

FINAL REPORT



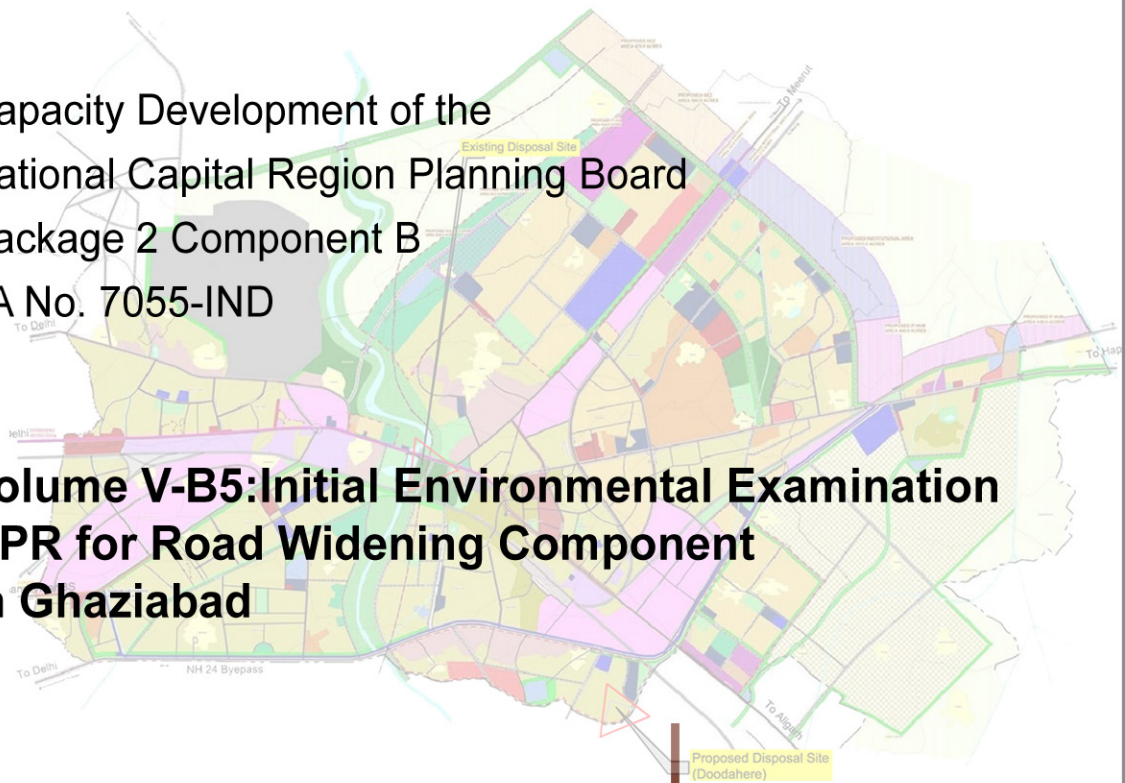
ADB



Asian Development Bank
National Capital Region Planning Board

Capacity Development of the
National Capital Region Planning Board
Package 2 Component B
TA No. 7055-IND

**Volume V-B5: Initial Environmental Examination
DPR for Road Widening Component
in Ghaziabad**



WilburSmith
ASSOCIATES

July 2010

NCR Planning Board
Asian Development Bank

Capacity Development of the National Capital Region Planning Board (NCRPB) – Component B (TA No. 7055-IND)

FINAL REPORT

Volume V-B5: DPR for Road Widening Component in Ghaziabad
Initial Environmental Examination Report

July 2010



Abbreviations

ADB	:	Asian Development Bank
BOD	:	Biochemical Oxygen Demand
CC	:	Construction Contractor
CGWA	:	Central Ground Water Authority
CGWB	:	Central Ground Water Board
CMA	:	Counter Magnet Areas
COD	:	Chemical Oxygen Demand
DFR	:	Draft Final Report
DPR	:	Detailed Project Report
EAC	:	Environmental Appraisal Committee
EC	:	Environmental Clearance
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
ESMC	:	Environmental & Social Management Cell of NCRPB
ESMS	:	Environmental & Social Management System of NCRPB
FR	:	Final Report
GDA	:	Ghaziabad Development Authority
GNN	:	Ghaziabad Nagar Nigam
GoH	:	Government of Haryana
GoI	:	Government of India
GoUP	:	Government of Uttar Pradesh
IA	:	Implementing Agencies
IEE	:	Initial Environmental Examination
IPT	:	Intermediate Public Transport
IRC	:	Indian Road Congress
km	:	Kilometer
KMPH	:	Kilometer per Hour
LA	:	Land Acquisition
LCV	:	Light Commercial Vehicle
LPCD	:	Liters per capita per day
MLD	:	Million Liters per Day
MoRTH	:	Ministry of Road Transport and Highways
MoEF	:	Ministry of Environment & Forests
NCR	:	National Capital Region
NCRPB	:	National Capital Region Planning Board
NCT	:	National Capital Territory
NGO	:	Non-governmental Organizations
NH	:	National Highway
O & M	:	Operation and Maintenance
PCU	:	Passenger Car Unit
PSC	:	Pre-stressed Concrete
R & R	:	Resettlement and Rehabilitations
RSPM	:	Respirable Suspected Particulate Matter
ROW	:	Right of Way
RCC	:	Reinforced Cement Concrete

SH : State Highway
SPM : Suspected Particulate Matter
TA : Technical Assistance
UP : Uttar Pradesh
UPJN : Uttar Pradesh Jal Nigam
UPSIDC : Uttar Pradesh State Industrial Development Corporation

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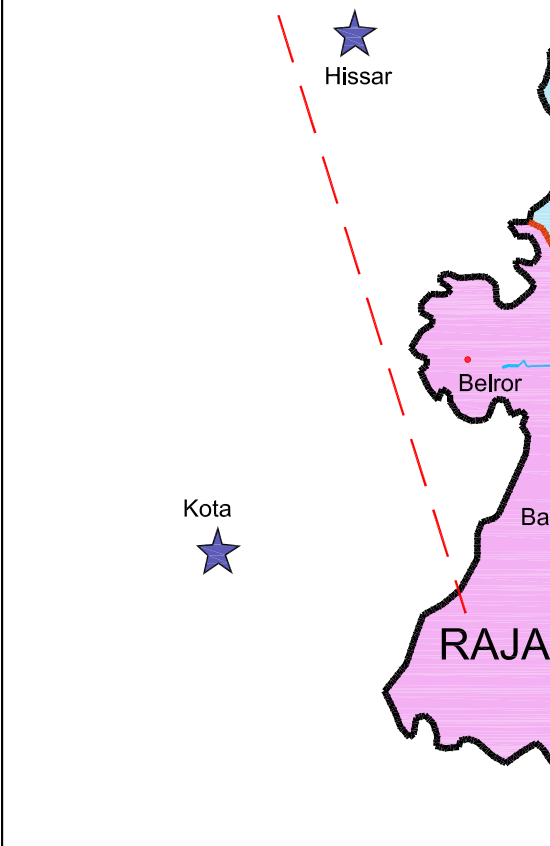
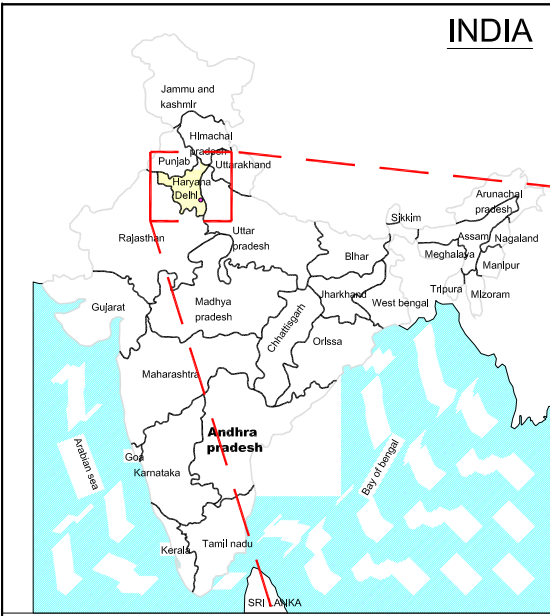
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1. INTRODUCTION

A. Background

1. Ghaziabad City is located in the western part of Uttar Pradesh State sharing the borders with the National Capital Territory Delhi. It is the district headquarters of Ghaziabad District. Owing to its location close to Delhi, and with good connectivity, it is one of the important and fast developing city in the State of Uttar Pradesh and as well as in the National Capital Region. City is well connected with important cities of the state and the country; three National Highways (NH 58, NH 91 and NH 24 - Delhi-Lucknow-Muradabad Road) pass through the City connecting it will Delhi, Meerut, Lucknow, Sikandrabad, Kolkata etc. Besides, it is well connected with its hinterland and surrounding towns by regional and local road network. It is also well connected with railways. Location of Ghaziabad is depicted in **Figure 1-1**.
2. The rapid development of city has also put its infrastructure on tremendous pressure. Due to rapid increase in vehicles and traffic, the road infrastructure is severely affected. The vehicle speed on various roads is decreased significantly, while junctions have become bottle necks free traffic movement. Similarly many roads are carrying traffic much beyond their capacity and are congested with vehicular traffic and pedestrians. National Highway 91, which is also known as the old NH24, is one of such busy corridors carrying a high volume of traffic. The stretch of this roadway between Hapur Bypass and Y Junction is currently a four-lane divided highway, however, because of number of commercial establishments on this stretch, part of the road is always occupied for parking and pedestrians, and roadway has become congested. The condition of road surface is also not good. Overall, the speed on this corridor is decreased considerably.
3. This Initial Environmental Examination (IEE) Report is prepared in accordance with NCRPB Environmental and Social Management System (ESMS) and Policy for project funding.



Capacity Development of the NCRPB: Component B (ADB TA 7055-IND)

Regional Setting of Ghaziabad

Legend

- NCR
- State Boundary
- District Boundary
- District Hq.
- Counter Magnet Areas
- River / Stream

Client:
**Asian Development Bank
 National Capital Region Planning Board**

Consultant:
Wilbur Smith Associates Pvt. Ltd.

