resilient Reconstruction**: Implementation of building codes, construction of flood-resistant infrastructure, and greening of urban and rural spaces.
- **Capacity Building and Institutional Strengthening:** Training for government officials, local councils, and frontline workers to integrate risk-informed planning.
- **Integration into Development Planning:** Align disaster recovery efforts with climate adaptation goals to ensure sustainability and reduce future vulnerabilities.

12.5 Monitoring and Evaluation

To ensure the effectiveness and sustainability of the Climate Change Resilience and Adaptability Plan (CCRAP) for District Ghotki, a robust and inclusive Implementation and Monitoring Framework is essential. This framework is designed to facilitate clear roles and responsibilities, timely execution, multi-sectoral integration, and real-time evaluation of adaptation actions. It aligns with national and provincial resilience goals and emphasizes local ownership and participatory governance. The monitoring framework uses a combination of quantitative, qualitative, process, and impact indicators to assess the success of adaptation interventions.

A) Quantitative Indicators

These are numeric indicators that measure resilience outcomes such as:

- Number of flood-resilient houses built.
- Percentage coverage of drinking water access.
- Number of early warning systems installed.

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B) Qualitative Indicators

These involve perceptual or descriptive feedback, often using scoring methods (1-5 scale or positive/neutral/negative), to assess:

- Stakeholder satisfaction with resilience programs.
- Community awareness of disaster risks.
- Inclusivity in planning processes.

C) Process Indicators

Track the execution of adaptation processes:

- Number of stakeholder consultations held
- Integration of resilience in land use and development plans
- Completion of risk assessments or vulnerability studies

D) Impact Indicators

Assess the long-term outcomes:

- Reduction in climate-related disease incidence
- Reduction in economic losses post-disaster
- Improved food and energy security metrics

12.5.2 Institutional Roles and Responsibilities

A) CCRAP Coordination Committee

Chaired by the Chief Secretary of Sindh, the provincial-level CCRA Coordination Committee will provide overall policy guidance and review district-level progress. It will ensure inter-departmental coordination.

B) District Implementation Team

Led by the Deputy Commissioner of Ghotki, this team will operationalize the CCRAP through nominated focal persons from each sector department.

Table 12-2, Implementation Team and Responsibilities

Department	Focal Agency/Official	Key Responsibility
Local Government	District Commissioner	Oversight and enforcement of district-wide CCRAP activities
Municipal Committee	Chief Officer / ADCs	Execute actions within urban boundaries
Irrigation	District Irrigation Officer	Implement flood management and water resilience actions
Agriculture	District Agriculture Officer	Promote climate-resilient crops and technologies
Health	District Health Officer	Ensure climate-sensitive healthcare facilities and awareness
PHED	Executive Engineer	Improve sanitation and drinking water services

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Department	Focal Agency/Official	Key Responsibility
Education	District Education Officer	Integrate climate literacy in schools
Social Welfare	District Social Welfare Officer	Engage vulnerable groups and improve social safety nets
Livestock and Fisheries	District Officer	Protect animal health and promote climate-smart farming
Disaster Management	DDMA District Officer	Early warning systems and disaster preparedness

12.5.3 Monitoring and Evaluation Mechanism

A) District Monitoring Unit (DMU)

Established under the Secretary, Environment and Climate Change Department, and operationalized by SEPA.

Table 12-3, Roles of District Level Implementation Team

Role	Person Responsible	Responsibility
Monitoring Lead	Director SEPA	Lead monitoring strategy and review implementation progress
Engineers	CCRA Engineers	Guide CCRA monitors, prepare technical monitoring reports
Monitors	CCRA Monitors	Field data collection, site validation, community coordination

12.5.4 Monitoring Methods

- **Mixed Methods:** Combining surveys, interviews, focus groups, GIS tools, and administrative data.
- **Local Ownership:** District focal persons are responsible for aggregating reports and data from their sectors.
- **Stakeholder Participation:** Involve CBOs, NGOs, academia, and the private sector for inclusive reporting and learning.
- **Adaptive Learning:** The monitoring system is iterative. Lessons learned will guide future adaptation decisions and plan updates.

12.5.5 Sample Monitoring Indicators for District Ghotki CCRAP

Table 12-4, Sample Parameters and Indicators to Track Performance

Sr. No.	Monitoring Parameter	Monitoring Indicators
1.	Exposure and Risk Assessment	• Number of flood-affected UC-level datasets collected. • % of hazard mapping completed in flood-prone areas.

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Sr. No.	Monitoring Parameter	Monitoring Indicators
2.	Resilience Capacity Building	• Number of district staff trained in resilience and adaptation. • % of community-based organizations engaged in climate awareness.
3.	Infrastructure and Services	• % coverage of green spaces and shaded walkways • % of rural and urban population with access to clean water and sanitation.
4.	Livelihoods and Food Security	• % increase in use of climate-resilient seeds. • % decrease in food insecurity levels in drought-affected areas.

***UC:** Union Council*

12.5.6 Reporting and Feedback System

Annual progress reports will be compiled by the District Monitoring Unit and submitted to:

- CCRAP Coordination Committee
- Planning and Development Department
- Public dissemination through district dashboards and public hearing session.

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SECTION - 13: URBAN LAND MANAGEMENT

13.1 Introduction

Land management refers to the strategic use and administration of land resources through appropriate technologies within different land use systems. While the concept is known by various names worldwide, all variations serve as tools for managing land effectively. In Pakistan, however, land management remains largely unpractised due to the absence of comprehensive policies and frameworks. The strong opposition of landowners to forced land acquisition, coupled with the extremely limited fiscal capacity of Local Government has left cities struggling to develop well-planned and serviced urban land. One promising solution to this challenge is Land Pooling and Reconstitution (LPR), a mechanism that enables landowners to collectively share the benefits of increased land value after infrastructure and services are provided. In return, landowners contribute a portion of their land and pay betterment charges to help finance the necessary infrastructure.

13.2 Goals

To establish an effective and sustainable land management framework in Ghotki, by implementing Land Pooling and Reconstitution (LPR) as a tool to optimize land use, address urban development challenges, and promote equitable growth.

13.3 Objectives

- Establish policies and regulations to implement Land Pooling and Reconstitution (LPR) for planned urban growth.
- Identify and utilize underdeveloped land to support sustainable urban expansion.
- Enhance the capabilities of local government bodies for effective land governance and implementation.
- Facilitate the provision of essential urban infrastructure and services through landowner contributions.
- Engage landowners, policymakers, and local communities in decision-making to ensure inclusive development.
- Integrate modern planning techniques to maximize land utilization while ensuring environmental sustainability.

13.4 Need Assessment

In Sindh, the shortage of developable land is not due to a lack of available land but rather stems from inadequate financial resources, limited institutional capacity to service land, and complex land ownership structures dominated

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by landlords. Additionally, outdated and ineffective land use policies further hinder urban expansion and sustainable development. Addressing these challenges requires a shift towards modern, inclusive land management practices that balance landowners' interests with urban development needs.

13.5 Urban Land Management Techniques

Urban land management techniques refer to strategies and tools used to regulate, allocate, and develop land in a way that promotes sustainable urban growth. These techniques ensure efficient land use, prevent urban sprawl, and facilitate infrastructure development. Common urban land management approaches include:

- zoning regulations,
- land readjustment,
- land pooling and reconstitution,
- public-private partnerships, and
- guided land development

Implementing these techniques helps cities optimize land resources, improve liveability, and accommodate future population growth effectively.

13.5.1 Urban Land Management in Ghotki

Ghotki, a historic city with significant economic and strategic importance, faces urban development challenges such as unplanned settlements, inefficient land use, and inadequate infrastructure. The lack of a structured land management framework has resulted in fragmented land parcels and difficulty in servicing new urban areas. To address these issues, a comprehensive urban land management approach is needed, incorporating policies that encourage organized land development, infrastructure provision, and stakeholder participation. Some key approaches include:

- Defining land use categories (residential, commercial, industrial, etc.) to ensure orderly growth.
- A participatory method for assembling land and providing infrastructure.
- Engaging private developers to invest in infrastructure and planned urban development.
- A strategic approach where urban growth is directed towards specific corridors or nodes to prevent haphazard expansion.

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13.5.2 Land Pooling and Reconstitution

Land Pooling and Reconstitution (LPR) is a widely used land management tool that facilitates planned urban expansion by consolidating fragmented land parcels and providing essential infrastructure and services. Unlike traditional land acquisition, which often leads to resistance from landowners, LPR is a participatory and inclusive approach that allows landowners to collectively contribute land for development while sharing the benefits of increased land value.

- Landowners voluntarily contribute a portion of their land to a common pool.
- The pooled land is restructured with proper roads, utilities, and public facilities.
- The remaining land (with better accessibility and services) is redistributed among the original landowners, with a portion allocated for public use.
- The developed land's value increases, and betterment charges are applied to fund infrastructure.

A) Benefits of LPR in Ghotki

LPR offers three key monetary benefits. First, the public agency does not incur the land acquisition cost. Second, the public agency is able to finance urban development through betterment charges and the sale of land. Third, the landowners gain from the appreciation in the land value due to the provision of infrastructure. In addition to monetary benefits, LPR provides several strategic advantages:

- Ensures fair allocation of land while compensating landowners through enhanced land value.
- Facilitates the creation of essential services such as roads, drainage, water supply, and public spaces.
- Encourages voluntary participation, thereby minimizing legal disputes and resistance.
- Creates opportunities for investment in real estate and infrastructure by attracting private developers.

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SECTION - 14: IMPLEMENTATION STRATEGY

14.1 Introduction

This section outlines the implementation framework for the Strategic Development Master Plan of Ghotki City, which aims to guide sustainable urban growth and development up to 2043. The plan provides a structured approach to prioritize, phase, and coordinate development initiatives under the governance framework of the Government of Sindh. It emphasizes stakeholder engagement, transparency, and equitable resource allocation to ensure inclusive and resilient urban development.

Key objectives include:

- Establishing a clear governance and institutional structure for plan execution.
- Defining roles and responsibilities of local governments and agencies.
- Aligning projects with legal and regulatory frameworks.
- Ensuring efficient delivery of physical and social infrastructure.
- Implementing a phased schedule for short-term (1-5 years) and long-term (5-20 years) projects.

14.2 Process of Implementation

The successful execution of Ghotki Strategic Development Plan requires a coordinated, multi-phase approach involving all tiers of government and key stakeholders. This structured implementation process ensures systematic delivery of housing, urban development, and social infrastructure projects while adhering to Sindh's legal framework and addressing local needs.

In accordance with Rule 7-B of the Sindh Building Control Ordinance, 1979 (amended in 2014), the Strategic Development Plan shall be submitted to the Government for consideration and will take effect upon its approval. The implementation process will be carried out through the following measures:

Planning and Prioritization Phase

- Conducted comprehensive needs assessments across for all land uses (residential, commercial, industrial, etc.)
- Prioritized based on urgency (short-term vs. long-term) and impact (environmental, economic growth, sustainability)
- Community consultations, workshops, and feedback loops integrated into final planning

Regulatory Approvals Phase

- Obtain clearances from SKAA for existing informal settlements

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- Secure approvals from Sindh Building Control Authority (SBCA) and Local Government and Planning Departments for new developments
- Obtain necessary building permits and environmental approvals
- Finalize inter-departmental agreements and partnerships

Resource Mobilization Phase

- Allocate government development funds
- Secure financing from local and international development partners
- Identify and prepare project sites

Execution and Construction Phase

- Implement slum upgrading programs through SKAA
- Deliver urban infrastructure projects via Municipal Committee
- Construct social infrastructure facilities

Monitoring and Quality Assurance Phase

- Track progress through digital dashboards
- Conduct regular field inspections
- Implement third-party quality audits

Handover and Sustainability Phase

- Transfer completed projects to local management
- Train local staff and community representatives
- Establish maintenance systems

14.3 Governance System

Local government is the only means of managing development in the Sindh province. It exercises jurisdiction over its local area, excluding any "Notified Areas" where relevant departments operate. The overall administrative control over local governments is with the Sindh Local Government Department. There are a large number of local governments and other agencies across the Sukkur division with land use planning responsibilities or responsibilities for delivering the required supporting physical and social infrastructure to support population growth.

14.3.1 Sindh Local Government Department

The Sindh Local Government Department (SLGD) is the provincial authority responsible for empowering local governance, ensuring effective service delivery, and promoting sustainable urban and rural development across Sindh. Established under the Sindh Local Government Act (2013, amended 2021), the department oversees municipal administrations, district councils, and union committees to foster participatory governance and decentralized

decision-making.

The Sindh Local Government Department plays a crucial role in Sukkur Division's, which comprises project cities i.e., Khairpur, Ghotki, Rohri and Mirpur Mathelo, development by overseeing municipal governance, infrastructure projects, and service delivery under the Sindh Local Government Act (2013).

Under the Sindh Local Government Act 2013 amended in 2021, the following structure of local government will be created within the Sukkur Division:

- Municipal Corporations for other urban areas of population greater than 500,000
- Municipal Committees for urban areas of population between 25,000 to 499,999
- Town Committees for urban areas of population between 15,000 to 24,999
- Union Councils – Municipal, town and district councils are divided into Union Councils
- District Councils for the whole rural area of each district

In Ghotki District, the department works closely with the Municipal Committee (MC) Ghotki and District Council to implement urban and rural development initiatives, such as water supply schemes, road maintenance, and solid waste management. The SLGD ensures that local bodies adhere to provincial policies while addressing Ghotki's unique challenges, including rapid urbanization, flood risks, and economic disparities.

To enhance governance in Ghotki, the SLGD is focusing on capacity-building programs for local councillors, digital monitoring systems for project transparency, and public-private partnerships (PPPs) for infrastructure upgrades. Key priorities include expanding clean water access, improving rural-urban connectivity, and strengthening disaster preparedness in flood-prone areas. By empowering Ghotki' s local institutions, the SLGD aims to foster sustainable growth and equitable service delivery across the district.

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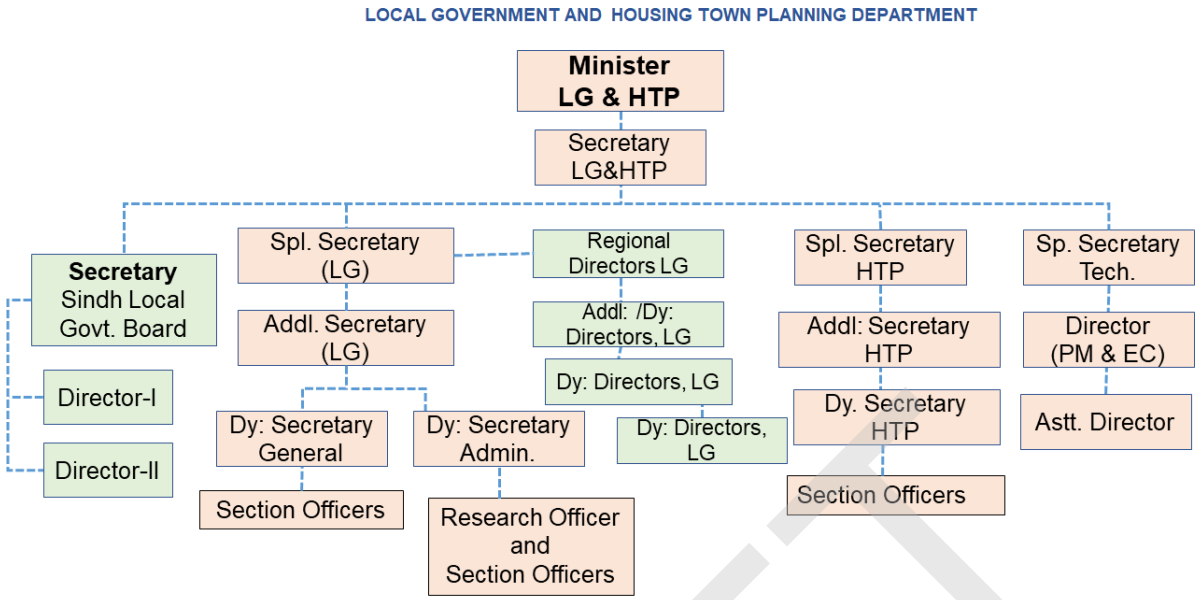


Figure 14-1, Local Government and Housing Planning Department

Source: *Local Government Department, Government of Sindh*

A) SOPs of Local Government

1. Roles and Responsibilities

Under the Sindh Local Government Act 2013 (2021 Amendment), the roles and responsibilities (as per Sections 10 – 16) of different local government tiers in Sukkur Division. The Act establishes a hierarchical system of local governments.

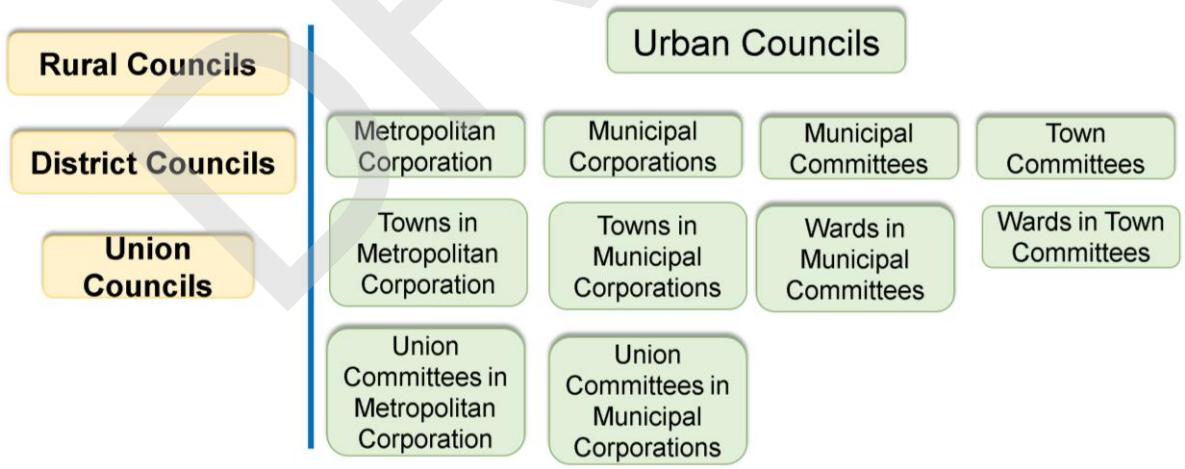


Figure 14-2, Local Councils

Source: *Local Government Department, Government of Sindh*

- The Minister for Local Government and Housing Town Planning (HTP) provides political leadership for all planning and development processes in the local government system and gives final approval for major development and master plans.

- The Secretary Local Government and HTP acts as the chief administrative head, overseeing planning proposals, ensuring compliance with policies, and coordinating between various departments and local councils.
- The Special Secretaries (Local Government, Housing, Town Planning, Technical Services) conduct technical evaluations of development and master plans to ensure legal, zoning, environmental, and infrastructure standards are met.
- The Directors and Deputy Secretaries are responsible for the administrative processing of development proposals, vetting documents for accuracy, and ensuring timely submission for decision-making.
- The Section Officers and Research Officers carry out detailed scrutiny of development files, including legal checks, financial analysis, technical drawings, and environmental compliance before sending proposals to higher authorities.
- The Regional Directors Local Government (LG) serve as the link between the provincial department and local councils, providing technical guidance, overseeing project implementation, and ensuring compliance with approved master plans.
- The Sindh Local Government Board (SLGB) manages human resources, staffing, training, promotions, and disciplinary matters for local government employees to ensure councils have qualified personnel for project implementation.
- The Municipal Committees (MCs), District Councils, Town Committees, and Union Councils are the key on-ground bodies that Prepare development and master plans, execute infrastructure and community development projects, manage municipal services like roads, sanitation, water, waste, and public spaces, ensure public engagement, compliance, and financial management.
- The Municipal Officers, Engineers, Planners, and Technical Staff working under local councils handle the physical implementation of projects, supervise works on-site, and report project progress to higher authorities.
- The Provincial Government retains the right to inspect, supervise, and intervene if any council fails to perform, misuses funds, or violates planning laws.

2. Approval Process of Master Plan

- Preparation of Master Plan is initiated under the Sindh Local Government Act, 2013, Sections 17, 18, 20 which empower local councils and planning agencies to prepare development plans.

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- Sindh Government or relevant Development Authority (e.g., KDA, LDA, MDA, SDA, HDA) hires a registered Town Planner or consultancy firm (registered with PCATP) to prepare the plan.
- Internal Review of Draft Plan (20-45 days) by the Technical Review Committee (TRC) formed by the Development Authority or Planning Department.
- Public Hearing and Consultation sessions conducted as per Environmental Protection Act, 2014, and Planning Procedure Guidelines to ensure stakeholder participation.
- After incorporating feedback, the Revised Draft Master Plan is submitted to the District Planning and Design Committee (DPDC) under the Sindh Local Government Department.
- Once approved at the district level, the plan is forwarded to the Sindh Local Government Department (LGD) or Physical Planning and Housing Department for Provincial Review.
- The final plan is submitted to the Sindh Chief Minister or Sindh Cabinet for Administrative Approval.
- Upon CM/Cabinet approval, the Master Plan is notified in the Official Gazette, making it a legal planning document.
- The notified plan is sent to all implementing agencies: development authorities, municipal corporations, and planning departments for enforcement.
- Plan is monitored and updated periodically (every 10–20 years) as per planning practice and government directives.

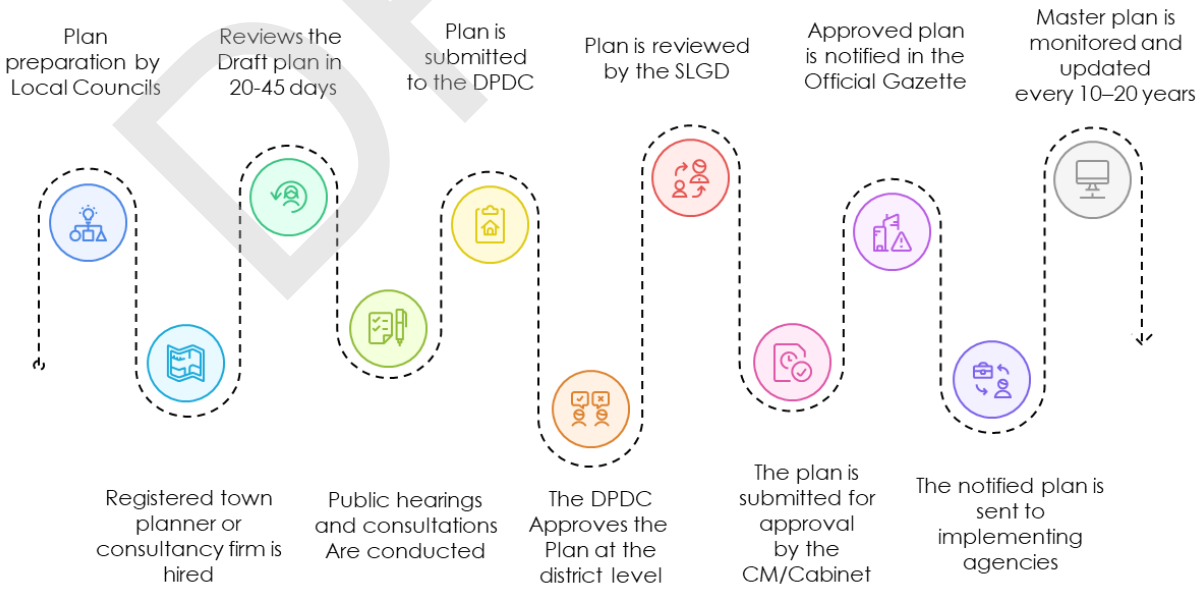


Figure 14-3, Approval Process of Master Plan

Source: *Local Government Department, Government of Sindh*

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3. Union Councils (UCs)

Union Councils (UCs) form the foundational tier of local governance, primarily focusing on grassroots administration. While they lack land use planning authority, UCs are responsible for vital functions such as maintaining socio-economic data, registering births and deaths, and providing basic services including public drinking water sources and local waste management. Their role in community dispute resolution through Musalihat Anjuman (conciliation committees) further strengthens local governance.

4. Town Committees (TCs)

Town Committees govern smaller urban areas with populations between 15,000 and 24,999, such as Ubauro, Therhi, Babarloi and Adilpur. Their responsibilities include approving intra-town development schemes and managing municipal infrastructure (Section 14(1)(d)) like street lighting, roads, parks, graveyards, and community centers. These committees serve as intermediaries between rural and urban governance structures.

5. Municipal Committees (MCs)

For larger urban centers with populations ranging from 25,000 to 499,999, Municipal Committees (MCs) in cities like Khairpur, Ghotki, Rohri, Mirpur Mathelo, assume broader authority. They possess land use planning powers, enabling them to prepare and enforce zoning regulations and master plans (Section 12(2)(a)). MCs also regulate private housing schemes, exercise building control, and oversee commercial licensing while performing all functions of Town Committees.

6. Municipal Corporations (MCs)

Major cities like Sukkur, with populations exceeding 500,000, are governed by Municipal Corporations (MCs), which combine all Municipal Committee functions with enhanced fiscal powers. These corporations can levy property taxes (Section 11(3)) and undertake strategic infrastructure projects such as city-wide water supply systems and mass transit planning.

7. District Councils

In rural areas, District Councils oversee administration across Sukkur, Khairpur, and Ghotki districts. As the primary land use authorities for rural territories, they prepare district-wide spatial plans (Section 15(1)(b)) and classify land for agricultural or industrial use. Their service delivery mandate includes maintaining rural road networks, irrigation systems, and solid waste management in non-municipal areas.

14.3.2 Other Agencies/ Departments

Other agencies/ departments which will be involved in the implementation of the strategic development plan are as follow:

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Sr. No.	Sectors	Agency /Department Involved	Role in Implementation	Cross-Reference of Agency/Department
1.	**Housing and Urban Development**	Sindh Local Government Department	• Coordinates municipal services (water, sanitation) • Supervises MCs/UCs	• DURP&SP, SHTPA, SBCA, SKAA, SEPA, SCIP, SEPCO, SSGC, PTA, MCs Leads, approves, and coordinates the entire master planning process.
		Directorate of Urban Policy and Strategic Planning (DURP&SP) - SLGD	• Urban policy development • Strategic spatial planning and implementation • Inter-Agency coordination	• SLGD, SHTPA, SBCA, SEPA, PDMA, Mass Transit, MCs work to designs the master plan,
		Sindh Housing and Town Planning Authority (SHTPA)	• Oversees affordable housing projects • Regulates planned urban expansion	• DURP&SP, SLGD, MCs, Utilities (Gas, Electricity, Telecom), SEPA supports in urban growth management.
		Sindh Building Control Authority (SBCA)	• Approves building designs • Enforces construction bylaws	• SHTPA, DURP&SP, MCs, SEPA Ensures building bylaws and safety regulations applied within the master plan framework.
		Sindh Katchi Abadis Authority (SKAA)	• Slum regularization • Infrastructure upgradation and social development	• SHTPA, DURP&SP, SLGD, MCs, Social Welfare Identifies informal settlements to integrate them into master planning
2.	**Social Infrastructure**	Sindh Education and Literacy Department	• Builds new schools/colleges • Upgrades vocational training centers	• SLGD, DURP&SP, SHTPA, PDMA, MCs Identifies need of education and its infrastructure.
		Sindh Health Department	• Constructs rural health centers • Upgrades DHQ/ THQ Hospitals (e.g., DHQ Khairpur, THQ	• SLGD, DURP&SP, SHTPA, PDMA, MCs help to Identifies land for health facilities.

