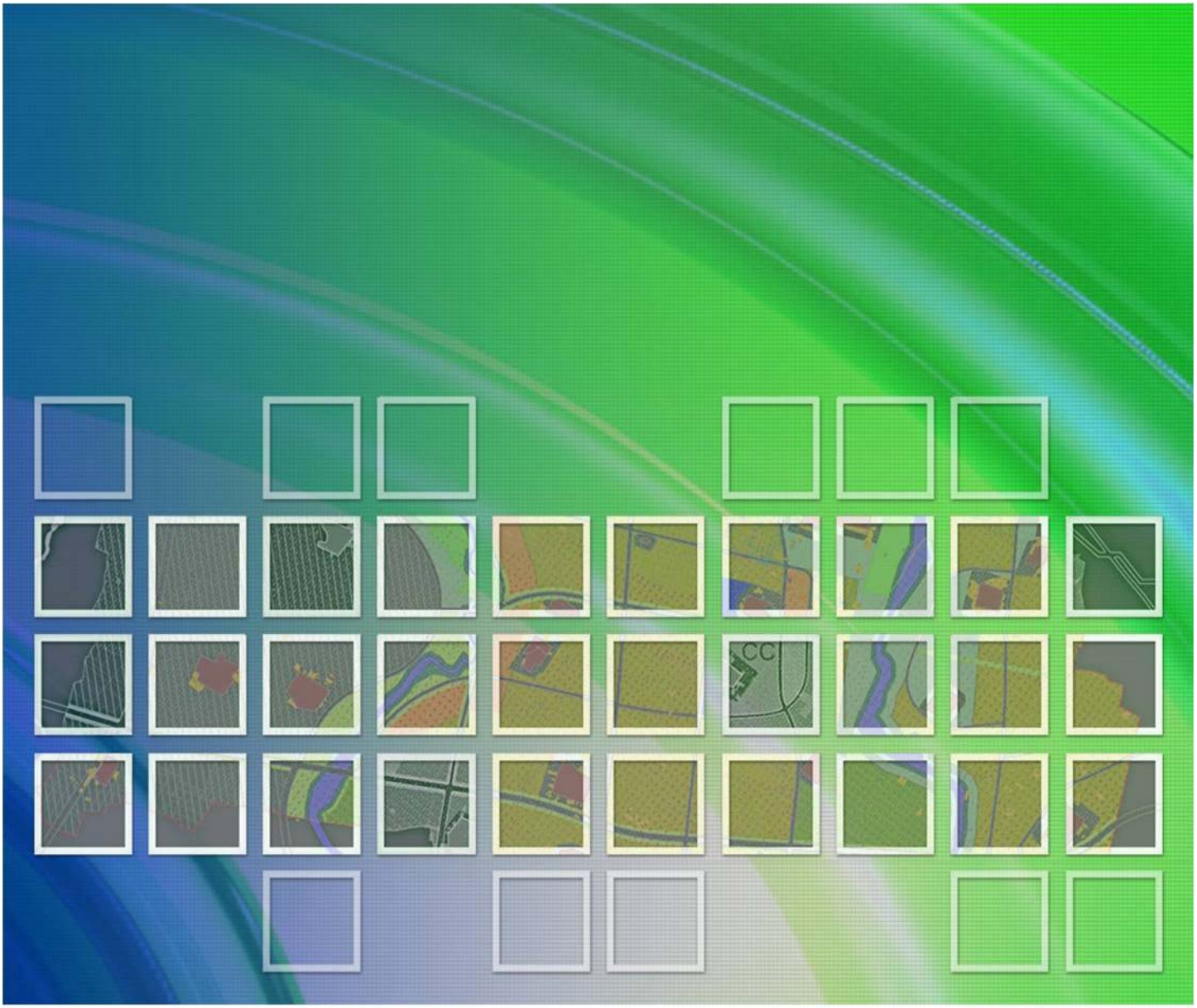

MULLANPUR LOCAL PLANNING AREA

GREATER MOHALI REGION PUNJAB (INDIA)

Master Plan Report

2008-2031

JURONG Consultants Pte Ltd

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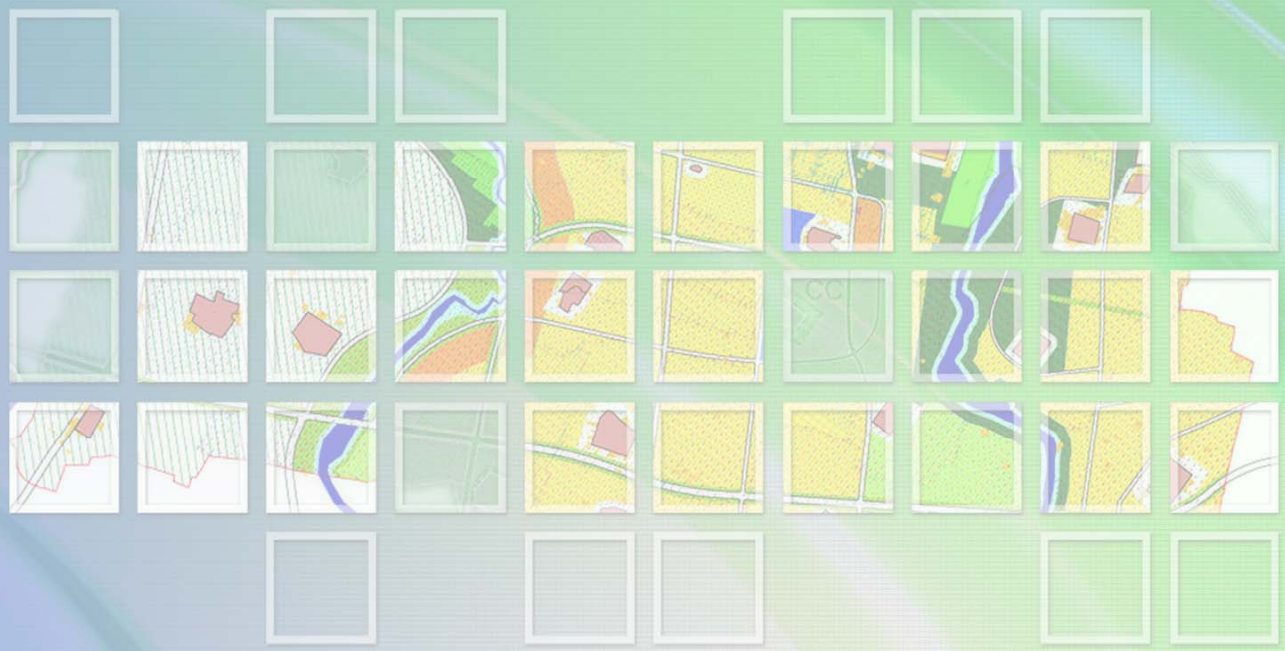
GREATER MOHALI REGION, PUNJAB (INDIA)



Chapter 0

PREFACE & INTRODUCTION

PREFACE

On the 22nd June 2007, the Greater Mohali Area Development Authority (GMADA) appointed JURONG Consultants Pte Ltd to complete a comprehensive Integrated Master Plan for its six Local Planning Areas (LPAs): **Banur, Dera Bassi, Kharar, Mullanpur, S.A.S Nagar** and **Zirakpur**. This project has involved the co-operation of several agencies namely the Punjab Urban Development Authority (PUDA), the Centre for Computational Engineering (CEC) at the Punjab Engineering College (PEC) and GMADA.

JURONG Consultants would like to thank the following people for their unwavering support and assistance in making this Report possible:

Secretary Housing and Urban Devp.and VC (GMADA)	Mr Arun Goel
Chief Administrator (GMADA)	Mr Vivek Pratap Singh
Chief Town Planner (Punjab)	Mr Rajinder Sharma
Chief Town Planner (GMADA)	Mr K.K. Kaul
District Town Planner (SAS Ngr)	Mr Gupreet Singh
AGM Projects (GMADA)	Mrs Namrita Kalsi
Manager (PEC)	Mr Rajeev Sehdev

The co-operation of various authorities and public agencies in Punjab must also be acknowledged. These are:

- Punjab Infrastructure Development Board (PIDB)
- Government of Punjab – Department of Forests & Wildlife Preservation
- The Louis Berger Group, INC

We also wish to thank all those who have contributed in one way or another to this Report, particularly to the officers from PUDA who have kindly accompanied us during the field trips. There are many individuals who have contributed to the report and thus, the above mentioned list is not exhaustive. We regret if we have inadvertently missed anyone in the list above.

This Report reflects the commitment and dedication of various agencies to the project. The help and guidance rendered is greatly appreciated.

This Report is the "Mullanpur Local Planning Area Master Plan 2008- 2031" and consists of the following sets of reports and supporting documents:

EXECUTIVE SUMMARY

MULLANPUR LPA MASTER PLAN

- Regional Framework
- Existing Condition
- Planning Analysis
- Development Framework
- Planning Proposal
- Infrastructure Proposal
- Implementation & Phasing
- Conclusion

This Report is accompanied by Mullanpur's proposed Land Use Plan (A1 Size).

INTRODUCTION

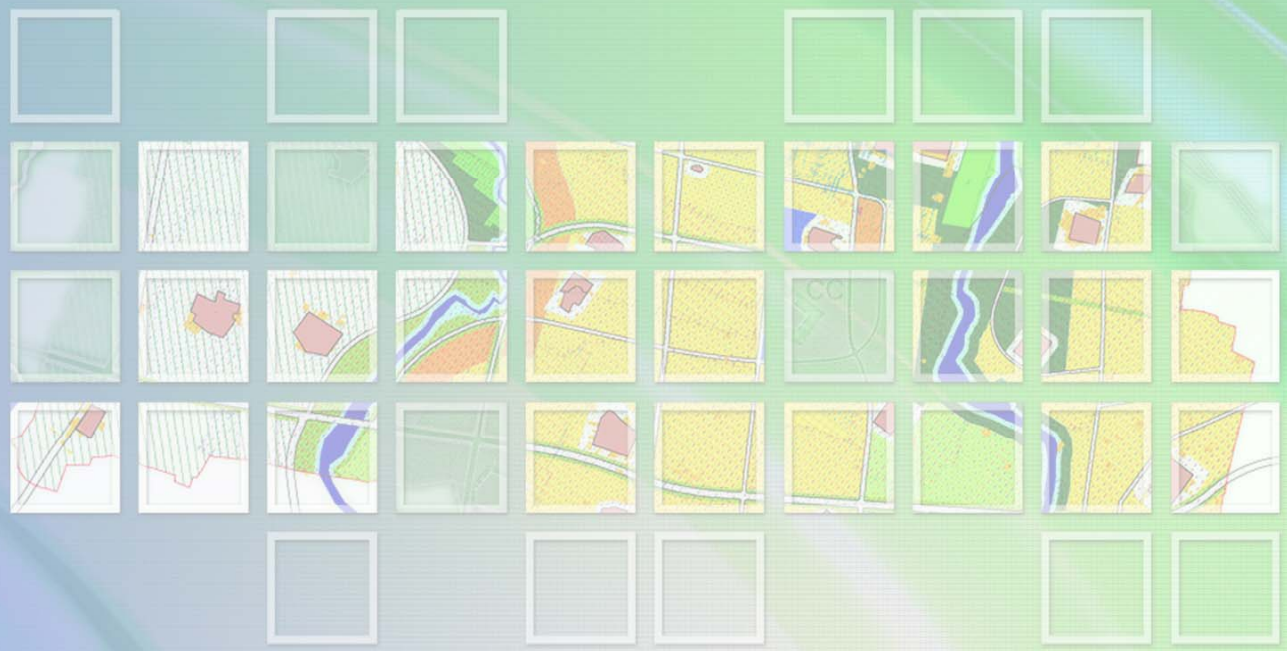
This report presents the third part of the consultancy work entitled “Integrated Masterplanning for Greater Mohali Area”. The report documents the Local Plan proposals and strategies for one of the six Local Planning Areas: Mullanpur.

Mullanpur Local Planning Area is in the north-east of GMADA (Latitude: 30° 49' 60 N, Longitude: 75° 40' 0 E). It is bounded by the existing MDR B and MDR C. Part of the planning proposal include the construction of 4 other roads namely PR 3, PR 4, PR 6 and PR 13, as dictated in the second part of the consultancy work under “Broad Structure Plan Report 2006-2056”. Mullanpur is about 10 km from Chandigarh.

There are 9 main sections to this report. Section 1 reiterates the regional framework. Section 2 highlights the existing site and infrastructure provision conditions. Section 3 analyses the strengths, weaknesses, threats and opportunities. Section 4 explains the development framework. Sections 5 and 6 articulate the planning and infrastructure proposals. Section 7 outlines the implementation and development phasing. Specific and detailed controls for development in Mullanpur will be covered in section 8 of this Report. This Report concludes by reiterating Mullanpur’s vision and its methodology in achieving that vision.

MULLANPUR LOCAL PLANNING AREA

GREATER MOHALI REGION, PUNJAB (INDIA)



Chapter 1

REGIONAL FRAMEWORK

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1. REGIONAL FRAMEWORK

1.1 Vision for Regional Development

The GMADA Structure Plan has mapped out a vision towards a city of excellence for the Greater Mohali Area and its six local planning areas of SAS Nagar, Zirakpur, Kharar, Mullanpur, Banur and Derabassi, covering a land area of 1190 sq km for a population of 4.5 million. The city of excellence vision is guided by the principle of attaining a balanced development within the Greater Mohali Area:

- Preserving natural, unique, historical and open space resources to achieve a more wholesome, vibrant and sustainable lifestyle;
- Introducing critical strategic economic growth initiatives including technology-knowledge-business park corridors;
- Promoting a comprehensive planned township that will enhance quality living, ensuring accessibility and managing overall growth.

The key development strategies in the Greater Mohali Area Regional Plan 2008-2058 include:

- Safeguarding and providing land for development to meet all needs;
- Encouraging sustained economic growth and coordinating infrastructural development;
- Enhancing the quality of life; Live, Work, Learn and Play.

1.2 Broad Planning Intention for Mullanpur Local Planning Area

The Greater Mohali Area Regional Plan 2008-2058 has envisaged a 35.9% urbanizable area (42, 740 ha) to be distributed among its six Local Planning Area (LPA). The objective is to establish a logical and sensitive growth and land utilization strategy for the Greater Mohali Area.

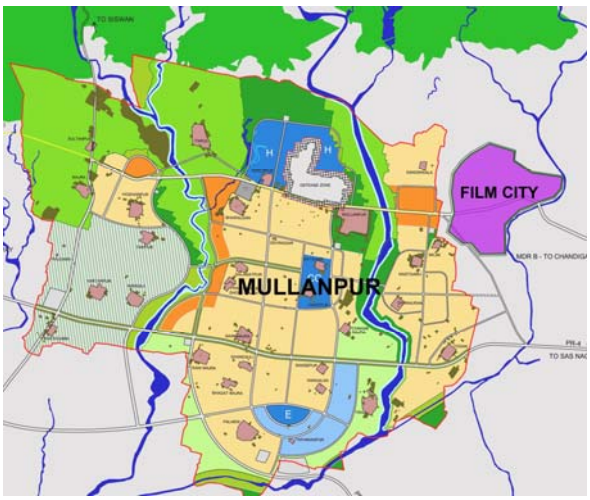
The Greater Mohali Area Regional Plan 2008-2058 has identified 7 economic clusters, each with its own distinctive primary/secondary economic activities.

Table 1.1: An overview of economic activities within the seven economic clusters

Economic Cluster	Primary/Secondary Economic Activities
Central S.A.S Nagar	CBD Financial District Arts and Culture Centre Administrative Centre
South-Eastern S.A.S Nagar	Airport Hub Logistic Hub Aviation Related Industries
Zirakpur	Hardcore Manufacturing Warehousing Medium/small manufacturing
Banur-Zirakpur Corridor	Instructional-Knowledge Belt Business-Technological Corridor Regional Park Southern Gateway (direct linked to Delhi)
Shivalik Hills	Nature Conservation and Preservation Regional Ecological Park Micro-Climatic Modifiers
Mullanpur	Resort Centre Low Density Country Living Northern Gateway
Agriculture (Rural) Zone	Diversification of Agriculture Activities Critical mass approach to rural development Preservation of agriculture lands

Mullanpur is one of these 7 clusters where the broad planning intention is low-density country living, resort centre and the northern gateway to GMADA. Mullanpur's locational proximity to the proposed film city and education city developments of Chandigarh offers the potential to develop its adjacent areas (in proximity to the north of Chandigarh) into a resort centre and a regional playground. This will complement the services and activities related to the film and education industries as well as add to the region's leisure and tourism products. Tourism is vital to the economy and future growth of the Greater Mohali Area.

Figure 1.1: Proximity of Mullanpur to Film City and Chandigarh



The immediate goal for this sector as set out in the Greater Mohali Area Regional Plan 2008-2058 is:

"To enhance the existing tourism and recreation sector of GMADA."

The medium and long-term goal is:

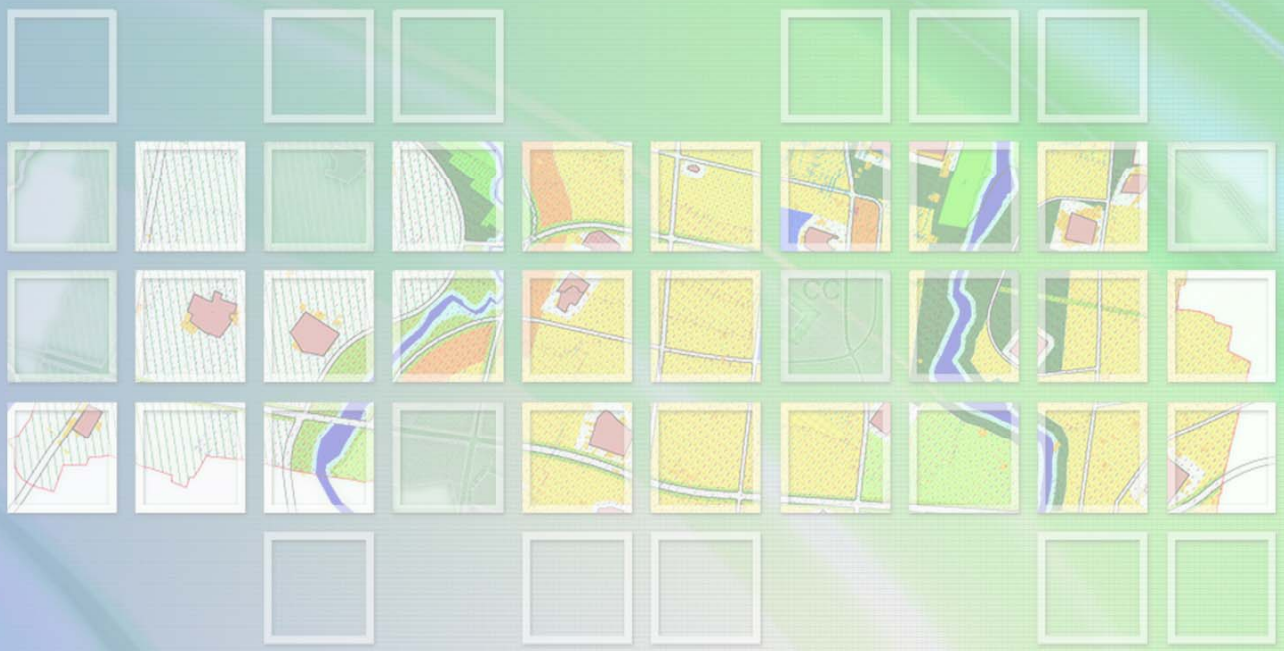
"To create a dynamic and trend setting tourism and recreation sector that will position GMADA to the fore of national tourism."

1.3 Development Framework for Mullanpur Local Planning Area

The Mullanpur LPA presents opportunity for a well-managed Eco-town environment with a variety of new and exciting developments to encourage diversified growth in tourism that balances economic growth with environmental, cultural and community values. The rivers and waterbodies within the local planning area offer opportunity for the development of Mullanpur as a Waterfront Urban Village. The development framework of Mullanpur Eco-town is elaborated in Section 5.

MULLANPUR LOCAL PLANNING AREA

GREATER MOHALI REGION, PUNJAB (INDIA)



Chapter 2

EXISTING CONDITIONS

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2. EXISTING CONDITIONS

The six LPAs of Greater Mohali Area have differing existing conditions. Mullanpur is distinguished by its agricultural farming. Some 75.5% of the land in Mullanpur is under agriculture.

Table 2.1: Major Economic Activities in Various LPAs within GMADA

At the present time, the area has limited tourism facility.

2.1 Land Use and Settlement Pattern

Figure 2.1: Existing Land Use Plan

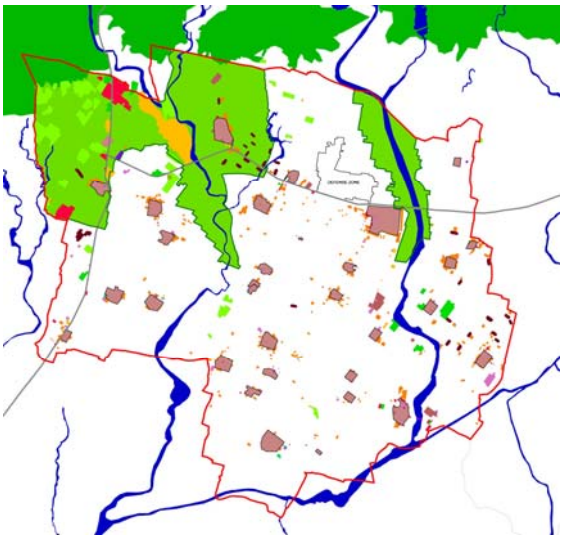


Table 2.2: Breakdown of Existing Land Use

Agriculture	4622.9	75.5
Waterbody	890	14.5
Rural Settlement	250	4.1
Special Use (Military)	140.8	2.3
Open Space	80	1.3
Industry (Brick Kilns)	80	1.3
Mixed Use	60	1
TOTAL	**6123.7**	**100**

Mullanpur is largely a rural area (See Figure 2.1 for landuse plan). The prevailing predominant land use (75.5%) is agriculture. The main settlements are the 32 villages (250 ha) scattered throughout the area. In total, there are 25,937 persons living in the villages. The largest of these is the historic Mullanpur Village with a Gurudwara complex which houses facilities like a primary school, a college, a hospital and temple.

Apart from agriculture, there are a number of brick kilns. The brick kilns are mainly on the south-eastern part of Mullanpur covering a total area of 80 ha (1.3%).

Figure 2.2: Brick kilns in Mullanpur LPA

As with other LPAs, unauthorized commercial development has mushroomed along the major arterial roads from Chandigarh, and around the rural settlement.

Figure 2.3: Parts of the Mullanpur Garibdas Census Town (entrance and residential)

Some part of the area is under restricted use. There is a restricted area (140.8 ha) next to MDR B that is dedicated for military use. In addition, 1150.2 hectares of land is under the Punjab Land Preservation Act, 1900, with restrictions on any development to protect the ecological balance and ecosystem of the surrounding Shivalik Hills. Despite Mullanpur's proximity to the Shivalik Hills, there is currently limited tourism facility in the town.

2.2 Demography

The 2001 Census of India forms the backbone of the population analysis for this report. The existing and proposed population projections for GMADA and Mullanpur are based on the 2001 Census as it is the latest available decennial census carried out by the Registrar General and Census Commissioner of the Government of India. The Census provides a comprehensive source of information and demographic data, ranging from macro level data such as population, economic activity and migration to micro level data such as household population and village directory. While other data sources work largely on samples and estimation, the 2001 census is a more reliable source in that it provides a variety of statistical information every 10 years and highlights the diversity of the people of India.

The Government of Punjab created the GMADA planning area in August 2006 using the provisions of the Punjab Town and Regional Planning and Development Act, 1995 (amended) 2006. With the notification (No. 13/52/2006-1HG3/7743 dated 14th August 2006), GMADA is officially established and is henceforth, responsible "for areas falling in Sahibzada Ajit Singh Nagar District and adjoining areas falling in other Districts". Mullanpur is subsequently affected, being an adjacent city to Chandigarh and S.A.S Nagar. The GMADA area unfortunately, does not correspond exactly to standard administrative units in the Indian context, i.e. state, district, sub-district, etc. This has implications for data availability as most data collated for the 2001 Census is at the level of various administrative units. For the purpose of this Report, the population of Mullanpur is taken based on data under Mullanpur Garibdas Census as shown in the 2001 Census. Rural population of the remaining 32 villages will be based on the Punjab Urban Development Authority's 2001 data, which uses the revenue plan to determine the rural population of Mullanpur.

2.2.1 Population Growth and Migration

The population of the GMADA area in 2001 was 711,210 persons, with 38.9% of the population classified as urban. The urban population of the GMADA area is highly concentrated in the city of S.A.S Nagar (44.6%), with the remaining 55.4% spread across nine other towns. Mullanpur village accounts for approximately 2.2% of the urban population in the GMADA area.

As of 2001, the population of Mullanpur was 6,147 in 1,171 households (source: 2001 Census of India). The population is predominantly rural (98%) with a total population of 27,873 in 32 villages (source: *Punjab Urban Development Authority,* 2001).