Drawn: Roopa
 Date:
 Scale: Not to scale

Checked:
 Approved:

2. POLICY & LEGAL FRAMEWORK

A. Extent of IEE Study

4. The subproject implementation shall comply with the policies of Government of India (GoI), Government of Uttar Pradesh (GoUP) and procedures/policies of NCRPB. Government regulations and the NCRPB policy require that impacts of the development projects have to be identified at the beginning and mitigation measures be incorporated in the project to reduce those impacts to acceptable levels. This is generally done through the process of environmental impact assessment.

B. Government Law and Policies

5. The GoI EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance (EC) is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts.
6. Category A projects requires EC from the national Ministry of Environment and Forests (MoEF). The proponent is required to provide preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the MoEF prepares comprehensive Terms of Reference (ToR) for the EIA study. On completion of the study and review of the report by the EAC, MoEF considers the recommendation of the EAC and provides the EC if appropriate.
7. Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorises the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares ToR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the EC based on the EAC recommendation. The Notification also provides that any project or activity classified as category B will be treated as category A if it is located in whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.
8. This subproject of widening¹ and strengthening of road does not falls under the ambit of

¹ EIA Notification 2006 attracts following road projects⊗ i) New National High ways (A Category) (ii) Expansion of National High ways greater than 30 KM, involving additional right of way greater than 20m involving land acquisition and passing through more than one State (A Category); (iii) New State High ways (Category B); and (iv) Expansion of National / State Highways greater than 30 km involving additional right of way greater than 20m involving land acquisition.

the EIA Notification, and, therefore EC is thus not required.

C. **Environmental and Social Management System of NCRPB**

9. Recognizing the importance of environmental and social issues that can arise in infrastructure projects, NCRPB has formulated an Environmental and Social Management Systems (ESMS) in line with Government and other multilateral agencies like ADB safeguard requirements for Financial Intermediaries (FIs). The ESMS provides an overall management system to NCRPB to identify, assess, and mitigate environmental and social issues that are likely to arise in projects funded by NCRPB. The ESMS outlines the policies, methods of assessments and procedures that will enable NCRPB to ensure that a project that it funds is developed in accordance with ESMS and is adequately protected from associated risks. Implementing Agencies (IAs) will have to comply with the ESMS and Policy.

1. *Environmental Policy*

10. *Policy Statement.* “National Capital Regional Planning Board (NCRPB) will continually strive to ensure and enhance effective environmental management practices in all its operations”. This is aimed to achieve through:
- Minimizing negative environmental (including health & safety) impacts in its operations and risks to the environment (particularly eco-sensitive areas and culturally important areas) and people who may be affected through formulating and implementing commensurate plans
 - Ensuring that environmental safeguards - defined as requirements of applicable Indian environmental legislation and multilateral / bilateral funding agencies - are being adequately integrated by the project proponent / IA in the planning, design, construction prior to its financing and in its implementation during the operational phase.
 - Ensuring that compliance to all applicable national and local environmental legislation.
 - Encouraging that public and stakeholder consultation be carried out by the project proponent / IA and disclosing the required information in all stages of the project cycle.
 - Integrating environmental risk into its overall internal risk management analysis.
 - Including environmental management considerations in all aspects of operations and interactions with the project proponent / IAs in all stages of the project cycle.
11. This policy statement emphasizes NCRPB's sensitivity, concern and commitment to environmental safeguards. NCRPB will strive to ensure that the projects that it supports meets government policies and as well as of the bilateral/multilateral agencies such as ADB.

2. *Environmental Assessment Requirements*

12. The nature of the assessment required for a project depends on the significance of its likely environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-effective mitigation measures. According to NCRPB ESMS, the projects are screened for their expected environmental impacts and are assigned to one of the following categories: E1, E2 or E3.

Table 2-1: Environmental Category

Environmental Scenario	NCRPB's Categorization	MOEFs Categorization	ADB Categorization
Significant impacts or in eco-sensitive area	E1	A	A
Limited impacts	E2	B1 or B2 or No Category	B
No impacts	E3	No Category	C

- (i) Significant impacts or in eco-sensitive areas (Category E1): If the project has significant adverse environmental impacts that are irreversible, diverse, or unprecedented, then it is regarded to have environmental scenario. These impacts may affect an area larger than the sites or facilities subject to physical works. These impacts will be considered significant if these are in eco-sensitive areas.
- (ii) Limited environmental impacts (Category E2): If the project has impacts that are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed.
- (iii) No environmental impacts (Category E3): If the project is likely to have minimal or no adverse environmental impacts, then it is regarded to have this environmental scenario.
13. The proposed subproject of widening and strengthening of road section between Hapur Bypass and Meerut Road 'Y' Junction is unlikely to have significant impacts and is also not located in or near any eco-sensitive area. However, as the subproject involves large-scale construction activity, it is expected to have typical impacts associated with the construction in urban areas and therefore classified as Category E2.
14. According to ESMS, E2 projects require carrying out Initial Environmental Examination (IEE) and preparation of IEE Report. This IEE report is prepared accordingly.

3. DESCRIPTION OF PROJECT

A. Proposed Project Road

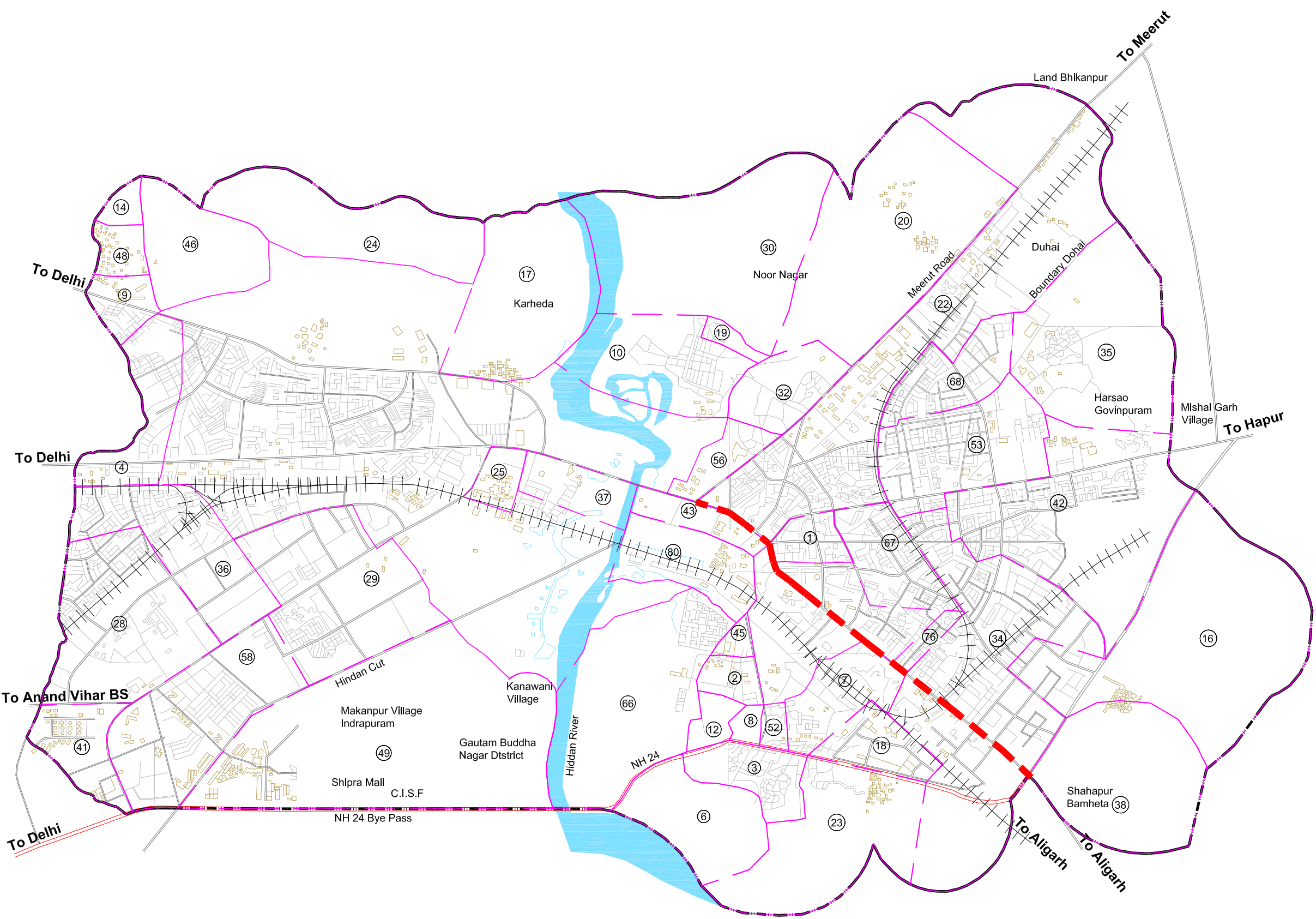
15. National Highway No. 91 (NH 91) starts from NH 2 in Kanpur and joins NH 24 in Ghaziabad. The entire length of this highway traverses within the State of Uttar Pradesh. It passes through important towns of Kannauj, Etah, Aligarh, and Bulandshahr before joining NH 24 and has a total length of 405 km. The project road under the present study is the last segment of NH 91, between Hapur Bypass intersection and end point where it joins NH 24. Total length of this section is 4.3 km and falls within Ghaziabad City limits.
16. The existing configuration of this is dual 2 lane divided carriageway of varying widths (7-10.5 m in each direction) separated by a central median of 1 m wide. Median openings are provided at junctions and intersections. The road carries mainly cars, two wheelers, trucks and auto rickshaws apart from comparatively lesser share of other vehicles. A Railway line crosses the highway at grade at Ch: 2+700. Earthen shoulders are seen dotted with trees. Drains are running parallel to the project road on both sides. Lamp posts are fixed in the central median. Location of the project stretch is illustrated in **Figure 3-1**.
17. *Existing Carriageway Details.* The road stretch has inconsistent carriageway width with in this short length. Four lane configurations with central median of width 1 m is available in the initial stretches which broaden to six lane configuration towards the end. Carriageway consists of bituminous surface which is, in general, in good condition.
18. *Right of Way (RoW).* The highway stretch comes in highly urban locale with many shops and multi storied establishments abutting the road on both the sides. Road inventory shows an existing right of way of 34 m to 45 m available between building lines. No specific RoW information could be gathered from site as there are no pillars existing marking the boundary.
19. The Delhi – Lucknow Railway line crosses the road stretch at Ch: 2+700. A Four lane ROB with at grade service road exists along the project stretch. The length of the ROB is 710 m. Improvements of ROB along with the approaches are not envisaged in the scope of the present study.
20. There are three major intersections and three major junctions present along the stretch. Minor junctions and intersections are many in number.