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Sr. No.	Sectors	Agency /Department Involved	Role in Implementation	Cross-Reference of Agency/Department
			Ghotki, THQ Rohri, etc.)	
		Sindh Social Welfare Department	• Establishes orphanages/ women's shelters • Runs poverty alleviation programs	• MCs, SLGD, SHTPA, SKAA help to make plans for social welfare facilities
		Municipal Committees (MCs)	• Prepare/enforce zoning and master plans (Sec. 12(2)(a)). • Regulate private housing schemes. • Building control and commercial licensing	• Key local body that implements zoning, building control, and infrastructure delivery
3.	**Transportation**	Sindh Mass Transit Authority	• Improved Ghotki transport by developing bus routes/terminals, for urban mobility connectivity.	• SLGD, DURP&SP, MCs Plans transportation routes in master planning.
5.	**Environment and Disaster**	Sindh Environmental Protection Agency	• Monitors pollution, enforces environmental laws and public health protection.	• SLGD, DURP&SP, Mass Transit, PDMA, MCs, provides environmental guidelines, approves EIAs, in master planning.
		Provincial Disaster Management Authority	• Disaster preparedness, risk reduction, and resilience building for emergency situations.	• SEPA, Health, Education, and MCs help ensure that disaster risk management and resilience are integrated into master planning.
6.	**WATSAN**	Sindh Cities Improvement Program	• Improves water supply, sanitation, and municipal services.	• Work with SLGD, MCs, WATSAN in urban improvement projects
7.	**Solid Waste Management**	Sindh Cities Improvement	• Improves SWM through better	• Work with SLGD, MCs, solid waste

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Sr. No.	Sectors	Agency /Department Involved	Role in Implementation	Cross-Reference of Agency/Department
		Program	collection, disposal, sanitation, and municipal capacity building.	management in urban improvement projects
8.	**Electricity**	Sukkur Electric Power Company	• Supplies electricity, maintains distribution network, and ensures power availability.	• SLGD, MCs, DURP&SP, SHTPA provide plans for gas network extensions.
9.	**Sui gas**	Sui Southern Gas Company	• Supplies natural gas, maintains pipelines, and ensures safe distribution.	• SLGD, MCs, SHTPA work in a plan for a gas network planning for urban expansion and master planning.
10.	**Telecommunication**	Pakistan Telecommunication Authority	• Telecom services/ensures quality, and digital connectivity.	• SLGD, MCs, DURP&SP work for telecom and digital infrastructure in projects.

14.4 Legal and Regulatory Framework

Local governance agencies responsible for handling development proposals must ensure that all activities related to development and their approval processes are conducted in strict compliance with the urban planning statutory frameworks established by the Government of Pakistan at all levels. This includes adherence to the legal provisions outlined in the relevant articles of the Constitution of Pakistan and the primary legislation governing land acquisition and compensation, specifically the Land Acquisition Act (LAA) of 1984.

14.4.1 National Level Policy Frameworks

The Constitution of the Islamic Republic of Pakistan, passed on April 10, 1973, and amended thereafter, serves as the supreme legal authority for all national and provincial laws. The Constitution legally validates planning-related legislation, particularly those related to land acquisition and compensation. The Land Acquisition Act, 1894 (LAA) remains the primary legislation governing the compulsory acquisition of land and related compensation for public sector projects across the country.

14.4.2 Provincial and Statutory Planning Frameworks (Sindh Level)

After the 18th Constitutional Amendment, the Government of Sindh assumed full legislative authority over urban planning, environment, and local governance. The Sindh Local Government Act (SLGA) 2013 governs municipal operations and urban development responsibilities in Sukkur Division. Planning and building control are managed under the Sindh Building Control Ordinance, 1979, which was extended to the entire province via notification on 14th February 2011, transforming the Karachi Building Control Authority into the Sindh Building Control Authority (SBCA). SBCA now operates across five regional offices; Karachi, Hyderabad, Mirpur Khas, Sukkur, and Larkana with Sukkur Division falling under the Sukkur Regional Office.

14.4.3 Land Management and Informal Settlements

Land administration and ownership are governed by the Sindh Land Revenue Act, 1967 and the Sindh Colonization of Government Lands Act, 1912, both of which guide classification, leasing, and taxation of land. Informal settlements in urban areas are addressed under the Sindh Katchi Abadis Authority Act, 1987, which provides mechanisms for regularization and integration into formal planning frameworks.

14.4.4 Environmental and Climate Regulation

All development projects in Sukkur are subject to environmental clearance under the Sindh Environmental Protection Act, 2014, which mandates Initial Environmental Examinations (IEE) or Environmental Impact Assessments (EIA). These are overseen by the Sindh Environmental Protection Agency (EPA Sindh), operating regionally to ensure compliance with the National Environmental Quality Standards (NEQS). Additionally, the Sindh Climate Change Policy (2022) provides strategic direction for climate adaptation and mitigation in vulnerable districts like Sukkur, Khairpur, etc.

14.4.5 Urban Infrastructure and Service Provision

To improve urban service delivery, the Sindh Cities Improvement Program (SCIP) supports water supply, sanitation, and solid waste management in secondary cities, including Sukkur. Development initiatives must also align with the Sindh Mass Transit Authority Act (2014) and Sindh High Density Development Board Act (2014), which provide guidance on transit planning and vertical urban growth.

14.4.6 Disaster Risk Management

The Sindh Disaster Management Act, 2010 established the Provincial Disaster Management Authority (PDMA Sindh), responsible for disaster risk reduction, emergency preparedness, and post-disaster recovery. This is crucial for Sukkur Division, which is prone to flooding and climate-related vulnerabilities

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14.5 Delivering the Necessary Physical and Social Infrastructure Recommendations

14.5.1 Political Hindrance to Optimal Infrastructure Delivery

In the context of Sukkur Division, the delivery of physical and social infrastructure remains hindered by political interference and prioritization that often does not align with on-ground needs. Despite the presence of local government institutions across cities like Khairpur, Ghotki, Mirpur Mathelo and Rohri infrastructure projects are frequently allocated based on political influence rather than objective assessments of service gaps or urban growth patterns.

Feedback received during the consultations for various planning initiatives including the preparation of local and regional master plans highlighted concerns that development in the division is dictated by political expediency. In some instances, projects are allocated to specific union councils or neighbourhoods due to political affiliations rather than actual need, leading to unbalanced development and neglect of peripheral or less-connected areas.

To address these imbalances, the capacity of local governments in cities like Khairpur, Ghotki, Mirpur Mathelo and Rohri must be strengthened, particularly in the areas of technical proposal development, project justification, and resource mobilization. A collaborative approach between neighbouring municipalities such as Sukkur-Rohri, Ghotki-Adilpur and Khairpur-Therhi can enhance the financial and operational feasibility of large-scale projects.

Active engagement with civil society, community-based organizations, and citizen groups must also be encouraged during the planning and prioritization phases. Local residents often have the most accurate understanding of service deficiencies, and their inclusion in decision-making processes can help depoliticize project selection and refocus development on public need. Elected representatives have a duty to uphold the integrity of the planning system. To promote good governance, they should:

- Refrain from supporting land use or infrastructure schemes that contradict approved master plans or violate zoning regulations.
- Avoid lobbying for projects that benefit specific individuals or groups to the detriment of the broader community.
- Disclose interactions with developers, contractors, or investors related to public projects.
- Participate in capacity-building sessions to understand planning systems and strategic goals.

Be subject to a Planning Code of Conduct, specifically drafted for local governments in Sukkur Division by the Sindh Local Government Department. This document should be publicly accessible to promote transparency and

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accountability. As part of the implementation framework for future plans in Sukkur Division, elected officials should be formally briefed on the strategic vision and development priorities to ensure their support for coordinated and evidence-based infrastructure development.

14.5.2 Staffing of Local Governments and Agencies

A major institutional challenge identified during planning engagements across Sukkur Division is the frequent rotation and relocation of public sector staff, particularly within municipal administrations, planning departments, and line agencies such as Public Health Engineering and Works and Services. In cities like Ghotki, Khairpur, Mirpur Mathelo and Rohri, technical officers are often posted for short periods sometimes less than two years before being transferred, often to posts in larger cities such as Sukkur or Hyderabad.

This rotation policy weakens institutional memory, disrupts project continuity, and prevents the establishment of trust with local communities. Many staff members are reluctant to relocate to rural tehsils or underdeveloped towns and treat such postings as temporary, contributing to poor service delivery and weak administrative ownership. Projects initiated by one team may be stalled, re-evaluated, or deprioritized by incoming personnel who lack understanding of local contexts. In Khairpur district, for example, several infrastructure initiatives have faced delays due to a lack of continuity in project oversight. To improve institutional effectiveness, it is recommended that:

- The provincial government review and reform staff rotation policies, particularly for critical posts within local governments and development authorities.
- Officers posted in cities of Sukkur Division be retained for a minimum of 3–5 years, especially those overseeing planning, engineering, or municipal services.
- Incentives such as housing, transport, and hardship allowances be offered to encourage professionals to stay longer in less-developed towns.

14.5.3 Institutional Framework for Plan Implementation and Infrastructure Delivery

To transition the Development Master Plan from a strategic document to tangible outcomes, a clear institutional structure is required. This framework establishes a high-level steering committee for oversight and a technical forum for operational coordination, ensuring integrated planning, implementation, and monitoring.

A) Implementation Committee

As the apex body for the Master Plan's execution, the Implementation Committee will provide strategic direction, secure inter-departmental

cooperation, and ensure accountability. Its establishment formalizes the governance structure for the plan, as notified by the Directorate of Urban Research, Policy and Strategic Planning (DURP&SP).

For the effective execution, oversight, and long-term monitoring of the Development Master Plan, a dedicated body titled the "Implementation Committee" shall be established. This committee will be responsible for the overall coordination, implementation, and monitoring of the Master Plan's objectives to guide future urban growth.

1. Team Composition

The composition of the committee shall be as follows:

- Commissioner Sukkur
- Deputy Commissioner Ghotki
- Municipal Committee Chairman
- Director Sindh Building Control Authority (SBCA), as Secretary
- Assistant Commissioner
- Representative of Directorate of Urban Research Policy and Strategic Planning (DURPSP)
- Executive Engineer Public Health Engineering (PHE)
- Representative of Government & Housing Town Planning (LG&HTP)

In addition, the heads of other relevant line departments shall be included as members or may be invited to participate in meetings when necessary to address specific agenda items.

2. Terms of Reference (TORs)

- Provide overall policy guidance and ensure adherence to the Master Plan's objectives during implementation.
- Review and approve annual implementation plans, and prioritize major projects based on strategic alignment and available resources.
- Champion and explore funding avenues, including public sector allocations, donor agencies, and Public–Private Partnerships (PPPs).
- Arbitrate and resolve high-level inter-departmental and jurisdictional conflicts that cannot be settled at the technical level.
- Receive and review quarterly progress reports from the proposed District Infrastructure Coordination Forum (DICF) and the Secretary, tracking key performance indicators against established targets.
- Ensure a structured mechanism for stakeholder consultation by mandating and reviewing outcomes from public forums and expert input sessions.

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B) District Infrastructure Coordination Forum (DICF-Ghotki): The Technical Arm

Supporting the projected population growth and remedying current infrastructure deficiencies requires breaking down institutional silos. Currently, municipalities, utility providers, and sectoral departments function in isolation, leading to fragmented development and duplication of efforts (e.g., housing schemes installing utilities without alignment, or health departments building facilities without consulting on road access).

The DICF-Ghotki is established as the primary technical coordination body, which will report directly to the Implementation Committee.

1. Composition & Chair

- Chairperson: Deputy Commissioner Ghotki
- Secretariat Support: Regional Office of the Sindh Local Government Department.
- Members:
  - Chief Officers, Planning Officers, and Engineers of all Municipal Committees in the district.
  - Representatives from Public Health Engineering, Education, Health, and Communication & Works Departments.
  - Executives from SEPCO, SSGC, WASA Ghotki, and other utility providers.
  - Representative from the Sindh Human Settlement Department.
  - Civil society observers and private sector stakeholders (e.g., chamber of commerce, housing developers).

2. Key Functions of DICF

- Ensure all infrastructure projects are aligned with the approved Master Plans and spatial strategies.
- Resolve technical-level conflicts and prevent duplication of investments by facilitating information sharing.
- Track project progress and troubleshoot implementation bottlenecks, escalating unresolvable issues to the Implementation Committee.
- Review technical capacity needs of local staff and recommend targeted training programs, to be supported by provincial agencies.

C) Capacity Building and Administrative Support

For this framework to function effectively, underlying administrative challenges must be addressed:

- Each participating local government shall conduct an internal assessment of staff capabilities in urban planning, engineering, GIS,

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and financial management. A targeted capacity-building program will be initiated based on the identified gaps.

- The staff rotation policy must be re-evaluated to ensure key personnel are retained for longer durations, enabling them to build institutional knowledge and see projects through to completion.

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14.6 Implementation Schedule

14.6.1 Implementation Schedule for Housing Sector

Strategies	Programs/ Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Katchi Abadi Upgradation	• Under-ground drainage Water points • Paving streets and walkways	Settlement Mapping Community Engagement Plans	Human Settlement Authority (HSA), Local Government, NGOs	Short to Medium Term (1–10 years)
Infill Development	• Mixed low-rise housing in core urban areas • GIS-based vacant plot identification	Detailed Urban Plan Design Charrettes Housing Demand Analysis	Public-Private Partnerships, Local Developers	Short Term (1–3 years)
Low-Income Housing Site	• 2500 units in 50 ha with roads, utilities, green areas	Land Suitability Analysis Environmental Assessment	Government of Sindh, Municipal Committee, Housing Agencies	Phased: Phase 1–3 (1–5 years)

14.6.2 Implementation Schedule for Education Sector

Strategies	Programs/ Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Infrastructure Improvement	• Rehabilitate 11 priority schools • Add classrooms, labs, libraries • Water, sanitation, electricity	School Site Planning, Needs Assessment, Survey, Budgeting	Education Works and Services Dept., Sindh Government, NGOs	Short Term (1–5 years)
Capacity Building	• Teacher training programs • ICT integration • Smart classroom initiatives	Curriculum Update, Digital Tools Design	SEMIS, STEVTA, NGOs, Teacher Associations	Ongoing (Short to Long Term)

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Strategies	Programs/ Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Access Enhancement	• New schools in underserved zones (e.g. Anwarabad) • Transport support for rural areas	Land Suitability Mapping, Enrolment Campaigns	Local Government, Sindh, Education Dept., Private Sector	Medium to Long Term (5–20 years)
Vocational and Inclusive Education	• Skill training centers • Financial aid programs • Special education for disabled	Vocational Policy Framework, Equity Strategy	TVET Institutes, NGOs, Local Govt	Medium Term (3–10 years)

14.6.3 Implementation Schedule for Health Sector

Strategies	Programs/ Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Healthcare Facility Upgradation	• Rehabilitate THQ Hospital • Secure facility, diagnostic lab	Health Needs Assessment Infrastructure Master Plan Environmental Health Assessment	District Health Dept., PHED, Local Govt, NGOs	Immediate to Short Term (1–5 yrs)
Expanded Access	• New BHUs and RHCs • Mobile Health Units • Telemedicine	Land Suitability Analysis Service Coverage Mapping	Sindh Health Dept., Private Sector, NGOs	Medium to Long Term (5–20 years)
Quality and Capacity Building	• Staff accommo-dation • Training for doctors and paramedics • Equipment provision	Workforce Strategy Public Health Outreach Plan	Government Hospitals, NGOs, Medical Colleges	Ongoing
Community Health Outreach	• Hygiene and vaccination drives	Health Awareness Strategy	Local Health Units, CBOs, Media Campaigns	Short to Medium Term (1–10 years)

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Strategies	Programs/ Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
	• Disease control campaigns	Monitoring Metrics		

14.6.4 Implementation Schedule for Parks/Recreation Sector

Strategies	Programs/ Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Equitable Access to Parks	• New parks in underserved areas • Mohalla-level green spaces	Green Space Suitability Mapping Public Consultations	Sindh Local Government Dept., Municipal Committee, NGOs	Short Term (1–5 years)
Upgradation of Existing Parks	• Landscaping, lighting, walkways, toilets, water facilities	Park Improvement Design Plans	Parks and Horticulture Authority, Private Sector	Short to Medium Term (1–10 years)
Promotion of Sports and Fitness	• Sports complexes • Outdoor gyms • Traditional games promotion	Sports Facility Master Plan Cultural Event Calendar	Sindh Sports Board, Local Government, Community Organizations	Medium to Long Term (5–20 years)
Smart and Sustainable Parks	• ICT monitoring systems • Urban forestry • Rainwater harvesting	Sustainability Plan Urban Forest Strategy	Local Government, Environmental Protection Agencies, IT Partners	Long Term (10–20 years)

14.6.5 Implementation Schedule for Transportation Sector

Strategies	Programs/ Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Rehabilitation of existing road network	• Resurfacing of existing roads. • Reconstruction of roads in poor condition • Construction of side shoulders and installation of roadside drainage	Road condition survey, Traffic survey, Geotechnical investigation.	Sindh Local Government Dept., Municipal Committee, highway division.	Short Term (1–5 years)

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Strategies	Programs/ Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
	• Clearance of encroachments			
Upgradation and addition of new road links	• Construction of new road links. • Provision of footpaths • Improvement of road-side infrastructure	Traffic survey, Alternate route study, Available ROW and adjacent landuse survey.	Sindh Local Government Dept., Municipal Committee, highway division.	Short to Medium Term (1–10 years)
Road connectivity to the future expansions	• Existing links to be extended • Upgradation of existing small earthen road. • Provision of road safety features	Available ROW and adjacent landuse survey, Traffic survey, Geotechnical investigation.	Sindh Local Government Dept., Municipal Committee, highway division.	Medium to Long Term (5–20 years)

14.6.6 Implementation Schedule for Water Supply

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Strategies	Programs / Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Expansion of Water Supply Network	• Provision of new water supply distribution network for urban boundary areas beyond core city • Replacement of old / damaged pipelines in core urban boundary	• Hydraulic modelling and zoning plan • Network mapping (GIS) • Detailed engineering design and BOQs	Government of Sindh (PHED), Municipal Committee Ghotki	Short Term (1 to 5 Years)
Development of Groundwater Source Infrastructure	• Installation of new tube wells • Rehabilitation of existing tube wells and pumps	• Bore log tests • Groundwater assessment • Equipment specifications and procurement planning	PHED Sindh, Municipal Committee, Contractors	Short Term (1 to 5 Years)
Water Storage Facilities	• Construction of Overhead Reservoirs (OHRs)	• Site identification • Structural design • Land requirement assessment • Cost estimation	PHED Sindh, Local Government, Engineering Consultants	Medium Term (5 to 10 Years)
Improvement of Distribution Efficiency	• Pressure management valves • Leakage detection and repair program • Network rehabilitation to reduce losses	• Non revenue water reduction plan • Network condition assessment • Asset inventory preparation	PHED Sindh, Municipal Committee, Private Operators	Short to Medium Term (1 to 10 years)
Metering and Revenue Generation	• Installation of consumer metering • Bulk flow metering at key locations	• Metering feasibility study • Tariff structure planning • Monitoring framework	PHED Sindh, Local Govt, Revenue Dept.	Medium Term 5 to 10 Years)

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Strategies	Programs / Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Water Quality Improvement	• Filtration / treatment improvements • Chlorination and water quality monitoring system	• Water quality baseline testing • Treatment technology selection • O&M planning	PHED Sindh, Health Dept., Environmental Agencies	Ongoing (medium to long term)
Long-Term Water Supply Sustainability	• Future expansion of network as per 2043 demand • Strengthening institutional capacity for O&M	• Long-term demand forecasting • Master planning updates • Staff training plans	PHED Sindh, Local Government	Ongoing

14.6.7 Implementation Schedule for Sewerage/ Drainage Sector

Strategies	Programs / Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Sewerage Network Development	• Installation of new sewerage network of urban boundary area • Provision of manholes and sewer appurtenances	• Sewerage master plan preparation • Design of sewerage lines • Detailed BOQs and cost estimates	Government of Sindh (PHED), Municipal Committee Ghotki	Short Term (1 to 5 Years)
Rehabilitation of Existing Drainage System	• Rehabilitation of existing drainage network • Cleaning of drains, pipes, and chambers • Reconstruction of damaged sections	• Drain condition survey • Rehabilitation design • Preparation of cost estimates	PHED Sindh, Municipal Committee, Contractors	Short Term (1 to 5 Years)
Improvement of Sewerage	• Rehabilitation/upgradation of disposal stations • Improvement of outfall sewer system	• Disposal station assessment • Equipment and machinery planning	PHED Sindh, Local Government	Medium Term (5 to 10 Years)

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Strategies	Programs / Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Disposal Infrastructure				
Construction of Wastewater Treatment Plants (WWTPs)	• Construction of 3 WWTPs (Zone 1, Zone 2, Zone 3) using waste stabilization ponds (WSP) • Phase-wise execution	• Feasibility study • Environmental assessment • Site selection and land requirement • Detailed engineering design	PHED Sindh, Municipal Committee, Environmental Protection Agencies	Medium Term (5 to 10 Years)
Trunk Sewer Development (Future Planning Horizon)	• Development of trunk sewers for 2043 planning horizon • Sewerage network expansion as per population growth	• Trunk sewer alignment study • Hydraulic design • ROW/land coordination	PHED Sindh, Consultants, Local Govt	Long Term
Storm Water Drainage Improvements	• Construction of new storm water drains in flood-prone areas • Rehabilitation of secondary drains	• Flood risk mapping • Drainage design and capacity calculations	Local Govt, PHED Sindh, Disaster Management Authority	Medium to Long Term
Institutional Strengthening & O&M Sustainability	• Development of SOPs and O&M manuals • Training of staff • Sewerage tariff introduction and cost recovery mechanism	• Training needs assessment • Institutional strengthening plan • Financial sustainability framework	Municipal Committee, PHED Sindh, NGOs	Ongoing

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14.6.8 Implementation Schedule for Telecommunication Sector

Strategies	Programs/Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Infrastructure Mapping and Pilot Expansion	• GIS-based mapping of PTCL/mobile infrastructure • Landline expansion in high-gap areas • Pilot digital literacy sessions in schools/community centers	Telecom Audits Stakeholder Consultations	PTCL, Telecom Regulators (e.g., PTA), Local Governments	Short Term (1–3 years)
Broadband and Public Wi-Fi Deployment	• Fiber-optic rollout in high-density zones • 10+ public Wi-Fi hotspots in CBDs/public buildings • Subsidized broadband packages for low-income households	Feasibility Studies Public-Private Partnership Frameworks	Telecom Companies (e.g., Jazz, Telenor), Municipal Authorities	Medium Term (5 – 10 years)
Universal Connectivity and Smart Integration	• 100% landline/broadband coverage • Smart poles and IoT network integration • E-governance digitization	City Master Plans Regulatory Adjustments	Federal IT Ministry, Private Tech Firms	Medium to Long Term (10–16 years)

14.6.9 Implementation Schedule for Power Sector

Strategies	Programs/Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Grid Modernization	• Installation of additional transformers at key locations. • Smart meter deployment • Basic monitoring systems for grid management	Load Analysis Pilot Project Feasibility Studies	SEPCO, Local Government, Private Contractors	Short Term (1–3 years)

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Strategies	Programs/Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Renewable Energy Expansion	• Pilot solar energy projects in residential areas • Utility-scale solar farm development • Energy storage solutions	Solar Potential Mapping Regulatory Approvals	Energy Department, Private Investors, Renewable Energy Firms	Medium Term (5 – 10 years)
Transmission and Distribution Upgrade	• Critical network upgrades to reduce losses • New transmission lines installation • Smart grid full deployment	Infrastructure Assessment Cost-Benefit Analysis	National Transmission Company, Engineering Firms, Government	Medium to Long Term (5–16 years)
Universal Access and Resilience	• Extend electricity to underserved areas • Grid protection against environmental disruptions • Advanced automation and real-time monitoring	Equity Mapping Disaster Risk Planning	Federal Energy Agencies, Local Authorities, NGOs	Long Term (10–16 years)

14.6.10 Implementation Schedule for Gas Sector

Strategies	Programs/Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Infrastructure Assessment and Initial Expansion	• Technical audit of existing gas network • Expansion to non-Sui gas areas • Installation of 1 TBS • Awareness campaigns in 3 underserved communities	Infrastructure capacity analysis Community needs assessment	SNGPL/SSGC, Local government bodies, Community organizations	Short Term (1-3 years)
Network Modernization	• 100% suburban coverage • Smart metering	GIS mapping of network	Gas utility companies, Engineering contractors, Safety regulators	Medium Term (5 - 10 years)

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Strategies	Programs/Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
and Expansion	implementation • Mobile service units for safety/connections • Pipeline replacement program initiation	Regulatory approvals Safety protocol development		
System Optimization and Digital Transformation	• Winter load shedding reduction (<1hr/day) • Predictive maintenance systems • Complete pipeline replacement	Advanced analytics planning Disaster resilience strategy Digital integration framework	Federal energy ministry, Technology partners	Medium to Long Term (10-16 years)

14.6.11 Implementation Schedule for Disaster Management Plan

Strategies (All Hazards)	Programs / Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
• **Multi-Hazard Risk Assessment & Mapping (Floods, Earthquake, Drought)** • **Early Warning Systems (Floods, Heatwave, Drought)** • **Emergency Preparedness & Evacuation Planning (Floods, Earthquake, Fire, Crowds)** • **Health & Livelihood**	• Union Council-level risk mapping & floodplain zoning • Install river gauges, weather stations & SMS alert systems • Identify shelters, cooling centers, and safe gathering areas • Fire alarms, detectors, evacuation drills in schools/offices • Vaccination & fodder	• Prepare hazard maps & GIS databases • Design alert protocols & SOPs (SMS, mosque loudspeakers, media) • Draft evacuation & shelter management plans • Develop fire & crowd safety training modules • Prepare community outreach campaigns	• Lead Departments: PDMA Sindh, Irrigation Dept., PMD, SBCA, Rescue 1122, Local Govts. • Support Departments: Education Dept., Health Dept., NGOs, Telecom Operators, SUPARCO, Police Dept., Social	Immediate to Short Term (1–3 years)

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Strategies (All Hazards)	Programs / Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Protection (Heatwave, Drought, Flood)	programs for livestock during drought • Train volunteers in first aid & rescue		Welfare Dept.	
• **Infrastructure & Engineering Resilience (Flood, Urban Flood, Fire)** • **Agricultural & Water Management (Drought)** • **Awareness & Capacity Building (All Hazards)** • **Recovery & Rehabilitation (Flood, Drought, Earthquake, Fire)**	• Strengthen embankments, bunds, drainage & stormwater systems • Rainwater harvesting, conjunctive water use, tank renovation • Introduce drought-resistant crops & seed banks • Retrofit priority public buildings for earthquake/fire safety • Annual hazard drills and volunteer training • Post-disaster needs assessments & restoration of infrastructure	• Conduct hydrological & structural surveys • Prepare engineering designs & cost estimates • Develop agriculture subsidy/credit schemes • Prepare awareness/IEC materials & drill schedules • Draft PDNA templates & beneficiary targeting criteria	• Lead Departments: Irrigation Dept., P&D Dept., Agriculture Dept., SBCA, Local Govt. Depts. • Support Departments: Works & Services Dept., Health Dept., Environment Dept., NGOs, CBOs, Social Welfare Dept.	Medium Term (5–10 years)
• **Institutional Coordination & Policy Strengthening (All Hazards)** • **Integrated Disaster Management**	• Strengthen coordination among PDMA, DDMA, line departments & NGOs • Integrate disaster management into district master plans & budgets	• Draft TORs & coordination frameworks • Schedule quarterly multi-agency meetings	• Lead Departments: PDMA Sindh, DDMA, Local Govts. • Support Departments: Health Dept.,	Medium to Long Term (5–16 years)

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Strategies (All Hazards)	Programs / Policies	Responsibilities to Plan	Implementation Responsibilities	Time of Implementation
Frameworks	• Establish multi-hazard emergency operations centers	• Allocate fixed budget share for resilience projects	Education Dept., NGOs, Municipal Authorities, P&D Dept.	
• **Long-Term Mitigation & Resilience (Floods, Urban Flood, Heatwave, Drought, Earthquake, Fire, Crowds)** • **Environmental & Social Safeguards**	• Promote flood-resilient construction, earthquake-resistant building codes, heat-resilient design • Expand urban green cover, watershed management, afforestation • Develop water resource information systems & drought research • Institutionalize psychosocial care & recovery systems • Transparent post-disaster communication & incident reporting	• Draft and enforce long-term building/planning codes • Launch large-scale afforestation & green infrastructure projects • Establish research-data partnerships with universities • Develop post-disaster M&E and knowledge-sharing frameworks	• Lead Departments: Sindh Environment Dept., Urban Planning Depts., Irrigation Dept., P&D Dept. • Support Departments: Forest Dept., Research Institutes, Local Govts., NGOs, Municipal Committees	Long Term (10–16 years)

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ANNEXURES

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ANNEXURE - 1: VISION WORKSHOP – MINUTES OF MEETING

DIRECTORATE OF URBAN REGIONAL POLICY & STRATEGIC PLANNING
PLANNING & DEVELOPMENT DEPARTMENT
GOVERNMENT OF SINDH

DIRECTORATE OF URBAN, REGIONAL POLICY & STRATEGIC PLANNING
P&D DEPARTMENT GOVERNMENT OF SINDH

MINUTES OF MEETING

Stakeholder Consultation & Vision Development Workshop – Ghotki and Mirpur Mathelo City

Project: Preparation of Development Master Plans for Twelve (12) Major Secondary Cities of Sindh (Package-1 Khairpur, Ghotki, Mirpur Mathelo and Rohri)

Date: 02-05-2024 (Thursday)

Location: Assembly Hall District Council, Mirpur Mathelo

Chaired By: Additional Deputy Commissioner-I Ghotki Mr. Liaquat Ali

Subject: Stakeholder Consultation and Future Visioning Workshop

Agenda of Workshop

The team conducted the future vision development workshop with stakeholders from various line departments as mentioned in the below table. The meeting was attended by the representative from Directorate of Urban Regional Policy & Strategic Planning, Planning & Development Department and Asian Consulting Engineers. Detailed list of attendees is attached in Annexure

From Client	From Consultant	Line Departments
Mr. Zulfiqar Ali Mr.Muhammad Soomar Mr. Ali Murad Abro	Mr. Ali Akbar Daudpota Dr. Ahsan Iqbal Mr. Shehroz Khan Mr. Faizan Ahmad Mr. Umair Khalid Mr. Majid Rehman Mr. Ammar Iqbal Mr. Muhammad Abbas Mr. Muhammad Ammar Asghar Mr. Saim Ahmed Khan	MC Ghotki, MC Mirpur Mathelo, Education Department, Health Department, Highway Department, Transport Department, Irrigation Department, Sukkur Electric Power Company (SEPCO), Sindh Environment Protection Agency (SEPA), Police and Forest Department Ghotki.