Table 2.3: Distribution of the Urban Population in GMADA Area in 2001

Urban Settlement	Nos. of Households	Nos. of Persons	% Share of Urban Population
S.A.S. Nagar	28,539	123,484	44.6%
Kharar	8,118	42,289	15.3%
Zirakpur	5,072	25,022	9.0%
Kurali	4,220	23,047	8.3%
Karoran	4,564	20,361	7.4%
Dera Bassi	3,284	15,841	5.7%
Bhankharpur	1,798	9,216	3.3%
Mullanpur Garib Das	1,171	6,147	2.2%
Bhabat	1,103	5,866	2.1%
Banur[1]	861	5,426	2.0%
Total:	58,730	276,699	100.0%

Source: Primary Census Abstract (PCA), 2001

The relatively low concentration of population in Mullanpur is due to a few reasons:

a. Emergence of the tri-city phenomenon comprising Chandigarh, Panchkula and S.A.S. Nagar (Mohali) leads to concentration of migration flows into the three areas instead of Mullanpur.
b. With vast proportion of its land used for agriculture (75.8%), Mullanpur remains a rural site while the nearby LPA, S.A.S Nagar attracts the bulk of investments due to spillover effects from Chandigarh.
c. Limited development of Mullanpur's services and manufacturing industry, the two driving forces of Punjab's economy.

Unlike S.A.S. Nagar, Kharar and Dera Bassi, Mullanpur's population data is limited to year 2001 with no record of past population numbers. As such, projected population for this 2031 master plan will be made by considering average population growth in other LPAs (e.g. Class 1 cities vis-à-vis Metropolitan cities), Punjab and India as a whole. Apart from population growth, a study on market forces and economic activities in relation to GMADA area is done to facilitate population projection.

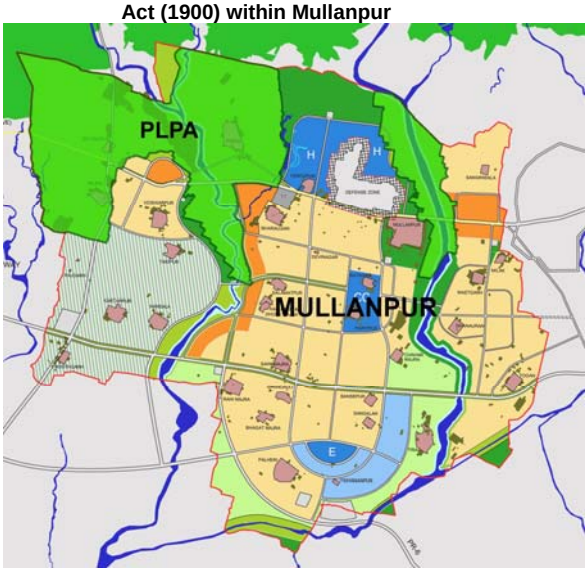
[1] Based on discussions with the Manager of the District Industry Centre, Patiala it was learnt that only a part of the town of Banur was part of the GMADA Area. These were identified as villages which are nevertheless under the jurisdiction of the municipal body of Banur – the population shown for Banur has been derived on this basis. The total population of Banur town as a while as shown in the 2001 Census was 15,013.

2.3 Environment

Mullanpur borders the Shivalik Hills. It is located south of the Shivalik range. A portion of its land adjoining the Shivalik Hills is affected by the Punjab Land Preservation Act (PLPA), 1900, north-east of Mullanpur LPA. Under the PLPA, large areas of land are protected and reserved as they often consist of highly erodable soil. The PLPA is a State legislation that imposes restrictions on land uses so as to prevent long-term effects of deforestation and/or ecological imbalance.

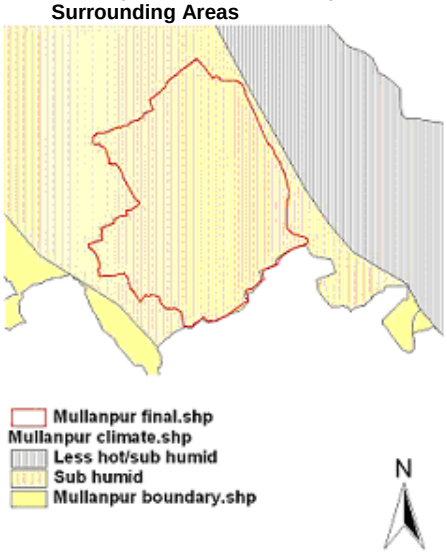
The Mullanpur PLPA land has a relatively flat topography, with moderately gentle slopes in the riverine areas where rivers and streams intercept the Greater Mohali Area. The meeting point of the streams descending from the hills and the plains becomes the ground water recharge zone. As such, it is necessary to ban any developments in the PLPA zone in order to protect this natural resource. Development on PLPA land may result in overgrazing, leading to massive soil erosion, which would in turn lead to floods and crop failure.

Figure 2.4: Land Affected by the Punjab Land Preservation Act (1900) within Mullanpur



2.3.1 Climate

Figure 2.5: Mullanpur's Climate in Comparison to Surrounding Areas

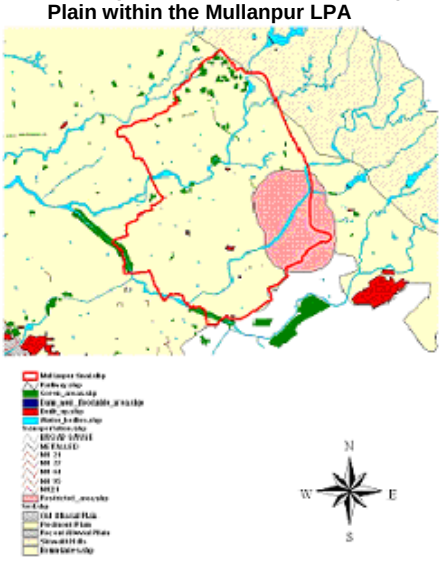


The behaviour of the climate has become inconsistent due to the global climate change. For example, northern India experienced heavy rainy season in 2007 as compared to the rest of the Greater Mohali Area. The rainfall in the entire region during the monsoon season is heavy. The monsoon season starts in the first week of July and continues until the middle of September. According to climatic data, annual average rainfall exceeds 1100 mm per year. The annual average rainfall for Mullanpur is 1140 mm. Due to heavy seasonal rainfall, the run off is high. Ground water recharge takes place during the monsoon months.

The region also experiences extreme weather conditions. The period from April to June experiences hot and dry season. In summers, the maximum temperature goes up to a high of up to 45ºC, while November to February is subjected to cold weather and in winters, the minimum temperature goes down to about 1ºC. Due to good ground water conditions, this area has been depending on ground water for water supply, for both domestic as well as agriculture use.

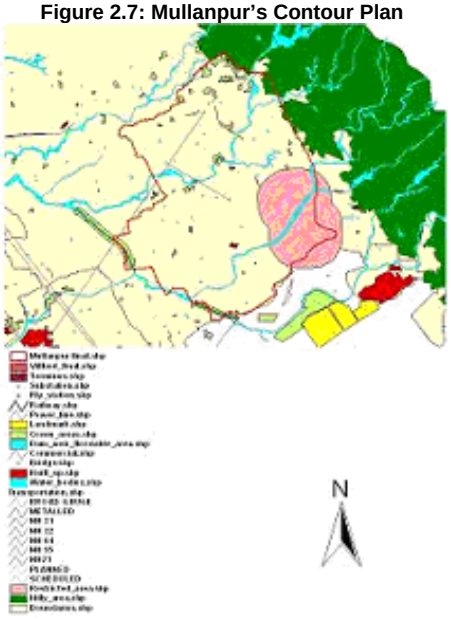
2.3.2 Topography and Soil

Figure 2.6: Mullanpur Consist of Predominantly Piedmont Plain within the Mullanpur LPA



Broadly, soil category 021 (soil of Piedmont plains: typic ustochrepts/ udic ustochrepts) covers the complete area. It is very deep, well drained, calcareous, coarse loamy soil on very gentile slopes with sandy surface and moderate erosion. This classification is of very good quality. It is reflected through the available agricultural land which is of high fertility. Therefore, it is very productive for raising multiple crops in a year.

Figure 2.7: Mullanpur's Contour Plan

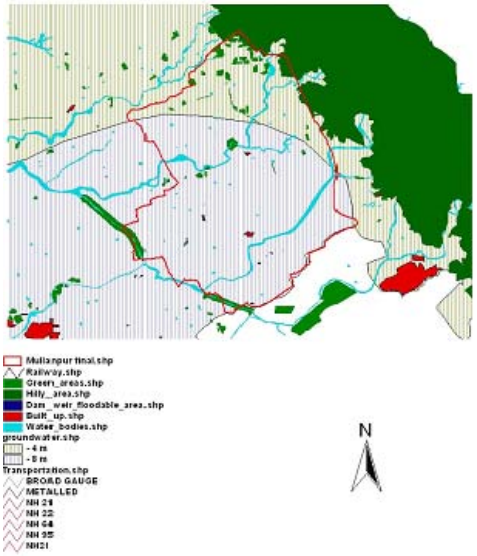


The broad and extensive contour map (Figure 2.7) implies that there is very shallow fall from the north to the south of the area.

The area is almost flat with gentle slopes. This factor is of paramount importance and would need to be taken into consideration while planning the surface drainage, water supply system and sewage disposal. This area is located at the foothills of the Shivalik ranges and Shivalik is a Reserve Forest. Considering the location and the number of streams that meet the plains in this area, this area is of great importance for ground water recharge. Judicious and sensitive land use designation is called for to protect the ecology of the Reserved Forest and the potential of ground water recharge.

2.3.3 Groundwater

Figure 2.8: Mullanpur's Distribution of Groundwater Depth



The average ground water table here is approximately 4 meters below ground level and is subjected to fluctuation in monsoon and non-monsoon seasons. This is a factor which needs to be taken into account for:

- Surface water drainage
- Sewerage pipe layout
- Water supply lines

The above factors would indicate the need for decentralized system which can be integrated with the temporal phasing of development.

2.3.4 Surface Hydrology

The surface hydrology in Mullanpur includes small channels of water, mainly rivers Jainti Devi Ki Rao, Siswan River, and Patiala Ki Rao. Their old courses of flow and catchments of these rivers are in regions up the Shivalik hills, which provide the best recharge areas for the ground water. Therefore, they must be conserved. It is advisable to limit the development in these areas and they may be designated for the specific purpose of water conservation and open space land uses. Demarcation of locations where bridges are to be constructed on these rivers has to be done, along with their construction materials for the purpose of minimizing the impact on the environment of the area.

2.3.5 Mullanpur's Forests

There are small patches of diminutive forests located all over the area. All forests are protected under the Forests Act. Although there is no legislative impediment to develop the land adjacent to forest, such development has not found favour with the Environmental Appraisal Committees constituted under the Environment Act. The decision of EAC has been generally upheld by the Courts of Law. It would be preferable to limit these as green areas and propose open spaces around them.

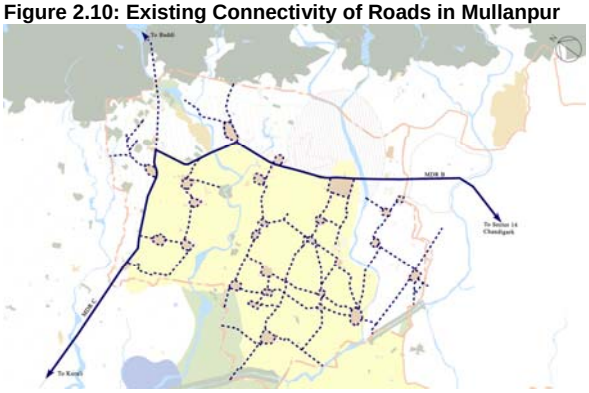
2.4 Transportation

The existing transportation infrastructure for the Greater Mohali Area was reviewed in the GMADA Regional Plan Report – Transportation. This report uses the "GMADA Structure Plan Report – Transportation" as a backdrop.

2.4.1 The Existing Roads

Figure 2.9: Existing Roads in Mullanpur LPA

Figure 2.10: Existing Connectivity of Roads in Mullanpur



The road access to Mullanpur is currently limited to only Major District Roads (MDR) B and C serving the area. Roads leading to the villages are typically about 2-lane wide and are usually unmade track roads (See Figure 2.9). Traffic volumes are generally low from observations. The particulars of the 2 existing roads are briefly as follows:

- MDR B which runs through Chandigarh (along Madhya Marg) between Panchkula and Mullanpur. In Chandigarh, the road forms part of the grid system linking SAS Nagar;

- MDR C which starts in the Mullanpur area and runs westwards to Kurali and further westwards towards Sirhind.

MULLANPUR LOCAL PLANNING AREA

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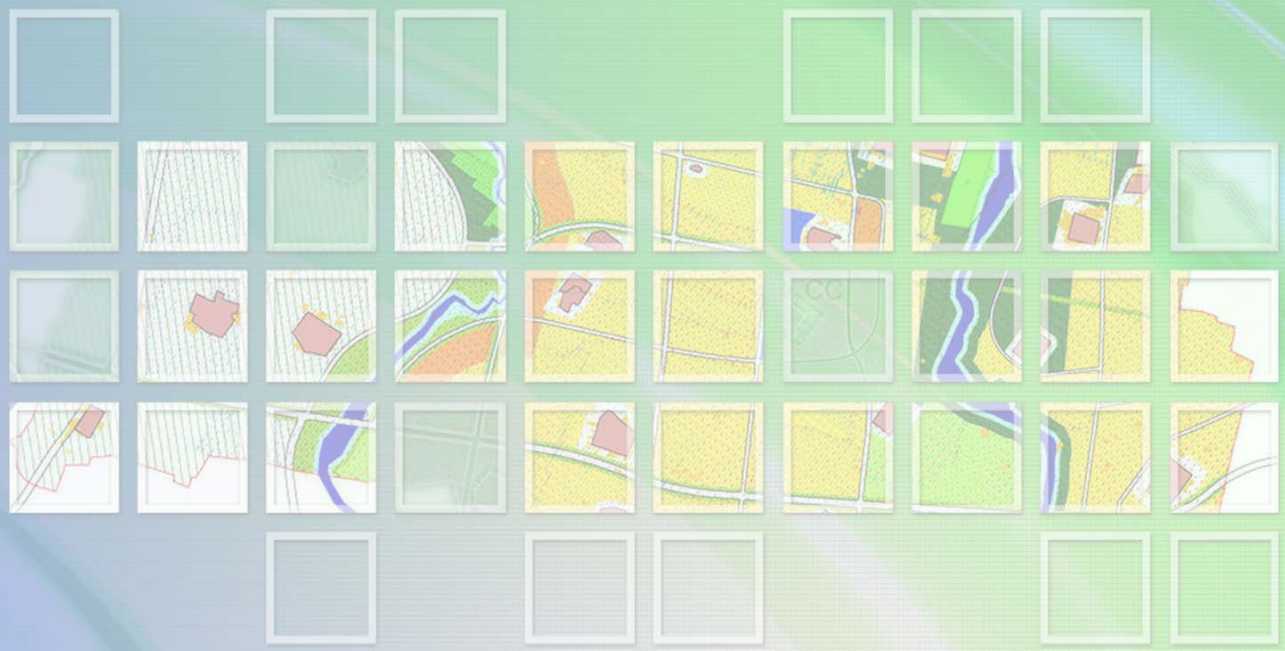

Chapter 3

PLANNING ANALYSIS

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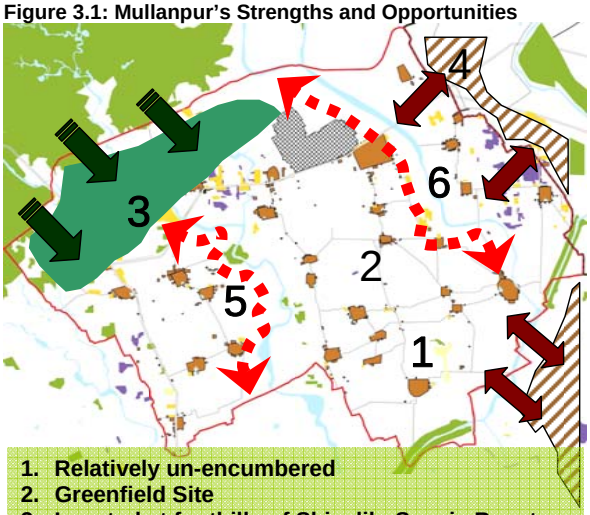
Figure 3.1: Mullanpur's Strengths and Opportunities



1. **Relatively un-encumbered**
2. **Greenfield Site**
3. **Located at foothills of Shivalik: Scenic Beauty**
4. **Proximity to Chandigarh and S.A.S. Nagar**
5. **Existing natural attractions**
6. **Rivers are prime assets.**

3.1.1 Strengths of Mullanpur

Topography

The Mullanpur area is relatively unencumbered. Its topography is relatively gradual (with the exception of the area under the foothills of Shivalik) and generally suitable for urban development. Apart from the foothills of Shivalik, the rest of Mullanpur consist of Piedmont plains with calcareous soil and very gentle slopes with sandy surface. Erosion is moderate, and will not be an issue in most parts of Mullanpur LPA.

Due to the favourable condition above, the Mullanpur LPA provides about 4000 ha of buildable land for development of new townships and urban activities. Large-scale development is plausible.

Greenfield Site

There are no major existing developments with the exception of developments within the town of Mullanpur Garibdass and the rural settlements (32 villages). Much of Mullanpur is currently used for agriculture (75.5%) and is mostly a greenfield site. Plans to develop Mullanpur can transpire easily with little hindrance or need for urban renewal and redevelopment.

Figure 3.2: Mullanpur's Greenfield site

The foothills of Shivalik are also full of greenery. Mullanpur's locational proximity to the Shivalik hills and forestland is a key attraction of the LPA (See Figure 3.2). This can enhance and help kick-start the eco-tourism that will be planned for the area.

Villages

Figure 3.3: Villages in Mullanpur

The Mullanpur Village traces its origin to more than a century ago. Its historic and heritage value is meaningful to many local residents and should be transmitted to future generations to ensure greater sustainability.

3.1.2 Opportunities

Scenic Beauty

The strategic location of the Mullanpur LPA at the foothills of the Shivalik range and a number of intertwining rivers and waterbodies provide an exceptional scenic quality to the entire area.

Figure 3.4: Foothills of the Shivalik Range

Location

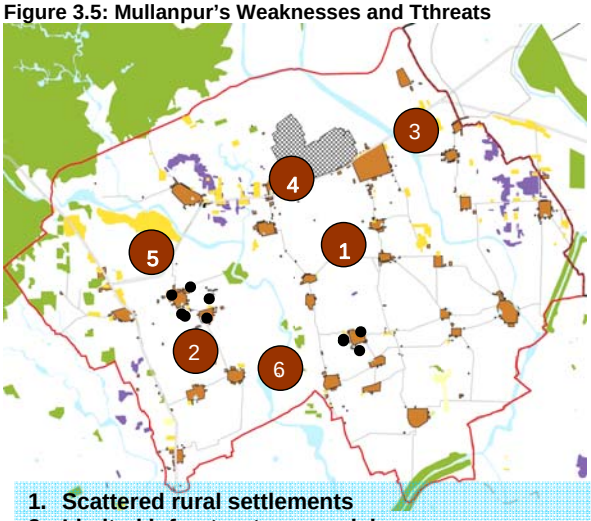
The Mullanpur LPA is bounded by both Chandigarh and S.A.S Nagar. It is also nearby to the industrial town, Baddi, in the state of Himachal Pradesh. Once the GMADA expressway is constructed, the Mullanpur LPA will be made more accessible to towns like Baddi and Anandpur Sahib.

Tourism Potential

Owing to its scenic nature and heritage value, Mullanpur presents several unique opportunities for tourism development. For instance, the village has a number of heritage resources which should be conserved and capitalized upon for tourism and cultural development. In addition, various types of activities can also be developed to tap on the serenity and pristine nature of this area. A place for recuperation and relaxation is an ideal development for Mullanpur.

3.2 Weaknesses and Constraints

Figure 3.5: Mullanpur's Weaknesses and Tthreats



1. **Scattered rural settlements**
2. **Limited infrastructure provision**
3. **Poor quality of roads**
4. **Land locked under defence related services**
5. **Incompatible uses like brick kilns**
6. **Seasonal nature of rivers**

3.2.1 Weaknesses

Villages

The rural villages in Mullanpur LPA are scattered. The LPA has about 32 odd large and medium size rural settlements (ranging from 3 ha to 21 ha) scattered all over the LPA region.

Some of the existing villages are outside the designated village boundary. This has implications on the overall road development. Road development becomes challenging as it is not possible to build roads without affecting all of these built up areas outside the village boundary.

The total land area of these rural settlements is 398.1 ha.

Restricted Areas / Uses

Figure 3.6: The Defense Site in Mullanpur. Fences Enclose the Air Force Stations and Installations

A proportion of the area is locked under defense-related activities. Under the Gazette of India (dated March 3rd, 2007 / Phalguna 12, 1928), the Works of Defence Act, 1903, states that land development restrictions must necessarily be imposed in the vicinity of the Indian Air Force Stations and Installations. There shall be no building or structure constructed, created or erected (including trees) within the limits of 100 meters from the crest of the outer parapet of Indian Air Force Stations and Installations. The Air Force Station Mullanpur falls under this jurisdiction as highlighted in Annexure A of the gazette. For the purpose of the Mullanpur local plan, a 100 m buffer is set aside around the perimeter of the defense installation. This amounts to 140.8 ha of land, with limited development potential.

Another parcel of land under restricted use is the northern Mullanpur area affected by the PLPA. The total area of this parcel is 1150.2 ha.

Brick Kilns

Figure 3.7: Brick kilns in Mullanpur LPA

There are 17 brick kilns found in Mullanpur LPA. These brick kilns are a source of pollution to the area. This type of pollutive industry will impose health and hazard to the nearby residential areas. It is therefore, incompatible with the planning intention of its surrounding areas. A policy decision is required to phase out these brick kilns within a given time frame, such as 5 years.

Unauthorized Developments

Unauthorised developments are found along both sides of the MDR B road and within the no construction zone of the defense area. Future widening of the MDR B to its full proposed width of 60 meters will be challenging. Enforcement action is required to remove these developments during the appropriate time of road construction.

Figure 3.8: Example of Development within the 100 meter Defense Zone Boundary

Streams and Rivers

The streams/*chos*/rivers along Mullanpur area are seasonal and with the construction of 5 dams (including Siswan Dam) along the foothills of Shivalik Hills, the water course is reduced to a very insignificant flow through its channel. There are three main rivers flowing through Mullanpur LPA – Jainti Devi Ki Rao, Siswan River and Patiala Ki Rao. Their old courses of flow provide the best recharge areas for ground water. Any development along these rivers should be selected for water conservation and open space land uses only. It is important that at areas where bridges are required, an Environmental Impact Assesment (EIA) is done to ensure that the groundwater recharge areas are not affected. The intention to create waterfront development at these rivers, thus poses a challenge to the engineers.

Figure 3.9: River Course of the Jainti Devi Ki Rao River in August 2008

Access to these river areas is also limited. The only way is through unmetalled rural roads for a major part of the length of the river. Road network along the river channels must be improved to enhance the quality of leisure and recreation areas of the waterfront.

Infrastructure

There is poor infrastructure provision due to the predominant rural character of the region. There is very limited availability of urban infrastructure such as water supply and sanitation facilities. Proper garbage disposal is necessary to minimize pollution of the environment. As shown in Figure 3.11, the littering of streams with garbage is a common sight.

Figure 3.10: Stream Filled with Litter in Mullanpur LPA

Infrastructure which includes surface water drainage, sewerage pipe layout and water supply lines must consider seasonal monsoon changes as the water table tends to fluctuate during different seasons. A decentralized system that integrates with the temporal phasing of development is necessary here.

Roads

Road access is limited to the existing MDR B (through Chandigarh) and MDR C (to Kurali) as well as the other unmetalled roads that provide access to the villages. Currently, the MDR B and MDR C are the only two roads that link Mullanpur to the other parts of Punjab.

In addition, the quality of the roads is low. The stretches of MDR B and C crossing Mullanpur have degraded road surfaces and the right-of-way has been encroached upon at many places by unauthorized developments.

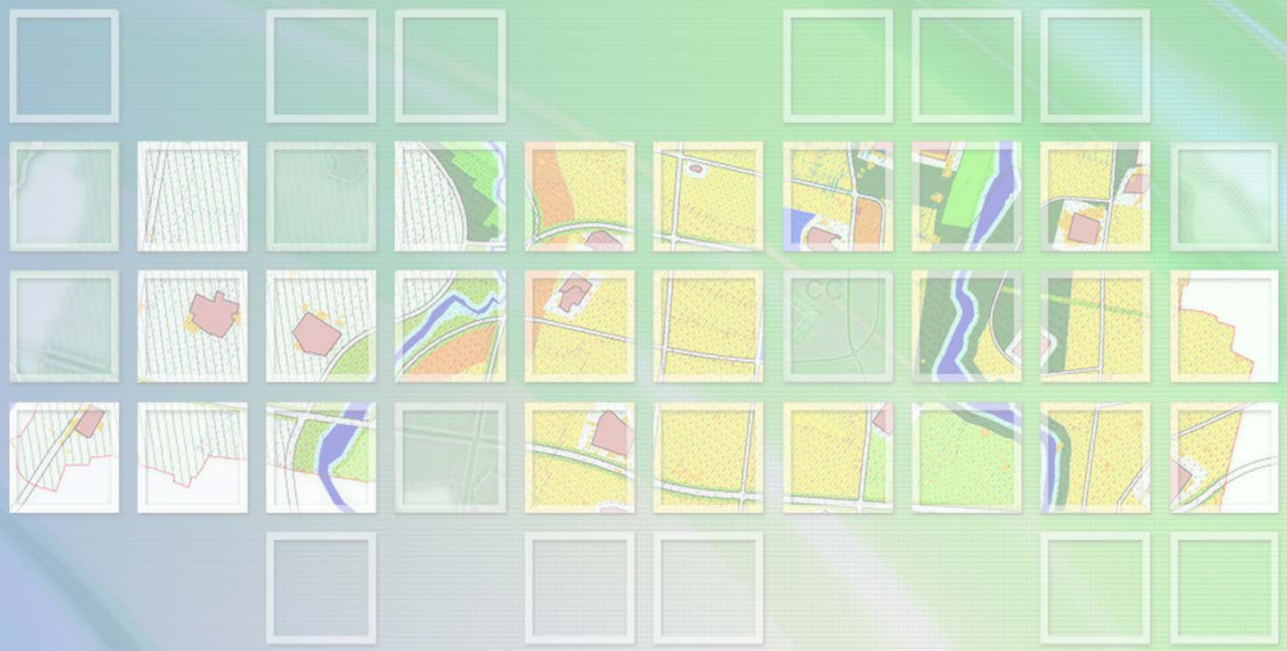
3.2.2 Threats/Constraints

There is encroachment of unauthorized developments within the environmentally sensitive hilly region and within the designated PLPA zone. Although no development is allowed in that area, some developments already exist such as two villages, Sultanpur and Paraul. Regulations must be strictly implemented so that the problem of continuous unauthorized development in the ecologically sensitive area is not aggravated.

