GUWAHATI METROPOLITAN DEVELOPMENT AUTHORITY

PART-I

Master Plan for Guwahati Metropolitan Area – 2025

(Detail of Plan with supporting documents)

July 2009

STATFED Building, 3rd Floor, GMCH Road, Bhangagarh, Guwahati-781005
Website: www.gmda.co.in Email: ceo_gmda@yahoo.com Phone No. 0361-2529824 Fax: 0361-259991

GUWAHATI METROPOLITAN DEVELOPMENT AUTHORITY

N O T I F I C A T I O N

GMDA/MP/1/98/Part-I/103 dated 7th July, 2009 - In exercise of the powers conferred by sub-section (1) of Section 21 of the GMDA Act 1985 the Guwahati Metropolitan Development Authority is pleased to publish the following Notice regarding the publication of the new final Master Plan and the Zoning Regulation 2025 for Guwahati as approved by Govt. under Section 19 of GMDA Act 1985 vide Govt. order No. GDD. 91/1997/395 dated 09/06/2009 for the area described in the Schedule-I.

NOTICE FOR THE PUBLICATION OF THE MASTER PLAN AND THE ZONING REGULATION 2025 FOR GUWAHATI

1. It is notified that the new final Master Plan and Zoning Regulation 2025 for Guwahati, prepared by Guwahati Metropolitan Development Authority is hereby published for operation with effect from 07/07/2009.

2. The final Master Plan and the Zoning Regulation together with all relevant papers and maps may be inspected free of cost during office hours at the offices of The Chief Executive Officer, Guwahati Metropolitan Development Authority, Bhangagarh, Guwahati-5, The Deputy Commissioner, Kamrup (Metro) and Kamrup, The Palasbari and North Guwahati Revenue Circle Offices, Guwahati Municipal Corporation and North Guwahati Town Committee. Copies of the Master Plan and Zoning Regulation and soft copy of report and maps are available at the office of The Chief Executive Officer, Guwahati Metropolitan Development Authority, Bhangagarh, Guwahati-5 for sale.

Sd/-
Chief Executive Officer
Guwahati Metropolitan Dev. Authority
Bhangagarh, Guwahati-5

SCHEDULE-I

A. SITUATION AND AREA: **-**

Districts : Kamrup (Metro) and Kamrup

1. Approximate area : Existing Master Plan and Guwahati Metropolitan Area -262 sq. km.

2. Approximate new area : 66 sq. km.

3. Approximate Total Area : 328 sq. km.

1. Mouzas and Villages included in the existing Master Plan for Greater Guwahati:

Mouzas		**Villages**
Silasindurighopa	:	Nort-Guwahati, Rudreswar, Gouripur, Abhoypur, Tilinggaon, Sila Grant, Ghorajan, Nomalijalah, Amingaon.
Pub Bangsar	:	Charmajuli pam.
Dakhin Rani	:	Barjhar, Kahikuchi, Jugipara.
Chhayani	:	Kaithasidhi.
Jalukbari	:	Garalgaon, Ajaragaon, Dharampur, Upar Mirjapur, Mikirpara Chakardai, Dipar Bill, Pamohi, Dehangarigaon, Kacharigarigaon, Pachim Jalukbari, Dakhin Jalukbari, Maj-Jalukbari, Uttar Jalukbari, Sadilapur, Tetelia, Pachim Baragaon, Pub Baragaon, Pub Baragaon N.C., Pachim Baragaon N.C., Tetelia N.C., Gotanagar, Maligaon, Durgasarobar N.C., Fatasilgaon N.C., Kamakhya, Gorpandu, Kumarpara, Pandu, Bharalumukhgaon, Jugipara.
Beltola	:	Dhalbama, Betkuchi, Jutikuchi, Fatasilgaon, Barsapara, Greenwood Grant, Odalbakra Grant, Odalbaragaon, Dakhingaon, Saukuchi, Saru-Sajoi, Bar-Sajoi, Natbama, Hatigaon, Jatia, Kahelipara-gaon, Kahelipara N.C., Dispur, Dispur N.C., Bhagargaon Grant, Japarigog, Hengrabari N.C., Hengrabari Garden, Hengrabarigaon, Saru Mataria, Rukunigaon, Bar Mataria, Khanapara, Maidam, Basistha, Basistha Grant, Basisthagaon, Duar-Andha, Bagharbari, Satgaon, Birkuchigaon, Birkuchi N.C., Kalitakuchigaon, Kalitakuchi N.C., Nunmati, Modghoria N.C., Modghoria No. 1, Modghoria No. 2, Nunmati Garden, Bondagaon, Bonda Grant-I, Bonda Grant-II, Bonda N.C., Kharghuligaon, Sunsali Grant, Kharghuli Gaon, Kharghuli N.C., Jansimalu, Jansimalu N. C.
Ulubari	:	Ulubari New Town, Sarania New Town, Bamuni Maidan New Town, Nunmatigaon, Ulubari, Bamuni Maidam, Ramcha Hill Grant, Chunsali Grant, Clarence Grant, Kharghuli New Town.
Guwahati	:	Guwahati

2. Description of the new area:

Sl. No.	Addition	Location	Area (sq. km.)
1	New Town-I **(Special Scheme Area).**	Nort-East of GMA (Sila-Matiya-Najirakhat-Fulung area)	14
2	New Town-II **(Special Scheme Area).**	Nort-West of GMA (Charmajulipam-Gandhmau-Ambari-Bamun Soalkuchi area)	23
3	New Town-III	South-West of GMDA (Panchniyapara-Sajjanpara-Gaiyapara-Alibari-Tarapatipara area)	19
4	Marginal adjustment in boundary and inclusion of Pamohi Village **(Special Scheme Area).**		10
		Total	66

Villages proposed in new towns:

New Town-I
1. Sila Gaon Part, 2. Jalah Gaon, 3. Balai Beel, 4. Bamuni Gaon, 5. Fulung, 6. Rang Mahal, 7. Barchandra, 8. Barchandra Grant, 9. Chang Chari Part

New Town-II
1. Char Majuli Pam, 2. Charmajuli Gaon, 3. Dali Bari, 4. Singimari, 5. Rawmari, 6. Gondh Mou, 7. Kismat Bangsor, 8. Ambari, 9. Nij Bangsor, 10. Rakhakhinir Char, 11. Bamun Bari.

New Town-III
1. Jabe, 2. Patgaon, 3. Sajanpara, 4. Mati Kuturi, 5. Paseniapara, 6. Jangalipara, 7. Kamargaon, 8. Rajapani Chnada, 9. Andherijuli, 10. Rangapara, 11. Kachari Ali Bari, 12. Losana, 13. Batabari, 14. Shathikapara, 15. Malhata, 16. Deor Ali Gaon.

Sd/-
Chief Executive Officer
Guwahati Metropolitan Dev. Authority
Bhangagarh, Guwahati-5

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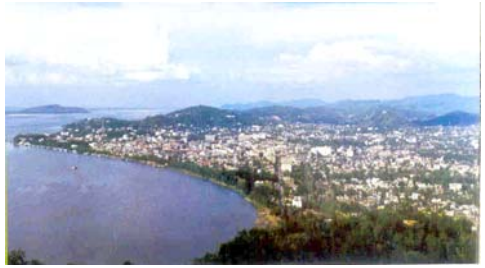
Abbreviations

A.T.C. : Area Traffic Control
B.O.D. : Biochemical Oxygen Demand
C.A.G.R. : Compounded Annual Growth Rate
C.B.D. : Central Business District
C.C.C. : Community Commercial Centre
C.F.C. : Community Facility Centre
C.M.P. : Comprehensive Master Plan
C.O.D. : Chemical Oxygen Demand
D.C.C. : District Commercial Centre
D.F.C. : District Facility Centre
E.C.S. : Equivalent Car Space
E.S.R. : Elevated Service Reservoir
F.A.R. : Floor Area Ratio
F.C. : Facility Centre
G.I.F.C.C. : Guwahati Integrated Freight Complex Company
G.I.T.B. : Guwahati Integrated Transport Board
G.M.A. : Guwahati Metropolitan Area
G.M.C. : Guwahati Municipal Corporation
G.M.C.A. : Guwahati Municipal Corporation Area
G.M.D.A. : Guwahati Metropolitan Development Authority
Ha : Hectare
H.C.V. : Heavy Commercial Vehicle
I.C.C. : Integrated Community Centre
I.D.C. : Integrated District Centre
I.F.C. : Integrated Freight Complex
I.P.T. : Intermediate Public Transport
L.C.V. : Light Commercial Vehicle
L.P.C.D. : Litres Per Capita per Day
L.R.T.S. : Light Rail Transit System
M.A.V. : Multi Axle Vehicle
M.L.D. : Million Litres per Day
M.G.D. : Million Gallons per Day
M.S.L. : Mean Sea Level
N.E.R. : North East Region
N.H.C. : Neighbourhood Centre
N.U.T.P : National Urban Transport Policy
O.H.S.R. : Over Head Service Reservoir
P.C.U : Passenger Car Unit
P.M.T.S. : Public Mass Transport System
P.S.U. : Planning Sub Unit
P.U. : Planning Unit
R.O.W : Right Of Way
R.S.U. : Remote Subscriber Unit
S.E.Z. : Special Economic Zone
S.P.V. : Special Purpose Vehicle
S.T.P. : Sewage Treatment Plant
T.A.Z. : Traffic Analysis Zone
T.E.M.U. : Traffic Engineering and Management Unit
T.S.M. : Traffic Systems Management
W.F.P.R : Work Force Participation Rate
W.T.P. : Water Treatment Plant

1 Introduction

1.1 Historical Background



Guwahati is said to be the legendary Pragjyotishpur, the City of Eastern Light. The City has a rich historical past and finds frequent mention in medieval historical sources and also in Mahabharata, Ramayana, Raghuvansham of Kalidasa. In 640 AD, the famous Chinese traveller Yuen Chawan visited the city. `

The emergence of modern Guwahati started in 1826. The town was connected by railway line with rest of India in 1890. Guwahati experienced phenomenal growth after independence of the country following the establishment of major institutions of higher education like Guwahati University, Engineering College, and Medical College. The Guwahati Oil Refinery was established in 1961. In 1972, after the reorganization of the Assam state, the capital was shifted from Shillong to Dispur (Guwahati), whereby the city gained enough political importance. Since then the city has grown enormously in terms of population and development of commercial activities.

1.2 Location and Linkages

1.2.1 Geographical Location

Guwahati is situated on the southern bank of river Brahmaputra with its cardinal points as $26^0 10'$ north latitude and $92^0 49'$ east longitude. It is located towards the south-eastern side of Kamrup district surrounded by Nalbari district in the North, Darrang and Marigaon districts in the East, Meghalaya State in the south and Goalpara & Barpeta districts in the West.

The city is situated on undulating plain with varying altitudes of 49.5 m to 55.5 m above mean sea level (MSL). The southern and the eastern sides of the city are surrounded by hillocks. The central part of the city has small hillocks namely Sarania hill (193 m), Nabagraha hill (217 m), Nilachal hill (193 m) and Chunsali Hill (293 m). The city is also covered by swamps, marshes and water bodies like Dipar *Bil*, Dighali Pukhri, Silsakoo *bil*.

1.2.2 Regional Linkages

Guwahati being the major city of the North-East has developed road, rail and air connectivity with the rest of the country. Refer **Fig. 1.1**

1.2.2.1 *Roads*

Guwahati is at the junction of National Highway 31, National Highway 37 and National Highway 40. National Highway 31 connects Guwahati with rest of the country in the west, while other National and State Highways connect Guwahati city with north-eastern states of Tripura, Meghalaya, Mizoram, Manipur, Nagaland and Arunachal Pradesh.

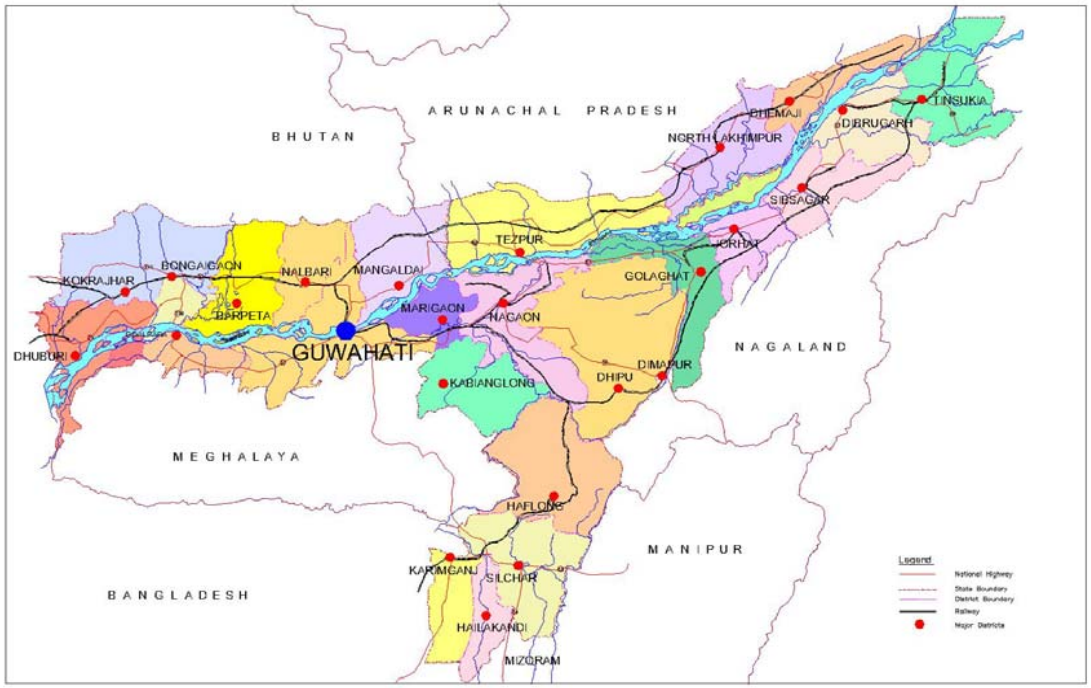


Fig 1.1: Location of Guwahati in Assam

1.2.2.2 *Railways*

A broad gauge railway line connects Guwahati with major parts of India. Another railway line connects Guwahati to Dibrugarh, Tinsukia and to other places of northeastern states.

1.2.2.3 *Airways*

Guwahati airport is the largest and the busiest airport in this region, which connects Guwahati to major cities in the country as well as to other major cities in Assam and the northeastern region. Guwahati airport is converted into an international airport.

1.1.3.4 Waterways

Guwahati once was well connected to Kolkata by a regular steamer service through river Brahmaputra. This route has been virtually closed after partition of the country.

1.3 Local Administration

In 1836, a Town Improvement Committee was formed in Guwahati under the initiative of the District Magistrate and Civil Surgeon owing to the appalling sanitary conditions of the city that resulted in fatal diseases like malaria and Kala azar. The city was given the status of Municipal Board in 1853 and finally elevated and categorised to Class-I category in 1876. Presently the city is a Municipal Corporation since 1974. Refer to **Map 1.2**.

1.4 Planning Efforts

The Guwahati Municipal Corporation was constituted with 34 wards in 1974. Since then, there has been a manifold rise in its population. The

wards were further delineated and their present number is fixed at 60. The corporation has four revenue zones and twenty-three public-works zones for administration.

In order to deal with rapid urbanization and related urban issues, the State government prepared a Master Plan for Greater Guwahati in 1965 under Section 10 of the *Assam Town and Country Planning Act, 1959.* The Plan had perspective 1986.

The *Modified Final Master Plan and Zoning Regulations for Guwahati* was prepared by the Town and Country Planning Organisation in exercise of the powers under section 14 and sub-section (2) of section 10 of the Assam Town and Country Planning Act and published the same in February 1987. The Master Plan was finally entrusted to the Guwahati Metropolitan Development Authority (which was constituted under Guwahati Metropolitan Development Authority Act 1985) for implementation of the Plan with Perspective 2001. The plan is now being revised to have a Comprehensive Master Plan (CMP) for Guwahati Metropolitan Area (GMA) with perspective 2025 under the GMDA Act, 1985.

1.4.1 Guwahati Metropolitan Area-2001

The region delineated under Guwahati Metropolitan Area (GMA) constitutes areas of Guwahati Municipal Corporation, North Guwahati Town Committee, Amingaon Census Town and 21 revenue villages (*Abhoypur, Rudreswar, Namati Jalah, Gouripur, Silamohekhaiti, Tilingaon, Shila, Ghorajan, Mikirpara, Kahikuchi, Mirjapur, Jugipara, Borjhar, Garal Gaon, Ajara Gaon, Dharapur, Jansimalu and Jansimalu (NC), Kalitakuchi & Kalitakuchi (NC), Kharghuli, Bonda, Bondagaon and Bonda Grant (I&II), Birkuchi)*.

The total area covered under GMA is approximately 262 sq. km.

1.4.2 Guwahati Metropolitan Area 2025 (GMA 2025)

In the Comprehensive Master Plan – 2025 (CMP-2025), presently under preparation, the existing Guwahati Metropolitan Area is proposed to be increased by 66 sq. km as in Table 1.1.

Table 1.1: Guwahati Metropolitan Area - 2025

Sl. No.	Addition	Location	Area (Sq. Km.)
1	New Town I (Special Scheme Area).	North-East of GMA (Sila-Matiya-Najirakhat-Bhulung area)	14
2	New Town II (Special Scheme Area).	North-West of GMA (Charmajulipam-Gandhmau-Ambari-Bamun Soalkuchi area)	23
3	New Town III	South-west of GMA (Panchniyapara-Sajjanpara-Gariyapara-Alibari-Tarapatipara area)	19
4	Marginal adjustments in boundary and inclusion of Pamohi Village (Special Scheme Area).		10
	Total		**66**

N.B. – Land use classification of the special scheme area is only indicative in nature. The final land use is required to be drawn up by GMDA after considering the ground realities.

1.4.2.1 Sub-division of the proposed GMA-2025 into Districts, Planning Units & Planning Sub-units

The Guwahati Master Plan-2001 had divided the Master Plan area into nine spatial units called planning units. In CMP-2025, Planning Unit-1 of the 2001 Plan has been subdivided to distinguish between Central Business District (CBD) and extended areas. Thus, the existing GMA-2025 has 13 Planning Units (including 3 units of the three New Towns).

Table 1.2: Planning Units

Planning Unit	Areas Covered
PU 1	Old Municipality Area
PU 2	Hatigaon-Basistha-Khanapara Area
PU 3	Hengrabari-Satgaon Area
PU 4	Narengi-Bonda Area
PU 5	Dipar Bil-Fatasil Hill Area
PU 6	Pandu-Maligaon Area
PU 7	Jalukbari-University Area
PU 8	Azara-Borjhar Area
PU 9	North Guwahati-Amingaon Area
PU 10	Extended Area of Old Municipality
PU 11	North-East of GMA (Sila-Matiya-Najirakhat-Bhulung area) (New Town I)
PU 12	North-West of GMA Charmajulipam-Gandhmau-Ambari-Bamun Soalkuchi area (New Town II)
PU 13	South-West of GMA Panchniyapara-Sajjanpara-Gariyapara-Alibari-Tarapatipara area (New Town III)

Refer to **Map 1.3**

The GMA-2025 area is further sub-divided into small spatial units called Planning Sub-units (PSU). A total of 74 PSUs have been identified including three new towns proposed for 2025. The PSUs 1 to 60 are co-terminus with municipal wards within the GMC area; beyond the GMC area, PSUs 61 to 71 are delineated by grouping villages as below:

Table 1.3: List of Villages included in PSUs 61-71

PSU	Villages Included
61	Villages (Kharguli NC, Bonda Grant II, Kharguli Goan
62	Villages (Bonda Grant I, Bonda Gaon)
63	Villages (Birkuchi NC, Bonda NC, Kalitakuchi NC)
64	Jansimalu Cantonment, Jansimalu, Jansimalu NC)
65	Villages (Dipar Bil, Mikipara Chakardoi))
66	Villages (Kahikuchi, Mirjapur)
67	Villages (Jugipara, Borjhar)
68	Villages (Garalgaon, Ajara, Dharapur)
69	Villages (Charmajulipam, Amingaon, Numali jalah, Silemohekhaiti)
70	Villages (Ghorajan, Siligrant, Tilingaon)
71	Villages (Gauripur, Abhoypur, Rudeshwar, North Guwahati)

PSUs 72, 73, 74 are respectively the New Towns I, II and III. The following Table shows the list of PSUs included in the Planning Units.

Table 1.4: List of Planning Sub-Units within Planning Units

Planning Unit	Planning Sub-Unit
1	18,19,20,21,23,25,26,27,28,29,30,31,32,33,34
2	15,16,17,22,24,55,56,57,58,59,60
3	51,52,53,54,64
4	46,61,62,63
5	10,12,13,65
6	3,4,5,6,7,8,9
7	1,2
8	66,67,68
9	69,70,71
10	11,14,35,36,37,38,39,40,41,42,43,44,45,47,48,49,50
11	72
12	73
13	74

To facilitate higher order planning, the Planning Units have been further grouped to form Planning-Districts with an average 5 lakh population. Refer to **Map 1.3.**

Table 1.5: Planning Districts

District	Planning Units
A	1,10,4
B	2,3
C	5,6,7,8,13
D	9, 11, 12

2 Vision and Goals

Guwahati, the capital city of Assam, is the most important city in North-East India in terms of its population size, transport connectivity and strategic location. It has a beautiful landscape with hills and vast Brahmaputra. Responding to multifarious developments, internal and external, the city of Guwahati must respond to its existing problems, the new emerging socio-economic forces with a vision of its own. Guwahati, most importantly being the state capital should stand out amongst other state capitals and the city should perform its functions well as gateway to the North East India. Thus, the vision for Guwahati for its development through 2025 is:

GUWAHATI CITY TO BE

ONE OF THE MOST ADMIRED STATE CAPITALS OF INDIA

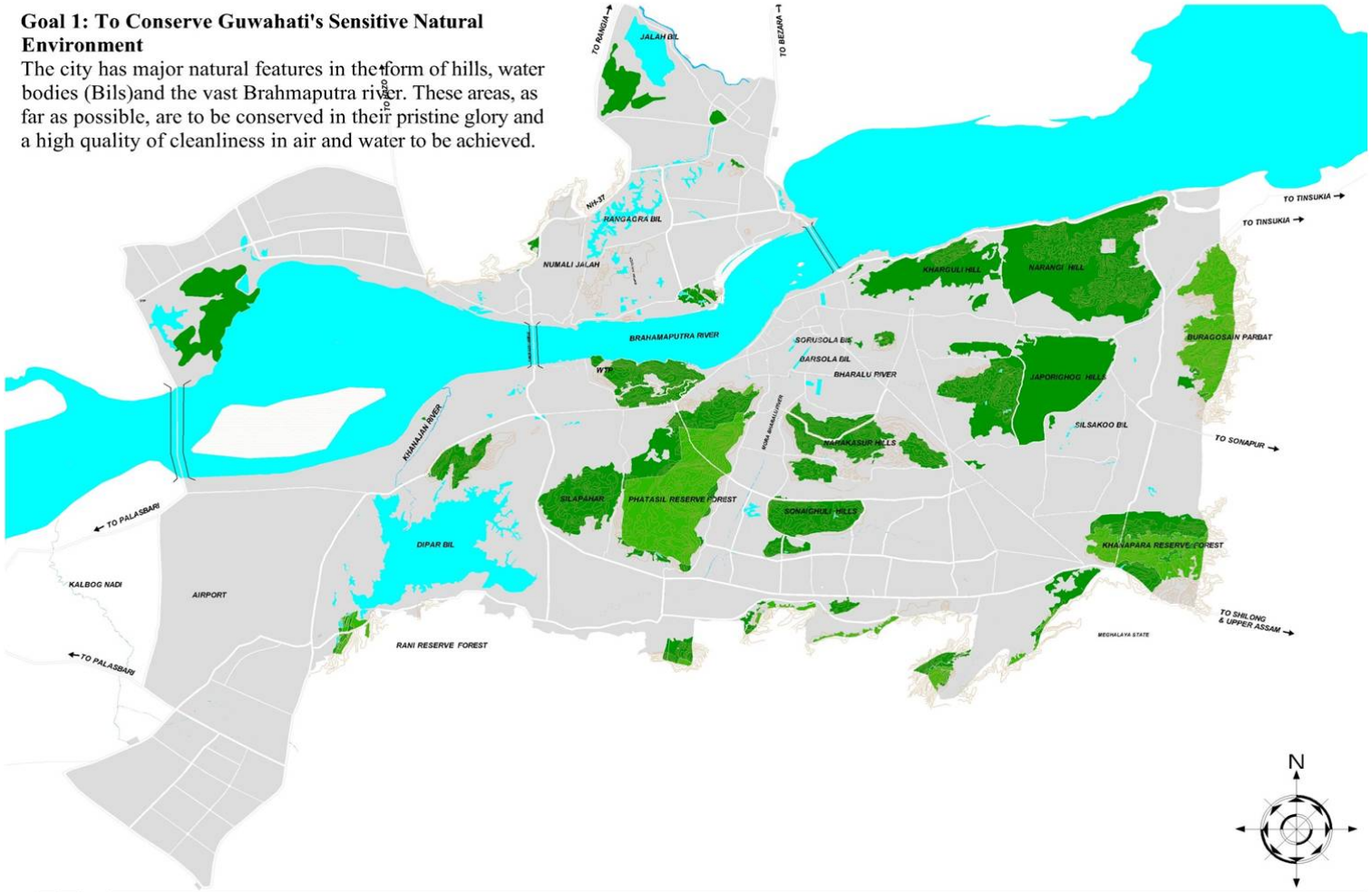
AS GATEWAY TO THE NORTH-EAST,

WITH A UNIQUE IMAGE OF ITS OWN.

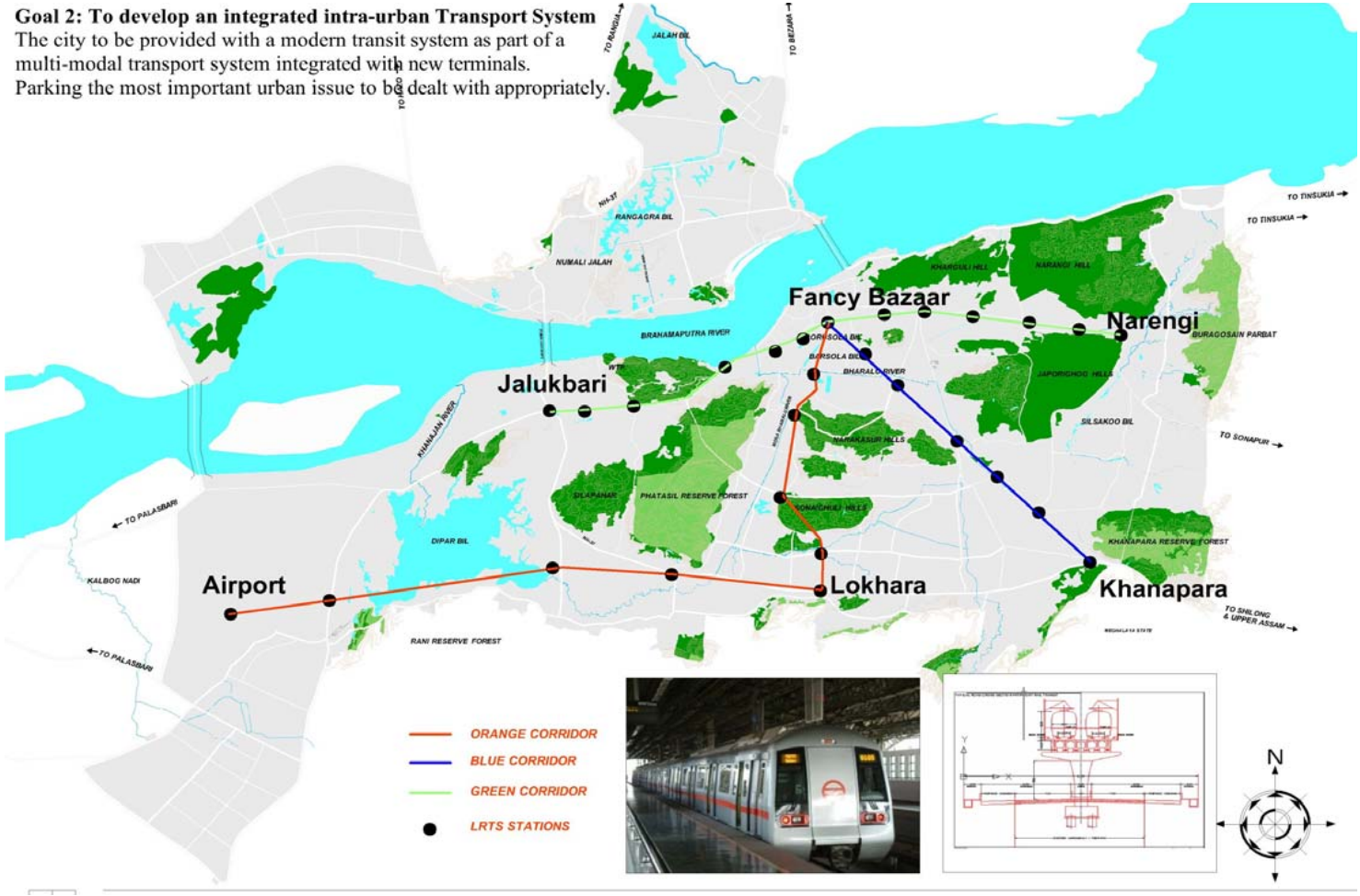
Vision being a cherished dream, to achieve this vision it is necessary to break it into a number of goals and subsequently to objectives.

Goal 1: To Conserve Guwahati's Sensitive Natural Environment

The city has major natural features in the form of hills, water bodies (Bils)and the vast Brahmaputra river. These areas, as far as possible, are to be conserved in their pristine glory and a high quality of cleanliness in air and water to be achieved.



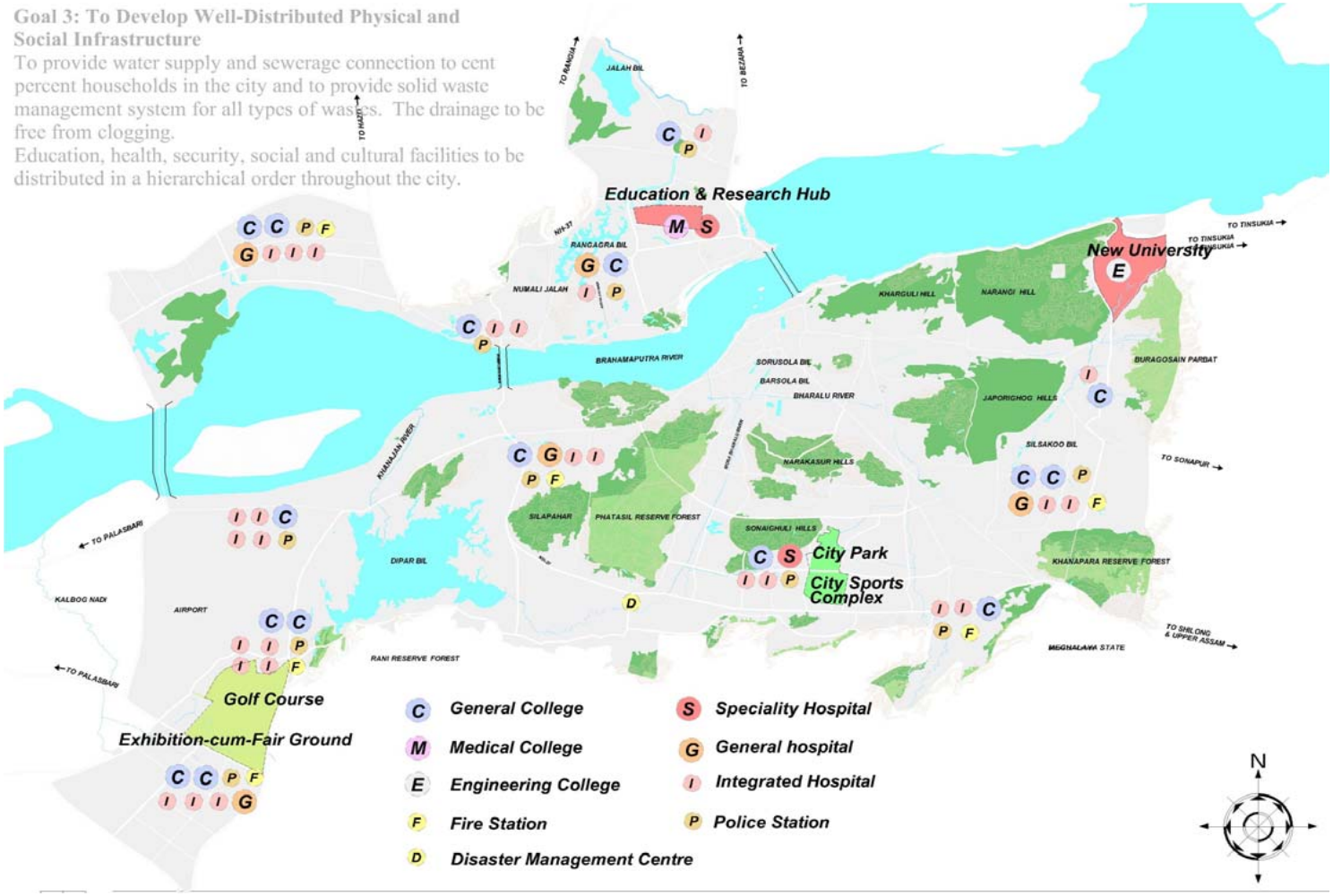
Goal 2: To develop an integrated intra-urban Transport System
The city to be provided with a modern transit system as part of a multi-modal transport system integrated with new terminals.
Parking the most important urban issue to be dealt with appropriately.



Goal 3: To Develop Well-Distributed Physical and Social Infrastructure

To provide water supply and sewerage connection to cent percent households in the city and to provide solid waste management system for all types of wastes. The drainage to be free from clogging.

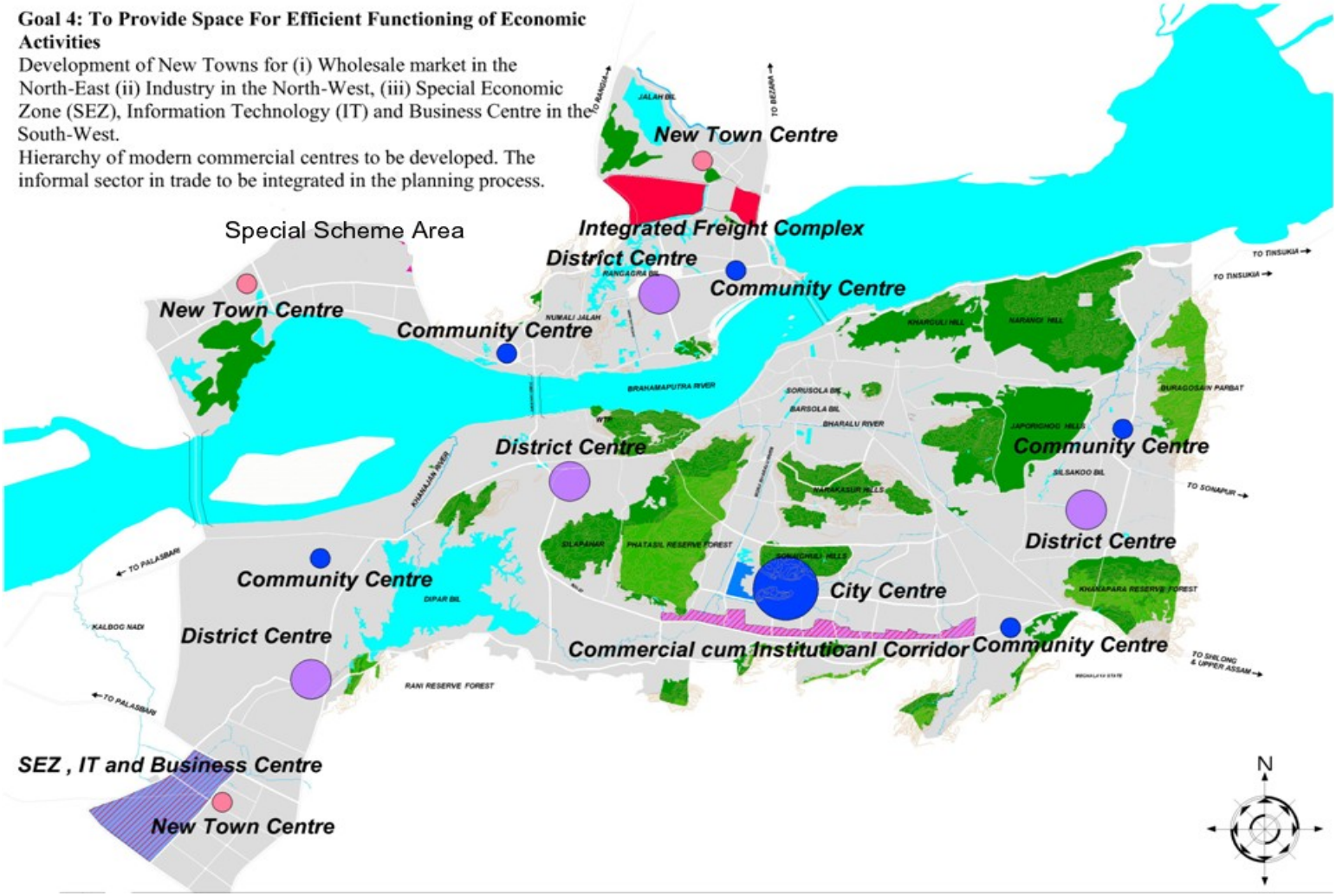
Education, health, security, social and cultural facilities to be distributed in a hierarchical order throughout the city.