Capacity Development of the NCRPB: Component B (ADB TA-7055)

Location of Project Road

Legend

- Municipal Boundary
- Ward Boundary
- (16) Ward Number
- == National Highway
- Other Roads
- Buildings
- ~ River, Stream
- Location of Project Road



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Wilbur Smith Associates

Drawn:SKG Checked: SKG
 Approved: NSS

Scale: NTS

Figure 3-1



B. Project Need and Proposed Improvements

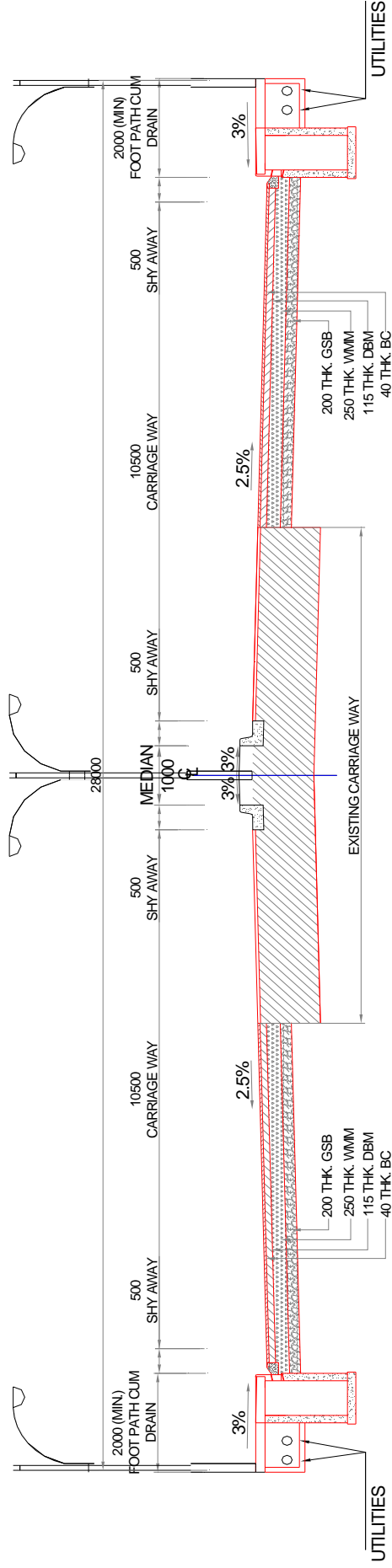
21. Detailed analysis of traffic data and projections warranted widening of the existing road stretch. Accordingly, a six lane divided carriageway is proposed with drain cum footpath on both the sides. Geometric improvements to the existing road and junctions are also planned. The salient proposals for the improvement of the stretch of project road are classified into the following items:
- Widening of the project road into 6 lane configurations based on traffic capacity requirement
 - Concentric widening is proposed for the entire project stretch
 - Improving the geometry of the existing road based on the design standards
 - Design of new pavement for widening and strengthening of the existing road
 - Improvements to all major and minor intersections and Junctions
 - Provision of road furniture for safety
22. The total length of the road proposed for the widening is 4.8 km. Based on the traffic requirement, six- lane is required. A three lane dual carriageway is proposed with a total width of 28 m as shown in **Figure 3-2** . Given the available ROW of 34-45 m, the widening works will be within this and therefore no land acquisition is required. Even though geometric conditions permit 100 km/hr, the speed is restricted to 80 km/hr because of heavy built-up. Design speed of 30 KMPH is considered for junction locations.

Table 3-1: Subproject Components

Component	Description	Remarks
Proposed road configuration	6 lane two way divided road with foot path cum drains on either side; total width of the road including foot path will be 28 m. Total length of the proposed section is 4.8 km	Road will be widened within the existing ROW. No land acquisition is required for the subproject
Pavement	Flexible pavement of total thickness 640 mm Consisting of: Granular base: 200 mm Sub base: 250 mm Bituminous surfacing (DBM): 150 mm Bituminous surfacing (BM): 40 mm	
Junction Improvements	It is proposed to improve all the major and minor junctions along the project road	There are a total of 21 junctions in the corridor; these will be improved within the available ROW
Drain cum Footpath	Drain cum footpaths of 2m wide will be constructed on either side of the road.	Will be constructed within the available ROW
Lighting	Lamp posts will be erected in the median or edge of the road with adequate height such that a uniform illumination of 40 lux is	Will be constructed within the available ROW

	available	
Road Furniture	<p>Following road signage and markings will be provided as part of the project</p> <ul style="list-style-type: none"> • Triangular Regulatory Signs • Stops Signs • Cautionary Sign Boards • Facility Information Signs • Direction and Location Signs • Overhead Gantry Sign Boards • Raised Pavement Marker (Cat's Eyes) • 200m stones (Both Sides) • Kilometer Stones (Both Sides) • Boundary Stones (Both Sides) 	These will be placed within the ROW.

Figure 3-2: Typical 6-lane Carriageway Cross Section



4. DESCRIPTION OF ENVIRONMENT

A. Physical Resources

1. Location

23. Ghaziabad City is located in the western part of Uttar Pradesh State sharing the borders with the National Capital Territory Delhi. It is the district headquarters of Ghaziabad District. Owing to its location close to Delhi, and with good connectivity, it is one of the important and fast developing city in the State of Uttar Pradesh and as well as in the National Capital Region. Geographically, Ghaziabad is situated at 28° 40' N latitude and 77° 25' E Longitude. Ghaziabad is situated at about 20 km east of Delhi, and 432 km west of the State Capital, Lucknow.
24. It is well connected with important cities of the state and the country; three National Highways (NH 58, NH 91 and NH 24 - Delhi-Lucknow-Muradabad Road) pass through the City connecting it with Delhi, Meerut, Lucknow, Sikandrabad, Kolkata etc. Besides, it is well connected with its hinterland and surrounding towns by regional and local road network. The Main railway line and the two branches of northern railway (Meerut Branch & Moradabad Branch) pass through the City. It is an important railway junction in the Northern Railway. Base map of Ghaziabad is at **Figure 4-1**.








2. Topography, Soil and Geology

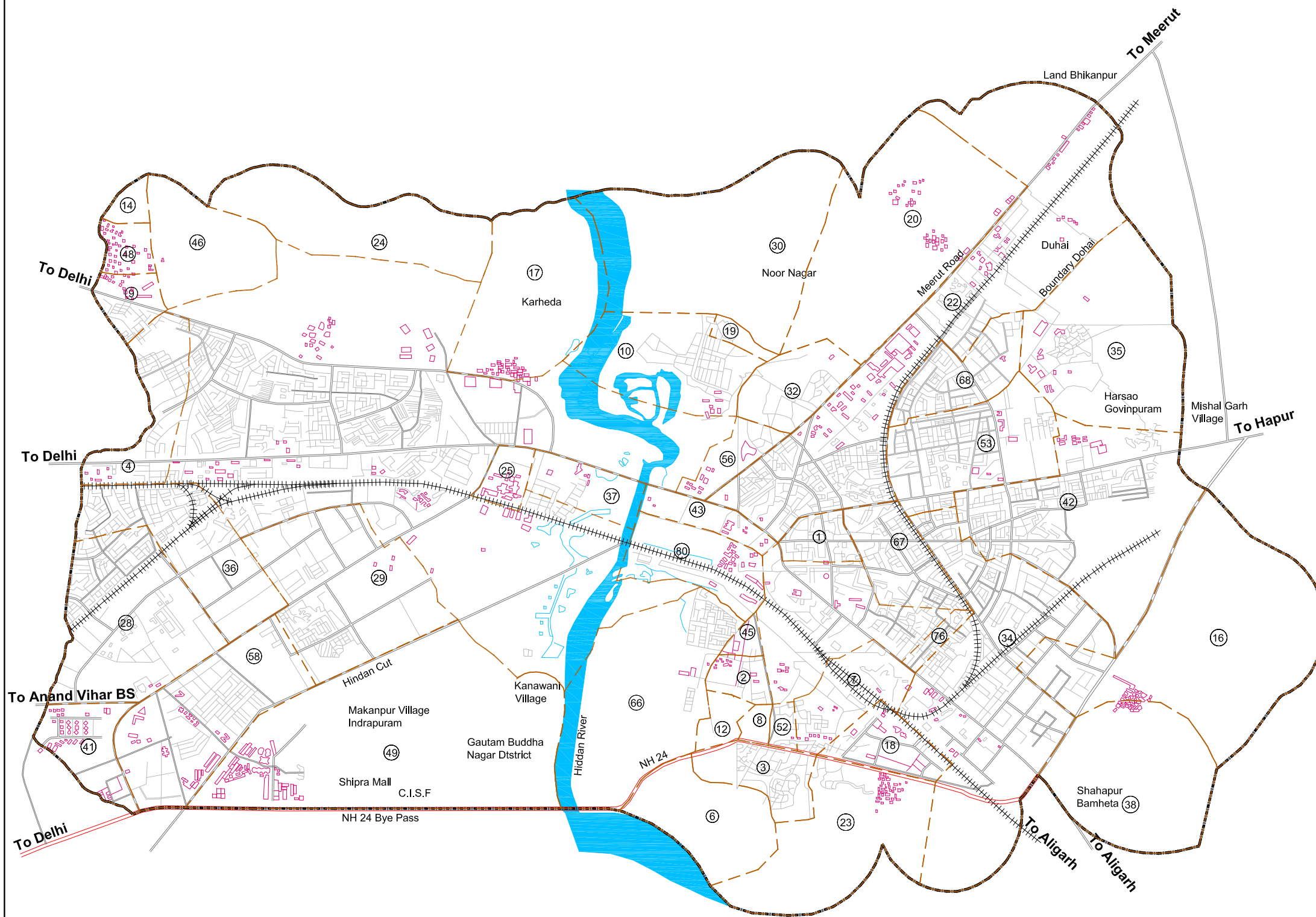
25. Originally established on the eastern side of River Hindon, present sprawling development of Ghaziabad can be observed on both sides of the River. Hindon River is an important tributary of Yamuna River of the Ganges River System. Flowing north-south, Hindon River passes through middle of the City and meets Yamuna about 35 km south of Ghaziabad. The topography of the City is almost plain and the general slope is from north to south.
26. Geologically, Ghaziabad forms a part of the Indo-Gangetic alluvium. Soil is characterized mainly by silty sand and loamy soils. Geotechnical investigations conducted at the proposed flyover site indicate that there is no hard rock till 25 m below ground level.
27. As per the seismic zoning map of India, Ghaziabad falls in sever intensity zone (Zone IV). However, there were no major earthquakes occurred in Ghaziabad till date.