Rapid urbanization may result in massive environment degradation if it is not carefully carried out. This threat can be overcome by conducting EIA for all the environmentally sensitive areas. Hence, to pre-empt such situations, greater development emphasis will be placed on areas not deemed environmentally sensitive.

MULLANPUR LOCAL PLANNING AREA

GREATER MOHALI REGION, PUNJAB (INDIA)



Chapter 4

DEVELOPMENT FRAMEWORK

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4. DEVELOPMENT FRAMEWORK

4.1 Vision and Objectives

Under the vision of Mullanpur Eco-town, Mullanpur is envisioned to rise as a distinctive and sustainable playground of the Greater Mohali Area. The existing rivers and their surrounding waterfronts will be enhanced to become prime physical assets of Mullanpur. Mullanpur will enjoy the distinction of being Punjab's first eco-town.

Mullanpur Eco-town offers a new lifestyle for the 21st century. It is planned with new ideas to,

- Protect unique environmental, historical and cultural resources;
- Capitalize on the regional assets and resources to promote dynamic and sustainable economic development;
- Ensure equitable distribution of resources-environmental, economic and social.

Emphasis is placed on encouraging consolidated growth around public transport and urban centre nodes, and building well-serviced and well-connected communities with distinct local character and identity. Its unique features will include renewable energy, solar and wind energy usage, water recycling, zero effluent discharge, zero or low carbon impact development, abundant greenery and a walkable environment. Mullanpur will become a town that is in harmony with its environment and nature (See Annex 1 for summary of planning vision and objectives for Mullanpur LPA).

4.2 Planning Parameters

In planning for GMADA's future development, it is necessary to take into consideration the natural growth, migration, urbanization and economic data of the Punjab region and of India as a whole. Understanding past trends and current level of economic activity can help to produce a feasible population scenario for both year 2031 and 2056.

4.2.1 Economic Projection Analysis

The level and composition of economic activity in the GMADA area is intrinsically linked to development and the population. GMADA's ability to sustain and support the projected increase in population will depend on the creation of employment opportunities.

The projected growth of Chandigarh (projected 4.2% growth for the next 20 years) and S.A.S. Nagar (44.6% urbanized) will have spillover effects. GMADA's economy is anticipated to grow as a result of Chandigarh's expansion.

At the industry sector level, GMADA is known for both its manufacturing base and services, particularly IT industry. The area has established a strong presence over the last 7 – 8 years and leads the Punjab state in terms of exports. The Software Technology Park of India (STPI) at Mohali has triggered the flow of investments in GMADA. With big companies such as Dell Computer, Tata Interactive Services and Quark Media House investing in the area, export for FY2007 is 57.1% (INR 3.21 bn) of total exports from Chandigarh alone. Based on current situation, the projected economic output of the GMADA area is as follows:

Table 4.1: Projected economic output of the GMADA area (INR Bn, FY2000 constant prices)

FY2007	28.5
FY2010	37.9
FY2015	50.0
FY2020	65.4
FY2025	85.1
FY2030	112.3
FY2035	148.8
FY2040	196.4
FY2045	254.2
FY2050	322.9
FY2055	410.1

From the above projection, it is anticipated that the economy of the GMADA area would grow to about four times its current size in 25 years and to around 14.5 times in 50 years.

Considering Chandigarh and GMADA's economic growth potential in the coming years, it is anticipated that economic growth will drive urbanization and can spur further growth in the nearby towns. The 6 LPAs play complementary roles to Chandigarh. This integrated development is promising and brings opportunity for economic and population growth in Mullanpur.

4.2.2 Population Projection for Mullanpur Local Planning Area

Against the favourable growth conditions, four types of population growth scenario can be anticipated for GMADA – low growth, moderate growth, high growth or very high growth.

Table 4.2: Population Growth Scenarios for GMADA

	Low Growth	Moderate Growth	High Growth	Very High Growth
Population 2001	0.71	0.71	0.71	0.71
Natural Growth	0.42	0.42	0.42	0.42
Migration	1.19	1.71	2.74	3.39
Population 2056	2.32	2.84	3.87	4.51

For the purpose of land use planning, Jurong Consultants shall assume the 'very high growth' scenario so as to accommodate the greatest demand and maximize GMADA's potential to develop fully into a competitive region, on par with other successful cities around the world.

The projected population for Mullanpur is 200,000 by 2031 and 350,000 by 2056. Based on the projected population of 200,000 by 2031, the planning parameters for Mullanpur are:

Table 4.3: Projected Population for Mullanpur LPA

	MULLANPUR
PROJECTED POPULATION-2056	350,000
% OF POPULATION GROWTH EXPECTED BY 2031 (assumptions based on Overall Phasing Strategy)	60%
PROJECTED POPULATION-2031	200,000
CLASSIFICATION OF TOWN	Tourism/ Recreational Center
AVAILABLE LAND AREA (HA)	6123.7
GROSS RESIDENTIAL DENSITY (ppa)	100

The projected population is based on the total population of both the rural and urban areas using the gross residential density of 100 persons per acre.

4.3 Planning Strategies

Based on the above analysis and planning parameters, the local plan adopted the following key planning strategies for its proposals.

A. Physical structure and layout

- Formal grid-iron layout
- Focal points and key activity zones
- Key vistas strengthened with carefully designed open spaces, boulevards and buildings that relate visually to each other
- Open spaces designed to encourage wildlife and increase biodiversity
- Create new water bodies and a 'permanent' river
- Preserve places of scenic beauty

B. Usage

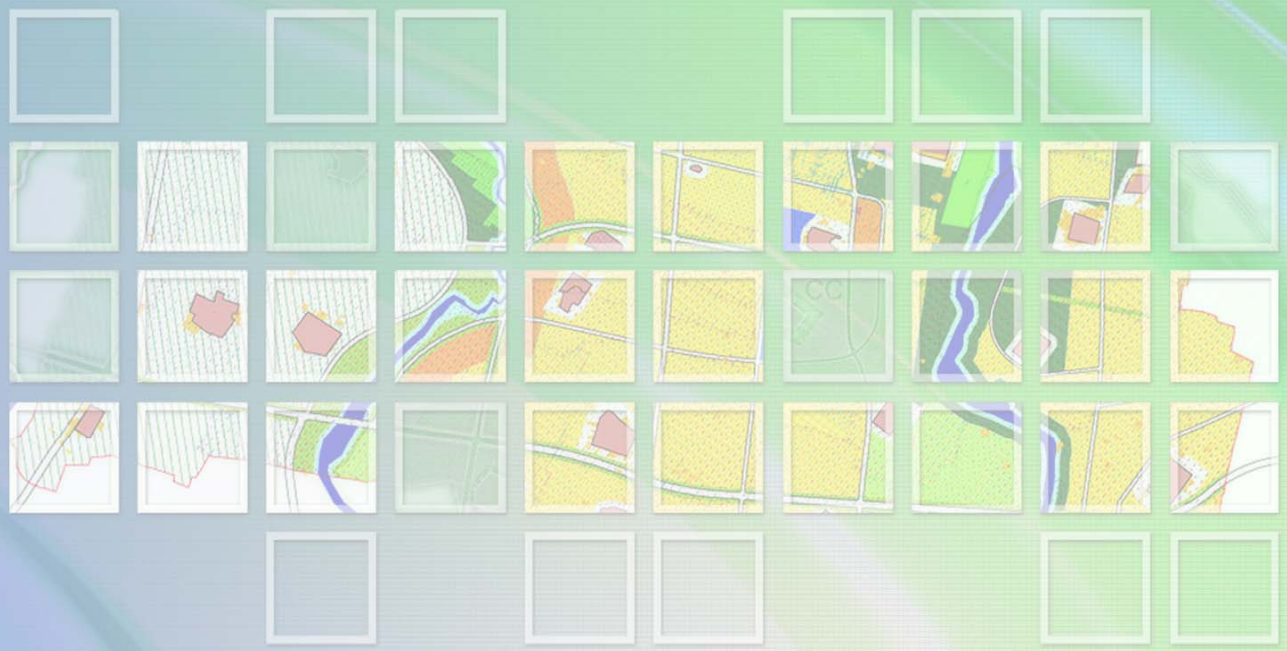
- Good mix of uses
- Facilities and spaces to support education and knowledge industry, medical and eco-tourism
- Wide range of recreational facilities
- Waterfronts fully exploited as areas for public-oriented activities
- Riverside village centres with riverside restaurants, shops and family entertainment

C. Linkage

- Continuous urban waterfront promenade
- Pedestrian linkages
- Road network to improve accessibility and connection to Chandigarh and rest of GMADA
- Public transport connectivity

MULLANPUR LOCAL PLANNING AREA

GREATER MOHALI REGION, PUNJAB (INDIA)



Chapter 5

PLANNING PROPOSAL

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5. PLANNING PROPOSAL

As stated earlier, the objective is to develop an Eco-town with a large urban playground around the area's water asset. Figure 5.1 sets out the master plan. Attention will be given to integrating land use, transport and economic activity. Land to accommodate urban development to 2031 will be identified.

5.1 Land Use Distribution

The land use distribution for Mullanpur LPA is as follows:

Table 5.1: Land Use Distribution in Mullanpur LPA

Land use	%
Residential	27.3
Agriculture	9.5
Rural Settlement & Villages	5.2
Mixed-use Development	3.2
Industrial (Knowledge Village)	2.5
Institutional	3.8
Green Spaces (Open Space, Recreational, Park, PLPA land)	33.3
Transport Hub	0.2
Restricted Area	2.3
Others (water bodies, roads, built-up, etc)	12.7
Total	100

Table 5.2: Mullanpur's Carrying Capacity & Gross Residential Density

	Gross Residential Density (ppa)	Carrying Capacity (Population for Year 2031)
Mullanpur LPA	100	200,000

This land use distribution is reflected in the proposed land use plan for Mullanpur LPA (see attached Figure 5.1).

The rise in residential areas is inevitable to accommodate the growing population of 200,000 persons from 2008-2031. With the number of industries growing in Mullanpur LPA, such growth is expected as a result in the growth in employment. Intra-Urban Migration is expected to be the main catalyst in population growth for Mullanpur LPA. As discussed in chapter 4 of economic and population projection, the growing emphasis of IT related industries and services intensifies the attractiveness of the LPA. For Mullanpur, the Knowledge Village, Health Village, Educational Institution and Service sector will propel future growth. As a result, the decrease in land used for agriculture can be expected to accommodate to this growing population and industries. The decrease of 4052.7 ha is necessary to spur urbanization within Mullanpur LPA.

Industries in Mullanpur will shift towards more service-oriented businesses such as IT, Health and Tourism. Existing brick kilns and wastelands will be removed due to its incompatibility with the surrounding land use and the hazard it poses to the area and people living and commuting in Mullanpur LPA.

There is no change in the area of the restricted defense site or the PLPA land.

5.2 Housing

Housing of different densities is envisaged (see Figure 5.3). New residential areas will be developed at densities that take into account the overall efficiency of existing and proposed transport and infrastructure services. There is opportunity to build eco-housing that features the latest carbon-neutral technologies. A variety of housing choices including waterfront housing will be provided. Shivalik Hills, being the main attraction of Mullanpur, will have an impact on the housing guidelines for the urban housing.

In the computation of housing provision, the computation does not include transient population, students' population, workers' population and tourists, whose numbers tend to fluctuate according to seasonal trends. The calculation is done based on a nett area (gross area X 50%), taking into account the need to provide social facilities, utilities, neighbourhood parks and transport corridors, etc within each residential land parcel.

The predominating characteristic of the housing and urban structure in Mullanpur is its spacious planning. Low density planning emphasizes the historic continuity built environment and provides opportunities for greening and for purification of air that support the creation of sustainable towns.

5.3 Mixed Use Development

The prime objective of the mixed use development is to provide a variation of retail, entertainment, accommodation and marketing convenience for residents, workers and tourists. These are primarily located along the rivers and major arterial roads. There will be two riverside village centres (marked 'regional centre' and 'town centre' in Figure 5.3). These are places that are encouraged to be pedestrian-oriented and of higher density development. The provision of adjacent and connected parks, open space and trail is vital to the livability and vibrancy of these places. The other mixed use area is the 'Neighbourhood Centre' (NC) along MDR B, located within the housing areas.

Planning Rationale (Mixed Use Development)

Based on the retail service hierarchy, the regional centre (RC) is expected to be the most intense, providing a wider catchment radius of at least 1 km. In order to maximize the waterfront urban edge, the selected site for the regional centre (RC) lines the waterfront. This site (107.7 ha) is earmarked for its strategic location, centrality, view and its high potential for retail and commercial businesses to flourish. It forms the main commercial hub of Mullanpur. The location of the proposed transport terminal in close proximity to this commercial hub heightens the site's easy connectivity and accessibility to the other LPAs and Chandigarh. Geographically, this main commercial centre is located at the centre of the most intensively built-up and populated area, accessible from 2 major arterial roads (MDR B and PR 4) to allure the most number of visitors. In addition, the site is carefully planned by incorporating road alignments and vista lines to emphasize its focal point in the whole of Mullanpur.

Other smaller mixed use areas are equally distributed throughout the LPA to provide an even coverage in terms of commercial catchment. Town Centre (TC) serves the north-eastern sector of the LPA, NC takes care of the north-western sector while the amenity centres within the R&D land parcel service the southern sector. TC, located along the MDR B to Mullanpur from Chandigarh forms the Eastern gateway while NC presents the Western gateway to Mullanpur from the other neighbouring town of Kurali via MDR C.

Focal points and key activity zones will be created within these mixed use development sectors to orientate and relate uses to different needs and customers. As a regional centre, the vision is to develop the RC site into a vibrant and trend setting commercial-leisure hub, serving a larger population catchment and offering the widest range of shopping and specialty goods and services. There will be 'signature' hotel and commercial facilities, the greatest range of restaurants and a myriad of arts and cultural attractions along the waterfront. One can expect a higher proportion of branded shops and a wider range of entertainment facilities setting up here to cater for both locals and the wider regional population.

The smaller centres along the MDR B (TC and NC) serve smaller populations and provide different attractions and services to the population. TC and NC will take on a more local specialization, hosting the range of shops and usage mix that will visibly position them as the respective Eastern and Western gateways to Mullanpur.

5.4 Industrial

In section 4.2.1 of this Report, economic and market studies indicate favourable prospect of the Greater Mohali Region becoming a technological and services hub in Punjab and India, with double digit projected growth of 14.5 times by 2056. To cater to this growth, the Greater Mohali Region and Mullanpur should develop the relevant industrial and business spaces. As the changing industrial needs are towards science and knowledge-based industries rather than land and labour intensive industries, the business space orientation must include mixed uses and the development of Business Parks.

Business Parks (total size of 324.4 ha) will largely be high technology, value-added kind of industrial development in the form of Science Park, Business Park and R&D parks. The target industries include education and knowledge industry (Knowledge Village) and medical-related R&D (Health Village). Spaces and facilities including post-operative care will be provided to support medical tourism (See section 5.8 under Special uses/ Concepts for elaboration on the Health and Knowledge Village).

Applying the appropriate FSI norms and the industrial worker density norm for the different types of industries, the estimated workers population is 114,090. Allowing an additional 10% for support industry, the ultimate workers population is 125,499. The breakdown is as follows:

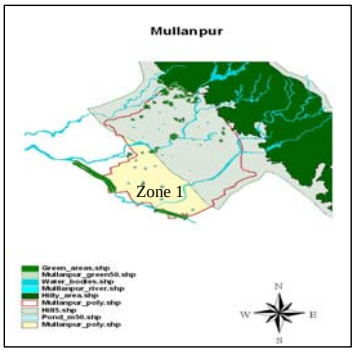
Table 5.5: Summary of Area and Estimated Worker Population for the three Industries

	Types of Industries		
	Health Village	**Education Institution**	**Business Park (R&D)**
Area (sq m)	1,497,000	268,000	1,549,000
Possible FAR	1.0	1.0	1.75

A viable rural industrial sector, capitalizing on existing advantages and ready to meet changing circumstances is also encouraged. Land will be allocated for organic farming, horticulture, agri-business and associated industries.

Planning Rationale (Industrial)

Figure 5.4: Zone 1 shows the Best Location for the Development of Industrial Areas within the Mullanpur LPA



The south-western areas of Mullanpur have been earmarked for industrial development. This is based on the environmental consideration for that area. Zone 1 in Figure 5.4 suggests the feasibility of locating the Industrial area there due to its unencumbered land that is located away from the highly sensitive areas of the PLPA. The selected site is suitable for development of low impact industries such as Business Parks and Agri-technology farms. This reduces the pressure of development on the environment.

A key objective in planning for employment is to provide sufficient land for a range of industrial uses including high technology and R&D industries in support of Mullanpur's economic development strategy. The Health Village and Knowledge Village are situated at opposite ends, on the fringe of Mullanpur to yield a better environment, improved accessibility and greater potential for economic growth. Such fringe locations offer the added advantage of moving workers and vehicles away from Mullanpur without traversing the residential areas. These vehicles need not go through the town and residential areas to reach their destination. From traffic management perspective, congestion is minimized as traffic to Business Parks is segregated from 'domestic' traffic. In addition, the location of the employment nodes at the two opposite ends of the LPA provides a more balanced distribution of jobs and housing. Growth and economic benefits are decentralized to maximize the use of land and optimize the spatial distribution of housing and infrastructure in Mullanpur.

As with other successful Business Parks around the world, it is crucial to integrate nature within the Business Park. The Health Village is located between the restricted PLPA land and a major park to provide a green environment for health and well-being.

The Knowledge Village on the other hand, enjoys the peripheral view of the sports and recreation centre, which aims to house a golf course and maintain its greenery.

Figure 5.5: Suzhou Industrial Park, China, where green spaces border the Business Park

Another rationale for the location is to optimize the use of industrial land at location of good accessibility. Both the Health Village and Knowledge Village are located along major arterial roads (MDR B and PR4). Good connectivity plays an extremely important factor in the success of industries. By staying connected to other LPAs and cities like S.A.S Nagar and Chandigarh, Mullanpur's industries will be able to tap into the pool of "out of town" workers where the need arises.

5.5 Open Space and Recreation

Open spaces and recreational areas in Mullanpur are important elements in the overall Greater Mohali Region strategic plan. Mullanpur's plan is to complement the other LPAs by providing a vibrant must-see recreation destination and attraction to both locals and tourists. It is intended to be the playground of Greater Mohali Region. For other LPAs, Mullanpur is the neighbouring hinterland to fulfill their recreational needs. Thus, it is important that provisions of open spaces and recreational areas focus on not only quantitative increase in new parks, but also qualitative improvements where nature and cultural values are preserved, and where park areas provide ample opportunities for contacts, experiences and the enjoyment of life. The greatest tourism resource is the land. The key strategy is to protect, manage and enhance areas of significant biodiversity, nature and cultural conservation in local planning and protect viewscapes for tourism and community. The surrounding forested areas of Shivalik Hills and the PLPA land provide scenic visual backdrop to the urban development.

A benchmarking study is conducted to determine the best provision of open and green spaces for Greater Mohali Region.

Table 5.6: Benchmarking study of open spaces planning guidelines

S/no.	Countries	
1	USA (San Francisco)	3.1 ha/ 1, 000 persons
2	USA (New York)	1.8 ha/ 1,000 persons
3	Canada (Vancouver)	3.5 ha/ 1,000 persons
4	Australia (Sydney)	2.36 ha/ 1, 000 persons
5	Singapore	0.8 ha/ 1,000 persons
6	GMADA	1.8 ha/ 1,000 persons

Using the 1.8 ha / 1,000 persons guideline, the total site area required is 360 ha for Mullanpur's population of 200,000 and 630 ha for year 2056 projection of 350,000 persons.

Table 5.7: Mullanpur's provision of open spaces and recreation areas

	Recreation Centre / Parks / Open Spaces
Site Area required	630 ha
Area proposed	877 ha
Deficit / Surplus (- / +)	+ 247 ha

The total land area of recreation, parks and open spaces set aside is 877 ha, giving Mullanpur a surplus of about 247 ha to be used for leisure, recreation and tourism.

Planning Rationale (Open Space and Recreation)

As shown in attached Figure 5.7, green spaces (including PLPA land) make up 33.3% (2037.4 ha) of Mullanpur's total area. A green matrix of protected forest, wetlands, open spaces and greenways (park connectors) is envisaged to provide the community with accessible green spaces and diverse opportunities for recreation. Natural open space such as forest and wooded areas, nature reserves, wildlife habitat areas and other areas of ecological merit will be preserved. Land for parks and gardens are also set aside for regional, city and neighbourhood use. Part of the green spaces at the southern part of Mullanpur is a sports and recreation area that include sports stadium, horse-riding grounds and golf courses. Other green spaces are the agricultural area, boundary separators and the green buffers.

In the period to 2031, particular development options include:

- Waterfront parks or Gardens by the Rivers are envisaged to bring a pervasive garden ambience and more entertainment, leisure and recreation activities and development to Mullanpur. The Gardens by the Rivers will complement the necklace of new play spaces that have been planned for around the rivers and edge of Mullanpur;
- New play spaces for informal and formal recreation such as sports hub, golf course and resort, chalets, turf club, equestrian centre, etc;

- New areas of ecological and nature conservation interest to improve biodiversity such as arboretum;
- Green cycle routes, footpath links and corridors;
- Extensive areas of landscape buffer to create a high quality environment and integrate development into the landscape. There will be green separators between residential / industrial areas as well as green buffers along roads and planting strips along road dividers to form a comprehensive green network.

Parks 5, 6 and 8 are potential sites for the development of Gardens by the river as well as new play spaces for formal and informal recreation. Thematic development of specific parks (e.g. skateboarding and youth Adventure Park) could be introduced as part of the new playscape. This is a viable joint venture with the private sector. Park 1 and the other smaller park plots, especially those near the rivers are best suited to be developed as wetlands, botanic gardens and arboretum of special flora and fauna from around the world.

Park 8 is an important open space for Mullanpur because the 161.7 ha land capitalizes on the scenic beauty of the Shivalik Hills while providing a one-stop destination for eco-tourism in Greater Mohali Region (see section 5.8 on special uses). Located adjacent to the Health Village, this park lends an ideal serene setting for the recuperation and well-being of both the sick, tired and well.

The setting aside of a sizable piece of contiguous land for regional recreational centre at the south-western side of Mullanpur offers immense development potential for major sports stadiums, lifestyle sports hub, golf courses and turf cities. By locating it near Mullanpur's boundary, such development offers a good natural buffer and distinction to the LPA boundary. In addition, its location on the fringe of Mullanpur allows room for future expansion through extension into adjoining land. The peripheral location may also alleviate traffic congestion during different sports season by ensuring easy connection via the PR 4.

Others smaller parks and open spaces are suitably located in the residential areas. Good quality living environment is created with a good distribution of green spaces near housing areas and the designation of appropriate and sizeable pieces of land as regional open space. The land affected by the PLPA further provides a good natural reserve to maintain the ecological equilibrium of Mullanpur urban developments. The PLPA ensures that a constant and large amount of green areas is available in Mullanpur.

Rural recreation opportunities and natural resource activities such as farmstay, hikes and trails, etc will be enhanced. Guidelines will be formulated to ensure that there are sufficient building setbacks and 3 m to 5 m green tree planting strips along the internal roads to produce a pleasant and green environment. In addition to transforming Mullanpur into a playground for the whole of Greater Mohali Region, planning guidelines will further emphasize Mullanpur's eco-town image.

5.6 Transportation

The GMADA Structure Plan Report – Transportation covered the provision of transportation infrastructure to meet the requirements for the projected development and population growth of the Greater Mohali area till year 2056. The proposed transportation infrastructure covered the following headings:

- The road network,
- The public transport system including the bus as a future public transport mode and the mass transit studies,
- The railway network in the area, and
- Chandigarh Airport.

This Report covers the transportation aspects of the Mullanpur Master Plan, which is 1 of the 6 Master Plans covering 6 study areas in the Greater Mohali area. This Report uses the "GMADA Structure Plan Report – Transportation" as a backdrop, and develops the proposals to a greater level of detail. The overall transportation concept plan is shown in Figure 6.6.1.

The Mullanpur Transportation Master Plan covers the following:

- The proposed road network
- Safeguarding of roads' right-of-way (ROW)
- The existing and future bus system
- Transit system studies
- Provision of parking facilities.

5.6.1 The Proposed Road Network

The proposed Master Plan road network (See Figure 5.9) has been developed in collaboration with the land use proposals for the Mullanpur planning area. The proposed road network has the following features:

- The network is built around the existing road network to strengthen and improve the existing road network's effectiveness and coverage,
- The road network has adequate capacity to cater for the projected traffic flows.
- The network links major destinations directly to facilitate the direct the routing of trips and avoid the routing of extraneous traffic within neighbourhoods and precincts,
- The network permits the staging of construction so that roads need only be built and extended when required.