Goal 4: To Provide Space For Efficient Functioning of Economic Activities

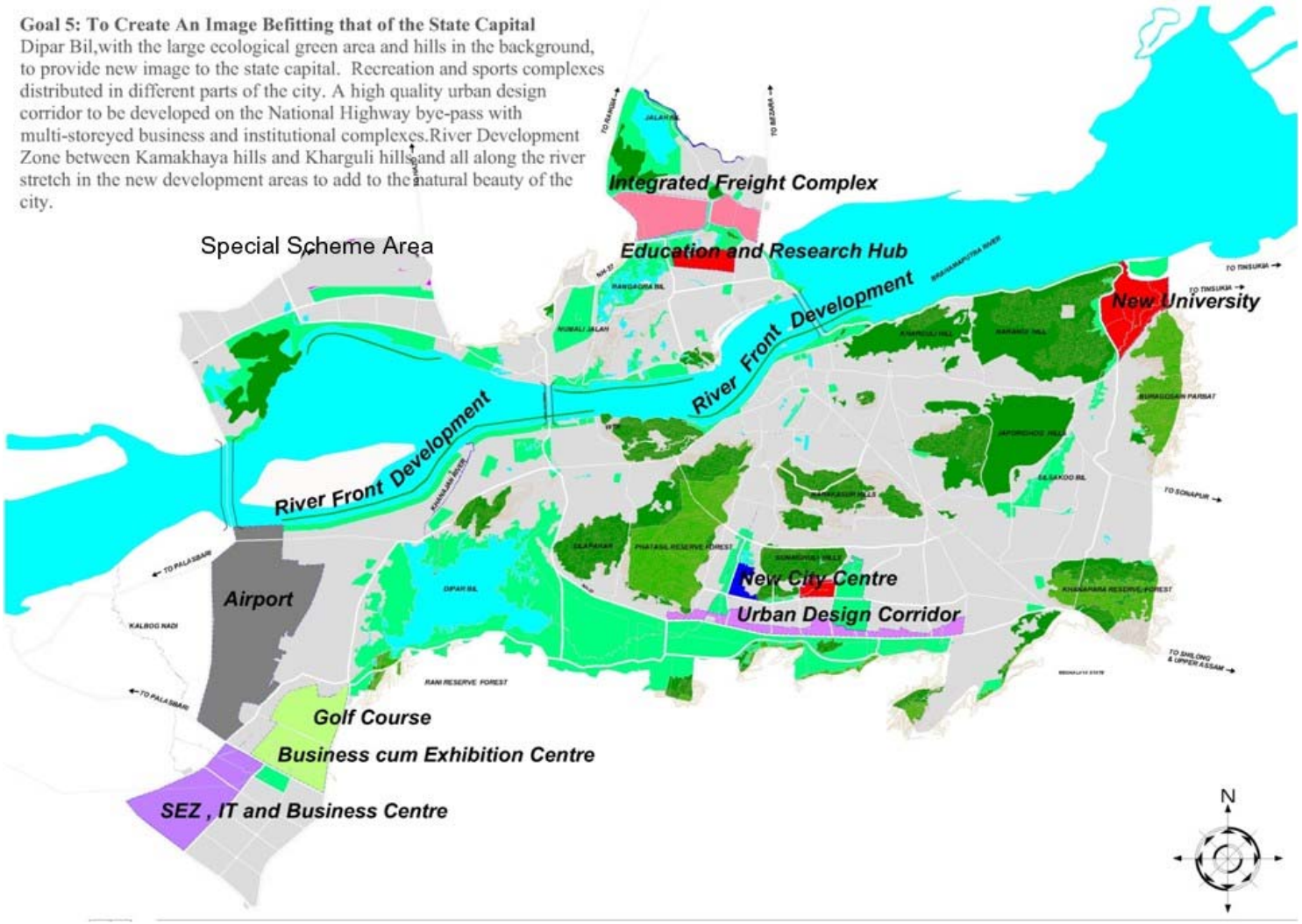
Development of New Towns for (i) Wholesale market in the North-East (ii) Industry in the North-West, (iii) Special Economic Zone (SEZ), Information Technology (IT) and Business Centre in the South-West.

Hierarchy of modern commercial centres to be developed. The informal sector in trade to be integrated in the planning process.



Goal 5: To Create An Image Befitting that of the State Capital

Dipar Bil,with the large ecological green area and hills in the background, to provide new image to the state capital. Recreation and sports complexes distributed in different parts of the city. A high quality urban design corridor to be developed on the National Highway bye-pass with multi-storeyed business and institutional complexes.River Development Zone between Kamakhaya hills and Kharguli hills and all along the river stretch in the new development areas to add to the natural beauty of the city.

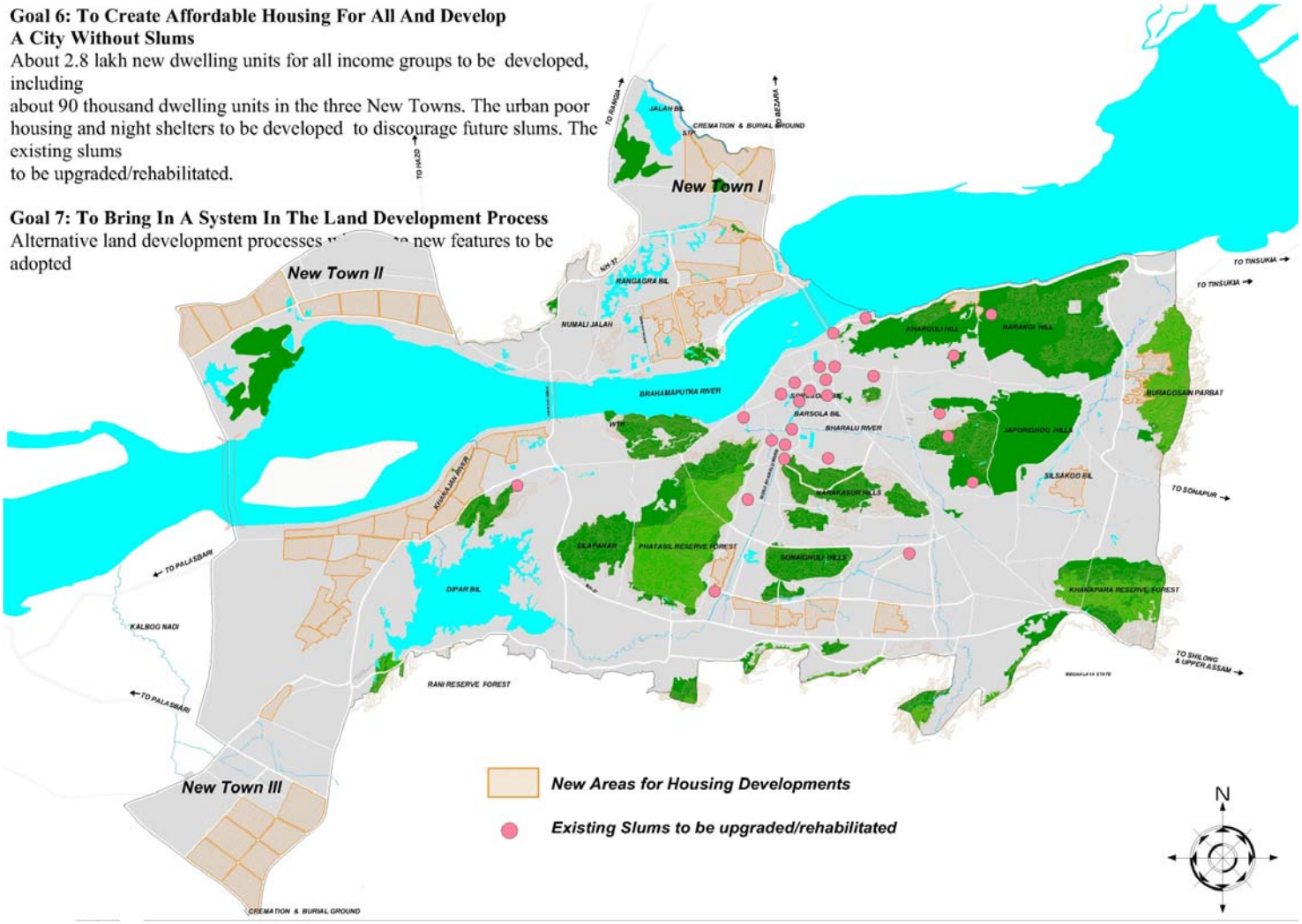


Goal 6: To Create Affordable Housing For All And Develop A City Without Slums

About 2.8 lakh new dwelling units for all income groups to be developed, including about 90 thousand dwelling units in the three New Towns. The urban poor housing and night shelters to be developed to discourage future slums. The existing slums to be upgraded/rehabilitated.

Goal 7: To Bring In A System In The Land Development Process

Alternative land development processes [illegible] new features to be adopted



3 Population and Employment

3.1 Population Growth: Guwahati Metropolitan Area

The population of Guwahati was 8,394 in 1891, which crossed the one-lakh limit in 1961. The population of Guwahati Municipal Corporation Area in 2001 was 809,895. The following table provides the growth of population in Guwahati and its constituent areas.

Table 3.1 : Growth of population in Guwahati : 1921 to 2001

Year	Population in GMCA	Decadal Growth (%)	GMA excluding GMCA	Decadal Growth (%)	GMA	Decadal Growth (%)
1921	16,480		-		-	
1931	21,797					
1941	29,594					
1951	43,615		53,774		97,389	
1961	100,707	130.90	98,775	83.69	199,482	104.83
1971	123,783	22.91	169,436	71.54	293,219	46.99
1981*	268,945	117.27	102,351	-39.59	435,280	48.45
1991	584,342	117.27	61,827	-39.59	646,169	48.45
2001	809,895	38.60	80,878	30.81	890,773	37.85

Source: 1. TCPO 1987 Table 3, Modified Final Master Plan and Zoning Regulations for Guwahati
2.Census of India 1991 and 2001
**No Census could be conducted in Guwahati in 1981. The 1981 population figures have been extrapolated on the basis of the 1971-1991 CAGR.*

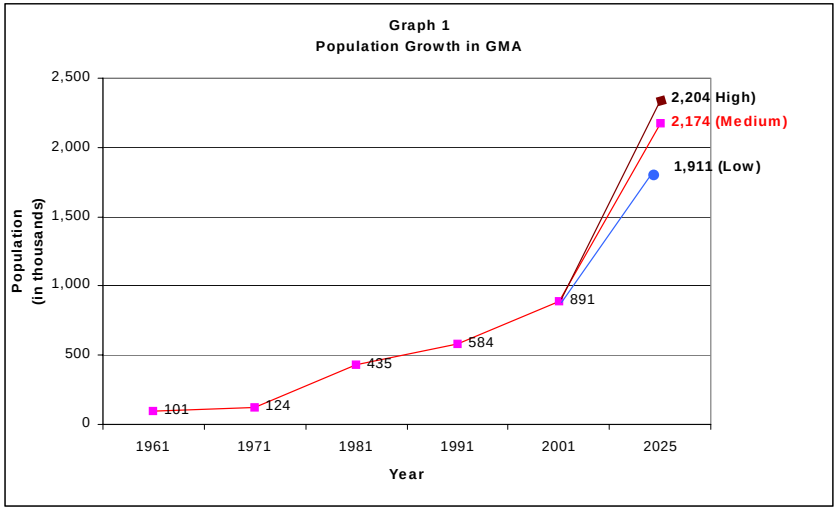
3.2 Population Estimates

Based on the past population growth trends– low, medium and high – population estimates for Guwahati Metropolitan Area for the period 2005 to 2025 have been worked out. It is estimated that the population of GMA may vary from low of 19.10 lakhs to a high of 22.50 lakhs in 2025. A medium projection of 21.74 lakh for GMA for the perspective year 2025 is adopted and the same is used for the planned development of GMA. Five yearly estimates of the population are given. Thus, the total population of GMA will be 21 lakh approximately in 2025. Refer to Table 3.2.

Table 3.2: Population estimates in GMA-2025 at 5 yearly intervals

Year	Population in GMA
2005	1,033,584
2010	1,244,713
2015	1,498,970
2020	1,805,163
2025	2,173,902

Source: Calculations by the Consultant



3.3 Floating Population

It is observed from the transportation survey that besides the normal population housed in the city, there is a floating population of about 10%, which comes to Guwahati for daytime activities. Thus, the daytime population in Guwahati in 2025 is estimated as 22.94 lakh.

3.4 Age-Sex Composition

Study of Age-Sex composition of population shows that the proportion of population in the working age group 15-64 and old age group 65+ is increasing. This is indicative of the increase in the participation rate and need of health infrastructure and recreational activities.

3.5 Population Distribution

Out of the total projected population, 17.74 lakh will be accommodated within the present GMA; the remaining 4 lakh population will be accommodated in the three New Towns. Planning-Unit wise distribution of the population is given in Table 3.3

Table 3.3: Population Distribution in GMA by Planning Units – 2025

Planning Unit	Residential 2025 (Ha)	Population 2001	Population 2025
1	494	155,483	165,076
2	1983	182,439	401,156
3	880	57,910	174,627
4	237	36,905	59,131
5	588	60,563	113,409
6	380	75,697	93,527
7	433	31,812	85,087
8	1172	33,889	230,694
9	793	30,951	156,124
10	1218	225,124	295,071
Sub-Total A	**8178**	**890,773**	**1,773,902**
11 (New Town I)	307	-	80,000
12 (New Town II)	707	-	160,000
13 (New Town III)	700	-	160,000
Sub-Total B	**1714**	**-**	**400,000**
Grand Total	**9892**		**2,173,902**

Refer **Map 3.1**.

The distribution of population in Districts A, B, C, D for the year 2025 is given in Table 3.4.

Table 3.4: Population Distribution in GMA by Planning Districts - 2025

District	Population-2025
A	519,278
B	575,783
C	682,717
D	396,124
Total	**2,173,902**

3.6 Employment Distribution-2025

For estimates and geographical distribution of employment for the year 2025 refer to the section - Economic Base and Work Areas.

4 Economic Base and Work Areas

4.1 Background

The economic sector is the main anchor behind the progress and growth of any city region. Guwahati has become one of the major hubs of economic activity in the entire North-East India. The establishment of Guwahati Refinery in 1962 marked the beginning of industrialization in the city. The construction of bridge over River Brahmaputra at Saraighat and the shifting of capital from Shillong to Guwahati in 1972 made tremendous economic impact on the city and turned Guwahati into one of the most important cities in the North-East.

4.2 Work-force

The workforce participation rate (WFPR) as per the 2001 Census is computed at 33.4% for Kamrup District. The same for Guwahati Metropolitan Area and Guwahati Municipal Corporation Area are respectively 34.8% and 35.1%. It is seen that the work participation rate in Guwahati Municipal Corporation Area increased from 32.3% in 1971 to 33.2 % in 1991 – the corresponding 2001 being 35.1%.

In view of the trend, a WFPR of 36% has been adopted for GMA for 2025. The workforce in GMA in 2025 works out as 782,605; considering additional 10% floating workforce, the total workforce in GMA works out as 860,866.

4.3 Sectoral Composition

On the basis of trends since 1961, workforce 2025 is estimated in all the given sectors and with a view to raising the employment in the Industry sector from the present (2001) 15% to 20%, employment values in all the other sectors are marginally adjusted. Refer Table 4.1.

Table 4.1: Distribution of work force in GMA in 2025

Activity	2001 (partly estimated)		2025 (adopted)	
	Workers	%age	Workers	%age
Primary Sector	7,545	2.63	8,609	1.00
Manufacturing in household industries	5,028	1.75	25,826	3.00
Manufacturing in other than household industries	37,159	12.96	146,347	17.00
Construction	17,597	6.14	51,652	6.00
Trade and Commerce	88,651	30.92	258,260	30.00
Transportation, Storage and Communication	31,340	10.93	86,087	10.00
Other Services	99,367	34.66	284,086	33.00
Total	**2,86,687**	**100.00**	**860,866**	**100.00**

4.4 Major Work Areas –Trade and Commerce

Commercial establishments in the Guwahati city may be divided into the following four broad categories.

- Wholesale — Fancy Bazaar Area
- Wholesale-cum-retail — In and around Fancy Bazaar, Machhkhowa, Paltan Bazaar

- Retail shops — Athgaon, Pan Bazaar, Ulubari, Silpukhri, Chandmari, Noonmati, Ganeshguri, Beltola, Maligaon, and Kalapahar
- Service Shops — Distributed throughout the city

4.5 Wholesale Trade

There are twenty-two wholesale market associations dealing in almost all types of trade and business activity in Guwahati Metropolitan Area. Presently there are 695 wholesalers, 345 wholesalers-cum-retailers and 5382 retailers registered with Kamrup Chamber of Commerce and other market associations. Wholesale Trade in Guwahati is to be organized for the following activities:

- Food grains and perishable items
- Fruit & vegetable market
- Hardware and Building materials
- Motor parts
- Coal Market
- Timber Market
- Wholesale Fish
- Wholesale cloth
- Tea auction centre

Their locations and the major related issues are as given in the following table:

Table: 4.2: Location and Issues of the Wholesale Markets of GMA-01

Sl No	Name & type	Location	Issues/ Remarks
1	Wholesale markets of food-grains and perishable items	Fancy Bazaar & Machkhowa areas	▪ Lack of basic services ▪ No arrangements for loading-unloading platforms and parking of vacant trucks ▪ Intermixing of goods and other traffic. ▪ Absence of proper solid waste management
2	Hardware and Building materials (Wholesale and retail)	▪ Fancy Bazaar and Athgaon ▪ A.T. Road from Fire Station in ASTC to Athgaon Railway crossing	▪ Lack of basic amenities. ▪ No proper arrangement solid waste management ▪ Congestion and spill over of activities
3	Motor Parts (Wholesale-cum-retail)	▪ A.T. Road (from Paltan Bazaar to Bharlumukh); ▪ Beltola (from Khanapara junction to Tetelia junction)	
4	Coal Market	▪ Along NH-37 from Khanapara junction to Biharibari junction	▪ Attract traffic. ▪ Around 1800 trucks pass through the city carrying coal. ▪ Needs to be relocated with proper regulations; it is a traffic hazard.
5	Timber market	▪ Mainly in Maligaon area	▪ Around 35 wholesalers and wholesale-cum-retailers
6	Wholesale fish market	▪ Near Paltan Bazaar area on the backside of Meghdoot cinema	▪ The average daily intake of fish for Guwahati is 4-5 three axle trucks while the daily requirement for entire North-East Region is 40 three axle trucks. ▪ Wholesale fish market for NE region is located at Rangia, 40 Km away from Guwhahati
7	Wholesale Cloth Market	▪ Fancy Bazaar Area	▪ Overcrowded and needs expansion

4.5.1 Area requirement of Wholesale Markets – 2025

Total employment in Trade and Commerce is estimated at 30% of the total employment in GMA which works out to 258,260. Wholesale employment at 14.89 percent of the trade & commerce employment would be 38,455, and considering the employment density of 270 workers per ha, the area requirement for wholesale markets works out to 143 ha.

4.5.2 Integrated Freight Complex

The Master Plan proposes to develop a new Integrated Freight Complex including Wholesale Markets in the Karaibari-Bhetamukh New Town of 0.8 lakh population in the Northern side of GMA. This location provides appropriate linkages for the incoming goods, outgoing goods and distribution of wholesale goods in the city.

In the Freight Complex, the Wholesale business could be operated more efficiently in a better environment. Basic functions of the Integrated Freight Complex are:

- to provide facilities for regional and intra-urban freight movement;
- to provide facilities for freight in transit as well as interchange mode;
- to provide warehousing and storage facilities and interlink these with the wholesale markets;
- to provide servicing, lodging and boarding, idle parking, restaurant, and other related functions in the complex.

The IFC will include other Central Area activities closely related to trade like financial institutions, administrative services, business entrepreneurship, physical and social infrastructure facilities and services, people related retail market facilities like eating places and other conveniences.

Following areas are reserved for Integrated Freight Complex, Coal yard and Truck Terminal.

Table 4.3: Area Break-up of IFC, Coal Yard and Truck Terminal

Sl. No.	Use	Area (ha)	%age
1	Integrated Freight Complex	270	68.2%
2	Coal Yard	66	16.7%
3	Truck Terminal	60	15.1%
	Total	**396**	**100.0%**

The broad land use break up of an IFC would be as under.

Table 4.4: IFC Space Norms

Sl. No.	Use Type	% of area	Area (ha)
1.	Wholesale Market and warehousing	53.0	143.0
2.	Transport Agencies	2.0	5.4
3.	Commercial and Public & Semi Public	5.0	13.5
4.	Utilities & Services	3.0	8.1
5.	Parking	12.0	32.4
6.	Circulation	25.0	67.6
	Total	100.0	270.0

Within the wholesale market, item-wise division of area for different commodities would be as following:

Table 4.5: Item-wise division of area in the New Wholesale Markets

Sl. No.	Item	Percentage of total area
1	Food grains	20%
2	Fruit and Vegetable Market	20%
3	Hardware and Building Materials	20%
5	Motor Parts	10%
6	Timber	10%
7	Fish	10%
9	Other	10%
	Total	**100%**

4.5.3 Existing Wholesale Market

Till such time the new wholesale market at New Town I is developed, the wholesale market activity is to continue from the existing areas. After the development of the new wholesale market, the existing wholesale market area would be used for retail activity, thus not allowing the movement of any heavy and medium commercial vehicles in the central city area.

4.6 Retail Trade

Retail shopping areas are important as these create an image of the city. In Guwahati retail shops are spread all over the city; however, the Fancy Bazar area is the major city level retail trade centre. Apart from this area, the other major retail centres are at Athgaon, Pan Bazar, Ulubari, Silpukhri, Chandmari, Noonmati, Ganeshguri, Beltola, Maligaon and Kalapahar.

To accommodate the required shopping, commercial offices, and other activities like cinema, hotel and related facilities, the following five-tier system of commercial development is proposed.

1. City level – Whole of the city including the three New Towns
2. District level
3. Community level
4. Neighbourhood level
5. Housing Areas level

4.6.1 Tier I: City Commercial Centre: Central Business District

The present central commercial areas i.e. Panbazar, Paltan Bazar, Ulubari etc., would continue to function as Central Business District. To cater to city-level business and shopping facilities, a new City-level magnet is proposed to be developed at Jatikuchi. It will be developed on around 56 ha land along with a City Facility Centre also including City Cultural Complex and City Park at Dakhingaon area. The City Commercial Centre would be a modern commercial centre with multi-storey commercial buildings and shall have major retail shopping malls, multi-storey commercial offices, banks, hotels, restaurants, and cine complexes. The City Commercial Centre along with the City Facility Centre and Recreational Centre shall together form the new City-Centre. **Refer Map 4.1**

The three new towns would also have town level commercial centres.

4.6.2 Tiers II and III: District Commercial Centres and Community Commercial Centres

District Commercial Centres (DCCs) are envisaged to serve a Planning District of 3 - 5 lakh population and Community Commercial Centres are to serve a population of 1-1.5 lakh. Four District Commercial Centres are envisaged and are geographically distributed to serve the city. These

District Commercial Centres are clubbed together with Facility Centres including Parks to form Integrated District Centres.

The District Commercial Centres are major shopping complexes, which while serving for reasonable selection of shops, departmental stores, malls, are also the centres of socio-cultural activities where the people get together. Each District Commercial Centre besides commercial facilities shall include a library, a multipurpose meeting hall, an exhibition centre for art exhibitions. For the activities to be included in DCC and Community Commercial Centre (CCC) refer to **Section 4.6.5.**

A total number of seven Integrated Community Centres (ICC) have been proposed for GMA-2025. These Integrated Community Centres include Community Commercial Centres and Community Facility Centres which are clubbed together. One lone Community Commercial Centre is also proposed in North Guwahati in Unit 9.

For the distribution of District Commercial Centres and Community Commercial Centres refer to Table 4.6. In case of New Towns II and III, New Town Commercial Centres are proposed to be developed.

Table 4.6: Distribution of District Commercial Centres and Community Commercial Centres

Districts	Planning Units	Estimated Population in 2004 (in lakh)	Proposed Population in 2025 (in lakh)	Additional Population (in lakh)	Proposed District Commercial Centre	Proposed Community Commercial Centre
A	1,4,10	4.6	5.1	0.5	-	1
B	2,3	2.6	5.7	3.1	1	2
C	5,6,7,8,13	2.3	6.8	4.5	2	2*
D	9, 11,12	0.4	3.9	3.5	1	4*
Total		**9.9**	**21.7**		**4**	**9**

** Includes one Town Commercial Centre*

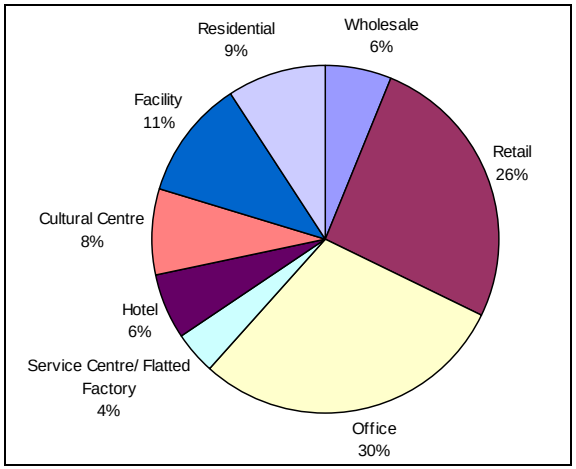
Refer to Map 4.2.

4.6.3 Percentage Floor Area Break-up for District Commercial Centres – Total Area 40 ha

The following table provides the proposed percentage break-up of different activities in terms of floor space in District Commercial Centres:

Table 4.7: Floor Area Break-up of District Commercial Centres

Sl. No.	Activity	Area	%age
1	Wholesale	2.4	6.0
2	Retail	10.4	26.0
3	Office	12.0	30.0
4	Service Centre/ Flatted Factory	1.6	4.0
5	Hotel	2.4	6.0
6	Cultural Centre	3.2	8.0
7	Public and Semi-public	4.4	11.0
8	Residential	3.6	9.0
	Total	40.0	100.0



4.6.4 Tiers IV and V– Neighbourhood Shopping Centres and Housing Area Shopping Centres

Within the residential land use, in new developments, two categories of shopping centres shall be provided:

- Local Shopping for a Neighbourhood of 15,000 population, area 0.46 ha, and
- Convenience Shopping for 5,000 population, area 0.11 ha.

4.6.5 Activities at different tiers

The activities that are proposed to be provided in the five-tier system of commerce areas are given in Table 4.8.

Table 4.8: Five-Tier Hierarchy of Commercial Activities

Central Business District	District Commercial Centre	Community Commercial Centre	Neighbourhood Commercial Centre	Cluster Centre
Tier I	**Tier II**	**Tier III**	**Tier IV**	**Tier V**
Population Served				
City level	About 4-5 lakh	About 1 lakh	About 15 thousand	About 5 thousand
Area				
	40 hectare	5.4 hectare	0.46 hectare	0.11 ha
Land Requirement Per Thousand Persons				
	800 Sqm.	540 Sqm.	306 Sqm.	220 Sqm.
Activities				
All activities of tier II	Shopping (Retail Service, Repair & limited Wholesale) Informal Shopping, Commercial Offices, Cinema, Hotel, Guest House, Nursing Home.	Shopping (Retail Service, Repair Informal Shopping, Commercial Offices, Cinema, Hotel, Guest House, Nursing Home)	Shopping Retail Service, Repair Informal Shops, Commercial Offices.	Shopping Retail Service, Repair Informal Shopping
	Service Industries: Auditorium, Museum, Library, Science Centre, Art/Craft/Music/ Dance School, Craft/Mela/Book Bazar, Weekly Markets (on close days), Local Government Offices.		Community Hall and Library	
	Bus Terminal, Fire Post, Police Post, Telephone Exchange, Electric Sub Station, Post and Telegraph Office, Petrol Pump Conveniences Residential	Post office, Dispensary, Petrol Pump (filling Station only) Weekly Markets (on close days) Electic Sub-Station Conveniences	Electric Sub-Station Conveniences	Electric Sub Station Conveniences.

Note : Besides the above, retail shopping of desired level may also be provided in all work centres and transportation nodes

4.7 Informal Sector

In Guwahati, the informal sector trade and services are scattered. The informal sector units locate themselves strategically near work centres, commercial areas, outside the boundaries of schools, colleges and hospitals, transport nodes and near large housing clusters. It is proposed to integrate the informal sector in trade and services in the planned development. This would be appropriately incorporated in the following developments:

- City Commercial Centre
- District Commercial Centre
- Community Commercial Centre
- Local Shopping Centre
- Convenience Shopping Centre
- Wholesale trade and Integrated Freight Complex
- Hospital
- Bus terminal
- Primary/Secondary/Senior Secondary/Integrated Schools
- Parks
    - City/District/Community/Neighbourhood Parks
- Residential developments
- Industrial developments
- Railway Terminus

In all the above developments, 1% of the total area shall be reserved for informal sector/ vendor market development. This area shall have temporary construction not to be included in coverage and FAR. At appropriate locations, reservations shall be made for night shelter. All such areas in CMP-2025 would accommodate approximately 52,000 informal sector units.

4.8 Weekly market

The city has a weekly market in the Beltola area which is located just 5 Km from Dispur Capital Complex and is said to be the oldest market of the city. The market is held twice in a week. People from the whole of Guwahati go to this market, the specific attention being local goods.

The weekly market, is proposed to function from Facility Centre III after its development. Such other weekly markets could operate from the parking areas of the Commercial Centres on the weekly off-days.

4.9 Industries

In the Modified Final Master Plan for Guwahati- 2001, 1375 ha area was reserved for Industrial use of which, around 520 ha area have been developed. Besides this in the CMP-2025, 400 ha of area is proposed to be developed for industries in the New Town II in the North West. An SEZ measuring around 541 ha is proposed for development in the Town III in the South West, which will also include the industrial activity.

No new heavy industries to be located in Guwahati Metropolitan Area. Refer to Annex I. The commercial areas proposed for Integrated District Centres and Integrated Community Centres should accommodate multi-storey flatted factories for small and light industrial units and software technology.

In the New Town-III, part of the industrial areas is to be developed for IT Industries.

Refer **Map 4.3** for location of major economic activities.

4.10 Distribution of Employment – 2025

The total employment as estimated for GMA-2025 is distributed in various Planning Units as given in Table 4.9. Also refer to Map 4.4 for employment distribution in GMA in 2004 and 2025.

Table 4.9: Employment Assignment in various Planning Units

Planning Unit	Employment -2004*	Employment-2025
1	91,754	1,14,403
2	42,444	1,30,723
3	12,768	71,392
4	8,575	38,949
5	7,296	26,199
6	29,543	35,433
7	8,201	22,618
8	5,308	93,807
9	4,703	71,196
10	71,108	97,746
Sub-Total	**281,700**	**702,466**
11 (New Town I)	-	39,600
12 (New Town II)	-	59,400
13 (New Town III)	-	59,400
Sub-Total B		**158,400**
Grand Total		**860,866**

**** Estimated***

5 Transport

Guwahati Transport System

5.1.1 The Concern

Passenger and goods transport movement as well as their related concerns in the city transport sector play a critical role enabling productivity of the city system and promoting the welfare of the city and its region. The present transportation exercise is to evolve a transport system best suited to the unique geography of the Guwahati city and to support the social and economic activities taking place there in.

5.1.2 Study Area and Traffic Zones

For the purpose of transport planning, the GMA area is divided into 71 Traffic Zones coterminus with the Planning Sub-units. The external areas are identified into 36 traffic zones. **Figure 5.1** presents the Traffic Zones.

5.1.3 Traffic Survey

The required traffic surveys and studies have been carried out to appreciate the traffic and travel characteristics, for identifying issues, constraints and potentials and to work out the most appropriate transport system for the city.

5.1.4 Road Network Characteristics

A main road network of 171.3 km in GMA has been studied. Of this arterial roads accounted for 42.3 km and sub-arterials for 54.3 km.; 54.1 km of roads had a median; Only 42% of the road length had a carriageway of 7.0 m (2 lanes) and above; 72% of road length did not have footpaths; 40% of the road length did not have drainage facility; Nearly 70% of the road length did not have street lighting facility.

5.1.5 Traffic Characteristics

A total of 71,824 vehicles (107,819 PCUs) entered and exited the study area at the Outer Cordon (OC), on an average day (2004). The peak hour volume at OC stations ranged between 7.4% and 14.4% of Average Daily Traffic (ADT). Goods modes accounted for 18.6 % of the ADT at the OC. 2.9% of the passenger modes and 7.8% of goods modes at OC were 'through' in nature. 25% of the goods vehicles at the OC were empty.

The average trip length and occupancy of passenger modes, at OC, were as under:

Vehicle Type	Trip Length (km)	Occupancy (No.)
2-wheelers	26.34	1.63
Auto	22.35	2.91
Car/Jeep/Taxi	56.0	5.55

A total of 223,871 vehicles (255,118 pcus) crossed the inner cordon (IC) on an average day. Motorized modes ranged between 41% and 91% at different count stations along the IC. Nearly 50% of the vehicles at IC, had a trip length upto 15 km.

The average occupancy of passenger modes, at IC, were as under:

- 2-wheeler - 1.49
- Auto - 2.23
- Car - 3.05

For Traffic Characteristics relating to goods movement refer to section 6.4.12. The traffic composition at Inner cordon and Outer cordon is presented in **Figure 5.2.**

5.1.6 Household Characteristics

Household Interview Survey (HIS) was carried out and a total of 4024 households accounting for 1.63% of all the households in the study area were covered. The average household size was 4.07. Nearly 73% of people were 40 years and below in age. By occupation 'Services' accounted for 15% and 'Business' accounted for 13.1%. Of the population, 'Housewife' accounted for 23% and 'Students' accounted for 28%.