Introduction and Welcome

The meeting began with a cordial welcome extended to all participants by the ADC-I Ghotki, who outlined the project's significance and necessity, expressing keen interest in the success of the development master plan. Following this, the Deputy Director (Housing) of URP&SP introduced the overall mandate of the directorate and consulting firm, providing details about

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the project and highlighting the firm's expertise in such endeavours, while also expressing confidence in Asian Consulting Engineers.

Overview of Workshop

Dr. Ahsan Iqbal, representing Asian Consulting Engineers, took charge and provided an insightful overview of the project to the attendees. He outlined the project's framework, methodology, current progress, and upcoming activities. Additionally, he presented the Ghotki and Mirpur Mathelo's current state based on situational analysis, covering various sectors within the project's scope, such as urban planning (including housing, healthcare, education, parks, and open spaces), transportation system, environmental analysis, disaster risk management, solid waste management, water and sanitation, power, telecommunication & gas and the urban & regional economy. Furthermore, he emphasized the importance of conducting a future vision development workshop in development master plan by explaining the workshop's purpose and the activities planned.

Discussion Session

ADC-l Ghotki commended the overall progress of the project and requested all the stakeholders to provide feedback to the consultant team on the existing situation of the cities. The following points were highlighted by the stakeholders from the line departments:

Mr. Asadullah Tunio (Environment Agency Ghotki) raised concerns about the existing dumping sites in Ghotki and Mirpur Mathelo, advocating for the proposal of a new landfill site to effectively manage solid waste and improve cleanliness in both cities.

In response, Dr. Ahsan Iqbal assured that the proposal for the landfill site is being planned in the upcoming stages. He emphasized that solid waste management experts will endorse the best solutions to address this issue in both cities.

Mr. Lal Bux Soomro and Mr. Zulfiqar Ali (Assistant Education Officer) brought attention to the current state of education institutes in the city. They suggested proposals for establishing new vocational, technological, and medical institutes in Mirpur Mathelo, as well as a high school in Ghotki city.

Dr. Ahsan Iqbal addressed their concerns by outlining the ongoing analysis of the education system in both cities. He acknowledged that while there are an adequate number of institutes, the facilities are not up to standard. He assured that the consultant will devise plans to enhance education facilities in both cities, incorporating suggestions from stakeholders.

Mr. Abdul Wahab and Mr. Khawand Bux (Highway Department Ghotki) highlighted the necessity of an intercity transport service, citing Speedo as an example. They also addressed the inadequate condition of transportation within the city and urged for an increase in right-of-way (ROW) in urban areas to enhance public transport services.

Mr. Muhammad Naeemudin (XEN PHED Ghotki Division) expressed concerns regarding damages to underground water infrastructure. He also brought attention to the mismanagement of hospital waste by the department, which is being disposed of alongside household waste, highlighting the need for proper disposal procedures.

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Mr. Najeeb Ali Mahar (Range Forest Department Ghotki) addressed the condition of existing parks and open spaces, proposing their upgrade. He also recommended the establishment of a community-level park in both Ghotki and Mirpur Mathelo.

Mr. Ashok (Public Health Institute Ghotki) raised concerns about the inadequate management of hospital waste and the presence of current dumping sites in cities. He suggested separate proposals for the management of hospital waste and the existing dumping sites. He also raised the question that whether the consultants have conducted Bore Log method for assessment of ground water? As this is an important matter. The consultants informed that although it is carried out but will certainly be conducted as part of TORs of the assignment.

Mr. Mozzam Ali Lohar (XEN Irrigation Mirpur Mathelo) highlighted the issue of untreated industrial waste directly contaminating water bodies. He proposed locating new industries in Ghotki city away from its boundaries and emphasized the need for wastewater treatment.

Mr. Qamar Zaman (Chief Municipal Officer Ghotki) provided an overview of the current facilities managed by the Municipal Corporation. He also highlighted the ongoing construction of a water treatment plant, which is expected to become operational soon. Additionally, he recommended enhancements to walkways along major roads in Ghotki. He expressed confidence in the coordination with the consultant team and emphasized the ongoing communication and discussions throughout the data collection and analysis period.

CMO also pointed out that solid waste collection figures are inaccurate and needs to be revised. He also mentioned that there are 5 parks, but presentation showed only 4. He raised concerns that drainage coverage as reported by the consultants is inaccurate and needs to be corrected. Furthermore, he told there are 12 disposal stations are present and two are not handed over to us.

All the suggestions have been noted down by the consultant team for their incorporation in the proposals.

Future Vision Development Workshop

The meeting concluded with an engaging exercise aimed at envisioning the future vision development of Ghotki and Mirpur Mathelo city. The consulting team distributed questionnaires and various forms to gather input from all participants. This exercise was structured into three tasks:

Task 1: "Have We Missed Anything?" This involved a mapping workshop where attendees mentally charted out aspects they felt were overlooked.

Task 2: "What Makes a City Great?" Participants engaged in discussions and documented existing challenges and suggestions for the city's future improvement.

Task 3: "What is the Future Development of Ghotki and Mirpur Mathelo city?" Another mapping workshop focused on outlining the envisioned future of Ghotki and Mirpur Mathelo.

Throughout this exercise, consultants diligently recorded attendees' insights regarding Ghotki and Mirpur Mathelo's current status and its projected trajectory over the next 20 years.

The meeting concluded with expressions of gratitude exchanged between the participants and the chairperson.

ANNEXURE - 2: VISION WORKSHOP STAKEHOLDER LOG

A) Vision Workshop - Attendance Sheet

Mirpur Mathelo & GHOTKI

"Preparation of Development Master Plans for Twelve (12) Major Secondary Cities of Sindh (Package-1 Khairpur, Ghotki, Mirpur Mathelo and Rohri)"

Attendance Sheet (SWOT Analysis & Future Vision Workshop)

Sr No.	Name	Contact Number	Designation and Department	Signature
1.	LIAQUAT ALI	—	ADC-I	
2.	Zulfiqar Ali	03072553549	DD - URP&SP	
3.	ABHEMENO	03480024770	AEN PHED S/D Daharki	
4.	M. Nadeemuddin	03053125123	XEN PHE DO, Ghotki	
5.	Zainalabdin Ghumro	03088775520	XEN B/dg Divi Ghotki PM.M	
6.	AsadullahTunio	03135080 61	Sindh Env: Protection Agency Ghotki	
7.	Rasool Bux	03153982948	(SEPA)	
8.	Kashif Laghari	0300-3132232	Range forest officer Social forestry Ghotki	
9.	Najeeb Ali Mahar	0300-3148842	Range Forest Officer Aff: Mirpur	
10.	Ali Murad Abro	03122097717	BDD.	
11.	Muhammad Soomar	03004171576	PRD	
12.	Mohammeddin	03009316131	S.D.O Spco, Wapda, Mirpur.	
13.	Babar Ali		AC Mirpur Mathelo	
14.	Qamar Zaman	0300-3229173	EMC MC Ghotki	
15.	Arif Ali	03003198717	DSH coordinator Ghotki	
16.	BASHIR AHMED ITAFL	03003191225.	Ass: Edu: Officer (A DEO (ES) HS) Ghotki	

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"Preparation of Development Master Plans for Twelve (12) Major Secondary Cities of Sindh (Package-1 Khairpur, Ghotki, Mirpur Mathelo and Rohri)"

Attendance Sheet (SWOT Analysis & Future Vision Workshop)

Sr No.	Name	Contact Number	Designation and Department	Signature
17.	Saeed Ahmad Laghari	0333-7249059	Pharmacist/DHO-Ghotki	
18.	DR: Ashok Lewa	03337245833	DNC, D.O PPHI Ghotki	
19.	Lal Bux Soomro	0307-3420866	A.E.O (D.E.O) Ghotki	
20.	ALi Raza Nasir	0300-3120235	District Engr. District Council	
21.	A. Qayoob	0300 9319398	Assistant Engineer	
22.	Khawand Bux	0300-3191634	Ex Helper EXEN Highways Division Ghotki	
23.				
24.	Abdul Rashid	0300 3117138	Assistant Exgine Hway	
25.	Abdul Qudoos	0307-8254678	HDM.	
26.	Zulfiqar Ali	03503266862	Assistant Education officer (M)	
27.	Asi Abdul Jabbar	03033570156	POLIC	
28.	MOUZZAM ALI LOHAR	03312709466	XEN IRRIGATION MIRPUR DIVISION @ M.Mathelo	
29.	Shehroze Khan	0331-7703505	Transportation Engr. From ASIAN	
30.	Faizan Ahmad	0321-4823097	WATSAN Engg. Asian	
31.	M. Ammar Asghar	0334-4847567	Junior. WATSAN Engg. ASIAN	
32.	Muhammad Abbas.	0304-5206118	Environmentalist, Asain Consultg.	

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Twelve (12) Major Secondary Cities of Sindh
(Package-1 Khairpur, Ghotki, Mirpur Mathelo and Rohri)"

Attendance Sheet (SWOT Analysis & Future Vision Workshop)

Sr No.	Name	Contact Number	Designation and Department	Signature
33.	Saim Ahmed Khan	—	Jr. Transportation Engr.	
34.	UMAIR KHALID	0321 6957Ha	Sr. Electrical Engr	
35.	Majid Rahman	0333-4300916	GIS Specialist	
36.	Dr. Ahsan Iqbal	0343-7161847	Sr. Urban Planner	
37.	Ammar Iqbal	0303-9605094	Jr. Town Planner Asian	
38.				
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B) Vision Workshop Activities

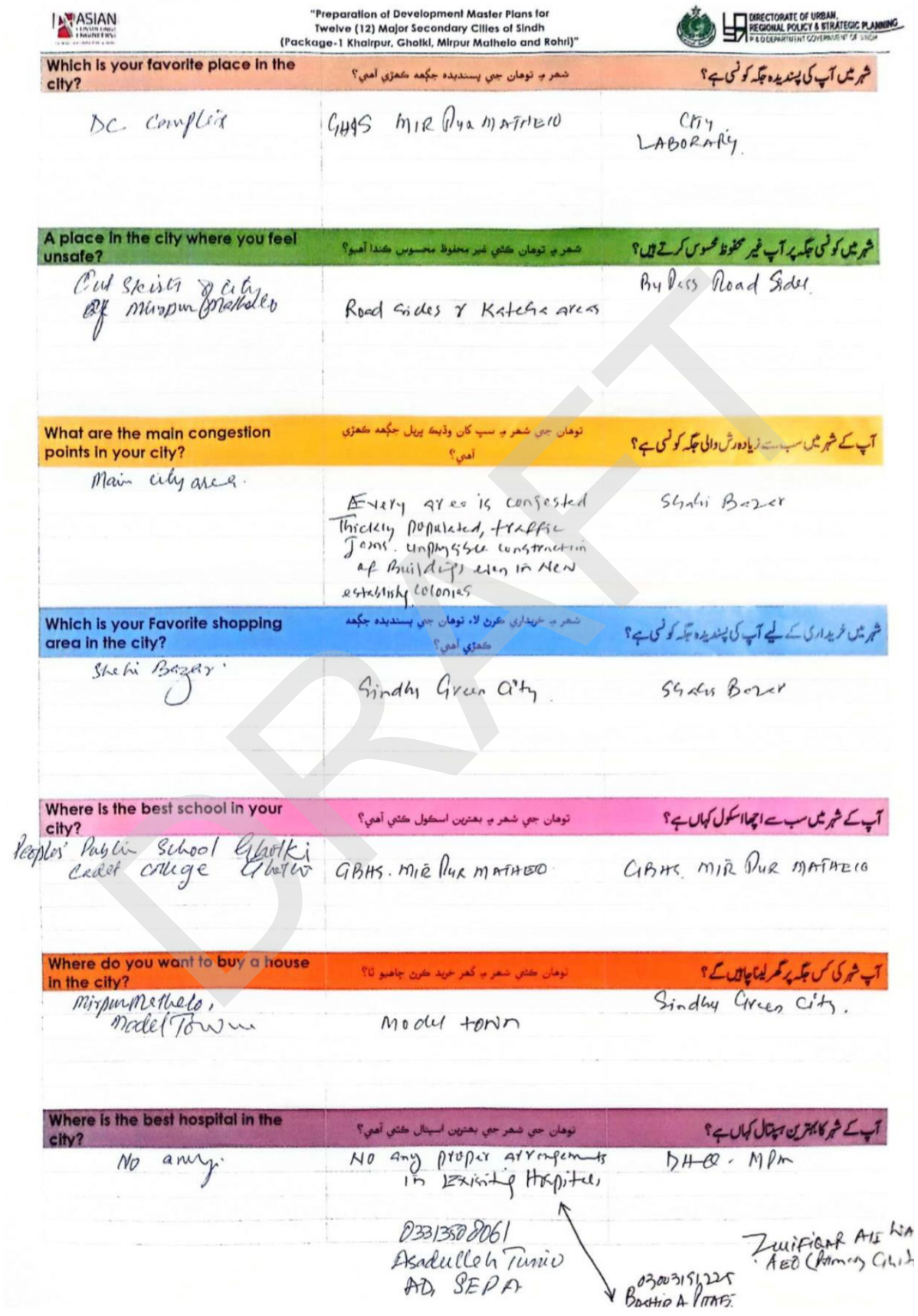
1. Session 1 – Have we Missed Anything?

"Preparation of Development Master Plans for Twelve (12) Major Secondary Cities of Sindh (Package-1 Khairpur, Ghotki, Mirpur Mathelo and Rohri)"

DIRECTORATE OF URBAN, REGIONAL POLICY & STRATEGIC PLANNING
P&D DEPARTMENT GOVERNMENT OF SINDH

Which is your favorite place in the city?	شهر ۾ توهان جي پسنديده جڳهه ڪهڙي آهي؟	شہر میں آپ کی پسندیدہ جگہ کونسی ہے؟
A place in the city where you feel unsafe?	شهر ۾ توهان ڪٿي غير محفوظ محسوس ڪندا آهيو؟	شہر میں کونسی جگہ پر آپ غیر محفوظ محسوس کرتے ہیں؟
What are the main congestion points in your city?	توهان جي شهر ۾ سڀ کان وڌيڪ پريل جڳهه ڪهڙي آهي؟	آپ کے شہر میں سب سے زیادہ رش والی جگہ کونسی ہے؟
Which is your Favorite shopping area in the city?	شهر ۾ خريداري ڪرڻ لاء توهان جي پسنديده جڳهه ڪهڙي آهي؟	شہر میں خریداری کے لیے آپ کی پسندیدہ جگہ کونسی ہے؟
Where is the best school in your city?	توهان جي شهر ۾ بهترين اسڪول ڪٿي آهي؟	آپ کے شہر میں سب سے اچھا اسکول کہاں ہے؟
Where do you want to buy a house in the city?	توهان ڪٿي شهر ۾ گهر خريد ڪرڻ چاهيو ٿا؟	آپ شہر کی کس جگہ پر گھر لینا چاہیں گے؟
Where is the best hospital in the city?	توهان جي شهر جي بهترين اسپتال ڪٿي آهي؟	آپ کے شہر کا بہترین ہسپتال کہاں ہے؟

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"Preparation of Development Master Plans for Twelve (12) Major Secondary Cities of Sindh (Package-1 Khairpur, Ghotki, Mirpur Mathelo and Rohri)"

DIRECTORATE OF URBAN, REGIONAL POLICY & STRATEGIC PLANNING

Which is your favorite place in the city?	شهر ۾ توهان جي پسنديده جڳهه ڪهڙي آهي؟	شہر میں آپ کی پسندیدہ جگہ کونسی ہے؟
DC Complex	GHS MIR Dya MATHELO	City LABORARY
A place in the city where you feel unsafe?	**شهر ۾ توهان ڪٿي غير محفوظ محسوس ڪندا آهيو؟**	**شہر میں کونسی جگہ پر آپ غیر محفوظ محسوس کرتے ہیں؟**
Old Sheikh City of Mirpur Mathelo	Road sides & Katchi areas	By Pass Road Side
What are the main congestion points in your city?	**توهان جي شهر ۾ سڀ کان وڌيڪ پريل جڳهه ڪهڙي آهي؟**	**آپ کے شہر میں سب سے زیادہ رش والی جگہ کونسی ہے؟**
Main city area.	Every area is congested thickly populated, traffic Jams. unplanned construction of Buildings even in New established colonies	Shahi Bazar
Which is your Favorite shopping area in the city?	**شهر ۾ خريداري ڪرڻ لاءِ توهان جي پسنديده جڳهه ڪهڙي آهي؟**	**شہر میں خریداری کے لیے آپ کی پسندیدہ جگہ کونسی ہے؟**
Shahi Bazar	Sindhi Green City	Shahi Bazar
Where is the best school in your city?	**توهان جي شهر ۾ بهترين اسڪول ڪٿي آهي؟**	**آپ کے شہر میں سب سے اچھا اسکول کہاں ہے؟**
Peoples' Public School Ghotki Cadet College Ghotki	GBHS. MIR Dur MATHELO	GBHS. MIR Dur MATHELO
Where do you want to buy a house in the city?	**توهان ڪٿي شهر ۾ گهر خريد ڪرڻ چاهيو ٿا؟**	**آپ شہر کی کس جگہ پر گھر لینا چاہیں گے؟**
Mirpur Mathelo, Model Town	Model town	Sindhi Green City.
Where is the best hospital in the city?	**توهان جي شهر جي بهترين اسپتال ڪٿي آهي؟**	**آپ کے شہر کا بہترین ہسپتال کہاں ہے؟**
No any.	No any proper arrangements in Existing Hospitals	DHQ. MPM
03313588061 Asadullah Junio AD, SEPA	03003151225 Bakhio A. PMAS	Zulfiqar Ali Lia AEO Planning Cell

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2. Session 2 - What Makes a City Great?

"Preparation of Development Master Plans for Twelve (12) Major Secondary Cities of Sindh (Package-1 Khairpur, Ghotki, Mirpur Mathelo and Rohri)"

DIRECTORATE OF URBAN, REGIONAL POLICY & STRATEGIC PLANNING
P&D DEPARTMENT GOVERNMENT OF SINDH

City Name: _____

Department: _____

Name and Designation: _____

1. **What sectors do you think are supporting city's economy? Rate from 1-5, with 1 being the highest, and strongest economic sector.**
   - ☐ Industries
   - ☐ Agriculture
   - ☐ Fishing
   - ☐ Hotels & tourism
   - ☐ Mines & minerals
   - ☐ Livestock & dairy
   - ☐ Any other (Specify) _____

Sr. No.	Sector	How is this a strong or weak sector?	Suggestions	Future potential sector (order 1-5)
1				☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
2				☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
3				☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
4				☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
5				☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

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"Preparation of Development Master Plans for Twelve (12) Major Secondary Cities of Sindh (Package-1 Khairpur, Ghotki, Mirpur Mathelo and Rohri)"
DIRECTORATE OF URBAN, REGIONAL POLICY & STRATEGIC PLANNING P & D DEPARTMENT GOVERNMENT OF SINDH

2. How can the city be developed to cater the residents' needs of the city? Rate the existing status of various sectors to assess the situation of city.

Sr. No.	Sectors	Existing status (G-Good, F-Fare, B -Bad)	Future needs for the next 20 years
1.	Housing	☐ Good ☐ Fare ☐ Bad	
2.	Basic Education (Primary – secondary)	☐ Good ☐ Fare ☐ Bad	
3.	Higher Education	☐ Good ☐ Fare ☐ Bad	
4.	Primary health care facilities	☐ Good ☐ Fare ☐ Bad	
5.	Secondary & tertiary Health care	☐ Good ☐ Fare ☐ Bad	
6.	Water	☐ Good ☐ Fare ☐ Bad	
7.	Sanitation	☐ Good ☐ Fare ☐ Bad	
8.	Waste management	☐ Good ☐ Fare ☐ Bad	
9.	Sports & recreation	☐ Good ☐ Fare ☐ Bad	
10.	Public Spaces	☐ Good ☐ Fare ☐ Bad	
11.	Transport infrastructure	☐ Good ☐ Fare ☐ Bad	
12.	Intercity public transport (railway, bus)	☐ Good ☐ Fare ☐ Bad	
13.	Freight transport (rail, road)	☐ Good ☐ Fare ☐ Bad	
14.	Local public transport	☐ Good ☐ Fare ☐ Bad	
15.	Electricity	☐ Good ☐ Fare ☐ Bad	
16.	Natural gas / alternative energy	☐ Good ☐ Fare ☐ Bad	
17.	Any other	☐ Good ☐ Fare ☐ Bad	

Any Suggestions?

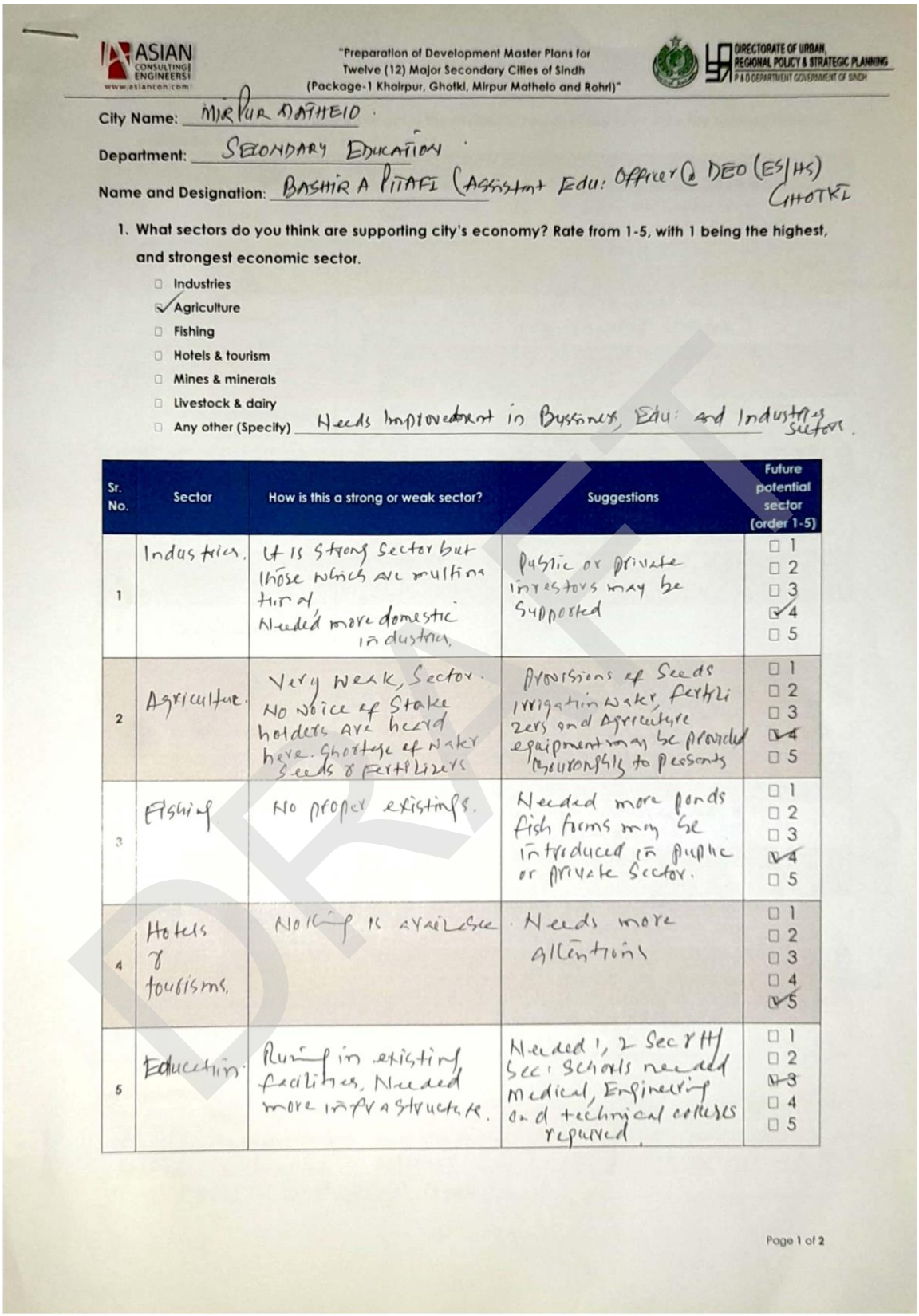
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"Preparation of Development Master Plans for Twelve (12) Major Secondary Cities of Sindh (Package-1 Khairpur, Ghotki, Mirpur Mathelo and Rohri)"

DIRECTORATE OF URBAN, REGIONAL POLICY & STRATEGIC PLANNING
P & D DEPARTMENT GOVERNMENT OF SINDH

City Name: MIRPUR MATHELO

Department: SECONDARY EDUCATION

Name and Designation: BASHIR A PITAFI (Assistant Edu: Officer @ DEO (ES/HS) GHOTKI

1. What sectors do you think are supporting city's economy? Rate from 1-5, with 1 being the highest, and strongest economic sector.