The land use proposal in the Master Plan is for Year 2031. The proposed roads and their recommended rights of ways (ROWs) are, however, based on traffic forecasts done for year 2056 at the Structure Plan stage for the whole GMADA area and documented in the Structure Plan Report. The proposed road network in the Structure Plan forms the overall road blueprint for the development of the Greater Mohali area. Based on traffic analysis done at the Structure Plan stage, the forecast traffic for the major roads for year 2056 was estimated. From that basis, the overall road network for Mullanpur was developed with adequate traffic capacity to meet the forecast travel demand. The forecast has also guided the proposed hierarchies of roads, the planning and development of the major roads and the local roads in the overall road network, and helped determine the proposed number of traffic lanes for each of the major roads including safeguarding the full ROWs required for the long term road reserves in the land use plans. The recommendations for the safeguarding of these ROWs can be found in the ensuing Section.

The Proposed Roads

The urbanisation of the Mullanpur planning area as shown in the land use plan will require many new roads to be built to meet the forecasted future travel demand. The total road network in the Master Plan, comprising existing and proposed new roads, includes the following:

- The GMADA Expressway (PR 1). The proposed alignment runs close to Mullanpur, Kharar, SAS Nagar, Banur and Lalru and will offer an alternative route to MDR A, linking the northern and southern parts of the Greater Mohali area,
- MDR B,
- MDR C,

- PR 3. A proposed major arterial road, which is a westward extension of PR4 from Mullanpur. The proposed road, which will intersect the GMADA Expressway, will reduce journey times from Chandigarh to northern Punjab. It then extends further north-westwards to Anandpur Sahib and forms one of the main linkages to Himachal Pradesh.
- PR 4. A proposed northwest major arterial extension from Chandigarh between Sectors 25 and 38 (Dakshin Marg) through Mullanpur to intersect MDR C. This proposed extension will provide a new link between Chandigarh and the proposed urbanized areas at Mullanpur.
- PR 6. This proposed major arterial road runs in a north direction between Sectors 73 and 74, SAS Nagar to Mullanpur (Anandpur Sahib). En route, it intersects NH 21 and the proposed PR 5. Part of the route of PR 6 from the edge of SAS Nagar up to PR 5 is based on a proposed road shown in the SAS Nagar Master Plan (1996 – 2016). East of SAS Nagar, this major arterial road continues as PR 7.
- PR 13. This proposed road starts at PR 6 at its eastern end to run north westwards to intersect MDR C and the proposed GMADA expressway before proceeding north-westwards towards Anandpur Sahib. Together with PR 3, PR 4 and PR 6, this proposed road will provide vital road capacity to the planned urbanized areas at Mullanpur.

Aside from the above major arterial roads, the Mullanpur planning area is also served by a network of collector roads and primary access roads. Figure 5.9 shows the overall road network in the Master Plan.

Proposed Road Cross- Sections

The proposed road right-of-way to be safeguarded for the long term plan is shown on Figure 5.10. The typical road cross-sections of the various hierarchies of roads are shown on Figure 5.11. The road cross-sections are adapted from the road cross-sections developed by the Indian Road Congress (IRC). They have been suitably enlarged to incorporate additional provisions for the laying of underground utility service lines for application in the Greater Mohali area. The justification for this enlargement of the road cross-sections and details on how the space will be safeguarded and used for the laying of underground utility services are detailed in the Chapters dealing with Infrastructure in the Structure Plan Report.

5.6.2 Safeguarding the Roads' Rights of Way (ROW)

A total effort is required of the planning and road authorities to ensure that the components of the overall road network are secured and that the land making up the roads' ROW is set aside.

Land for the roads' ROW is usually secured in the following two main ways:

- Through land acquisition using the country's land acquisition laws. This is usually done when a particular road has secured financial approval for implementation, and the ROW has to be secured on an urgent basis. Land owners are compensated for the land taken and encumbrances cleared.

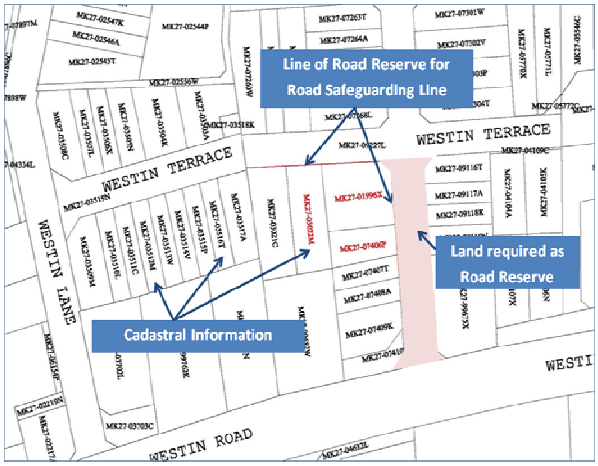
- Through the development control process. In this process, the planning approval for building development is used as a mechanism to secure land for the roads' ROW. In this process, land required to form the future road's ROW, and which falls within the lot of land is required to be vested in the state as a planning condition for that development. Land subdivision takes place on completion of the building, and the ROW is identified as a new lot to indicate that it is a ROW for a future road. The process is expedient but necessary. Otherwise, land approval for building development would be lost for good and the road, if required, would require costly and wasteful acquisition by the state.

However, before land can be set aside via the development control process, the ROWs of all roads (major and minor) have to be demarcated onto lithographic plans, which contain cadastral boundaries of all lots of land. This is a major process by the land survey, planning and road authorities. The development of the

road network's ROW for an urban area is a massive effort by the land surveying and planning organizations. The updating of such information is a continuing process whenever the road network is revised. There is no short cut to this process though computerization of many land surveying and planning processes in recent years has made the mechanism less laborious.

Such plans are called Road Line Plans (RPL) in Singapore. RLPs are sold by the Land Transport Authority (LTA) in Singapore and can be conveniently downloaded. Singapore has had such RLPs to guide land owners, developers and architects for many years. A sample of a RLP is shown below.

Figure 5.12: An Example of Road Line Plan



5.6.3 The Existing and Future Bus System

The Existing Bus System

The area is at present largely rural. Development densities are extremely low. Bus services are sparse and infrequent as demand for bus services are low. Bus services ply along the major roads. Many of the villages are unserved by bus services and have to rely on para-transit modes and private transport modes.

The Future of the Bus System

However, as Mullanpur is progressively urbanised in accordance with the Master Plan as a tourism hub with low density resort living, the character of the entire area will be transformed. Demand for public transport will grow with population growth and will have to be addressed. New bus services will need to be introduced to serve not only the areas within Mullanpur but link the Mullanpur area with the rest of the Greater Mohali area, e.g. to Chandigarh, SAS Nagar and Zirakpur just to name a few examples.

With rising income too, the expectation of the bus commuter will rise. While the cheap and spartan bus service seen in Chandigarh and SAS Nagar today suffices, improvements will have to be made to the many facets of bus service over time. And that includes the future bus services for Mullapur. It is crucial to recognize the need to develop and improve the bus transport system to cater to the travel needs of people who do not own private transport modes.

Buses will continue to provide trunk public transport services and serve as the backbone of the public transport system in the area. Bus services are flexible. Bus routes can be easily changed and schedules adjusted to meet changing demand. There are buses of different capacities and performance to meet the different requirements of bus operators.

There are many areas in which improvements will need to be considered to make bus travel more comfortable. The bus commuter's total travel experience includes his experience at the bus interchange or bus stop, his ride on the bus and his walk at the start and end of his journey. Improvements to all these facets can be addressed. The following proposals can be considered:

- Upgrade existing bus fleet by having newer and more comfortable buses
- Provide better facilities for waiting passengers at bus terminals and interchanges
- Display bus arrival and departure schedules at bus terminals and interchanges
- Provide bus shelters and seats and lights at bus stops
- Build covered pedestrian linkways from bus stops to the nearby buildings
- Improve bus routing and expand coverage
- Improve bus operating schedules

- Implement bus priority measures e.g. bus only lanes, along the major roads
- Adopt integrated ticketing system for all transit services.

Some of these measures are illustrated in Figure 5.13.

With the planned urbanization of the Greater Mohali area over the next few decades, bus travel demand will grow in tandem. New bus terminals in the new urbanized areas will need to be developed to serve the new and expanded bus services and routes. Opportunity must be taken to integrate these terminals vertically and horizontally with the commercial development of the urban centres. The commercial development can include offices, shops, department stores, supermarkets, food courts, medical suites, gymnasiums, etc. The attractiveness of such commercial areas will be enhanced due to their excellent accessibility while the heavy movements of bus commuters and pedestrians will be made seamless. In doing so, the bus as a public transport mode will be enhanced. Such integration is indeed a brilliant business idea as the human traffic from the offices and shopping malls to the bus interchange is extremely heavy.

Opportunities must be seized to bring in such integration at appropriately located sites that are zoned for commercial development in the Mullanpur Master Plan. See Figure 5.9 for the proposed site for a transport interchange.

5.6.4 Transit System Studies

The GMADA Structure Plan Report – Transportation has addressed sufficiently the longer term requirement for a transit system suitable for the Greater Mohali area. JURONG Consultants would like to emphasize that it is imperative for a technical, economic and financial feasibility study to be conducted for the proposed transit systems and transit networks. These detailed studies are necessary before sensible and proper safeguarding of transit corridors and transit stations can be established.

There are many available alternative public transport or transit systems but the appropriate type can only be determined on completion of these detailed studies. The proposed system can be an all bus system, a bus rapid system (BRT) or a light rail system (LRT) and/or a heavy rail system (MRT). The recommendations of these studies are important as they will determine the extent of the routes, the width of transit corridors to be safeguarded, the development setback requirements, the size and footprints of the stations and the depot size and footprints and whether the system is at-grade level, elevated or underground or a combination.

Thus, any transit proposal shown in the land use plans at this stage is only indicative and based on preliminary land use and load assessment. JURONG Consultants would like to highlight that these are subject to changes and verifications following the detailed study.

5.6.5 The Provision of Parking Facilities

The policy directing the management and operation of car parking facilities in an urban area like SAS Nagar is very much an integral part of the overall transport policy. This is also the case for urbanized Mullanpur. The parking policy should touch on the standards of provision, the locations of the car parking facilities and the cost of parking as these facets have a strong influence on the travel mode choice of motorists into the urban area.

The standard of provision of car parking lots for the different building types and land uses is likely to be spelt out in the local legislation. It is not clear from the responses to the consultant's queries as to who regulates the provision of car parking facilities in new development and who regulates the operation of parking facilities in existing buildings and as well as on-street parking. But it is clear from observations in the older quarters and sectors of Chandigarh that the provision of parking facilities looks very inadequate. Vehicles are parked haphazardly along service roads and grass verges and open grounds. It is apparent that many of the older buildings have insufficient parking facilities or none at all.

JURONG Consultants understand that car ownership level in Chandigarh is the highest in India. With increasing income, car ownership trend will continue to rise. It is not clear whether studies had been done to examine the impact on car parking requirements, especially in the urban areas as a result of the increase in car ownership

levels over the foreseeable future. The impact of the high projected car ownership level in the foreseeable future has to be recognized, and addressed in terms of the urban area's parking policy and provision.

Two important matters require address,

- That there should be current standards of parking provision for the different development and building classes, and

- That there is an established methodology in the planning and building byelaws for the systematic provision of vehicle parking facilities by building developers through the development control process.

High car ownership has to be taken into account in the standard of parking provision for residential development.

An important point to note is that the parking "problem" cannot be solved over a period of a year or two. The policy has to be established, and the measures have to be systematically applied in a sustained fashion over the longer term future. Manpower has to be trained to draw up parking standards and identify locations of parking facilities when local development plans are drawn.

Over time, new buildings will have to be self-contained in parking facilities, and on-street parking can be progressively removed to maximize road space for traffic flow and create a more attractive streetscape for the community.

5.7 Social Infrastructure

Following the structure plan, JURONG Consultants have further refined the social infrastructure required for Mullanpur LPA. At the regional and city / town level, clusters of community and social facilities including education institutions, fire station, libraries, markets will be provided close to the housing areas (See Annex 2 for a list of facilities and its provision).

Based on the parameters of 40,595 dwelling units, the amenities required for a town are shown in Figure 5.14. Some facilities like the bus interchange and bus depot are built together under one transport hub. Other community facilities such as the fire station and police post must also be highlighted and included in the land use proposal to assist future planning.

Planning Rationale (Social Infrastructure)

The plan provides for a civic and community institution site next to the riverside town centre. Social facilities such as the community centre and library will be located within the civic and community centre land parcel to act as a meeting point for the residents. This land parcel plays an important role in building camaraderie among Mullanpur's residents. This land parcel is centrally situated between a park, commercial centre and residential areas to attract residents to its facilities and the town centre. It is envisaged that this land parcel will house various social facilities such as the integrated sports and recreation centre which include a swimming complex, recreation club and a multi-purpose hall.

The strategic location of the fire station on the residential land parcel adjacent to the civic and community centre is to tap the road connectivity of Mullanpur. It is situated in a central position within Mullanpur to minimize traveling time to all parts of Mullanpur when the need for its services arises. Similarly, two police posts are situated within residential areas, close to roads for convenience of both officers and the people needing help during emergencies.

5.8 Special Uses / Concepts

5.8.1 Restricted Sites

As shown in Figure 5.15, there are two sites with restricted developments – The first is the defense site (140.8 ha). The second is the land affected by the PLPA (1150.2 ha). There must not be any development on these two sites. As elaborated in section 2.3 of the environment chapter, the PLPA areas are ecologically sensitive areas that warrant protection from both planned and unplanned developments.

5.8.2 Eco-park

Another land parcel that is under special uses is Park. Reflecting the broad planning intention for this area, this piece of land is allocated for the development of eco-tourism. Eco-tourism, being a priority area in Mullanpur's development, must ensure that developments here are environmentally friendly and sustainable.

The intensity of the development here has to be low (recommended FSI 0.3 maximum). Eco-parks with nature youth camps, eco-friendly accommodation, trekking and nature walks, herbal eco-tourism, visitor interpretation centres, adventure sports, etc. may be developed in this designated area.

A seamless extension of forest and open spaces, With its chalets, camping grounds, parks and a variety of leisure and recreation spaces in and around the water edge will further enhance Mullanpur 's attraction as the 'playground' of the Greater Mohali Region.

Figure 5.16: Examples of Eco-Friendly Developments

5.8.3 Health Village

The Health Village (149.7 ha) offers a medical community complete with specialty hospital, outpatient facilities, pre- and post-operative care, rehabilitation and long-term care facilities, hospice and diagnostic laboratories, healthcare commercial services with emphasis on nutrition, wellness and fitness. It aims to provide a unique healthcare environment for the sick as well as the healthy and kickstart Greater Mohali's medical tourism. The Health Village is home to medical, dental, nursing and allied health schools. It takes advantage of Mullanpur's scenic landscape and extensive leisure and recreation offering to provide quality health care and fitness services and an integrated centre of excellence for clinical and wellness services, medical education and research.

5.8.4 Knowledge Village

The Knowledge Village (154.9 ha) is proposed to move Mullanpur into the knowledge-based economy. Its aim is to develop Mullanpur as the Greater Mohali Area destination for learning excellence and spearhead education tourism development. Knowledge Village will provide land for knowledge-based industrial development including knowledge-based entities such as training centres and learning support entities, Science Park and higher education institutions (medical college, junior college, vocational institutions, etc) to attract knowledge workers to live and work in Mullanpur.

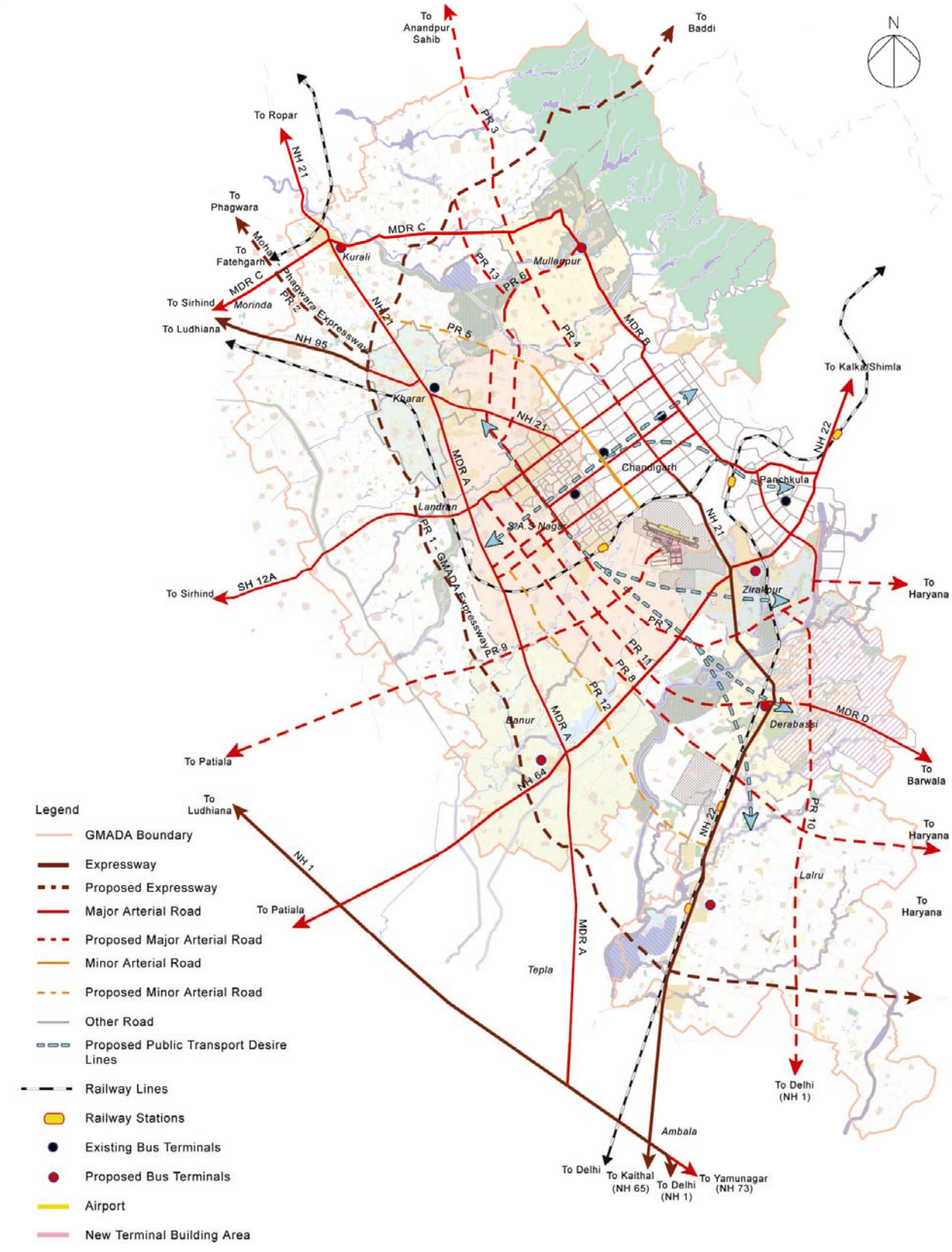


Figure 5.8: Overall Transportation Concept Plan

Figure 5.9: Proposed Road Network in Mullanpur

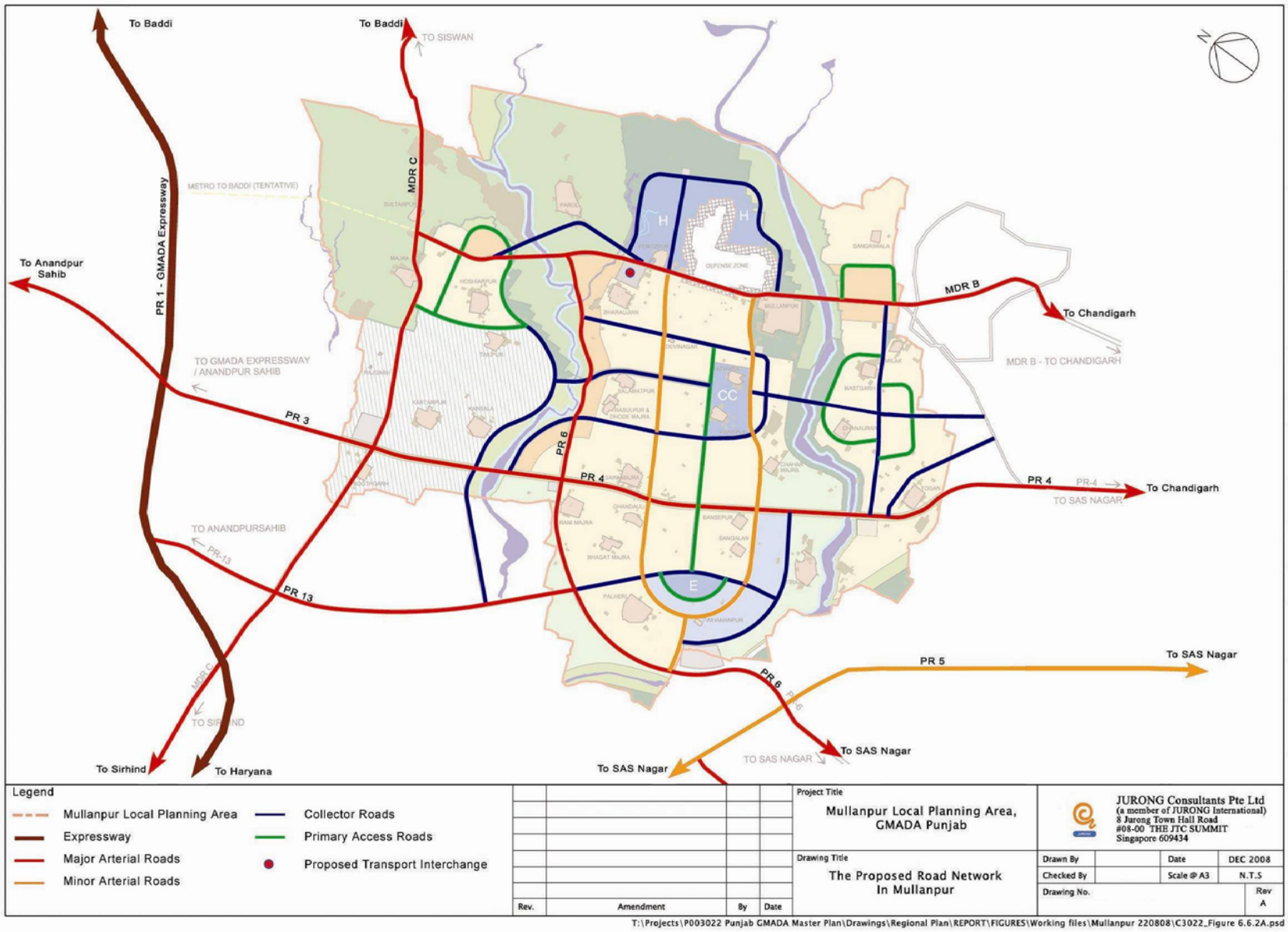
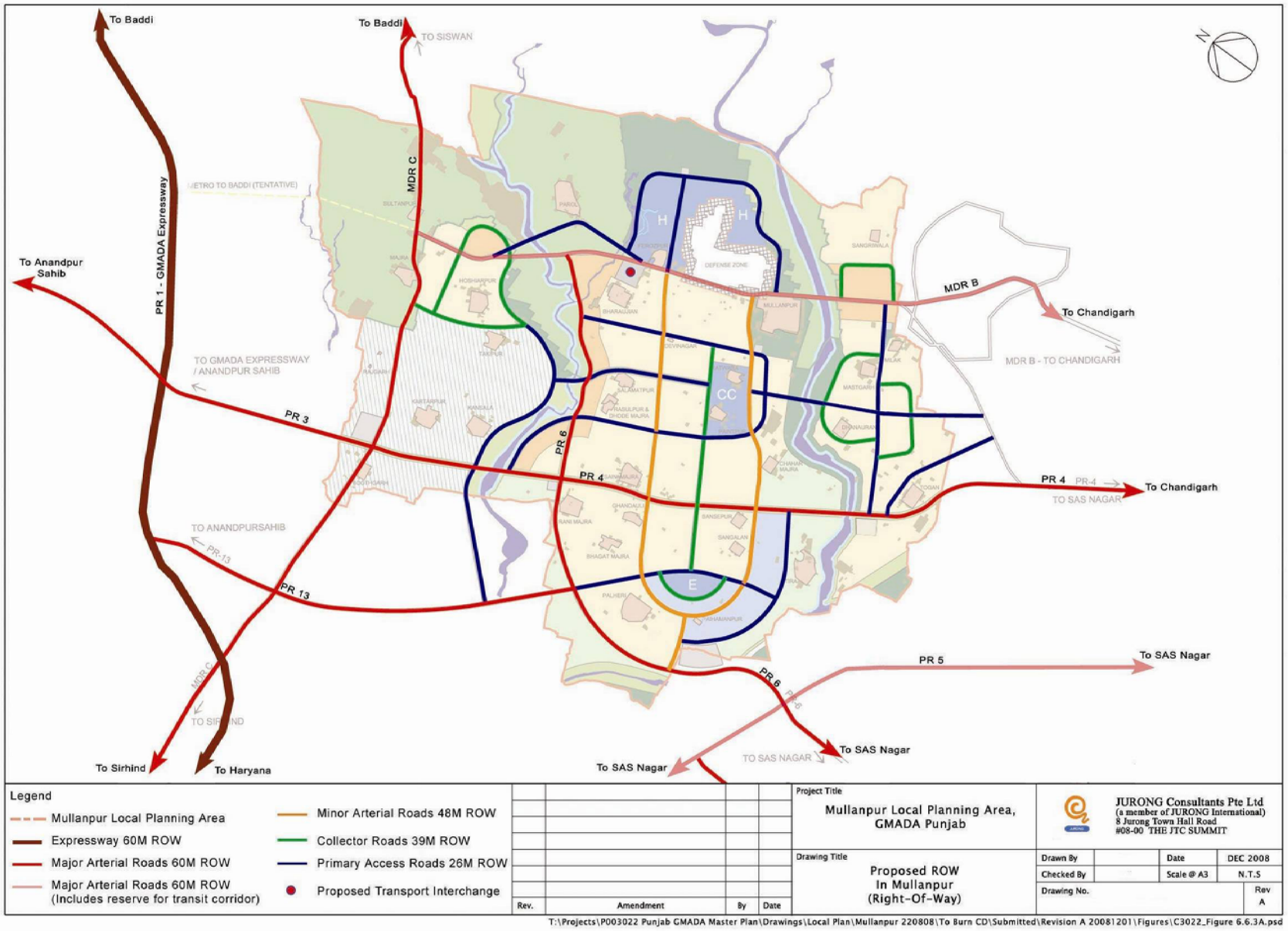
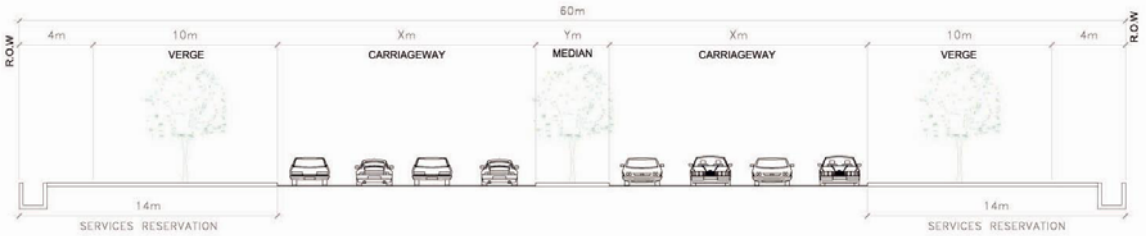