The average household monthly income in GMA was Rs. 8651. 'Food' accounted for 44% and 'Transport' accounted 16.5% of HH expenditure. Nearly 75% of households owned a vehicle of some type. The details about age structure, monthly expenditure and occupation details estimated from Household survey are presented in **Figure 5.3.**

Figure 5.2 Traffic Composition at Cordon Lines

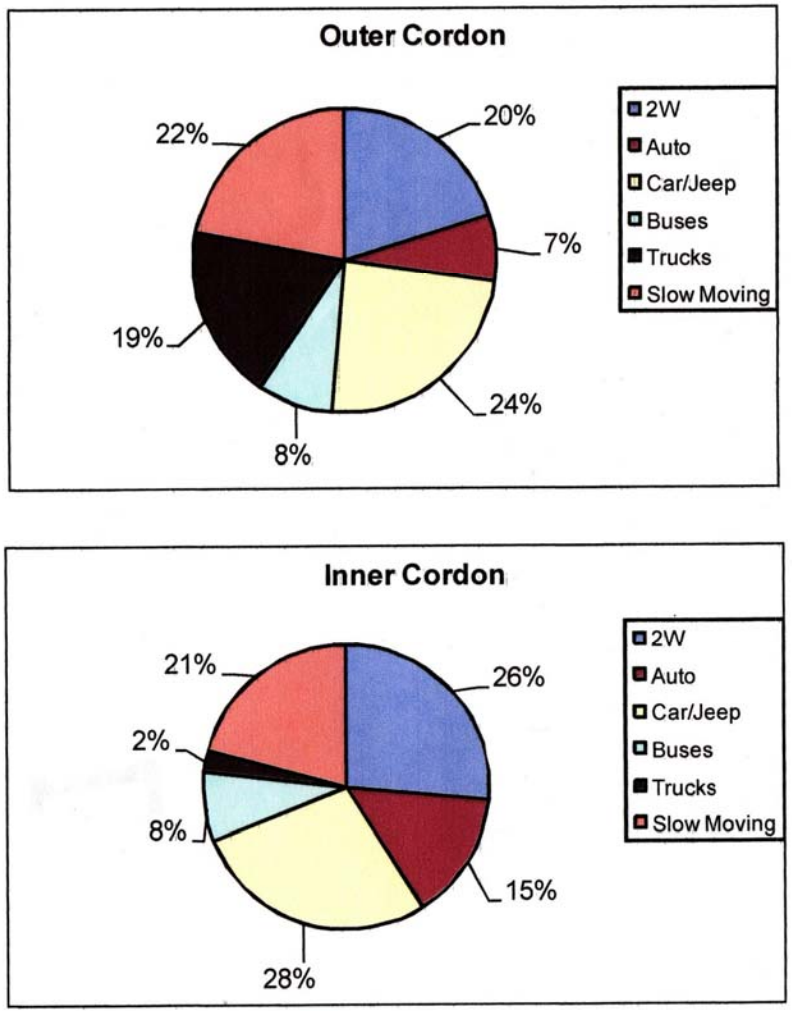
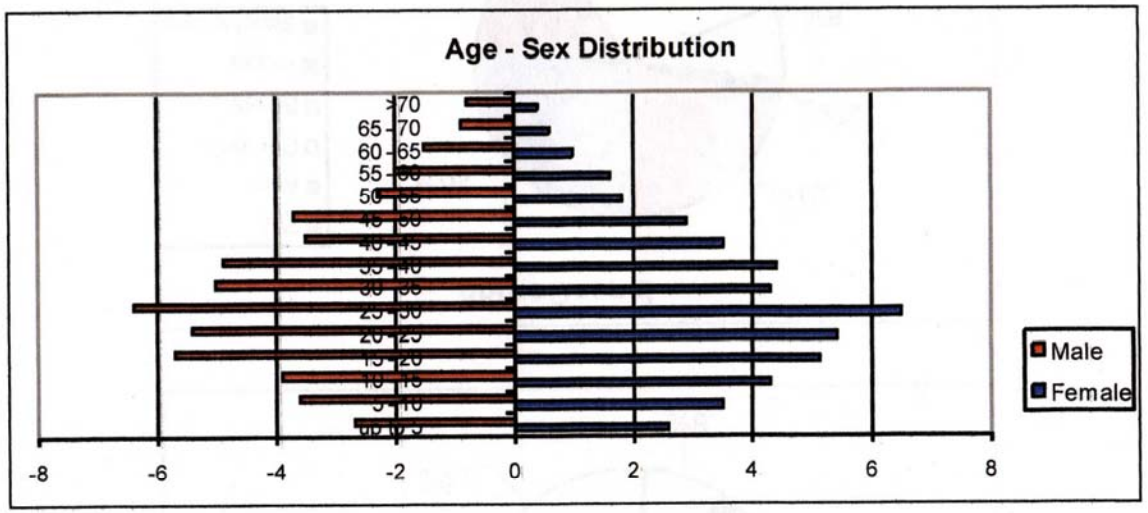


Figure 5.3 Household Characteristics of Guwahati City



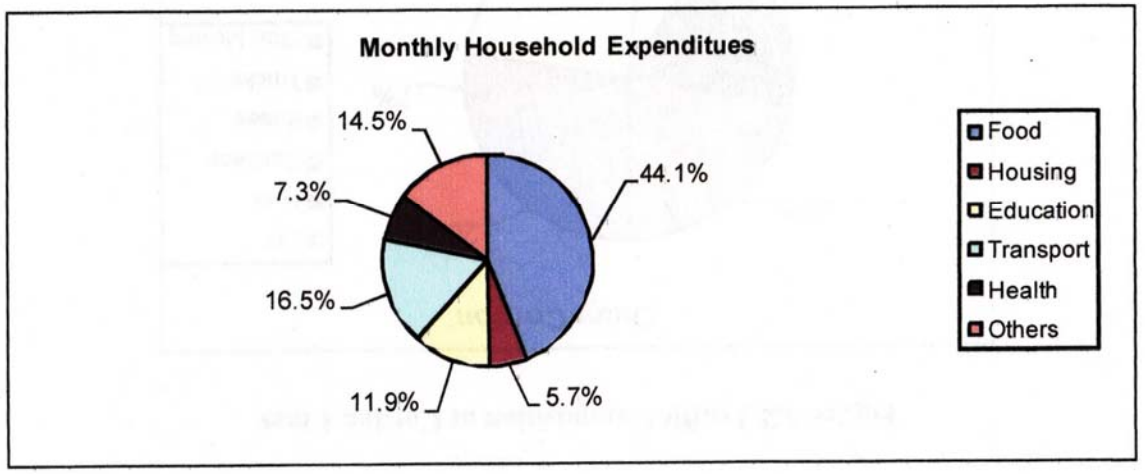
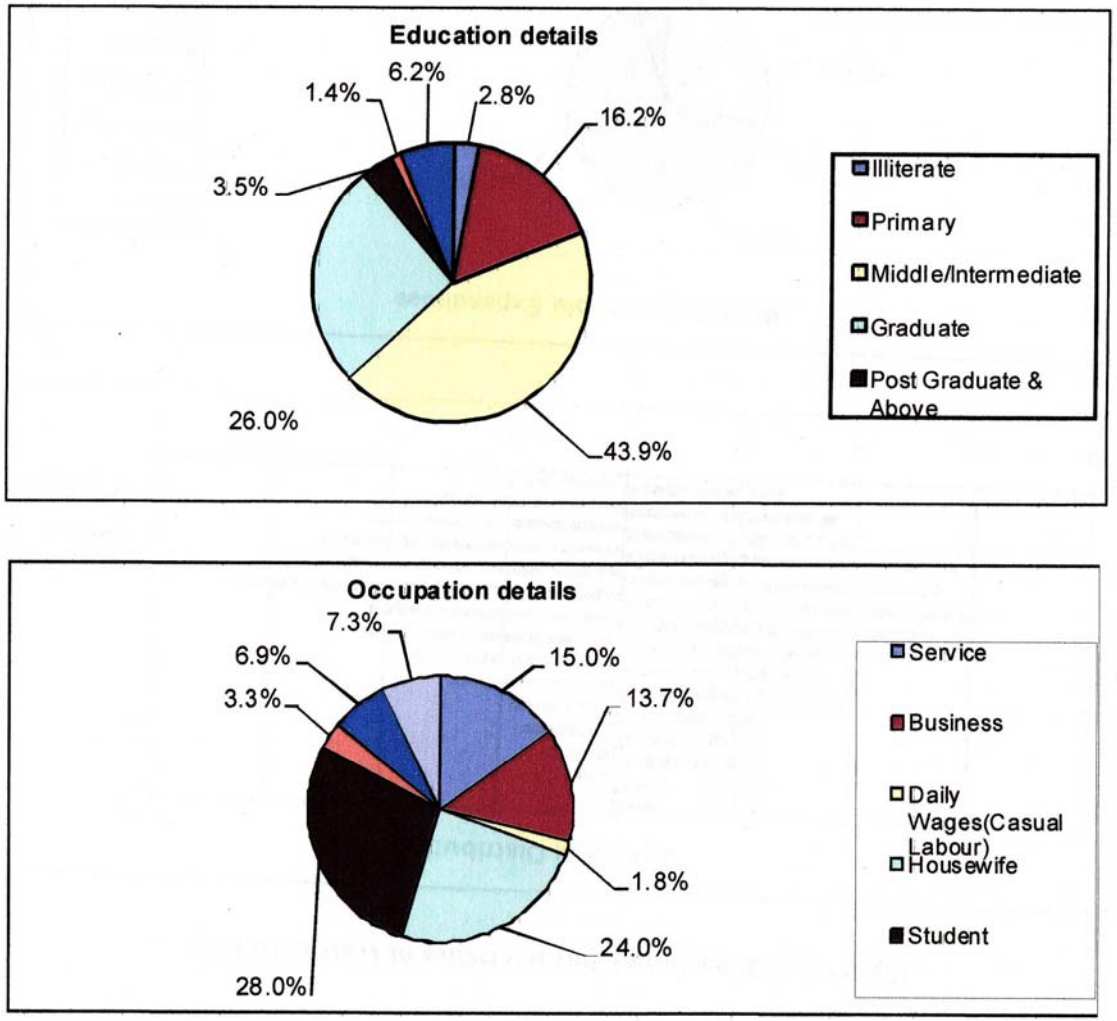


Figure 5.3 Household Characteristics of Guwahati City



5.1.7 Trip Characteristics

A total of 924,282 trips were generated by the households in GMA, on an average day. 18.2% of trips were by 'Walk'. The per capita trip rate (PCTR) was 0.94 including 'walk' trips and 0.77 excluding 'walk' trips. Modal share was as under:

- Walk - 18.2%
- Private Modes - 31.3%
- Buses - 30.2%
- IPT's - 13.5%
- Others - 6.1%

The average trip length was 5.8 km. Average trip length of 'walk' trip was only 1.16 km. Average trip length by 'city bus' was 7.31 km. 'Work' was the predominant purpose of trips (32.08%). 'Business' trips accounted for 22.63% and 'Education' trips for 15.01%. The degree of self-containment, of trips, by Planning Units ranged between 30.25% (PU 8) and 60.22% (PU 9). Travel demand, in terms of passenger-kms, was observed to be 5.36 million per day. Of that 'Walk' trips accounted for only 3.64%. Rest was by vehicular modes.

5.1.8 Population

The population of GMA is growing at a high rate. Between 1991 and 2001 it registered a decadal growth rate of 37.85 %. Based on studies the population size of GMA is estimated to be as under:

- 2001 - 8,90,773
- 2011 - 11,95,760
- 2021 - 17,65,465
- 2025 - 21,73,902

On an analysis of the residential patterns, availability of land for development, the estimated population is distributed amongst the various planning sub-units (traffic zones). The overall gross city level density is proposed to increase from 34 to 68 persons per hectare. The residential densities by traffic zones range between 267 to 600 persons per hectare.

5.1.9 Employment

The total employment size including floating employment is estimated to be 8,60,866. The place of work is distributed all over the spatial form of the city and varies with the type, intensity and locale of activities. The Land Use plan reflects the spatial distribution of activities and there by the people and the work spaces. The spatial distribution of employment has been based on the concept of multi-nuclei structure, present and proposed land use pattern and the levels of accessibility.

5.1.10 Student Facilities

Education trips account for a good share of all trips. Guwahati is also emerging as a major education center. A policy of 100% enrolment in elementary and higher secondary school levels is adopted. Planning efforts are to locate the elementary and higher secondary schools within the catchment of residential neighborhoods/sectors to enable access to schools predominantly by walk. Higher education facilities are distributed at selected locations over the city spatial frame

The distribution of population, employment, student facilities, by traffic zone, for base and horizon years are presented in **Annexes II and III** respectively.

5.1.11 Economy

The economy of GMA is fast growing. The average household income, in 2005, has been observed to be Rs. 8651. Income has a major influence in the mode choice for travel. The average household income by 2025, is estimated under low, medium and high growth scenarios as under:

Year	Low (CAGR at 3%)	Medium (CAGR at 5%)	High (CAGR at 6.5%)
2005	8911	9084	9213
2011	10640	12173	13444
2016	12334	15536	18419
2021	14299	19828	25235

For estimate of travel demand, medium growth scenario has been adopted.

5.1.12 City Structure

In the Comprehensive Master Plan- 2025, a decentralised multi nuclei structure has been adopted including a new city centre, a capital complex, three new towns, an integrated freight complex and a number of other nodes and sub-nodes.

5.2 Travel Demand Forecast

5.2.1 Travel Demand - Intercity

The inter-city traffic has been estimated based on projected growth rates, by mode type. The growth rates of traffic from the previous studies are adopted to estimate the future inter city and through traffic. The estimated traffic (inter city & through), at Outer Cordon, by 2025 is as under.

(no. of vehicles per day)

Mode Type	Year	
	2004	2025
Two Wheelers	10949	60219
Autos	3939	14957
Cars	15475	66942
Mini Buses	1670	2385
Standard Buses	1917	2740
Private Buses	2021	2888
Goods Vehicles	11967	38764

5.2.2 Travel Demand – Intra City

Person Trips

Considering the development scenario adopted for the city, about 2.79million person trips are estimated to be performed every day in the city by 2025. In addition are the intercity trips on intra city system and the commercial vehicle trips. The break-up of these trips by purpose is presented in Table 5.1.

Table 5.1: Travel Demand by Purpose – 2025

S.No.	Purpose	No.of Person Trips
Home Based Trips		
1	Work and Business	973799
2	Education	878790
3	Others	610243
Non Home Based Trips		
1	Work and Business	172685
2	Education	66597
3	Others	89364
Total		**2791478**

Commercial Vehicle trips

The intra-city commercial vehicle trips per day have been estimated as under:

LCV : 4275
HCV : 2470

5.2.3 Modal Split

Modal split has been worked out by the modal split model as under:

Non Motorised Transport
Walk and Cycle Modes - 12.14%*

Motorised Vehicular Modes

- Public Transport
  - Buses - 47.99%
  - IPT - 6.65%
- Private Transport
  - Two Wheeler- 24.66%
  - Car - 8.56%

* Does not include access walk trips

5.3 Policy Framework

The National Urban Transport Policy (NUTP) of the Ministry of Urban Development, Government of India, which is a path breaking step in the process of urban development in general and urban transport planning, development, operation and management, in particular, forms the basis for the policy framework. The Vision and Objectives of the NUTP are:

Vision

To recognize that people occupy centre-stage in our cities and all plans would be for their common benefit and well being. To make our cities the most livable in the world and enable them to become the "engines of economic growth" that power India's development in the 21st century.

Objective

The objective of this policy is to ensure safe, affordable, quick, comfortable, reliable and sustainable access for the growing number of city residents to jobs, education, recreation and such other needs within our cities. Some of the parameters through which this is to be achieved are:

Incorporating urban transportation as an important parameter at the urban planning stage rather than being a consequential requirement. Encouraging integrated land use and transport planning so that travel distances are minimized and access to livelihoods, education, and other social needs, especially for the marginal segments of the urban population is improved. Bringing about a more equitable allocation of road space with people, rather than vehicles, is its main focus. Investing in transport systems that encourage greater use of public transport and non-motorized modes instead of personal motor vehicles. Promoting the use of cleaner technologies. Associating the private sector in activities where their strengths can be beneficially tapped.

5.4 Transport System Development Plan

5.4.1 State and Regional Level

At the state (Assam) and regional (North East Region) the most important programme that would affect the transport plan of GMA is the development of east-west national highway corridor from Silchar to Porbandar, as a four lane corridor under National Highway Development Programme (NHDP). This corridor passes through GMA (NHs 37 and 31). A large volume of inter-state and international traffic is estimated to move along this corridor. Hence it is important to establish the interface between the intra-GMA and inter-region road systems and also define the path for regional traffic within GMA. A new peripheral road system in GMA has been planned to facilitate inter-regional and intra-GMA freight traffic. This includes construction of a new bridge across river Brahmaputra east of the existing bridge.

5.4.2 City Road Network

The CMP-2025 recommends development of a hierarchy based arterial road network system comprising primary arterial, sub-arterial and collector roads. The main functional roads recommended are:

- Peripheral Ring Road to enable movement of bypass traffic
- CBD Orbital
- Ring Roads
- City Radials/Axials
- Alternative Corridors
- All Purpose Roads in Central Area

Overall around additional 194km of road network is proposed to be developed over and above the existing road network. This configuration reflects the net effective carriageway requirements for traffic movements. Proposed road network for the horizon year is presented in **Figure 5.4**.

Proposed road network

The proposed road network comprises of a radial-cum ring system. The radial/axial roads are inter-connected by three ring roads i.e. inner ring road (CBD Orbital), ring road and the peripheral ring road. The peripheral ring runs at the outer part of GMA with a proposed ROW of 60 m. The CBD orbital road, which is around the central core, would help in diverting the non destined traffic away from the central area. It would also help in providing access to central core area from the periphery.

Movement Around Central Area

The share of 'non-destined' traffic with reference to the Central Area will be high. The movement pattern needs to be re-organized. As part of the city road network system, an orbital road around the CBD has been identified and proposed to be developed as a high speed urban corridor with good level-of-service. Through traffic management measures traffic needs to be encouraged to move along the orbital road and enter Central Area at entry points near to their destination.

The existing roads

The existing roads are proposed to be upgraded in terms of ROW, capacity and other geometrics. The new roads need to be planned and designed for a higher level of service from their entry into GMA to their meeting with the CBD orbital Road. Within the core area the roads will lose their characteristics and are to be developed as all-purpose roads. The primary arterial roads have a ROW varying between 45 to 60 m. In addition the city level roads comprise sub-arterial roads (24-45 m R/W), and collector roads (15-24 m R/W). The proposed ROWs of the major road network are presented in **Figure 5.5**.

The network grids

The network grids each encompass an area of about 2 to 3 sq. km. The roads within each grid need to be planned as part of the Local Area Plan (LAP) for each sector. The main roads within them inter connecting arterial grid roads will need to be classified as sub-arterial and collector roads. Residential access roads will be planned and developed as part of residential area development plans.

The road links in CBD

The road links within the CBD Orbital will need to be classified as 'All Purpose' roads. Traffic volumes on them will be high. Speed is not important. Access needs predominate. Providing parking space is important. However it should be in accordance with the Parking Policy. Pedestrian movement will be high. Wide footpaths, safe crossing with exclusive phase period where signalized, refuge islands, clear markings, good lighting, guard rails, good signage are important components of the roads.

Radial cum Orbital Network

The present road network comprises radial corridors diverging from the city CBD area. The major corridors are:

- Jalukbari - Bharalumukh - Kachari - Noonmati - Narengi
- Paltan Bazar - Bhangagarh - Ganeshguri - Khanapur
- Paltan Bazar - Lokhra
- Kumarpara - Garchuk

A few new road links are added to the road network system to enable it function as a more defined radial-cum-orbital network system. Some of the new links are:

New bypass along eastern side branching from NH-31 through -North Guwahati-Rajardwar-New bridge across Brahmaputra-Uzan Bazar-Narengi (along the river bank)-Panjabari-Khanapara. Conection between proposed north and south new towns with a new bridge across river Brahmaputra on the western side. New peripheral road from Basistha

chariali, off bypass, to run along south boundary of GMA upto its intersection with NH-37. Orbital road through Saulkuchi, Beltola. Orbital road through Dhirenpara, Odalbakra, Kahilipara and Dispur last gate along with a tunnel in the Fatasil hill ranges to meet AT Road

New link from Dhirenpara to GMC Jn. Lal Ganesh jn. – Ganeshguri (part existing; part new). Hengerabari – BG Tiniali. Road network in New towns and Wholesale market area.

A tunnel is proposed to connect AT road with Fatasil-Ambari road. It will connect the proposed orbital road through Dhirenpara, Kahilipara and Dispur last gate to AT road. It is observed that this link is going to carry substantial amount of traffic. Hence it is proposed to conduct the feasibility study of this tunnel link immediately as substantial amount of travel time and travel cost savings would be there.

5.4.3 **Public Mass Transport System**

The Modal Split Model has indicated a potential size of 62.1% (excluding walk and Cycle) by public transport in the horizon year (2025). This means a total travel demand of 13.7 lakh person vehicular trips per day. To cater the above demand an integrated multi-modal transport system has been conceptualized. The component modes include the bus system catering the study area, supported by a medium capacity rail based system along three identified corridors and supplemented by the IPT modes.

The estimated modal shares, of vehicle person trips (excluding Cycle) by 2025, are as under:

- Private Modes : 37.81% (832860 Person Trips)
- Public Transport: 62.19% (1370054 Person Trips)
- *Sub Modal Share*
- *Bus and LRTS : 87.83% (1224607 Person Trips)*
- *IPT : 12.17% (169731 Person Trips)*

5.4.4 **Light Rail Transit System**

A modal share of about 55% of all vehicular trips by public mass transport would mean a demand of about 12 lakh trips per day on the PMT system. This calls for introduction of a medium capacity rail based system. It is proposed to plan and develop Medium Capacity Transit System in the city. Three corridors are identified. The proposed technology would include Bus Rapid Transit System and/or Light Rail Transit System. An incremental development approach is suggested. In the first phase Bus Rapid Transit System (BRTS) is developed and operated. As the city grows the traffic builds up and exceeds the capacity of BRTS, the system technology is replaced by Light Rail Transit System (LRTS). BRTS would require a segregated right -of -way. Where it is difficult to provide segregated right-of-way, there elevated way may be provided. However the via –duct needs to be designed to accommodate LRTS in the future. Proposed BRTS/LRTS is presented in **Figure 5.6**. The first corridor, called Green Corridor, runs east-west, from Narengi to Jalukbari. This corridor runs through the CBD area. It is proposed that this system may be aligned and developed along the existing rail line. However it would be independent of the Railways in terms of ownership, operation and management. The corridor is of 16.3 km in length. 13 stations are proposed along the corridor at:

- Narengi, Forest Gate, Noonmati, Bamunimaidan, Silpukhri, Paltan Bazar, Fancy Bazar, Bharalumukh, Kamakhya, Maligaon, Adabari, Jalukbari.

A second corridor in the north-east direction, from the Guwahati Railway station, running along G.S. road, upto the Khanapur, to be called as Blue Corridor, is also identified. This corridor, of length 10.2 km is proposed to be aligned along the G.S. road, on elevated tracks. 7 stations are proposed along this corridor and they are:

- Paltan Bazar, Ulubari, Bhangagarh, Ganeshguri, Dispur, Six mile, Khanapara

The third BRTS/LRTS corridor called the Orange Corridor, starts from the Railway Station and runs northwards along the Fatasil-Aambari road upto Lokhra where a new activity complex with employment spaces of more than 100,000 has been proposed. From this it turns westwards to link the proposed Capital Complex and from there on it runs northwest along the road corridor to airport, and ends at the airport.

The Orange Corridor is about 22.6 km in length and 9 stations are proposed along it at:

- Paltan Bazar, Sarabpatti, Kalapahar, Lalganesh junction, Lokhra, Garchuk, West Boragaon, Azara and Airport

Guwahati Rail station will be a major interchange station amongst the three corridors and between them and the regional rail system.

It is estimated that there will be 13.7lakh public transport trips (intra-city) by the year 2025. In addition, about 3.47 lakh trips will be generated by inter-city public transport passengers who use the intra-city network. In all, public transport trips would be 48% of the total person trips in 2025.

5.4.5 Bus System

The existing bus system needs to be modernised and expanded to meet the travel needs in the coming years. There is a need to improve its image and the quality of service. Modern, high capacity urban buses to be introduced. The operating environment needs to be improved by providing the buses dedicated lanes along major radial corridors. The bus system needs to be provided good infrastructure support in terms of depots, terminals, stops etc.

With the capacity of buses at 60, fleet utilization at 90%, vehicle utilization at 200 km per day and a load factor of 0.7, the requirement of buses, with the implementation of LRT system by 2025, is estimated to be around 900. This would mean an introduction of 45 buses per year and in addition are replacements. The requirement of buses will go up to around 2400 if the LRT system is not implemented. Efforts be made to identify and franchise private sector operators, with adequate capacity, to operate and manage the city bus system.

Bus Depots

To service the bus system, 9 depots, each of 2 ha in extent, are required along with the LRT system implementation. The requirement of bus depots will go upto 24 along with the other infrastructure for the bus

system if the LRT system is not implemented. The bus depots are proposed at the following locations:

- In the industrial area of Guwahati
- Adjacent to the all 6 nodal terminals
- One in each of the two New Towns (Northwest and South)

Locations of proposed bus depots are shown in **Figure 5.7**.

Workshop

One workshop, of extent 5 ha, in the industrial area in New Town II is proposed.

5.4.6 Terminals

In the integrated transport network concept, terminals are very important components as they enable integration between the different modes of the system. A large number of terminals of different type get developed in a metropolitan city. The objective is to organise the terminals in a hierarchy and locate them appropriately.

5.4.7 Passenger Terminals

The passenger terminals to be implemented during the plan period are:

- Inter-city Rail Passenger Terminal at existing Guwahati Railway Station
- Inter-city Bus terminal at Lokhra along Bypass Road
- Intra-city Bus Passenger Terminals at 6 locations

Location of the proposed truck and bus terminals are included in Figure 5.7.

Inter – City Bus Terminal

Study has indicated that, by the horizon year 2025, on an average day, 3.47lakh passenger trips by inter city buses are estimated to move into and out of Guwahati. A new bus terminal, along by-pass road, is being developed. This terminal is proposed to be expanded and developed as an integrated bus terminal providing for inter-state, inter-city and intra-city bus services. Facilities are also to be provided for parking of private and IPT modes and other passenger amenities. The terminal abuts the existing bypass road (which is proposed to be developed as a major urban activity corridor) and the proposed radial road. Hence it has good accessibility from all parts of the city. The terminal is proposed to be developed as a multi-use complex providing space for commercial, public, semi-public and institutional uses. This would enable the terminal to be developed as a bankable project under Public Private Partnership (PPP) route. A land reservation of 5 ha for the integrated terminal has been made.

Intra – City Bus Terminals

Intra-city Bus Terminals are planned at three levels :

City Level Nodal Terminals; Zonal Level Sub Nodal Terminals; Local Area Level Mini Terminals

Nodal Bus Terminals

6 Nodal Bus Terminals for intra-city bus services are proposed at the following locations:

(i) In the present Central Area abutting proposed CBD Orbital, presently functioning as intercity terminal (ii) Along with Inter-city Bus Terminal along the by-pass road (iii) In the proposed District centres I, II, III. (iv) In North Guwahati Area as part of the proposed District centre IV.

An area of 2 ha for each of these nodal terminals is reserved. The nodal terminals need to provide parking areas for private and IPT modes. The nodal terminals are proposed to be developed as multi-use complexes, under PPP route.

Sub – Nodal Terminals

10 sub-nodal terminals are proposed at the following locations:

7 sub-nodal terminals at the facility centres 1, 2, 3, 6, 8, 11, 12; 1 at the Airport, 1 at the Capital Complex/Govt. Office Complex, 1 at the proposed Whole Sale Trade Complex (Facility Centre X). An extent of 1 ha of land for each of the sub nodal terminals is proposed.

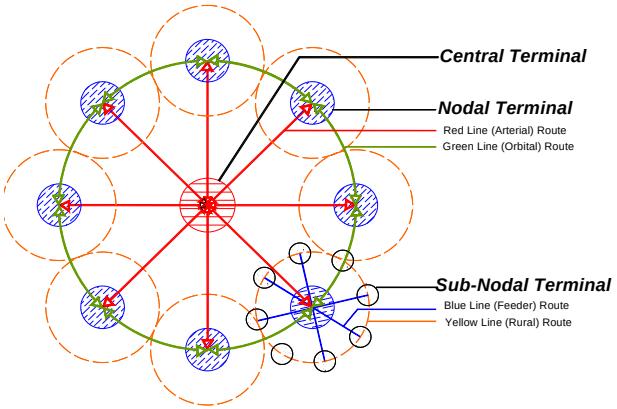
The sub nodal terminals are proposed to be developed as multi-use complexes, under PPP route.

Local Area Mini Terminals

Every local area (city municipal ward/ new housing development area), as part of Local Area Plans (LAPs) to provide for mini terminal facilities for bus services serving the area. These terminal facilities could be incorporated as part of the commercial/facilities complex of the Local Area. Hence no separate allocation and reservation of land is made for these terminals. Care to be taken to provide for easy access and exit provisions, convenient bays for the buses and shelters for the passengers. Such terminals can be provided in the proposed neighbourhood centres.

Bus Route Network System

It is recommended that the entire intra-city bus services route network system is reorganized. The concept of direction oriented services to be adopted. 'Hub and spoke' form of network system provides good scope for organizing the bus services. Direct, fast and frequent services to be operated amongst the nodal terminals. Groups of sub-nodal terminals to be integrated with identified nodal terminal with bus services. Local Area terminals to be connected to sub-nodal terminals. While the above proposed route structure system



enables optimisation of bus services, special direct services between major OD traffic generators to be operated.

A study on City Bus System Planning and Route Rationalisation be initiated to enable reorganisation of bus route service pattern and development of bus related infrastructure.

Bus Stops

The bus stops must be easily accessible at a walking distance of not more than 500 meters. The spacing of bus stops to be in the range of 500 to 600 meters. Bus shelters need to be well designed to provide shelter to the passengers and add aesthetics to streetscape. Bus shelters are proposed to be developed as revenue generating measures with provision of spaces for commercial advertisement.

5.4.8 Traffic Management Plans

With the concentration of activities within central area and along corridors, coupled with inadequate capacity of the road network to meet the growing parking demands, there is a need to balance between the traffic needs and capacity. Preparation and implementation of Transportation System Management (TSM) Plans offers the best strategy. It is recommended that TSM plans be prepared on an area and corridor basis. The TSM plans should include the circulation system, segregation and minimising of conflicting movements, priority for high occupancy vehicles, appropriate geometric design and installation of control systems at intersections, identification and provision of facilities for pedestrians, identification and allocation of parking areas, provision of traffic signs, lane markings etc. and a concerted program of enforcement and education.

Pedestrianisation of areas and streets in central area to be aimed as part of Traffic Management Plans. Also along roads such as MG road, which abuts the green belt along the bank of river Brahmaputra , feasibility of pedestrianisation of the streets need to be studied . However it may require provision of elevated roadway for vehicles. Feasibility studies need to be carried out to plan and design.

In addition TSM plans be prepared on continuous basis for critical areas and corridors for optimizing the usage of the system capacity. The proposed Traffic Engineering and Management Unit (TEMU) in GMDA/GMC to be responsible for this function.

5.4.9 Improvement of Intersections

The transport system plan includes improvement of intersection geometrics including provision of channelisers, acceleration/deceleration lanes, traffic signs, lighting etc and provision of appropriate traffic control systems. In all around 7 intersections are recommended for grade separation during the plan period. However, 12 junctions are identified for improvement. **Figure 5.8** shows location of the proposed grade separators and junctions for improvement. It is recommended that all the major intersections, especially those on the arterial and sub-arterials be signalised and in the next level of improvement be linked and integrated and brought under a central Area Traffic Control scheme (ATCs). Grade Separators/Flyovers may be built based on traffic intensity, site conditions and environmental acceptability.

5.4.10 **Pedestrian Facilities**

Walking is a predominant mode in the city. The transport system plan promotes and facilitates walking. The main strategies and measures proposed as part of the plan are as under:

- Provision of side walks on primary arterials, sub-arterials and collectors on both sides of the road and on at least one side on local roads
- Cross pedestrian facilities to be provided as per the warrants recommended by Indian Roads Congress.
- Side walks on all the major roads to be designed for level of service "C"
- Improvement measures in terms of pedestrian controlled facilities at intersections, grade separators and widening of side walks in the Central Area and along major corridors

5.4.11 **Parking Policy**

Parking Policy – Need and Dimensions

Every vehicle trip ends in a demand for parking of the vehicle at its trip ends. The parking of vehicles need extensive and exclusive land area. Otherwise parking would spill over to other use areas like road carriageway and footpaths, open spaces. In turn they affect safety and environmental quality.

The escalating demand and varied needs of parking in Guwahati can only be met and organized in the framework of a comprehensive Parking Policy. Parking policy needs to move from 'non-restrictive' to 'restrictive' policy. 'Restrictive' policy would include from banning of parking to restricted provision, regulation and pricing of parking spaces.

Parking Characteristics

Parking characteristics within Guwahati vary by areas, by land use activities and by time period. In residential areas it is by private vehicles and of long-term duration during the night hours. In central areas it is of mixed type – private and public vehicles, passenger and goods vehicles and of short term and long term needs. In industrial, warehousing and wholesale market areas it is predominantly of goods vehicles.

The on-street parking surveys carried out as part of the Master Plan Study have presented interesting characteristics. Parking Surveys at 10 selected on-street stretches indicate the following characteristics.

- Peak accumulation, per half an hour, is high, ranging between 143 ECS (AT Road) to 237 ECS (HB Road)
- Two wheelers constitute the major share (around 54%) of parked vehicles (up to 67.7% on SS Road)
- Cars constitute 41.5% of parked vehicles on Kamarpatty Road
- Short term (up to 2 hours) parking accounted for the maximum share (80 to 92%)
- Medium term (2 to 4 hours) parking accounted for a low of 7% (AT Road) to a high of 29.3% (on MS road)
- Long term parking was considerably low at all stretches ranging in between 2 to 6.1% except at two locations where it was 15.8 and 8.2% respectively at MS Road and Kedar Road

Planning of Parking Areas

Planning or provision of parking areas needs to be through multi pronged strategies providing parking areas at three levels (or types):

- On-street
- Public off-street spaces
- Private off-street spaces

Equivalent Car Space

Every type of vehicle has different physical size and operational maneuverability. For establishing parking standards they are expressed in equivalent car spaces (ECS) with car as the standard reference unit. The suggested ECS values for different types of vehicle modes in Guwahati are as under:

Vehicle Type	ECS
Two Wheeler	0.25
Auto	0.5
Cars, Taxis, Jeeps, etc.	1.0
Small Bus	1.0
Large Bus	2.0
LCV	1.5
Medium Truck	2.0
Heavy Truck	2.5
Truck Trailer	3.0

Norms and Space Standards

Parking Norms

The following norms by use type are prescribed.

Use Type	Number of ECS per 100 sqm of Floor Space
Residential	1.33
Commercial	1.67
Public and Semi Public	1.00
Industrial	1.00

It is important that the norms are periodically reviewed and revised to accommodate changing patterns and needs.The provision of the car spaces may be in open area of the condominiums layout, under stilts of the buildings or aggregated and provided in one or more separate areas as part of the complex. The last option is recommended for adoption, as it would enable optimization of space and better management by the association of residents. Over a long term, it provides some flexibility for expansion of capacity through modernization of technology.

The following space standards are recommended:

- Open surface level : 23 Sqm per ECS
- Under stilts : 28 Sqm per ECS
- In basement : 32 Sqm per ECS

On-street Parking

On-street parking spaces are provided on the right-of-way, on or off the carriageway, provided by the road agency and controlled by the police or municipal enforcement officers.

While providing on-street parking the needs of the functional hierarchy of the roads need to be respected. Safety margins at the intersections to be provided. Movements of public mass transport modes are not to be interrupted. Their entry and exit to be defined. Stops not to be blocked. Access to properties not to be affected. As a general rule no on-street parking on the carriageway be permitted on roads identified for high speed movement. On arterial and sub arterial road links, on-street parking to be provided only if the road is 6-lanes or more wide. On collector streets on-street parking to be provided if the road is of 4-lanes without median. Parking on footpaths on all road links to be strictly prohibited. If the road right-of-way is wide then service road after footpaths to be provided and parking along service roads organized. Parking on front off-set space of a building, considered as private parking, to be strictly regulated. Access to these parking through footpaths to be strictly prohibited. Along cross streets in central areas where traffic flow is low and carriageway is 4-lanes or more, parking on both sides may be organized. When carriageway is less than 4-lane, then the road stretch may be declared as one-way street and parking on one side of the carriageway may be organized.

Type of Parking

Only parallel parking to be permitted for on-street parking on the carriageway. Angular parking on the right-of-way of the road only if the access to parking is through service roads.

Off-street Public Parking Spaces/Facilities

Strictly organized and effectively enforced on-street parking can meet a reasonable but only a part of the demand. The supply needs to be supplemented by provision of off-street public parking facilities. The investment on, and development and management of these off-street facilities may be by public agencies or by private sector by promoting off-street parking facilities as a business venture by provision of land at concessional lease rates, permitting the facility to be a multi-use complex with commercial uses and prescribing charges for parking based on vehicle type and duration of parking.

Lane Markings and Signage

- All on-street parking spaces need to be clearly defined by lane markings.
- Adequate and appropriate signages to be installed at all places on the street network to identify ‘parking’ and ‘no parking’ areas.
- Off-street parking places to be clearly identified by signs and distinguishing marks.