**Capacity Development of
the NCRPB: Component B
(ADB TA-7055)**

**Ghaziabad
Base Map**

Legend

-  Municipal Boundary
-  Ward Boundary
-  Ward Number
-  National Highway
-  Other Roads
-  Buildings
-  River, Stream



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Consultant
Wilbur Smith Associates

Drawn:SK
Date: August, 2009
Scale: NTS

Checked: SKG
Approved: NSS

Figure 4-1



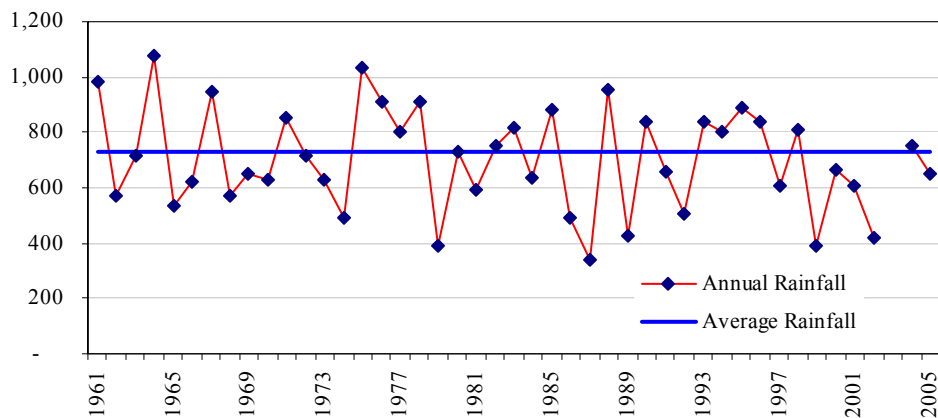
3. *Climate*

- 28. Typical humid subtropical climate of north India prevails in Ghaziabad, with high variation between summer and winter temperatures and precipitation. There are three distinct seasons – first of which is the monsoon season - hot and humid season from mid-June to September. Second season, winter, is the cool and dry season from October to March. The third phase, summer, is characterized by hot and dry weather which prevails from April to mid-June.
- 29. Rains in the region are concentrated in the monsoon season. The region receives rainfall mainly under the influence of southwest monsoon from July to September. Over 75 percent of the total rainfall is received during the monsoon months and the remaining rainfall is received during December to February. The annual average rainfall is 732 mm. Dust and thunderstorms occur in summer season while fog occurs in the winter.

Table 4-1: Rainfall Pattern in Ghaziabad (2004-2008)

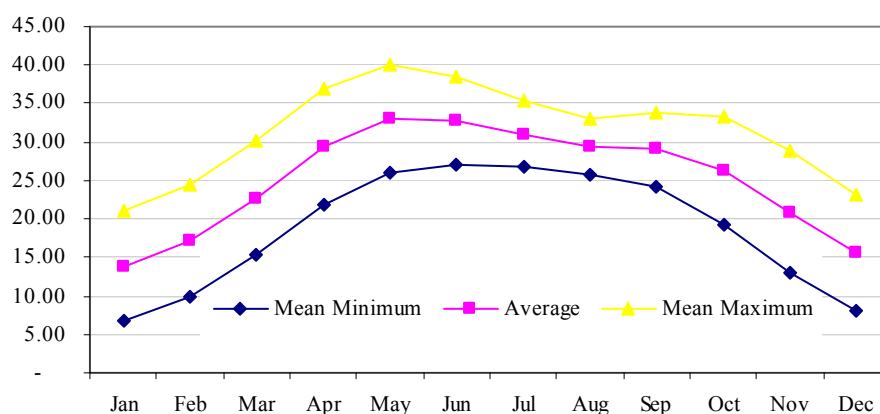
Month	Rainfall (mm)					
	Normal	2004	2005	2006	2007	2008
January	20.5	7.8	0	0	0	NA
February	20.6	0	23.9	0	45	NA
March	17.4	0	19	NA	64	NA
April	5.8	30.4	0	0	0	NA
May	12.8	75	0	0	0	NA
June	43.8	20.6	80.5	34.2	64.1	16.4
July	216.5	36.8	185.7	250.5	84.1	124.4
August	234.5	520.6	57.9	20.4	99.8	58.1
September	129.2	50.4	284.2	114	4.7	8.7
October	34.1	12.6	0	16	0	0
November	4.3	0	0	0	NA	2
December	6.1	0	0	0	0	NA
Total	745.6	754.2	651.2	-	-	-

Figure 4-2: Long-term Annual Rainfall Pattern of Ghaziabad (in millimeter)



30. Owing to its sub-tropical continental monsoon climate with hot summers and cold winters, Ghaziabad experiences large variations in temperature across the year. May and June experiences high temperatures and the lowest is recorded in the months of December and January. **Figure 4-3** depicts the monthly averages of minimum, mean and maximum temperature. Winds predominantly blows from north, north-west and west direction, followed by from east and south-east direction.

Figure 4-3: Average Monthly Temperature (in Degrees Centigrade)



4. Air Quality

31. Ambient Air Quality in Ghaziabad is monitored by Uttar Pradesh Pollution Control Board (UPPCB). Due to dry weather coupled with dusty roads, particulate matter is high while levels of oxides of sulphur and nitrogen are well within the National Ambient Air Quality Standards (NAAQS). According to UPPCB, air pollution status in Ghaziabad has been termed as “low”.

Table 4-2: Air Pollution Status in Ghaziabad (2008)

Land use	Sulphur Dioxide (SO ₂)	Nitrogen Dioxide (NO _x)	SPM
Residential	L	L	C
Industrial	L	L	H

C – Critical; L – Low; H – High (see below Table for values); NA: Data not available

Table 4-3: Air Pollution Classification based on Annual Mean Concentration Range (µg/m³)

Air Pollution Status	Industrial Area		Residential Areas	
	SO ₂ & NO _x	SPM	SO ₂ & NO _x	SPM
Low (L)	0 – 40	0 - 180	0 – 30	0 – 70
Moderate (M)	40 – 80	180 - 360	30 – 60	70 - 140
High (H)	80 – 120	360 - 540	60 – 90	140 - 210
Critical (C)	>120	>540	>90	>210

Source: UPPCB

Table 4-4: NAAQ Standard – Annual Average Concentration in µg/m³

Land use	RSPM	SPM	SO _x	NO _x
Residential	60	140	60	60
Industrial	120	360	80	80

Source: CPCB

5. *Surface Water*

32. Hindon River is an important tributary of Yamuna River of the Ganges River System. Hindon meets Yamuna about 35 km south of Ghaziabad. The confluence is located about 40 Km downstream of Okhla barrage. A short cut canal called the Hindon Cut joins River Yamuna at Okhla barrage from where the Agra canal takes off. The Hindon Cut thus serves to make the Hindon river water, including the supplemental discharge from the upper Ganga Canal, available for diversion to the Agra canal for irrigational use. The river stretch remains dry, except during rains. During winter and summer seasons, river flow is mainly limited to industrial effluents discharged from various industries located in Ghaziabad and as well as upstream areas.
33. Due to illegal entry of industrial and domestic wastewater, Hindon River water is polluted. As per the CPCB, the dissolved oxygen content in the river is low and BOD is presence in notable quantities. Illegal disposal of untreated/partially treated effluent from textile dying and printing industries located in Shahid Nagar and Janakpuri in the trans-Hindon area are said to be one of the main reasons for pollution of Hindon River stretch in Ghaziabad.

6. *Groundwater*

34. Due to its location in Gangetic Plains, the underlain aquifers have good groundwater potential. However, the rapid development and increase in demand for water has put tremendous stress on groundwater reserves, both in terms of quantity and as well as quality. The groundwater decline is at much rapid phase and considering this alarming situation the Central Ground Water Authority (CGWA) has notified the area under GMC limits for regulation and control of groundwater extraction. No groundwater extraction is allowed without prior permission of Central Ground Water Board (CGWB).
35. General groundwater quality in Ghaziabad is good except in certain industrial and residential pockets where there is concentration of nitrates, fluorides and heavy metals beyond permissible limits. Indiscriminate disposal of untreated industrial and domestic wastewater is said to be the main reason for pollution of groundwater.

B. Ecological Resources

36. There are no forests or any other environmental sensitive locations in or near project site. Ghaziabad City is an urban area surrounded by land that was converted for agricultural use many years ago. There is no remaining natural habitat in the city, and the flora is limited to artificially planted trees and shrubs, and the fauna comprises domesticated animals plus other species able to live close to man. Tree cover along few main corridors is considerable; main tree species include Keekar (*Acacia karoo*); Neem (*Azadirachta indica*); Peepal (*Ficus religiosa*); Honge (*Pongamia Pinnata*); and eucalyptus.

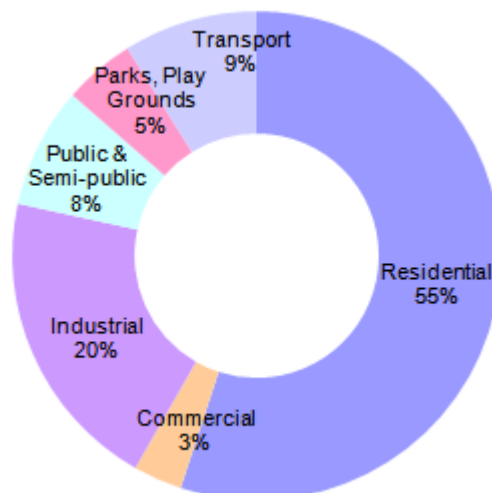
C. Economic Development

1. *Land Use*

37. Owing to its location, adjacent to the National Capital, Delhi, over the years, Ghaziabad City has experienced a very rapid development and urbanization. Originally established on the eastern side of River Hindon, present sprawling development of Ghaziabad can be observed on both sides of the River. The City is almost merged with Delhi - City’s development stretching towards Delhi on west side and vis-à-vis Delhi expanding to east towards Ghaziabad.