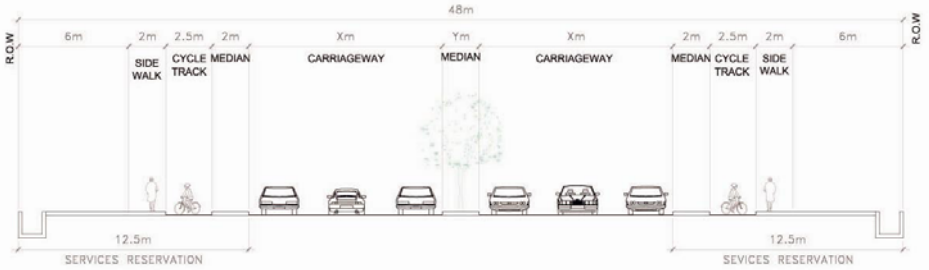
Figure 5.10: Proposed road Right-of-Way to be safeguarded for future expansion





Major Arterial Road (Without Service Road)

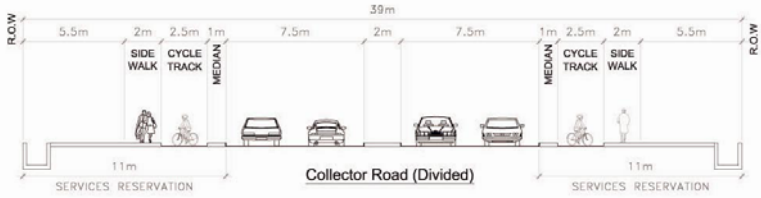
Road Type	Traffic Lanes	X (m)	Y (m)	ROW (m)
Dual 4-Lane	8	14.0	4	60
Dual 3-Lane	6	10.5	11	60



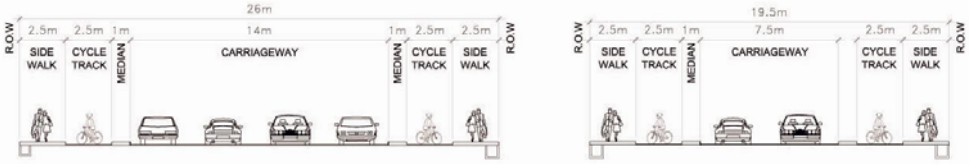
Minor Arterial Road (Major District Road/ Other District Road)

Road Type	Traffic Lanes	X (m)	Y (m)	ROW (m)
Dual 3-Lane	6	10.5	2	48
Dual 2-Lane	4	7.5	8	48

Collector Road (Undivided)



Collector Road (Divided)



Primary Access Road

NOTE:
SERVICES RESERVATION PROVIDED EXCLUDE TRANSMISSION MAINS OF WATER & POWER.

0 5 10 Metres
Scale 1:250

Rev.	Amendment	By	Date

Project Title: Mullanpur Local Planning Area GMADA Punjab

CONSULTANT FOR MASTER PLAN: JURONG Consultants Pte Ltd (a member of JURONG International) 8 Jurong Town Hall Road #06-00 THE JTC SUMMIT Singapore 609434

Drawing Title: Typical Proposed Road Cross Sections (Sheet 2 of 2)

Drawn By	HBH	Date	AUG 2008
Checked By	LKL	Scale @ A3	AS SHOWN
Drawing No.			REV -