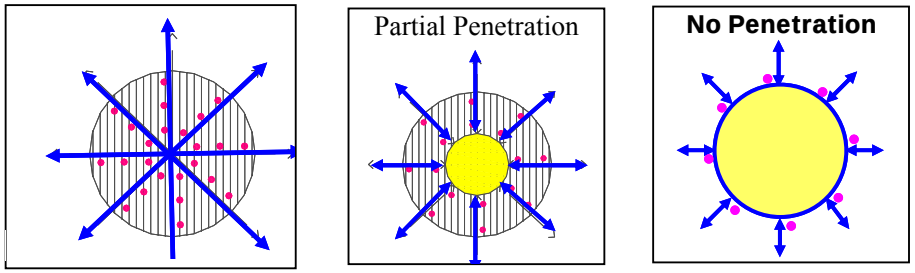
Access Policy

Provision of off-street public parking facilities in Central Area and sub-centers is important. The location of the facility needs to be carefully chosen to meet the objectives of Traffic Management Plans of the area. If the strategy is ‘full penetration’ then the location of off-street parking facility could be anywhere subject to traffic flow requirements. If the strategy is ‘partial-penetration’ then the facility needs to be at the edge of

restricted access part of the central area. If the strategy is 'no-penetration' then the facility needs to be provided at the edge of the central area along the central area orbital road.

Presently, in Guwahati, the strategy is 'full penetration'. However it is prudent to adopt 'partial-penetration' strategy and move towards 'no-penetration' strategy over the years. Hence location of off-street parking facilities needs to be carefully decided so that they integrate with traffic management plans. The design of facility should also enable flexibility in the use of the facility.

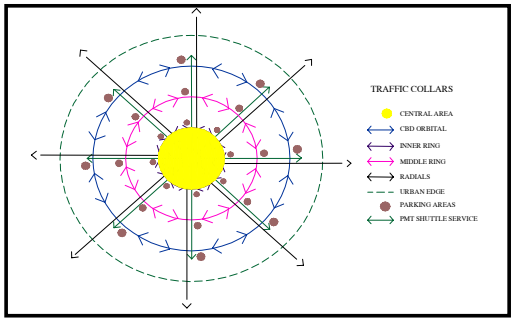
Park and Ride System



Parking Policy needs to be integrated with Public Mass Transport System policies and planning. Every major terminal of the bus system and every station of the medium/high capacity system like Bus Rapid Transit/Light Rail Transit shall be developed as a 'Park and Ride' facility. Adequate parking area for different modes are envisaged as part of the PMT stations, particularly in the outlying residential areas, so that people can park their private modes at these stations and travel by public mass transport.

Traffic Collars

As the city grows, traffic volumes will increase and levels of congestion within central areas will be high. As a part of Traffic Management Plans, it is recommended to develop off-street parking facilities along 'traffic collars', a series of imaginary circular rings spaced away from the central area. The capacity of the facility to increase as it moves away from the Central Area.



Location of off street parking areas:

14 parking areas are proposed to be developed. 12 as part of facility centres, one individual location and one as part of present jail area of about 1 ha. each to accommodate about 300 cars at each individual location.

Promotion of PMTS

Parking Policy needs to promote the public mass transport system (PMTS). Restricted parking provision coupled with good quality service

by PMT is an effective measure to promote PMTs, reduce congestion in Central Areas, optimize resources and improve environment quality.

Parking Pricing

Pricing use of parking space is an important component of the Parking Policy. Parking on public space anywhere in the city at any time, by any mode, needs to be charged a price. The objectives of pricing are to (i) generate revenues, (ii) provide employment, especially poor, (iii) restrain demand, (iv) promote PMT, (v) encourage private sector investment, and (vi) rationalize parking duration.

Provision of parking space costs money. It needs to be recouped by charging a fee. This measure of charging fee for on-street parking should be extended to all road stretches in the city. Apart form generating revenues, parking pricing needs to be used as an effective tool for demand management. It is important to design and implement a differential parking price policy with low fees at the periphery of the city and increasing fees as one moves towards the center and high or penal fees within the central areas. The differential parking policy combined with provision of good quality PMT service, with 'park & ride' facilities would discourage use of private vehicles for journey to central areas and promote patronage of PMT systems. Apart form locations, 'differential pricing' needs to be applied by time duration. Long term parking, on-street, needs to be discouraged and short term parking encouraged to maximize turn over.

Compounding Fee

Provision of off-street private parking facilities through zoning regulations and building byelaws has been referred to. This strategy has potential for abuses. Parking spaces shown at the time of approval of building plans are liable for abuse and misappropriation to other uses. Provision of parking spaces is costly and opportunity costs of the space created are high. The result is that the parking demand spills over to on-street. To prevent misuse, the concerned public agencies need to exercise strict monitoring and control.

To avoid such a vicious circle, it is recommended that the policy of charging 'Compounding Fee' or 'In-lieu Fee' may be adopted. In this, the property developer needs to pay a compounding fee per unit parking space, fixed from time to time by the Municipal Authorities, for the total parking space he needs to provide as per regulation/byelaw. This frees him from the obligation of providing and maintaining public parking space within his premises. The Municipal authority would need to pool these 'compounding fees' and use them to promote development of off-street parking facilities in association with private sector. There is a need to prescribe 'compounding fees' rate from time to time, by location. This strategy may be applied in central areas where demand for space is high, availability is low and opportunity costs are high.

Technology

Presently the technology of parking and collecting fees are of low type. The parking is by owner. Over a period of time attendant parking in off-street parking facilities needs to be introduced for efficient space utilization. In the long run, it is prudent to adopt mechanical parking technology wherein, the cars are received at the entry, assigned and parked at a bay and retrieved and delivered at the exit gate, by automatic microprocessor systems. The advantage of the technology is in the increase of car spaces per unit land area.

Institutional Arrangement

In Guwahati the three agencies most concerned are:

- Guwahati Metropolitan Development Authority (GMDA)
- Guwahati Municipal Corporation (GMC)
- Guwahati City Traffic Police

GMDA needs to organize itself to prepare Transport System Management Plans for different areas, of which parking policy and provision will be an important component. They need to fix parking fees. They may franchise operation and collection of fees to private enterprise through a bidding process.

GMC is in-charge of road construction and maintenance. Provision of on-street parking areas with necessary road cross-section design and construction, lane markings, installation of signs, etc. would be the responsibility of GMC. As they have a good engineering construction department, they can also undertake construction, operation, maintenance and management of off-street public parking facilities. However it is prudent to allocate this role to private enterprise. Traffic police are responsible for enforcement of parking plans and rules.

In residential areas, the maintenance and management of parking areas within a housing colony may be assigned to the Residents Welfare Associations (RWAs). If no such association is formed, the residents may be encouraged to form such associations and participate in managing the services and facilities within their colonies.

Functional Plans

Over a period of time, it is important to prepare 'functional plans' for every link of the primary road network system of the city comprising arterial, sub-arterial and collector streets. The functional plan should incorporate all aspects of the road like geometrics, controls, traffic management and uses including on-street parking demarcation. Appropriate organizational arrangements with capacity and logistics need to be established, GMDA providing traffic engineering & traffic management plans and Traffic Police providing traffic enforcement. Capacity in the agencies to perform these tasks on a continuous basis needs to be built.

Private Sector Participation

Private sector is presently involved in maintaining and managing the on-street parking. This participation needs to be extended to maintain and manage on-street parking all over the city and more so, to invest in, develop and manage off-street public parking facilities. Municipal Authorities to facilitate this process by providing land at concessional lease rates, regulating on-street parking, permitting multi-uses in the complex and extending other administrative support. The 14 parking areas could be developed through Private sector participation.

Parking for Disadvantaged

The concept of 'Orange Badge' may be introduced to facilitate easy and convenient parking of vehicles driven by disadvantaged persons. The vehicles need to be distinguished by special orange bands/tokens and they

are given priority for parking and also exempted from some of the rules of parking as applicable to general public.

Parking and Environment

Large scale development of off-street parking areas provide a good opportunity to design and develop them to ensure that they are aesthetically attractive. They need to be planned and developed as elements of urbanscape.

5.4.12 **Goods Movement**

A large volume of goods traffic moves within, into, out of and through Guwahati enabling city's production and consumption patterns. Efficient movement of goods traffic is important in reducing costs and increasing economic productivity of city activities. It is important that needs of goods traffic are given attention at the planning stage and adequate land resources are allocated.

Goods Traffic

13,128 goods vehicles move into and out of Guwahati every day (outer cordon, 2004). Of these 2-axle trucks account for 79.1%, 3-axle trucks for 10.5% and LCVs 9.2%. Composition of Multi-Axle vehicles is still small at 1.2%. A total of 1.03lakh tonnes of commodities of various types move into and out of Guwahati on an average day.

The average load/lead of goods vehicles at the outer cordon, including empty vehicles, were as under:

LCV	-	1.75 tonnes	48.05 Km
2/3 Axle Trucks	-	8.23 tonnes	247.71 Km
MAV	-	12.46 tonnes	696.70 Km

Nearly 87% of goods traffic was to and from Guwahati, signifying its importance as a generator of goods traffic. The desire pattern of goods vehicles, at the outer cordon, was observed to be as under:

Internal-Internal	-	5.4%
Internal-External	-	42%
External-Internal	-	44.8%
External-External	-	7.8%

Coal was the major commodity, accounting for 17.92% of goods vehicles at the outer cordon. "Construction Materials and Cement' accounted for 12.23%. The share of empty vehicles at the outer cordon was a high at 25.12% indicating high degree of flow from the adjoining areas but also indicating the loss in productive utilization of the vehicles.

5278 goods vehicles crossed the inner cordon on an average day. Of them LCVs were 30.7%, 2 Axle trucks were 37.1% and 3-Axle trucks were 0.6% and MAVs were 1.6%. The average loads, by vehicle type, including empty vehicles, at Inner Cordon were as under:

LCV	-	1.87 tonnes
2/3 Axle Truck	-	3.58 tonnes

'Fruits & Vegetables' was the main commodity, accounting for 11.64% of vehicles. 'Miscellaneous' commodity accounted for 17.65%. 'Forest Product, Wood' (7.21%), 'Fuel, Oil and Gas' (4.07%), 'Iron & Steel' (7.23%) were other major commodities moving across the inner cordon.

Goods Traffic Prospects

The transport modeling has indicated that the goods traffic, at the Outer Cordon, would be 38764 vehicles on an average day, by the horizon year. It is important that the movement of goods traffic is rationalized to increase efficiency, improve productivity, reduce congestion and promote safety.

Planning for Goods Movement

Planning for goods movement in an urban area includes three components. They are:

- Planning for goods generating activities like wholesale markets, major industries, warehousing and storage areas, etc.
- Planning for movement of goods modes and
- Planning for parking and servicing of goods vehicles

Goods Terminals

A major goods terminal is proposed to be developed as part of the Integrated Freight Complex along with rail depot and truck terminal at North Guwahati area in proposed New Town I. This would be rail cum road terminal. The praposal is to develop an Integrated Freight Complex at the new location. In the land use plan, an area of 238 ha in North Guwahati has been zoned for the IFC. The IFC and other related facilities like rail terminal, truck terminal, supporting public and semi public facilities etc. to be developed in this zone. It is recommended that a pre feasibility study of the IFC may be conducted and an integrated plan and program of implementation prepared immediately.

The concept of IFCs, simply put, is replication of Central Area, in terms of functions and facilities, at a smaller scale, at the new location identified for relocation of activities. The IFC is not commodity specific but would include all commodities markets so that a customer, who is a retail dealer in all commodities, within or outside Guwahati, would be able to get his needs of all commodities and services at one place.

The important and critical component of an IFC is the transport component. The IFC is connected to other parts of the city, including the central area, and the city regions, with a good transport network and service system. Transport terminal both of truck and rail terminals are integral parts of an IFC. Adequate parking for all modes is important.

An organization which may be called as the 'Guwahati Integrated Freight Complex Company (GIFCC)' may be set up with equity contribution by Guwahati Metropolitan Development Authority (GMDA) and the stakeholders. The GIFCC shall be responsible for planning and promoting the development of the IFC. It shall also mobilize resources for IFC development. It shall advocate for enactment of proclamations/regulations for the operation of the IFC. The GIFCC should also advocate for implementation of incentives and disincentives for relocation of trade and other functions from central area to the IFC.

The GIFCC may set up one or more Special Purpose Vehicles (SPVs) to construct, operate and manage all or the different components of the IFC. The management of the SPVs shall be by private sector with a small share in the equity by the GIFCC.

Planning, development, operation and management of IFC (s) is an answer to the growing needs of the city, increasing congestion within and

deteriorating environment quality of central areas, increasing accidents on the road network system, increasing costs of goods and services, reducing productivity of resources and reducing competitiveness and image of Guwahati.

Truck Terminal Space Norms

Truck terminal and Rail terminal are integrated as adjacent parts of a IFC. The broad land use break up of a truck terminal would be as under:

Sl. No.	Use Type	% of Area	Area (ha)
1	Transport Operators (office, storage, loading/unloading)	30.0	18.0
2	Service Industry (Fuel Filling Stations, Service area, weigh bridge, etc)	6.0	3.6
3	Public & Semi-Public (Police, Post, Telephone, Telecommunication, health conveniences, etc)	3.0	1.8
4	Commercial (eating places, dormitories, rest rooms, shops, etc)	3.0	1.8
5	Parking (Idle, transit, others)	18.0	10.8
6	Open Spaces	10.0	6.0
7	Circulation	28.0	16.8
8	Others	2.0	1.2
Total		**100.0**	**60.0**

Rail Link

The above identified location needs to be linked by the regional rail system. The main rail line to Guwahati runs on the west of the proposed zone. It is suggested that a rail branch link from this main line be extended to the IFC. However the rail terminal cum depot plan needs to be prepared as an integral component of IFC plan.

This rail link is proposed to be extended to run along the eastern edge of New Town I and North Guwahati and cross river Brahmaputra to link with the main line. The proposed bridge across river Brahmaputra could be a rail-cum-road bridge or they could be two separate bridges. Techno-economic feasibility study needs to be carried out to decide the location of bridge(s), alignment of rail line and alignment of the peripheral by-pass road.

Road Network for Major Goods Movement

An exclusive road network to cater future needs of GMA has been proposed in this CMP-2025. AT the top of the hierarchy is the bypass system taking off from NH-31 in the North, circumscribing the proposed wholesale market area, crosses river Brahmaputra on the east side, runs eastwards along the river bank upto Tadibagan, turns southwards and run southwards to meet Shillong Road (NH-37) at the intersection with the present Bypass road. A new road south of the existing Bypass road and in parallel to it is proposed from Shillong road upto the Airport road (Azara). On the western side the peripheral Bypass road runs from NH-31 in the north, run westwards connecting the proposed New Town, turn southwards, cross river Brahmputra and run southwards west of the airport and connect to the road network of the proposed New Town on the south. Two bridges across river Brahmaputra are proposed, on the east and west sides of the existing bridge, along the proposed Bypass alignment. All heavy goods vehicles are proposed to be routed along this Bypass Road, accessing the wholesale market area, the industrial areas, the New Towns and other destination points.

Movement of Goods Modes

The movement of goods modes on the road network needs to be rationalized. Goods modes can be grouped into three types as under:

- Small sized vehicles like pick ups
- Medium sized vehicles like LCVs and
- Large size vehicles like 2/3 Axle Trucks, Truck Trailer & MAVs

Small size vehicles like 'Pick ups' perform an essential distribution function. In space occupancy and maneuverability they are similar to cars. Their movement on all road sections, at all times of day may be permitted. As part of traffic management plans, separate parking areas for 'Pick ups' may be identified.

Medium size vehicles like LCVs are important to move goods to and from industries, warehouses and other major activities. They affect overall level of service of traffic. These are not to be permitted in the central city i.e. Planning Unit 1 after the development of I.F.C..

Movement of Large Size Goods Vehicles

Large sized goods vehicles consume high proportion of road capacity, impede traffic flows, cause accidents, adversely effect environment and consume large extent of land for parking. As these vehicles are bringing in/taking out traffic from/to other parts of the country, exclusive vehicle related restrictions that are valid only to Guwahati can not be prescribed. These vehicles need to be received at the urban periphery and facilitated in terms of planned terminals. Major truck terminals and/or idle parking is proposed to be developed as part of IFC.

Movement of 'Non-Destined' Traffic

Traffic surveys indicate a high share of 'non-destined' or 'through' traffic of goods mode at the outer cordon. With the development of the states of North East Region and the federal road system the intensity of movement of 'non-destined' mode would continue to increase. This traffic would be facilitated through the system of bypass roads.

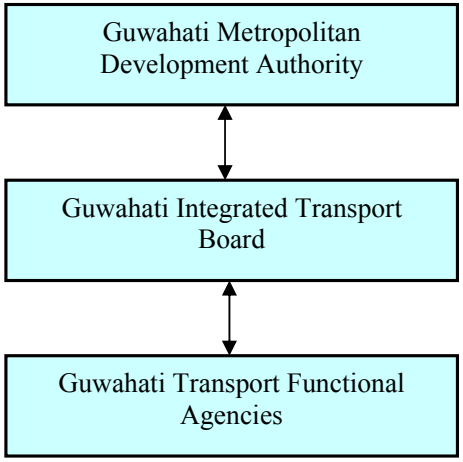
5.4.13 **Environment**

With growing traffic demand, environment pollution would become a major issue affecting the local as well as the macro environment. The plan proposes the following strategies in order to manage the down effects of urban transport on the environment:

- Plan, Develop, Operate & Manage Integrated, Balanced Transport System as in CMP - 2025
- Introduce Public Mass Transport System (PMTS)
- Prescribe Vehicle Exhaust Norms
- Introduce Pollution Check of Vehicles
- Introduce Clean Fuel (Low Sulphur Diesel)
- Restrict Age of Commercial Vehicles to 15 years
- Adopt Traffic Management
- Impart Education and Training
- Monitor Air Quality on a Continuous Basis

5.5 Institutional Arrangement - Guwahati Integrated Transport Board and Office

The 3-Tier Model



Guwahati city is in an advantageous position to bring about effective coordination in the planning, development, operation and management of an integrated, multi-modal transport system of the city. Some basic changes in the hierarchy and functioning of the institutional arrangements need to be done. A three tier conceptual model is suggested. It includes the Guwahati Metropolitan Development Authority (GMDA) at the apex, the Guwahati Integrated Transport Board (GITB), to be newly set up, at the next level and the functional agencies like Guwahati City Roads Authority, Guwahati Transport Authority. Guwahati City Bus Companies, Guwahati Light Rail Transport Corporation, Guwahati Integrated Freight Complex Company, etc at the third level reporting to the Guwahati Integrated Transport Board.

GITB

The GITB, shall be constituted by a resolution of the Assam State Government. The objects of the Board shall be to promote and secure the development of the transport system of the territory of Guwahati Metropolitan Area (GMA) and provision of transport service according to plan and for that purpose the Board shall have the power to hold, manage and dispose off land and other fixed and movable assets and other property to carry out building, engineering, and other operations to provide or cause to provide, transport service, to execute works in connection with development of transport facilities and supply of transport service and amenities, and generally to do anything necessary or expedient for purposes of such development and for purposes incidental thereto.

6 Physical Infrastructure

6.1 Water supply

6.1.1 Present Water Supply Status

Presently only 30% of the Guwahati city area is covered under piped water supply. The total installed capacity of potable water generation under GMC area is around 98 MLD considering the capacities of the treatment plants at Panbazar, Patpabhri and Hengrabari although the total water produced is 79 MLD. The present requirement of water (@ 135 lpcd) for the 9.8 lakh population would be 132 MLD.

Sources of Raw Water

1. Surface Water

The main source of raw water for existing Guwahati Metropolitan area is the River Brahmaputra. The average discharge of river Brahmaputra near Saraighat Bridge area is 4500 m^3/sec and flows nearly full for a

considerable length of time. The level of water remains at 48.17 metres above MSL for 50% of the days out of 150 monsoon days.

2. Ground Water

Yield from the shallow tube wells is not significant within the Guwahati Metropolitan Area. Possibilities of extracting ground water in considerable quantity are remote in the hard rocky areas.

6.1.2 Norms for Water Supply

Per capita water supply for designing of various schemes as suggested in "Manual on Water Supply and Treatment" of the Central Public Health Engineering Organisation, Government of India. In order to calculate the water demands for each node of the water supply distribution, ward-wise water requirement has been calculated in DPR for water supply, storm water drainage, underground sewerage and road restoration of Guwahati metropolitan area under "JNNURM" scheme. For ICI water demand, an exhaustive list of such units for 2007 has been prepared and per capita ICI demand has been calculated from 2007 projected population. This lpcd has been added with static water demand (i.e @135lpcd) and total water demand has been calculated over projected population of 2025 (the water demand has been calculated for 21.8 lakh in the DPR under JNNURM). Capacities of all components, except for pipelines, are based on 2025 water demand considering UFW @15% as per CPHEEO manual.

6.1.3 Projected Water Demand in different Planning Units

For preparation of water demand, entire GMA has been divided into four parts: - North Guwahati, South Guwahati West, South Guwahati Central and South Guwahati East. (ref. Map 6.1) The water demand for each planning unit is based on projected population for the year 2025. The total water demand in the existing GMA as in 2025 is 425 MLD.

Table 6.1: Water Demand in GMA-2025

Zones	Planning Unit	Wards Covered	Projected Population	Gross Water Demand (in MLD)
North Guwahati	9	69, 70, 71	147,809	38
South Guwahati West	5, 6, 7, 8	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 (Part), 65, 66, 67, 68	582,749	107
South Guwahati Central	1, 2, 3, 5, 10	13 (Part), 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 41, 42, 43, 44, 45 (Part), 47 (Part), 48 (Part), 49, 50 (Part), 51 (Part), 57 (Part), 59, 60	1,007,236	192
South Guwahati East	2, 3, 4, 10	40, 45 (Part), 46, 47 (Part), 48 (Part), 50 (Part), 51 (Part), 52, 53, 54, 55, 56, 57 (Part), 58, 61, 62, 63, 64	442,489	88

6.1.4 Water Requirement for Major Industries/Railways/Airports

At present the major industry like Noonmati IOC's refinery and Railways, Airports and defence establishment are collecting and treating their water requirement by themselves without depending on Municipal Water Supplies. Their main source of raw water is the river Brahmaputra.

It is proposed that in future, all the major industries will arrange their water need depending on their special requirement. The treatment and disposal of wastewater is also to be undertaken by these agencies. Municipal Corporation may not take this responsibility, as special treatment is required by each industry.

6.1.5 Water Intake, Treatment and Distribution

The water supply to the city is provided by three agencies viz. Assam Urban Water Supply & Sewerage Board (AUWSSB), Guwahati Municipal Corporation (GMC) and Public Health Engineering Department (PHED) through their existing system. Beside Railways, Indian Oil and Defence agencies also have their own independent supply systems for their areas. GMDA is now coordinating the water supply under JNNURM. All these agencies have their own future plans which need to be coordinated between the agencies by the GMDA which has already been identified as the nodal agency for the JNNURM funded for Water Supply project. Separate organisation such as Guwahati Metropolitan Water Supply and Sewerage Board may be constituted for the area to implement and execution of the project.

6.1.5.1 Water Intake

The water level of the river Brahmaputra varies around 10 meter between winter and monsoon period. During monsoon, the water level of the river sometimes goes higher than ground level of the city and stays so for more than a month. Thus, generally floating platform with flexible pipe connections are to be used for water intake. River Brahmaputra remains the best surface water source and has been considered for intake of raw water at four locations viz. Gopalnagar, Kharguli, West Kamakhya and near IIT Guwahati Complex for North Guwahati.

6.1.5.2 Water Treatment

Based on the physiography, population distribution and ease in operation and maintenance, the entire Guwahati Metropolitan Area is divided into four zones for the distribution of water, namely; **South Guwahati West Zone** covering the planning Units 5 (part), 6, 7 and 8; and **South Guwahati Central** covering the planning units 1, 2, 3, 5 (part) and 10; and **South Guwahati East** covering the planning units 2 (part), 3 (part), 4 and 10 (part). For **North Guwahati** another zone has been proposed, namely; **North Guwahati Zone** covering the planning Unit 9. Refer **Map 6.1**.

Each service district should have one intake arrangement for drawing raw water from the river Brahmaputra from a floating barge. The raw water will be pumped to the treatment plant located in each zone through a raw water pumping mains. The location of water intake and water treatment plant is given in Table 6.2.

Table 6.2: Proposed Location of Intake and Treatment Plant, Area to be Served and Capacity of W.T.P. (in MLD) by 2025

S. No	Water Intake	Treatment Plant	Planning Unit (area to be served)	Zone	Reqm. (in MLD)	Capacity of Proposed Plant (considering 15% losses) in MLD (area in ha)
1	Near IIT Campus	Near IIT Campus	9	North Guwahati	32.31	38 (9.52 ha)
2	West Kamakhya	Sadilapur	5, 6, 7, 8	South Guwahati West	94.47	107 (11.33 ha)
3	Kharghuli	Kharghuli	1, 2, 3, 5, 10	South Guwahati Central	166.83	192 (8.37 ha)
4	Gopal Nagar	Gopal Nagar near Refinery	2, 3, 4, 10	South Guwahati East	73.25	88 (11.80 ha)
Total					**319.28**	**383.14**

6.1.5.3 Water Distribution

A design of water supply distribution network system has been done by

AUWSSB for Eastern Service district & Western Service district. It is observed that the system is not fully a close network distribution system. It is mostly of dead-end type, which does not ensure the equitable distribution of water everywhere. It is proposed to connect one network with the adjacent networks with provision of valves so as to prevent non-supply during any major repair works in a particular network.

13 in North Guwahati, 9 in South Guwahati West, 2 in South Guwahati Central, and 2 in South Guwahati East of hydraulic zones are proposed in new water distribution zones for GMC under JNNURM scheme. All of these will be independent distribution network in each distribution zone. It is recommended that a comprehensive distribution system starting from major W.T.P in each service district be designed and the present pipeline system and W.T.P.s already available and in working condition to be integrated with the proposed system. The design recommended should consider a terminal head pressure of 0.7 kg/cm2 at peripheral locations.

6.1.5.4 Transmission Main/Clear Water Pumping Main and Service Reservoirs

It is proposed to provide a separate clear water service reservoir for each of zone which will supply water through distribution mains located at corresponding unit. Treated water for zones will be supplied through distribution mains directly from the service reservoir.

Service Reservoirs (SR)/Elevated Service Reservoirs (ESR)

There are 20 service reservoir/elevated services reservoir is proposed for GMC, which would store the quantity requirement for the respective planning unit. The SR/ESR would receive the quantity of water through the clear water pumping mains from the treatment plants. The water demand of various SR/ESRs for each unit is as under:

Table 6.3: Distribution of Service Reservoirs

Zone	Name of the Hill Top Reservoir /ESR	Water Demand (in MLD)
North Guwahati	IIT Hill	38
South Guwahati West	Ganeshpara (West)	12.54
	Ganeshpara (East)	12.42
	Durga Sarubar (Ganeshpara - Central)	9.04
	West Kamakhya	35.00
	West Kamakhya Hill Top	2.30
	Jalukbari	25.00
	Mirzapur (ESR)	6.00
	Borjhar (ESR)	6.00
South Guwahati Central	Ramsa Hill	31.00
	Amiya Nagar	29.00
	Geetanagar	31.00
	Lechu Bagan	17.00
	Sonaighuli	33.00
	Narakasur	43.00
South Guwahati East	Gopal Nagar (Main)	27.00
	Bijoy Nagar Subzone	8.10
	Subzone near Sector III	8.10
	Jonaki Nagar	54.00
	Khanapara Subzone	3.40

6.4Sewerage

6.2.1 Existing Sewerage System

Presently the Guwahati Metropolitan Area (GMA) does not have any integrated sewerage system except for certain pockets such as Railway colonies, I.O.C Refinery and Defence establishments having their own independent system. There are generally septic tanks in Guwahati. The effluent is released untreated into the nearby drains and low-lying areas.

Similar is the case of industrial wastewater. In case of septic tanks, the soak pits are becoming non-functional in many areas because of high sub-soil water table within a short span of time.

6.2.2 Projected Wastewater Generation

Considering the various factors, the per capita wastewater generation would be 80% of the water supply. Planning unit wise discharge of the wastewater is given in the Table 6.4. For places covered refer Table 6.1.

The planning units are combined into 3-service district for better collection and treatment of wastewater. Thus, the total area has been divided into three districts as in the case of water supply.

Table 6.4: Wastewater Load in Guwahati Metropolitan Area (GMA)

Planning Unit	Wards Covered	Projected Population (Year – 2025)	Generated wastewater in MLD (Year 2025)
1	18,19,20,21,23,25,26 27,28,29,30,31, 32,33 & 34	165076	23.77
2	15,16,17,22,24,55,56,57,58,59 & 60	401156	57.77
3	51,52,53,54 & 64	174627	25.14
4	46,61,62 & 63	59131	8.51
5	10,12,13 & 65	113409	16.33
6	3,4,5,6,7,8 & 9	93527	13.46
7	1 & 2	85087	12.26
8	66,67 & 68	230694	33.22
9	69,70 & 71	156124	22.48
10	11,14,35,36,37,38,39,40,41,42,43,44,4547,48,49,50	295071	42.49
	Total	**1773902**	**255.42**

6.2.3 Disposal of Industrial Effluent

A number of large and medium size industries are located in Guwahati Metropolitan Area (GMA). These industries discharge their industrial effluent into a big natural drain, which ultimately merges into River Brahmaputra with lot of chemicals being discharged by the industries, which pollute the water. Therefore, it is proposed that all large industries should have their own effluent treatment plants while industrial estates should have Common Effluent Treatment Plant (CETP) to meet the standard for discharge of treated industrial effluent. Small industries with very little pollution load can discharge their effluents after some primary treatment into municipal sewage network.

6.2.4 Proposed Domestic Sewage Disposal System

Considering various factors for STP siting, like availability of adequate land, convenience of disposal/transfer of sludge/effluent, natural topography, and three locations has been selected for STP location. Refer Table 6.5 and Map 6.2.

Table 6.5: Proposed Location of STP with Location by 2025

Sl. No.	Service Sector	Planning Unit	Location	Capacity in MLD (area in ha)
1	Eastern Service Sector	1,2,3,4 & 10	At Dhirenpara area	157.68 (20.60 ha)
2	Western Service Sector	5,6,7 & 8	On the Bank of Khanajan River	75.27 (8.66 ha)
3	North Service Sector	9	Near Confluence of Ghorajan River	22.5 (3.07 ha)
Total				**255.5**

After thorough investigation of several methods i.e. activated sludge, extended aeration and oxidation pond method of sewage treatment for wastewater, the activated sludge system has been found suitable for treatment of sewage at different sewage treatment plants.

6.3 Water Supply and Sewerage for New Towns

Three New Towns have been proposed as extensions of GMA in the population assignment for 2025 as following:

New Town	Planning Unit	Proposed Population - 2025
New Town I	11	0.8 lakh
New Town II	12	1.6 lakh
New Town III	13	1.6 lakh
Total		**4.0 lakh**

6.2.5 Water Supply

6.3.1 Sources of Raw Water for the New Towns

The main source of raw water for the proposed new towns i.e. New Town I & New Town II of Guwahati Metropolitan area shall be River Brahmaputra.

The New Town III is located towards south western side of Guwahati Metropolitan Area. Since it is away from River Brahmaputra, it is proposed to have deep tube well (submersible) in this area. It is observed that the yield from the tube wells should be sufficient to cater for the proposed water demand of the New Town III.

Projected Water Demand for the New Towns

The Water demand for the new towns (ref. Map 6.1) is based on projected population for year 2025 and the special uses proposed respectively.

The water demand for the projected population is based on @ 180 lpcd for urban area. For industrial, wholesale commercial and SEZ use areas, water demand @ 45000 litres/ha/day has been adopted. The total water demand as on 2025 is 134 MLD for the three new towns. Refer to Table 6.6.

Table 6.6 : Water Demand for the year 2025

New Town	Planning Unit Covered	Placed covered	Projected Population (in No.)/Area (Ha)	Gross Water Demand (in MLD)
I	11	North East of GMA (Sila-Matiya-Najirakhat-Bhulung area)	80,000	15
		Integrated freight complex and truck terminal	400.00 Ha	18
II	12	North East of GMA (Charmajuli Pam, Gandhmau, Ambari Bamun, Sualkuchi)	1,60,000	29
		City Industrial Area	400.00 Ha	18
III	13	South West of GMA (Panchniyapara, Sajjanpara,Gariyapara, Alibari, Tarapatipara)	1,60,000	29
		SEZ, IT and Business Centre	561.07 Ha	25
			Total	**134**

Water Treatment for the New Towns

New Towns I and II should have one intake structure with water drawing arrangement for drawing raw water from the river Brahmaputra from a floating barge and the raw water will be pumped to the treatment plant through a series of raw water pumping mains. The location of water intake, water treatment plant and area to be served would be as in Table 6.7. Also Refer **Map 6.1**.

Table 6.7: Proposed Location of Intake and Treatment Plant, Area to be served and capacity of WTP (in MLD)

Sl. No.	Location of Intake	Location of Treatment Plant	Town No. (Planning Unit No.)	Requirement in MLD (2025)	Capacity of proposed plant considering 20% losses MLD (area in ha)
1	Upper Rajadwar	Nazirakhat	I (11)	33	39.6 (2.5 ha)
2	Charmajuli Pam	Charmajuli Pam	II (12)	47	56.4 (3.68 ha)
3	Near Sajjan Para (Deep Tubewell)	Near Sajjan Para	III (13)	54	64.8 (4.2 ha)
			Total	**132**	161

Service Reservoirs (SR)/Elevated Service Reservoirs (ESR)

A service reservoir/elevated services reservoir is proposed for each of the proposed town, which would store the quantity requirement for the respective town. The SR/ESR would receive the quantity of water through the clear water pumping mains from the treatment plants. Proposed locations of different SR/ESRs are shown in the map enclosed. The capacities of various SR/ESRs for each town are as under:

Table 6.8: Distribution of Service Reservoirs in New Towns

New Town (Planning Unit No.)	Capacity of Service Reservoir (in million litre)
I (11)	15.60
II (12)	16.20
III (13)	15.54

6.3.2 Sewerage

Project Wastewater Generation for the New Towns

Considering the various factors per capita waste water would be 80% of the water supply. Town wise discharge of the wastewater is given in the Table 6.9.

Table 6.9 : Generation of Wastewater in New Towns in 2025

New Town	Planning Unit No.	Placed covered	Generated Wastewater (in MLD)
I	11	North East of GMA (Between Agyathuri Hills & Rawmari)	26.4
II	12	North East of GMA (Charmajuli Pam, Gandhmau, Ambari Bamun, Soalkuchi area)	37.6
III	13	South West of GMA (Panchniyapara, Sajjanpara, Gariyapara, Alibari,Tarapatipara area)	43.2
		Total	**107.2**

Sewage Disposal System for the New Towns

Considering various factors for STP sites, like availability of adequate land, convenience of disposal/transfer of sludge/effluents, natural topography, locations in each town have been selected for STP location. Each town would have their independent sewerage treatment plants.

The location of STP, area to be served and their capacity would be as in Table 6.10. Refer Map 6.2.

Table 6.10: Distribution of STP in New Towns

Town No.	Planning Unit No.	Capacity in MLD	Area (in ha)
I	11	26.4.0	3.4
II	12	37.6	4.8
III	13	43.2	5.6
	Total	**107.2**	**13.8**

6.4 Drainage

6.4.1 Drainage Basins

Considering the topographical features, the whole GMA area is divided into 6 (six) numbers of drainage basins, which are ultimately drained into the river Brahmaputra either directly or through various drainage channels and reservoirs. These six basins are:

Bharalu Basin: Bharalu river being the most flood prone and the focal point of the entire Guwahati drainage system is with a catchment area of 4200 hectare, it gets the top place in the drainage scheme. The developments have blocked the natural drainage pattern. The Basin is almost flat with several pockets of low-lying areas. During heavy rain, there is a back flow of water.

Dipar Basin: This is the largest single drainage basin located at the southern most part of the Guwahati Metropolitan Area with an area of 20135 hectares, comprising 2/3 hilly areas and 1/3 plain areas. It is the largest existing drainage basin in Guwahati. River Basistha also finally discharges into Dipar Beel. The basin is again sub-divided into two sub-basins: Bijubari sub-basin and Deepar sub-basin.

Silsako Basin: Silsako basin covers 6534 hectares in the east of Guwahati. The basin includes military area, refinery and the townships of various industrial establishments. All the areas are sloping towards the Silsako Beel and at present the Beel receives all the runoff from the whole basin. Silsako Beel is connected with Brahmaputra River through Bondajan River.

Foreshore Basin: The areas include main residential, commercial, institutional and business areas in Guwahati. Water logging takes place in some areas (Uzanbazar) as most areas are at a considerable height.