38. Ghaziabad Master Plan 2001 was formulated for an area of 100.4 sq. km, of which by 2001, about 84.8 sq. km was developed. As depicted in the following figure, the existing land use of Ghaziabad development area (84.8 sq km) shows that 60 percent of the land is under residential use followed by industrial areas. There are no agricultural areas within this development area. The gross density of the population is 130 persons per hectare. Anticipating a big growth in the near future, the Ghaziabad Master Plan 2021 has been formulated to an area of 155.54 sq. km.

Figure 4-4: Existing Land Use



2. *Industry & Agriculture*

39. The City of Ghaziabad is known for medium and large scale industries. During 1970-80 decade a number of prestigious and large scale industries are established along Meerut Road, Bulandhshahar Road, Link Road, Sahibabad and Loni Road in Ghaziabad City. In addition to UPSIDC developed industrial areas, there are a number of industries located in Mohan Nagar and Mohan Industrial Area. Ghaziabad houses a variety of industries including distilleries, chemical, engineering, steel, and textile and dyeing units etc.
40. Industrial sector is a major employment generator in Ghaziabad. Industrial development in Ghaziabad however declined in the decade of 1991-2001 and no new industries were established during that decade.
41. Within the city limits, there are no agricultural areas left. Almost all of the land is converted for residential or for other development.

3. *Infrastructure*

42. *Water Supply.* Two agencies are involved in provision of water supply service in Ghaziabad; while the state line agency Uttar Pradesh Jal Nigam (UPJN) is responsible for development of new infrastructure and all capital works, the Ghaziabad Nagar Nigam (GNN) is responsible for its day-to-day operation and maintenance. Water supply system in Ghaziabad is groundwater based. Water is extracted from 186 bore wells and a total of 160 MLD of water is supplied everyday at a rate of 145 LPCD (gross supply). In industrial areas, water is supplied by UPSIDC.
43. *Sewerage System.* UPJN carries out all new and capital works while the GNN operates and maintains the sewerage system in the City. Around 70 – 75 percent of the city population is covered with underground sewerage system. At present an estimated 128 MLD of sewage is generated in the City. There are 17 sewage pumping stations in the City to pump the sewage to two sewage treatment plant for treatment and further disposal. The total treatment capacity available is 126 MLD however present usage is only about 71 percent. Industrial waste water treatment and disposal is managed by individual industries and UPSIDC.
44. *Solid Waste Management.* Municipal solid waste management is the responsibility of Ghaziabad Nagar Nigam. At present about 750 tons of solid waste is generated daily in Ghaziabad at a rate of 550 gm per capita per day. City is divided into five zones for better management of solid waste collection and disposal. There is no door-to-door collection system in the City. The solid waste is collected through bins located at various places in the neighborhood. Sanitary workers collect waste from bins and transport to disposal site at Sai Upvan on the banks of Hindon River. There is no proper disposal facility; the waste is disposed by crude open dumping method.

4. *Transportation*

45. Ghaziabad City is well connected with important cities of the state and the country; three National Highways (NH 58, NH 91 and NH 24 - Delhi-Lucknow-Muradabad Road) pass through the City connecting it with Delhi, Meerut, Lucknow, Sikandrabad, Kolkata etc. Besides, it is well connected with its hinterland and surrounding towns by regional and local road network. The Main railway line and the two branches of northern railway (Meerut Branch & Moradabad Branch) pass through the City. It is an important railway junction in the Northern Railway.
46. It is 20 km east of Delhi and 46 km southwest of Meerut. Other roads lead northwest to Loni and Baghpat and east to Hapur and Garhmukteshwar. Buses run at frequent intervals to Delhi, Meerut, Aligarh, Bulandshahar, Moradabad, Lucknow and other cities. The City acts as the main entrance of Uttar Pradesh and is also called the “Gateway of Uttar Pradesh”.
47. Internal road network within the town is well developed. Most of the roads however are congested with traffic, pedestrians and activities such as parking of trucks/other vehicles and presence of informal business activities (squatters and vendors) within the ROW.
48. According to available 2003 data, over 70 percent of the vehicles in the town are two wheelers followed by cars. Internal travel in the city is mainly through public transport (buses and mini buses) and intermediate public transport system consisting of Auto Rickshaws.

D. **Social and Cultural Resources**

1. *Demography*

49. According to the national census the population of Ghaziabad was 968,521 in 2001, increased from 511,759 in 1991, recording an unprecedented growth rate of 89.3 percent over the decade. The population of overall GDA area in 2001 was 1,327,330, which was increased from 732,957 in 1991, with a growth rate of 81 percent.

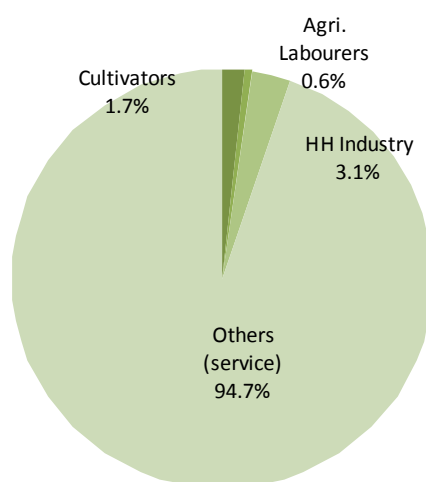
Table 4-5: Population Growth of Ghaziabad City

Year	Population	Decadal Growth Rate (%)
1971	128,036	
1981	287,170	124.3%
1991	511,759	78.2%
2001	968,521	89.3%

Source: Census of India

50. Overall literacy is 80 percent, reported at 87 percent for males and 72 percent for females, which is considerably better than literacy in the state, which is 60.4 percent overall, and 75.7 percent for males and 44.0 percent for females. Sex ratio is however significantly below the natural 1:1 ratio, being 858 females per 1000 males, lower than both the state and national averages (879 and 929 respectively).
51. According to the census 2001, workforce participation rate (WPR) in Ghaziabad was 28 percent. As shown in the following figure, nearly 95 percent of the total workforce was engaged in service sector (formal, informal, trade, commerce and industrial and other service sectors). Contribution of other sectors is very minimal – about 3.1 percent are engaged in household industries the remaining 2.3 percent of population are engaged in primary sector activities.

Figure 4-5: Occupational Structure



52. Majority of people in Ghaziabad are Hindus and the remainder are mainly Muslims, Sikhs, Jains, Christians and Buddhists. Hindi is the main language of the area. Around 16% of the population belongs to scheduled castes (SC) category. Population belonging to Scheduled Tribe (ST) category in Ghaziabad is negligible and is part of the mainstream population.

2. *Health & Education Facilities*

53. Ghaziabad is a main centre for educational and health facilities in the region. There are a number of schools, colleges, professional education institutions, general and special health care facilities in the City, serving a large number of population from the City and the other near and far areas.

3. *History, Culture and Tourism*

54. The City was founded in 1740 by the Emperor, Ghazi-ud-din, who called it Ghaziuddin Nagar after himself and built a spacious structure consisting of 120 rooms of masonry with

pointed arches. Only the gate, a few portions of the boundary wall and a massive pillar about fourteen feet high remain now, the precincts now being inhabited. His mausoleum still stands in the city but is in a bad state. Ghaziabad played active role in the Indian freedom struggle, the revolt of 1857. An encounter took place between the freedom fighters and British force in Ghaziabad during that time. This was regarded as the first war of independence and it brought Ghaziabad much of its glory. On 14th November 1976, Ghaziabad became a separate district. Then on, Ghaziabad has developed in all fronts and it is now one of the biggest and fast developing centers in NCR.

55. There are no notified or protected monuments or sites of archeological and historical importance in the City. The tourism potential of is minimal.

E. Profile of Proposed Road

56. The project road is the last segment of NH 91 starting from Hapur bypass intersection to the end point where it joins with NH 24 (Meerut Road Y Junction) having a length of 4.8 km. The full stretch comes within Ghaziabad City and runs almost in the centre of the city from northwest to southeast.
57. Adjoining areas on both sides of the road are highly developed with are mostly industries, and commercial establishments housed in multistory structures. Few hospitals and residential areas are also abutting the road. There are many branch roads deviating and leading to suburban colonies, market places and industrial towns present on both sides of the road.
58. Existing road consists of carriage way of width varying from 4 to 6 lanes with median. Drains are located on both edges of the road. Carriageway consists of bituminous surface. The existing right of way available varies from 34 to 45 m.
59. The topography of the site is plain and soil is characterized by silty sand and clay. There are no water bodies/streams traversing the road.
60. The widening and strengthening of the road and improvement of junctions will be conducted within the available road right of way (RoW) and therefore no land acquisition or structure demolition is involved. However, informal squatters and vendors are encroached on the ROW at some locations. 23 APs are estimated to be affected and there are 5 Common Property Resource (CPR) that will be affected by the subproject. All the 23 households are commercial squatters squatting upon the ROW. They run their small business like tea stall, vehicle repairing shop etc and earn their livelihood. During consultations, the APs expressed their willingness to shift their business to make the ROW encumbrance free as required by the sub project.
61. There are a number of trees along the road project road. All the trees are of domestic species and there are no endangered or protected species. The tree species observed include: Keekar (*Acacia karoo*); Neem (*Azadirachta indica*); Peepal (*Ficus religiosa*);

Honge (*Pongamia Pinnata*); and Eucalyptus. Trees of various girth size are observed - from small growing plants to fully grown trees, some of which need to be cut off for the project.



Photo 1: View of the Project Road



Photo 2: ROW available for Widening



Photo 3: Heavy Built-up along the Road



Photo 4: Small Temple abutting the Road



Photo 5: Road side Trees of Various Sizes/Ages

5. ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

A. Overview

62. As a general practice, an IEE should evaluate impacts due to the location, design, construction and operation of the project. Construction and operation are the two activities in which the project interacts physically with the environment, so they are the two activities during which the environmental impacts occur. In assessing the effects of these processes, therefore, all potential impacts of the project should be identified, and mitigation is devised for any negative impacts. Following sections evaluate impacts of the proposed road widening subproject in Ghaziabad.