Figure 5.11: The typical road cross sections of the various hierarchies of roads

Figure 5.13: Proposed Bus Service Improvement Measures

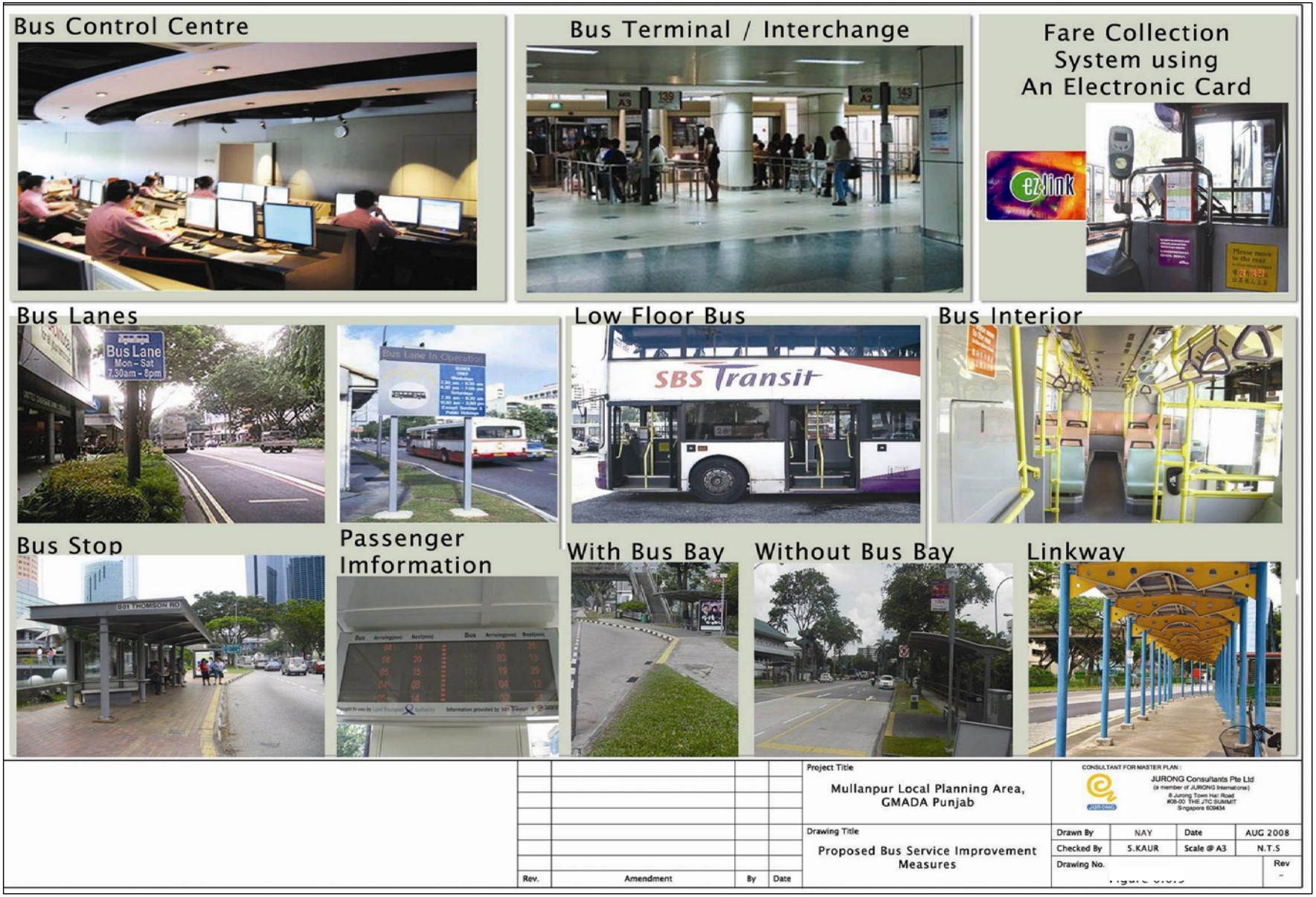


Figure 5.1: Proposed Land Use Plan

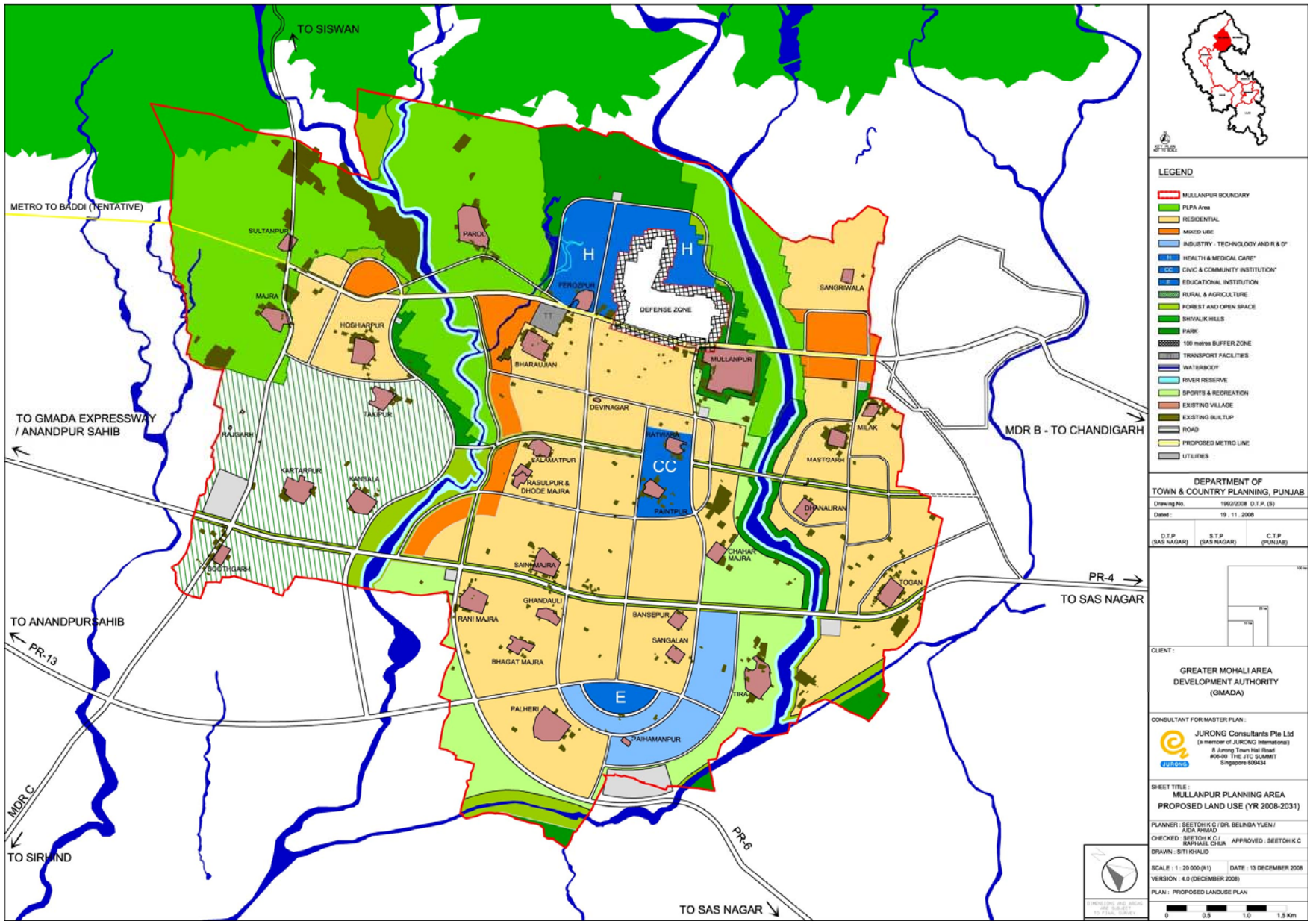


Figure 5.2: Residential Plan

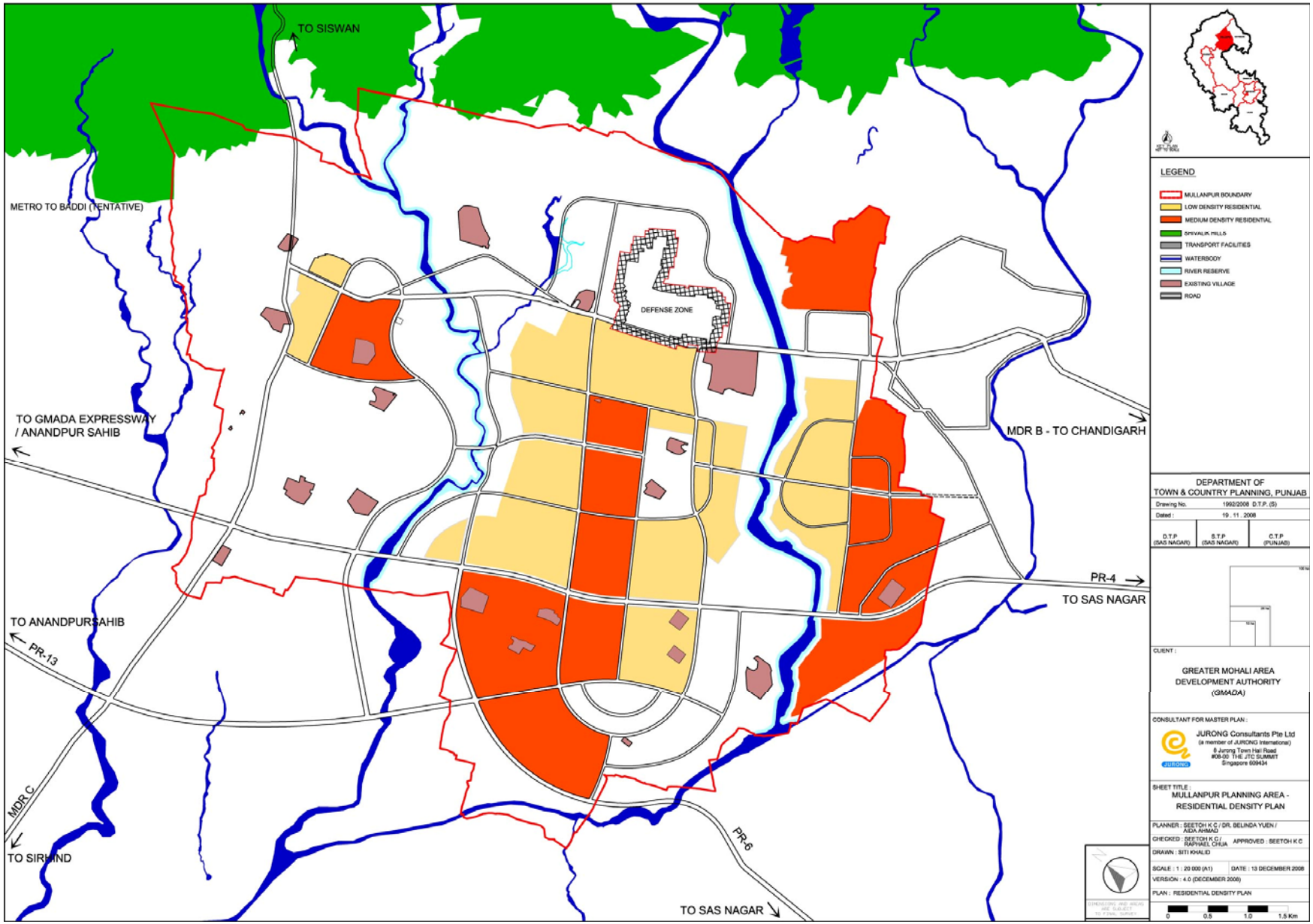


Figure 5.3: Mixed Use Catchment Plan

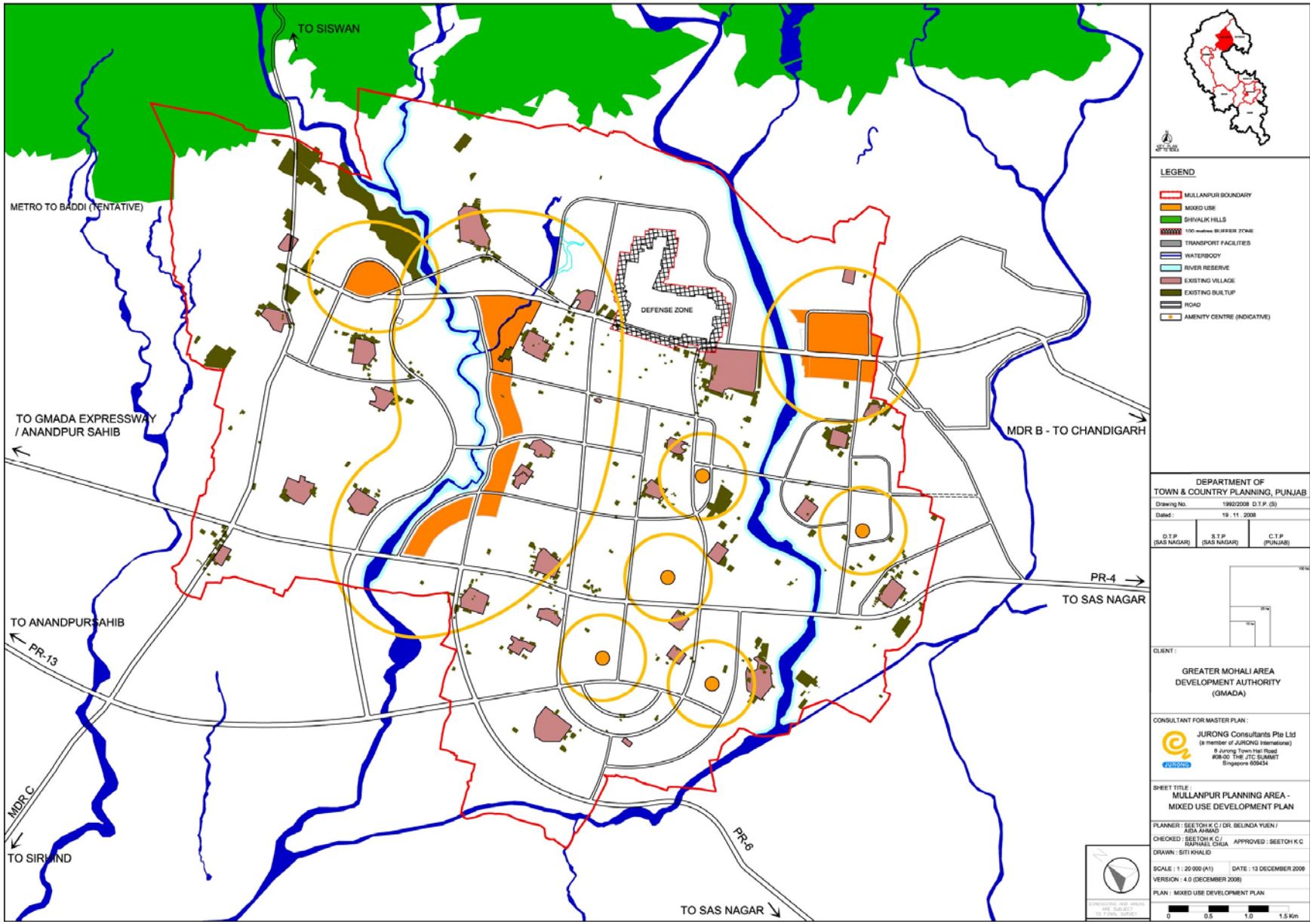


Figure 5.6: Industrial Plan

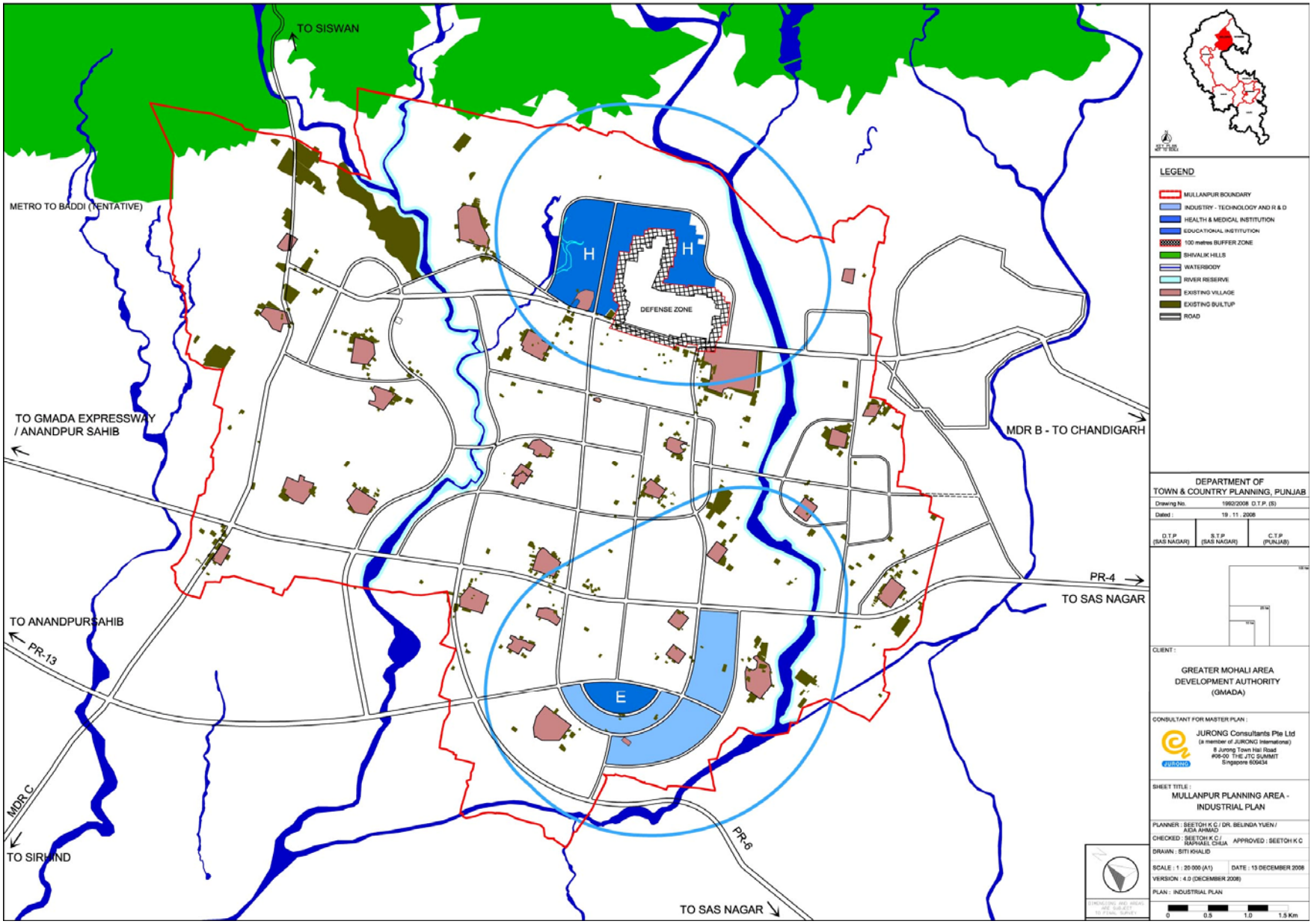


Figure 5.7: Green & Blue Catchment Plan

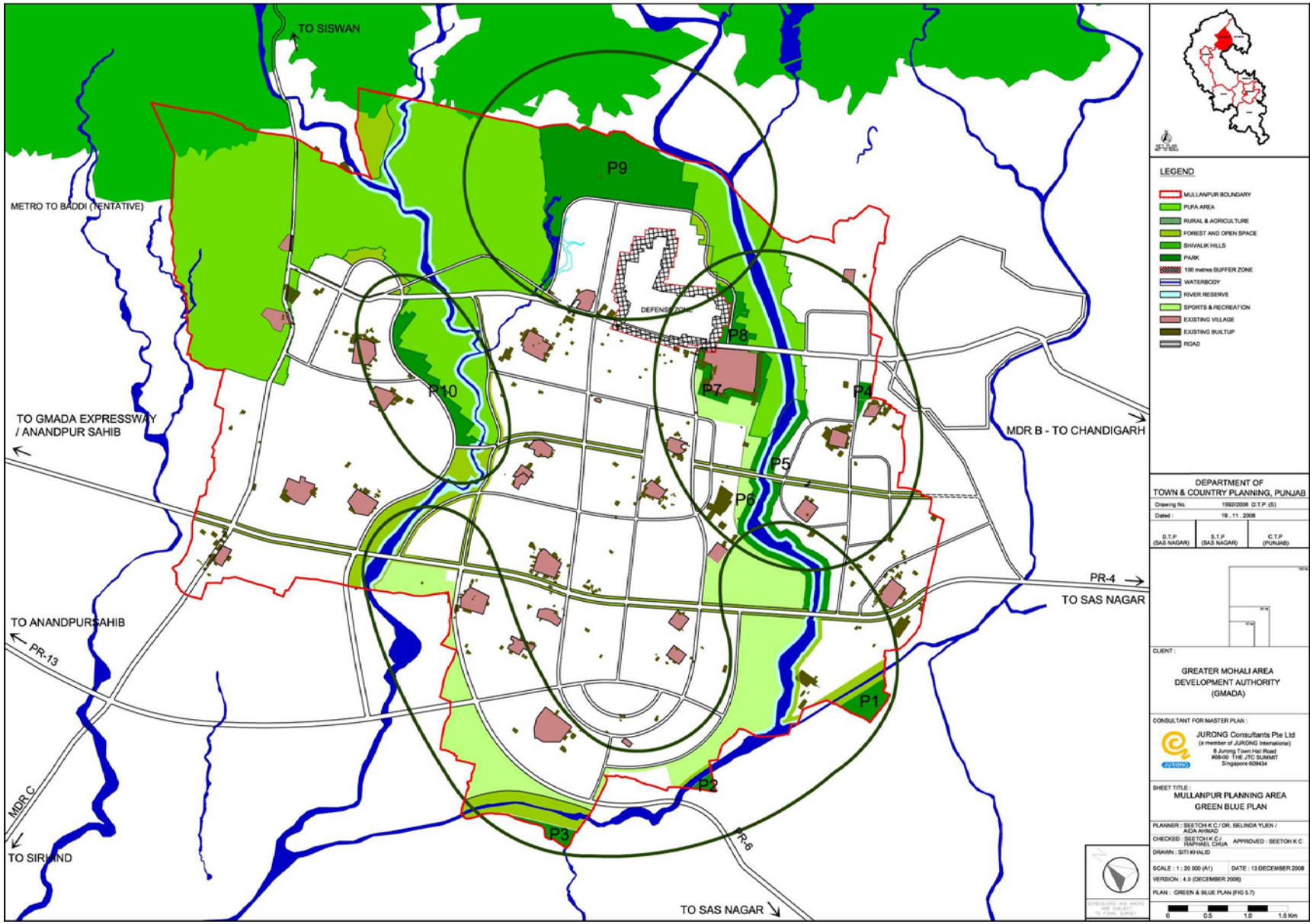


Figure 5.14: Land Use Plan with Social Facilities Incorporated

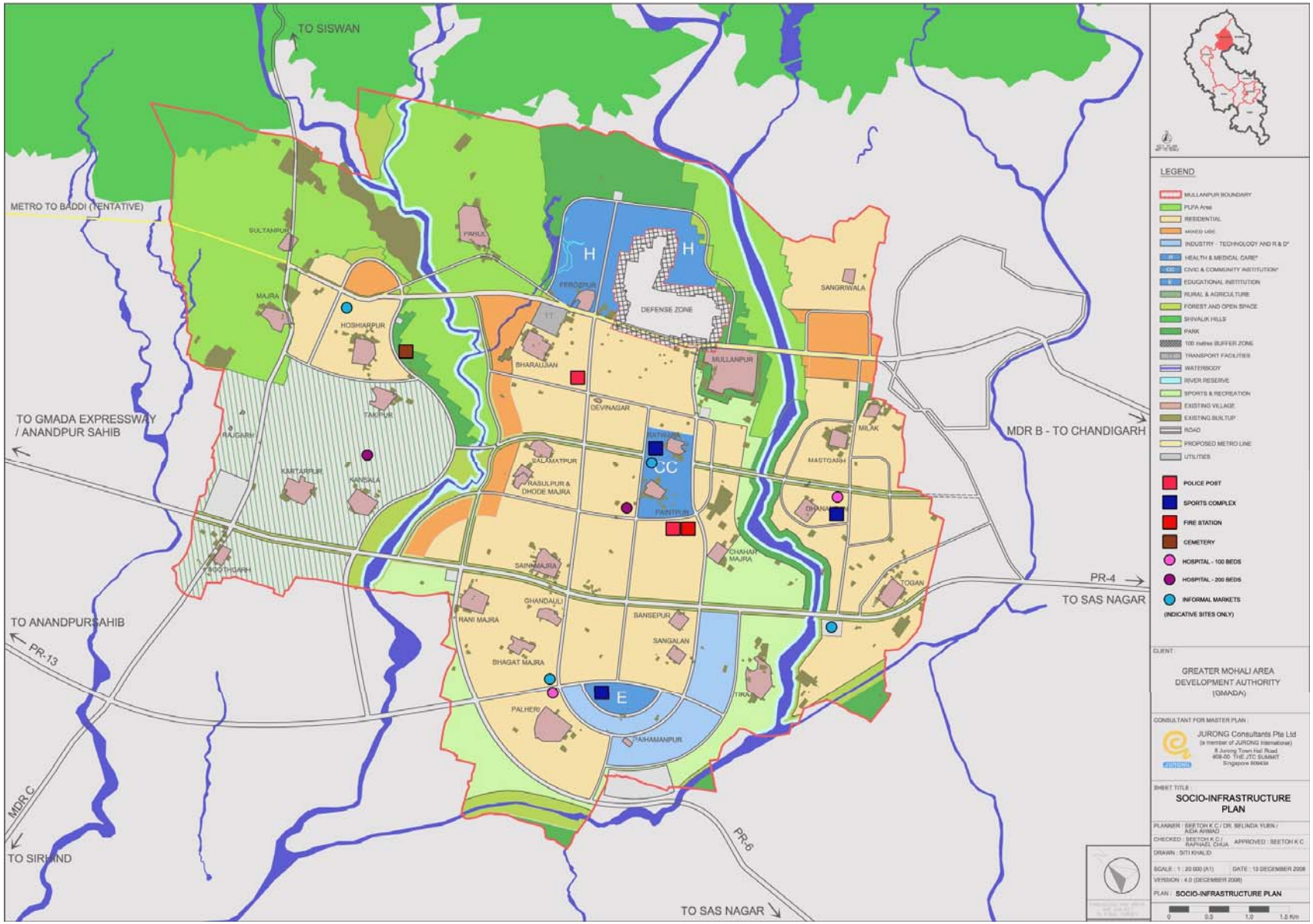
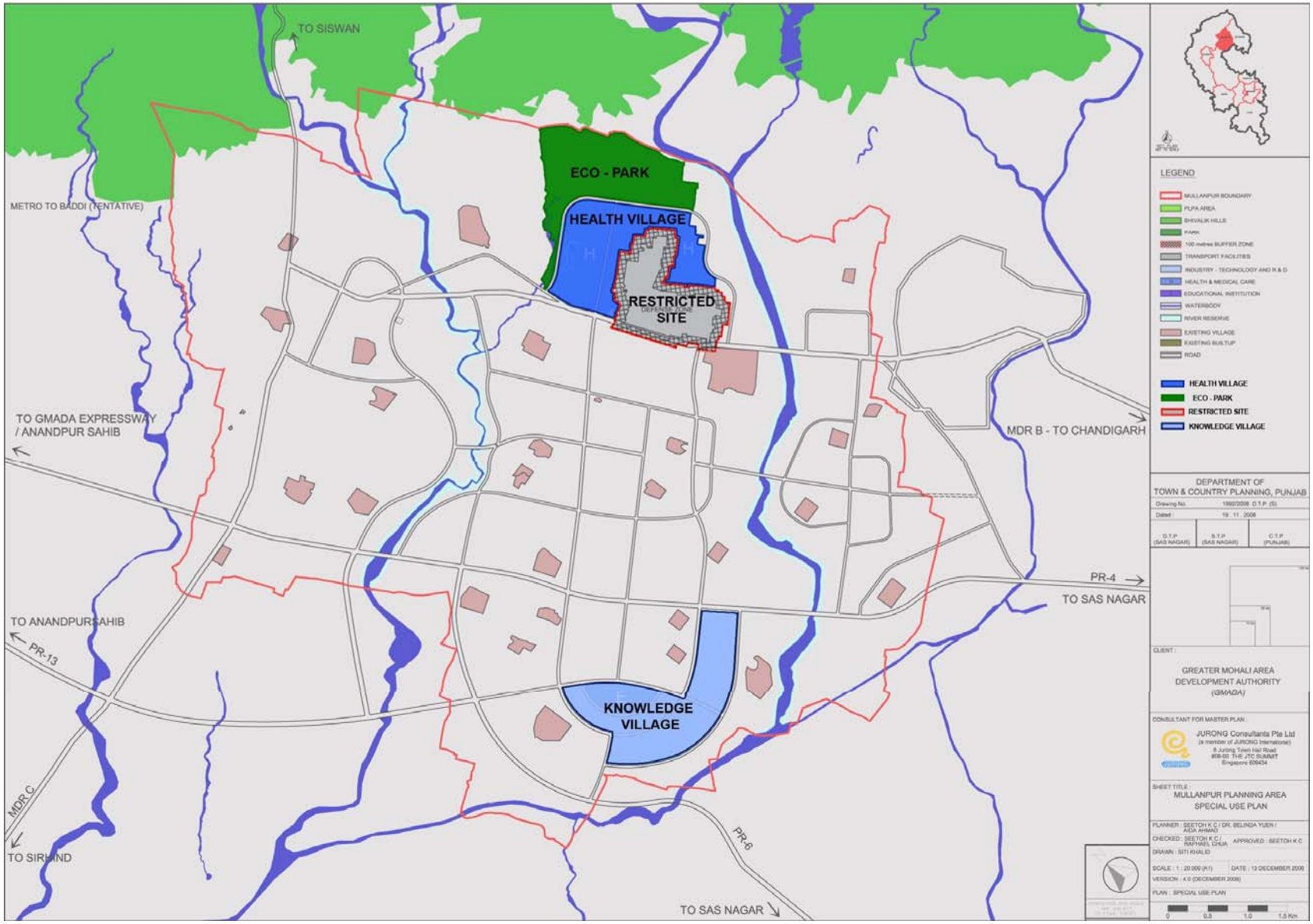
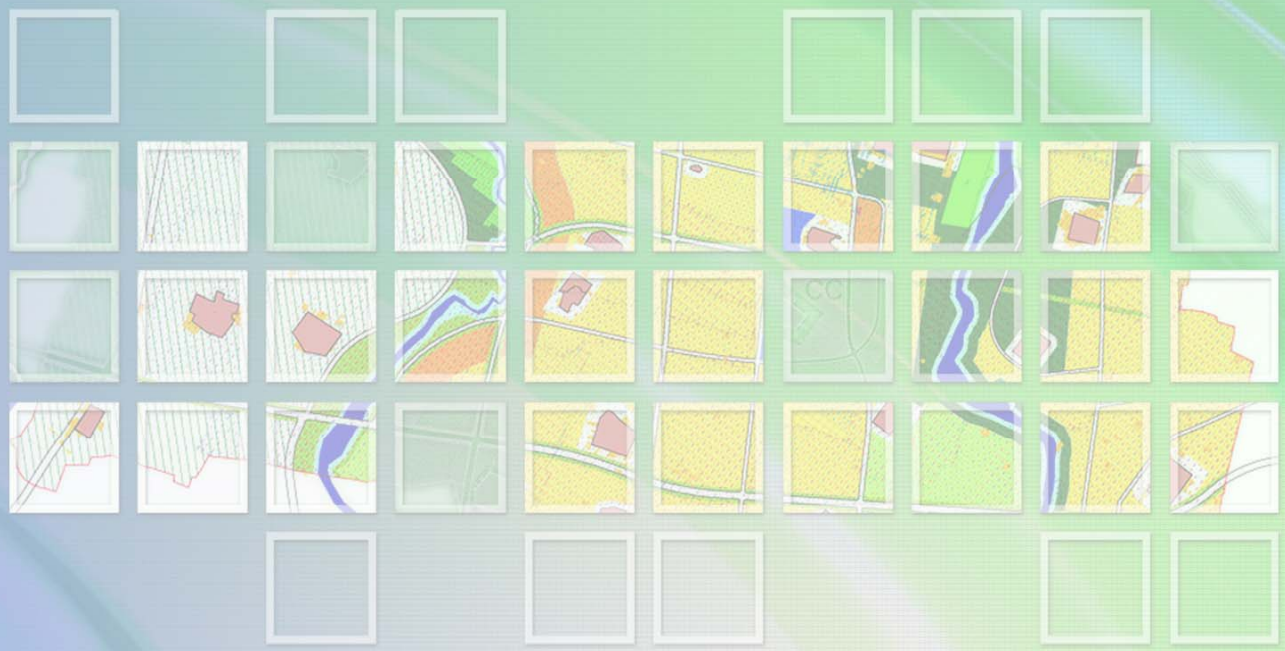


Figure 5.15: Land Use Plan of Prominent Special uses in Mullanpur



MULLANPUR LOCAL PLANNING AREA

GREATER MOHALI REGION, PUNJAB (INDIA)



Chapter 6

INFRASTRUCTURE PROPOSAL

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6. INFRASTRUCTURE PROPOSAL

6.1 Water Supply and Distribution

6.1.1 Introduction

This section provides an assessment of the existing water supply condition, a projection on the water requirement (in year 2031) and recommends the appropriate potable and recycled water supply and distribution system for the Mullanpur Local Planning Area.

The system has been designed in accordance with international standards, modified as appropriate to conform to local conditions.

6.1.2 Existing Conditions

The existing Mullanpur Local Planning Area is mainly rural & agriculture land. In the rural settlements, the villagers depend on ground water as the main water source. Centralized water supply and distribution system is not practiced in the entire Mullanpur Local Planning Area.

6.1.3 Water Demand Projection

6.1.3.1 Planning Assumptions

The following assumptions have been adopted for Mullanpur Local Planning Area:

- **Unit water demand**

Land Use	Unit Water Demand*
Residential	250 lpcd
Rural Settlements	100 lpcd
Industrial	45 cum/ha/d
Commercial, Institutional, Utilities	45 cum/ha/d
Roads	5 cum/ha/d
Green Area	60 cum/ha/d

* lpcd represents litre per capita per day

* cum/ha/d represents cubic metre per hectare per day

- **Fire fighting demand**
  Fire demand in kilolitres per day=100√p, where p=population in thousands
- **Water Transmission and Distribution Losses**
  Total Water Loss of 15% includes 5% transmission loss and 10% distribution loss
- **Workforce consumption** is incorporated into the respective unit demand
- **Recycled water** will be used mainly for irrigation purpose
- **Green Area**
  10% of the plot area (for residential, commercial, industrial, institutional, utility use) will be green area and gardening water for the green will be recycled water.
- **Water demand for agriculture land** is excluded.
- **Water demand for PLPA area** is excluded.

6.1.3.2 Projected Water Demand Requirement

Based on the land use distribution and population projection (year 2031) for the Mullanpur local area, the water demand has been worked out. **Table 6.1.1** shows the projected water demand for Mullanpur Local Planning Area.

Table 6.1.1 Projected Water Demand for Mullanpur Local Planning Area (year 2031)

Local Area	Projected Water Demand* (MLD)		
	Total	Potable	Recycled
MULLANPUR	165	83	82

*** Based on the projected population of 200,000 by year 2031**

6.1.4 Water Supply

The main sources of water supply include surface water, rainwater and recycled water. The main source of potable water will be surface water from perennial river, which will come from Bhakra Canal by pumping or Ganguwal by gravity (under feasibility study).

It may not be advisable to depend solely on the ground water source as the ground water is depleting at a very fast pace and the water quality is also deteriorating due to

over exploitation and contamination. In addition, unrestricted and unregulated abstraction of groundwater has serious long term environmental implications.

The dams constructed, including Mirzapur dam, Siswan dam, Jainti dam, Perch dam, can store excess rainwater during monsoon for use during the dry season. Presently, the dammed water is mainly used for irrigation of agriculture land. The dammed water may not be reliable to be used as potable water source as it will be affected by many factors including

(1) the rainfall intensity and its duration
(2) the catchment area
(3) the storage capacity
(4) the quantity allocated for potable water use

For reliability reason, surface water will be a better alternative for potable water source while ground water and rainwater collected can only supplement the potable water supply.

The source of recycled water will be the treated sewage effluent from the proposed sewage treatment plant serving the Mullanpur Local Planning Area, which will treat sewage up to tertiary level for irrigation use. Assuming a generation rate of 70% of sewage flow, the recycled water generated will work out to be about 44 MLD. Since the recycled water demand is 82 MLD, there will be a deficit of recycled water 38 MLD which would need to be supplied from the potable water source. Thus, the potable water supply will be increased to be 121 MLD. **Table 6.1.2** shows the projected water supply.

Table 6.1.2 Projected Water Supply for Mullanpur Local Planning Area (year 2031)

Local Area	Projected Water Supply (MLD)		
	Total	Potable	Recycled
MULLANPUR	165	121	44

6.1.5 Proposed Water Supply and Distribution System

The proposed water system for Mullanpur Local Planning Area comprises the two main systems: water supply system and water distribution system. For the water supply system, water will be pumped to the proposed water works in various zones. Each of the proposed water works includes facilities serving both potable and recycled water. For the water distribution system, water stored in the water works will be distributed to the consumers in the respective zones.

(1) Potable Water Supply and Distribution

Potable water will be supplied from the proposed Local Water Treatment & Storage Work No. 2 (LWTW 2) located within Mullanpur Local Planning Area. From LWTW 2, clear water will be pumped to the water works and distributed to the tenants and residents within Mullanpur Local Planning Area. **Figure 6.1.1 Proposed Potable Water Supply Main** shows the potable water from LWTW 2 feeding to respective proposed water works (WW1 to WW5). Since the service corridor within the typical road sections does not include water supply lines, dedicated reserve is needed for these water supply lines as shown in **Figure 6.1.1**. Each of these proposed water works is capable to serve a sub-catchment of the development as indicated in **Figure 6.1.2 Proposed Potable Water Distribution Zone.** Potable water from these water works will be distributed to the respective zone users as shown in **Figure 6.1.3 Proposed Potable Water Distribution Main**.

(2) Recycled Water Supply and Distribution

The recycled water supply and distribution system is an independent system and does not share the same water pipeline with the potable water supply system. The recycled water will come from the sewage treatment plant, which will treat the sewage up to tertiary level to meet the requirements for irrigation use. The recycled water will supply to the water works in various zones first and then distribute to the zone users. The recycled water supply and distribution system is shown in the following figures:

Figure 6.1.4 Proposed Recycled Water Supply Main
Figure 6.1.5 Proposed Recycled Water Distribution Zone
Figure 6.1.6 Proposed Recycled Water Distribution Main

The details of the proposed potable & recycled water utilities are shown in **Table 6.1.3 Proposed Water Utilities Facilities.** It should be noted that the land area

requirements of the water utilities are based on the projection for year 2056. The locations and land area requirements indicated in the Figures are only indicative and may subject to changes.

Table 6.1.3 Proposed Water Utilities Facilities

Name	Land Area Requirement (Ha)	Function
LWTW2	18	Potable water treatment & storage
STP1	28	Recycled water treatment & storage
WW1	0.5	Potable & recycled water storage
WW2	1.0	Potable & recycled water storage
WW3	2.0	Potable & recycled water storage
WW4	2.0	Potable & recycled water storage
WW5	1.5	Potable & recycled water storage

6.1.6 Recommendations

Dual water supply and distribution system is recommended for potable and recycled water. A gridiron system of pipe network is recommended for the proposed water distribution network**.** Within the gridiron system of pipe network, all arterial and secondary mains are looped and interconnected. This arrangement eliminates dead ends and permits water circulation such that a heavy discharge from one main allows drawing water from other pipes. This also helps in preventing water from developing tastes and odours due to stagnation. In addition to the water supply for plots, the piping system also includes water supply for fire fighting.

6.2 Power Supply and Distribution

6.2.1 Introduction

A power supply scheme comprises power source development, transmission, and step down to usable voltage for area and local distribution network. Development of power resource has been considered in the Regional Planning Report for the whole area of Greater Mohali.

Generally power reaches the area by 220KV high-tension overhead lines drawn on pylons. Such power line shall reach the Regional Sub stations (220KV). One such sub-station is planed in Mullanpur area. This substation taps the required power and converts this voltage to 66KV. Electricity, then flows through underground armored cables to 66KV substation for local distribution. Step down to 11KV is achieved at this stage, before electricity flows to local 11 KV sub-station for local distribution. At this local sub station, electricity enters the local network of distribution boxes and cables where electricity flows at 220V and reaches each household. This transmission and distribution system is suggested in GMADA.

6.2.2 Power Demand Estimation

Estimated Power Demand (MW)				
Year	*2011*	*2021*	*2031*	*2051*
Demand in %	30 %	75 %	100 %	125 %
Mullanpur	237	593	790	989

The estimate for Local Planning Area (LPA) is for the year 2031. Estimated demand at 790 MW for this year is taken for local planning purpose.

6.2.3 Power Distribution System

Power distribution system shall be based on a series of substations and step down transformation is as shown in following chart.

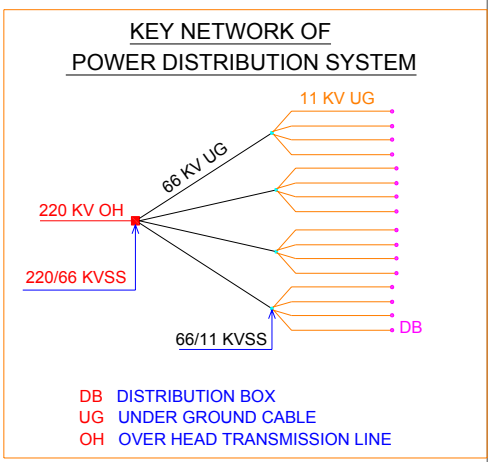
Local Planning Area		220 KV		66 KV
	Demand (MW)	No of SS*	Total Capacity (MW)	No of SS
Mullanpur	790	1	800	16

* SS denotes sub-station

One (1) 220 KV substation having capacity 800 MW will be placed in a selected location in Mullanpur, then it will be distributed to **sixteen (16) numbers of 66KV** substations at different locations in Mullanpur. Each of this 66KV sub-station shall further distribute to 11 KV substations. Then it will transfer to distribution boxes to building units.

6.2.4 Power Distribution Network

Power shall reach the area by 220KV high-tension overhead lines drawn on pylons. Regional Sub stations (220KV) tap the required power and convert this voltage to 66KV. Electricity, then flows through underground armored cables to 66KV substation for local distribution. Step down to 11KV is achieved at this stage, before electricity flows to local 11 KV sub-station for local distribution. At this local sub station, electricity enters the local network of distribution boxes and cables where electricity flows at 220V and reaches each tenant. **Figure 6.2.1** shows the proposed distribution network.



6.2.5 Proposed Locations

i) Proposed Corridor for Overhead 220KV Power Line

A 30 metre wide corridor is proposed for all existing/proposed overhead 220KV power lines. The

request is as per discussions held in January 2008 with the Punjab State Electricity Board (PSEB).

ii) Site Location for 220KV / 66KV substations at South West in Mullanpur

Electricity network on local planning area has been planned to ensure equitable distribution of 220Kv substations. Proposed 220KV Power line to Mullanpur & Nayagaon is planned from existing power line coming from Roper – Chandigarh near Kharar. The proposed location for 220KV/66KV sub-station is on the route and the spot is nearer to IT belt hence easier to prepare effective network to cater the needs of IT based industries.

iii) Site Location for 66Kv / 11Kv substations at the junctions of roads

These sub-stations need small area and can be placed at corners of road, in a private plot also or anywhere near big development. At present planning level, there aren't any details for specifying the exact location of these sub-stations. Or otherwise, it is recommended that can keep this issue for Development Control Rules in which can ask for the land from developers.

iv) Site Location for 11Kv substations

All 11KV substations are to be placed at any major development proposed. These 11Kv substation require very small area (max 50 m^2) and can be inside a building also. From here the power goes to each road side distribution box (area 2 m^2) from which lines go to each building. Every distribution box can cater to about 15 buildings of 50 people each or a max of 750 to 1000 people. Accordingly they can be located. In case of major housing project or an industry, then a 11KV substation can be enforced as this substation will cater to about 5000 people.

6.3 Surface Water Drainage

6.3.1 Introduction

This section provides an assessment of the existing drainage conditions, drainage concept and the recommendation of a drainage scheme for the proposed Mullanpur Local Planning Area (LPA).

6.3.2 Planning Objectives

The storm water drainage planning aims to achieve the following objectives:

i) To protect people and property from storm water inundation.

ii) To achieve a fully gravitational storm water drainage system whenever possible.

6.3.3 Existing Drainage Conditions

The existing Mullanpur site terrain has the following characteristics:

i) Steep land gradient. Highest point is about 365.0 m at the northern boundary of the LPA. Lowest point is about 323.0 m at the southern boundary.

ii) Two non-perennial rivers namely Jainta Devi Ki Rao and Siswan River crosses the LPA from the north to the south. These rivers receive their rainfall catchment from the Shivalik hills which is located just north of Mullanpur LPA.

iii) The non-perennial Sialba River passed just outside the western boundary of Mullanpur LPA. The non perennial Patiala Ki Rao passes just outside the eastern boundary of Mullanpur LPA.

Based on the existing terrain profile, storm water falling on the existing site area during the rainy season in winter will readily flow naturally towards the four rivers of Jainta Devi Ki Rao, Siswan River, Sialba River, Patiala Ki Rao for discharge. Any other surface runoff that reaches the south of the LPA would then be diverted by the 1st and 2nd Diversion Canals towards Siswan River in the East.

There is no known flooding that occurred before in Mullanpur Local Planning Area.