North Guwahati Basin: It has mostly hill ranges comprising the north and western boundary. Most of the area drains into the river Brahmaputra either directly or through the river Ghorajan via Namalijalah Beel. This covers a total area of 3230 hectare.

Kalmoni Basin: The whole of the basin falls outside the Guwahati Metropolitan area. The major outlet River Kalmoni finds its way into the river Brahmaputra partly through Dipar Beel and the Khana River and partly through Thengbhanga Beel and the Kalbog river. The total area occupied by the basin is 6650 hectares.

The drainage problem of GMA is to tackle ‘Basin wise’, if required flood water is to be diverted to another basin, if the capacity of one basin is found inadequate.

6.4.2 Guwahati Drainage Studies

Following are some important actions in the form of drainage studies or implementation of drainage projects undertaken so far:

a) A Master Plan for drainage, sewerage and water supply of Guwahati Metropolitan Area was prepared by Assam Government in 1971 with the help of Calcutta Metropolitan Planning Organisation (CMPO).
b) The Master Plan for Drainage was revised in the year 1991 to hold good for a period upto 2021.

c) The Town and Country Planning Department undertook some measures for storm drainage and completed construction of drains including box drains of total length of 17 km from 1973-74 to 1996-97.
d) In 1998-99 the Town and Country Planning Department prepared a Detailed Project Report (DPR) on Guwahati Metropolitan Area Storm Drainage Improvement Programme for assistance from HUDCO, on the basis of the revised version of the CMPO Master Plan.

6.4.3 Present Drainage Situation

With the exception of a small area of the city where Town and Country Planning, Government of Assam have implemented drainage schemes, nowhere within the Guwahati Metropolitan area any planned drainage system is in existence. The Guwahati Municipal Corporation area has got some roadside small drains which are not efficient enough to provide relief to the locality.

With the studies mentioned above with little implementation and with encroachments alongside drains, inadequate section of the outfall channels, over-flooding of the local drains, de-silting of hills, inadequate section of the outfall channel, existence of low-lying ditches within the local drains pattern having inadequate banks result in frequent over-flooding of the adjoining areas due to inefficient carrying capacity. This endangers the health and property of the area. This is more so within the corporation area where density of population is high and areas where buildings are constructed in low-lying areas blocking the natural drainage courses. The drainage situation is such that many areas of the city remain water logged during the rainy months.

6.4.4 Inadequate Drains

The drains of the city are grossly inadequate and insufficient. Since most of the drains fall on the upstream side of River Bharalu, the level of which is higher than the level of the drains, the outlet of the water is retarded by the difference in the levels.

6.4.5 Flooding of drainage system

Bharalu basin is the most flood prone area in the region. If the Bharalu River fails, the entire drainage system of the city collapses. The main causes for flooding include heavy siltation on the Bharalu River and encroachments on the natural drainage catchments areas. There are encroachments on the other drainage systems as well. Apart from that, there is garbage dumping which has resulted in blocking of natural drains.

6.4.6 Possible Solutions and Further Action

Some of the important actions suggested are:

Bharalu Basin

- The re-sectioning of the main drainage channel i.e. River Bharalu to increase the water flow;
- The trunk and major drains within the drainage basin tributary of the river Bharalu to be redesigned;
- The sluice structure near Pragjyotishpur College to be abandoned as it is too small. A new sluice structure for the entire opening to be constructed at a point near K.R. Chowdhury Road upstream of the railway line.

Foreshore Basin

This is sub-divided into three sub-basins:

- The Sub-Basin-1 comprises of the easternmost areas upto Kharguli. It includes the housing colony of the refinery. There is no problem of water logging during the rainy season in this area as they have storm water drainage system working satisfactorily.
- The Sub-Basin-2 includes Kamakhya T.C., the Pandu Railway Colony, the University and the other adjacent areas. The area from Assam Trunk Road upto Bharalumukh is subjected to flooding. Thus, it is proposed to construct a proper size intercepting drain along the Northern berm of the Assam Trunk Road.
- The Sub-Basin-3 covers the municipal area lying along the river. For this area 5 special outfall structures with sluice control have been suggested.

Dipar Basin

- Construction of main gate along the national highway from the diversion point to the Fatasil Road point where it enters Deepar Beel and construction of the new sluice on the Khanajan River for the proper flow and the river area has to be re-sectioned.

Silsako Basin

- Silsako Beel area should be used for storage for storm water and it should be developed as a recreational area.

Other recommendations:

- The encroachments on natural drainage system, which is the main reason for the blockage, should be stopped.
- Existing manholes of drain are inadequate; more manholes and inlet are required for the quick disposal of silt and stagnated water. The size of the inlet holes and their position need to be redesigned.
- Silt pit of proper size should be constructed in suitable areas and provision of periodical cleaning the silt pit should be done to avoid blockage in the drainage system.
- Effective garbage collection system (including domestic and other type of garbage) to be in place so that this does not block the drainage channels.
- A new canal to take excess water may be built from Konna towards west parallel to Kakermara where HFL of the river is lower than the city level. This is subject to detailed feasibility study. Refer **Map 6.3**.

For a detailed note on drainage refer Annex VI. The city now needs a new comprehensive study and action programme for drainage system and network also considering the developments upto 2025 as suggested in this plan.

6.5 Solid Waste Management

Presently important sources of solid waste generation are (i) Residential areas including slum habitations (ii) Fruit and vegetable market (iii) Hotels and restaurants (iv) Hospitals (v) Drains de-silting (vi) Commercial & Industrial wastes from these areas.

A comprehensive picture of solid waste generation per capita based on an international 1995 study is detailed in Table 6.11.

Table 6.11: Relation between GNP and Expected Generation of Municipal Solid Waste

Sl No	Country	Year 1995			Perspective 2025		
		GNP per capita US$	Urban Population (% of Total)	Urban MSW Generation (Kg/capita/day)	GNP per capita US$	Urban Pop. (% of Total)	Urban MSW Generation (Kg/capita/day)
Low Income		490	27.8	0.64	1.05	48.8	0.6-1.0
1	Nepal	200	13.7	0.50	360	34.3	0.6
2	Bangladesh	240	18.3	0.49	440	40.0	0.6
3	Myanmar	240	26.2	0.45	580	47.3	0.6
4	Vietnam	240	20.8	0.55	580	39.0	0.7
5	Mangolia	310	60.9	0.60	560	76.5	0.9
6	India	340	26.8	0.46	620	45.2	0.7
7	Lao PDR	350	21.7	0.69	850	44.5	0.8
8	China	620	30.3	0.79	1,500	54.5	0.9
9	Sri Lanka	700	22.4	0.89	1,300	42.6	1.0
Middle Income		1,410	37.6	0.73	3,390	61.1	0.8-1.5
10	Indonesia	980	35.4	0.76	2,400	60.7	1.0
11	Philippines	1.05	54.2	0.52	2,500	74.3	0.8
12	Thailand	2,740	20.0	1.10	6,650	39.1	1.5
13	Malaysia	3,890	53.7	0.81	9,400	72.7	1.4
High Income		30,990	79.5	1.64	41,140	88.2	1.1-4.5
14	Korea	9,700	81.3	1.59	17,600		1.4
15	Hong Kong	22,990	95.0	5.07	31,000	93.7	4.5
16	Singapore	26,730	100	1.10	36,000	100	1.1
17	Japan	39,640	77.6	1.47	53,500	84.9	1.3

Source: "What a Waste", Solid Waste Management in Asia, Urban Development Sector Unit, East Asia and Pacific Region, October 1998

From the table, it can be concluded that with the economic development and the increase in growth of per capita GNP, the per capita generation of solid waste generation increases. It is estimated that, per capita solid generation for Guwahati for the year 2025 would be of the order of 0.8 kg per capita per day.

The Table 6.12 shows the solid waste generation at 5-year intervals in the Guwahati.

Table 6.12: Projection of Solid Waste Generation

Year	Actual/Projected Population	Estimated generation	
		Kg/day/person	MT/day
1991	6.46 lakhs	0.30	193.8
2001	8.9 lakhs	0.35	311.5
2010	12.4 lakhs	0.60	744.0
2025	21.74 lakhs	0.80	1739

6.5.1 Solid Waste from Specific Specialized Areas

Vegetable & Fruit Market: A good quantity of solid waste will also be generated from vegetable & fruit markets. Solid Waste from vegetable markets is basically a large quantity of green waste that confirms the presence of commendable C/N ratio. But no data on the specific generation of quantity is available so far. A study is suggested.

Hotels and Restaurant: Generally hotels in cities generate @ 0.5 kg per bed per day. It is roughly worked out that each restaurant produces @ 200 gms of waste per visitor depending of volume of business.

Hospital Waste: As far as hospital waste is concerned, there is no separate disposal site in Guwahati. There is no functional incinerator, which is mandatory in government hospitals. Generally, there is generation @ 0.5 kg per bed per day of solid waste from hospital.

Table 6.13: No. of Hospital beds & projected solid waste generation

District	Present No. of Beds as on 2005	Beds projected No. of beds as on 2025	Solid waste generated per day in MT (2005)	Projected Solid Waste generated/day 2025 (MT)
A	3,661	3,918	1.83	1.959
B	614	2,770	0.307	1.385
C	572	3,498	0.286	1.749
D	0	2,045	0	1.022
Total			**2.417**	**6.115**

Drain De-silting: Guwahati has at present more than 50 km of open drains passing through the city area. Due to carriage of lot of mud by rain from the hill cut areas, these drains are filled up considerably every year. So the de-silting of drains is a common practice. This silt also increases the solid waste.

Commercial Waste from shops: Generally each shop produces commercial waste in the form of paper, packages material & other waste varying from 0.5 kg to 5.0 kg per day depending on their business volume.

Other Sources: Besides the above sources, the solid waste is also generated from (1) Construction and Demolition Activities, (2) Motor Garages, (3) Industries, (4) Carcass Disposal, (5) Dairy and (6) Dhobi Ghat.

6.5.2 Quality of Solid waste Generation

The characteristics of solid waste generation in Guwahati reveals that more than 90% is organic including paper (refer to Table 6.14) and rest constitute of non-biodegradable like plastic, glass etc.

Table 6.14: Composition of garbage in Guwahati

Sl No	Composition of garbage	Percentage
1	Organic Waste	78.0
2	Paper	14.0
3	Glass	1.8
4	Plastic	6.2
	Total	**100.0**

6.5.3 Landfill Area Requirement

The Landfill area requirement based on methods of calculation as per Manual on Municipal Solid Waste Management (1st edition) by Central Public Health and Environmental Engineering has been worked out as shown in Table 6.15. Solid Waste Management site is proposed at Pachim Boragaon of 24 Ha. Refer Map 6.2

Table 6.15: Land Requirement for Solid Waste Land Filling

Sl No	Year	Estimated quantity of solid waste generated (in MT/day)	Total Area required (in Hectare)
1	1991	193.8	-
2	2001	311.5	16.27
3	2010	744.0	38.0
4	2025	1739	91.0

Each landfill site for solid waste disposal should be equipped with the required facilities including fencing, weigh bridges, proper access roads, proper drainage system, leachgate collection system, gas handing equipments.

6.6 Power

6.6.1 Power Demand

There is a gap of nearly 48 MVA (as per UDPFI guide lines for urban development) between the power demand and the availability at present in Guwahati City. The total requirement is 1100 MVA by 2012 as per ASEB.

It is proposed to build three additional Main Receiving Grid Stations (132/11 kV) of capacity 150 MVA, where power will be obtained from Assam State Electricity Board and different power plants of central sector. The tentative locations of grid stations have been shown in **Map 6.4**. Power will further be transmitted to various sector substations (33/11 kV). Considering maximum capacity of each such substation as 20 MVA, 23 such sub-stations would be required with 4 and 19 numbers coming up in first and last three phases respectively. Therefore, a total of 23 sub-stations are required to be built in or around the town to meet the power demand of the city by 2025.

The tentative locations of proposed sub-stations have been shown in **Map 6.4**.

Table 6.16: Location of Electric Sub-stations

S.No.	Location of Substation	Capacity (in MVA)
01.	Fatasil	2 x 10
02.	Jalukbari	3 x 5
03.	Paltan Bazar	2 x 10
04.	Jawahar Nagar	1 x 10 + 2 x 5
05.	Narengi	3 x 5
06.	Ulubari	2 x 10
07.	Uzanbazar	2 x 10
08.	Zoo Road	1 x 10 + 1 x 5
09.	Medical College	1 x 2.5 + 1 x 2.5 (Future)
10.	Gorbanga	2 x 5
11.	Borjhar	1 x 2.5
12.	Mirza	1 x 5 + 1 x 3.16
13.	Rani	1 x 2.5
14.	Chhayagaon	1 x 2.5
15.	Boko	1 x 1.6 + 1 x 2.5
16.	Amingaon	2 x 5
17.	Jagi Road	1 x 2.5
18.	Malibari	2 x 5
19.	Sonapur	2 x 2.5

6.6.2 General Recommendations for Improvement in Transmission & Distribution of Power Supply

The following steps are recommended for improvement in Transmission & Distribution of Power Supply in the long term, short term as well as in present condition.

1. Power at 33kV to be taken using overhead transmission line.
2. Power at 11kV shall also be taken using overhead transmission line or through underground cables depending upon the condition/necessity/importance and town development planning.
3. To ensure minimum interruption of Power Supply, 11kV underground distribution system can be connected in Ring Main. It will ensure alternate source of power supply for all substations connected to the Ring Main.
4. It is proposed to take LT power supply using underground cables in the town area. It will ease the distribution of Power Supply in the densely populated area of the town.

5. Wherever it is necessary to use overhead transmission (Outside city limit), LT Arial Bunch cables can be used to check power theft.
6. 11/0.433kV substations can be indoor or outdoor type.
7. Whenever there is any space constraint in congested areas, Modern compact packaged outdoor substations can be used. This type of modern outdoor substation contains transformer, RMU, capacitor and all the switchgear arrangement in a single compartment. Space required for this substation is 5m x 5m x 4m.
8. The main receiving stations should have the SCADA (Supervisory Control & Data Acquisition) facility to ensure on line monitoring & control of power supply. All substations & distribution stations will be interconnected with controlling stations by using modern methods e.g. Fibre optics. Radio communication may be used for voice communication.

7 Social Infrastructure

7.1 Components of Social Infrastructure

Social Infrastructure includes education, health, recreation, socio-cultural facilities, police, fire, postal services, telecommunication and distributive services.

7.2 Education

System of Education in the State

The Education in the State is classified in the following categories:

Table 7.1: System of Education in the State

Elementary Education • Primary • Upper Primary	Age 6-14 years	Classes I-VIII
Secondary Education	Age14-16 years	Classes IX-X
Higher Secondary	Age 17-18 years	Classes XI-XII
Higher Education • University • Institutes of National Importance • Degree Colleges		
Technical and Vocational Education Vocational Institutes		

Source: Economic Survey of Assam 2003-04.

In the field of education, the primary objective of the State Government has been the universalization of elementary education and Qualitative improvement of Higher Education.

7.2.2 Primary and Senior Secondary Schools

There are at present 388 primary schools and 101 secondary and higher secondary schools including degree colleges with Classes XI and XII catering to a population of around 8.9 lakh.

To provide primary, secondary and higher secondary school facilities to cent percent school-going children, the following standards are adopted. (Ref. Table 7.2)

Table 7.2: Norms for provision of School level Educational Facilities (upto school level education)

No	Educational Facility	Level	Pop./Unit (approx.)	Strength	Plot Area
1	Pre-primary/Nursery School	Housing Area	2,500	250	0.08
2	Primary School	Housing Area	3,000~5,000	500	0.40
3	Senior Secondary School	Neighbourhood	7,500	1,000	1.60
4	Integrated School with hostel facility	Community	90,000~1,00,000	1,000	3.90
5	School for Handicapped	Community	45,000	400	0.50

To cater to the school-level facilities, 70 neighbourhood centres – each to include 2 senior secondary schools and 2 primary schools – are proposed in the existing GMA. Additional required pre-primary and primary schools as per standards given above would be provided in the detail plans of the residential developments. The integrated schools and the schools for handicapped are provided in the Facility Centres in new developments distributed throughout the city. In case of new towns, in the detail plans, the schools at above standards would be provided.

7.2.3 Higher Education

There are at present 18 Higher Education Institutions, including Cotton College, Guwahati Medical College and Hospital, Assam Engineering College besides Guwahati University and the Indian Institute of Technology. In addition there are three Polytechnics in Guwahati.

Table 7.3: Norms for provision of Higher and Vocational Education

No	Educational Facility	Level	Pop./Unit (approx.)	Strength	Plot Area (ha)
1	General College	Community	80,000	1,000-1,500	4.00
2	Technical Education Centre	-	3,00,000	500	4.00
	a. Polytechnic			400	2.40
	b. ITI			100	1.60

The Table 7.3 gives the norms for provision of General College and Technical Education Centres to include Polytechnic and ITI. This would accommodate about 17 students per 1000 population. Additional 3 students per 1000 population would be accommodated in the proposed new University and professional colleges.

On the basis of the above norms, the additional requirement and proposed distribution of General colleges are as under:

Table 7.4: Requirement and Proposed Distribution of General Colleges in GMA-2025

District/	Planning Unit	Additional Population Perspective 2025	Existing Number	Additional Number	Total Number Perspective 2025
A	1,4,10	59,591	10	1	11
B	2,3	311,152	1	4	5
C	5,6,7,8,13	460,353	4	6	10
D	9, 11,12	362,045	1	5	6
Total		1,193,142	16	16	32

The plan includes the provision of Facility Centres where a group of education, health and other facilities are provided. The additional 16 colleges have been provided in the proposed Facility Centres and distributed in the GMA as follows:

Table 7.5: Distribution of Additional Colleges in proposed Facility Centres

Sl No	Location			Number of Colleges
	Planning District	Planning Unit	Facility Centre	
1	District A	4	FC I	1
2	District B	2	FC II	1
3		2	FC III	1
4		3	FC IV	2
5	District C	6	FC V	1
6		8	FC VI	1
7		8	FC VII	2
8		13	FC XII	2
9	District D	9	FC VIII	1
10		9	FC IX	1
11		11	FC X	1
12		12	FC XI	2
	Total			**16**

Apart from General Colleges, four additional Technical Education Centres have been proposed in Facility Centres No IV, V, VII and IX.

One new University campus, including Technical and Professional Colleges, is proposed to be located in Kharghuli NC in Planning Unit 4 with a total area of 230 ha. A new Medical College is proposed on 15 ha land in the proposed Education and Research Hub in Planning Unit 9.

Refer to **Map 7.1** for proposed distribution of education facilities.

7.3 Health

The World Health Organisation (WHO) defines health as a state of complete physical, mental and social welling. The objective is to attain the same for the total Guwahati city population.

7.3.1 National Health Policy

The objective of the National Health Policy is to achieve an acceptable standard of good health amongst the general population of the country. The approach is to increase access to the decentralized public health system by establishing new infrastructure in deficient areas, and by upgrading the infrastructure in the existing institutions. In principle this policy provides for the participation of the private sector in all areas of health activities. The State Government follows the National Level policy for development of Health Infrastructure, one of the major objectives being attainment of 'health for all'.

7.3.2 Existing Situation

Presently, there are four Government hospitals with 2427 beds including the one of CRPF. There are 23 hospitals with 1724 beds and 24 nursing homes with 696 beds run by non-governmental and private organizations.

Table 7.6: Hospital beds in GMA

Sl. No.	Hospitals/ Nursing Homes	Number	Number of beds
1	Government Hospital	4	2427
2	Non-government/ Private Hospitals	23	1724
3	Non-government/ Private Nursing homes	24	696
	Total	51	4847

The present availability of hospital beds is 4.9 beds per 1,000 population, which is reasonably good but for its geographical disparity. Refer to Table 7.7.

Table 7.7 : Existing Number of Hospital Beds in GMA District-wise

Planning District	Estimated Population (2004)	Existing Number of Beds (A)	Beds per 1000 population
A	459,687	3,661	8.0
B	264,631	614	2.3
C	222,364	572	2.6
D	34,079	0	0.0
Total	**980,761**	**4847**	**4.9**

7.3.3 Norms for Health facilities

The Norms and Standards for provision of Health Infrastructure in urban areas adopted for CMP-2025 are given in Table 7.8. This is worked out to

provide for 5 beds per 1,000 populations as against the existing 4.9 beds per 1,000 populations and also to result in a balanced distribution of health facilities throughout the city. On this basis, in the year 2025, Guwahati city would have 12,231 beds against 4,847 beds at present by addition of 7,384 beds.

Table 7.8: Planning Norms and Standards for future provision of Health Infrastructure

Sl. No.	Category	Population Served	Hierarchy	Planning Norms and Standards	
				Population /Unit	Plot Area
1	General Referral Hospital (500 beds)	5 Lakh	District	1 for 2.5 lakh	6.0 ha
2	Intermediate Hospital A (200 beds)	1.0 lakh	Community	1.0 lakh	3.7 ha
3	Intermediate Hospital B (80 beds)	1.0 lakh	Community	1.0 lakh	1.0 ha
4	Nursing Homes, Child Welfare, Maternity Centre, Polyclinics	1.0 lakh	Community	0.45 lakh to 1 lakh	0.2 to 0.3 ha
5	Dispensary	0.15 lakh	Neighbourhood	0.15 lakh	0.08 to 0.12 ha
6	Medical College		City Level	Total City	15.0 ha
7	Speciality Hospital – City Level		City Level	Total City	8.0 ha

7.3.4 Proposed Distribution of Health Facilities – CMP 2025

On the basis of the norm of 5 beds per 1000 population, the additional bed requirement for GMA works out as 7,384 beds including the present deficiencies. The planning-district-wise distribution of proposed health facilities for 2025 shall be as under:

Table 7.9: Proposed Distribution of Additional Health Facilities in GMA for 2025

District	Planning Unit	Population (2025)	Additional Population	Additional Requirement of beds - CMP 2025	Distribution of additional health facilities by number			
					General Hospital	Intermediate Hospital A	Intermediate Hospital B	Nursing Homes
A	1,4,10	519,278	59,591	257	-	1	0	2
B	2,3	575,783	311,152	2156	2*	2	4	2
C	5,6,7,8,13	682,717	460,353	2926	2	6	7	8
D	9, 11, 12	396,124	362,045	2045	2	3	4	8
Total		2,173,902	1,193,143	7384	6	12	15	20

* 1 Speciality Hospital with 500 beds provided in the City Facility Centre

One Speciality Hospital with 500 beds shall be provided in City Facility Centre and a Special Hospital of 500 beds will be provided with Medical College separately in Planning Unit No 9 at Rudreswar village. The other required number of general and intermediate hospitals and nursing homes shall be distributed in various Facility Centres throughout the city as in Table 7.10.

Table 7.10: Distribution of Health Facilities in Facility Centres

Sl No	Location			Number of Different Health Facilities			
	Planning District	Planning Unit	Facility Centre	General Hospital	Intermediate Hospital A	Intermediate Hospital B	Nursing Homes
1	A	4	FC I	-	1		2
2	B	2	FC II	-	1	1	1
3		2	FC III	-	1	1	-
4		3	FC IV	1	-	2	1
5	C	6	FC V	1	1	1	2
6		8	FC VI	-	2	2	2
7		8	FC VII	-	2	2	2
8		13	FC XII	1	1	2	2

Sl No	Location			Number of Different Health Facilities			
	Planning District	Planning Unit	Facility Centre	General Hospital	Intermediate Hospital A	Intermediate Hospital B	Nursing Homes
9	D	9	FC VIII	-	1	1	2
10		9	FC IX	1	0	1	2
11		11	FC X	-	1	0	2
12		12	FC XI	1	1	2	2
	Total			5	13	15	20

Also refer to **Section 7.12**. Refer to Map 7.2 for proposed distribution of Health Facilities in GMA-2025.

7.3.5 Social Well-being

The Comprehensive Master Plan-2025 is a plan with integral facilities for social well-being such as parks, areas for sports and cultural activities distributed throughout the city to be accessible to all.

7.4 Recreation

Although Guwahati city has large eco-sensitive areas like hills and water bodies, but very few developed parks and playgrounds are available. Based on existing land use survey, presently only 114 ha area is under developed parks and playgrounds.

In the CMP-2025, 5,299 ha area is earmarked for recreational activity at city level. Out of this 5,299 ha area is indicated as recreational use and is part of Composite land use in District Facility Centres and Community Facility Centres.

Major part of 5,299 ha area is around eco-sensitive zone and similar areas. These are Regional/City recreational areas. Two picnic areas are proposed to be located in this. It also includes City level park (60 ha) and City level sports centre (97 ha). A Special Children's Park at City level is proposed to be developed in the City-level Park.

The river Brahmaputra has a vast and beautiful expanse all along it which makes it ideal for river front development. The River Development Zone has been marked in the existing area along the river. In the areas for new developments, As per CRZ III, a 200 m wide green belt has been marked as recreational green. Area for the same is indicated in the land use plan. The river-front area may be developed based on a landscape plan with seating in part of the area and on the water expanse attractive laser shows could be organised for tourists and for the local population.

Planning Unit wise distribution of the 5,299 ha hectare area is given in Table 7.11.

Table 7.11: Planning Unit wise distribution of Recreational Areas in CMP 2025

Planning Unit	Recreational Area (Hectare)
1	109
2	801
3	133
4	106
5	1487
6	43
7	360
8	515
9	645
10	23
New Town I	270
New Town II	475
New Town III	332
Total	5299

7.4.1 District level Parks

Norms for district level, community level, neighbourhood and housing area level parks, is given in Table 7.12 and provision for the same in Table 7.13:

Table 7.12: Norms and Standards for provision Parks

Sl. No.	Facility	Population	Area	Location
1	District Park	5 lakh (average)	6.0 ha	To be provided in District Facility Centres
2	Community Park	1 lakh	3.0 ha	To be provided in Community Facility Centres
3	Neighborhood Park (to be provided in Neighborhood centers)	15,000	1.0 ha	In Neighbourhood Centres
4	Housing area Park	5,000	0.5 ha	In the layout plan

Table 7.13: Distribution of Recreational areas within District, Community and Neighbourhood Centres

Sl. No	Type	Area/ Unit (ha)	Total No	Total Area (ha)	Provision
1	District Park	6	4	24	Within Integrated District Centres
2	Community Park	3	8	24	Within Integrated Community Centres
3	Neighbourhood Park	1	70	70	Within Neighbourhood Centres

7.4.2 Sports

Sports activities are an important part in the physical and social development of an individual and its importance in community life cannot be overstated. The CMP-2025 emphasises the provision of space for sports activities at all levels of the hierarchy. The norms for the provision of Sports areas are as under:

Table 7.14: Sports Facilities in GMA-2025

S. No	Category	Population per Unit	Area (Ha)	Number	Provision
1	City Sports Centre	22 lakh	97	1	Provided within City Centre
2	District Sports Centre	5 Lakh	4	4	Provided with in District Facility Centres
3	Community Sports Centre	1 – 1.5 lakh	1	8	Provided within Community Facility Centres
4	Neighborhood Play Area	15,000	1	80	Provided within Neighbourhood Centres

For locational distribution of recreational areas in GMA-2025, refer to **Map 7.3.**

7.5 Socio-Cultural Facilities

Socio-cultural facilities are an important component. At present there are 5 City Clubs, 2 Marriage Halls and 9 Public Function Halls within GMCA.

For the new areas, socio-cultural facilities shall be provided based on the norms given in Table 7.15.

Table 7.15: Proposed Norms for provision of additional Socio-cultural facilities

No	Socio-cultural facilities	Hierarchy	Pop./Unit (approx.)	Area (sq.m.)	Remarks
1	Community hall including provision for marriages, small public gathering, function, eating joint, and library etc.	Neighbour-hood	15,000	2,000	To be accommodated in Neighbourhood centres (70 nos.)
2	Recreational Club including Music, dance and drama centre	Community	100,000	10,000	To be provided in Community Facility Centres (7 nos)
3	District Socio-cultural Club	District	500,000	15,000	To be provided in District Facility Centres (4 nos)
3	City level Socio-cultural centre	City	City Level	40,000	To be provided in the City Facility Centre (1 no.)

Marriage and banquet halls each of 0.1 ha, shall be provided one each in the proposed 12 facility centres.

7.6 Police

Presently, there are 16 Police Stations and 11 Police Outposts in Guwahati. There is one existing jail, on around 8 hectares of land, which lies in the central area of the Guwahati.

7.6.1 Norms and Standards

The following planning norms are adopted for security facilities for CMP 2025:

Table 7.16: Proposed Norms for provision of Security facilities

No	Security Facilities	Hierarchy	Pop./Unit (approx.)	Area
1	Police Station	Community level	0.75 lakh	1.0 ha
2	Police Post	Community level	For every Police Station	0.16 ha
3.	Jail	City level	City Level	

7.6.2 Provision - 2025

Thirteen additional police stations and the same number of outposts are required, which shall be distributed as in Table 7.17.

Table 7.17: Existing and Proposed Distribution of Police Stations

Planning District	Planning Units	Population 2025	No. of Police Stations	Total No. of Police Stations 2025	Addl. Police Stations	Addl. Police Posts
A	1,4,10	519,278	8	8	0	0
B	2,3	575,783	3	6	3	3
C	5,6,7,8, 13	682,717	4	9	5	5
D	9, 11, 12	396,124	1	6	5	5
Total		2,173,902	16	29	13	13

The Police Stations are provided as part of the Facility Centres. One Police Station shall be provided in the proposed University Area in District B. The city jail is proposed to be relocated in PU 9 in North Guwahati.

The existing Jail area is proposed to be developed as a multi-use complex with details as given under:

- Cultural and Institutional 30% 2.4 ha
- Commercial 30% 2.4 ha
- Parks 20% 1.2 ha
- Parking 20% 1.2 ha

Refer to **Map 7.4.**

7.7 Fire

7.7.1 Existing Situation

Fire Services are needed for protecting people from fire hazards, building collapses, and other unforeseen emergencies. At present, there are 6 nos. of Fire Stations in GMA including North Guwahati fire Station out of which, four are regular Fire Stations i.e. Guwahati Fire Station (in between Panbazar and Paltanbazar), Dispur, Chandmari and Pandu, and two are Adhoc Fire Stations at Santipur and North Guwahati. Out of the six Fire Stations, only 2 (two) Fire Stations like Guwahati Fire Station and Dispur Fire Station have been accommodated in their own premises and the Pandu Fire Station is being constructed at its location. The other Fire Stations are accommodated in rented premises.

7.7.2 Norms and Standards

The following norms are prescribed for the provision of fire stations:

- 1 fire station or sub-fire station to be provided for 1.5 lakh population within 3 Km radius.
- Area for fire station with essential residential accommodation 1.00 ha
- Area for sub-fire-station with essential residential accommodation 0.6 ha

7.7.3 Fire Services-2025

9 new Fire Stations have been proposed to be developed in GMA by 2025. The total additional land requirement for fire services is 7.0 ha by 2025. The following table shows the number of the existing and the proposed fire stations in GMA.

Table 7.18: Existing and Proposed Fire Stations in GMA

Planning District	Planning Unit	Population 2025	No. of Fire Stations 2004	Additional No. of Fire Stations	Additional Land Requirement (Ha)	Total No. of Fire Stations 2025
A	1,4,10	519,278	4	-	-	4
B	2,3	575,783	0	4	4	4
C	5,6,7,8,13	682,717	1	3	3	4
D	9, 11, 12	396,124	1	2	2	3
Total		2,173,902	6	9	9	15

The following Guidelines are to be followed for locating the Fire Stations and other Fire Fighting Facilities.

- Fire Stations to be located on corner plots as far as possible and on main roads with minimum two entries.
- In new layouts for residential, commercial and other developments, concept of under ground pipe lines on the periphery, exclusively for fire fighting services should be considered.

- Fire Stations shall be permitted in all land use zones except recreational and eco-sensitive zones.

7.7.4 Disaster Management Centre

Guwahati is prone to natural hazards including floods and earthquakes. According to the Indian Seismic Zone Map, Guwahati is placed in the Seismic Zone V. A Disaster Management Centre has been proposed in GMA on 4 ha of land in Pub Boragaon area in Planning Unit 5 with suitable open area (2 ha) for soft parking, temporary shelter etc. This centre would accommodate a Fire Station and Trauma Centre for coordination at the time of emergencies. The Trauma Centre should be on 1 hectare of land and have a minimum of 100 beds. This would be linked with lower order Trauma Centres to be provided in selected hospitals. Refer to **Map 7.4**

The following policies and strategies for Disaster Management are proposed:

1. Pre-Disaster Preparedness

- The Fire Services department being the nodal agency for disaster management, should identify vulnerable areas e.g. areas with high density and poor accessibility in the city and propose suitable measures.
- Sensitize people about after effects of disaster particularly school children.
- Make people aware through media campaigns and advertisements about emergency procedures and location of emergency shelters etc.

2. Post Disaster Management

- It has been observed that any disaster is generally followed by break down of communication lines and disruption of essential services. Therefore, the key communication centres should be safely located to be free from natural disasters e.g. flood, fire and earthquake.

7.8 Postal Services

7.8.1 Existing Facilities

The Guwahati City has a network of 48 post offices – a post office on average serving 5 sq. Km.

Table 7.19: Post Offices in Guwahati

Post Office	Number
Delivery Post Offices	2
Delivery Sub Post Offices	36
Non Delivery Post Offices	10
Branch Post Offices	4

Source: Guwahati City Postal Directory, Chief Postmaster General, Assam Circle

7.8.2 Norms and Standards

Planning norms for provision of postal facilities in the GMA are given in Table 7.20.

Table 7.20: Planning Norms for provision of Postal Facilities in GMA

No	Postal Facility	Pop./Unit (approx.)	Area
1	Post Office Counter without delivery (At Local Shopping Centre)	10,000 to 15,000	60 sq.m~ 85 sq.m.
2	Head Post Office with Delivery Office (At Community Centre)	2 lakh ~ 2.5 lakh	480 sq.m~600 sq.m.
3	Head Post Office with Administrative Office (At District Centre)	4 lakh ~ 5 lakh	2,000 sq.m.~2,500 sq.m.

7.8.3 Proposed Additional Postal Facilities

Proposal for postal facilities for GMA-2025 is given in Table 7.21.

Table 7.21: Proposed number of postal facilities and the area required

No	Postal Facility	Provision	Additional Requirement (Number)	Additional Area Required (in Ha)
1	Head Post Office with Delivery Office	Community Commercial Centre	5	0.3
2	Head Post Office with Administrative Office	District Commercial Centres I, III and IV	3	0.75
	Total Area			**1.75**

The Post Office Counters without delivery shall be provided in the Neighbourhood Centres.

7.9 Telecommunication

7.9.1 Existing Situation

There are 20 Telephone exchanges in Guwahati as Short Distance Charging Area (SDCA) and 6 exchanges in Digital Line Connectors (DLC).

7.9.2 Additional Provision

With privatization, most of the space requirement is expected to be satisfied in the private sector. Norms for provision of Telephone Exchanges is given in Table 7.22.

Table 7.22: Norms for provision of Telephone Exchanges

No	Postal Facility	Pop./Unit (approx.)	Area	Location
1	Telephone Exchange (With 40,000 lines)	4.0 – 5.0 lakh	2500 sq.m.	District Commercial Centre
2	RSU (Remote Subscriber Unit)	1 No. within a radius of 3 Km	300 sq.m.	Community Commercial Centre

Each of the District Commercial Centres is provided with 1 Telephone Exchange (area 2500 sq.m.) and on similar lines each of the Facility Centres within Community Centres is provided with an RSU (300 sq.m.). In the new Towns, these facilities will be provided in their Facility Centres.

7.10 Distributive facilities

7.10.1 Existing Facilities

Distributive Facilities include Milk Distribution, LPG Storage and Distribution and Petrol Pumps.

7.10.2 Norms and Standards and Provision

Planning Norms for Milk distribution and LPG storage are given in Table 7.23.

Table 7.23: Planning Norms and Standards for Distributive Facilities

S.No.	Category	Planning Norms and Standards
1.	Milk Booth/Milk and Fruit and Vegetable Booth	One per 5,000 population (in residential developments)
2.	LPG Godown including Booking Office.	3 LPG Godowns per 1 lakh population in facility centres.