- ☐ Industries
- ☑ Agriculture
- ☐ Fishing
- ☐ Hotels & tourism
- ☐ Mines & minerals
- ☐ Livestock & dairy
- ☐ Any other (Specify) Needs improvement in Business, Edu: and Industries sectors.

Sr. No.	Sector	How is this a strong or weak sector?	Suggestions	Future potential sector (order 1-5)
1	Industries.	It is strong Sector but those which are multinational, Needed more domestic industries.	Public or private investors may be supported	☐ 1 ☐ 2 ☐ 3 ☑ 4 ☐ 5
2	Agriculture.	Very Weak Sector. No voice of Stake holders are heard here. Shortage of Water Seeds & Fertilizers	Provisions of Seeds Irrigation Water, fertilizers and Agriculture equipment may be provided Reasonably to peasants	☐ 1 ☐ 2 ☐ 3 ☒ 4 ☐ 5
3	Fishing	No proper existings.	Needed more ponds fish farms may be introduced in public or private Sector.	☐ 1 ☐ 2 ☐ 3 ☒ 4 ☐ 5
4	Hotels & tourisms.	No info is available.	Needs more attentions	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☒ 5
5	Education.	Run in existing facilities, Needed more infra structure.	Needed 1, 2 Sec & HH Sec: Schools needed Medical, Engineering and technical colleges required.	☐ 1 ☐ 2 ☒ 3 ☐ 4 ☐ 5

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"Preparation of Development Master Plans for Twelve (12) Major Secondary Cities of Sindh (Package-1 Khairpur, Ghotki, Mirpur Mathelo and Rohri)"
DIRECTORATE OF URBAN, REGIONAL POLICY & STRATEGIC PLANNING P&D DEPARTMENT GOVERNMENT OF SINDH

2. How can the city be developed to cater the residents' needs of the city? Rate the existing status of various sectors to assess the situation of city.

Sr. No.	Sectors	Existing status (G-Good, F-Fare, B -Bad)	Future needs for the next 20 years
1.	Housing	☐ Good ☐ Fare ☑ Bad	Needs more infrastructure, colonies requirments must be fulfilled.
2.	Basic Education (Primary – secondary)	☐ Good ☑ Fare ☐ Bad	Needs more infrastructures i.e- Buildings, Laboratories and furnitures, 2 or 3 more Sec: Schools needed.
3.	Higher Education	☐ Good ☐ Fare ☑ Bad	Needs Technical colleges, Mendical & Engineering colleges.
4.	Primary health care facilities	☐ Good ☐ Fare ☑ Bad	Needs more improvements
5.	Secondary & tertiary Health care	☐ Good ☐ Fare ☑ Bad	Usually All Projects Which ~~are~~ existing are unphysical.
6.	Water	☐ Good ☐ Fare ☑ Bad	Needs more Alter Plants RO Plants. Waste must be dumped proper.
7.	Sanitation	☐ Good ☐ Fare ☑ Bad	Some proper arrangements needed, especially best way drains needed.
8.	Waste management	☐ Good ☐ Fare ☑ Bad	Dumping Areas must be arranged.
9.	Sports & recreation	☐ Good ☐ Fare ☑ Bad	Required.
10.	Public Spaces	☐ Good ☐ Fare ☑ Bad	Some more public parks, & Community Halls required.
11.	Transport infrastructure	☐ Good ☐ Fare ☑ Bad	Public transports needed as yellow, pink and Red buses introduced
12.	Intercity public transport (railway, bus)	☐ Good ☐ Fare ☑ Bad	Needed more improvent.
13.	Freight transport (rail, road)	☐ Good ☐ Fare ☑ Bad	Infrastructure needed more Attention.
14.	Local public transport	☐ Good ☐ Fare ☑ Bad	More Attention needed.
15.	Electricity	☐ Good ☐ Fare ☑ Bad	Very poor condition, needed more Attention.
16.	Natural gas / alternative energy	☐ Good ☐ Fare ☑ Bad	Usually a Long Stoppage / Load Shedding is observed. Needed improved
17.	Any other	☐ Good ☐ Fare ☐ Bad	More things Required.

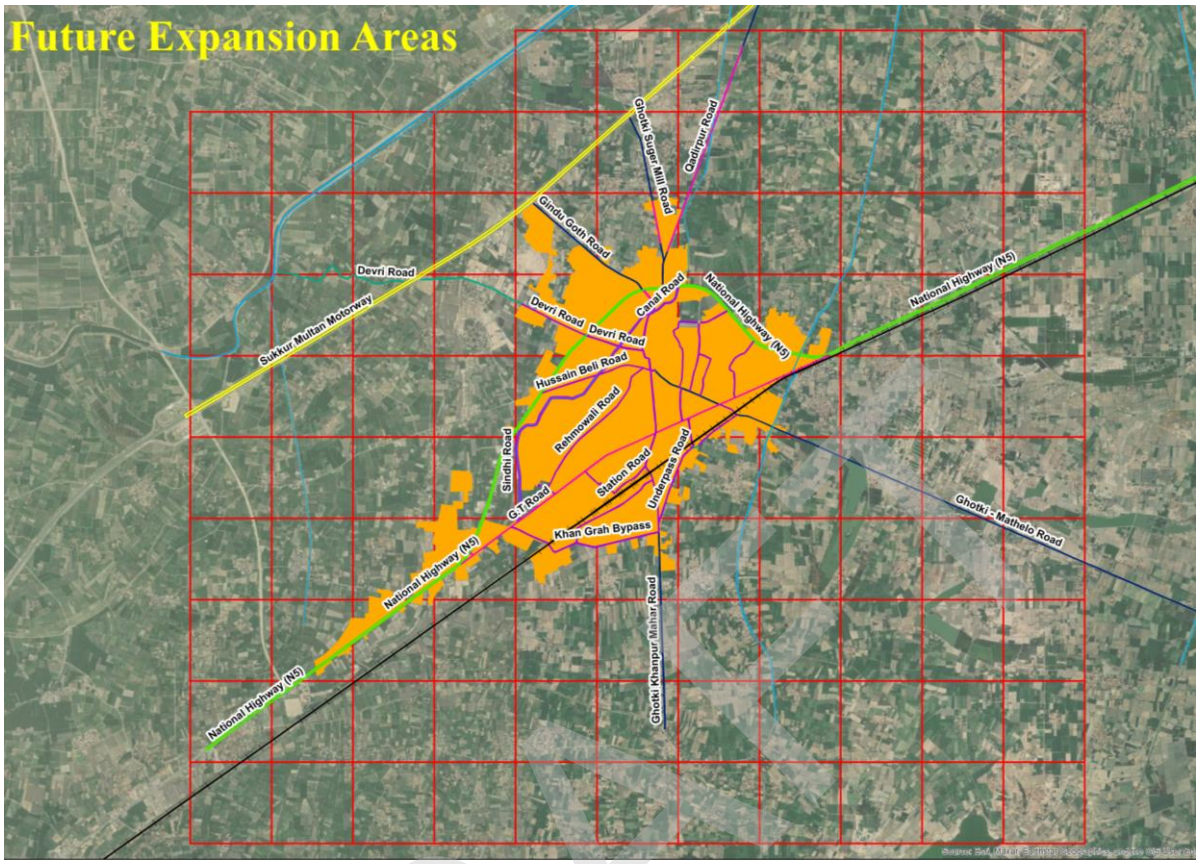
Any Suggestions?

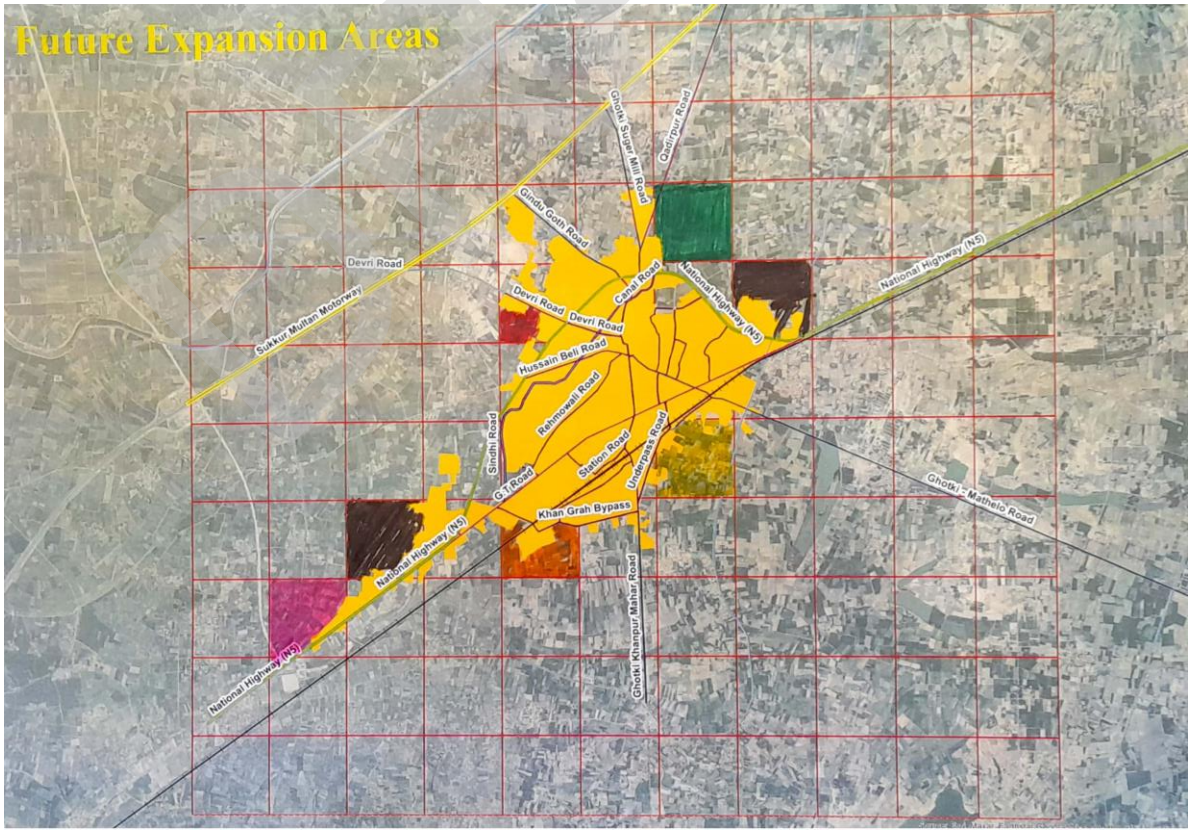
Some more Sec: & H/Sec: Schools needed in Mirpur Mathelo
Dly Technical, Engin: and medical college required. Public Parks and Community Needed in colonies. Sanitations proper arrangements required
Urgent repairs of Roads, Drains Needed.

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3. Session 3 - What will be the Future Development?






promote
management
sustainable
development
inclusive
End
Ensure
achieve
access
build
combat
hunger
productive
resilient
poverty
halt
food
equitable
improved
security
agriculture
healthy
nutrition
education
gender
forms
quality
learning
energy
countries
cities
lifelong
women
lives
infrastructure
Conserve
desertification
degradation
employment
equality
availability
opportunities
innovation
decent
foster
impacts
change
reverse
seas
settlements
reliable
sanitation
modern
water
use
ages
industrialization
inequality
climate
human
economic
empower
affordable
land
girls
Reduce
consumption
partnership
implementation


urbanization
city
architecture
downtown
business
building
urban
economics
planning
house
engineering
metropolis
architectural
construction
traffic
street
town
center
design
sociology
geography
competitive
industrialization
modern
cityscape
transportation
metropolitan
modernization
district
road
opportunity
skyscraper
urbanized
transport
urban planning
settlement
highway
area
apartment
jobs
urban area
culture
skyline
estate
development
housing
buildings
tower
plan
structure
competitive
education
avenue
architect
SENSA
HI-LIGHTER

C) Vision Workshop Pictures













ANNEXURE - 3: GHOTKI BORE LOGS REPORT AND TEST SHEETS

A) Borehole Log Report

14.1 Executive Summary

The Client intends to have a Geotechnical Investigation of the proposed area available project **"Preparation of Development Master Plans for 12 Major Secondary Cities of Sindh."**

The task was entrusted to **Asian Consulting Engineers Pvt. Ltd**. to carry out the geotechnical investigations of the project. Geotechnical investigations aimed at ascertaining the subsoil information prevailing at the project site i.e., generalized lithology, geotechnical characteristics of each encountered stratum and the corresponding design of foundation system.

A comprehensive scope of geotechnical investigations was defined by the Client. These investigations comprised drilling of boreholes, soil sampling, laboratory testing, evaluation of sub-surface conditions, recommendation of foundation system and preparation of geotechnical investigations report. The field investigations for this project were carried out during the months of **July 2025**. The details on each aspect of these geotechnical investigations are covered in forth coming dedicated chapters of this report.

Based on field investigations, laboratory test results, interpretation and structural requirements, feasibility of several foundation options was evaluated. Considering economy and safety, as well as the structural requirements, foundation options have been recommended to support the structural loadings.

Structural engineer has been provided the choice to select foundations based on structural analysis and design. Alternate foundation options can be evaluated if required by the Structural Designers. The variation of net allowable bearing pressures is presented in this report.

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14.2 Introduction

14.2.1 Introduction

To evaluate the subsurface conditions at site and to arrive at a safe and economical design of the foundation for the proposed development works, geotechnical investigations were considered necessary. The task of investigations was entrusted to M/s Asian Consulting Engineers (Pvt) Ltd, Lahore by the Client. These investigations were carried out in the month of July 2025. This report provides an account of the subsurface activities carried out at the site, the characteristics of subsurface materials, and details of field and laboratory tests and the necessary recommendations for the design & construction of foundation.

14.2.2 Objectives of Geotechnical Investigation

The geotechnical investigations were undertaken to meet the following objectives:

1. To delineate the major subsoil types spread over the site area.
2. To delineate the location of groundwater and its fluctuations within the project area if encountered.
3. To evolve parameters for the design of foundations of the proposed structure.
4. To evaluate the geotechnical considerations for the construction of foundation.

14.2.3 Scope of Geotechnical Investigation

The following geotechnical investigation plan was developed to fulfil the above-mentioned objectives:

- Execution of **Six (06) boreholes at preidentified location** up to the maximum depth of 50 feet below E.G.L within the project area by Hand Auger.
- Analyses of field & laboratory data and determination of foundation design parameters including soil parameters, foundation type, foundation depth, foundation size versus net allowable bearing pressure.
- Compilation of a comprehensive Geotechnical Investigations report based on the above studies and submission of the report to the Client.

14.3 Geology and Seismicity of the Area

14.3.1 Geology of the Area

The geology of Ghotki district is dominated by Quaternary deposits laid down by the Indus River system. The surface consists mainly of alluvial sands, silts,

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clays, and occasional gravel layers that have accumulated over thousands of years. Beneath these young deposits, the Siwalik Group forms the main bedrock, composed of sandstone, siltstone, and clay beds of Neogene age, reflecting ancient fluvial environments. Aeolian dune sands also occur in some areas, influencing soil permeability and groundwater recharge patterns. This geological setup makes Ghotki a fertile agricultural zone but also susceptible to flooding due to low-lying, fine-grained sediments that quickly become saturated during monsoon rains.

14.3.2 Surficial Geology

The site is situated at an average elevation of 217 meters above mean sea level. The alluvial subsoils are of late Pleistocene and were formed by the flood plains of river Ravi. These consist of clay, silt and sand.

14.3.3 Seismicity of Area

The project area lies in the Lower Indus basin which is seismically moderately active. Probabilistic seismic hazard assessment recently carried out for Lahore area as part of the revision of Seismic Provisions of the Building Code of Pakistan shows that the Project area falls in Zone 2A.

It is, therefore, recommended that the design of the project structures should be based keeping in view the requirements of Zone 2A of Seismic Provisions of the Building Code of Pakistan (2007).

14.4 Field and LAB Geotechnical Investigation

14.4.1 General

Keeping in view the scope of the geotechnical studies, a field investigation program was developed. The investigation included the following activities;

- Drilling of exploratory borehole
- Soil sampling for subsequent laboratory testing

The details of field work conducted at the project site are discussed in this chapter. The locations of exploratory boreholes and test pits are shown on the layout plan attached in Annexure-A.

The field work was supervised by a Geologist (Site Supervisor) who was responsible for client liaison, field co-ordination, logging of the strata encountered and handling of the collected samples. The field work component of the investigation was carried out in the month of July 2025.

14.4.2 Execution of Boreholes

Boreholes were bored by hand auger drilling having maximum depth of 50 feet below Existing Ground Level (E.G.L) Borehole location plan is attached in Annexure -A of this report.

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Field borehole logs were developed based on the materials encountered at the site and were later confirmed based on the laboratory test results. The borehole logs are shown in Annexure-F.

14.4.3 Disturbed Soil Samples

Disturbed soil samples were obtained using a split spoon sampler while performing the SPTs in the boreholes. The specimens collected from boreholes were carefully placed in polythene bags which were stored in plastic jars. All samples were clearly labelled identifying the following details;

- Project name,
- Project ID,
- Borehole designation for which sampling is being performed,
- Sample designation,
- Depth of collection, and
- Date of collection subsequent laboratory for testing.
- Date of collection subsequent laboratory for testing.

14.4.4 Ground Water Investigation

Groundwater was not encountered at all depths across the site. The depth of ground water table is mentioned on borehole logs for each site. However Seasonal variation might affect the water table.

14.4.5 Discussion of Laboratory Test Results

A) Classification of soil

Bulk Composite representative soil samples were subjected to sieve analysis as per ASTM D 422. Test results indicated that the overburden soils mainly consist of Silty Clay (CL-ML), Silty Sand (SM) and Poorly Graded Sand with Silt (SP-SM) as per unified soil classification system (USCS).

Test Results are attached in Annexure of the Report.

14.5 Site Geotechnics

14.5.1 General

Geotechnical investigations were planned in such a manner to effectively explore the site geotechnics of the project site.

This Chapter mainly discusses our evaluations for subsoil lithology & stratigraphy, liquefaction potential and other geotechnical characteristics of the soils prevailing at the project site.

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14.5.2 Lithology & Stratigraphy

At the time of these investigations, maximum depth of drilled boreholes was 50 feet below the Existing Ground level (E.G.L.)

General stratigraphy of the project area, as deduced from the site investigations duly corrected in the light of laboratory test results (wherever required), indicates the presence of following stratigraphic units.

14.5.3 Strata Encountered at Different Depths

Table 14-1, Strata Encountered at Different Depths

Stratum	Thickness (ft)	Material Description	Soil Parameters
Stratum - 1	0-15	Silty Clay with variable Sand / Silty Sand	γ_b = 17.0 KN/m^3 ϕ' = N/A c' = 25 kPa Es = 15,000 KN/m^3 μ = 0.30
Stratum - 2	15-25	Sand with varied Silt	γ_b = 18.0 KN/m^3 ϕ' = 32^0 Es = 25,000 KN/m^3 μ = 0.30
Stratum - 3	25-50	Sand with varied Silt	γ_b = 19.0 KN/m^3 ϕ' = 34^0 Cu = N\A Es = 55,000 KN/m^3 μ = 0.30
Water Table was encountered at variable depth across all of the sites.			

14.5.4 Shear Strength

Direct Shear Test carried out relatively Coarse Grained Sils indicated that the soils are in medium dense state of Packing.

14.5.5 Expansion Potential

The plasticity index (PI) of the soil provides an indication of how much clay will shrink or swell. The higher the PI, the greater is the shrink-swell potential. The PI of top onsite soils are plastic nature having PI < 15, indicates that the cohesive on-site soils are having low expansion potential.

14.5.6 Liquification Potential

Loose to medium dense, water-submerged, cohesion-less soils are susceptible to liquefaction under dynamic loads caused by earthquakes. Liquefaction results in total or partial loss of shear strength thereby leading to substantial subsidence, ground heave and/or uplifting of lightweight

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structures, etc

During these investigations, groundwater was not encountered at an depth of 90 feet. Moreover, the overburden soils consist of thick cover of cohesive soil stratum at top. Therefore, as such the soil deposits are not likely to liquefy during earthquakes.

14.5.7 Chemical Aggressively

A study of salt concentration determined at a few spread-out locations indicates that sulphates and chlorides are present in low proportions in all the tested soil samples as per ACI Building Code Requirements. Therefore, OPC can be used in foundation concrete.

14.5.8 Site Class

Based on the properties of the on-site soils, the site is classified as Site Class D in accordance with ASCE 7 as recommended in Pakistan Building Code 2021.

14.6 Foundation Design

14.6.1 General

Based on the field investigations and the subsequent laboratory testing, subsurface strata at the project site have been established and the corresponding design of foundations has been carried out. The details of foundation design recommendations are provided in the following sections.

14.6.2 Geotechnical Design Criteria

The foundations of the proposed structures should meet the following minimum design criteria:

1. These should be safe against shear failure of the supporting ground.
2. These should not settle excessively under the service loads. A limit 50 mm has been put on the total settlement Raft foundation respectively. On the field investigations and the subsequent laboratory testing, subsurface strata at the project site have been established and the corresponding design of foundations has been carried out. The details of foundation are provided in the following sections.
3. The angular distortion between two adjacent foundations of the same building block should not exceed 1/500.
4. Preferably, the building blocks of different heights located adjacent to each other, should be structurally isolated, so as to ensure better performance.
5. The foundations must stay safe under tensile, lateral, moment and

earthquake loadings.

14.6.3 Foundation Type & Depth

The field investigation data indicated that the overburden soil generally has medium strength. Based on the loading requirements of the proposed structure and the existing subsurface conditions.

For light weight or temporary structures strip Square Foundations can be opted at 2.5 feet from EGL. The bearing capacity can be oted as 75 kPa if water table is present on at shallow depths, then WBM and Sand cushion is recommended to be provided below foundation.

14.6.4 Foundation Recommendation

The footings to be placed at **desired depth** should be placed below the existing ground level on a subgrade to be prepared as described below:

1. Excavate soil at the foot prints to desired depth below the existing ground level (EGL).
2. The excavation should extend at least 4-inch away from the footing edges.
3. Trim any moist or organic soil layer and Proof roll foundation sub-grade using appropriate compaction equipment. Compact the bed, of foundation at 95 % of MDD.
4. Backfill the foundation pit/trench with one (01) foot, **A-3 type soil** (as per AASHTO classification) with fines content less than 15%, placed in layers not exceeding six (06") inches in thickness and compacted to dry density not less than 95% Modified Proctor dry density.
5. Provide a well-compacted pad of at least 4 inches of 1:4:8 P.C.C. and the footing should bear on this pad.

If the material encountered at the base of the foundation conforms to A-3 type soil with **fines content less than 15%**, and with a coefficient of uniformity **(Cu ≥ 4)** greater than or equal to 4 and a coefficient of curvature **(1≤ Cc ≤ 3)** between 1 and 3, then same should be compacted to 95% of the maximum dry density (MDD).

14.6.5 Modulus of Subgrade Reaction (KS)

Vertical Modulus of Subgrade Reaction (Ks) also referred as soil "spring" constant or coefficient of subgrade reaction is defined as the deformation induced in the soil per unit application of pressure. This modulus is frequently used for design of mat foundations and rigid pavements. Its magnitude is not only a function of stiffness of the foundation supporting strata, but it is also depended on the foundation size and its rigidity. The Modulus of Subgrade Reaction can be estimated using the following relationship

(Ref.: Foundation Analysis and Design by J.E. Bowles).

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$$Ks = 20\ (FOS)qa \quad (for\ 50\ mm\ settlement)$$

$$ks = 40\ (fOS)qa\ (for\ 25\ mmn\ settlemnt)$$

14.6.6 Coefficients of Earth Pressures

The on-site soils where silty clay or sandy silts are presents as per the samples obtained from the boreholes are not suitable to be used as backfill behind retaining walls. It should contain limited fines.

The backfill should be compacted to around 90% Modified Proctor maximum dry density. In case of backfill materials, it is considered that as recommended in subsequent section, the materials shall be granular and compacted to a dry density of not less than 95% of the maximum Modified Proctor Density (ASTM D 1557).

The granular backfill materials compacted to these recommended densities must develop an angle of friction of the order of 30 degrees. Therefore, the coefficients of Earth Pressures for the well compacted engineering fill will be as under:

1. Active Earth Pressure (Ka) = 0.33
2. Passive Earth Pressure (K_p) = 3.00
3. At rest Earth Pressure (Ko) = 0.50

14.6.7 Type of Cement

The chemical tests carried out on the soil samples indicate low concentrations of sulphate in the subsoil at the site. Therefore, Ordinary Portland Cement (OPC) should be used in the construction below NSL.

14.6.8 Damp Proofing Measures

Proper damp proofing measures should be taken to prevent the ingress of water in foundations. Besides, adequate provision should be kept preventing the excavation slopes against rains by tarpaulins. Emergency arrangements of dewatering pumps of pumping the rainwater from excavations should also be provided. The Contractor should submit his method statement for the approval of Engineer.

14.7 Earth Work

14.7.1 Clearing, Grubbing, Levelling and Grading

Prior to any construction activity at the site, it must be cleared of all debris, and surface vegetation. This can be carried out by graders/dozers. For levelling and grading, stakes should be installed on a grid marked by Surveying Crews. The required levels to be attained through cut or fill at the grid points must also be identified. The levelling and grading can be carried out by normal earth moving machine.

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14.7.2 Excavations

The excavations for construction of foundations, other substructures or for trenches for utility lines can be made by using conventional earth moving machinery including scrappers, dozers and trenchers etc.

All the excavations should be properly sloped or supported to avoid any stability failure as well as movement in the adjacent structures. After reaching the designed foundation level and before placing the foundation, it is recommended that the soil should be well compacted by using appropriate roller or equivalent.