6.3.4 Planning Criteria

The storm water peak runoff and discharge capacities from within the respective catchments of the development site are computed based on the following design parameters:-

6.3.4.1 Peak Runoff

The peak runoff is computed based on Rational formula.:-

$$Q_r = C\ I\ A\ .\ (1/360)$$

Where,

Q_r = quantity of runoff (m^3/s)
C = coefficient of runoff
I = intensity of rainfall (mm/hr)
A = catchment area (Ha)

6.3.4.2 Runoff coefficient

The co-efficient of runoff adopted in the drainage computation are appended below:

Table 6.3.1: Runoff Coefficient

Type of Drainage Area	Runoff Coefficient
Roads	0.90
Built Up	0.70
Green	0.20

Based on the land use table, the weighted average coefficient of runoff is worked out to be **0.56** and this value is used for the conceptual drainage scheming.

6.3.4.3 Rainfall Intensity

Hourly records of the one-day highest rainfall in a year for Ambala for years 1972 – 2005 (except 1973, 1976, 1978, 1983, 1987, 1993) were obtained from the National Data Center at Pune. As Ambala is located just adjacent to the southern boundary of Lalru, these data could be applied for Greater Mohali District as well.

For a 1-hour rainfall, the rainfall intensity of Ambala (and Greater Mohali) is worked out to be approximately **32mm/hr for a rainfall return frequency of 2 years**, or

approximately **53mm/hr for a rainfall return frequency of 5 years**. For rainfall duration of less than 1 hour, the intensity could be estimated using the following formula from the Indian Road Congress:-

$$I = I_o \left(\frac{2}{t+1} \right)$$

Where I_o = 1-hour rainfall intensity
t = rainfall duration (of less than 1 hour)
I = rainfall intensity corresponding to t

For roadside drains and outlet drains design, JURONG recommends using a storm return frequency of 5 years.

6.3.4.4 Discharge Capacity

The sizings of the drains are designed to the discharge capacity of Q_c to cater adequately for the estimated peak runoff. The Colebrook-White's formula for pipe drains (up to 1.8m or where commercially available) and Manning's formula for box drain adopted respectively:-

i) Pipe Drain design by Colebrook's formula:

$$Q = A.V$$

Where, A = Flow area of pipe (m2)
V = velocity (m/s)

$$V = -2 (\sqrt{2}\, gdI). \text{Log} [(k / 3.7\, d) + (2.51\, \upsilon) / (d * (\sqrt{2}\, g\, d\, I))]$$

Where, L = hydraulic gradient (%)
K = roughness coefficient (m) = 0.00003 m
υ = kinematic viscosity (m^2/s) = 0.0000009
d = internal diameter (m)
g = acceleration due to gravity (9.81 m/s^2)

ii) Box Drain design by Manning's formula:

$$Qc = 1/n \, . \, A.R^{2/3} \, S^{1/2} \quad (m^3/sec)$$

Where, A = Flow area of drain (m^2)
R = Hydraulic mean radius (m)
S = Bed gradient
n = roughness coefficient = 0.015 for concrete

6.3.4.5 Drain Material

Drainage pipes are recommended to be reinforced cement concrete (RCC) where pipe internal diameter is up to 1.80 m or where commercially available. Reinforced concrete box drains are recommended where the pipe internal diameter is larger than 1.80 m. Open box drains could be adopted if regular drain maintenance is available.

6.3.5 Proposed Storm Water Drainage Scheme

Based on analysis of the existing terrain and Master Plan for Mullanpur LPA, eighteen (18) Catchment Areas and their respective proposed discharge outlets are identified. **Figure 6.3.1** shows the proposed Catchment Areas.

The surface water from each catchment would be served by a network of roadside drains which would then discharge into proposed outlet drains, and eventually discharge into the existing Jainta Devi Ki Rao, Siswan River, Sialba River or Patiala Ki Rao.

The proposed drains sizes range from pipe diameter of about 0.7m for roadside drain along lower hierarchy road serving small plot of about 4 ha, and up to about 5.5m (width) by 2.5m (depth) for a large outlet drain serving catchment area of about 410 ha. **Figure 6.3.2** shows the proposed drainage networks.

6.3.6 Proposed Water Body at Siswan River

Mullanpur is envisaged to develop into an eco-town primarily with lush greenery and scenic water body. It is thus proposed that storm water surface runoff from the Shivalik hills could be dammed along the Siswan River for creating such water body. Shops and restaurant could then be lined up along the water body for leisure purpose. The water body concept along Siswan River can be achieved by the following approach:-

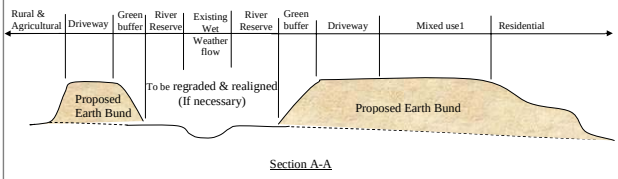
- Resettlement may be required for villages affected.
- Creating a weir downstream of the river, so that storm water runoff coming upstream from the Shivalik hills region could fill up the proposed water body during rainy days.

- If allowable and in excess, additional water could be released from Siswan Dam, to help in filling up the water body.

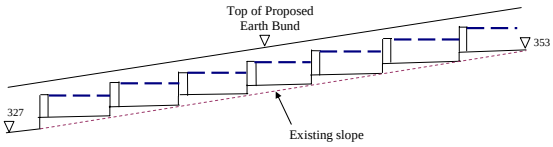
- Due to the steep existing slope, about 25.0 metres level drop over length of approximately 4.0 km, at slope of 1: 160, it may be required to dredge/regrade the existing slope to form a cascaded profile as shown in Section B-B for water retention purpose.

- The above is a conceptual proposal and it is subjected to further engineering studies to assess the technical feasibility by other specialists, with the availability of all the relevant soil data and detailed topographical information.

Figure 6.3.3 shows the proposed water body at Siswan river.



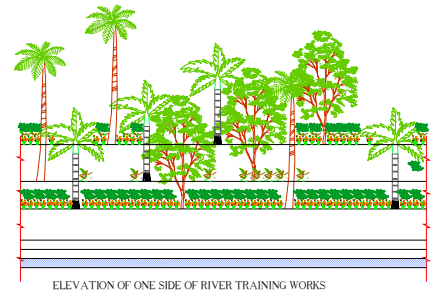
Section A-A



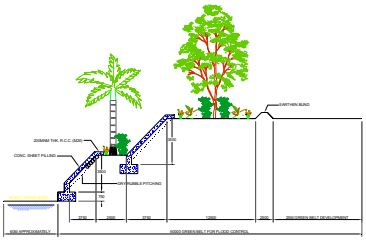
Section B-B

The bund could be constructed within the proposed 40 metres wide reserve, so that additional water capacity is created in the flood period, which is of short duration. The height of the bund can be approximately 2 to 2.5 meters only.

Likewise, such river training works could be proposed along various sections of the other rivers in Mullanpur. It helps to ensure stability of banks of the river during the whole year and especially during monsoon. This will also increase the water conveying capacity of the river. The same will also act as a physical demarcation zone for river reservations. The planned vegetation cover also prevents encroachments.



ELEVATION OF ONE SIDE OF RIVER TRAINING WORKS



CROSS SECTION OF ONE SIDE OF RIVER TRAINING WORKS

Figure 6.3.4 Proposed River Bunds

6.3.7 Rain Water Harvesting / Ground Recharging / Irrigation

6.3.7.1 Present status

There is no irrigation project run by Govt. in GMADA**.** Hence to ensure sustainability of green space rainwater harvesting has become important. Local and private irrigation systems run within the confines of the land owned by an individual. Village pond system also help in ground water recharging which in turn adds to available water in tube well and open well. However the general findings of the survey and studies done in recent past indicate that the ground water table is fast deepening. Unless immediate steps are taken on large scale, the ground water table will recede to unviable levels.

6.3.7.2 Water availability for Recharging

a) Rainwater

Total rainfall in GMADA area is average 800 mm per year. The total land area of Mullanpur is approximately **60 sq km**. It is assumed we will able to collect rainwater from 50% of area, which will be open un-constructed land. The total of **48 x 10^6 cum** of water available for storage using rainwater harvesting. Generally if the rain water harvesting collection system is not a lined pond or constructed sump, then about 30 to 40 % of collected water will seep into ground aiding ground water recharging locally. Such seeping water will enable recharging of ground water. When the present village pond system is strengthening the entire area shall have a network of such ponds, which will aid the rising of ground water in Mullanpur area.

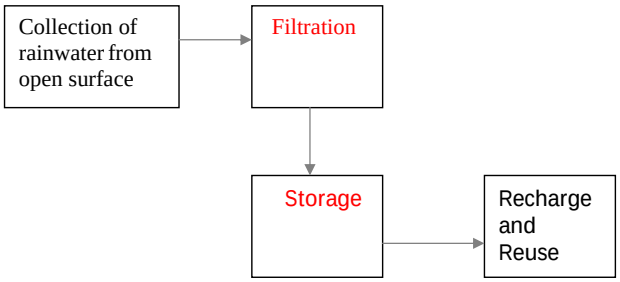
b) River water

Two main rivers/ rivulets running in Mullanpur can be classified in in type that originating from the immediate northern hilly area where small and medium check dams have been constructed in recent past 20 to 30 years. The water in these rivulets is not perennial and depends on rains. They generally act as highways for rain water runoff. Adding more check dams can increase retention percentage. No other major rivers flows within Mullanpur region. Both these rivers add to drainage of rainwater from the Mullanpur to adjoining areas like Sas Nagar and Karrar.

6.3.7.3 Available Systems

a) Land surface Catchments

Rainwater harvesting using ground or land surface catchment areas is less complex way of collecting rainwater. It involves improving runoff capacity of the land surface through various techniques including collection of runoff with drainpipes and storage of collected water. Compared to rooftop catchment techniques, ground catchment techniques provide more opportunity for collecting water from a larger surface area. This technology can meet water demands during initial dry periods. Various techniques available for increasing the runoff within ground catchment areas involve:



We recommend defining command area of each village pond. Refer to the drawing in which the approximate command area of all **28 to 30 ponds** is classified. All surface water shall be properly drained to these village ponds. To accommodate this water, ponds shall be strengthened as shown in illustration plan. In this way we can collect maximum rainwater locally. Presence of Village ponds is put to use in an effectively by ensuring all storm water drains are diverted to local ponds. The drains can also have properly designed silt and debris traps constructed at every 500 or 750 meters. They also can have vertical sand drains to allow normal water flows to naturally recharge ground water. Such sand drains will act as local recharging points and allow water collected from immediate area to be recharged in the same area. This will reduce the cross sections of drains and also reduce the capital cost of conveying water over longer distances.

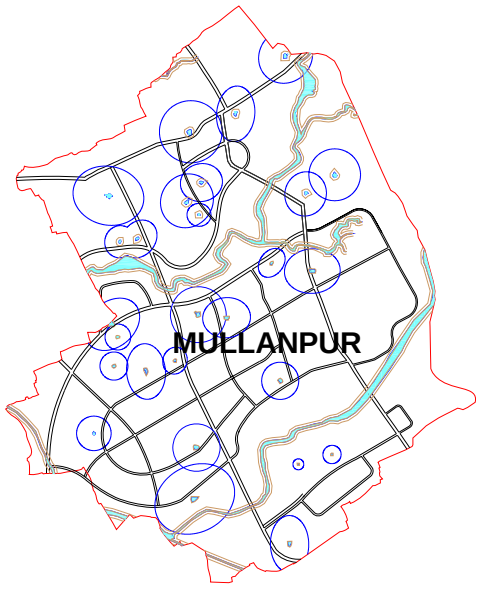


Figure 6.3.5 Proposed Pond Catchment Areas (marked blue)

Methodology to get proper Runoff:

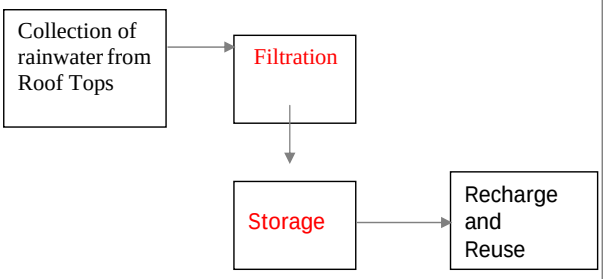
i) Clearing or altering vegetation cover: - Clearing vegetation from the ground can increase surface runoff but also can induce more soil erosion. Use of dense vegetation cover such as grass is usually suggested as it helps to both maintain a high rate of runoff and minimize soil erosion.

ii) Increasing the land slope with artificial ground cover: - Steeper slopes can allow rapid runoff of rainfall to the collector. However, the rate of runoff has to be controlled to minimize soil erosion from the catchment field. Use of plastic sheets, asphalt or tiles along with slope can further increase efficiency by reducing both evaporative losses and soil erosion.

Reducing soil permeability by the soil compaction: - This involves smoothing and compacting of soil surface using equipment such as graders and rollers. To increase the surface runoff and minimize soil erosion rates, conservation bench terraces are constructed along a slope perpendicular to runoff flow.

This method of land surface catchment should be implemented in village and horticultural development areas.

b) Rooftop Catchments



Systems defined in the vision plan can be suggested to individual house owners for rainwater harvesting.

c) Conveyance systems: -

Rooftop Catchments System requirements: -

1) Special designs required:
The system consist of particular collection of rainwater, waterproofing treatment to terrace etc. and hence will require precision and workmanship while installing the system.

2) Special roof treatment require pumping and storage system for supplying, distributing the water.

This method should be adopted for urbanized areas.

c) Storm water from streets: -

Sump with sand traps shall be provided at intervals to the Storm Water Drains of the streets. These sumps will design in such a way that storm water will be collected and it will reach down to enrich ground water table.

This method should be adopted to collect water from street and paved campus.

6.4 Sewerage

6.4.1 Introduction

This section assesses the estimated quantity of sewage flow with respect to the planning Year of 2031. It also introduces the sewerage system which comprising the conveyance network and treatment facility.

6.4.2 Planning Objectives

The planning strategies for sewerage system include the following aspects:

- To put in place extensive sewerage network system appropriately mapped up and transformed into a model environment in the urbanized area
- All new developments are to be connected to the eco-friendly Sewage Treatment Plant (STP)
- To provide an efficient recycling system and infrastructure in the light of reducing the amount of wastewater and potable water usage

These strategies have been developed based on the following objectives:

Protection: to protect public health and the long term health of the water environment
Reliability: to ensure the safe and continuous removal of wastewater
Demand Planning: to pursue demand planning as one of the most cost effective means of ensuring sustainability in the Mullanpur LPA wastewater system.

6.4.3 Planning Criteria

Similar to the water supply system, the urbanized area will be the focus for the development of Mullanpur LPA. The following planning criteria are adopted for the proposed sewerage system:-

a) Sewage Flow

The sewage generation computation is based on 80% of the average potable water demand plus 10% infiltration rate. Based on the land use distribution and population projection of the various planning areas, the sewage generated for Mullanpur LPA will reach 62 MLD by Year 2031 (refer to **Table 6.4.1**).

Table 6.4.1 Estimated Sewage Generated

Local Planning Area	Sewage Generated (MLD)
	Year 2031
Mullanpur	62

b) Peak Factor

Based on the projected population for the development, a peak factor of 2.25 is adopted.

c) Discharge Capacity

The sewers are designed to the discharge capacity of Qc to cater adequately for the estimated peak runoff using Manning's formula for the pipe sewers:

$$Qc = 1/n \cdot A.R^{2/3} S^{1/2} \quad (m^3/sec)$$

Where, A = Flow area of pipe (m^2)
R = Hydraulic radius (m)
S = Slope of hydraulic gradient
n = Roughness coefficient

d) Design Criteria of Pipes and Networks

The following general standards are recommended to be adopted in gravity pipe network design:

- A minimum velocity of 0.6 m/s at peak flow for self cleansing
- A maximum velocity of 3.0 m/s to prevent scouring
- Manholes shall be provided at all junctions and all points of change of sewer size, slope and direction. Manholes shall be provided at appropriate interval in the straight reaches of the sewers. The distance between manholes shall not be more than 120 m.
- Maximum depth of invert shall not be greater than 8 m.
- Maximum design depth of flow shall be 0.8 of pipe diameter at peak flow.
- The minimum diameter for a public sewer is 200 mm.

6.4.4 Existing Sewerage System

Currently, there is no or negligible sewerage network provided in Mullanpur Local Planning Area. There is no sewage treatment plant provided in and some of the sewage is discharged into soak pits / septic tanks and in some areas, the sewage is discharged to the water bodies and open spaces untreated.

6.4.5 Proposed Sewerage System

The sewerage network being primarily a gravity network is dependent on the topography of the area. The terrain varies across the Mullanpur LPA and the general sloping of land is towards South. The sewage generated will be collected through a gravity network based on the grading levels. At this design stage, main lines' collecting the sewage from the various elements is proposed which will discharge the sewage generated into the proposed STP as shown in the drawing.

The proposed sewerage treatment system for Mullanpur LPA comprises both the primary and the biological treatment in order to ensure effluent compliance with Bureau of Indian Standards. A typical example of sewerage system and treatment plant is illustrated in **Figure 6.4.1** below.

Figure 6.4.1 A Typical Biological Sewage Treatment Plant

The details of proposed sewage treatment works are shown in **Table 6.4.2 Proposed Sewage Treatment Works.** The proposed catchment zone for STP is shown in **Figure 6.4.2 Proposed Sewerage Catchment** and the sewerage network is shown in **Figure 6.4.3 Proposed Sewerage Network**. The location and land area requirements of the proposed sewage treatment plant are only indicative and may subject to changes and site verification. The land area requirements for Sewage Treatment Plant are estimated based on conventional sewage treatment system (Activated Sludge Process) with tertiary treatment. However if modern sewage treatment methods like SBR (Sequential Batch Reactor), MBR (Membrane Batch Reactor), etc., were to be adopted, there will be substantial decrease (40 – 50%) in the land area requirement.

Table 6.4.2 Proposed Sewage Treatment Plants

Sl. No.	Planning Area	Capacity (MLD)	Land Area Requirements* (Ha)
		2031	
1	Mullanpur LPA	62	28

* Sewage Treatment Plant includes the ultimate area safeguarded for tertiary treatment

6.5 Solid Waste Management

6.5.1 Introduction

Mullanpur is envisioned to be an eco-town with unique features like renewable energy, water recycling, abundant greenery etc. The success of these features would require great effort in keeping the environment clean and green. Waste management in Mullanpur therefore plays a vital role here.

This section recommends the effective management of solid waste system and the criteria setting for the selection of solid waste facilities locations. The governing principles for the bio-medical waste management are also discussed in this section.

6.5.2 Existing Condition

At present, as recorded in 'State of Environment Punjab-2007' prepared by Punjab State for Science & Technology, Chandigarh, Annexure 3.1 – Status of land available for disposal of municipal solid waste and quantity of MSW generated by various municipal authorities of the state, the solid waste generated in the current Mullanpur district estimated to be about 4.5 ton/day with majority of the waste from the municipal source. However, there is no designated landfill site for the disposal of the waste. The solid wastes are most likely to be dumped in vacant land without proper treatment which would pose environment hazard to the community.

6.5.3 Effective Management of Solid Waste

In supporting Mullanpur as an eco-town, effective solid management systems are critical to ensure better human health and safety. They must be safe for workers and safeguard public health by preventing the spread of disease. In addition to these prerequisites, an effective system of solid waste management must be both environmentally and economically sustainable.

(a) Environmentally sustainable: it must reduce, as much as possible, the environmentally impacts of waste management.
(b) Economically sustainable: It must operate at a cost acceptable to community.

An economically and environmentally sustainable solid waste management system is effective if it follows an integrated approach whereby it deals with all types of solid waste materials and all sources of solid waste. A multi-material, multi-source management approach is usually effective in environmental and economic terms than a material specific and source specific approach. Specific wastes should be dealt within such a system but in separate streams. An effective waste management system includes one or more of the following options:

(a) Waste collection and transportation.
(b) Resource recovery through sorting and recycling i.e. recovery materials such as paper, glass, metals etc through separation.
(c) Resource recovery through waste processing i.e. recovery of materials such as compost or recovery of energy through biological, thermal or other processes.
(d) Waste transformation (without recovery of resources) through reduction of volume, toxicity or other physical/ chemical properties of waste to make it suitable for final disposal.
(e) Disposal on land in an environmentally safe and sustainable disposal method in landfill.

6.5.4 Waste Generation

Mullanpur is intended to be planned as a leisure zone where the activities in the district consist mainly on recreation, hospitality and tourism. Wastes generated in this district are estimated to be mostly comes from the residential area and the recreation activities, such as sport facilities, parks and open spaces which generate about 39% of total waste from residential and about 25% of the total waste from sport facilities, parks and open space within the district planning area. Most wastes generated would be municipal solid waste which could be further classified into biodegradable, non-biodegradable, recyclable and organic material for its different treatment and disposal method.

Solid waste generation per capita (including recyclable waste) is broadly estimated and presented in Table 6.5.1.

Table 6.5.1 Estimated Solid Waste Generation Rate

Sl No	Source of solid waste	Solid Waste Generation
1	Residential	0.8 kg/capita/day
2	Business park R&D	0.4 kg/capita/day
3	Mixed Use	180 kg/ha/day
4	Civic & community institution, education institution	60 kg/ha/day
5	Health & medical institution	300 bed hospital/nursing home, 1.5kg/bed
6	Green	30 kg/ha/day
7	Transport hub	30 kg/ha/day
8	Existing built-up, rural & villages	30 kg/ha/day

Table 6.5.2 below shows the waste generated at the planning year 2031.

Table 6.5.2 Projected solid waste generation by year 2031

Planning area (ha)	Projected population by 2031	Solid waste generation source	Projected generation of solid waste by Year 2031 (Ton/day)
6,124	200,000	Residential	96
		Business park R&D	16
		Mixed use	36
		Civic & community institution, education institution	5
		Health & medical institution	25
		Green	61
		Transport hub	1
		Existing built-up, rural & villages	7
		TOTAL	**247**

6.5.5 Waste Handling, Sorting and Storage at the Source

Waste handling, sorting and storage at source involve placing the waste in the storage containers for collection. Handling encompasses the movement of loaded containers to the point of collection. The point of collection could be done in the following methods:

(i) Bin centres

Bin centre is a centralized point of waste storage. This waste is first transferred to these collection points and stored in bulk containers or compactors. Each collection point usually serves a precinct which comprises of domestic high-rise apartment blocks, and may include shopping and commercial complexes, market and food centres. However, the only disadvantage of this method is having separate groups of workers to transfer waste from the sources of the waste to the collection point, thus results in double handling of waste.

(ii) Centralised waste chutes

Only one common centralized waste chute is provided with the discharge point located near the lift lobby of each floor. The chute terminates in a storage chamber on the ground floor where an automated waste handling facility is installed to serve the entire block. This system eliminates doubling handling of waste and also minimizes smell nuisance. However, it is less efficient as compared to indirect collection from bin centres as the waste collector has to collect from every block instead of collectively from bin centres that serve several blocks each.

(iii) Litterbins on streets and public places

In order to ensure that streets and public places are not littered with waste materials such as used cans, cartons of soft drinks, used bus tickets, wrappers of chocolates or empty cigarette cases and the like generated while on move, little bins may be provided on streets, markets, public places, tourist spots, bus and railway stations, large commercial complexes, etc at a distance ranging from 25metres to 250metres depending on the local condition.

Removal of waste from these litter bins should be done by beat sweepers during their street cleaning operations. Waste from the litterbins should be directly transferred into the bulk bin.

6.5.6 Waste Collection

The waste collection system should be determined based on the nature, volume, source location, disposal destination and relative cost of waste collection.

The developer can invite companies to tender and compete for license for the waste collection services for the domestic and trade premises. Successful tenderers were appointed as Public Waste Collectors (PWCs) for the respective sectors for a term, say 5-year period. Licensed waste collectors are required to comply with the Environmental Public Health Regulations and guidelines stipulated by Punjab Pollution Control Board.

The waste collectors can provide waste collection services from households, trade premises, commercial buildings and industrial premises daily.

Waste can be collected by the following listed methods:

(i) Direct collection

This method involves the removal of waste directly from individual domestic premises in landed private housing estates and individual trade premises such as shop houses. A waste truck with the collection crew move from door to door to collect the waste placed outside the premises. However, this method pose some disadvantages of being labour intensive, thus incur high cost and this method usually require more time for collection.

(ii) Indirect collection

This method involves the collection of waste from designated centralized collection points such as bin centres and centralized waste chutes. This method is generally more productive and efficient as the bulk refuse is collected from bin centre hence only reduce the collection time.

6.5.7 Sorting, Processing and Transformation of Solid Waste

The sorting, processing and transformation of solid waste materials is the fourth of the functional process. The recovery of sorted materials, processing of solid waste and transformation of solid waste occurs primarily in locations away from the source of waste generation. Sorting of commingled (mixed) wastes usually occurs at a transfer station. Sorting often includes the separation of bulky items, separation of waste components by size using screens, manual separation of waste components, and separation of ferrous and non-ferrous metal.

Waste processing is undertaken to recover conversion products and energy. The organic fraction of municipal solid waste (MSW) can be transformed by a variety of biological and thermal processes. The most commonly used biological transformation process is aerobic composting. The most commonly used thermal transformation process is incineration.

Waste transformation is undertaken to reduce the volume, weight, size or toxicity of waste without resource recovery. Transformation may be done by variety of mechanical (eg shredding), thermal (eg. incineration without energy recovery) or chemical (eg. encapsulation) techniques.

6.5.8 Transfer and Transport of Solid Waste

The functional element of transfer and transport involves two steps: (i) the transfer of wastes from the smaller collection vehicle to the larger transport equipment and (ii) the subsequent transport of the wastes, usually over long distances to a processing or disposal site. The transfer usually takes place at a transfer station. The station is marked as transfer station 1 **(TFS1)** within the Mullanpur district as shown in **Figure 6.5.1** where it shows the solid waste facilities in local plan Mullanpur.