Petrol Pumps

It is estimated that 57 additional petrol pumps shall be required in GMA by 2025. These are distributed as under:

Table 7.24: Proposed Locations of Petrol Pumps

Area	Number of Petrol Pumps
Unit 11 (New Town I)	3
Unit 12 (New Town II)	6
Unit 13 (New Town III)	6
Unit 2	11
Unit 3	6
Unit 5	4
Unit 7	4
Unit 8	11
Unit 9	7

The petrol pumps shall adhere to the following conditions:

a) Minimum frontage
   - i. Only filling station — 30 M x 17 M
   - ii. Filling cum service station — Min. Size: 36 M x 32 M; Max. Size: 45 m x 33 M
   - iii. Frontage of the plot should not be less than 30 m
   - iv. Longer side of the plot should be the frontage

b) Road R/W distance from the road intersection:
   - i. New Petrol pumps shall not be located on the road R/W less than 30 M
   - ii. Minimum distance from road intersections 100 metres

7.11 Cremation and Burial Grounds

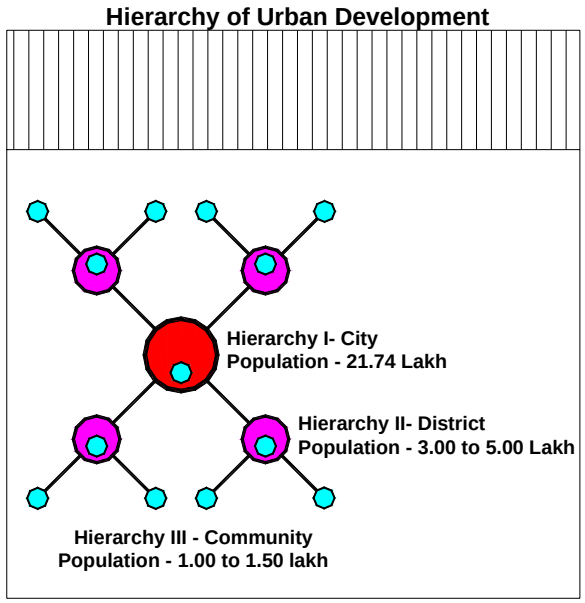
At present there are 6 cremation grounds in Planning Units 1 (2 nos), 5, 6, 7 and 10 (2 nos.). There are 6 Burial grounds at Planning units 1, 2 (2 nos.), 7, 10 (2 nos.).

In CMP-2025 three additional sites have been proposed for Cremation and Burial grounds in Units 11, 12 and 13 each of 2 ha.

7.12 Hierarchy in Social Infrastructure

A planned city for an environment of convenience should have a hierarchical cellular structure; with nuclei to contain essential facilities and services at different levels. Accordingly a five-tier hierarchy is proposed for the provision of social infrastructure as follows:

- Tier I : City level City Population
- Tier II : District level 3-5 lakh population
- Tier III : Community level 1-1.5 lakh population
- Tier IV : Neighbourhood level 15,000 population
- Tier V : Housing Cluster level 5,000 population



The pattern of a community module is conceived as residential area containing a 'neighborhood' with senior school and shopping facilities for day-to-day needs. The higher level of additional facilities is to be provided at Community, District and City levels. Such a structure could be maintained during the preparation of plans on the basis of standards set in the foregoing sections.

7.13 Facility Centres

The lower level additional facilities like primary schools, nursery schools, and dispensary are to be provided at the neighbourhood plan level in new development/ redevelopment schemes. The higher order facilities such as general hospital, intermediate hospital, college, integrated schools, school for handicapped, socio-cultural and recreational club, fire and police stations need to be provided at the master plan level. As it would not be desirable to provide individual locations for these facilities, concept of facility centre has been evolved where a group of facilities along with park and play areas shall be provided in areas available for development within GMA. Accordingly 12 such Facility Centres have been identified on the land use plan to provide for the required social infrastructure. The Facility Centres are envisaged at three hierarchical levels viz., City level, District level and Community level. Their locations are shown in **Map 7.5**.

At the community level, Facility Centres shall contain Community level parks and play areas and shall be clubbed together with Community Commercial Centres. 7 such Facility Centres are as given in **Table 7.25.**

Table 7.25: Community level Facility Centres

Facility Centre	District/ Planning Unit	Area (in Ha)	Components
FC-I	A/4	18	Intermediate Hospital A, Nursing Home (2) Integrated School with Hostel , School for Handicapped, General College Recreational Club Night Shelter LPG Godown, RSU BusTerminal, Parking Community Park and Play area
FC-III	B/2	24	Intermediate Hospital A, Intermediate Hospital B Integrated School with Hostel, Schools for Handicapped (2), General College LPG Godown, RSU Religious Building, Recreational Club, Night Shelter Bus Terminal, Petrol Pump Fire Station, Police Station Parking , Community Park and Play area
FC-VI	C/8	27	Intermediate Hospital A(2), Intermediate Hospital B(2), Nursing Homes, Clinic for pet animals Integrated School with Hostel, Schools for Handicapped (2),General College Religious Building, Recreational Club, Banquet Hall Night Shelter Bus Terminal, Petrol Pump, LPG Godown, RSU Police Station Parking , Community Park and Play area
FC-VIII	D/9	21	Intermediate A, Intermediate B, Nursing Home (2), Clinic for pets Integrated School with Hostel, Schools for Handicapped, General College Police Station Petrol Pump, Bus Terminal, LPG Godown, RSU Recreational Club, Religious Building, Night Shelter Parking , Community Park and Play area
FC-X	D/11	19	Intermediate A, Nursing Home (2) Integrated School with Hostel, School for Handicapped (2), General College Petrol Pump, Bus Terminal, LPG Godown, RSU Religious Building, Recreational Club Police Station Parking
FC-XI	D/12	38	General Hospital, Intermediate Hospital A, Intermediate Hospital B (2), Nursing Home (2) Integrated School with Hostel (2), School for Handicapped (3), General College (2) Petrol Pump, Bus Terminal, LPG Godown, RSU Religious Building, Recreational Club Fire Station, Police Station Parking
FC XII	D/13	38	General Hospital, Intermediate Hospital A, Intermediate Hospital B (2), Nursing Home (2) Integrated School with Hostel (2), Integrated School without Hostel (2), School for Handicapped (3), General College (2) Petrol Pump, Bus Terminal, LPG Godown, RSU Religious Building, Recreational Club Fire Station, Police Station Parking

At District level, Facility Centres shall contain some higher order district level facilities like District-level Socio-cultural Club, General Referral Hospital, Technical Education Centre in addition to general community facilities. These Facility Centres are proposed to be part of Composite Use Integrated District Centres where District Commercial Centres and District level parks and play areas shall also be developed in addition to Facilities. Refer to Table 7.26.

Table 7.26: District level Facility Centres

Facility Centre	District/ Planning Unit	Area (Ha)	Components
FC-IV	B/3	42	**District-level facilities** District Club General Referral Hospital, Hospital for pets Technical Education Centre Old Age Home, Orphanage, Working Men/Women Hostel, Bus Depot District Park and Play Area **Other Community Facilities** Intermediate Hospital B (2), Nursing Home Integrated School with Hostel, Schools for Handicapped (2), General College (2) Religious Building Night Shelter LPG Godown Fire Station, Police Station Parking
FC-V	C/6	33	**District level facilities** District Club General Referral Hospital Technical Education Centre District Park and Play area **Other Facilities** Intermediate Hospital A, Intermediate Hospital B, Nursing Homes (2) Integrated School with Hostel, Schools for Handicapped (2), General College (2) Religious building, Socio-cultural club Night Shelter Fire Station, Police Station LPG Godown Parking
FC-VII	C/8	44	**District level facilities** Hospital for pets Technical Education Centre Old Age Home, Orphanage District Park and Play area **Other Facilities** Intermediate Hospital A(2), Intermediate Hospital B(2), Nursing Homes (2) Integrated School with Hostel, Schools for Handicapped (3), General College Night Shelter Religious Building, Banquet Hall LPG Godown Fire Station, Police Station Parking
FC-IX	D/9	44	**District level facilities** District Socio-cultural Club, General Referral Hospital, Veterinary Hospital Technical Education Centre Orphanage, Old Age Home, Working Men/Women Hostel District Park and Play area **Other Facilities** Intermediate B, Nursing Home (2) Integrated School with Hostel, Schools for Handicapped (2), General College Religious Building LPG Godown, Night Shelter Police Station Parking

The City-level Facility Centre shall contain higher order city-level facilities in addition to general community facilities. The City Facility Centre is envisaged to be developed on 52 ha land at Saukuchi. For the components to be included in the city level facility centre refer to **Table 7.27**

Table 7.27: City level Facility Centre:

Facility Center	District/ Planning Unit	Area (ha)	Facilities
FC-II	B/2	52	**City level facilities** (22 ha) Sports Club (4 ha), Socio-cultural Club (2 ha), Exhibition Gallery-cum-Cultural Centre (4 ha) , Museums (2 ha), Speciality Hospital (6 ha) Multi family housing, hotels and hostels (8 ha) **Other Facilities** (16 ha) Intermediate Hospital A, Intermediate Hospital B, Nursing Home Integrated School with Hostel, Schools for Handicapped (2), General College Police Station Parking

Public and Semi-public areas of city/ regional significance

In addition to the above, the following public and semi-public facilities of city/regional significance are located in different parts of GMA.

Table 7.28: Major City level facilities

Facilities	Area (in Hectare)
Exhibition-cum-Fair Ground	412
Golf Course	121
City Park	79
Education and Research Hub (including Medical College)	107
University and Professional College	304
Sports Complex	97
Total Area	**1120**

7.13.1 Neighbourhood Centres

These centres are the nuclei of 15,000 population. Seventy-three such centres are proposed to be distributed throughout the GMA except in the predominantly already developed areas. In case of New Towns, in addition, such centres would be located in each sector.

For the development of such centres, it is proposed that an area of 12 ha is to be acquired out of which about 70% net area I.e., 8.4 ha shall be available after providing for roads and common facilities like common parking, shopping etc. 5.4 ha shall be developed for part provision of social infrastructure for the neighbourhood. The remaining 3 ha shall be developed for housing out of which 10% of the total sector area i.e., 1.2 ha shall be given back to the persons from whom the land has been acquired, proportionate to the area acquired at no-profit-no-loss basis. Remaining residential area shall be used for housing to be disposed of in open auction. This method is developed to make the land acquisition process attractive to the landowners. Once this experiment is successful, the same could be adopted for development of other residential and other areas in Guwahati. For distribution of 12 ha area, refer to table 7.29.

Table 7.29: Details of Neighbourhood Centres

Sl. No	Facilities	No.	Area	Total Area (sq.m.)	Total Area (Ha)
1	Sr. Secondary School	2	10,000	20,000	2.00
2	Dispensary	2	1,000	2,000	0.20
3	Community hall and Library	1	2,000	2,000	0.20
4	Electric Substation 11 KV	2	460	920	0.09
5	Local Shopping incl. Service centre	1	4,600	4,600	0.46
6	Three wheeler and taxi stand	1	500	500	0.05
7	Neighbourhood Park	1	8,000	8,000	0.80
8	Neighbourhood Play Area	1	8,000	8,000	0.80
9	Primary School	2	4,000	8,000	0.80
	Sub-Total A				5.40
10	Housing Area		30,000	30000	3.00
	Sub-Total B				9.40
11	Roads and Common Facilities		26,000		3.6
	Grand Total				12.00

The Neighbourhood Centres in the planning Units provide for facilities for the additional population and considering 30% existing deficiency in social infrastructure. Refer **Table 7.30**. Refer to **Map 7.6**.

Table 7.30 : Distribution of Neighbourhood Centres in various Planning Units

Planning Unit	Population 2025	No of Neighbourhood. Centres	Area (in ha)
1	165076	2	24
2	401156	18	216
3	174627	9	108
4	59131	1	12
5	113409	5	60
6	93527	2	24
7	85087	5	60
8	230694	14	168
9	156124	8	96
10	295071	6	72
Total	**1,773,902**	**70**	**840**

8. Housing and Slums

8.1 Present housing situation – Census of India, 2001

In 2001, Guwahati Metropolitan Area contains 183,491 housing units out of which 178,838 units are exclusively residential and 4,753 are put to residence-cum-other uses. Out of the total housing, 48.4% households live in owned residences, 46.4% in rented and 5.2% in other accommodations. Out of the total 178,838 residences in 2001, 98,889 (55.3%) are of good condition; 68,383 (38.3%) of liveable condition and 11,466 (6.4%) in dilapidated condition. 57% of the population lives in one- or two-roomed accommodation; 29.6% in three- or four-roomed accommodation and 12.4% in 5-roomed and above.

8.2 Housing Shortage in 2001 and 2005

Housing shortage in Guwahati Metropolitan Area in 2001 is 12,817. Census data on the number of households, number of residential houses is as follows:

A.	Total no of households	1,84,454
B.	Total number of residential houses and houses used for residence-cum-other purposes	1,83,491
C.	Backlog of housing required (A-B)	963
D.	Dilapidated houses (Residence and Residence-cum-other uses)	11,854
E	**Total Housing Shortage in 2001 (C+D)**	**12,817** (6.95% of the households)

Based on the above, in 2005 the housing shortage works out to 19,802.

8.3 Housing – CMP 2025

8.3.1 Household Size

As per 2001 Census, the average household size in GMA is 4.45. This has decreased from 4.72 in 1991.

Table 8.1: Growth of Population and households in GMA

Jurisdiction	2001			1991		
	Population	**No Of House-holds**	**Persons per house-hold**	**Popu-lation**	**No. of House-holds**	**Persons per house-hold**
GMC area	8,09,895	184,454	4.39	584,342	125,906	4.64
GMA excluding GMCA	80878	15,804	5.12	64,307	11,553	5.57
Total GMA	**890,773**	**200,258**	**4.45**	**648,649**	**137,459**	**4.72**

Source: Census of India

The main reasons for smaller household size is single person resulting in low sex ratio and smaller family size. For 2025, a household size of 4.4 has been adopted to workout the housing requirement.

8.3.2 Housing Need 2025

The projected housing requirement in GMDA area in 2025 is as under:

- Projected additional population for 2025 1,283,129
- Additional households between 2005 and 2025 @ 4.4 persons per household 259,163
- Housing shortage in 2005 19,802
- Need for additional dwellings between 2006 & 2025 278,965 (This is excluding the slum areas.)

It is seen from section 9.3 that the housing deficiency in the GMC area has significantly increased in the last decade from 0.7% of the total number of households to 3.1% of the total number of households; and considering dilapidated houses it would work out to 6.95%. It may also be seen that GMDA needs to provide for about 2.8 lakh new housing units to be distributed in the existing and new developments in the next 20 years.

The additional housing units shall be provided in the following manner:

- New Towns : 90,909 dwelling Units
- New Residential Developments : 131,721 dwelling units
- Infill in existing residential areas: 56,335 dwelling units

Refer to **Map 8.1.**

8.3.3 Housing requirement at 5 year intervals

The housing requirement phase-wise is calculated for the periods 2006-10, 2011-15, 2016-20, 2021-25.

Table 8.2 : Housing Requirement at 5-year interval period (2006-2025)

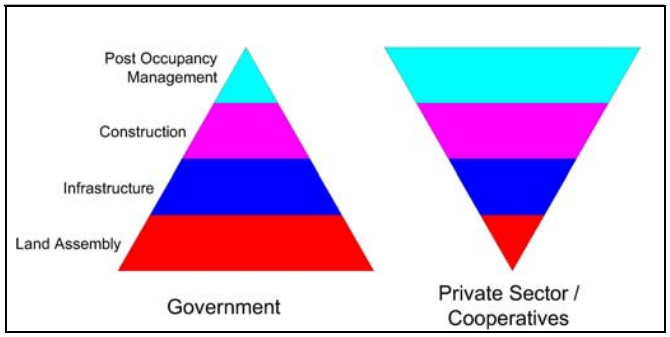
Year	Additional Population	Additional Houses	Total Requirement of Houses
2006-2010	211,129	47984	*57885
2011-2015	254,257	57786	*67687
2016-2020	306,193	69589	69589
2021-2025	368,739	83804	83804
	1,140,318	259163	278965

** Including existing deficit*

8.3.4 Private sector participation

Privatisation in the form of individuals and builders/developers should be encouraged to participate in the house building activity. The Development Authority could provide land with offsite physical and social infrastructure for the private entrepreneurs to invest in house building and onsite infrastructure development. Also developed individual residential plots could be provided to families where more than one dwelling unit could be constructed.

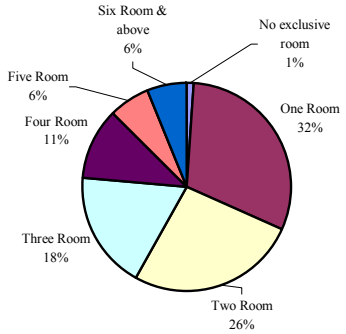
Housing has four distinct components for its development i.e., Land Assembly, infrastructure provision, building construction and post occupancy management. The following diagram gives an idea how these activities should be distributed amongst the Government, private and cooperatives making the Government a facilitator for housing development.



8.3.5 Houses in Different Categories

58% of the households in GMC area live in one and two room houses (32% in one room and 26% in two room). 41% of the households live in three room houses and above (18% in three room, 11% in four rooms & 6% each in five and six room houses).

Fig 8.1: Distribution of Dwelling Units by number of rooms in GMCA



On the basis of the emerging trend in the proportion of population occupying 1-2 rooms, 3-4 rooms and 5-plus rooms by comparing the 1991 and 2001 Census data, a distribution in the above categories for 2025 have been projected as under:

Table 8.3: Distribution of population by no. of rooms

Category	No of rooms	Proportion of total population		
		1991	2001	2025
I	1-2	61%	58%	51%
II	3-4	28%	30%	36%
III	5+	12%	13%	15%
		100%	100%	100%

8.3.6 Housing provision by different agencies

On the basis of the above studies, a possible indicative scenario in terms of housing supply by different agencies emerges as under:

Table 8.4: Housing by different agencies in plan period (2001-2025)

Sl No	Agency	Housing Categories		
		I	II	III
1	ASHB	80%	20%	-
2	Cooperatives	12%	50%	30%
3	Private	8%	30%	70%
	Total	**100%**	**100%**	**100%**

8.3.7 Community Module

Housing should be related to affordability and be integrated. The community (about 1 lakh population) may contain a complete cross-section of the income groups, also including hostel accommodation for single. This would have about 50% housing up to 2-rooms dwellings to provide shelter for low-income families in the community. With changing socio-economic conditions, requirement of different types and sizes of housing may considerably vary in time and should be reviewed regularly at a maximum of 5-years interval.

8.4 Slums

8.4.1 Existing slum areas

The Census of India 2001 has proposed to treat the following as 'Slum' areas: -

- All areas notified as 'Slum' by State/Local Government and UT Administration under any Act;
- All areas recognized as 'Slum' by State/Local Government ad UT Administration which have not been formally notified as slum under any Act;
- A compact area of at least 300 population or about 60-70 households of poorly built congested tenements, in unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities.

According to the information provided by the Town and Country Planning Department, Assam, there are 26 slum pockets in the GMC area housing around 0.16 million persons (about 20% of the total population). Refer to **Map 8.2** for location of slums in GMA.

8.4.2 National Slum Development Programme

The components of this program include:

- Provision of physical amenities like water supply, storm water drains, community bath, widening and paving of existing lanes, sewers, community latrines, street lights, etc.
- Community Infrastructure: - Provision of Community centres to be used for pre-school education, non-formal education, adult education, recreational activities etc.
- Community Primary Health Care Centre Buildings to be provided
- Social Amenities like pre-school education, non-formal education, adult education, maternity, child health and Primary health care including immunization etc.
- Provision of Shelter: The Scheme to have a component of shelter up-gradation or construction of new houses as may be required.

8.4.3 Concept of City Without Slums

The Asian Development Bank through a study have worked out comprehensive guidelines for the program – 'City Without Slums'. One of the major objectives of such a program is eradication or significant reduction of poverty of urban areas. Besides this, the other objectives are to ensure the following:

- Security of tenure;
- Minimum acceptable standards of municipal infrastructure and social services;
- Improved employment and income earning opportunities;
- Improved education, skills, training and health care;
- Better access to credit and other financial services for house/plot purchase, home improvement, enterprise development and livelihood activities, and
- Improved level of community organization capacity and empowerment.

The above objectives are inter-sectoral and inter-departmental. To facilitate the above, the following is envisaged in the CMP-2025:

- In case of existing slums, which are on Government lands that are not needed for development of any infrastructure or other urban activities, plans for upgrading of slums may be prepared and implemented.
- Other slum pockets may be resettled at appropriate areas with due consideration of their distance from work places.
- In all new housing schemes, at least 30% of total housing shall be one-roomed houses, part of which will go to the urban poor generally living in slums. These may be provided with cross-subsidy.

In any new land development scheme, 1% of the total land shall be reserved/developed for informal sector/vendor markets, which should be available to the urban poor families to conduct their livelihood earning activities. Such a land can be for informal sector units in food/vegetable/eating stalls and any other activities. Part of the land shall be developed for night shelter where fresh migrants to the city, having no shelter, could be provided with facility to sleep and have sanitation and bathing facilities.

8.5 Urban Renewal

8.5.1 Central City Areas

The Central City i.e., Unit 1, has congested residential and commercial areas, which have high building density on land and high occupancy within buildings. These areas need immediate urban renewal. Refer to **Map 8.3.**

8.5.2 Guidelines for urban renewal

The basic objective of the urban renewal plans are to upgrade the living and working environment by implementing schemes considering the existing physical and socio-economic conditions of the area. The schemes for the urban renewal are to be prepared after a comprehensive study, which should be in the form of a project report and a number of maps and plans. The following sets of plans are considered to be essential to project the existing conditions -

i. Land Use
ii. Physical condition of structures
iii. Facilities and services
iv. Circulation pattern
v. Open spaces, park and playgrounds
vi. Special feature (if any)

The plan proposals for the urban renewal should indicate:

i. clearance areas and areas to be acquired (This would include subsequent plans for redevelopment of these pockets),
ii. population distribution (in relation to holding capacity),
iii. proposed land use,
iv. proposed circulation system (indicating widening of streets, pedestrian streets, parking areas, access of emergency vehicles),
v. upgradation of facilities and services,
vi. the existing Public and Semi-public uses and services like hospitals, dispensaries, colleges, schools, police stations, fire stations, post offices, local government offices, parking etc. to be retained in their present locations and also additional sites required to be indicated in the Urban Renewal Scheme; and
vii. recreational areas (indicating totlots, parks, play grounds and other recreational facilities).

Note: Reduced space norms may be adopted for community facilities/ social infrastructure. The concept of Accommodation Reservation i.e. allowing construction of community facilities without counting in FAR may also be applied

The Urban Renewal Plans would be prepared within the framework of the land use of the area as indicated the land use plan. In case of residential areas, the possibilities of mixed use (on ground floor) and street commercial may be explored. Special characteristics and features of the area would be kept in view. As far as possible, the urban renewal project should be self-financing.

9 Environment and Natural Hazards

9.1 Environment-Sensitive Areas

9.1.1 Hills and Forests

Guwahati City has large areas under hills and water bodies. Because of high intensity of urbanization, these areas are under tremendous pressure.

The hills and large water bodies are categorised as Eco-sensitive zone in the CMP-2025.These areas are to be conserved with no urban developments.

9.1.1.1 Hill Cutting and Soil Erosion

The construction on the hills in Guwahati has resulted in the removal of vegetation cover in the forest area and exposed surface. The soil loss is 60 times more on the exposed slopes than on the vegetable covered slopes. The problem of soil erosion is significant not only from the view point of loss of soil fertility, but also from the many environmental issues like water logging, flash flood, decrease in ground water table and dusty environment on sunny days. To deal with the given situation, forest areas need to be sanctified and conserved with no further development whatsoever, any cutting of trees and encroachments to be stopped. Similarly massive afforestation programmes are to be undertaken.

9.1.2 Rivers

9.1.2.1 Brahmaputra River

Brahmaputra river with Assam is almost 700 k.m. long with more than 100 tributaries. Brahmaputra, the major natural feature in Guwahati, has total length of 28.67 km in Guwahati and total area 49 sq.km.

This vast and beautiful river needs all along river front development. The River Development Zone has been marked in the existing area along the river. In the areas for new developments, As per CRZ III, a 200 m wide green belt has been marked as recreational green. Area for the same is indicated in the land use plan. The river-front area may be developed based on a landscape plan with seating in part of the area and on the water expanse attractive laser shows could be organised for tourists and for the local population.

9.1.2.2 River Bharalu

The Bharalu River rises as a small stream from the southern range of Khasi Hills and flows through the city gaining momentum in width and depth and ultimately joining river Brahmaputra. The natural topography of the city guides flow of the rainwater towards rivers Bharalu and Basishtha. Due to siltation, the bed level of river Bharalu has considerably risen. The shores often create temporary wetlands in winter. Most of the drains, directly or indirectly fall into river Bharalu. This is an important channel for the drainage of the city.

9.1.3 The Bils – Natural Water Bodies

9.1.3.1 Dipar Bil

Dipar bil is an important water body in Guwahati. It is fresh water lake in a former channel of the Brahmaputra River. It has been declared as one of the Ramsar Site and is recognized as wetland of national importance and has been proposed as a Bird Sanctuary in the Master Plan for Guwahati – 2001. The bil is the natural habitat of many species of birds, various aquatic life and vegetation.

It is proposed to develop the adjoining area connecting the National Highway as Capital Complex and the *Bil* area to form a nature reserve as extension of the Capital Complex.

9.1.3.2 Other Bils

Borsola and Sarusola Bils

Borsola and Sarusola *Bil*s are two linear wetlands, which are located in the heart of the city. As there is a close link, they can be treated as a one system. Both the wetlands separately connect to Bharalu River in Sabipool area. The total area of the *bil*s is approximately 12 hectares.

Narengi and Silsako bils

The Narengi and the Silsako *bil*s are situated in the Bondajan Basin. The Silsako bil is connected with two small rivulets. The Narengi *bil* is connected with Bondajan.

9.1.3.3 Wetland Degeneration

Wetland degeneration is a problem in Guwahati, there is shrinking of wetlands by encroachment, natural siltation, earth filing and garbage dumping. This affects decreases in the water retention capacity. Ultimately, the degeneration of wetlands is leading to siltation in wetlands and drains; flash floods; water logging and depletion of the flora and fauna.

9.1.3.4 Actions envisaged

- To check depletion of wetlands, earth filling in the wet and low-lying areas should be stopped.
- The water quality of Sola Bil is highly polluted mainly because of the dumping of rice bran and other wastes from the wholesale fish market. This dumping of waste in Sola Bil should be stopped. The area could be used as tourist attraction
- As in the previous Master Plan – 2001 Botanical Garden cum City Forest is suggested in the areas along Dipar Bil Basistha and Silsakoo Bil to have picnic spots.

- The Dipar Bil could be a major possible recreational area for the city.
- To overcome sewage entering into the bils, the complete solution would be to provide sewage treatment and solid waste management for all residential and other urban areas.

Refer to **Map 9.1** for the proposed Eco-sensitive areas in GMA-2025.

9.2 Water and Air Pollution

River Brahmaputra has excessive bacterial pollution due to discharge of raw sewage directly into the river without treatment. In Bharalu river, the dissolved oxygen (DO) is depleted due to the presence of various oxygen demanding matter inflowing into the river.

The ground water pollution generally shows a moderate mineral content with slightly higher concentration of iron and the toxic elements. Chemical Oxygen Demand (COD) Value and concentration of Chloride shows a trend indicating seepage of polluted surface water to shallow level.

Air Pollution in Guwahati has increased in recent years due to growth of traffic and other urban activities. Moreover, due to uneven topography, the geographical conditions and the climatic factors and elements like circulation of air, temperature, radiation level and alternate change of local low and high pressure gradient have a role in the growing concentration and unequal dispersion of the air pollutants within the city. The concentration of pollutants is also affected by the micro-level changes in the atmosphere. As the city is blocked on three sides by the hills and the hillocks, free movement of air is hampered for which the pollution level is comparatively higher in few pockets

Vehicular emission is also increasing in the city. The numbers of vehicles in Guwahati have doubled in the last five years which has lead to more fuel consumption and more emission in the city. The vehicles during traffic congestion throw high collective air pollutants into the environment.

9.2.1 Actions Envisaged

- Scientific and systematic management of the liquid wastes.
- The mass rapid transport system to reduce the vehicle on the road to reduce the air pollution.
- Industries in the region and within Guwahati to follow the PCB norms.
- Preparation of landscape plans, and large scale plantation.
- Refer to Section 5.5.13 also.

9.3 Natural Hazards

9.3.1 Floods

Refer to section on ‘Drainage’.

9.3.2 Earthquake

The Brahmaputra valley and its adjoining highlands constitute a highly active seismic zone. Guwahati falls in the Seismic Zone V, where

earthquakes of magnitude 8 or more can occur i.e. the zone with highest intensity along with the entire north-eastern region. Guwahati and its surrounding area are situated on the fringe of hard rock formation.

Since, earthquakes are among the most dangerous and destructive natural hazards, a comprehensive earthquake hazard reduction programme should be prepared, which should include earthquake prediction, control measure, and post earthquake rehabilitation measures.

Disaster Management Centre

Refer to **section 7.7** (Fire).

10. Heritage Conservation and Tourism

10.1 Heritage Conservation

10.1.1 Conservation Zones

Guwahati city and its surrounding area are rich in cultural and historical heritage. There are a number of important archaeological and architectural sites of historical importance. The creation of conservation zones is important to integrate the overall conservation of the area. Following conservation zones have been identified.

- Kamakhya Temple Zone
- Brahmaputra River Temple Zone: The Umananda Temple, the Janardhanan Temple, Sikh Temple (Fancy Bazaar).
- Vasistha Ashram Complex

10.1.2 Strategy for Conservation

Built heritage of Guwahati needs to be protected, and nurtured and passed on to the coming generations. For this purpose, a heritage conservation committee (HCC) may be established by the State Government. The HCC shall prepare a list of Heritage Buildings based on the following criteria:

i) The age of the building;
ii) Its special value for architectural or cultural reasons or historical periods
iii) Its relevance to history
iv) Its association with a well-known character or event
v) Its value as part of a group of buildings
vi) The uniqueness of the building or any object or structures fixed to the building or forming part of the land and comprised within the cartilage of the building. Also refer Section 13.5.

10.2 Tourism

Major Tourist Attractions in and around Guwahati

Vasistha Ashram

The Guwahati Metropolitan Area contains various sites for tourist attractions, which include historical and religious sites, nature related sites and others like museums and science centres. Some of the important religious/historic sites in

Guwahati are Kamakhya Temple, Vasistha Ashram, Dol Gobinda Temple and Umananda Temple. The religious tourist attractions around Guwahati include Sibasagar, Sualkuchi, Madan Kamdev, Barpeta, Tezpur, Hajo, Majuli. Amongst these, Hajo and Sibsagar are important religious centres.

Guwahati is rich in scenic landscapes, hills and flora and fauna including *bils.* Around Guwahati there are Bhairabkunda, Bhalukpung, Haflong, Kaziranga and Manas National Park, Orang and Nameri National Park, as the major sites for nature related and adventure tourism.

10.2.2 Tourism Vision – 2025

Assam Tourism should aim to position tourism as an engine of economic growth and to harness its multiplier effects for employment generation and economic development.

10.2.2.1Tourist Projections

It is proposed to develop integrated inter and intra district tourist circuits based on the unique cultural and natural heritage of the area. These circuits shall cover the entire Guwahati area along with nearby tourist attractions (Refer Map). In accordance with the growth of tourist attractions and opportunities, the estimated number of tourist expected to arrive by 2025 in Guwahati is around 46 lakh, including domestic and foreign. An annual growth rate of 9% has been taken to project the tourist population in Guwahati.

Table 10.1: Tourist Projections for Guwahati

Year	Domestic	Foreign	Total
2000	5,11,459	2,738	5,14,197
2001	2,71,231	3,586	2,74,817
2002	6,37,909	3,804	6,41,713
2003	7,01,459	3,311	7,04,770
2025 (estimate)	4,670,735	22,047	46,92,782

Source: Calculations by Consultants

10.2.2.2Tourists Accommodation

Presently there are 5151 beds at the rate of 7 beds per 1000 tourists. Considering the same, the number of tourist beds required in 2025 is 32849 beds; thus 27,698 additional hotel beds are to be developed during the Master Plan period. These would be provided in Community, District and other commercial centres.

10.2.2.3Tourism Strategies

The city and its surroundings can offer a wide variety of tourism experiences to its visitors and high quality amenities.

- **Tourism Options**

  Assam has immense potential in its diverse landscape and culture. Hence Cultural Tourism, Religious Tourism, Wildlife Tourism, Eco-tourism Water Tourism and Adventure Tourism hold options. The hills and the Brahmaputra River provide scope for development of adventure tourism. Sports like rock climbing, trekking, para-sailing, water sports, hang gliding and angling could be promoted through competitions and special excursions to

these sites. Some potential sites for such activities are the Nilachal Hills, Brahmaputra river etc.

- **Tourist Circuits**

  Development of the tourist circuits is another important component of tourism linking the major tourist attractions in the city and its surroundings. The tourism department in coordination with the private sector could develop these circuits towards making tourism an important economic sector.

- **Intra State Circuits**

  - City Tour
  - River Cruise on Brahmaputra (extension of Jolporee River Cruise)

  - **Inter-city Tours**

    - Guwahati – Manas – Dubri
    - Guwahati – Kaziranga – Majuli – Sibsagar – Guwahati
    - Guwahati – Tezpur – Bhalukpung - Nameri Wildlife Sanctuary - Pobitra Wildlife Sanctuary – Guwahati
    - Guwahati – Pobitra Wildlife Sanctuary – Haflong – Jatinga – Maibong – Guwahati

- **Inter State Circuits**

  - Guwahati-Kaziranga-Tezpur-Bhalukpung-Bomdila-Tawang
  - Guwahati-Jorhat-Majauli-Tinsukia-Tezu-Parsuramkund
  - Guwahati-Jorhat – Itanagar – Machuka

- **Infrastructure**

  All infrastructure connected with tourism such as good roads, hotels and safari resorts, and information support services needs to be developed.

  - Basic amenities like clean public toilets, easily accessible telecommunication services, tourist information centres, banks and currency exchange centres, food courts and restraints, hotels and lodges etc. among other services to be provided.
  - Quality Hotels, recreation and shopping centres, local transportation, taxi services etc.
  - Development and maintenance of the tourist destinations.
  - Developing the handicraft and handloom haats.

- **Tourism Package for North-east**

  Assam and in particular Guwahati, as stated before, is the gateway to North-East with splendid reservoir of natural beauty. There are many tourist attractions in the neighbouring states like Shillong, Cherapunji in Meghalaya and Tawang, Tezu, Bomdilla etc in Arunachal Pradesh. Hence an integrated approach could be followed as is reflected in the proposed Inter-state circuits.

11 City Image and City Structure

11.1 City Image

To transform Guwahati into one of the most admired State Capitals of the country. The city-image has to be enhanced through the creation of landmarks and by developing a hierarchical city structure.

11.2 City Structure

11.2.1 Existing City Structure

The Guwahati City is an undulating plain located on the foothills of Meghalaya plateau. The old city lies in a horse-shoe shaped valley surrounded on the North by the Brahmaputra River and by Kharguli and Chunchali hills in the east, Japorigog, Nilachal and Fatasil hills on the south and the famous Kamakhya hill on the west. There are also a number of *bil*s and wetlands in the GMA. Being physically constrained by hills and natural *bil* areas, the city has sprawled in a curvilinear fashion surrounding the central area, along the main corridors towards the east and the south.

The Old Municipal Area still functions as the Central Business District with wholesale and city level retail markets located there. A ribbon-like commercial-industrial mixed-use development has taken place in the south of the city along the NH-37 bypass, a corridor which has the potentials of being developed into a beautiful urban corridor.

Apart from the central commercial area, the other nuclei that have formed in the city are the Oil Refinery at Noonmati, Military Cantonment at Narengi, Secretariat at Dispur, Railway Colonies at Maligaon-Pandu, Guwahati University and Engineering College at Jalukbari, Airport at Borjhar and Industrial area at Amingaon.

However, a hierarchical form of urban development is absent in the City Structure.

11.2.3 Proposed City Structure

A new city structure for GMA is envisaged for the integrated hierarchical development of the city and the development of City Image. Refer to **Map 11.1.**

11.2.3 Tier I: City Level

One of the major goals of the plan is to create a unique image for the city of Guwahati befitting that of a State Capital. This can be achieved through the creation of landmarks and interesting urban forms. Some of the major city level projects identified for enhancing the capital city image of Guwahati are as under:

11.2.3.1 City Centre

To cater to the City level commercial and facilities requirement, a new City Centre is envisaged. The City Centre shall comprise:

- City-level Commercial Centre at Jatikuchi to function as the Central Business District on 56 ha of land,

- City-level Facility Centre at Dakhingaon area containing city level facilities such as, Socio-cultural Club, exhibition gallery and cultural centre, museums, Speciality Hospital, general community facilities and housing along with recreational facilities on 52 ha of land,
- a City-level Sports Complex (97 ha), and
- a City-level Park (79 ha).