14.7.3 Fill Materials

A) General Fill

The top soils on site are not suitable as per samples obtained from boreholes. The general backfill should be granular and should contain limited fines <15%.

B) Structural Fill

The fill intended to support the structural foundations or floors must comprise only the "select materials". The "select fill material" must be free of organic and other deleterious substances.

The select fill must be well-graded granular material. The fines (i.e., particles passing no. 200 sieve) fines should not be more than 15%.

C) Backfill for Utility Trenches and around Substructures

The soils used for backfilling the trenches and around substructures must be free draining when im-permeability is not required, when free drainage is desired, or when particularly good bedding or foundations of low compressibility. are desired. Tractor compacted fill or fills compacted by consolidating processes, the materials used must be free draining sandy and gravelly soils.

D) Placement and compaction

Permanent slopes beyond width should not be steeper than 1 vert: 2 Horz. All fill materials must be placed in layers not exceeding 20 cm in loose state- In case of general fill each layer should be compacted to a dry density not less than 90% as determined by Modified Proctor Compaction Tests (ASTM D-1586), or to a minimum relative density of 70 percent. In case of structural fill, the compacted density must not be less than 95% determined based on Modified Proctor Compaction Tests (ASTM D-1586), or not less than 75% of the relative density. All compaction should be carried out at a moisture content, within a tolerable range of -2 to + 2 percent of optimum moisture content.

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14.7.4 Inspections and Construction Verifications

The comments and design recommendations presented in this report are based on descriptions of conditions at known points (i.e., boreholes). Since the subsurface conditions can vary from the inferred ground model for the site, it is important that the ground behaviour should be reviewed during construction and compared with the design assumptions.

The comments and design recommendations presented in this report are based on descriptions of conditions at known points (i.e., boreholes). Prior to construction, confirmatory boreholes should be carried out at the foundation locations to confirm the lithology at critical loading points of the structures.

Accordingly, it is recommended, provision be made for a construction review and performance monitoring program, with inspections to cover but not limited to the following aspects of the works:

- footing excavations
- subgrade preparation at foundation level

14.8 Conclusions and Recommendations

- The geotechnical investigations conducted in the project area indicate that the overburden soils primarily consist of Silty Clay (CL-ML) and Sand with variable Silt (SP-SM).
- The groundwater table was encountered at a varied depth of from the Existing Ground level (EGL).
- Trench excavations having a depth of 5-feet or more must be excavated and shored in accordance with OSHA regulations, and we recommend that the project Contractor be solely responsible for shoring and site safety.
- Water must not infiltrate from any source; proper water proofing must be done in order to avoid any damages to foundation.
- Experienced engineer should observe the construction activities to check that the works are performed in accordance with the plans and specifications. Field and laboratory tests should be performed to confirm that the material quality, compaction and strength meet the project specifications
- If weak/soft soil encountered at foundation excavation base of shallow foundation, it should be completely removed and backfilled with engineered fill material. The guidelines for backfill material is discussed in section 7.3 of this report.
- If there is a substantial lapse of time between submission of this report and the start of work at the site and conditions have changed due either to natural causes or to construction operation at or adjacent to site, we urge that we be promptly informed and retained to review

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our report to determine the applicability of the conclusions and recommendations, considering the changed conditions and/or time lapse.

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Senior Geotechnical Engineer
PEC: CIVIL/52452
Engineers Australia - ANZSCO: 233211
Asian Consulting Engineers Pvt. Ltd.

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14.9 Limitations

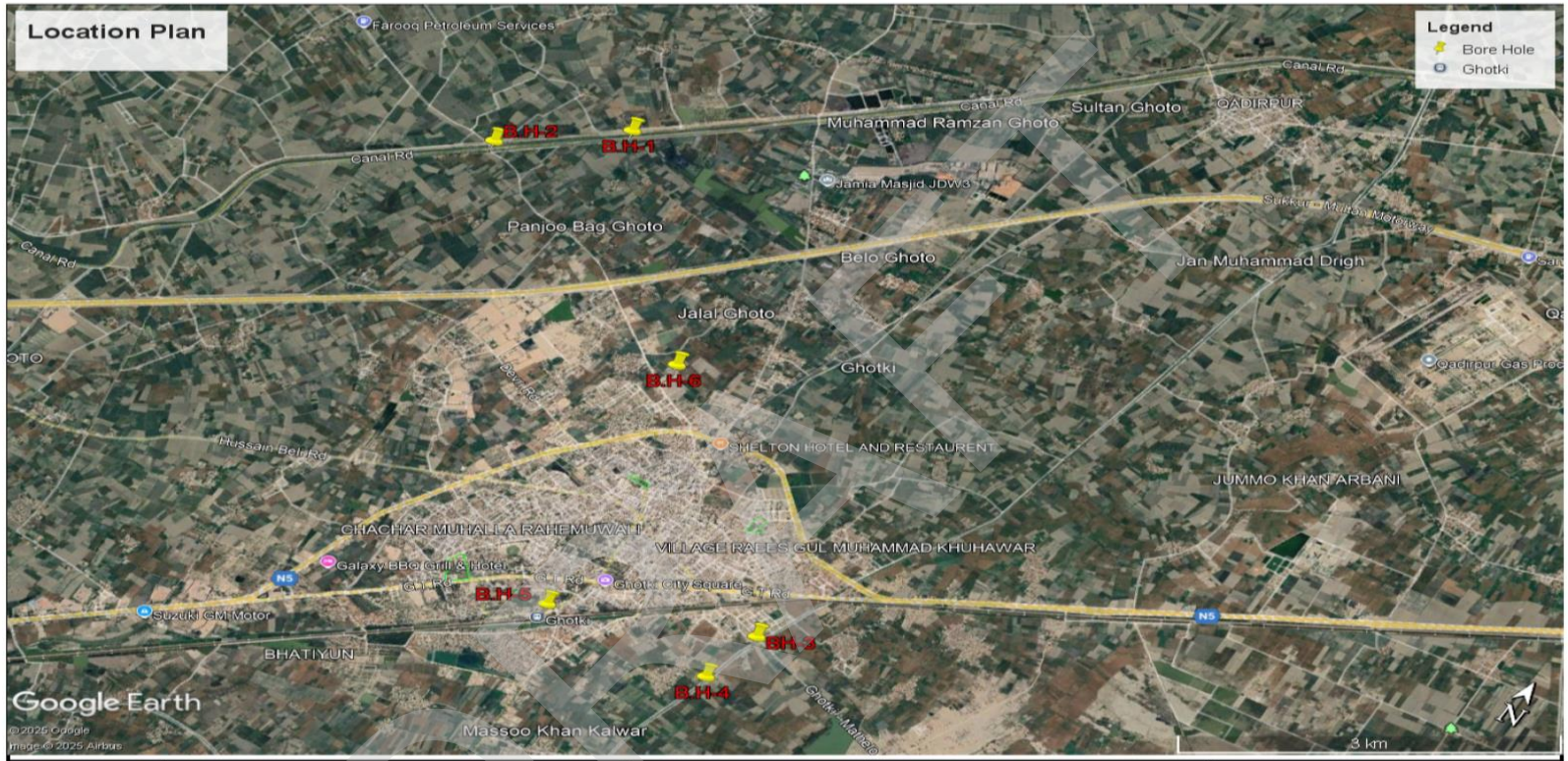
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- The comments given in this report are intended only for the guidance of design engineers. This report is intended solely for the Client named.
- No portion of this report may be used as a separate entity, it is written to be read in its entirety.
- Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations and conditions which were not detected or could be anticipated at the time of the site investigation may exist.
- The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.
- This work has been undertaken in accordance with normally accepted geotechnical engineering practices and for site assessments.
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B) Location Plan



Date	Coordinate			Drawing Title	Project	Consultant
	Bore Hole No	Northing	Easting			
24-Jul-25	1	28.0384	69.2938	Bore Hole Location Plan	Ghotki	ASIAN GEOMATS www.asiangeomats.com
	2	28.0326	69.2845			
	3	27.9993	69.3305			
	4	27.9942	69.3291			
	5	27.9948	69.3141			
	6	28.0196	69.3101			

C) Bore Logs and Test Sheets

ASIAN GEOMATS

Project :	Canal Road, Ghotki.		
Water Table	6'	**Date:**	24/07/2025
Northing	28.0384	**Easting**	69.29380
Bore Hole No	1		

Type of sample	Depth (feet)	Sample	Depth (feet)	Strata Encountered
1	5	◊	0-10	Dark Brown Silty Clay
2	10	◊ ţ		
3	15	◊	10-50	Light Gray Sand with Silt.
4	20	◊		
5	25	◊		
6	30	◊		
7	35	◊		
8	40	◊		
9	45	◊		
10	50	◊		

Legend		
Disturbed Sample	◊	Fill
Undisturbed Sample	Δ	Poorly graded sand
S.P.T	↓	Sandy Silt
Water Table	ţ	Silty Clay
Drill Core Sample	Ẓ	Lean Clay
Vane Shear Test	⊗	Silty Sand
		Clayey Silt

Tested By: Checked By:

DRAFT

ASIAN GEOMATS

Project :	Jindu Ghoto Road, Ghotki.		
Water Table	6'	**Date:**	24/07/2025
Northing	28.0326	**Easting**	69.28450
Bore Hole No	**2**		

Type of sample	Depth (feet)	Sample	Depth (feet)	Strata Encountered
1	5	◊	0-25	Dark Brown Silty Clay
2	10	◊ ṭ		
3	15	◊		
4	20	◊		
5	25	◊		
6	30	◊	25-50	Light Gray Sand with Silt.
7	35	◊		
8	40	◊		
9	45	◊		
10	50	◊		

Legend			
Disturbed Sample	◊		Fill
Undisturbed Sample	Λ		Poorly graded sand
S.P.T	↓		Sandy Silt
Water Table	ṭ		Silty Clay
Drill Core Sample	Ẓ		Lean Clay
Vane Shear Test	⊗		Silty Sand
			Clayey Silt

Tested By: Checked By:

DRAFT

ASIAN GEOMATS

Project :	Masso Khan Road, Ghotki.		
Water Table	6'	**Date:**	25/07/2025
Northing	27.9993	**Easting**	69.33050
Bore Hole No	3		

Type of sample	Depth (feet)	Sample	Depth (feet)	Strata Encountered
1	5	◊	0-5	Dark Brown Silty Clay
2	10	◊ ṭ		
3	15	◊		
4	20	◊		
5	25	◊		
6	30	◊	5-50	Light Gray Sand with Silt.
7	35	◊		
8	40	◊		
9	45	◊		
10	50	◊		

Legend			
Disturbed Sample	◊		Fill
Undisturbed Sample	Λ		Poorly graded sand
S.P.T	↓		Sandy Silt
Water Table	ṭ		Silty Clay
Drill Core Sample	Ẓ		Lean Clay
Vane Shear Test	⊗		Silty Sand
			Clayey Silt

Tested By: Checked By:

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ASIAN GEOMATS

Project :	Masso Khan Road, Ghotki.		
Water Table	3'	**Date:**	25/07/2025
Northing	27.9942	**Easting**	69.32910
Bore Hole No	**4**		

Type of sample	Depth (feet)	Sample	Depth (feet)	Strata Encountered
1	5	◊ ṯ	0-5	Dark Brown Silty Clay
2	10	◊		
3	15	◊		
4	20	◊		
5	25	◊		
6	30	◊	5-50	Light Gray Sand with Silt.
7	35	◊		
8	40	◊		
9	45	◊		
10	50	◊		

Legend			
Disturbed Sample	◊		Fill
Undisturbed Sample	Δ		Poorly graded sand
S.P.T	↓		Sandy Silt
Water Table	ṯ		Silty Clay
Drill Core Sample	Ẓ		Lean Clay
Vane Shear Test	⊗		Silty Sand
			Clayey Silt

Tested By: Checked By:

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ASIAN GEOMATS

Project :	Near Railway Station, Ghotki.		
Water Table	12'	**Date:**	24/07/2025
Northing	27.9948	**Easting**	69.31410
Bore Hole No	**5**		

Type of sample	Depth (feet)	Sample	Depth (feet)	Strata Encountered
1	5	◊	0-10	Dark Brown Silty Clay
2	10	◊		
3	15	◊ ṯ	10-50	Light Gray Sand with Silt.
4	20	◊		
5	25	◊		
6	30	◊		
7	35	◊		
8	40	◊		
9	45	◊		
10	50	◊		

Legend		
Disturbed Sample	◊	Fill
Undisturbed Sample	Δ	Poorly graded sand
S.P.T	↓	Sandy Silt
Water Table	ṯ	Silty Clay
Drill Core Sample	Ẓ	Lean Clay
Vane Shear Test	⊗	Silty Sand
		Clayey Silt

Tested By: Checked By:

DRAFT

ASIAN GEOMATS

Project :	Jindu Ghoto Road, Ghotki.		
Water Table	5'	**Date:**	24/07/2025
Northing	28.0196	**Easting**	69.31010
Bore Hole No	6		

Type of sample	Depth (feet)	Sample	Depth (feet)	Strata Encountered
1	5	◊ ţ	0-5	Dark Brown Silty Clay
2	10	◊		
3	15	◊		
4	20	◊		
5	25	◊		
6	30	◊	5-50	Light Gray Sand with Silt.
7	35	◊		
8	40	◊		
9	45	◊		
10	50	◊		

Legend

Disturbed Sample	◊	**Fill**
Undisturbed Sample	Δ	**Poorly graded sand**
S.P.T	↓	**Sandy Silt**
Water Table	ţ	**Silty Clay**
Drill Core Sample	Ẓ	**Lean Clay**
Vane Shear Test	⊗	**Silty Sand**
		Clayey Silt

Tested By: Checked By:

DRAFT

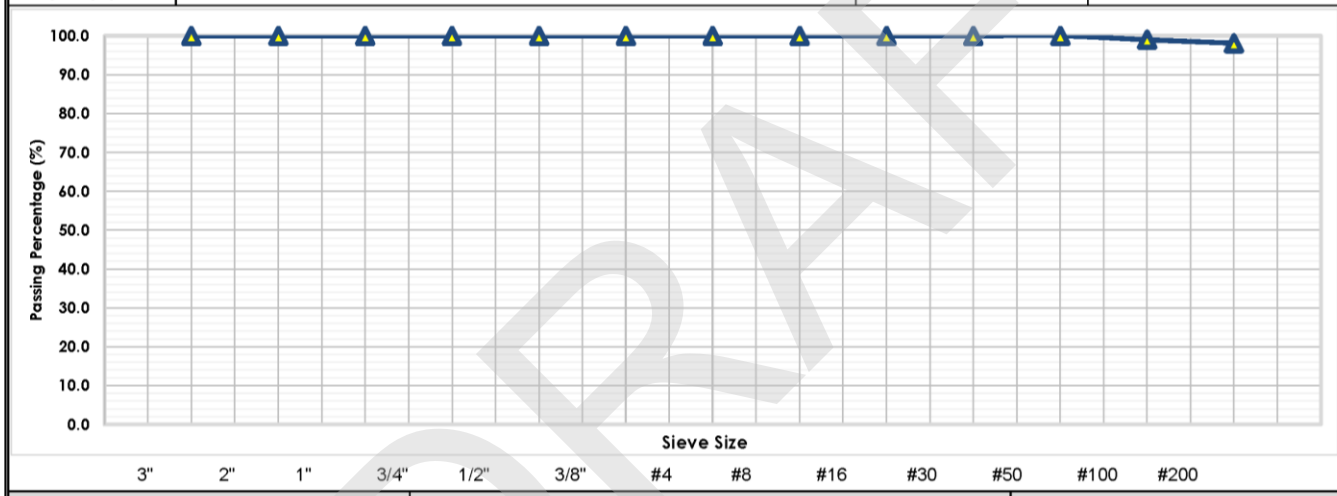
D) Soil Classification

ASIAN GEOMATS

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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Canal Road, Ghotki.		
Borehole No:	1	**Sample No :**	1
Depth (ft) :	5.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	100.0
0.15	99.0
0.075	98.1

Gravel %	Sand %	Silt & Clay %
0	2	98

Tested By :

Checked By:

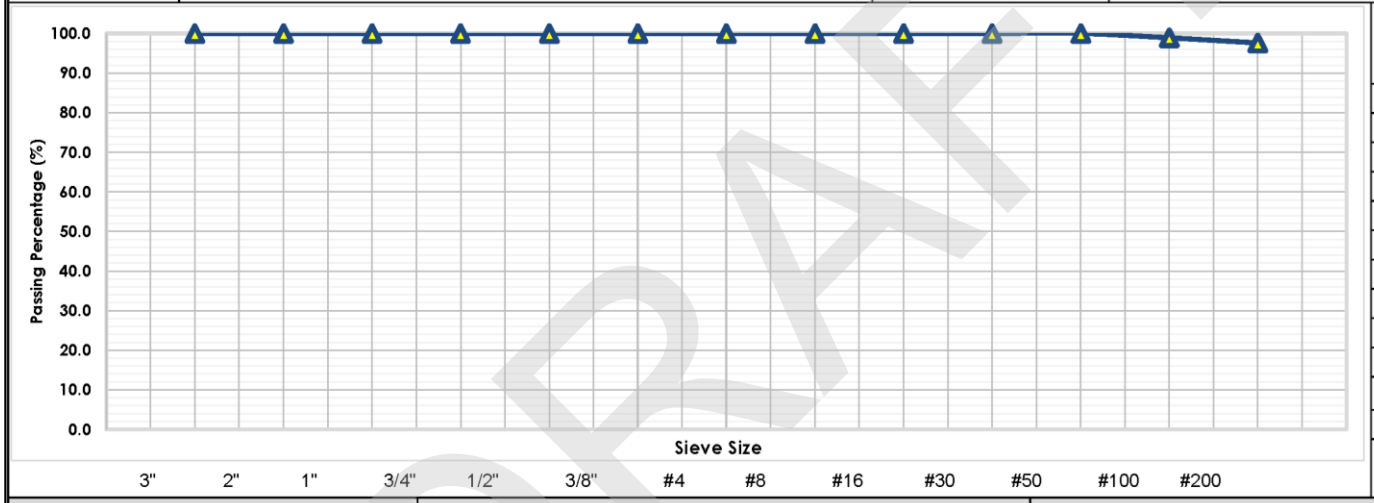
DRAFT

ASIAN GEOMATS

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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Canal Road, Ghotki.		
Borehole No:	1	**Sample No :**	2
Depth (ft) :	10.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	100.0
0.15	98.9
0.075	97.6

Gravel %	Sand %	Silt & Clay %
0	2	98

Tested By :

Checked By:

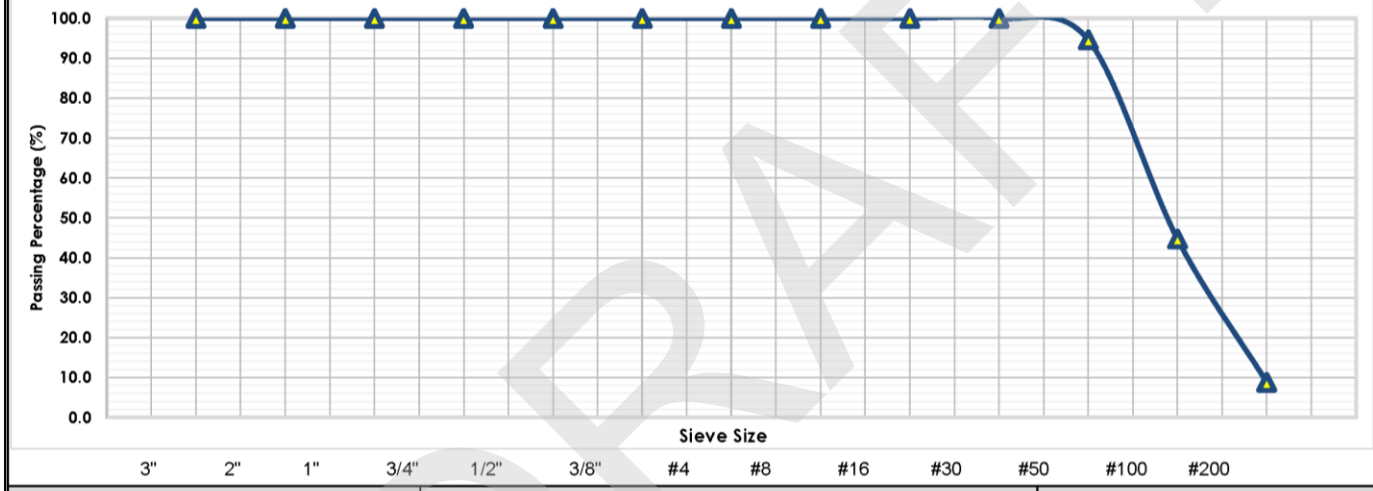
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ASIAN GEOMATS

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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Canal Road, Ghotki.		
Borehole No:	1	**Sample No :**	4
Depth (ft) :	20.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	94.6
0.15	44.7
0.075	8.8

Gravel %	Sand %	Silt & Clay %
0	91	9

Tested By :

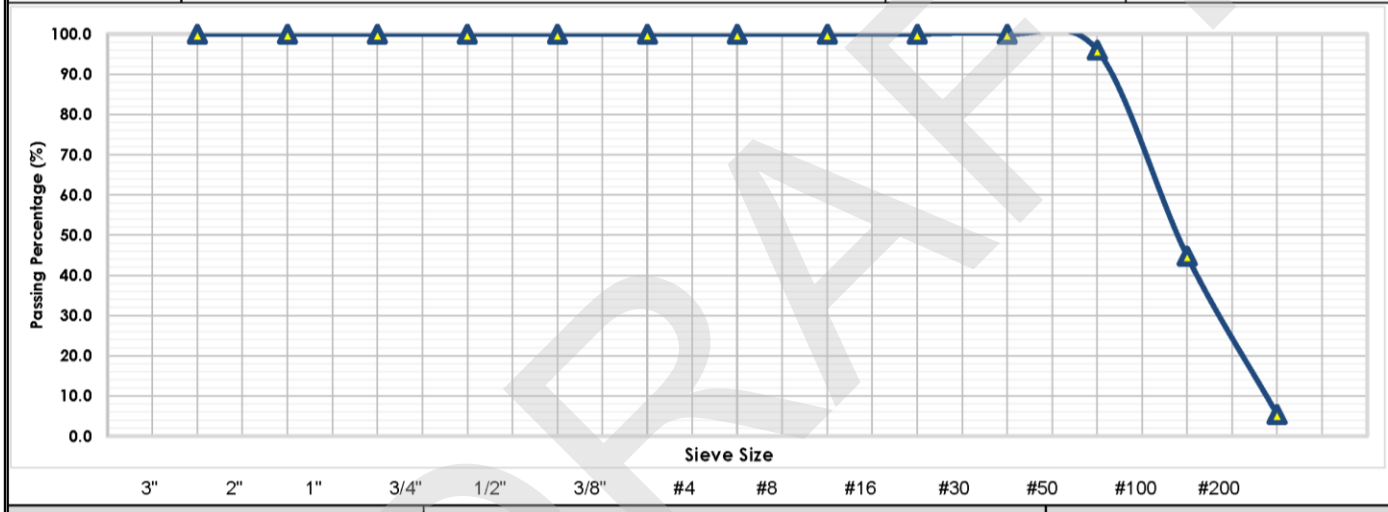
Checked By:

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ASIAN GEOMATS

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Canal Road, Ghotki.		
Borehole No:	1	**Sample No :**	6
Depth (ft) :	30.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	96.0
0.15	44.8
0.075	5.4

Gravel %	Sand %	Silt & Clay %
0	95	5

Tested By :

Checked By:

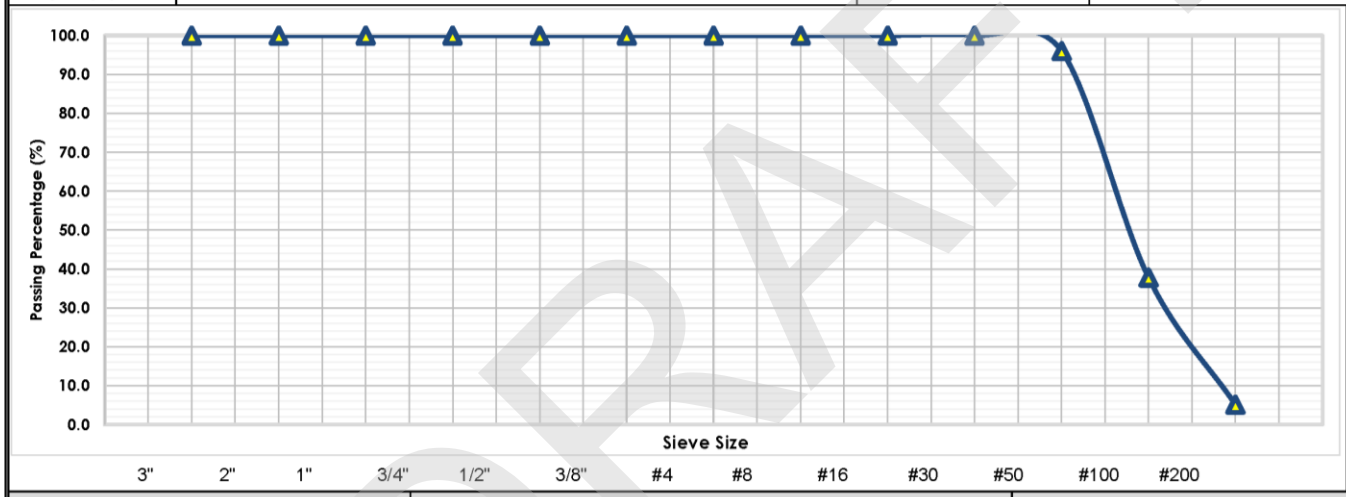
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Canal Road, Ghotki.		
Borehole No:	1	**Sample No :**	8
Depth (ft) :	40.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	96.0
0.15	37.8
0.075	5.1

Gravel %	Sand %	Silt & Clay %
0	95	5

Tested By :

Checked By:

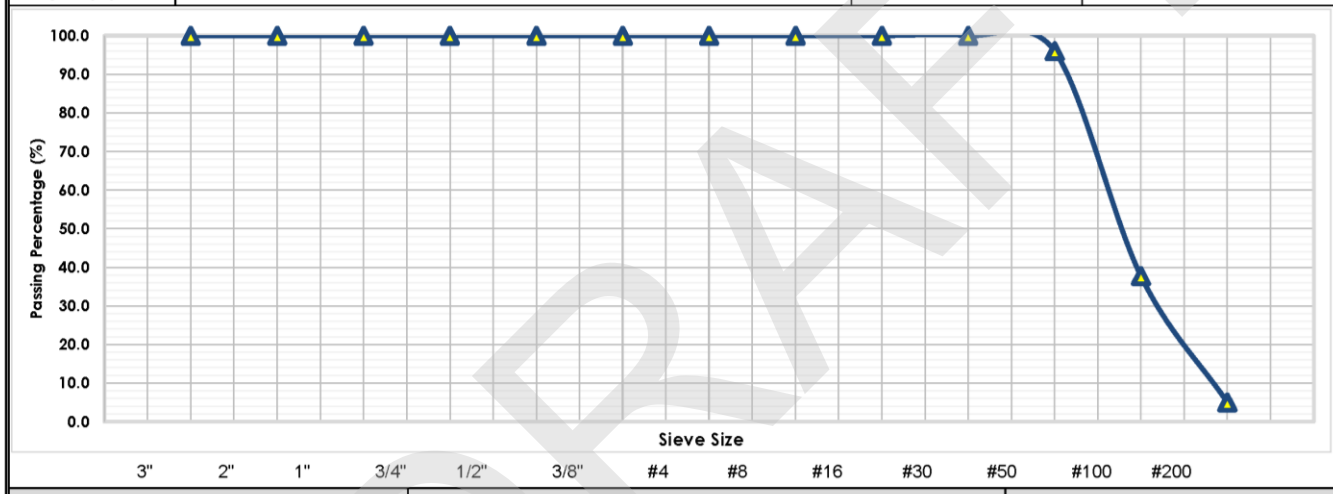
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Canal Road, Ghotki.		
Borehole No:	1	**Sample No :**	10
Depth (ft) :	50.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	96.0
0.15	37.7
0.075	5.0