B. Construction Impacts

63. This subproject will involve construction of the following elements:
- Widening of existing carriage way (varying from 4 to 6 lane) to uniform 6-lane carriage way with a central median
 - Side drains cum foot path of 2 m wide (foot path will be developed over the drains)
 - Junction improvements – geometric improvement, formation of traffic islands and medians, etc
 - Provision of road furniture – this will include road marking, fixing of caution, information and warning boards and street lights.

Table 5-1: Construction Method & Materials of Flyover

Element	Construction Details	Construction Activities
Widening & strengthening of carriage way	The existing bituminous pavement (varying from 14 to 20 m wide) will be widened to 24 m including 1 m median in the centre.	The road will be widened by constructing 640 mm thick pavement of required width along the existing pavement on both the sides. The widening portion will be marked, site will be cleared and the soil will be removed to necessary depth to accommodate 640 mm pavement with reference to the existing road level. The pavement will be constructed in layers. A granular base and sub base will be formed to a depth of 450 m. Suitable gravel & aggregate material, bought from quarries, will be leveled, watered and compacted in layers. Over the base course, a bituminous macadam layer of 150 m will be laid. The final layer of 40 mm bituminous concrete finishing surface will be laid over the widened

Element	Construction Details	Construction Activities
		<p>portion as well as the existing pavement. Following construction equipment will be used in this activity: excavators, power road rollers, vibratory rollers, emulsion pressure distributors, mechanical brooms, paver finishers and smooth wheeled, vibratory and tandem rollers.</p> <p>All works will be conducted within the available ROW.</p>
Side drains and foot path	Drains and foot path of 2 m wide on either side of road	<p>A new drain of uniform width will be constructed all along the project road. The surface will be cleared and the trench will be excavated to necessary depth. Concrete wall will be formed, surface smoothed, and precast concrete blocks will be placed over the drain, which will also act as foot path.</p> <p>All works will be conducted within the available ROW.</p>
Junction improvements	Geometric improvements and construction of traffic island and beautification	<p>Based on the geometric design, the junctions will be widened, marked, and traffic islands will be formed. Grass and bushes will be planted in the islands.</p> <p>All works will be conducted within the available ROW.</p>
Road furniture	Road marking, fixing of caution, information and warning boards and street lights	<p>Road marking will be done by Road Marker. Readymade boards and street lights will be erected at necessary locations.</p> <p>All works will be conducted within the available ROW.</p>

64. Total quantity of earthwork excavation for the subproject has been estimated as 20,319 m³. The requirement of construction material is estimated as follows: good earth/soil – 9,195 m³; gravel – 4,690 m³ and stone aggregate 26,880 m³. Construction materials will be sourced from quarries approved by the respective Mines & Geology Departments. Yamuna Nagar in Haryana about 200 km away is a known source for stone aggregate. Ghaghar (180 km) and Haridwar (160 km) are sources for sand. Noida, 30 km away, is a source for soil. Bitumen will be procured from refineries.

1. *Impacts on Physical Resources*

65. Widening and strengthening (resurfacing) of 4.8 km road and excavation of drains alongside carriageway will involve a considerable amount of physical disturbance, the effects of which could be significant, as they will occur in a busy part of the city, where there is lot of commercial and other activities.
66. The work involves significant quantities of earthwork excavation as well as filling works.

The excavation work is estimated to generate over 20,000 m³ of waste soil, which needs to be disposed off safely. The contractor shall implement the following measures:

- Utilize the waste soil in construction work; significant construction works like roads, flyovers are under construction in Ghaziabad and surroundings, waste soil must be utilized in construction of earthen ramps and shoulders, etc.
 - Utilize the waste soil in filling up low lying area and raising the ground level of the building sites in newly developing areas particularly in Trans-Hindon area, which is located at a lower level than Hindon River
 - Waste shall be disposed only at a designated place specified by the engineer in-charge and shall not be disposed off in water bodies, drains, and along the roads.
67. Silt-laden runoff from the construction site during rainfall could lead to silting of drains, water accumulation and affect people who live and work near the site and reduce the quality of adjacent land. The earthwork will not mostly be conducted in rainy season, so this will avoid any problems from runoff.
68. One possible impact on drainage is that existing drains have to be remodeled and therefore needs to be stopped during the construction work. During this transitional phase, the following measures shall be implemented to avoid water accumulation due to disruption of drains:
- Work section-wise and divert the drain in the working section by providing a temporary drain if required
 - Complete construction of new drain as soon as possible and restore the flow
69. Besides considerable quantity of earthwork conducted at the site, there will be also activities like transport, loading and unloading of significant quantities of construction material (gravel, aggregate). In Ghaziabad, dry weather prevails in most part of the year, and therefore generation of dust from these activities may be significant. It will therefore be necessary to prevent dust, which could be generated in quite large quantities. The Contractor should therefore:
- Barricade the work area which will also act as a dust and noise barrier
 - Damp down the soil/material stock piled at the site
 - Transport the waste soil immediately from the site to the disposal location
 - Use tarpaulins to cover soil/materials when transported by truck
 - Control dust generation while unloading the material (particularly aggregate) at the site by sprinkling water and unloading in a barricaded area
 - Sprinkle water in truck after downloading material; or cover it with tarpaulin to avoid dust razing from the truck while it is moving
70. Large quantities of construction material like soil, gravel and aggregate will be required for road construction work. There could be impacts due to mining of materials if the mining activities are not conducted properly. Therefore to ensure that there are no impacts

due to mining, the Contractor should procure construction materials only from quarries licensed by Department of Mines and Geology.

2. *Ecological Resources*

71. There are no protected areas in or around project road, and no known areas of ecological interest. There are however a number of trees lined along the project, some of which needs to be cut off for the proposed road widening. A total of 167 trees of various domesticated species - Keekar (*Acacia karoo*); Neem (*Azadirachta indica*); Peepal (*Ficus religiosa*); Honge (*Pongamia Pinnata*) and Eucalyptus, located on the ROW, need to be cut off for road widening.
72. Cutting of trees could not be avoided as the trees are located within the ROW. Necessary approvals from competent authority (Forest Department/Ghaziabad Nagar Nigam) shall be obtained and the guidelines for compensatory measures, if any of the competent authority, must be adhered to. In any case, as a compensatory measure, three trees will be planted and maintained for each tree felled.

3. *Economic Development*

73. The work will be conducted within the available ROW and therefore no land acquisition is envisaged. However, there are some encroachments in the form of squatters/vendors which needs to be cleared off for the project. All 23 squatters are commercial squatters squatting upon the ROW and they run their small business like tea stalls, vehicle repairing shop etc and earn their livelihood. NCRPB Environmental and Social Management System (ESMS) and Policy provides that the owners and tenants of these businesses do not suffer economically as a result of the project, and a Resettlement Plan and Resettlement Framework have been prepared to assess the nature and extent of the losses and the type and extent of reparation that is needed. This indicates that owners and tenants of businesses that will lose property, other assets and/or income as a result of the project will be provided with:

- Compensation equivalent to the amount of business income lost as a result of the construction process;
- Compensation at replacement cost for lost income-generating assets (shop premises, etc);
- Additional financial assistance to enable them to re-establish their business at an alternative location.

74. Some shops and other premises along the road may lose business income because the presence of the construction activity will deter customers, and at some locations access will be impeded by excavation of trenches, the presence of heavy vehicles and machinery, etc. Implementation of the following best construction measures will reduce the inconvenience and disturbance to the public:

- Inform all residents and businesses about the nature and duration of any work well in advance so that they can make necessary preparations;
- Leave spaces for access between mounds of excavated soil and other stored materials and machinery, and providing footbridges so that people can crossover open trenches
- Barricade the construction area and regulate movement of people and vehicles in the vicinity, and maintain the surroundings safely with proper direction boards, lighting and security personnel – people should feel safe to move around
- Control dust generation

75. Transportation is the principal activity that will be impeded by this work. During the construction of widening portion on either side, the traffic can move on the existing carriageway without any major hindrance. During the strengthening and re-surfacing of the existing carriageway, the work will be taken up on one-side at a time and the traffic will be allowed on other side. Although the road will not be closed completely, there will be disturbance and congestion due to restricted entry and presence of construction vehicles and equipment. The following measures therefore shall be implemented to minimize the disturbance:

- Provide alternative traffic arrangement/detours so that traffic can be distributed and move on different roads and ensure that public is informed about such traffic diversions;
- Allow smooth traffic movement by confining and barricading the construction area; ideal vehicles and equipment shall be parked within the confined area;
- Provide necessary personnel to guide and control the traffic;
- Provide information to the public through media – daily news papers and local cable television (TV) services, about the need and schedule of work, and alternative routes;
- At work site, public information/caution boards shall be provided - information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints;
- Barricade the site properly; avoid accidental entry of traffic (pedestrian/vehicular) into site.

76. The proposed construction work could disturb the existing water supply lines, sewers, telephone cables and power supply lines, which are located within the ROW. It is therefore required to implement following measures to avoid or minimize the impact during construction:

- Notify the respective agencies (GNN, BSNL, and UP Electricity Board) in advance about the construction work and if there is any need for shifting
- Coordinate with respective agencies and provide prior information to public about the disruption in services during construction; this can be announced via mass communication systems like local/vernacular news papers.

- Provide alternative arrangement for disrupted services such as water supply based on the necessity and duration of disruption

77. Since the subproject is located in an urban area with presence of large scale commercial, residential and industrial establishments, the disturbance and nuisance due to construction work in the vicinity will be significant. Following measures shall be implemented:

- Consultation with the local community to inform them of the nature, duration and likely effects of the construction work, and the mitigation measures in place, as formulated above
- Proper planning of the work programme so that any noisy or otherwise invasive activities can be scheduled to avoid sensitive times;
- Avoiding noise-generating activities at night;
- Implementing the measures to reduce dust;
- Utilising modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions, and ensuring that these are maintained to manufacturers' specifications at all times.

4. *Social and Cultural Resources*

78. There are no historical or cultural heritage sites in Ghaziabad in general or at the project site in particular. Therefore there are no likely impacts.