11.2.3.2 Education and Research Hub

The Education and Research Hub shall contain regional-level institutions for research activities. A Medical college with a speciality Hospital covering 15 ha shall also be located within this area. The hub shall have Institutional area, residential area, sports and cultural area and landscape component. Its details are as under:

- Area : 107 ha
- Location : Rudreswar village, Planning Unit 9

11.2.3.3 New University including New Engineering Colleges

Area is reserved in the Plan for a New University and Engineering College to be located in Kharghuli NC under Planning Unit 4 with a total area of 304 ha.

11.2.3.4 Exhibition-cum-Fair Ground

Guwahati is the cultural and economic hub of not only the state of Assam but also the entire northeast region. There are a number of festivals and fairs held in the city, chiefly in the Judge's Field or some other parks in the city. Considering the number of tourists visiting these fairs, it is proposed to develop an exclusive exhibition cum fair ground to organize fairs, exhibitions and shows and events for cultural as well as economic benefits. Its area and location are as under:

- Area : 412 ha
- Location : Planning Unit No. 8 and New Town III (partly)

11.2.3.5 Golf Course

A golf course is proposed to be developed in the New Town III located in the south of the GMA. Around 121 ha area is reserved for the same.

11.2.3.6 Airport Expansion

In view of the anticipated future requirement of large sized aircrafts, long runways (of around 4.2 Km) would be required for the landing of the same. Considering this, 1193 ha of land has been proposed for Airport Expansion under CMP-2025, which could accommodate the longer runway and desired Terminal facilities.

11.2.3.7 River Front Development

River front development along the river Brahmaputra is envisaged to celebrate the beauty of the river and integrate it with the recreational green belt along it. The existing developments along the MG and DG road towards the river side shall make way for the river development zone. Also in areas on new development along the river, a 200-m wide belt is proposed to maintain the serenity of the river.

11.2.3.8 Urban Design Corridor

The CMP-2025 proposes to earmark the northern side of the National Highway - 37 from Garchuk *chariali* to Basistha *Chariali* as a Composite Use Zone of Type II for development of large multi-storeyed institutional-commercial development to cater to the future needs of the city and the region. The area would be developed on the basis of an urban design scheme, which will add to the image of the city.

11.2.3.9 Urban Renewal

The entire Old Municipality area corresponding to Planning Unit 1 has been earmarked for Urban Renewal in CMP-2025. Refer to **Section 8.5**.

Note: Once the by-pass comes up, the Government may review and the area to the south of NH-37 may be notified as Composite Use and other uses like Capitol Complex etc.

11.2.4 Tier II: District Level

To cater to the social infrastructure and commercial requirements at the District level, four Integrated District Centres (IDC) are envisaged. An IDC shall generally contain the following elements:

- District Commercial Centre (on around 40 ha of land for 5 lakh population)
- District-level Facility Centre (Containing higher order facilities catering to District and Community Population on around 35-45 ha of land)
- District level Park

The location and areas of the proposed Integrated District Centres are as follows:

Table 11.1: Proposed Integrated District Centres in GMA-2025

Integrated District Centre	Location			Area (Ha)	Components
	District	Planning Unit	Planning Sub-Unit		
IDC-I	B	3	51	108	District Commercial Centre I (40 ha), District level Facility Centre (FC IV-32 ha) including Parks and Play areas (10 ha) Parking and Circulation
IDC-II	C	6	2,5	68	District Commercial Centre II (20 ha) District level Facility Centre (FC V-23 ha) including Park and Play area (10 ha) Parking and Circulation
IDC III	C	8	66	101	District Commercial Centre III (28 ha), District level Facility Centre (FC VII-34 ha) including Park and Play area (10 ha) Parking and Circulation
IDC IV	D	9	71	84	District Commercial Centre IV (35ha) District level Facility Centre (FC IX-34 ha) including Park and Play area (10 ha) Parking and Circulation
Total Area				361	

11.2.5 Tier III: Community Level

At the Community level, Integrated Community Centres (ICC) is proposed at different locations. A Community Centre shall contain:

- Community Commercial Centre of about 5.4 ha land for 1 lakh population
- Community-level Facility Centre containing Community level facilities, including Community-level Parks and Play areas

Table 11.2: Proposed Integrated Community Centres in GMA-2025

Integrated Community Centre	District/ Planning Unit	Area (in Ha)	Components
ICC-I	A/4	33	FC-I (18 ha) CCC-I (5.4 ha) Parking and Circulation
ICC-II	B/2	40	FC-III (24 ha) CCC-II (5.4 ha) Parking and Circulation
ICC-III	C/8	42	FC-VI (27ha) CCC-III (5.4 ha) Parking and Circulation
ICC-IV	D/9	35	FC-VIII (21 ha) CCC-IV (5.4 ha) Parking and Circulation
ICC-V	D/11	33	FC-X (19 ha) CCC-V (7.5 ha) Parking and Circulation
ICC-VI	D/12	64	FC-XI (38 ha) CCC-VI (23ha)
ICC-VII	D/13	67	FC XII (38 ha) CCC-VII (20 ha) Parking and Circulation

11.2.6 New Towns

Out of 21.74 lakh population, 17.74 lakh is proposed to be accommodated within existing GMA; the remaining 4 lakh population is proposed to be accommodated in three New Towns proposed at the North-West, South-West and North-East in GMA. These new towns are reserved as scheme area for subsequent planning of various uses. The new towns may be developed on PPP mode. Their details are as under:

Table 11.3: Location, population and economic base of New Towns

Sl. No.	New Town	Location	Population	Economic Base
1	New Town I (Special Scheme Area	North-East of GMA (Sila-Matiya-Najirakhat-Bhulung area)	0.8 lakh	Wholesale Market/ Integrated Freight complex
2	New Town II (Special Scheme Area	North-West of GMA (Charmajulipam-Gandhmau-Ambari-Bamun Soalkuchi area)	1.6 lakh	Industry
3	New Town III (Special Scheme Area	South-west of GMA (Panchniyapara-Sajjanpara-Gariyapara-Alibari-Tarapatipara area)	1.6 lakh	SEZ and IT
	Total		4.0 lakh	

11.2.6.1 New Town I

The New Town I located on the North East of GMA. Its major economic base is the wholesale trade for Guwahati and the whole of North-East. The town is to be designed for about 80,000 population. A conceptual land use provision for the New Town has been worked out. Refer Table 11.4.

Table 11.4: Tentative Land Use Break-up of New Town I

Sl. No.	Land Use Categories	Area (Ha)	Percentage
1	Residential	307	21.1
2	Business and Commerce	343	23.6
5	Public and Semi-Public	84	5.8
8	Recreation & Open Space	270	18.6
9	Transportation	154	10.6
10	Eco-Sensitive /Eco-Friendly Zone	294	20.2
	Total	1452	100.0

11.2.6.2 New Town II

The New Town II is proposed to be located in the North West in GMA. It is envisaged to cater to a population of 1.6 lakh. It has around 500 ha of land reserved for the development of industry. In addition, a large area of land is dedicated for the development of recreational facilities. Refer to Table 11.5 for tentative land use break up. It is understood that some part of the proposed new town gets submerged due to floods. A Techno-Feasibility may be conducted for construction of an embankment along the river.

Table 11.5: Tentative Land Use Break-up of New Town II

Sl. No.	Land Use Categories	Area (Ha)	Percentage
1	Residential	707	30.2
2	Business and Commerce	40	1.7
3	Industrial	400	17.1
4	Public and Semi-Public	130	5.5
5	Recreation & Open Space	475	20.3
6	Transportation	208	8.9
10	Eco-Sensitive /Eco-Friendly Zone	382	16.3
	Total	2342	100.0

11.2.6.3 New Town III

The New Town III, proposed to be located in the South West in GMA. It is to accommodate 1.6 lakh population. This New Town being near to the Airport is envisaged to be developed into an IT and SEZ hub with 560 ha of land being reserved for the same.

Since the city of Guwahati also lacks quality recreational space, an 18-hole golf course shall be developed in the New Town. One residential sector of

about 80 hectares in the New Town is proposed to be developed as Bungalow area. For tentative Land Use break-up refer to Table 11.6.

Table 11.6: Tentative Land Use Break-up of New Town III

Sl. No.	Land Use Categories	Area (Ha)	Percentage
1	Residential	700	36.30
2	Business and Commerce	40	2.10
3	Public and Semi-Public	122	6.30
4	Composite Use II	541	28.10
5	Recreation & Open Space	332	17.20
6	Transportation	192	10.00
	Total	1927	100.10

Annex II
Zonal Distribution of Planning Variables, Trip Productions and Attractions in the Base Year

Zone no.	Population	Resident Workers	Resident Students	Employment	Student Enrollment	Home Based Productions			Non-Home Based Productions			Home Based Attractions			Non-Home Based Attractions		
						Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others
1	20028	4687	3334	4395	2723	5832	4609	5622	882	285	456	5469	3764	3565	881	285	456
2	14998	4615	2773	5485	5617	5742	3833	4210	1100	588	569	6825	7765	4450	1100	588	570
3	11294	3516	2425	2212	2042	4375	3352	3170	444	214	230	2752	2823	1794	444	214	229
4	13894	4237	2082	2865	1362	5272	2878	3900	575	143	297	3565	1883	2324	575	143	297
5	8057	2216	1553	21851	10723	2757	2147	2262	4383	1123	2268	27190	14824	17728	4383	1123	2269
6	9987	3081	2391	1619	851	3834	3305	2803	325	89	168	2015	1176	1314	325	89	168
7	21102	7956	3670	3981	8680	9900	5073	5924	799	909	413	4954	11999	3229	798	909	413
8	11003	4362	964	1060	170	5428	1333	3089	213	18	110	1319	235	860	212	18	110
9	8007	4448	1190	2001	0	5535	1645	2248	401	0	208	2490	0	1623	401	0	207
10	9905	3656	2348	583	0	4549	3246	2780	117	0	61	725	0	473	117	0	61
11	13577	4640	3431	2250	2213	5774	4743	3811	451	232	234	2800	3059	1825	451	232	234
12	37265	12122	5497	5088	1191	15083	7599	10461	1021	125	528	6331	1647	4128	1021	125	528
13	18287	6335	4276	2568	170	7883	5911	5133	515	18	267	3196	235	2083	515	18	267

Zone no.	Population	Resident Workers	Resident Students	Employment	Student Enrollment	Home Based Productions			Non-Home Based Productions			Home Based Attractions			Non-Home Based Attractions		
						Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others
14	23259	8618	4058	4951	4085	10723	5610	6529	993	428	514	6161	5647	4017	993	428	514
15	14902	4867	3498	2737	0	6056	4835	4183	549	0	284	3405	0	2221	549	0	284
16	18557	6728	5233	3377	6468	8372	7234	5209	677	678	351	4202	8941	2740	677	678	350
17	12028	4217	2387	1928	1362	5247	3300	3376	387	143	200	2399	1883	1564	387	143	200
18	8141	3506	1586	5300	5787	4363	2192	2285	1063	606	550	6595	8000	4300	1063	606	550
19	16526	7511	2265	2994	340	9346	3131	4639	601	36	311	3725	470	2429	601	36	311
20	13056	4864	2386	2891	2723	6052	3298	3665	580	285	300	3597	3764	2346	580	285	300
21	7236	3258	872	764	511	4054	1205	2031	153	54	79	951	706	620	153	53	79
22	17330	5040	4103	2764	681	6271	5672	4865	554	71	287	3440	942	2242	555	71	287
23	12143	5577	711	2815	1362	6939	983	3409	565	143	292	3502	1883	2284	565	143	293
24	17576	6618	3144	1240	511	8235	4346	4934	249	54	129	1543	706	1006	249	53	128
25	20286	6959	2434	3955	1702	8659	3365	5695	793	178	411	4921	2352	3209	794	178	411
26	11786	5166	1557	12844	4255	6428	2152	3308	2576	446	1333	15981	5882	10420	2577	446	1333
27	11808	4923	1561	5775	5787	6126	2158	3315	1158	606	599	7186	8000	4685	1158	606	599
28	10825	5238	1849	1382	511	6518	2556	3039	277	54	143	1720	706	1122	277	53	143

Zone no.	Population	Resident Workers	Resident Students	Employment	Student Enrollment	Home Based Productions			Non-Home Based Productions			Home Based Attractions			Non-Home Based Attractions		
						Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others
29	9320	5239	1502	6276	511	6519	2076	2616	1259	54	651	7809	706	5092	1259	53	651
30	8328	2683	1436	16143	3404	3338	1985	2338	3238	357	1676	20086	4706	13097	3239	357	1676
31	6183	2604	1195	29166	10723	3240	1652	1736	5851	1123	3028	36292	14824	23662	5851	1123	3027
32	11280	4613	2017	8703	6127	5740	2788	3166	1746	642	903	10830	8470	7061	1746	642	904
33	11595	4396	2250	6649	5617	5470	3110	3255	1334	588	690	8274	7765	5394	1334	588	690
34	12675	4881	2163	4871	3574	6073	2990	3558	977	374	506	6061	4941	3952	977	374	505
35	13177	2679	1860	2344	1702	3333	2571	3699	470	178	243	2917	2352	1902	470	178	243
36	16500	4870	2716	9404	5957	6060	3754	4632	1886	624	976	11702	8235	7629	1887	624	976
37	16015	4871	2642	2232	1532	6061	3652	4496	448	160	232	2777	2118	1810	448	160	232
38	8944	3933	1052	16118	9872	4894	1454	2511	3233	1034	1673	20056	13647	13076	3233	1034	1673
39	14596	6255	1195	2311	511	7783	1652	4097	464	54	240	2876	706	1875	463	53	239
40	3765	1575	545	4684	1872	1960	753	1057	940	196	486	5829	2588	3801	940	196	486
41	22417	7536	5774	4258	4255	9377	7982	6293	854	446	442	5298	5882	3454	854	446	442
42	13412	4599	1866	1381	1702	5723	2579	3765	277	178	143	1718	2352	1121	277	178	143
43	5946	1791	993	17351	5106	2229	1373	1669	3481	535	1801	21590	7058	14077	3480	535	1801

Zone no.	Population	Resident Workers	Resident Students	Employment	Student Enrollment	Home Based Productions			Non-Home Based Productions			Home Based Attractions			Non-Home Based Attractions		
						Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others
44	16644	7535	3114	3016	1702	9376	4305	4672	605	178	313	3753	2352	2446	605	178	313
45	17222	6042	3190	1636	511	7518	4410	4834	328	54	170	2036	706	1328	329	53	170
46	25824	9288	3257	5990	1191	11557	4502	7249	1202	125	622	7454	1647	4860	1202	125	622
47	8587	3243	1410	4195	2723	4035	1949	2410	842	285	435	5220	3764	3403	842	285	436
48	12796	4419	2017	7466	3064	5499	2788	3592	1498	321	775	9290	4236	6057	1498	321	775
49	28972	4433	4710	600	170	5516	6511	8133	120	18	62	747	235	486	120	18	62
50	12037	4112	2501	1461	340	5117	3457	3379	293	36	152	1818	470	1186	294	36	151
51	28614	9032	5143	3169	511	11239	7109	8032	636	54	329	3944	706	2571	636	53	329
52	7146	2084	1691	2944	1362	2593	2338	2006	591	143	306	3664	1883	2388	591	143	305
53	9478	2995	1262	2371	681	3727	1745	2661	476	71	246	2950	942	1923	475	71	246
54	16897	5224	2023	6457	1362	6500	2797	4743	1295	143	670	8034	1883	5238	1295	143	671
55	12976	4947	2277	4517	851	6156	3148	3643	906	89	469	5621	1176	3665	906	89	469
56	21671	5758	4670	2085	681	7165	6456	6083	418	71	216	2594	942	1692	418	71	216
57	17774	5868	2731	17095	9021	7302	3775	4989	3429	945	1775	21271	12470	13870	3429	945	1774
58	25038	11215	4987	8362	1532	13955	6894	7028	1677	160	868	10405	2118	6784	1677	160	868

Zone no.	Population	Resident Workers	Resident Students	Employment	Student Enrollment	Home Based Productions			Non-Home Based Productions			Home Based Attractions			Non-Home Based Attractions		
						Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others
59	20496	6974	3437	5436	1362	8678	4751	5753	1090	143	564	6764	1883	4410	1090	143	564
60	22523	8454	5716	1588	170	10519	7902	6322	319	18	165	1976	235	1288	318	18	165
61	4455	1738	338	1900	0	2163	467	1251	381	0	197	2364	0	1541	381	0	197
62	5334	1489	1052	1465	0	1853	1454	1497	294	0	152	1823	0	1188	294	0	152
63	5020	1774	820	974	0	2207	1134	1409	195	0	101	1212	0	790	196	0	101
64	1625	626	377	439	0	779	521	456	88	0	46	547	0	357	88	0	46
65	1224	536	143	551	0	667	198	344	111	0	57	685	0	447	111	0	57
66	8711	2356	1225	484	0	2932	1693	2445	97	0	50	603	0	392	97	0	50
67	5566	1676	718	2249	681	2085	993	1562	451	71	233	2798	942	1825	451	71	233
68	23036	6160	3043	3661	4766	7665	4207	6466	734	499	380	4556	6588	2971	735	499	380
69	9804	2378	1884	961	1362	2959	2604	2752	193	143	100	1196	1883	780	193	143	100
70	389	157	42	222	0	195	58	109	45	0	23	276	0	180	44	0	23
71	23886	7346	3648	4483	1872	9141	5043	6705	899	196	465	5578	2588	3637	899	196	465
Total	**980761**	**339345**	**170210**	**339343**	**170207**	**422251**	**235291**	**275308**	**68072**	**17832**	**35223**	**422253**	**235291**	**275307**	**68073**	**17825**	**35219**

Annex III

Zonal Distribution of Planning Variables, Trip Productions and Attractions in the Horizon Year

Zone no.	Population	Resident Workers	Resident Students	Employment	Student Enrollment	Home Based Productions			Non-Home Based Productions			Home Based Attractions			Non-Home Based Attractions		
						Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others
1	36189	13028	10582	6499	9409	16211	14628	10159	1304	986	675	7351	13006	4607	1304	986	674
2	48898	17603	14298	16119	12713	21903	19765	13726	3233	1332	1673	18234	17575	11426	3233	1332	1673
3	11100	3996	3245	2031	2886	4972	4486	3116	407	302	211	2298	3989	1440	407	302	211
4	13654	4915	3993	2631	3550	6116	5520	3833	528	372	273	2976	4908	1865	528	372	273
5	19538	7034	5714	20066	10880	8752	7899	5485	4025	1140	2083	22698	15040	14224	4025	1140	2083
6	9815	3533	2870	1486	2552	4396	3967	2755	298	267	154	1681	3528	1053	298	268	154
7	20739	7466	6065	6409	5392	9290	8384	5822	1286	565	665	7250	7453	4543	1286	565	665
8	10813	3893	3162	973	2811	4844	4371	3035	195	295	101	1101	3886	690	195	294	101
9	7868	2832	2301	1837	2046	3524	3181	2209	368	214	191	2078	2827	1302	368	214	191
10	25831	9299	7554	2544	6716	11571	10442	7251	510	704	264	2878	9284	1803	510	703	264
11	24126	8685	7055	2067	6273	10807	9753	6772	415	657	215	2338	8671	1465	414	657	215
12	48572	17486	14204	9625	12629	21758	19635	13635	1931	1323	999	10887	17457	6823	1931	1323	999
13	34997	12599	10234	11498	9099	15677	14147	9824	2306	953	1194	13006	12579	8151	2306	953	1194

Zone no.	Population	Resident Workers	Resident Students	Employment	Student Enrollment	Home Based Productions			Non-Home Based Productions			Home Based Attractions			Non-Home Based Attractions		
						Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others
14	22859	8229	6684	4885	5943	10239	9240	6417	980	623	507	5526	8216	3463	980	623	507
15	15194	5470	4443	3200	3950	6806	6142	4265	642	414	332	3620	5461	2268	641	413	332
16	34558	12441	10106	34125	14285	15480	13970	9701	6845	1497	3542	38602	19747	24190	6845	1496	3542
17	67191	24189	19649	25573	17470	30098	27162	18861	5130	1830	2655	28928	24149	18128	5130	1830	2655
18	8000	2880	2339	4867	2080	3584	3233	2246	976	218	505	5506	2876	3450	976	219	505
19	16241	5847	4750	5943	4223	7275	6566	4559	1192	442	617	6722	5837	4213	1192	443	616
20	12831	4619	3752	3068	3336	5747	5187	3602	615	349	318	3470	4612	2175	616	349	318
21	7111	2560	2080	2017	1849	3185	2875	1996	405	194	209	2281	2555	1430	404	193	209
22	16453	5923	4812	4482	4278	7370	6652	4619	899	448	465	5070	5914	3177	899	448	465
23	11934	4296	3490	2586	3103	5346	4824	3350	519	325	268	2925	4289	1833	519	326	269
24	17272	6218	5051	5138	4491	7737	6982	4848	1031	470	533	5812	6208	3642	1031	470	533
25	19982	7194	5843	4572	5195	8952	8077	5609	917	544	475	5172	7182	3241	917	544	474
26	17124	6165	5007	11794	4452	7671	6921	4807	2366	466	1224	13341	6154	8360	2365	467	1225
27	11605	4178	3393	5303	3017	5199	4690	3258	1064	316	550	5998	4171	3759	1064	317	550
28	10638	3830	3111	6348	2766	4766	4301	2986	1273	290	659	7181	3824	4500	1274	290	659
29	9160	3298	2679	7135	2382	4104	3703	2571	1431	249	741	8071	3292	5058	1431	250	740

Zone no.	Population	Resident Workers	Resident Students	Employment	Student Enrollment	Home Based Productions			Non-Home Based Productions			Home Based Attractions			Non-Home Based Attractions		
						Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others
30	8184	2946	2393	14824	2128	3666	3308	2297	2974	223	1539	16768	2941	10509	2974	223	1538
31	6077	2188	1777	26782	1580	2723	2456	1706	5372	166	2780	30295	2184	18985	5372	165	2780
32	11086	3991	3241	7993	2882	4966	4480	3112	1603	302	830	9042	3984	5666	1603	302	829
33	11395	4102	3333	6699	2963	5104	4607	3199	1344	310	695	7577	4095	4749	1344	311	695
34	3708	1335	1084	4472	964	1661	1498	1041	897	101	464	5059	1333	3170	897	101	464
35	12950	4662	3787	2153	3367	5801	5235	3635	432	353	223	2436	4655	1526	432	352	224
36	16216	5838	4742	8635	4216	7264	6555	4552	1732	442	896	9767	5828	6121	1732	442	896
37	15740	5666	4603	2050	4092	7050	6363	4418	411	429	213	2319	5657	1454	412	428	213
38	10714	3857	3134	14801	2786	4799	4332	3008	2969	292	1536	16743	3851	10492	2969	291	1537
39	17185	6187	5025	2123	4468	7698	6946	4824	426	468	220	2401	6176	1505	425	468	220
40	8465	3047	2475	4301	2201	3791	3421	2376	863	231	446	4866	3042	3049	863	230	447
41	24440	8798	7147	7600	6354	10947	9880	6861	1525	666	789	8597	8784	5388	1525	666	789
42	25642	9231	7498	5625	6667	11486	10365	7198	1128	698	584	6363	9216	3987	1129	699	583
43	12359	4449	3614	15933	3213	5536	4996	3469	3196	337	1654	18023	4442	11295	3196	336	1654
44	16357	5889	4783	2770	4253	7328	6612	4592	556	446	288	3133	5879	1963	556	446	287
45	16925	6093	4949	3900	4401	7582	6841	4751	782	461	405	4412	6083	2765	783	461	405

Zone no.	Population	Resident Workers	Resident Students	Employment	Student Enrollment	Home Based Productions			Non-Home Based Productions			Home Based Attractions			Non-Home Based Attractions		
						Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others
46	25380	9137	7422	22449	6599	11369	10260	7124	4503	691	2330	25394	9122	15914	4503	691	2330
47	13626	4905	3985	3852	6843	6103	5509	3825	773	717	400	4357	9459	2730	772	717	400
48	15873	5714	4642	6757	7027	7110	6417	4456	1355	736	701	7643	9714	4790	1356	736	702
49	28472	10250	8326	8118	7403	12754	11510	7992	1628	776	843	9183	10233	5754	1628	776	843
50	13122	4724	3837	2174	3412	5878	5304	3684	436	357	226	2459	4716	1541	437	357	226
51	97435	35077	28493	15671	28333	43646	39388	27351	3144	2968	1627	17727	39167	11109	3144	2968	1627
52	21540	7754	6299	18427	10400	9648	8707	6047	3696	1090	1913	20844	14377	13062	3696	1090	1913
53	19725	7101	5767	6833	5129	8836	7972	5537	1371	537	709	7729	7089	4844	1371	537	709
54	34330	12359	10039	10064	8926	15378	13877	9637	2019	935	1045	11384	12339	7134	2018	935	1045
55	19752	7111	5777	11432	6636	8848	7986	5545	2293	695	1187	12931	9173	8104	2293	696	1187
56	40330	14519	11794	8078	11986	18066	16304	11321	1620	1256	839	9137	16569	5726	1621	1255	839
57	19026	6849	5564	15698	4947	8522	7691	5341	3149	518	1630	17757	6838	11128	3149	519	1629
58	58827	21178	17203	12888	15295	26352	23781	16513	2585	1602	1338	14579	21143	9136	2585	1603	1338
59	58955	21224	17240	4660	15328	26409	23832	16549	935	1606	484	5271	21189	3303	935	1606	483
60	53598	19295	15674	5449	13935	24009	21667	15046	1093	1460	566	6164	19264	3862	1093	1460	566
61	4378	1576	1280	9121	6638	1961	1769	1229	1830	695	947	10318	9177	6465	1829	696	947

Zone no.	Population	Resident Workers	Resident Students	Employment	Student Enrollment	Home Based Productions			Non-Home Based Productions			Home Based Attractions			Non-Home Based Attractions		
						Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others	Work+ Business	Education	Others
62	24440	8798	7147	6485	6354	10947	9880	6861	1301	666	673	7336	8784	4597	1300	666	673
63	4933	1776	1443	894	1283	2210	1995	1385	179	134	93	1011	1773	634	179	134	93
64	1597	575	467	20397	415	715	646	448	4092	43	2117	23072	574	14459	4091	43	2117
65	4009	1443	1172	2532	1042	1796	1620	1125	508	109	263	2864	1441	1795	508	109	263
66	66329	23878	19397	16314	23446	29711	26814	18619	3273	2456	1693	18454	32410	11564	3273	2456	1694
67	21625	7785	6323	30169	5623	9687	8741	6070	6052	589	3132	34126	7773	21386	6052	589	3132
68	142740	51386	41741	47324	42912	63940	57701	40069	9493	4496	4913	53532	59320	33547	9492	4495	4913
69	11633	4188	3403	35198	5925	5211	4704	3266	7061	621	3654	39815	8190	24951	7060	620	3654
70	21895	7882	6403	14215	9493	9808	8851	6146	2851	994	1476	16080	13122	10076	2852	995	1475
71	122596	44134	35851	21785	31874	54916	49559	34414	4370	3339	2261	24643	44061	15442	4370	3339	2261
NT II	160000	57600	46789	59400	48300	71672	64679	44914	11915	5060	6166	67192	66767	42107	11915	5060	6166
NT III	160000	57600	46789	59400	48300	71672	64679	44914	11915	5060	6166	67192	66767	42107	11915	5060	6166
NT I	80000	28800	23394	39600	25600	35836	32339	22457	7944	2682	4111	44794	35388	28071	7944	2682	4111
Total	**2173902**	**782603**	**635712**	**860866**	**635714**	**973792**	**878780**	**610241**	**172685**	**66598**	**89363**	**973790**	**878779**	**610241**	**172682**	**66598**	**89359**

Annex IV
Cost Estimates for Transportation System Development in GMA

a) Cost Estimates of Arterial Road Improvements in GMA

S.No.	Name of Road	From	To	Length (km)	Base year			Horizon Year without LRT		Road Classification	Improvement Measures	Unit Cost (Rs. Crores)	Total Cost (Rs. Crores)	Phasing
					ROW	Carriageway width	Configuration	ROW	Configuration					
1		Narengi	Noonmati	3	17.6	5.6	IL	30	4L	Arterial	Widening from IL to 4L	1.5	4.5	1
2		Noonmati	Chandmari flyover jn.	2.95	24.2	8	2L	30	4L	Arterial	Widening from 2L to 4L	1	2.95	2
3		Chandmari flyover jn.	Ulubari rd.Jn. (GHY club)	1.95	20.9	10	2L	30	6L	Arterial	Widening from 2L to 4L	1	1.95	1
											Widening from 4L to 6L	1	1.95	2
4		Kachari jn.	Bhutnath	3.9	20.2	15.8	4L	30	6L	Arterial	Widening from 4L to 6L	1	3.9	1
5	AT Road	Bhutnath	Maligaon	3.1	25.1	17	4L	40	8L	Arterial	Widening from 4L to 6L	1	3.1	1
											Widening from 6L to 8L	1	3.1	2
6		Maligaon jn.	Jalukbari	2.5	34.5	21.4	4L	40	8L	Arterial	Widening from 4L to 6L	1	2.5	1
											Widening from 6L to 8L	1	2.5	2

S.No.	Name of Road	From	To	Length (km)	Base year			Horizon Year without LRT		Road Classification	Improvement Measures	Unit Cost (Rs. Crores)	Total Cost (Rs. Crores)	Phasing
					ROW	Carriageway width	Configuration	ROW	Configuration					
7		Jalukbari	Airport jn. (VIP rd.)	11.9	56	7	2L	60	8L	Arterial	Widening from 2L to 4L	1	11.9	1
											Widening from 4L to 6L	1	11.9	2
											Widening from 6L to 8L	1	11.9	3
8		Ranigate	Patgaon	1.2	33.6	3.5	SL	60	4L	Arterial	Widening from SL to 4L	1.5	1.8	1
9	Bypass Road	Khanapara	Basistha Chariali	2.8	61.2	18.5	4L	61.2	6L	Arterial	Widening from 4L to 6L	1	2.8	1
10		Basistha Chariali	Lokhra	5.1	65	18.6	4L	65	6L	Arterial	Widening from 4L to 6L	1	5.1	1
11		Lokhra	Garchuk	4.4	61.7	18.5	4L	61.7	6L	Arterial	Widening from 4L to 6L	1	4.4	1
12		Jalukbari Jn.	Garchuk	7.8	61.3	17.55	4L	61.3	6L	Arterial	Widening from 4L to 6L	1	7.8	1
13	Garchuk Road	Garchuk Jn.	Fatasil-Ambari	6.4	11.4	3.6	SL	30	NMR	Arterial	Improvement	0.2	1.28	1
14		Fatasil-Ambari	Kumarapara	1.2	11.2	6.5	2L	30	4L	Arterial	Widening from 2L to 4L	1	1.2	1
15		Jalukbari jn.	Amingaon(Hajo Rd.jn.)	3.9	11	7	2L	60	8L	Arterial	Widening from 2L to 4L	1	3.9	1
											Widening from 4L to 6L	1	3.9	2
											Widening from 6L to 8L	1	3.9	3

S.No.	Name of Road	From	To	Length (km)	Base year			Horizon Year without LRT		Road Classification	Improvement Measures	Unit Cost (Rs. Crores)	Total Cost (Rs. Crores)	Phasing
					ROW	Carriageway width	Configuration	ROW	Configuration					
16		Amingaon(Hajo Rd.Jn.)	Dadara	6.6	11	5.5	IL	30	4L	Arterial	Widening from IL to 4L	1	6.6	2
17		Gauripur	Amingaon	5.5	44.4	7	2L	60	8L	Arterial	Widening from 2L to 4L	1	5.5	1
											Widening from 4L to 6L	1	5.5	2
											Widening from 6L to 8L	1	5.5	3
18	G.S. Road	Paltan bazar	Ulubari	0.8	28	14	4L	30	6L	Arterial	Widening from 4L to 6L	1	0.8	1
											Widening from 6L to 8L	1	0.8	2
19		Ulubari jn.	Bhangagarh Jn.	1.65	29.3	17	4L	40	8L	Arterial	Widening from 4L to 6L	1	1.65	1
											Widening from 6L to 8L	1	1.65	2
20		Bhangagarh Jn.	Ganeshguri	2.5	39.8	26	4L	40	8L	Arterial	Widening from 4L to 6L	1	2.5	1
											Widening from 6L to 8L	1	2.5	2
21		Ganeshguri jn.	Six mile	3.25	39.3	14	4L	40	8L	Arterial	Widening from 4L to 6L	1	3.25	1
											Widening from 6L to 8L	1	3.25	2
22		Six mile	Khanapara jn.	2	34.5	14	4L	40	8L	Arterial	Widening from 4L to 6L	1	2	1

S.No.	Name of Road	From	To	Length (km)	Base year			Horizon Year without LRT		Road Classification	Improvement Measures	Unit Cost (Rs. Crores)	Total Cost (Rs. Crores)	Phasing
					ROW	Carriageway width	Configuration	ROW	Configuration					
											Widening from 6L to 8L	1	2	2
23		Lal Ganesh Rd.Jn.	Charabatti	0.5	16.5	8.3	2L	30	4L	Arterial	Widening from 2L to 4L	1	0.5	1
24	Lokhra Road	Charabatti	Kalapahar	1.4	16.5	8.3	2L	30	4L	Arterial	Widening from 2L to 4L	1	1.4	2
25		Kalapahar	Lokhra jn.	6.6	17.1	6.8	2L	30	4L	Arterial	Widening from 2L to 4L	1	6.6	1
26		Basistha Chariali	Beltola jn.	1.3	27.6	7.5	2L	30	4L	Arterial	Widening from 2L to 4L	1	1.3	3
27		Beltola jn.	Dispur last gate	2.05	26.8	7	2L	30	4L	Arterial	Widening from 2L to 4L	1	2.05	3
28		Dispur last gate	Ganeshguri jn.	1.5	26.2	13.5	3L	30	4L	Arterial	Widening from 3L to 4L	0.5	0.75	2
29		Ganeshguri jn.	Chandmari flyover jn.	4.5	25	14	4L	30	4L	Arterial	Improvement	0.2	0.9	4
30		Khanapara jn.	Shillong Rd.	0.9	24.4	6	IL	60	8L	Arterial	Widening from IL to 4L	1.5	1.35	1
											Widening from 4L to 6L	1	0.9	2
											Widening from 6L to 8L	1	0.9	3
31		Khanapara jn.	Beltola jn.	2	19.1	7	2L	30	4L	Arterial	Widening from 2L to 4L	1	2	1
32	VIP Road	Six mile	Narengi	6.6	33.4	14	4L	33.4	4L	Arterial	Improvement	0.2	1.32	4