Gravel %	Sand %	Silt & Clay %
0	95	5

Tested By :

Checked By:

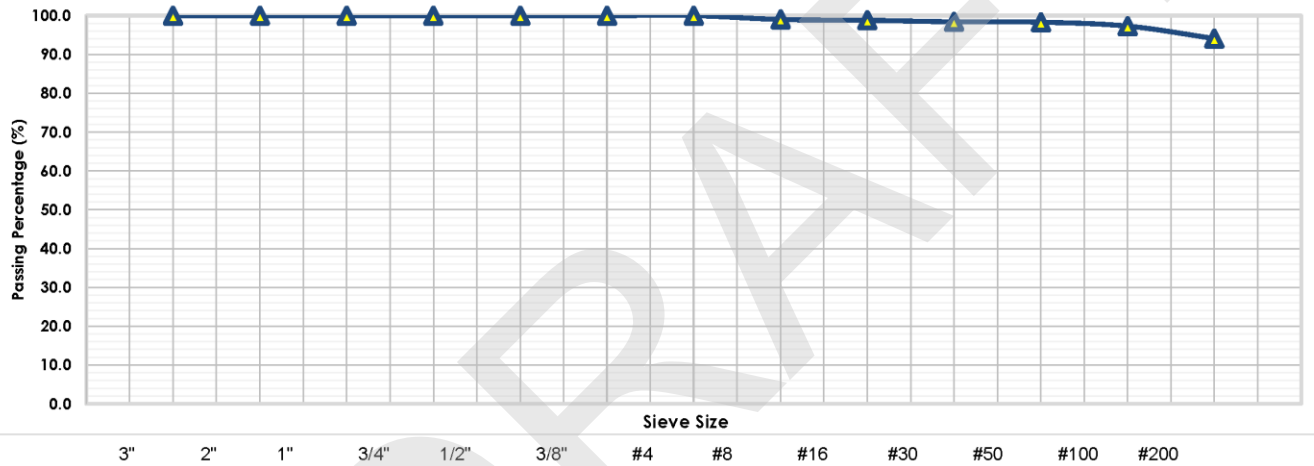
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Jindu Ghoto Road, Ghotki.		
Borehole No:	2	**Sample No :**	1
Depth (ft) :	5.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	99.0
1.18	98.8
0.6	98.4
0.3	98.3
0.15	97.3
0.075	94.1

Gravel %	Sand %	Silt & Clay %
0	6	94

Tested By :

Checked By:

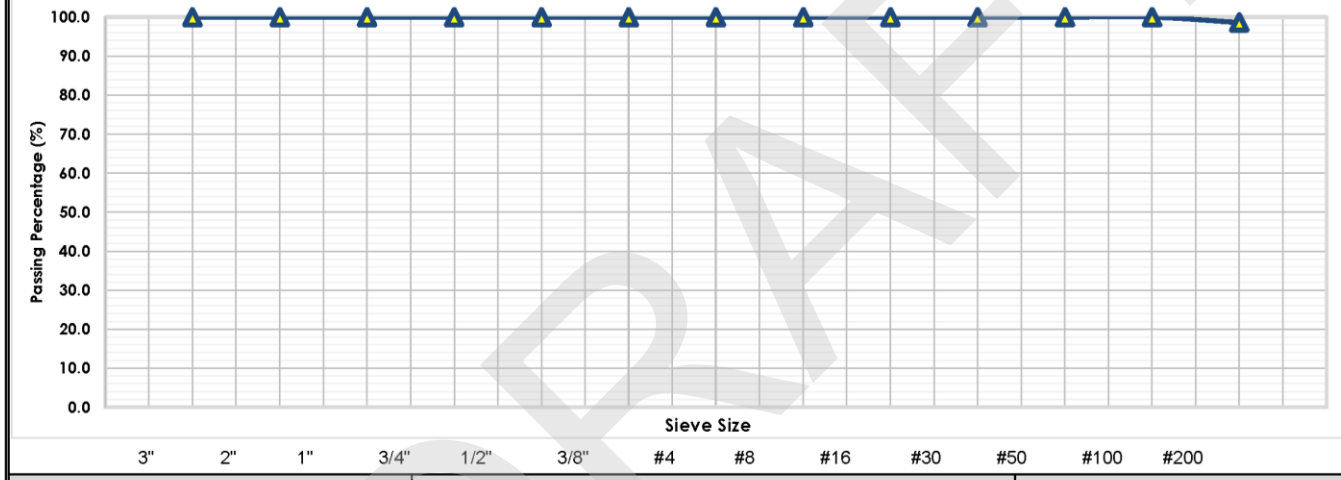
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Jindu Ghoto Road, Ghotki.		
Borehole No:	2	**Sample No :**	2
Depth (ft) :	10.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	100.0
0.15	100.0
0.075	98.6

Gravel %	Sand %	Silt & Clay %
0	1	99

Tested By :

Checked By:

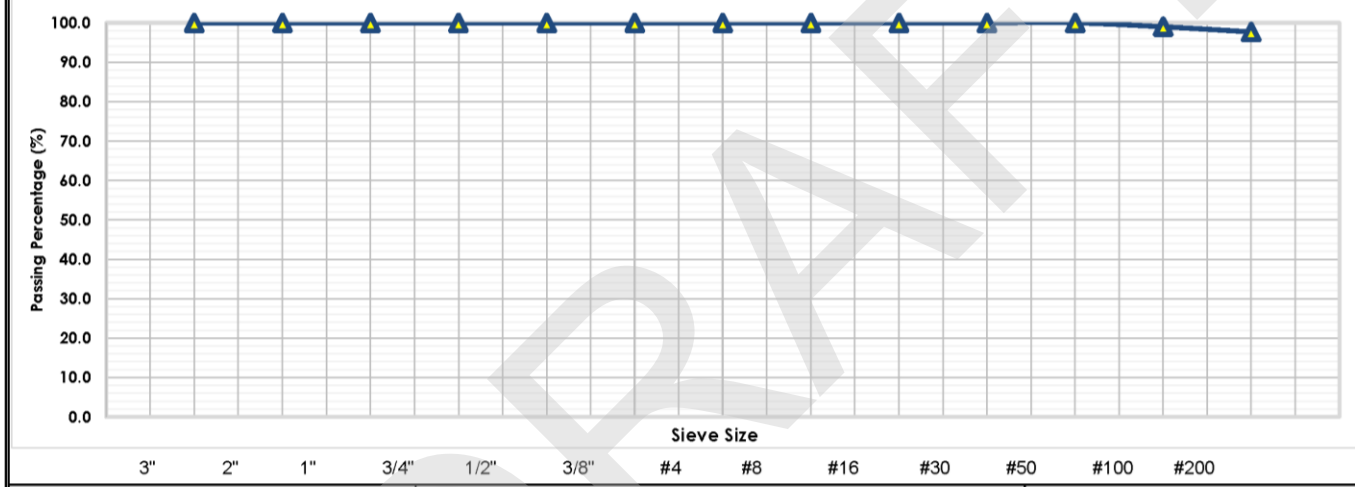
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Jindu Ghoto Road, Ghotki.		
Borehole No:	2	**Sample No :**	3
Depth (ft) :	15.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	100.0
0.15	99.0
0.075	97.7

Gravel %	Sand %	Silt & Clay %
0	2	98

Tested By :

Checked By:

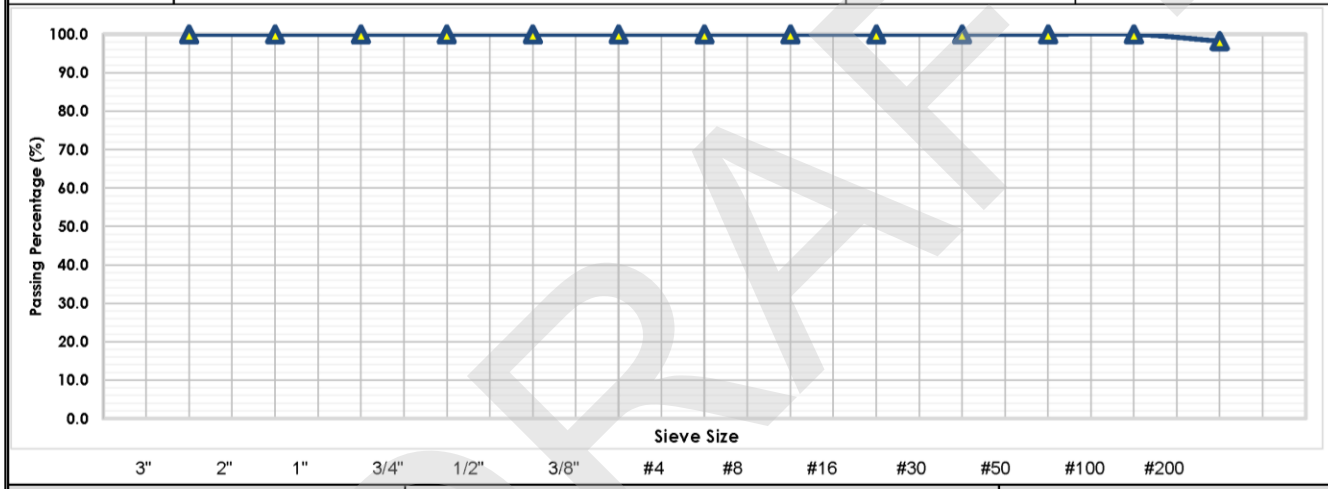
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Jindu Ghoto Road, Ghotki.		
Borehole No:	2	**Sample No :**	5
Depth (ft) :	25.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	100.0
0.15	100.0
0.075	98.2

Gravel %	Sand %	Silt & Clay %
0	2	98

Tested By :

Checked By:

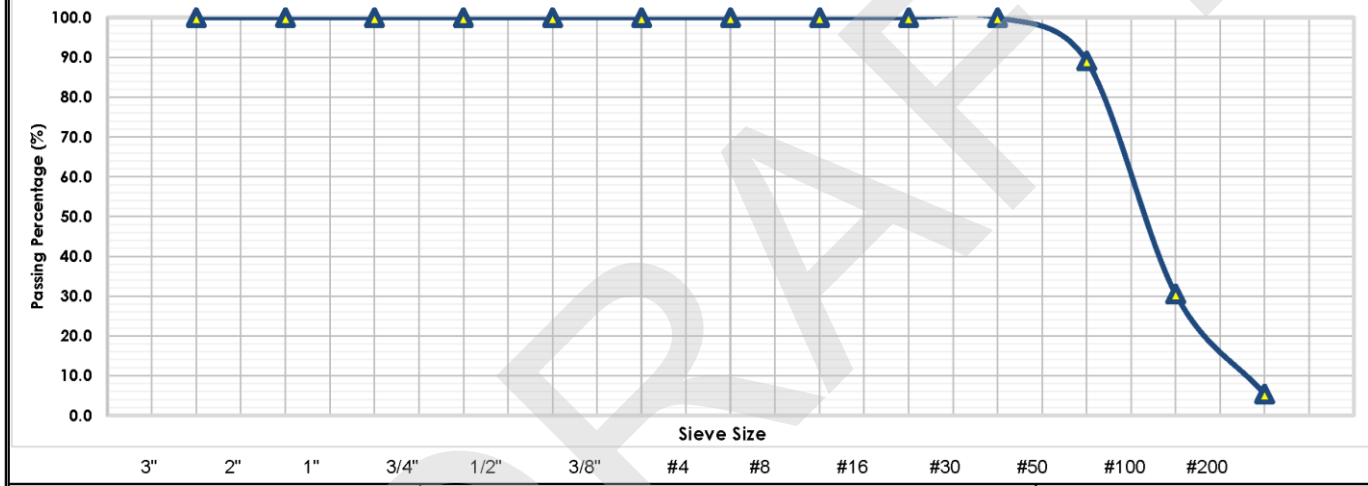
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Jindu Ghoto Road, Ghotki.		
Borehole No:	2	**Sample No :**	7
Depth (ft) :	35.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	89.1
0.15	30.5
0.075	5.4

Gravel %	Sand %	Silt & Clay %
0	95	5

Tested By :

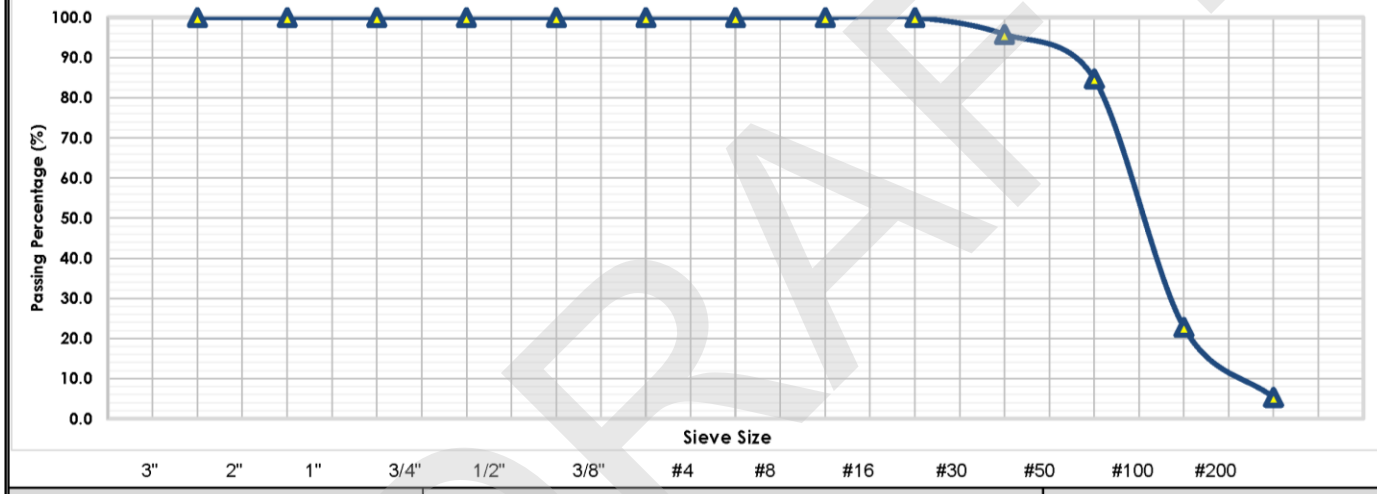
Checked By:

DRAFT

ASIAN GEOMATS

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Jindu Ghoto Road, Ghotki.		
Borehole No:	2	**Sample No :**	9
Depth (ft) :	45.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	95.8
0.3	84.7
0.15	22.8
0.075	5.3

Gravel %	Sand %	Silt & Clay %
0	95	5

Tested By :

Checked By:

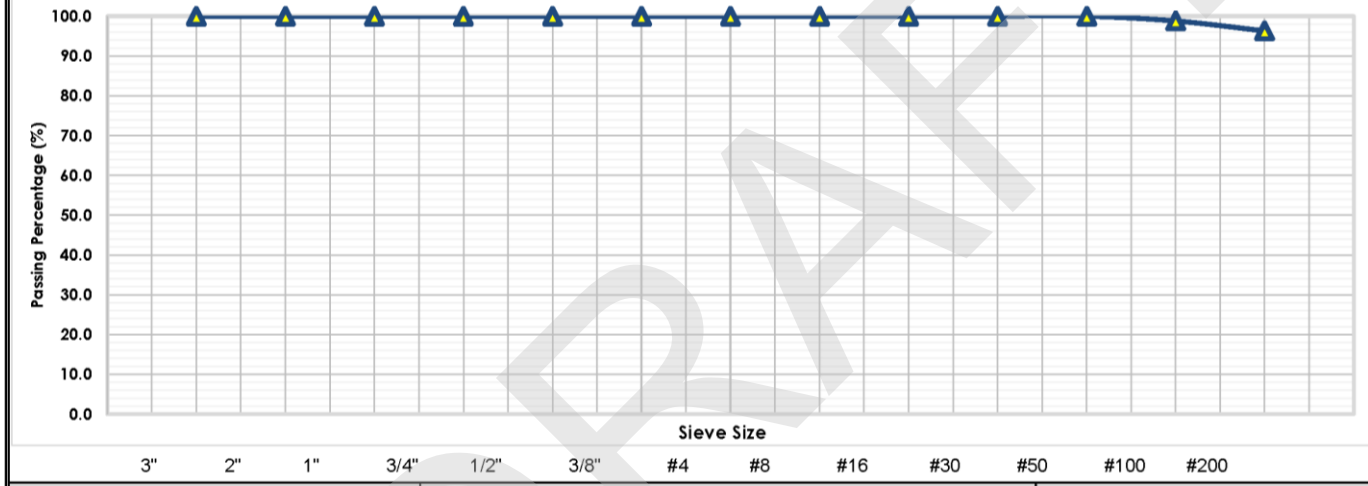
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Masso Khan Road, Ghotki.		
Borehole No:	3	**Sample No :**	1
Depth (ft) :	5.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	100.0
0.15	98.8
0.075	96.3

Gravel %	Sand %	Silt & Clay %
0	4	96

Tested By :

Checked By:

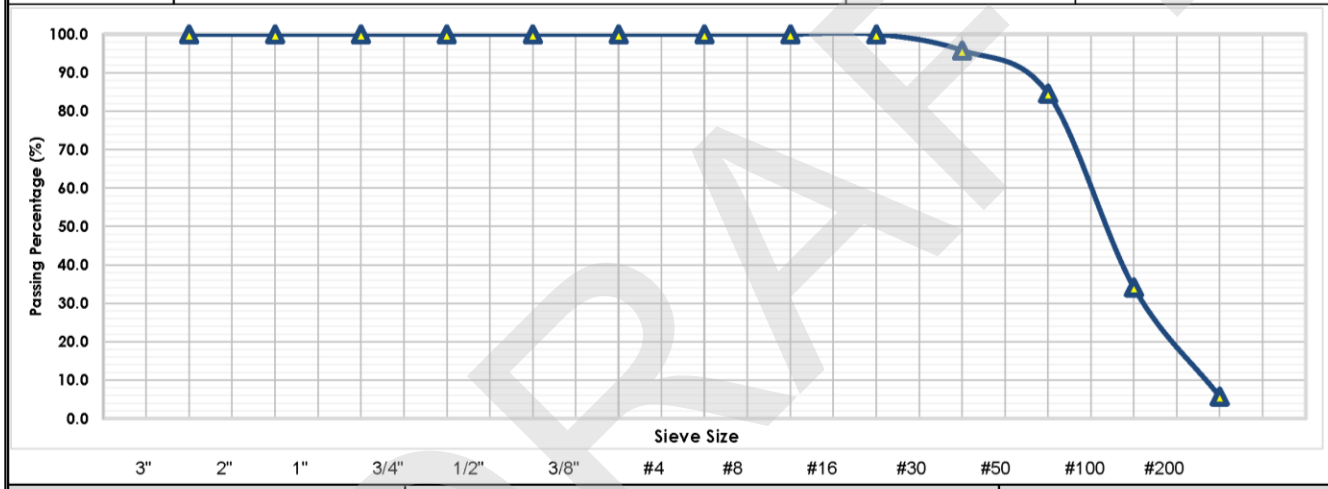
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ASIAN GEOMATS

www.asiangeomats.com

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Masso Khan Road, Ghotki.		
Borehole No:	3	**Sample No :**	2
Depth (ft) :	10.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	95.8
0.3	84.6
0.15	34.1
0.075	5.7

Gravel %	Sand %	Silt & Clay %
0	94	6

Tested By :

Checked By:

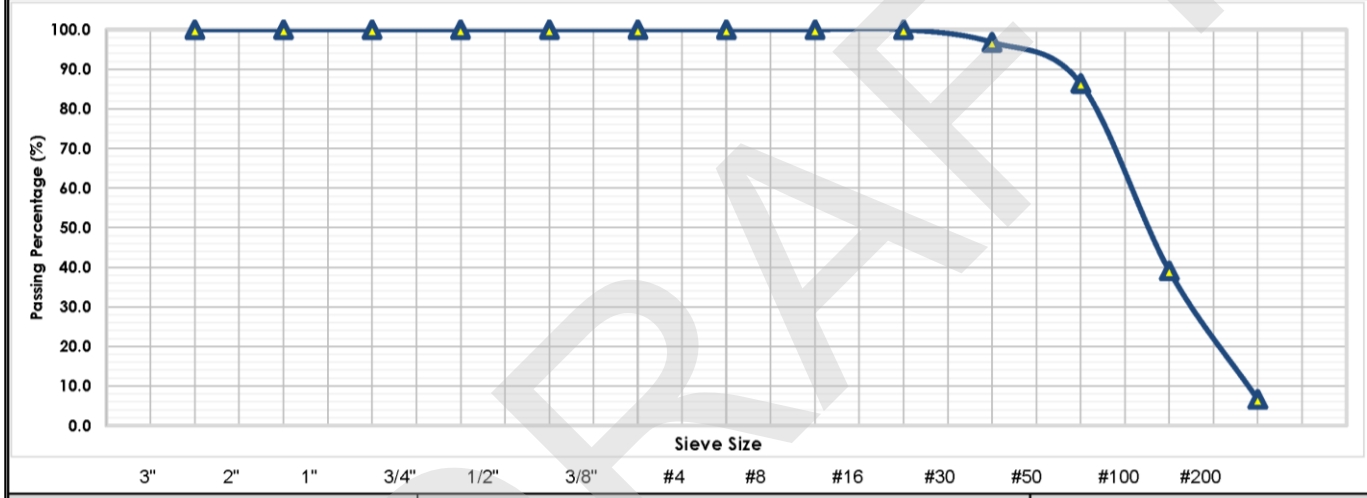
DRAFT

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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Masso Khan Road, Ghotki.		
Borehole No:	3	**Sample No :**	4
Depth (ft) :	20.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	96.8
0.3	86.4
0.15	39.1
0.075	6.6

Gravel %	Sand %	Silt & Clay %
0	93	7

Tested By :

Checked By:

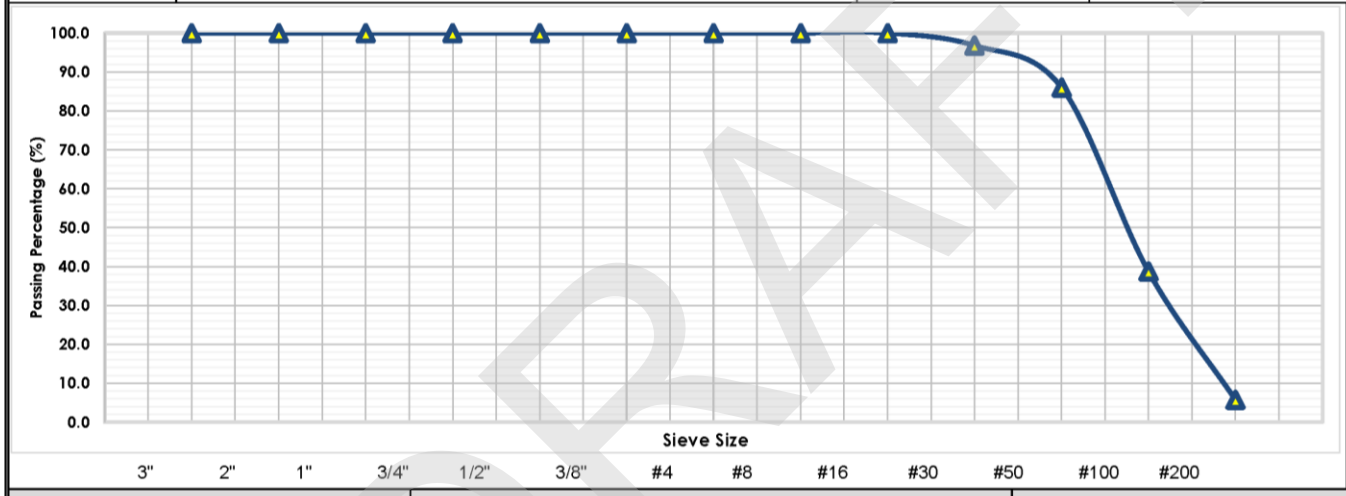
DRAFT

ASIAN GEOMATS

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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Masso Khan Road, Ghotki.		
Borehole No:	3	**Sample No :**	6
Depth (ft) :	30.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	96.8
0.3	86.0
0.15	38.7
0.075	5.7

Gravel %	Sand %	Silt & Clay %
0	94	6

Tested By :

Checked By:

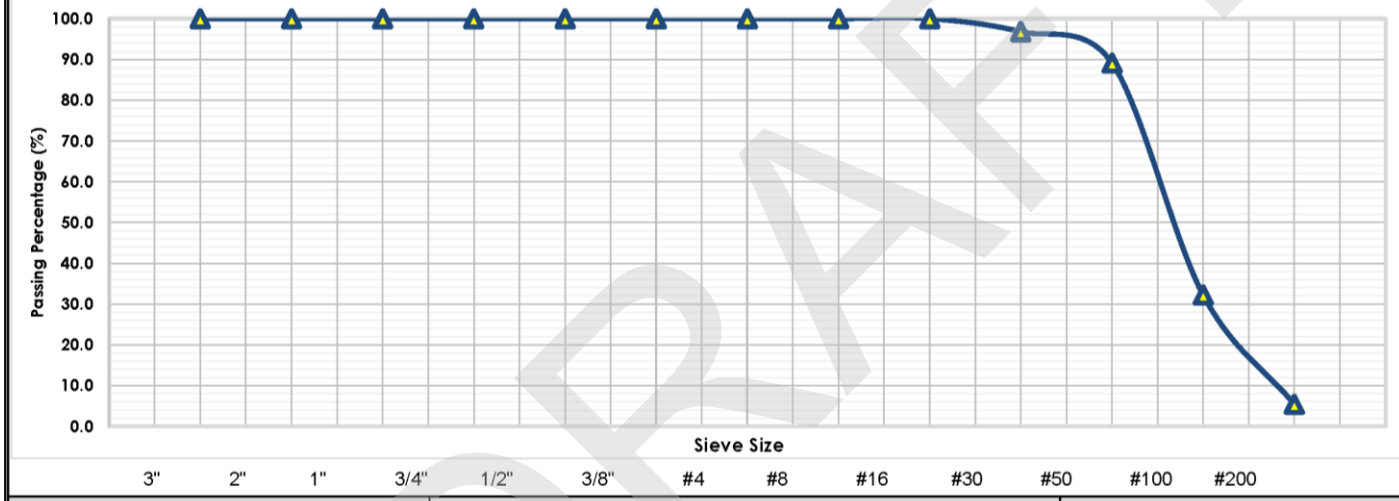
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Masso Khan Road, Ghotki.		
Borehole No:	3	**Sample No :**	8
Depth (ft) :	40.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	96.8
0.3	89.1
0.15	32.2
0.075	5.4