79. There are few schools, colleges, hospitals, cinema halls and religious places (temples and a church) located along the project road. The work could disturb these modern-day social and cultural resources. Impacts will include noise, dust, and interrupted access for pedestrians and vehicles. Mitigation will therefore be needed to protect these resources and to enable usage by local people and visitors to continue throughout the construction work. This will be achieved through several of the measures including:

- Avoiding working at sensitive times,
- Dust control measures as suggested above;
- Providing wooden bridges for pedestrians and metal sheets for vehicles to allow access across open trenches where required (including access to houses);
- Using modern vehicles and machinery with standard adaptations to reduce noise and exhaust emissions, and ensuring they are maintained to manufacturers' specifications.

80. There is invariably a safety risk when substantial construction such as this is conducted in an urban area, and precautions will thus be needed to ensure the safety of both workers and citizens. The Contractor will be required to produce and implement a site Health and Safety Plan, and this should include such measures as:

- Following standard and safe construction practices

- Excluding the public from the site – enclosing/barricading the construction area, providing warning boards and sign boards and posting of security guards 24-hours
- Ensuring that all workers are provided with and use appropriate Personal Protective Equipment (helmet, hand gloves, boots, masks, etc);
- Follow standard practices of safety checks as prescribed before use of equipments;
- Provide on -site Health and Safety Training for all site personnel;
- Report accidents to the authorities promptly, and maintain records

81. There could be some short-term socio-economic benefits from the construction work if local people gain employment in the workforce. To ensure that these benefits are directed to local people, the Contractor should be required to employ as much of his labour force as possible from the local communities in the vicinity of construction sites. Drawing of majority of workforce from local communities will avoid problems that can occur if workers are imported, including social conflicts and issues of health and sanitation due to labour camps. If temporary labour camps are to be provided; Contractor should ensure that they are maintained well with proper water supply and sanitation facilities.

C. Operation Stage Impacts

82. The road generally operate without the need for major maintenance or repair, therefore there are no impacts envisaged. During its design life, the road should require no major repair or refurbishment, beyond routine maintenance like small scale ad hoc repairs of surface damage caused by traffic use or accidents; repairs and replacement of damaged safety barriers and signs, and regular inspection of drains and unblocking where necessary, to ensure their continuing operation and prevent damage to the road from flooding or water seepage.
83. Once the road is widened and operating it will improve the physical environment by removing the traffic congestion that is a feature of this road at present, with the resulting concentration of vehicle noise and pollution. The widened road will allow the maintenance of a smooth flow of traffic.
84. The junction improvement, pedestrian facilities, street lighting and other road safety measures incorporated into the project, will improve the public safety and reduce or mitigate the risk of accidents. Considering safety features in place, there is no likely risk due to increase in vehicle speed. The citizens of the city will benefit from a more effective transportation route as they will spend less time in stationary traffic exposed to noise, pollution and the associated physical and psychological stresses. Social and cultural resources may also benefit in a small way as it will be easier for people to their destinations.

D. Location and Design Impacts

85. In many environmental assessments there are certain effects that, although they will occur

during either the construction or operation stage, should be considered as impacts primarily of the location or design of the project, as they would not occur if an alternative location or design was chosen.

86. However, in the case of this subproject it is not considered that there are any impacts that are a result of the design or location. This is because:
- The project is located and designed within the available ROW
 - The project will be built at a single relatively small location and involves straightforward construction and low-maintenance operation, in an environment that is not especially sensitive, so it is unlikely that there will be major impacts;
 - Most of the predicted impacts are associated with the construction process, and are produced because that process involves quite extensive groundwork. However the routine nature of the impacts means that most can be easily mitigated.
87. There is one impact that can be called as location and design, i.e. cutting of 167 trees located in the ROW for the subproject. This could not be avoided as these are located within the ROW and there is no alternative land available. As stated earlier, as a compensatory measure three trees will be planted and maintained for each tree felled. These trees will be planted within the ROW, on the side of the road, where the land is available, and in the median.

6. INSTITUTIONAL ARRANGEMENTS

A. Institutions Involved

88. Following agencies will be involved in implementing this road widening subproject in Ghaziabad:
- (i) NCRPB: National Capital Region Planning Board is the funding agency for the project.
 - (ii) Implementing Agency (IA): Implementing Agency of the Project will be Ghaziabad Development Authority. IA will be responsible for the project implementation. Operation & maintenance will also be the responsibility of the IA.
 - (iii) Design and Supervision Consultants: Implementing Agency will be assisted by Design and Supervision Consultants (DSC) in tendering, and reviewing and revising designs during the construction, if required, and supervising the construction to ensure quality.
 - (iv) Construction Contractors: IA will appoint Construction Contractors (CC) to build the infrastructure elements.
89. Implementing the project according to and in compliance with the policies the funding agency, NCRPB, will be the responsibility of the Implementing Agency (IA). The Environmental and Social Management Cell (ESMC) of NCRPB will deal with environmental and social safeguard issues. ESMC would guide and monitor IA in complying with its ESMS and Policy.
90. *ESMC*. The ESMC will be housed inside the appraisal function of NCRPB and will have two distinct sub-functions, i.e. managing environmental safeguards and social safeguards. ESMC will be provided with one full-time staff - safeguards officer, who will look after the day-to-day activities related to the safeguard compliance. Safeguard Officer will be responsible for both environmental and social safeguard functions. Based on the necessity, the Safeguards Officer will source expertise from outside/external consultants on a case-to-case basis.
91. ESMC will review and approve IEE, oversee disclosure and consultations, and will monitor the implementation of environmental monitoring plan and environmental management plan where required. The CC will implement mitigation measures in construction. IA or DSC will monitor the implementation of mitigation measures by the CC. ESMC will oversee the implementation of EMP. Implementation of mitigation and monitoring measures during the O&M stage will be the responsibility of the implementing agency.

7. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

92. The proposed subproject and its components, the baseline environmental profile of the subproject area, the anticipated environmental impacts and appropriate mitigation measures to avoid/ reduce/ mitigate/compensate for the identified impacts have been discussed in detailed in earlier sections.
93. An Environmental Management Plan is developed for implementation listing the impacts, appropriate mitigation measures, delegating the responsibility of implementation to concerned agencies. This is shown in the following **Table 7-1**.

B. Environmental Monitoring Plan

94. A program of monitoring will be conducted to ensure that all parties take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. Regular monitoring of implementation measures by construction contractors will be conducted by the Implementing Agency. Periodic monitoring and overseeing of implementation of mitigation measures will be conducted by the ESMC of NCRPB. Monitoring during operation stage will be conducted by the Operating Agency.
95. Most of the mitigation measures are fairly standard methods of minimizing disturbance from building in urban areas (public inconvenience and traffic disruptions). Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects.
106. **Table 12** shows the proposed Environmental Monitoring Plan (EMP) for this Project, which specifies the various monitoring activities to be conducted during different phases of the project. The EMP describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring).

Table 7-1: Environmental Management Plan

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
<p>Preconstruction</p> <p>Involuntary resettlement</p> <p><i>Description:</i> Displacement of 23 squatters encroached on the ROW</p>	L	P	<ul style="list-style-type: none"> • Implement compensatory measures as recommended by the Resettlement Plan prepared in compliance with NCRPB ESMS • Suggested measures must be implemented before the signing of contract for civil works including: <ul style="list-style-type: none"> ○ Compensation equivalent to the amount of business income lost as a result of the construction process; ○ Compensation at replacement cost for lost income-generating assets (shop premises, etc); ○ Additional financial assistance to enable them to re-establish their business at an alternative location. 	GDA	Road widening site	Part of RP Cost
<p>Construction</p> <p>Tree Cutting</p> <p><i>Description:</i> The proposed work requires cutting of 167 trees of domesticated and local species</p> <p>Excavation will produce large quantity of waste soil, which needs proper disposal.</p> <p><i>Description.</i> Excavation for road and bridge construction will produce an estimated 20,000 m3 of waste soil.</p>			<ul style="list-style-type: none"> • Obtain necessary approvals from Forest Department/Ghaziabad Nagar Nigam for tree cutting • Plant and maintain three tree for each tree felled as a compensatory measure • Utilize the waste soil in construction work; significant construction works like roads, flyovers are under construction in Ghaziabad and surroundings, waste soil must be utilized in construction of earthen ramps and shoulders, etc. • Utilize the waste soil in filling up low lying area and raising the ground level of the building sites in newly developing areas particularly in Trans-Hindon area, which is located at a lower level than Hindon River 	CC	Road widening site	Part of project cost
	L	P		CC	Road widening site	Part of standard contract

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
Dust nuisance due to construction <i>Description.</i> Due to dry weather conditions the dust generation from construction activities will be significant. Since the project is located within an urban area with large scale development, the impact due to dust could be significant.	M	T	<ul style="list-style-type: none"> Waste shall be disposed only at a designated place specified by the engineer in-charge and shall not be disposed off in water bodies, drains, and along roads. Barricade the work area which will also act as a dust and noise barrier Damp down the soil/material stock piled at the site Transport the waste soil immediately from the site to the disposal location Use tarpaulins to cover soil/materials when transported by truck Control dust generation while unloading the material (particularly aggregate) at the site by sprinkling water and unloading in a barricaded area Sprinkle water in truck after downloading material; or cover it with tarpaulin to avoid dust raging from the truck while it is moving 	CC	Work site & material and waste transport routes	Part of standard contract
Impacts on drainage			<ul style="list-style-type: none"> Work section-wise and divert the drain in the working section by providing a temporary drain if required Complete construction of new drain as soon as possible and restore the flow 	CC	Work site & material and waste transport routes	Part of standard contract
Generation of noise and other construction related disturbances <i>Description.</i> Since the project is located within an urban area with large scale development, the nuisance and disturbance to community may be considerable.	L	T	<ul style="list-style-type: none"> Consult the local community to inform them of the nature, duration and likely effects of the construction work, and the mitigation measures in place Proper planning of the work programme; schedule noisy or otherwise invasive activities to avoid sensitive times; Avoid noise-generating activities at night; Implementing the measures to reduce dust; Utilizing modern vehicles and equipment with the requisite adaptations to limit noise and exhaust 	CC	Work site	Part of standard contract