S.No.	Name of Road	From	To	Length (km)	Base year			Horizon Year without LRT		Road Classification	Improvement Measures	Unit Cost (Rs. Crores)	Total Cost (Rs. Crores)	Phasing
					ROW	Carriageway width	Configuration	ROW	Configuration					
33		Ring Road1 through Dispur Last Gate		9.3				60	4L	Arterial	New Construction of 2L	1	9.3	1
											Widening from 2L to 4L	1	9.3	3
34		Tunnel through Fatasil Hills		2.5				24	4L	Arterial	New Construction of 4L	125	312.5	2
35		Ring Road2 through Basistha Chariali		8.1				60	2L	Arterial	New Construction of 2L	1	8.1	2
36		Road parallel to existing bypass		19.6				60	4L	Arterial	New Construction of 2L	1	19.6	1
											Widening from 2L to 4L	1	19.6	2
37		New bypass along eastern side (Excluding Bridge)		24				60	4L	Arterial	New Construction of 2L	1	24	1
											Widening from 2L to 4L	1	24	2
38		New Towns connecting Road (Excluding Bridge)		8.7				60	4L	Arterial	New Construction of 2L	1	8.7	1
											Widening from 2L to 4L	1	8.7	2

b) Cost Estimates of Sub - Arterial Road Improvements in GMA

S.No.	Name of Road	From	To	Length (km)	Base year			Horizon Year without LRT		Road Classification	Improvement Measures	Unit Cost (Rs. Crores)	Total Cost (Rs. Crores)	Phasing
					ROW	Carriageway width	Configuration	ROW	Configuration					
1		Zoo Tiniali	Narengi	6.1	26	16.1	4L	26	4L	Sub-Arterial	Improvement	0.2	1.2	3
2		Ulubari rd.Jn.	Deghali Pukhuri jn.	0.8	24	13.6	3L	24	4L	Sub-Arterial	Widening from 3L to 4L	0.5	0.4	1
3		Deghali pukhuri jn.	Kachari jn.	0.6	18	10.5	3L	18	4L	Sub-Arterial	Widening from 3L to 4L	0.5	0.3	3
4		Palashbari Rd. jn.	Goral	2.25	54	5.5	IL	54	4L	Sub-Arterial	Widening from IL to 2L	0.5	1.1	1
											Widening from 2L to 4L	1	2.3	3
5		Amingaon	Amingaon Law colony	1.8	12	5.5	IL	30	Improvement	Sub-Arterial	Improvement	0.2	0.4	4
6		Amingaon Law colony	Rajadwar	7	11	3.5	SL	30	Improvement	Sub-Arterial	Improvement	0.2	1.4	4
7		North Guwahati	Gauripur	2	12	5.5	IL	60	4L	Sub-Arterial	Widening from IL to 4L	1.5	3.0	2
8		GHY club(ulubarird.)	Ulubari jn.	1.2	14	9.7	2L	30	6L	Sub-Arterial	Widening from 2L to 4L	1	1.2	1
											Widening from 4L to	1	1.2	2

S.No.	Name of Road	From	To	Length (km)	Base year			Horizon Year without LRT		Road Classification	Improvement Measures	Unit Cost (Rs. Crores)	Total Cost (Rs. Crores)	Phasing
					ROW	Carriageway width	Configuration	ROW	Configuration					
											6L			
9		Paltan Bazar one way Rd.		0.55	19	8.5	2L	30	6L	Sub-Arterial	Widening from 2L to 4L	1	0.6	1
											Widening from 4L to 6L	1	0.6	2
11		Sarabatti	Kumarapara jn.	1.3	14	6.5	2L	24	4L	Sub-Arterial	Widening from 2L to 4L	1	1.3	4
12		Sarabatti	Ulubari jn.	1.7	15	6.5	2L	30	4L	Sub-Arterial	Widening from 2L to 4L	1	1.7	4
12		Kumarapara jn.	Bharalu jn.	1.2	19	7	2L	24	4L	Sub-Arterial	Widening from 2L to 4L	1	1.2	1
13		Bharalu jn.	Paltan Bazar flyoverjn.	1.6	21	11.5	3L	30	6L	Sub-Arterial	Widening from 3L to 6L	1.5	2.4	2
14		Paltan Bazar flyoverjn.	One way Rd.End	0.75	19	13.5	3L	30	6L	Sub-Arterial	Widening from 3L to 6L	1.5	1.1	1
15		Six mile	Panjabari	1.6	22	14	4L	24	Improvement	Sub-Arterial	Improvement	0.2	0.3	1
16		Six mile	Panjabari	1.2	23	7	2L	24	4L	Sub-Arterial	Widening from 2L to 4L	1	1.2	1
17		Kalapahar	Fatasil-	1	10	5.8	IL	24	4L	Sub-Arterial	Widening	1.5	1.5	2

S.No.	Name of Road	From	To	Length (km)	Base year			Horizon Year without LRT		Road Classification	Improvement Measures	Unit Cost (Rs. Crores)	Total Cost (Rs. Crores)	Phasing
					ROW	Carriageway width	Configuration	ROW	Configuration					
			Ambari								from IL to 4L			
18		Narengi	Tadibagan (Amingaon)	3.6	24	5	IL	30	4L	Sub-Arterial	Widening from IL to 4L	1.5	5.4	1
19		Narengi	Sonapur Army camp	2.8	20	5.5	IL	24	Improvement	Sub-Arterial	Improvement	0.2	0.6	3
20		GMC Jn	Kalapahar	3.9				60	4L	Sub-Arterial	New Construction of 2L	1	3.9	1
											Widening from 2L to 4L	1	3.9	2
21		Connections from existing bypass to parallel road		4.66				60	2L	Sub-Arterial	New Construction of 2L	1	4.7	1
22		3		2.9				45	4L	Sub-Arterial	New Construction of 2L	1	2.9	1
											Widening from 2L to 4L	1	2.9	2
23		4		2.2				45	2L	Sub-Arterial	New Construction of 2L	1	2.2	1
24		5		1.1				45	4L	Sub-Arterial	New Construction	1	1.1	1

S.No.	Name of Road	From	To	Length (km)	Base year			Horizon Year without LRT		Road Classification	Improvement Measures	Unit Cost (Rs. Crores)	Total Cost (Rs. Crores)	Phasing
					ROW	Carriageway width	Configuration	ROW	Configuration					
											of 2L			
											Widening from 2L to 4L	1	1.1	2
25		6		3.4				45	2L	Sub-Arterial	New Construction of 2L	1	3.4	1
26		Hengerabari	Panjabari	2				30	2L	Sub-Arterial	New Construction of 2L	1	2.0	1
27	North Town	Category 1		27.1				60	4L	Sub-Arterial	New Construction of 2L	1	27.1	1
											Widening from 2L to 4L	1	27.1	2
28	North Town	Category 2		8				30	2L	Sub-Arterial	New Construction of 2L	1	8.0	1
29	South Town	Category 1		23.55				60	2L	Sub-Arterial	New Construction of 2L	1	23.6	1
30	South Town	Category 2		13.2				30	2L	Sub-Arterial	New Construction of 2L	1	13.2	1

c) Cost Estimates of Collector Road Improvements in GMA

S.No.	From	To	Length (km)	Base year			Horizon Year without LRT		Road Classification	Improvement Measures	Unit Cost (Rs. Crores)	Total Cost (Rs. Crores)	Phasing
				ROW	Carriageway width	Configuration	ROW	Configuration					
1	GMC Jn.	Lal Ganesh Rd.Jn.	2.5	9.1	3.7	SL	24	Improvement	Collector	Improvement	0.2	0.5	4
2	Flyover Jn.	4 legged jn. (flyover portion)	0.3	10.9	7.3	2L	24	6L	Collector	Widening from 2L to 6L	30	9	1
3	Flyover end point	Pan bazar water tank	0.7	13.7	7.7	2L	15	2L	Collector	Improvement	0.2	0.14	4
4	Kachari Jn.(rly stn.rd.)	Rly stn.Jn.	0.45	17.8	12.8	3L	17.8	Improvement	Collector	Improvement	0.2	0.09	4
5	Rly stn.Jn.	4-legged jn.	0.5	13.2	7	2L	24	4L	Collector	Widening from 2L to 4L	1	0.5	2
6	Ulubari rd.Jn.	Rajgarh rd.Jn.	1.05	5.8	3.8	SL	15	Improvement	Collector	Improvement	0.2	0.21	1
7	Chandmari(rajgarh Rd.)	Bhangagarh Jn.	2.15	9.7	6.6	2L	24	6L	Collector	Widening from 2L to 4L	1	2.15	2
										Widening from 4L to 6L	1	2.15	4
8	Nepali Mandir	Charabatti	1.25	15.5	5.8	IL	15.5	4L	Collector	Widening from IL to 2L	0.5	0.625	1
										Widening from 2L to 4L	1	1.25	2
9	Ganeshguri jn.	Hengerabari	2	14	5	IL	24	6L	Collector	Widening from IL to 4L	1.5	3	2
										Widening from 4L to 6L	1	2	4
10	GHY club	Uzan Bazar	1.2	12.9	8.5	2L	30	Improvement	Collector	Improvement	0.2	0.24	4
11	Lal Ganesh	Ganeshguri jn.	4.8	8	5	IL	30	Improvement	Collector	Improvement	0.2	0.96	4
12	Maligaon jn.	Gotanagar	4.8	10.5	5.5	IL	24	Improvement	Collector	Improvement	0.2	0.96	4

S.No.	From	To	Length (km)	Base year			Horizon Year without LRT		Road Classification	Improvement Measures	Unit Cost (Rs. Crores)	Total Cost (Rs. Crores)	Phasing
				ROW	Carriageway width	Configuration	ROW	Configuration					
13	1		2.8				45	4L	Collector	New Cobnstruction of 2L	1	2.8	1
										Widening from 2L to 4L	1	2.8	4
14	2		1.7				45	4L	Collector	New Cobnstruction of 2L	1	1.7	1
										Widening from 2L to 4L	1	1.7	4
15	7		2.9				45	6L	Collector	New Cobnstruction of 2L	1	2.9	1
										Widening from 2L to 4L	1	2.9	3
										Widening from 4L to 6L	1	2.9	4
16	Wholesale market area roads		16.7				30	6L	Collector	New Cobnstruction of 2L	1	16.7	1
										Widening from 2L to 4L	1	16.7	2
										Widening from 4L to 6L	1	16.7	4

d) Cost Estimates of Construction of Grade Separators/ Flyovers/ Bridges/ ROB/ RUB

S.No.	Description	Area (sqm)	Unit Cost (Rs.thousands) / sqm	Total Cost (Rs. In Crores)	Phasing
1	Khanapara Circle flyover (4L)	10000	25000	25	1
	Khanapara Circle flyover (4L - 8L)	10000	25000	25	2
2	Six Mile junction flyover (4L)	10000	25000	25	1
	Six Mile junction flyover (4L - 8L)	10000	25000	25	2
3	Bhangagarh Junction flyover (4L)	10000	25000	25	1
	Bhangagarh Junction flyover (4L - 8L)	10000	25000	25	3
4	Jalukbari flyover (4L)	10000	25000	25	1
	Jalukbari flyover (4L - 8L)	10000	25000	25	2
5	Flyover at bifurcation of Eastern bypass from NH-31 (4L)	10000	25000	25	2
	Flyover at bifurcation of Eastern bypass from NH-31 (4L - 8L)	10000	25000	25	4
6	Junction of NH-31 with Hajo road (4L)	10000	25000	25	2
	Junction of NH-31 with Hajo road (4L - 8L)	10000	25000	25	4
7	Bridge on river Brahmaputra on eastern side of existing bridge (4L)	30000	40000	120	1
	Bridge on river Brahmaputra on eastern side of existing bridge (4L - 8L)	30000	40000	120	2
8	Bridge on river Brahmaputra on western side of existing bridge (2L)	42000	40000	168	1

S.No.	Description	Area (sqm)	Unit Cost (Rs.thousands) / sqm	Total Cost (Rs. In Crores)	Phasing
9	Improvement of Existing Bridge (2L - 4L)	15000	40000	60	1
	Improvement of Existing Bridge (4L - 8L)	30000	40000	120	2
10	Junction of NH-37 with New towns connecting road (4L)	10000	25000	25	3
	Junction of NH-37 with New towns connecting road (4L - 8L)	10000	25000	25	4

e) Cost Estimates of Construction and Improvement of Terminals

Sl.No	Description	Number	Unit Cost (Rs. Crores)	Total Cost (Rs. In Crores)	Phasing
1	**Freight**				
	Integrated Frieght Complex at Wholesale Market Area	1	200	200	1,2,3,4
2	**Passenger Terminals**				
	Improvement of Bus Terminal for intercity public transport	1	5	5	1,2,3,4
	Intra City Bus System (Buses & Other Infrastructure)				
	Construction of Nodal Terminals for intra city Bus Traffic	1	10	10	1
		2	10	20	2
		2	10	20	3
		1	10	10	4
	Construction of Sub-Nodal Bus Terminals for intra city traffic	2	5	10	1
		3	5	15	2
		3	5	15	3
		2	5	10	4
	Construction of Mini Terminals	6	1	6	1
		8	1	8	2

Sl.No	Description	Number	Unit Cost (Rs. Crores)	Total Cost (Rs. In Crores)	Phasing
		8	1	8	3
		4	1	4	4
	Bus Depots	3	5	15	1
		3	5	15	2
		3	5	15	4

f) Cost Estimates of Junction Improvements

SL No.	Description	Proposed Measures	Total Cost (Rs. In Lakhs)	Phasing
1	Guwahati club junction	Road widening, provision of medians, construction of traffic islands, foot path, railing, kerb stones, painting of kerb stones, road marking, signages, street lighting, signalling etc.	25	1,2,3,4
2	Deghali Pukhri Junction	Road widening, provision of medians, construction of traffic islands, foot path, railing, kerb stones, painting of kerb stones, road marking, signages, street lighting, signalling etc.	25	1,2,3,4
3	Bharalu Junction	Road widening, provision of medians, construction of traffic islands, foot path, railing, kerb stones, painting of kerb stones, road marking, signages, street lighting, signalling etc.	25	1,2,3,4
4	Paltan bazar flyover junction	Road widening, provision of medians, construction of traffic islands, foot path, railing, kerb stones, painting of kerb stones, road marking, signages, street lighting, signalling etc.	25	1,2,3,4
5	Ganeshguri Junction	Provison of medians, foot path, railing, kerb stones, road markings, signages, relocation of exising features, street lighting, Signalling etc.	25	1,2,3,4
6	Zoo Tiniali Junction	Road widening, provision of medians, construction of traffic islands, foot path, railing, kerb stones, painting of kerb stones, road marking, signages, street lighting, signalling etc.	25	1,2,3,4
7	Kumarpara Junction	Road Widening, provision of median, rotory, foot path, railing, laying and painting of kerb stones to footpath, median & islands, road markings, signages, relocation of electric poles & telephone poles street lighting etc.	15	1,2,3,4
8	Sarabpatti Junction	Road Widening, provision of median, rotory, foot path, railing, laying and painting of kerb stones to footpath, median & islands, road markings, signages, relocation of electric poles & telephone poles street lighting etc.	15	1,2,3,4
9	Last gate Junction with GS Road	Road widening, provision of medians, construction of traffic islands, foot path, railing, kerb stones, painting of kerb stones, road marking, signages, street lighting, signalling etc.	25	1,2,3,4
10	Hatigaon road junction	Road Widening, provision of median, rotory, foot path, railing, laying and painting of kerb stones to footpath, median & islands, road markings, signages, relocation of electric poles & telephone poles street lighting etc.	15	1,2,3,4
11	Narengi circle	Road Widening, provision of median, rotory, foot path, railing, laying and painting of kerb stones to footpath, median & islands, road markings, signages, relocation of electric poles & telephone poles street lighting etc.	25	1,2,3,4
12	Airport Junction	Road widening, provision of medians, construction of traffic islands, foot path, railing, kerb stones, painting of kerb stones, road marking, signages, street lighting, signalling etc.	25	1,2,3,4

Annex V
Functions of Guwahati Integrated Transport Board

The functions of GITB shall be to –

1. Prepare Transport System Plan of the territory of Guwahati City Administration for a specified period of time being not more than twenty years from the date of preparation of the plan;
2. Prepare Transport System Management Plans, for a period of not more than five years for the district, or zone, or area, or corridor of the territory of Guwahati City Administration;
3. Mobilize resources for development of transport facilities and provision of transport services;
4. Ensure preparation of, and approve, Corporate Plans and Transport Service Plans by the subsidiary agencies and concerns engaged or to be engaged in the transport of passengers or goods by road or by urban rail or by light rail transit system or by high speed transit system or by bus, within, to and from the territory of Guwahati City Administration;
5. Ensure integrated planning, development and operation of transport system facilities and transport service;
6. Decide the need for and timing of new transport facilities or service provider;
7. Prescribe the terms and conditions of a license to a transport facility or service provider;
8. Provide finance, land and other resources, as loan or grant or equity, on terms and conditions prescribed, to transport facility or service provider;
9. Facilitate participation of private enterprise and flow of private resources for development of transport system facilities and provision of transport service through entering into agreements with the private person, or concern, or corporation, or company, on build-operate-transfer, build-own-operate-transfer, build-own-lease-transfer, and such other arrangements;
10. Formulate integrated fare policy for transport service;
11. Regulate arrangement amongst transport service providers for sharing their revenue derived from providing integrated transport service based on integrated fare structure and common ticket as prescribed by the Authority;
12. Coordinate the provision of transport facilities and operation of transport service by different providers of service;
13. Grant license with terms and conditions, to a person, or a concern, or a corporation, or a company, for provision of public transport passenger service within the territory of Guwahati City Administration;
14. Ensure compliance of terms and conditions of license;
15. Revocate license for non-compliance of terms and conditions of license;

16. Facilitate competition and promote efficiency in the operation of passenger transport service so as to facilitate growth in such services;
17. Protect the interest of the users of the transport facilities or service and the general public of the territory of Guwahati City Administration;
18. Monitor the quality and standards of development and maintenance of transport system facilities;
19. Monitor the quality of service and conduct periodical survey of such service provided by the service providers;
20. Maintain register of agreements and of all such other matters as may be provided in the regulations;
21. Keep register maintained under clause (t) open for inspection to any member of public on payment of such fee and compliance of such other requirements as may be provided in the regulations;
22. Settle disputes amongst transport system facility developers, transport service providers, and between transport system facility developers and transport service providers;
23. Render advice to Guwahati Metropolitan Development Authority in the matters relating to the development of urban transport technology and any other matter relatable to urban transport industry in general;
24. Design and maintain Guwahati Transport Information System and arrange to publish salient features on a regular basis;
25. Levy fees and other charges at such rates and in respect of such facilities or services as may be determined by regulations;
26. Conduct, or secure conduct of, research and development of manpower;
27. Prescribe norms and standards of development of transport facilities in the territory of Guwahati City Administration;
28. Prescribe quality of transport service;
29. Prescribe safety standards in the use and operation of transport facilities or transport services;
30. Perform such other functions including such administrative and financial functions as may be entrusted to the Authority by the Guwahati Metropolitan Development Authority or as may be necessary to carry out the provisions of this act/regulation.
31. Any other.

Annexure VI
Drainage System in Guwahati

Topographical Feature of Guwahati Metropolitan Area

The city of Guwahati extends along the Bank of Brahmaputra in a linear shape and is bounded by the river on the north and a series of hills along the remaining periphery, except for a portion in the west where a natural wetland, the Deepar Beel is situated. Inside this natural boundary the terrain consists of a bowl shaped valley which has a number of hills and a few beels (natural wetlands) interspersed randomly. **Sola beel, Silsako beel and Deeper beel** are the three notable wetlands.

Natural Drainage Channel

Two rivulets run through the city of Guwahati both originating from the Southern Hill range of KJ hills of Meghalaya. The two rivulets, Bharalu (the upstream portion of which is called Bahini) and Basistha are the natural drainage channels for Guwahati Metropolitan Area. The Bharalu channel has its outfall in Brahmaputra and Basistha Channel flows to Deepar Beel through Mora Bharalu channel. Deepar Beel is connected with Brahmaputra by a stream known as Konna Jan. There is another stream named Bonda Jan in the east of the city connecting Silsakoo Beel with the river Brahmaputra. The Brahmaputra river bank in Guwahati is higher than most of the city areas. The average GL of the river bank is 51.3m whereas the average GL of the rest of the city, except hill and wet lands (Beel) is around 49m. But the HLF of Brahmaputra at the DC court is 51.37m as recorded in 1988. The water level of river remains above 49 m every year for a number of days during the seasons of heavy rain. Therefore, gravity flow of storm water of the city into river cannot take place in those days and lot of pumping required during rainy season.

Drainage Basins of GMA

Guwahati Metropolitan Area has on the south a hill range known as KJ Hills, on the east isolated hilly areas, on the north river Brahmaputra and on the west low laying areas of Deepar Beel. Any rain on these hill slopes towards the Metropolitan area will create run off of considerable volume entering into GMA. So the storm on the nearby hills are also required to be considered for drainage plan of Guwahati.

Considering the topographical features, the whole GMA area is divided into 6 (six) numbers of drainage basins which are ultimately drained into the river Brahmaputra either directly or through various drainage channels and reservoirs. These are (1) Silkaso Basin, (2) Bharalu Basin, (3) Foreshore Basin, (4) Deepar Basin, (5) Kalmoni Basin, (6) North Guwahati Basin.

The details of basins are given below :

- **Bharalu Basin:** Bharalu river being the most flood prone and the focal point of the entire Guwahati drainage system has a catchment area of 42 sq.km. It gets the top place in the drainage scheme. The unplanned developments have blocked the natural drainage pattern in this basin. The Basin is almost flat with several

pockets of low-lying areas. During heavy rain, there is a back flow of water from Bharalu Channel also.

- **Deepar Basin**: This is the largest single drainage basin located at the southern most part of the Guwahati Metropolitan Area with an area of 20135 hectares, comprising 2/3 hilly areas and 1/3 plain areas. It is the largest existing drainage basin in Guwahati. River Basistha finally discharges into **Deepar Beel.** The basin is sub-divided into two sub-basins: **Bijubari sub-basin** and **Deepar sub-basin.**

- **Silkaso Basin**: Silsako basin covers 6534 heactares in the east of Guwahati. The basin includes military area, refinery and the townships of various industrial establishments. All the areas are sloping towards the Silsako Beel and at present the Beel receives all the runoff from the whole basin. Silsako Beel is connected with Brahmaputra River through **Bondajan River**.

- **Foreshore Basin**: The areas include main residential, commercial, institutional and business areas in Guwahati. Water logging takes place in some areas (Uzanbazar) as most areas are at a considerable height.

- **North Guwahati Basin**: It has mostly hill ranges comprising the north and western boundary. Most of the area drains into the river to Brahmaputra either directly or through the river Ghorajan via **Namalijalah Beel**. This covers a total area of 32.3 sq.km.

- **Kalmoni Basin**: The whole of the basin falls outside the Guwahati Metropolitan area. The major outlet River **Kalmoni** finds its way into the river Brahmaputra partly through **Deepar Beel** and the Khana River and partly through **Thengbhanga Beel** and the **Khalbhog river**. The total area occupied by the basin is 66.5 sq.km.

The drainage problem of GMA is to tackle "Basin wise". It is recommended, if required flood water is to be diverted to another basin, if the capacity one basin is found inadequate.

Flooding in GMA

Problems of flooding in GMA is analysed here below:

On the south bank of river Brahmaputra there are as many as five tributaries such as Bharalu, Mara Bharalu, Barapani, Khanajan and Bondaijan. Bharalu tributary flows through the alluvial depression of Guwahati Municipal Corporation area to meet at Bharalumukh. Bondajan in the east and Khanajan in the west both rivers originate from Silsako Beel and Deepar Beel respectively. Backflow of the water from the river Brahmaputra due to blockage in the drainage system through Bharalu, Khanajan and Bondajan cause floods frequently in every summer. More than 40 percent of its land surface is susceptible to flood damage, the total flood prone area in the Brahmaputra valley is 32 lakh hectares.1 Thus, the

[1] Goswami Dulal C., Flood Forecasting in the Brahmaputra River, India: A Case Study, Department of Environmental Science, Guwahati University.

natural reservoirs have diminished because of development and resulted in the submergence problem in the city.

The main causes of the flooding and water logging of GMA are

Natural Features of GMA

- Topography of Guwahati is significantly undulating.
- Heavy seasonal rainfall. The number of rainy days in a year ranges from 90 to 120 days. Around 80% of the rainfall occurs only in two months. This nature of rainfall is the main cause of water logging in the city. 2 Excessive silt carried by rain water during monsoon generally deposited in the bed of existing drainage channel reducing the containing capacity of the channel and creating the submergence problem.

Inadequate Drainage

- Both the natural and artificial drains are not adequate or capable of carrying the storm water due to the rise in their bed and narrowness.
- There is lack of maintenance of drainage channels, low lying areas (beels) and drains. Due to heavy siltation and dumping of garbage, the capacity of drains to discharge the strom water to main arteries and strom water reservoirs have been reduced to a great extent.
- The filled up areas possess high seepage capacity because of lower compactness and saturate at a faster rate, therefore, do not allow the flow of flood water.
- The original swamps and natural water reservoirs are filled up for the development purposes.
- Rising of the ground water table with the rise of the Brahmaputra level saturates the entire plain area and reduces the rate of percolation.

Man-made damages and encroachments

- Cutting of hill slides for filling up the low lying areas and large scale defforestation are responsible for **sheet wash**, the **blockage of channels**, **destruction of top soil** and **high rate of soil erosion on the exposed hill slopes** which increases the amount of surface flow as well as suspendeded materials load and mud flow.
- Construction of buildings and roads over the man made drains are also responsible for the bottlenecking the drainage.
- Encroachment on natural drainage system of the city
- Huge affluent of the Refinery passing through the city

Areas which faces acute problem of water logging are usually low-lying residential and commercial areas, which are as follows:

1. G.N.B. Road from Guwahati Club to Noonmati (except the New Guwahati area).
2. Guwahati College approach road.
3. Nabagraha road and its nearby areas.
4. Along the Kanwachal road, particularly the southern part.

[2] K.Alam, N.C.Das, A.K.Borah, Guwahati: The Gateway to the East, 2001

Basic Problem & Remedial Measures

Lack of scope for gravity flow of flood water to the river Brahmaputra throughout the year is the basic problem of drainage of Guwahati. During floods the river water rises above the level at which gravity flow can take place through their the three outlets viz. Bharalu channel, Bonda Jan, Khona Jan where there are sluice gates for prevention of back flow. When the sluice gates are closed storm water is discharged by the set of pumps installed at Bharalu sluice gates. Sluice gates are closed for 30 days continuous period for sometimes. Thus during the seasons of heavy rain storm water discharge is dependent on pumping only. This is a very dangerous condition.

Earlier Studies on the drainage of Guwahati

Various studies have so far done on it and several recommendations made from time to time. But it is observed that the proper coordination in formulation and execution of the scheme was not done and it was found that many components of the scheme were only partially completed. This has resulted only the shifting the drainage problem from one locality to another area as flow through connecting drain has improved without corresponding improvement of downstream channel flow.

There was no proper conceptualization of the **Guwahati Metropolitan Area Storm** water drainage scheme based on scientific study of the present field condition, the CMPO report of 1971 being the only authentic base.

List of some major studies in this issue are given below :

a) A Master Plan for drainage, sewerage and water supply of **Guwahati Metropolitan Area** was prepared by Assam Government in 1971 with the help of Calcutta Metropolitan Planning Organisation (CMPO).

b) The Master Plan for Drainage was revised in the year 1991 to hold good for a period upto 2021.

c) The Town and Country Planning Department undertook some piecemeal measures for storm drainage and completed construction of drains including box drains of total length of 17 km from 1973-74 to 1996-97.

d) In 1998-99 the Town and Country Planning Department prepared a Detailed Project Report (DPR) on Guwahati Metropolitan Area Storm Drainage Improvement Programme for assistance from HUDCO, on the basis of the revised version of the CMPO Master Plan.

e) The proposals contained in the project are not basically different from the components of the GMASWD scheme under enquiry.

f) The implementation of the GMASWD scheme started with the formation of coordination/technical committee on 04.11.99 i.e. only five months after PIB clearance from HUDCO loan. There was, thus, insufficient time for field study and scientific analysis.

Existing Drainage Facilities

The drainage of Guwahati Metropolitan area falling in the south bank of the Brahmaputra river is mainly through the river Bharalu and the river Basistha –Deepar Beel, the Khana river and through Silsako-Tapar Beel system. There are some low-lying water bodies, which are termed as "Beels" in local language, in Guwahati which act as temporary storm water retention reservoirs. The vast low-lying areas situated on the South-West portion of the Metropolitan area called the Deepar Beel receives discharge from the major part of Metropolitan area and ultimately discharges into the Brahmaputra river through the Khana river. On the eastern-most side another low-lying area namely Silsako Beel also receives considerable drainage and ultimately discharges into the river Brahmaputra. In the North Bank area mostly the discharge is either directly to the river Brahmaputra or through Ghorajan River into the river Brahmaputra.

Necessity of the Drainage Project

With the exception of a small area of the city where Town and Country Planning, Government of Assam has implemented drainage schemes, no where within the Guwahati Metropolitan Area any planned drainage system, is in existence. Though the Guwahati Municipal corporation area has got some roadside small drains which is not efficient enough to provide relief to the locality. Encroachment alongside the drains, inadequate section of the outfall channel, existence of low-lying ditches within the local drains pattern having inadequate banks result in frequent over-flooding of the adjoining areas due to inefficient carrying capacity. This stagnant feature seriously endangers the health and property of the area. This is more so within the Corporation area where density of population is high and areas where buildings are constructed indiscriminately in low-lying areas often blocking the natural drainage courses.

The chronic water logging in different areas of the city during the monsoon create innumerable problems like disruption of traffic movement very often in many of the city's main through fares apart from submergence of low-lying areas. About 80% of the city area is flooded during rainy season and many areas remain water logged for 3 to 4 months causing serious health hazard.

Since the Corporation area is not entirely covered by piped water supply system & the entire civil population has only individual septic tank (or without any sanitary provision), during monsoon due to lack of drainage system rain water overflows the settlements. This results in contamination of drinking water sources like tube wells, ring wells, etc. Thus the city population is always exposed to water born disease like diarrhea, dysentery, hepatitis, etc. and water logged areas become breeding grounds for mosquitoes leading occurrences of Malaria time to time.

It is, therefore, felt that immediate arrangements should be made for construction of storm drains for efficient and quick removal of storm water from the populated areas of the city.

Underground drains

The underground drains in the city carry wastewater from the residences, commercial complexes, etc., throughout the year,

though as per concept, the polluted wastewater should have gone to a sewerage system for treatment. These drains are meant for the storm water of the plots and lanes and by-lanes abutting on the roads. [3]

The flow of water through these drains is restricted due to silt deposit over the years causing flood in adjoining areas. The drains have ceased to function mainly because of the manholes which have been closed and blocked during the construction of the road. Some of these drains are located in the following areas:

- Col.J.Ali Road
- AT Road
- Lachitnagar Road
- Hadeyetpur Road
- Ambari Road
- G.S. Road
- G. N. Bordoloi Road[4]

Encroachment on the Drainage System

Due to uncontrolled construction works, there have been encroachments in the natural drainage system. Apart from that, there is garbage dumping which has resulted in blocking of natural drains.

Inadequate Drains

The drains of the city are grossly inadequate and insufficient. It is also observed that most of the drains are old and their levels in many cases are below the level of the River Bharalu. Since most of the drains fall on the upstream side of River Bharalu the level of which is higher than the level of the drains the outlet of the water is retarded by the difference in the levels.

Possible Solutions & Further Action

Bharalu Basin

- The resectioning of the main drainage channel i.e. River Bharalu to increase the water flow
- The trunk and major drains within the drainage basin tributary of the river Bharalu to be redesigned.
- The sluice structure near Pragjyotishpur College to be abandoned as it is too small. A new sluice structure for the entire opening to be constructed at a point near K.R. Chowdhury Road upstream of the railway line.

Foreshore Basin which is sub-divided into three sub-basins

[3] http://www.axom.faithweb.com/flood/
[4] M.Bezborah, "Flood in Guwahati City, A preliminary study with remedial suggestions," G.M.C.

- The Sub-Basin 1 comprises the easternmost areas upto Kharguli. It includes the housing colony of the refinery. There is no problem of water logging during the rainy season in this area as they have storm water drainage system working satisfactorily.
- The Sub-Basin 2 includes Kamakshya T.C., the Pandu Railway Colony, the University and the other adjacent areas. The area from Assam Trunk Road upto Bharalumukh is subjected to flooding. Thus, it is proposed to construct a proper size intercepting drain along the Northern berm of the Assam Trunk Road.
- The Sub-Basin 3 covers the Municipal area lying along the river. For this area 5 special outfall structures with sluice control have been suggested.

Deepar Basin

- Construction of main gate along the national highway from the diversion point to the Fatasil Road point where it enters deepar beel and construction of the new sluice on the Khana River for the proper flow and the river area has to be resectioned.

Silsako Basin

- Silsako Beel area should be storage for storm water and it should be developed as a recreational area.[5]

[5] http://www.axom.faithweb.com/flood/jun2.html

Other recommendations:

- The encroachments on natural drainage system, which is the main reason for the blockage, should be stopped.
- Existing manholes of drain are inadequate; more manholes and inlet are required for the quick disposal of silt and stagnated water. The size of the inlet holes and their position need to be redesigned.

- Silt pit of proper size should be constructed in suitable areas and provision of periodical cleaning the silt pit should be done to avoid blockage in the drainage system.[6]
- Effective garbage collection system (including domestic and other type of garbage) to be in place so that this does not block the drainage channels.[7]

Constructing Canal upto Kukurmara

At about 15 km downstream of Guwahati, however, the level of Brahmaputra, even at the time of high floods, is sufficiently lower to permit gravity flow of storm water from the city through Deepar Beel and a connecting canal to a discharge point at Kukurmara. This was once considered feasible and it is worth while to examine this possibility of natural means of storm water drainage. It is suggested that a canal may be built from the Konna much where Konna river falls on Brahmaputra)

[6] K.Alam, N.C.Das, A.K.Borah, Guwahati: The Gateway to the East, 2001.
[7] White Paper on Pollution in Guwahati with Action Points prepared by PCBA and SRDC.

toward west parallel to the river upto **Kukurmara** where HFL of the river is lower than city level.

Taking into consideration the existing network of drains and channels and the potential for utilization of the topographical features suggest that remedial measures should be taken with the following objectives.

a) Augmentation of discharge and retention capacity of the existing drainage system.
b) Reduction of flow through Bharalu and Basistha channels by flow diversion from their upstream portions.
c) Utilisation of natural wetlands for storm water retention.
d) Control of silting in drains and channels and their desilting.

It is also suggested that the remedial measures should be based on the concept of basin-wise drainage as elaborated in the CMPO report.

Other Remedial Measures

The following remedial measures are suggested for adoption after thorough planning and design based on elaborate survey of present field conditions.

1) A drainage system should be constructed for the Silsako basin with a drainage channel from Silsako Beel to Bonda Sluice. The capacity of the sluice gate should be increased and pumps should be installed for discharge of storm water when necessary.

2) Silsako Beel should be desilted to recover its retention capacity and further encroachment on the adjoining wetland area should be stopped. It was found that considerable reduction in retention capacity of the area had taken place due to dumping of garbage and earth filling by a number of organizations. Garbage dumping should be stopped and further earth filling should not be allowed except by excavation in the wetland area.

3) In order to reduce flow through Bharalu channel storm water flow through Bahini stream should be diverted to Silsako basin drainage system by constructing a truck drain from Beltola Bazar.

4) Appropriate measures should be taken to prevent flow of storm water from Silsako basin to Bharalu channel along the OIL pipeline corridor.

5) Storm water from Japorigog – Hengrabari area should be diverted to Silsako basin by constructing a trunk drain along the Hengrabari-Narengi road.

6) The Bahini stream should be re-sectioned and provided with walled banks after removal of encroachment.

7) The Hume pipe culvert on GS Road at Rukmini Gaon Bus Stoppage should be replaced by a bridge.

8) Waterway under Zoo road (RGB road) bridge on Bharalu should be augmented and the water ways under the other bridges on Bharalu should be clared of encroachment and obstructions.

9) Water pipes and telephone cables obstructing flow under bridges and through culverts at the various locations should be shifted.

10) The underground drains along S R Bora Path, constructed under the scheme, should be directly connected to Bharalu channel.

11) The feasibility of diverting storm water from Silpukhuri-Chenikuthi area to Brahmaputra by a trunk drain along the abandoned railway track (from Ambari to Uzan Bazar Railway Colony) should be examined.

12) The portion of the drain from Guwahati Railway station to Sola Beel via the culvert near Nandan Hotel should be improved.

13) Sola Beel should be cleared of encroachment and desilted to recover its retention capacity.

14) Resectioning of Mora Bharalu should be completed upto Deepar Beel.

15) Storm water flowing from Meghalaya through Basistha river and from Koinadhara-Bakrapara area should be diverted to Deepar Beel by constructing a canal along the southern side of NH bye-pass.

16) Hatigaon channel improvement work, taken up under the scheme but not completed, should be completed upto Basistha channel.

17) The downstream portion of Basistha Channel beyond Jyotikuchi-Dhopolia area should be completed upto Deepar Beel via Mora Bharalu.

18) The Khona Jan from Deepar Beel to Brahmaputra should be improved, the capacity of the Khona Mukh sluice should be augmented and pumping facility should be provided at the sluice.

19) Deepar Beel should be cleared of encroachment and desilted to recover its retention capacity.

20) Soil conservation and silt trapping measures should be adopted to control silting in drains and channels and there should be regular desilting operation for the entire drainage network.

21) The inflow and outflow in the Bharalu channel should be so controlled by operating sluice gate & pumps that any time its water level is below the outlet of the subsidiary drains discharging in it.