Gravel %	Sand %	Silt & Clay %
0	95	5

Tested By :

Checked By:

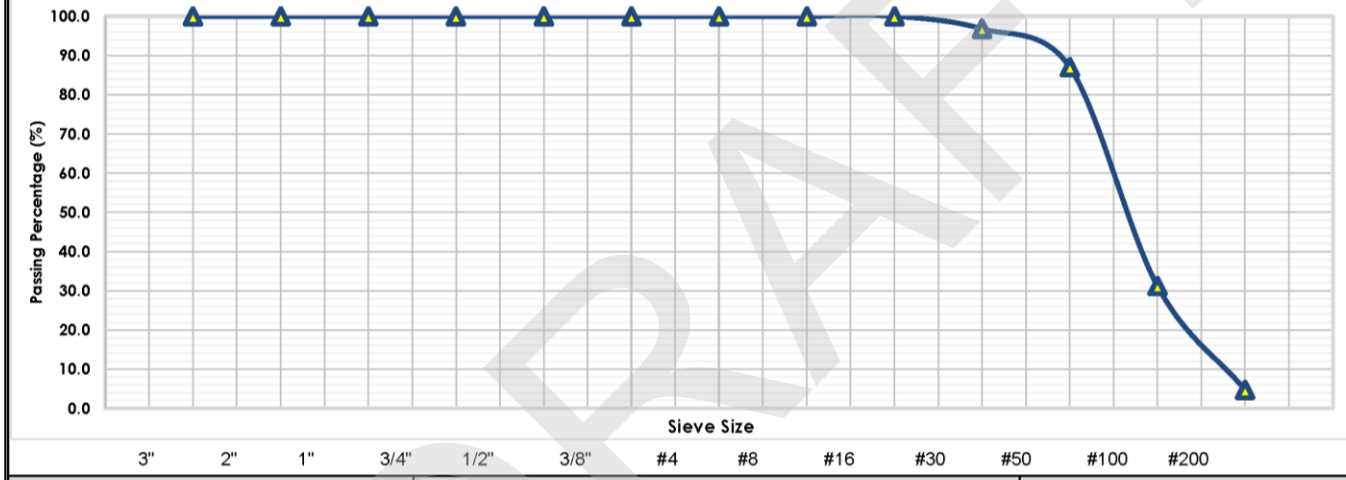
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Masso Khan Road, Ghotki.		
Borehole No:	3	**Sample No :**	10
Depth (ft) :	50.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	96.8
0.3	87.0
0.15	31.2
0.075	4.7

Gravel %	Sand %	Silt & Clay %
0	95	5

Tested By :

Checked By:

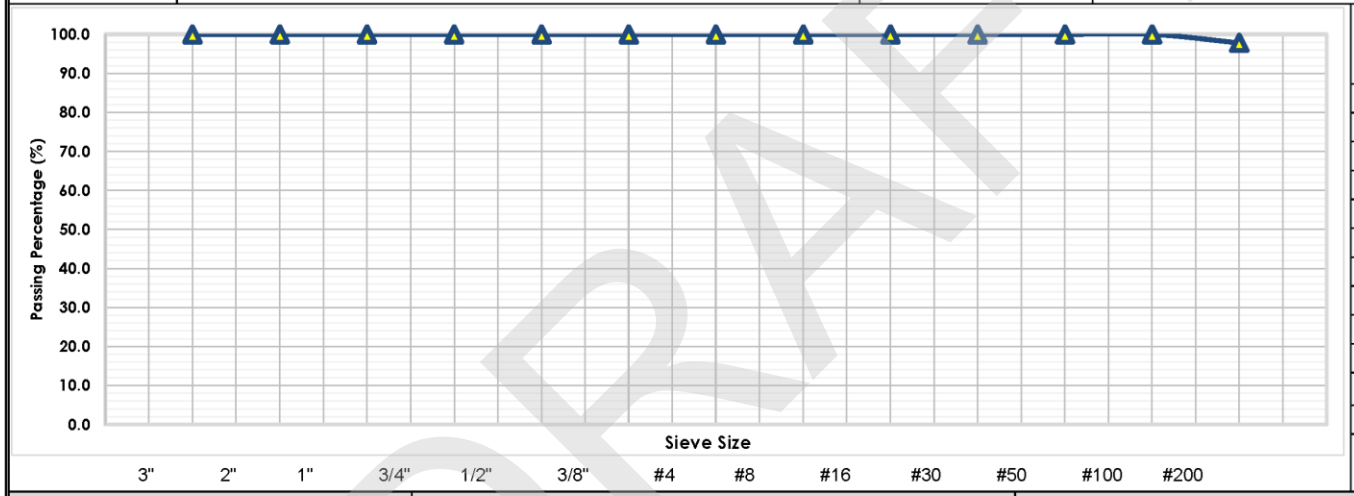
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Masso Khan Road, Ghotki.		
Borehole No:	4	**Sample No :**	1
Depth (ft) :	5.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	100.0
0.15	100.0
0.075	97.8

Gravel %	Sand %	Silt & Clay %
0	2	98

Tested By :

Checked By:

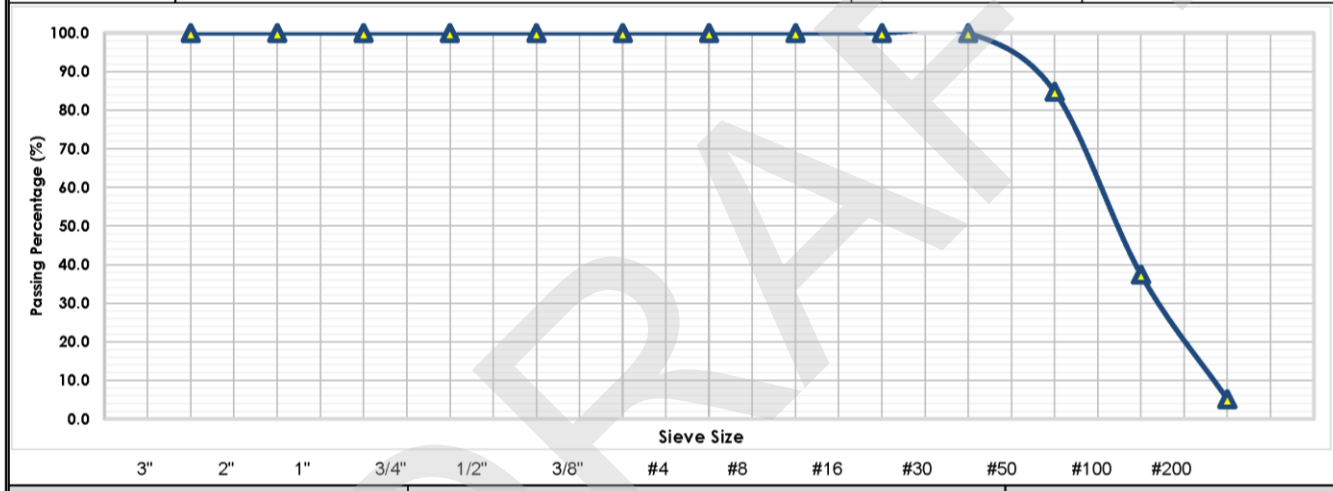
DRAFT

ASIAN GEOMATS

www.asiangeomats.com

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Masso Khan Road, Ghotki.		
Borehole No:	4	**Sample No :**	2
Depth (ft) :	10.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	84.8
0.15	37.4
0.075	5.1

Gravel %	Sand %	Silt & Clay %
0	95	5

Tested By :

Checked By:

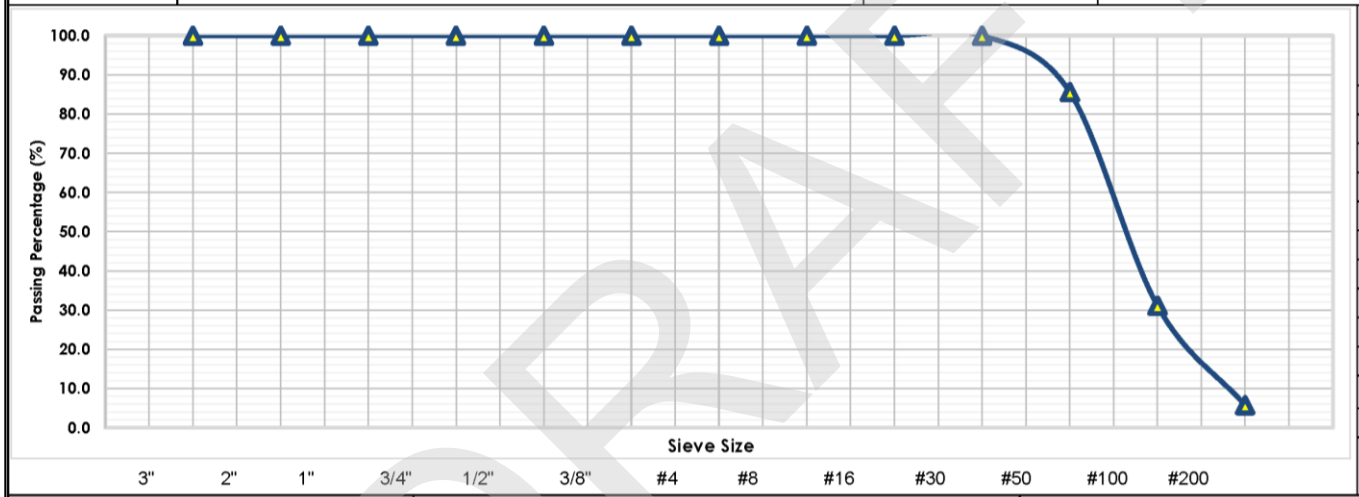
DRAFT

ASIAN GEOMATS

www.asiangeomats.com

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Masso Khan Road, Ghotki.		
Borehole No:	4	**Sample No :**	3
Depth (ft) :	15.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	85.6
0.15	31.1
0.075	5.7

Gravel %	Sand %	Silt & Clay %
0	94	6

Tested By :

Checked By:

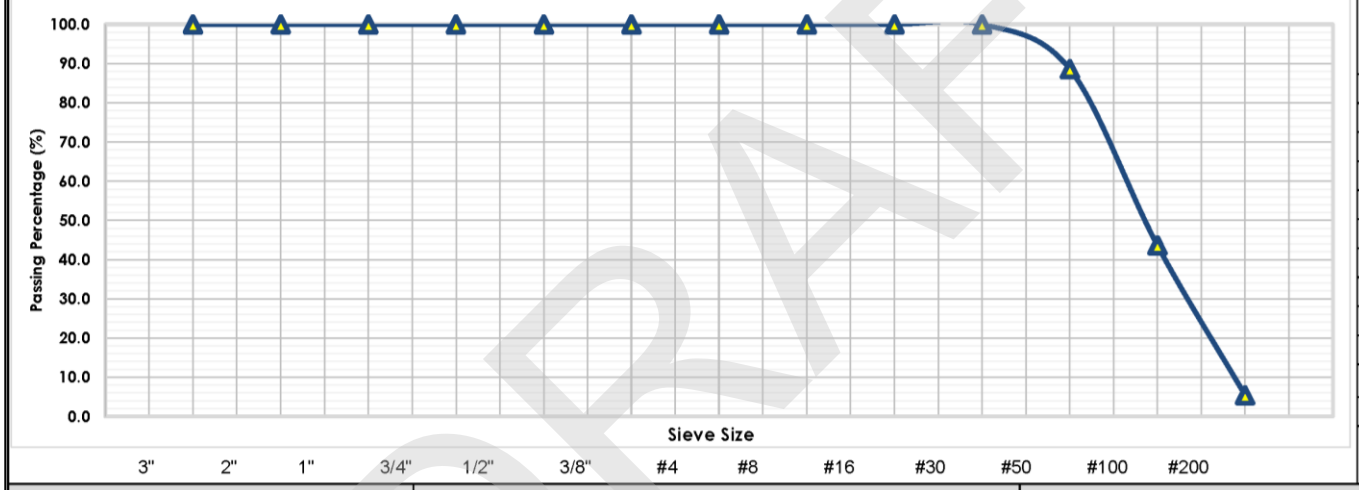
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ASIAN GEOMATS

www.asiangeomats.com

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Masso Khan Road, Ghotki.		
Borehole No:	4	**Sample No :**	5
Depth (ft) :	25.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	88.6
0.15	43.6
0.075	5.4

Gravel %	Sand %	Silt & Clay %
0	95	5

Tested By :

Checked By:

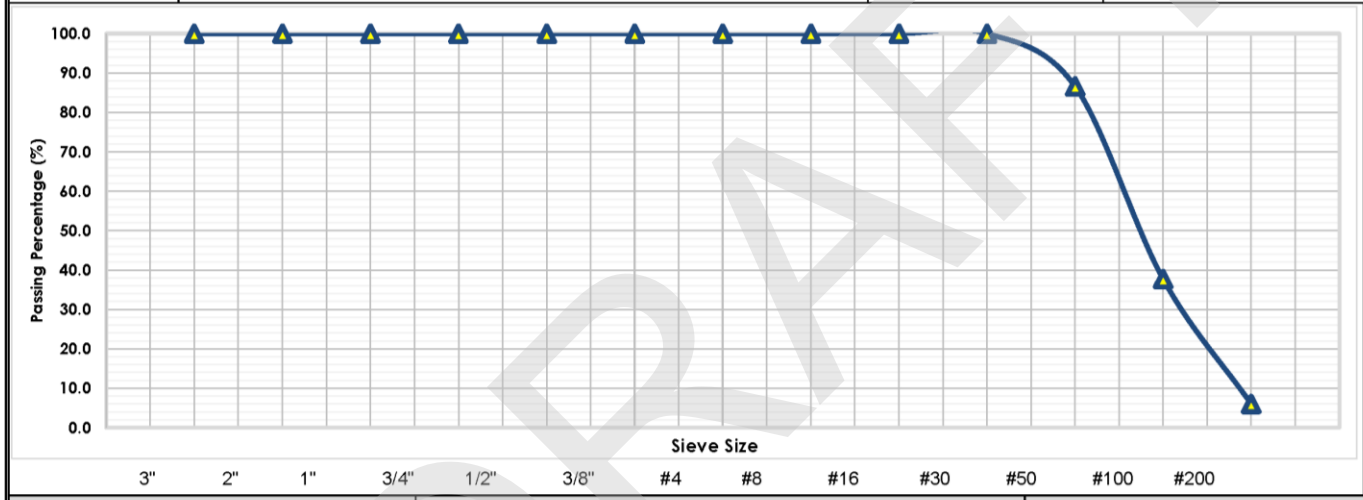
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ASIAN GEOMATS

www.asiangeomats.com

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Masso Khan Road, Ghotki.		
Borehole No:	4	**Sample No :**	7
Depth (ft) :	35.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	86.6
0.15	37.7
0.075	6.0

Gravel %	Sand %	Silt & Clay %
0	94	6

Tested By :

Checked By:

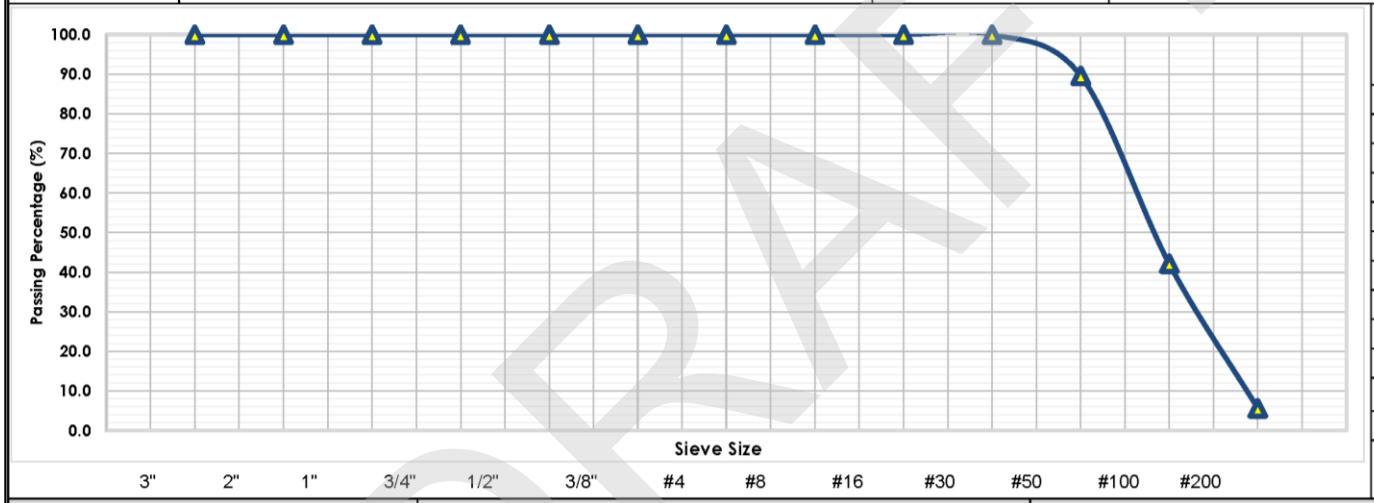
DRAFT

ASIAN GEOMATS

www.asiangeomats.com

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Masso Khan Road, Ghotki.		
Borehole No:	4	**Sample No :**	9
Depth (ft) :	45.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	89.6
0.15	42.1
0.075	5.6

Gravel %	Sand %	Silt & Clay %
0	94	6

Tested By :

Checked By:

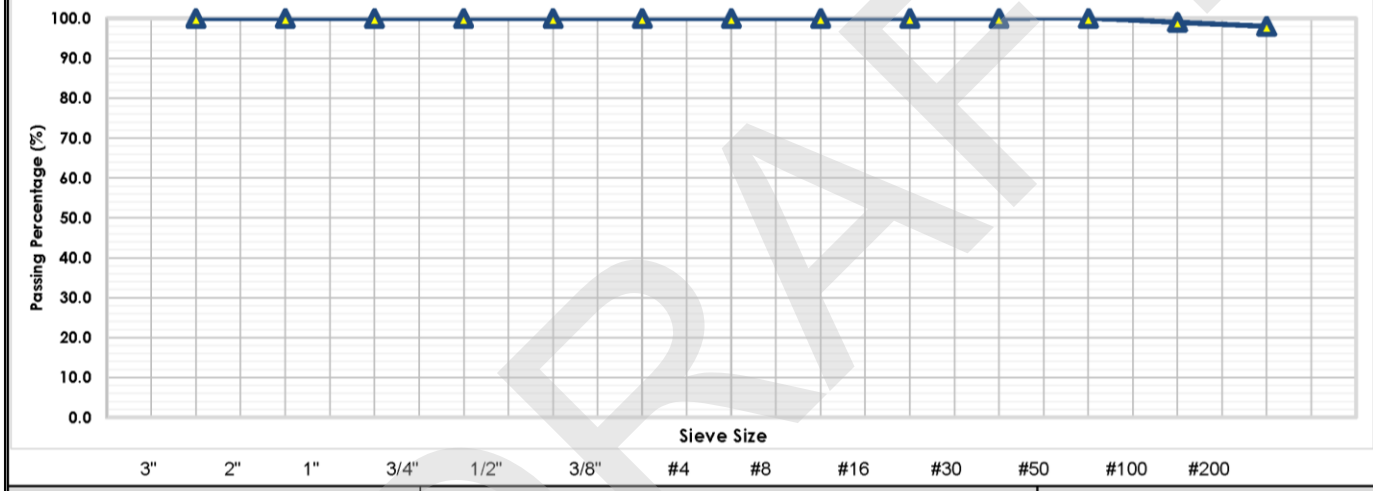
DRAFT

ASIAN GEOMATS

www.asiangeomats.com

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Near Railway Station, Ghotki.		
Borehole No:	5	**Sample No :**	1
Depth (ft) :	5.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	100.0
0.15	99.0
0.075	98.0

Gravel %	Sand %	Silt & Clay %
0	2	98

Tested By :

Checked By:

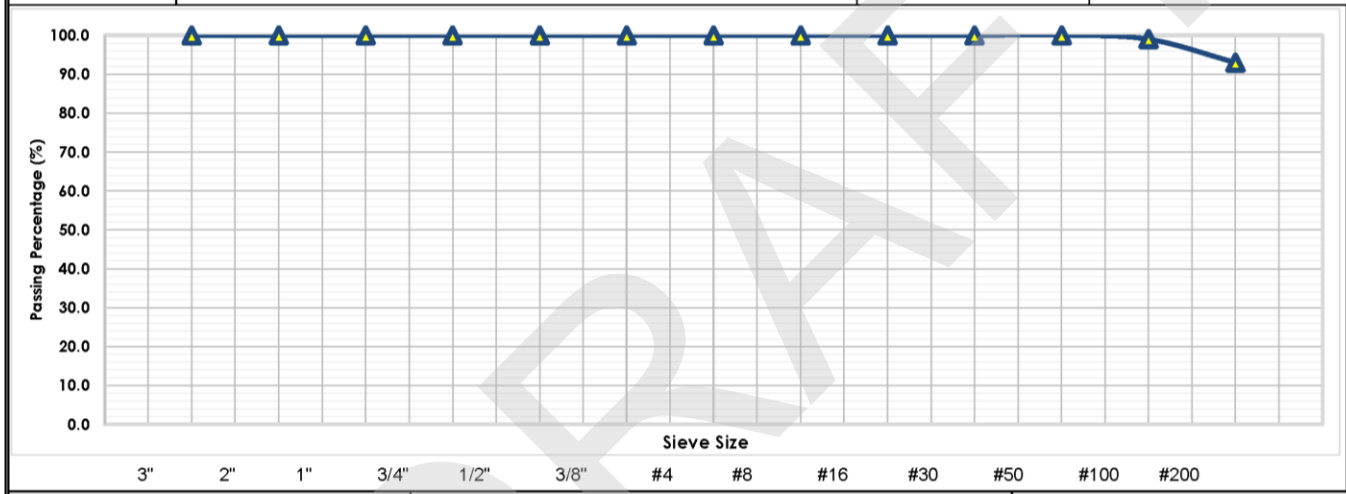
DRAFT

ASIAN GEOMATS

www.asiangeomats.com

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Near Railway Station, Ghotki.		
Borehole No:	5	**Sample No :**	2
Depth (ft) :	10.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	100.0
0.15	99.0
0.075	93.0

Gravel %	Sand %	Silt & Clay %
0	7	93

Tested By :

Checked By:

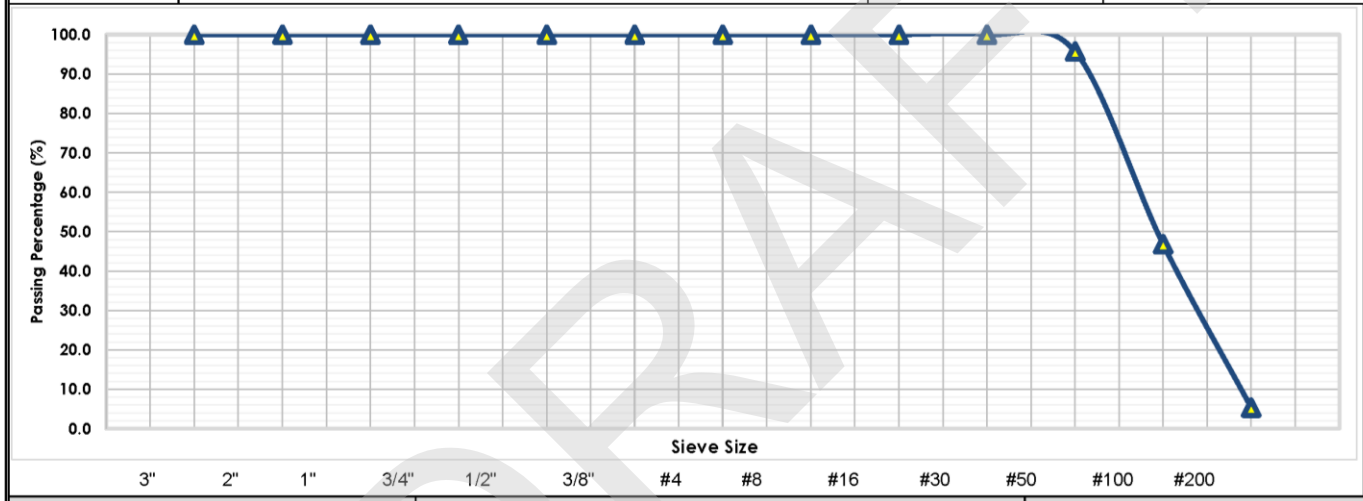
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ASIAN GEOMATS

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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Near Railway Station, Ghotki.		
Borehole No:	5	**Sample No :**	4
Depth (ft) :	20.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	95.7
0.15	46.8
0.075	5.3

Gravel %	Sand %	Silt & Clay %
0	95	5

Tested By :

Checked By:

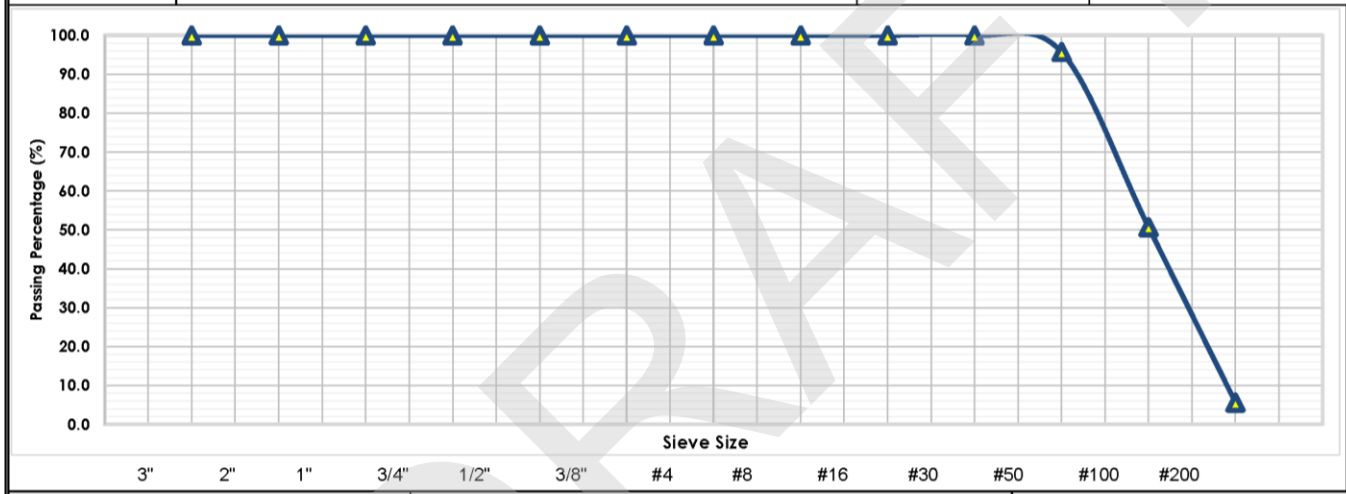
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Near Railway Station, Ghotki.		
Borehole No:	5	**Sample No :**	6
Depth (ft) :	30.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	95.7
0.15	50.7
0.075	5.6