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
<p>Impacts due to improper mining for construction materials</p> <p><i>Description.</i> Large quantities of construction material like sand, gravel and aggregate will be required for construction work. Yamuna Nagar in Haryana about 200 km away is a known source for stone aggregates, Ghaghar, 180 km away and Haridwar, 160 km away are sources for sand and Noida, 30 km away for gravel.</p>	L	P	<p>emissions, and ensuring that these are maintained to manufacturers' specifications at all times.</p> <ul style="list-style-type: none"> Ensure that construction materials (sand, aggregate and gravel) are obtained from quarries licensed by Geology and Mining Departments of respective state governments (Haryana/ Uttar Pradesh /Uttarakhand) 	CC	NA	Part of standard contract
<p>Shops and other business may loose income if costumer's access is impeded</p> <p><i>Description.</i> Although there will be inconvenience due to construction work, the road will not be closed completely and the traffic is allowed on service roads</p>	L	T	<ul style="list-style-type: none"> Inform all residents and businesses about the nature and duration of any work well in advance so that they can make necessary preparations; Leave spaces for access between mounds of excavated soil and other stored materials and machinery, and providing footbridges so that people can crossover open trenches Barricade the construction area and regulate movement of people and vehicles in the vicinity, and maintain the surroundings safely with proper direction boards, lighting and security personnel Control dust generation 	CC	Construction work site	Part of standard contract

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
<p>Excavation could damage existing infrastructure/utilities</p> <p><i>Description.</i> There are various utilities (electric poles, transformers, telephone cables, water lines and sewers) within the ROW, which needs to be relocated. No major impact envisaged as these utilities will be relocated suitably before the start of work. However, it needs to be confirmed during construction about the underground utilities.</p>	L	P	<ul style="list-style-type: none"> Notify the respective agencies (GNN, BSNL, and UP Electricity Board) in advance about the construction work and if there is any need for shifting Coordinate with respective agencies and provide prior information to public about the disruption in services during construction; this can be announced via mass communication systems like local/vernacular news papers Provide alternative arrangement for disrupted services such as water supply based on the necessity and duration of disruption 	CC and respective agency (BSNL, UP Electricity Board, GNN)	Construction work site	Part of standard contract
<p>Hindrance to traffic due to construction work</p> <p><i>Description.</i> As this is a major transport corridor carrying considerable traffic, the construction work could create large scale disturbance</p>	M	T	<ul style="list-style-type: none"> Provide alternative traffic arrangement/detours so that traffic can be distributed and move on different roads and ensure that public is informed about such traffic diversions Allow smooth traffic movement by confining and barricading the construction area; ideal vehicles and equipment shall be parked within the confined area Barricade the site properly; avoid accidental entry of traffic (pedestrian / vehicular) into the work site Provide necessary personnel to guide and control the traffic Provide information to the public through media – daily news papers and local cable television (TV) services, about the need and schedule of work, and alternative routes At work site, public information/caution boards shall be provided - information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that 			

Potential Negative Impacts	Sig	Dur	Mitigation measures	Responsibility	Location	Cost
Increase in traffic due to trucks carrying construction material and heavy equipment	L	T	<p>road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints.</p> <ul style="list-style-type: none"> Plan routes to avoid narrow streets, congested roads, and places of religious importance Plan work to avoid peak traffic hours 	CC	NA	Part of standard contract
<p>Workers and public at risk from accidents on site</p> <p><i>Description.</i> Deep excavations, operating heavy-duty construction equipment</p>	M	T	<ul style="list-style-type: none"> Following standard and safe construction practices Excluding the public from the site – enclosing/barricading the construction area, providing warning boards and sign boards and posting of security guards 24-hours Ensuring that all workers are provided with and use appropriate Personal Protective Equipment (helmet, hand gloves, boots, masks, etc); Follow standard practices of safety checks as prescribed before use of equipments; Provide on -site Health and Safety Training for all site personnel; Report accidents to the authorities promptly, and maintain records 	CC	Construction work site	Part of standard contract
Economic benefits for people employed in workforce	L	T	<ul style="list-style-type: none"> Ensure that most of the unskilled workforce is from local communities 	CC	All sites	-

Table 7-2: Environmental Monitoring Plan

Mitigation measures	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost
Pre-Construction					
<ul style="list-style-type: none"> Implement measures as recommended by RP Obtain necessary approvals for tree cutting Plant and maintain three tree for each tree felled Notify the respective agencies for shifting of utilities Inform public about the likely disruption of services Ensure alternate arrangements during the relocation 	GDA CC CC & respective agency (BSNL, UJS, GNN)	Records review; interview with APs Records review; on site-observation Observations on-site; CC records; consult respective agencies; informal public interviews	As needed As needed Weekly	ESMC GDA GDA	Part of project management cost Part of construction supervision cost Part of construction supervision cost
<ul style="list-style-type: none"> Procure construction material only from licensed quarries 	CC	Records review	As needed	GDA	Part of construction supervision cost
Construction					
<ul style="list-style-type: none"> Utilize waste soil in construction activities elsewhere Waste shall be disposed only at a designated place Barricade the construction work area Damp down the soil/material stock piled at the site Transport the waste soil immediately to disposal site Use tarpaulins to cover soil/materials during transport Control dust generation by sprinkling water Work section-wise; divert drains Complete construction of new drain quickly Consult the local community to inform them of the work Plan work programme to reduce the disturbance Avoid noise-generating activities at night 	CC	Observations on-site/off-site; CC records; informal public interviews	Weekly	GDA	Part of construction supervision cost

Mitigation measures	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost
<ul style="list-style-type: none"> ● Utilizing modern vehicles and equipment ● Provide prior information to business & residents ● Leave spaces for access and provide footbridges ● Regulate movement of people and vehicles ● Notify the respective agencies for utility shifting ● Coordinate provide prior information to public ● Provide alternative arrangements, if required ● Provide alternative traffic arrangement/detours ● Allow smooth traffic movement ● Avoid accidental entry of pedestrian/vehicles into site ● Provide personnel to guide and control the traffic ● Provide information to the public through media ● Provide public information/caution boards at site ● Plan routes to avoid narrow streets, congested roads, etc ● Plan work to avoid peak traffic hours ● Following standard and safe construction practices ● Excluding the public from the site ● Ensuring that all workers are provided with PPE ● Follow standard practices of safety checks ● Report accidents to the authorities, and maintain records ● Draw unskilled workforce from local communities 	CC	Observations on-site/off-site; CC records; informal public interviews	Weekly	GDA	Part of construction supervision cost

8. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project Stakeholders

96. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Primary stakeholders are:

- People near the proposed road site;
- Public representatives and prominent citizens;
- Ghaziabad Nagar Nigam;
- Ghaziabad Development Authority

97. Secondary stakeholders are:

- Other concerned government institutions (utilities, regulators, etc)
- NGOs and CBOs working local area;
- Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- The beneficiary community in general
- NCRPB as the Funding Agency

B. Consultation and Disclosure

98. A series of public consultation meetings were conducted during project preparation. Various forms of public consultations (consultation through household surveys, ad hoc discussions on site) have been used to discuss the project and involve the community in planning the project and mitigation measures.

9. RECOMMENDATION AND CONCLUSION

A. Recommendation

99. The process described in this document has assessed the environmental impacts of the proposed road widening and strengthening sub-project in Ghaziabad. Potential negative impacts were identified in relation to design, location, construction and operation of the widened road. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and measures have been included in the designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design. These include:

- Widening of road within the available ROW of existing road to avoid the need to acquire land or relocate people
- Integration of road safety aspects into design and provision of road safety furniture and facilities for safe movement of vehicles and pedestrians as part of the project

100. Regardless of these and various other actions taken during the IEE process and in developing the project, there will still be impacts on the environment when the construction work is taken up. This is mainly because clearance of encroachments on ROW; because of the large-scale construction located in a busy urban area. Because of these factors there are impacts on the physical, social and human environment.

101. Following are some of the important mitigation measures suggested:

- Implementation of compensatory measures for clearance of encroachments as recommended by the Resettlement Plan prepared in compliance with NCRPB policies
- Condition that the all compensatory/resettlement measures must be implemented before the signing of contract for civil works

102. During the construction phase, impacts mainly arise from generation of dust from soil excavation and material transport and unloading; and from the disturbance to residents, businesses, and traffic and important buildings by the construction work. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation. Among these, cutting of trees, disturbance to traffic and business; public and worker safety due to large scale construction, and dust nuisance during construction is considered to be significant. Important measures suggested include:

- Compensatory afforestation to the tune of three trees for each tree felled
- Dust control measures such as water sprinkling and cover the loose material during

transport

- Proper planning and scheduling of noise generating activities
 - Providing alternative traffic routes/detours and informing public about the same
 - Providing information to the public through media – daily news papers and local cable television (TV) services
 - Providing public information boards at site (project details, traffic arrangements, executing agency and contractor details; safety and contact information)
 - Follow standard and safe construction practices (barricade the site properly; avoiding accidental traffic entry including pedestrians; deployment of safety and security staff; warning board; provision protection equipment, etc)
103. Once the construction is over, the road will function without any major maintenance so no impacts envisaged.
104. The main beneficiaries of the road widening will be the citizens of Ghaziabad and road users in general.
105. Mitigation will be assured by a program of environmental monitoring conducted to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged. This will include observations on and off site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the NCRPB.
106. Stakeholders were involved in developing the IEE through both face-to-face discussions on site and a large public meeting will be held in the town, after which views expressed will be incorporated into the IEE and the planning and development of the project.
107. There are two essential recommendations that need to be followed to ensure that the environmental impacts of the project are successfully mitigated. The IA shall ensure that:
- All mitigation, compensation and enhancement measures proposed in this IEE report and in the Resettlement Plan (RP) of the subproject are implemented in full, as described in these two documents;
 - The Environmental Monitoring Plan proposed this report and the monitoring proposed in the Resettlement Plan are also implemented in full.

B. Conclusion

108. The environmental impacts of the proposed road widening and strengthening subproject in Ghaziabad have been assessed by the Initial Environmental Examination reported in this document, conducted according to NCRPB ESMS. Issues related to Involuntary Resettlement were assessed by a parallel process of resettlement planning and will be compensated by measures set out in detail in the Resettlement Framework for the subproject.

109. The overall conclusion of both processes is that providing the mitigation, compensation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of location, design, construction or operation of the subproject.
110. There are no uncertainties in the analysis, and no additional work is required to comply with NCRPB procedure or national law. There is thus no need for further study or Environmental Assessment.

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