Gravel %	Sand %	Silt & Clay %
0	94	6

Tested By :

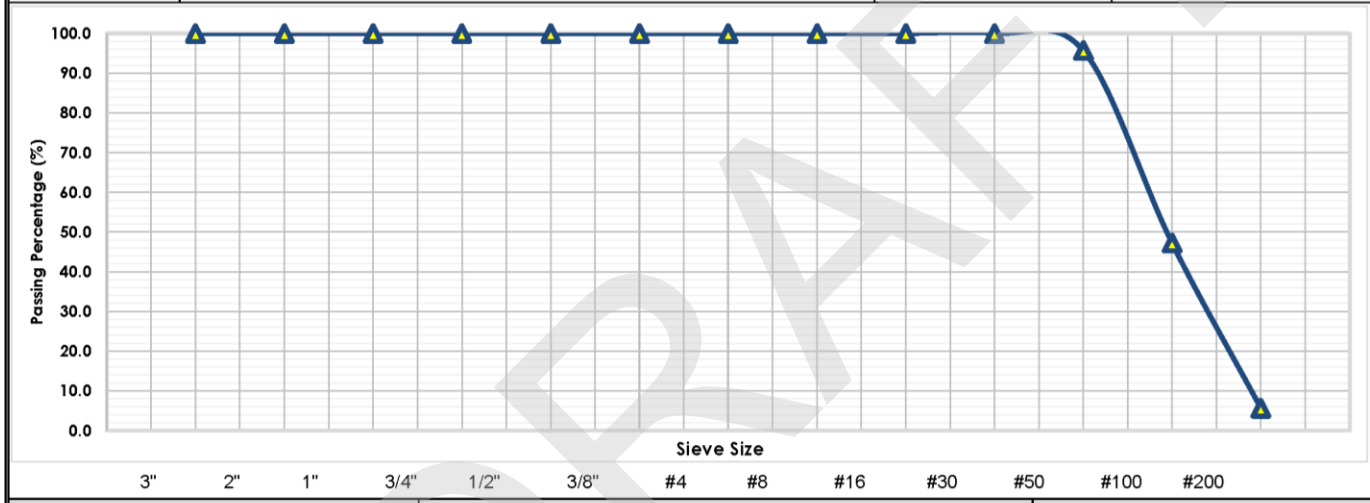
Checked By:

DRAFT

ASIAN GEOMATS

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Near Railway Station, Ghotki.		
Borehole No:	5	**Sample No :**	8
Depth (ft) :	40.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	95.7
0.15	47.2
0.075	5.6

Gravel %	Sand %	Silt & Clay %
0	94	6

Tested By :

Checked By:

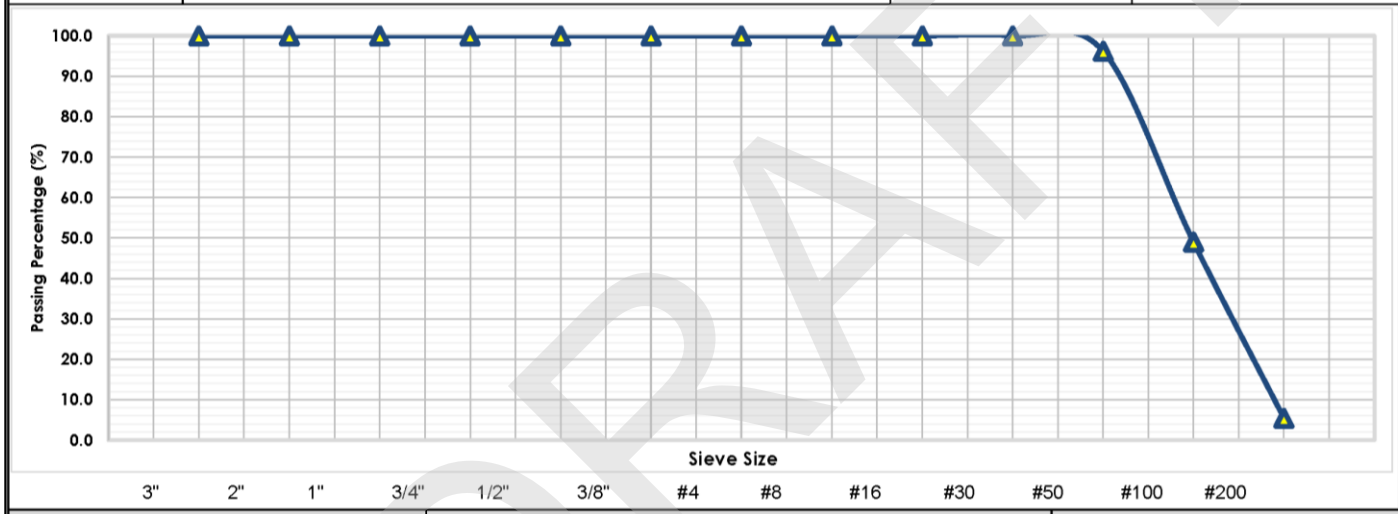
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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Near Railway Station, Ghotki.		
Borehole No:	5	**Sample No :**	10
Depth (ft) :	50.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	96.2
0.15	49.0
0.075	5.4

Gravel %	Sand %	Silt & Clay %
0	95	5

Tested By :

Checked By:

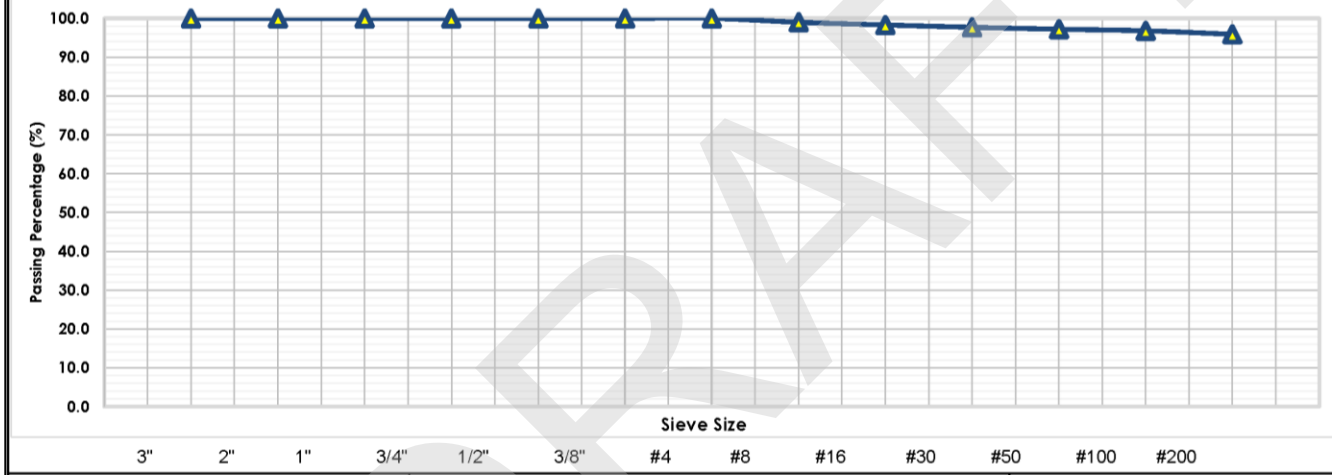
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ASIAN GEOMATS

www.asiangeomats.com

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Jindu Ghoto Road, Ghotki.		
Borehole No:	5	**Sample No :**	1
Depth (ft) :	5.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	99.0
1.18	98.3
0.6	97.7
0.3	97.2
0.15	96.8
0.075	95.9

Gravel %	Sand %	Silt & Clay %
0	4	96

Tested By :

Checked By:

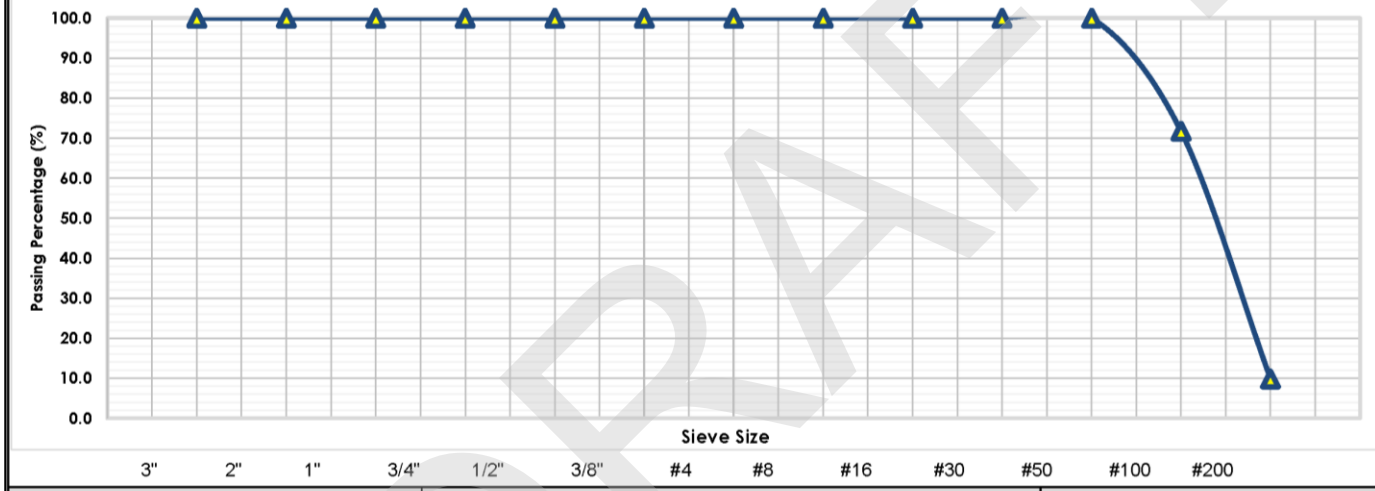
DRAFT

ASIAN GEOMATS

www.asiangeomats.com

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Jindu Ghoto Road, Ghotki.		
Borehole No:	5	**Sample No :**	2
Depth (ft) :	10.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	100.0
0.15	71.7
0.075	9.8

Gravel %	Sand %	Silt & Clay %
0	90	10

Tested By :

Checked By:

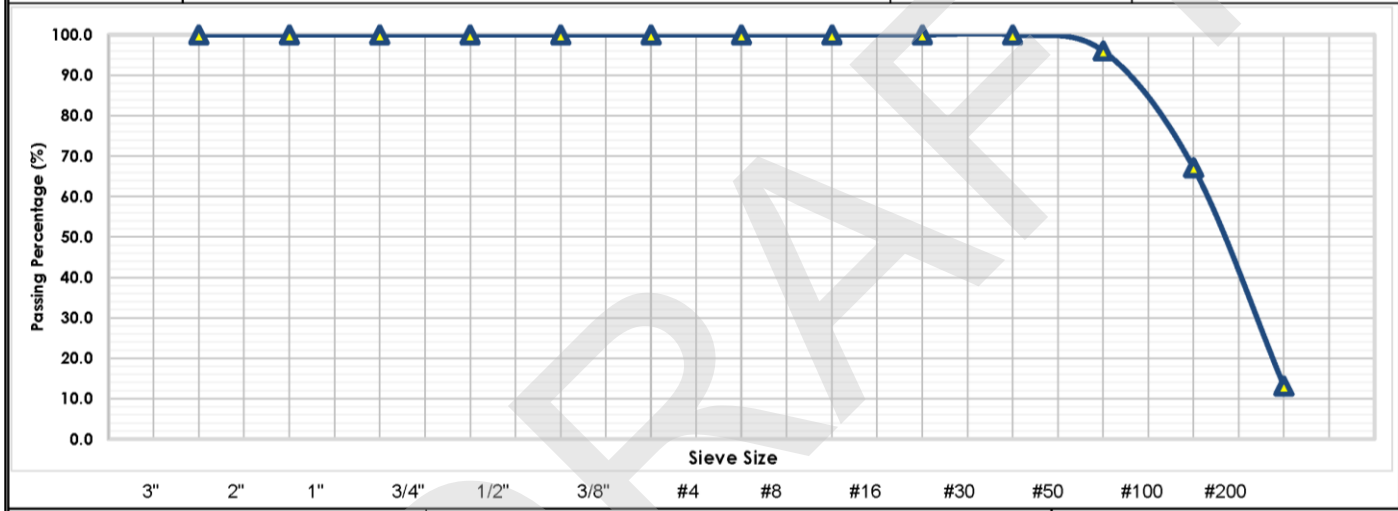
DRAFT

ASIAN GEOMATS

www.asiangeomats.com

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Jindu Ghoto Road, Ghotki.		
Borehole No:	5	**Sample No :**	3
Depth (ft) :	15.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	96.0
0.15	67.1
0.075	13.1

Gravel %	Sand %	Silt & Clay %
0	87	13

Tested By :

Checked By:

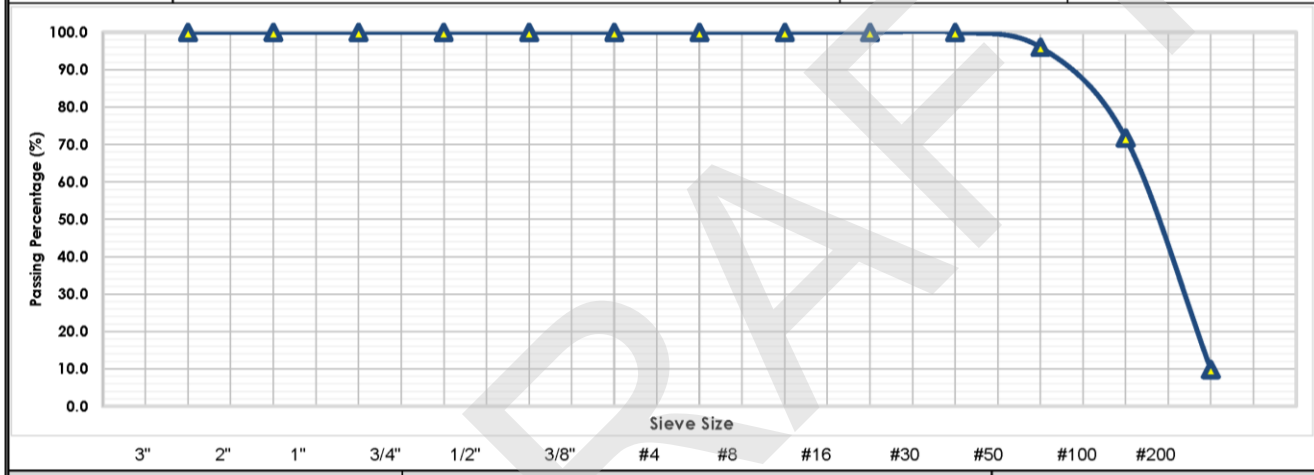
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ASIAN GEOMATS

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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Jindu Ghoto Road, Ghotki.		
Borehole No:	5	**Sample No :**	5
Depth (ft) :	25.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	96.0
0.15	71.7
0.075	9.8

Gravel %	Sand %	Silt & Clay %
0	90	10

Tested By :

Checked By:

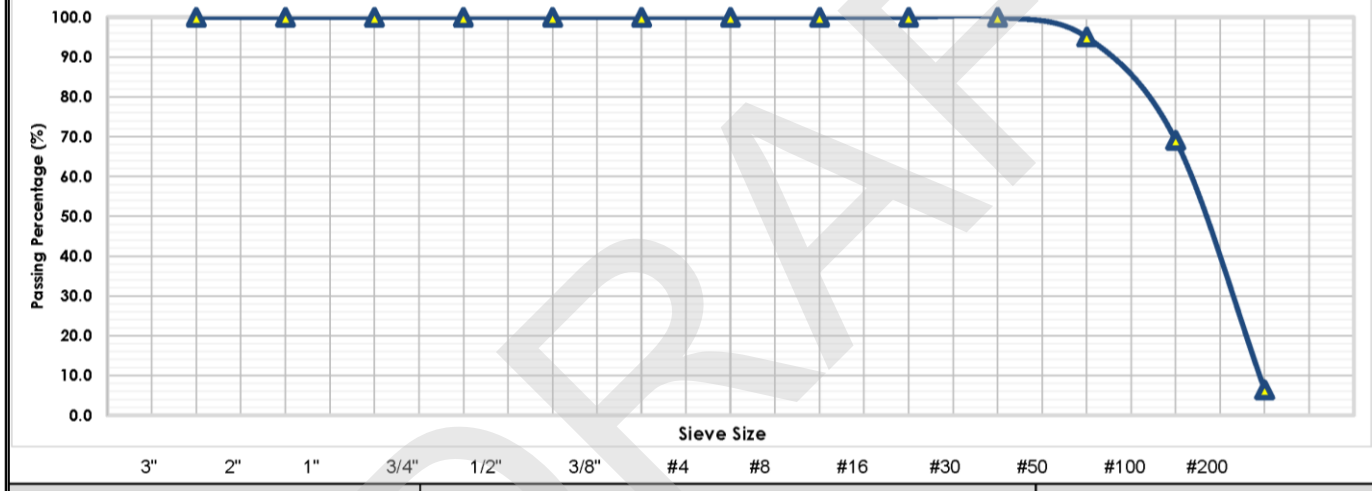
DRAFT

ASIAN GEOMATS

www.asiangeomats.com

Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Jindu Ghoto Road, Ghotki.		
Borehole No:	5	**Sample No :**	7
Depth (ft) :	35.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	95.0
0.15	69.1
0.075	6.4

Gravel %	Sand %	Silt & Clay %
0	94	6

Tested By :

Checked By:

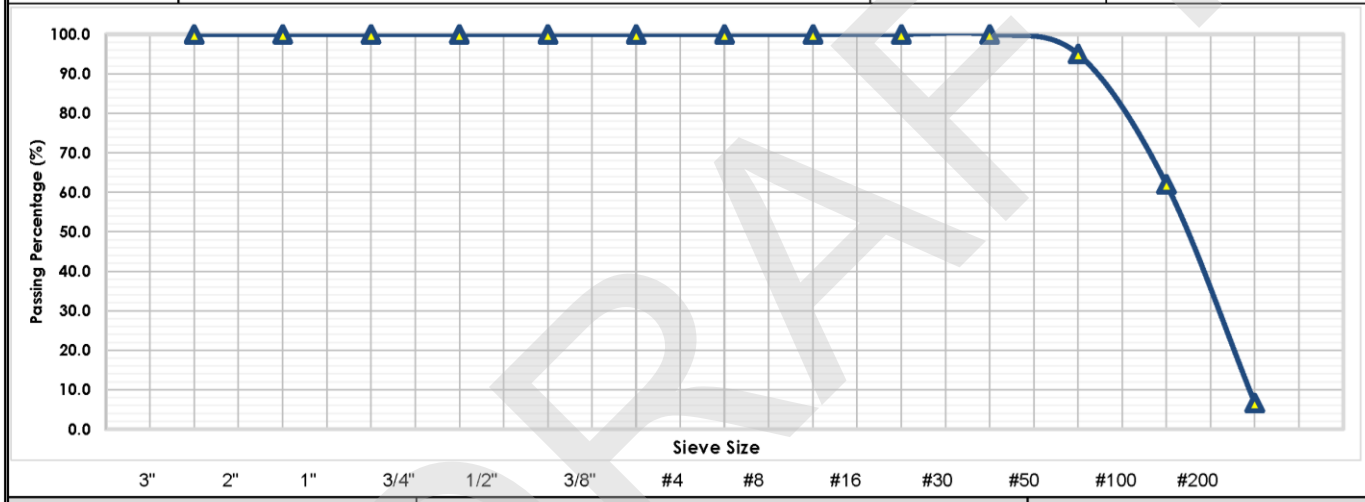
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ASIAN GEOMATS

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Grain Size Analysis (AASHTO T-89,90)(ASTM D-208,209,210)

Project :	Jindu Ghoto Road, Ghotki.		
Borehole No:	5	**Sample No :**	9
Depth (ft) :	45.0	**Date :**	30/07/2025



Sieve Size Inch/No	Passing % age
3"	100.0
2"	100.0
1"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
4.75	100.0
2.36	100.0
1.18	100.0
0.6	100.0
0.3	95.0
0.15	62.0
0.075	6.6

Gravel %	Sand %	Silt & Clay %
0	93	7

Tested By :

Checked By:

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E) Pictures


ASIAN GEOMATS
G.T.Rd
Station Rd
IRRIGATION COLONY
Ghotki
Adilpur Rd
Qadria Factory Rd
Google
7/24/25 17:09
27.9947N 69.3142E
Altitude:75.0m
Speed:0.0km/h
#BH -05 #GHOTKI Sindh pakistan


ASIAN GEOMATS
G.T.Rd
Station Rd
IRRIGATION COLONY
Ghotki
Adilpur Rd
Qadria Factory Rd
Google
7/24/25 17:09
27.9948N 69.3141E
Sindh
Altitude:78.9m
Speed:0.0km/h
#BH -05 #GHOTKI Sindh pakistan


ASIAN GEOMATS
7/24/25 17:10
27.9948N 69.3142E
Sindh
Altitude:81.7m
Speed:0.0km/h
#BH -05 #GHOTKI Sindh pakistan
IRRIGATION COLONY
Ghotki
Station Rd
Adilpur Rd
Qadria Factory Rd
Google


ASIAN GEOMATS
7/24/25 17:10
27.9948N 69.3142E
Sindh
Altitude:79.8m
Speed:4.4km/h
#BH -05 #GHOTKI Sindh pakistan
G.T Rd
Station Rd
IRRIGATION COLONY
Ghotki
Adilpur Rd
Qadria Factory Rd
Google

DRAFT

F) Summary

ASIAN GEOMATS

Summary Sheet of Laboratory Test Results

Project : Canal Road, Ghotki.

BH No.	Depth (ft)	Sample	Soil Strata			Atteberg,s Limits			Soil Classification	
			Gravel (%)	Sand (%)	Silt & Clay (%)	LL	PL	PI	Group Symbol	Group Name
1	5	SPT-1	0	2	98	27.7	21.2	6.5	CL-ML	Silty Clay
	10	SPT-2	0	2	98	27.7	21.2	6.5	CL-ML	Silty Clay
	20	SPT-4	0	91	9	Non Plastic			SP-SM	Poorly graded Sand with Silt
	30	SPT-6	0	95	5	Non Plastic			SP-SM	Poorly graded Sand with Silt
	40	SPT-8	0	95	5	Non Plastic			SP-SM	Poorly graded Sand with Silt
	50	SPT-10	0	95	5	Non Plastic			SP-SM	Poorly graded Sand with Silt

Tested By Checked by

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ASIAN GEOMATS

www.asiangeomats.com

Summary Sheet of Laboratory Test Results

Project : Jindu Ghoto Road, Ghotki.

BH No.	Depth (ft)	Sample	Soil Strata			Atteberg,s Limits			Soil Classification	
			Gravel (%)	Sand (%)	Silt & Clay (%)	LL	PL	PI	Group Symbol	Group Name
2	5	SPT-1	0	6	94	27.2	21.3	5.9	CL-ML	Silty Clay
	10	SPT-2	0	1	99	28.3	21.4	6.9	CL-ML	Silty Clay
	15	SPT-3	0	2	98	27.9	21.3	6.6	CL-ML	Silty Clay
	25	SPT-5	0	2	98	27.9	21.3	6.6	CL-ML	Silty Clay
	35	SPT-7	0	95	5	Non Plastic			SP-SM	Poorly graded Sand with Silt
	45	SPT-9	0	95	5	Non Plastic			SP-SM	Poorly graded Sand with Silt

Tested By

Checked by

DRAFT

ASIAN GEOMATS

www.asiangeomats.com

Summary Sheet of Laboratory Test Results

Project : Masso Khan Road, Ghotki.

BH No.	Depth (ft)	Sample	Soil Strata			Atteberg,s Limits			Soil Classification	
			Gravel (%)	Sand (%)	Silt & Clay (%)	LL	PL	PI	Group Symbol	Group Name
3	5	SPT-1	0	4	96	27.5	21.2	6.3	CL-ML	Silty Clay
	10	SPT-2	0	94	6	Non Plastic			SP-SM	Poorly graded Sand with Silt
	20	SPT-4	0	93	7	Non Plastic			SP-SM	Poorly graded Sand with Silt
	30	SPT-6	0	94	6	Non Plastic			SP-SM	Poorly graded Sand with Silt
	40	SPT-8	0	95	5	Non Plastic			SP-SM	Poorly graded Sand with Silt
	50	SPT-10	0	95	5	Non Plastic			SP-SM	Poorly graded Sand with Silt

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Summary Sheet of Laboratory Test Results

Project : Masso Khan Road, Ghotki.

BH No.	Depth (ft)	Sample	Soil Strata			Atteberg,s Limits			Soil Classification	
			Gravel (%)	Sand (%)	Silt & Clay (%)	LL	PL	PI	Group Symbol	Group Name
4	5	SPT-1	0	2	98	27.9	21.3	6.6	CL-ML	Silty Clay
	10	SPT-2	0	95	5	Non Plastic			SP-SM	Poorly graded Sand with Silt
	15	SPT-3	0	94	6	Non Plastic			SP-SM	Poorly graded Sand with Silt
	25	SPT-5	0	95	5	Non Plastic			SP-SM	Poorly graded Sand with Silt
	35	SPT-7	0	94	6	Non Plastic			SP-SM	Poorly graded Sand with Silt
	45	SPT-9	0	94	6	Non Plastic			SP-SM	Poorly graded Sand with Silt

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Summary Sheet of Laboratory Test Results

Project : Near Railway Station, Ghotki.

BH No.	Depth (ft)	Sample	Soil Strata			Atteberg,s Limits			Soil Classification	
			Gravel (%)	Sand (%)	Silt & Clay (%)	LL	PL	PI	Group Symbol	Group Name
5	5	SPT-1	0	2	98	27.8	21.3	6.5	CL-ML	Silty Clay
	10	SPT-2	0	7	93	27.2	21.1	6.1	CL-ML	Silty Clay
	20	SPT-4	0	95	5	Non Plastic			SP-SM	Poorly graded Sand with Silt
	30	SPT-6	0	94	6	Non Plastic			SP-SM	Poorly graded Sand with Silt
	40	SPT-8	0	94	6	Non Plastic			SP-SM	Poorly graded Sand with Silt
	50	SPT-10	0	95	5	Non Plastic			SP-SM	Poorly graded Sand with Silt

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Summary Sheet of Laboratory Test Results

Project : Jindu Ghoto Road, Ghotki.

BH No.	Depth (ft)	Sample	Soil Strata			Atteberg,s Limits			Soil Classification	
			Gravel (%)	Sand (%)	Silt & Clay (%)	LL	PL	PI	Group Symbol	Group Name
6	5	SPT-1	0	4	96	27.4	21.3	6.1	CL-ML	Silty Clay
	10	SPT-2	0	90	10	Non Plastic			SP-SM	Poorly graded Sand with Silt
	15	SPT-3	0	87	13	Non Plastic			SM	Silty Sand
	25	SPT-5	0	90	10	Non Plastic			SP-SM	Poorly graded Sand with Silt
	35	SPT-7	0	94	6	Non Plastic			SP-SM	Poorly graded Sand with Silt
	45	SPT-9	0	93	7	Non Plastic			SP-SM	Poorly graded Sand with Silt

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