6.5.9 Disposal of Solid Waste

Generally, majority of the solid wastes generated can be disposed of at sanitary landfills and considerable quantity of solid waste can be disposed by other methods such as composting and recycling of waste.

Location of landfill has been earmarked during the structure plan stage – LFS1, LFS2 and LFS3. The solid waste generated from Mullanpur is to be disposed off at landfill site LFS1 located outside the district. Waste

disposal to landfill site should be limited to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing.

Pathogenic waste shall be treated and disposed by licensed hazardous waste treatment companies due to its hazardous in nature.

6.5.9.1 Sanitary Landfill

Sanitary landfill within the Mullanpur district would definitely pose health hazard to the community due to residential and public areas. Hence, it is recommended to propose the landfill site out of Mullanpur district. The following considerations have demonstrated the unsuitability of locating the sanitary landfill site within the Mullanpur development:-

Following is the siting criteria for sanitary landfill:

- Groundwater table's seasonally high level (i.e., 10 year high) should be at least 1.5 meters below the proposed base of any excavation or site preparation to enable landfill cell development.
- A minimum depth of 1 meter of soils above the groundwater table's seasonably high level exists.
- No underlying limestone, carbonate, fissured or other porous rock formations which would be incompetent as barriers to leachate and gas migration, where the formations are more than 1.5 meter in thickness and present as the uppermost geologic unit above sensitive groundwaters.
- No environmentally significant wetlands of important biodiversity or reproductive value are present within the potential area of the landfill cell development.
- No perennial stream within 300 meters down gradient of the proposed landfill cell development
- No siting within a floodplain subject to 10-year floods to eliminate the potential for washout.
- None of the areas within the landfill boundaries are part of the 10-year groundwater recharge area for existing or pending water supply development.
- No known rare or endangered species or significant protected forests are within 500 meters of the landfill cell development area.
- No open areas of high winds, otherwise windblown litter will not be readily manageable.
- No residential development within 250 meters from the perimeter of the proposed landfill cell development.
- No visibility of the proposed landfill cell development area from residential neighborhoods within 1 km.
- Avoid siting within 1 km of culturally sensitive sites where public acceptance might be unlikely (i.e., memorial sites, churches, schools) and avoid access roads which would pass by such sites.
- No major lines of electrical transmission or other infrastructure (i.e., gas, sewer, water lines) are crossing the landfill cell development area.

Besides population and solid waste generation rate figures estimated for the municipal and industrial waste, the quantity of solid waste generation required for landfill will also depend on other factors such as :-

1) ratio of solid waste for landfill (assumed to be 0.70)
2) density and volume of compacted solid waste landfill
3) volume of compacted soil cover
4) volume of compacted total landfill volume
5) design life for landfill
6) depth of landfill (assumed to be 10m maximum – 3m below ground and 7m above ground)
7) areas required for leachate treatment / evaporation ponds (assumed to be 2 ha)
8) areas required for receiving solid waste (assumed to be 2 ha)
9) areas required for buffer zone (assumed to be 10% of total areas required for landfill, leachate treatment / evaporation ponds and receiving solid waste)

The amount of waste to be generated within the proposed Mullanpur development up to year 2031 is projected to be about 247 tonnes per day.

About 18 ha of land out of allocated landfill area in LFS1 will be required for the purpose of waste disposal for Mullanpur till year 2031. The required landfill area includes receiving areas, leachate treatment / evaporation ponds and landscaped buffer zone.

6.5.9.2 Incineration

In the long-term, say approximately 15 to 20 years later from the initial development, other more efficient methods such as incineration can be studied to cope with the fast-growing quantities of solid wastes. Waste incineration, which offered a high volume reduction of as much as 90%, is considered as the more effective method as compared to sanitary landfill method.

Location of the incineration plant has been earmarked in the structure plan. The incineration plant is located at southern side of Greater Mohali Region and within the Lalru district. Alternative location of incineration plant is to situate near the alternative location of gas fixed power plant at the western side of Greater Mohali Region, near Kharar.

6.5.10 Waste Minimization and Recycling

The need to reduce waste to a level that it can be handled at a reasonable cost, without threat to public health and within the assimilation capability of the environment is increasingly more important.

To meet this challenge in waste management, a unit can be set up within the government board to promote and spearhead waste minimization movement. Preventing the initial creation of waste is the most favourable waste management practice, followed by reuse, recycle and recover. This will help to prolong the life span of the sanitary landfill site, the waste generated can be minimised by adopting the waste management hierarchy, ie. the 3Rs - Reduce, Reuse and Recycle.

- Reduce - to avoid unnecessary waste generation.
- Reuse - to use again.
- Recycle - to convert unwanted things into useful and marketable recycled products.

Recycling programmes such as waste minimisation and recycling could be promoted in the homes, condominiums, private apartment estates, schools, industrial estates, offices, hotels, etc.

6.5.11 Bio-medical Waste

Bio-medical solid waste comprises the waste from hospitals, medical institutions, nursing homes and other medical facilitators of biomedical waste. These wastes are generated during the diagnosis, treatment or immunization of human beings or animals, or in research activities pertaining thereto, or in the production or testing of biological. The bio-medical wastes generally includes non-liquid tissue, body parts, blood, blood products, and body fluids from humans and other animals, laboratory and veterinary wastes, which contain human disease-causing agents, and discarded sharps (including needles, syringes, blades, scalpels, slides, broken glass, etc.).

6.5.11.1 Management Issues of Bio-medical Waste management

The management principles are based on the following aspects:

- Reduction/ control of waste (by controlling inventory, wastage of consumable items, reagents, breakage etc.)
- Segregation of the different types of wastes into different categories according to their treatment/disposal options in **Bio-medical Waste (Management and Handling) Rules, 1998.**
- Segregation collection and transportation to final treatment/ disposal facility so that they do not get mixed.
- Proper treatment and final disposal as indicated in the **Bio-medical Waste (Management and Handling) Rules, 1998**.
- Safety of handling, full care/protection against operational hazard for personnel at each level.
- Proper organization and management.

It is necessary to implement proper bio-medical waste management system for each and every hospital, nursing home, pathological laboratory etc. Comprehensive management system for each and every health care establishment has to be planned for optimal techno-economic viability. Since there are a large number of health care establishment in the Mullanpur district, common treatment and disposal facility is essential. It is

marked as common treatment and disposal facility **(CTF)** in **Figure 6.5.1**.

6.6 Information Technology and Communication

6.6.1 Introduction

This section deals with the proposed main ICT infrastructure for Mullanpur. Forecast of telecommunications lines is based on land usage and population data in Mullanpur.

6.6.2 Existing Telecommunications Infrastructure

The existing telecommunications utilities are shown in **Figure 6.6.1**.

6.6.3 Planning Assumptions

The planning assumptions for the infrastructure requirements have been covered in the structure plan report for the Greater Mohali Area (GMA).

The following technologies are deemed to be the most appropriate for deployment, viz., optical fibre technology for the backbone and wired line access networks, and cellular technology for wide area wireless services. .All these would be complemented by short range wireless networks like Wi-Fi, Bluetooth and other WLAN .technologies.

In the urban areas, cables should be run in underground ducts and sub ducts, instead of being directly buried, including the local access network component, so as to minimize the visual pollution for the Greater Mohali Area. For the more remote areas, overhead plants could be used until such time when it becomes economical to go underground. Another opportune time would be when there is an appropriate road construction activity where the ducts could be laid at the same time to minimize cost of laying the ducts.

It is recognized that provision of services via underground ducts is a more costly solution in the beginning. However, over the longer term, the higher initial investment will more than pay off as there is more flexibility to cater for growth, and plants replacement, especially when technology is developing at such a fast pace and equipment and systems have to be upgraded/replaced at increasingly shorter intervals. The use of underground ducts will also facilitate maintenance and enable quicker repair time.

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The cost of laying the underground ducts could be minimized if the construction work is carried out in conjunction with the road works or the laying of other underground infrastructures, e.g., power, gas, water and sewerage. Wherever possible, the ducts should be laid in the side table of a road.

To minimize the frequency of road digging, it is recommended that one party, or a consortium, be selected to lay the ducts and sub-ducts. Such facilities could then be leased to the service providers for them to offer the various types of services.

All existing outdoor distribution cabinets and other telecommunications termination housings should be replaced by in-building equipment rooms wherever possible.

All major new buildings should have an appropriate Main Distribution Frame (MDF) room for the termination of cables and equipment to serve customers in the buildings and the surrounding areas.

For the major buildings and important customers, diversity routing should be provided to ensure a more resilient network. .

To minimize cost for telecommunications providers, existing exchanges have been recommended for reuse where applicable. To optimize on land usage, co-location of competitors' equipment in exchanges should be encouraged. .

As for mobile network infrastructure, radio base station sites should be shared as far as possible. This is to minimize the visual pollution, especially with more and more services being met by mobile networks using frequencies in the higher frequency bands which require more radio sites to be deployed.

6.6.4 Services To Be Provided

The newer services require larger and larger bandwidths. Such services include data, TV and other interactive games and video services. And as services become more affordable with improvements in technology and cost structure, more and more homes can afford the services. In our planning, we have assumed that all homes in the urban areas would be equipped with 100mbits to 1Gbits bandwidth capacity by 2031. In order to do this, all homes should be equipped with fibres. Passive Optical Network is at present the preferred technology because of its better cost structure. As this will take some time to roll out, DSL and other wireless technologies would have to be deployed in the meantime to meet demands.

Wireless technologies like 3G, 3.5G, LTE, and the future 4G, will continue to be an important means of meeting demands for broadband services, especially in those areas where it would be costly to provide wired line broadband services. Even in urban areas where fibre to the home (FTTH) is readily available, wireless technology will continue to complement the wireline facilities.

6.6.5 Recommendations

By 2031, planned urban population of Mullanpur is 200,000.

The telecommunications requirements for this region will be relatively small. Wired telecommunications services are presently being served from some existing exchanges. The existing number of exchanges can be consolidated to one, since the new generation technology can service a larger number of customers, and over longer distances as well.

6.6.6 Forecast of Subscribers

Todate, there is insufficient data to do a more detailed forecast. For planning purposes, we have used the projected population data to work out a rough estimate of subscribers. When more detailed data becomes available, the forecast figure can then be fine tuned. The forecast is shown in **Table 6.6.1**.

Table 6.6.1 Projected Telecom Subscribers for Mullanpur Local Planning Area (year 2031)

Local Planning Area	Projected Telecom Subscribers
MULLANPUR	67,000

6.6.7 Ducts Routing

The proposed duct and cable routing is shown in **Figure 6.6.2** and **Figure 6.6.3**.

6.7 Gas Supply and Distribution

6.7.1 Introduction

There is no Gas supply in the region now. But it is expected to reach GMADA in coming 5 to 10 years. It will come either from Iran-Pakistan or from neighboring states in the south. Hence it is recommended to keep provision for the gas distribution network accounting for both possible gas pipeline network. Hence planning has accounted for both the possible scenario. The gas will reach Mullanpur from either location to the Mullanpur gas zonal regulating station and shall be distributed to the region from the gas regulating station.

6.7.2 Distribution Network

Presently there is no gas distribution network on site or in vicinity. But as recommended land shall be required for the working stations and storage shall be earmarked. It is proposed the lying of gas distribution network all along each road on either side with the land area reserved for such pipe laying restricted to about 0.5 metres width on secondary and inside roads and to 1.5 metres on all main roads.

6.7.3 Demand Estimate

The estimated Gas consumption is 60,000 SCM.

6.7.4 Agencies Dealing With Gas Service In The Region

Since there is no present gas distribution network in the region there is no nodal agency in the region catering to such facility. However the GAIL (Gas Authority of India Limited) can be considered to be the nodal agency. GAIL shall be responsible to decide the planned implementation of gas pipeline to bring gas to GMADA. They shall also ensure which of the two possible scenarios emerge. Later GMADA will have to establish either a Public Private Partnership (PPP) or a government nodal agency responsible for gas procurement and distribution within GMADA.

6.7.5 Proposed Gas Distribution System

GAIL shall be responsible for conveying gas to GMADA region through either a dedicated pipeline from the nearest pipe or through a general route pipe line passing near GMADA region.

a) City Gate Station (Located outside the Mullanpur plan area)

Once gas reaches GMADA, one city gate station shall have to be provided. It is planned to have such a city gate station in the same area reserved for Gas based power station as the Gas essential for Gas based power station will be also brought to GMADA region. The City Gate station shall be responsible for controlling the entry of gas into GMADA region. From here each of the six (6) Local Planning Areas (LPAs) can be provided with individual dedicated pipe line going from city gate station to each LPA (e.g. CGS to Zirakpur, CGS to SAS Nagar zone, CGS to Mullanpur, etc).

b) Zonal Regulating Station: (Located within Mullanpur)

The zonal regulating station is planned to be located within Mullanpur at the rural-agricultural area, beside the road. The area require for the station including ancillary facilities is about 0.25 ha. From the zonal regulating station pipe line distribution network is planned to move in the service corridor provided on each road. This service corridor shall be the main core of the network for gas distribution.

Other components of the gas distribution network inside each locality are as following (No area needs to be reserved for any of the below stated component of the network):-

i) The Service Regulator

It is housed in a blue fiber-glass kiosk, which reduces the gas pressure from 4 BAR to 100 mBAR and ensures the flow of gas at constant pressure at all time.

ii) Buried Polyethylene Pipes

The pipes are installed at a safe and secure depth. It provides low-pressure gas (100 mBAR) to individual buildings. These lines/ conduits will be housed within the utility corridor by the MGL authorities.

iii) The Riser Pipe (GI pipe)

This is an external connection on the building to each apartment. Each Riser Pipe (GI pipe) has a Riser Isolation Valve.

iv) The Meter Control Valve

Fitted in each apartment, this valve is between the riser pipe and meter.

v) The Meter Regulator

Installed before the meter, the meter regulator reduces the gas pressure from 100 mBAR to 21 mBAR.

vi) The Appliance Valve

This valve switches on/off the gas to burning appliance.

6.8 Overall Infrastructure Plan

The locations and safeguarded land areas for various infrastructure utilities, including storm water drainage, water, sewerage, solid waste, power, telecom, gas, are shown in **Figure 6.8.1 Overall Infrastructure Plan (Year 2031)**.

The proposed utilities locations and safeguarded land areas are indicative only and subject to changes during site verification and detailed planning and design stage.

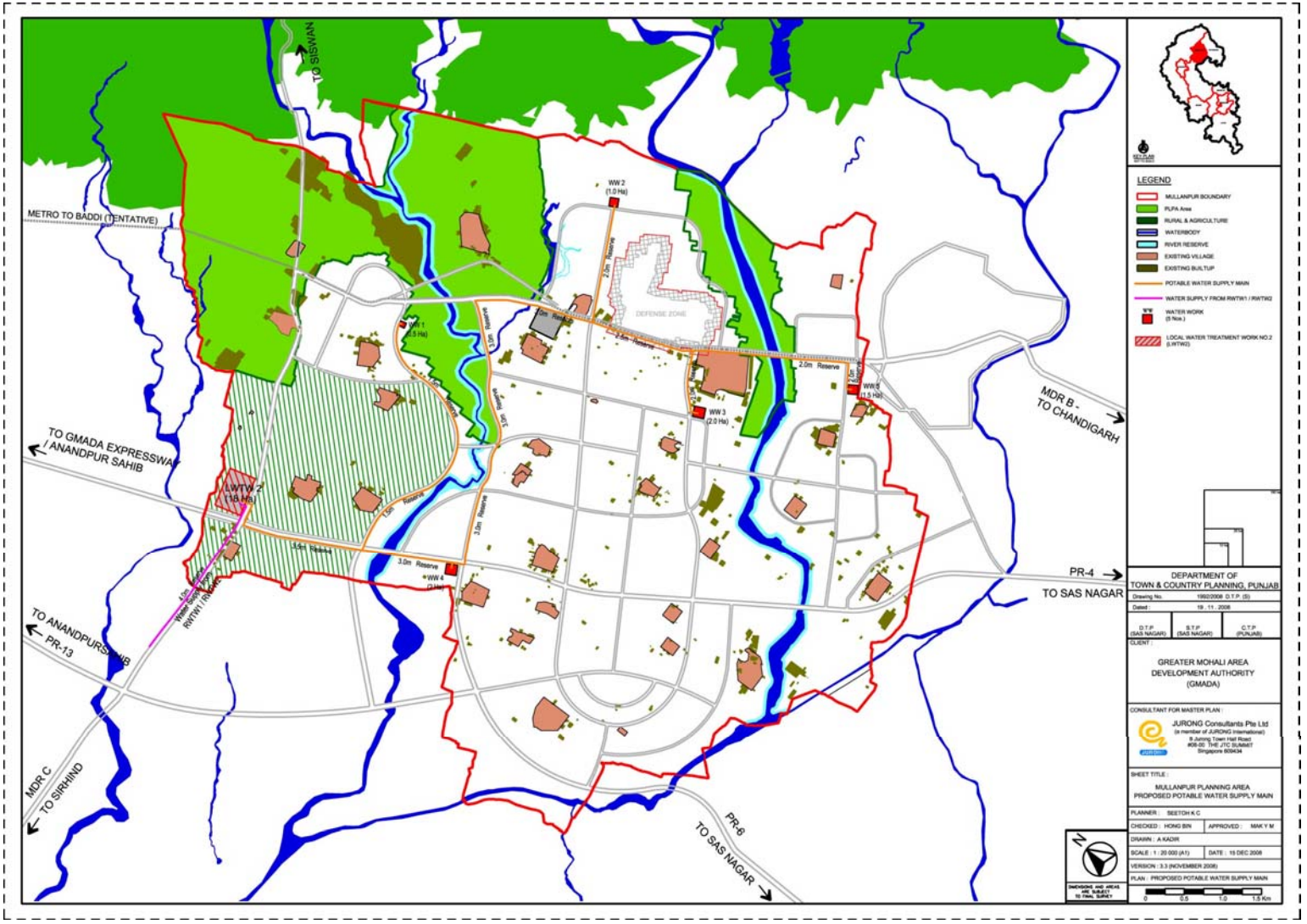


Figure 6.1.1 Proposed Potable Water Supply Main

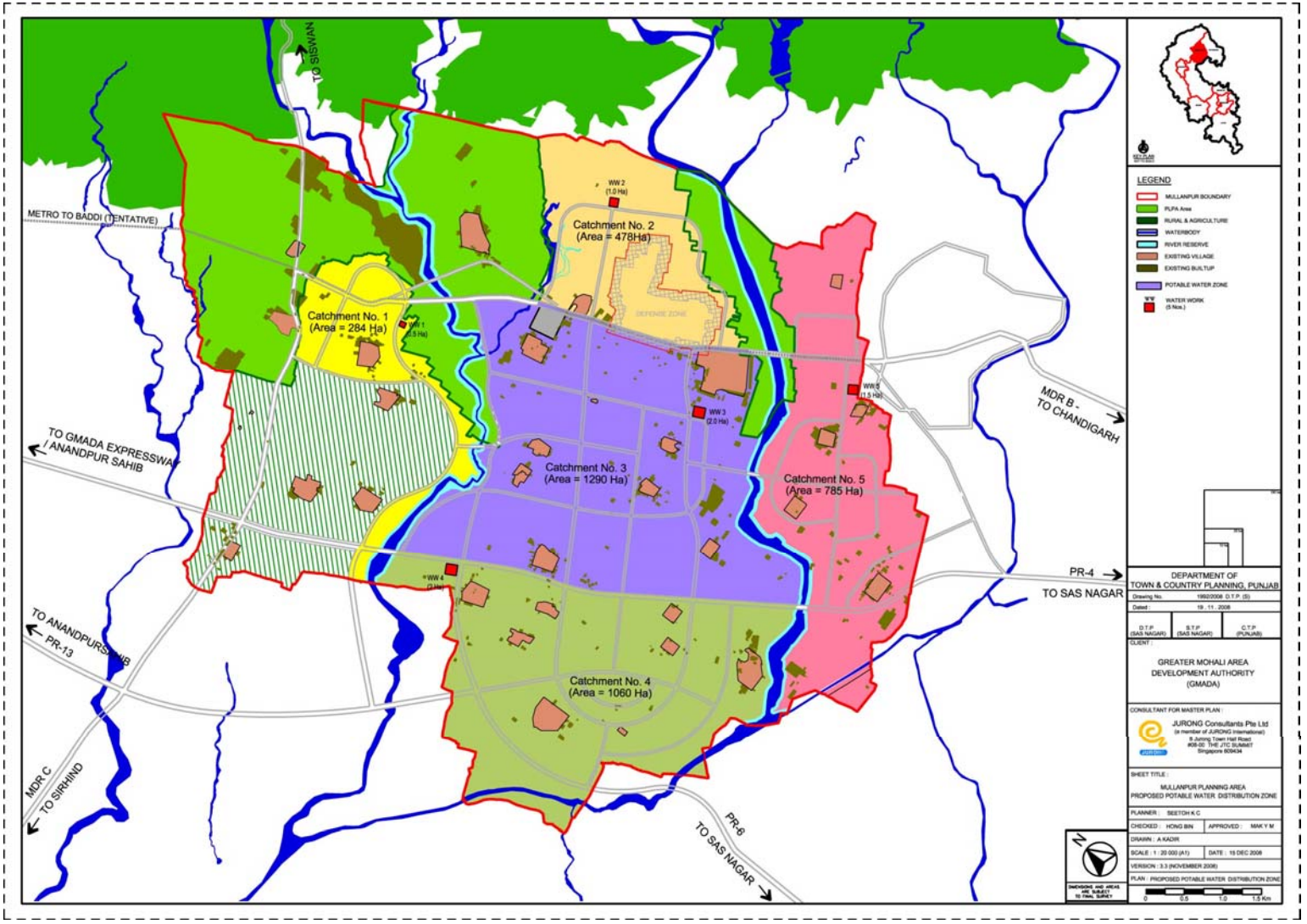


Figure 6.1.2 Proposed Potable Water Distribution Zone

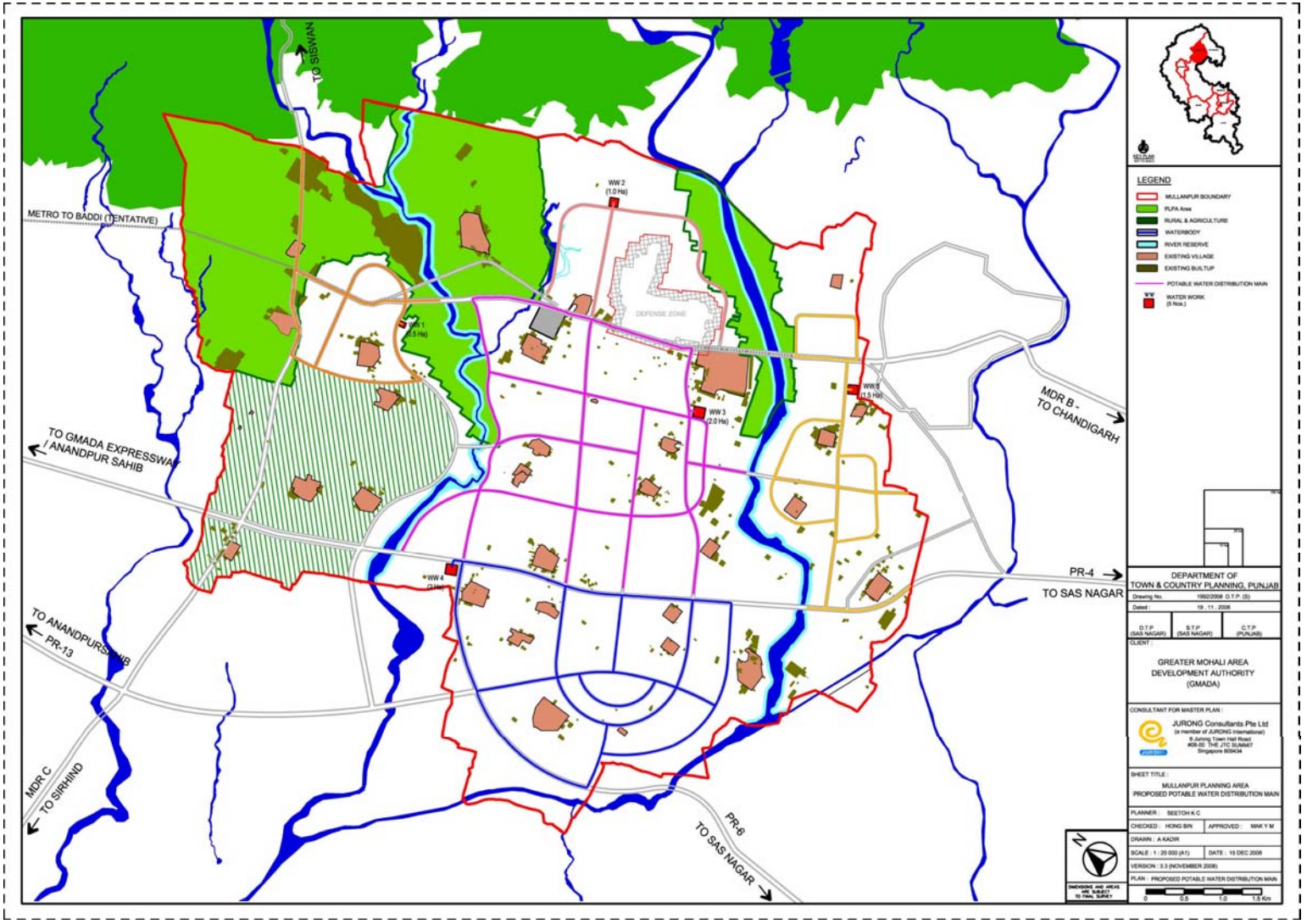


Figure 6.1.3 Proposed Potable Water Distribution Main

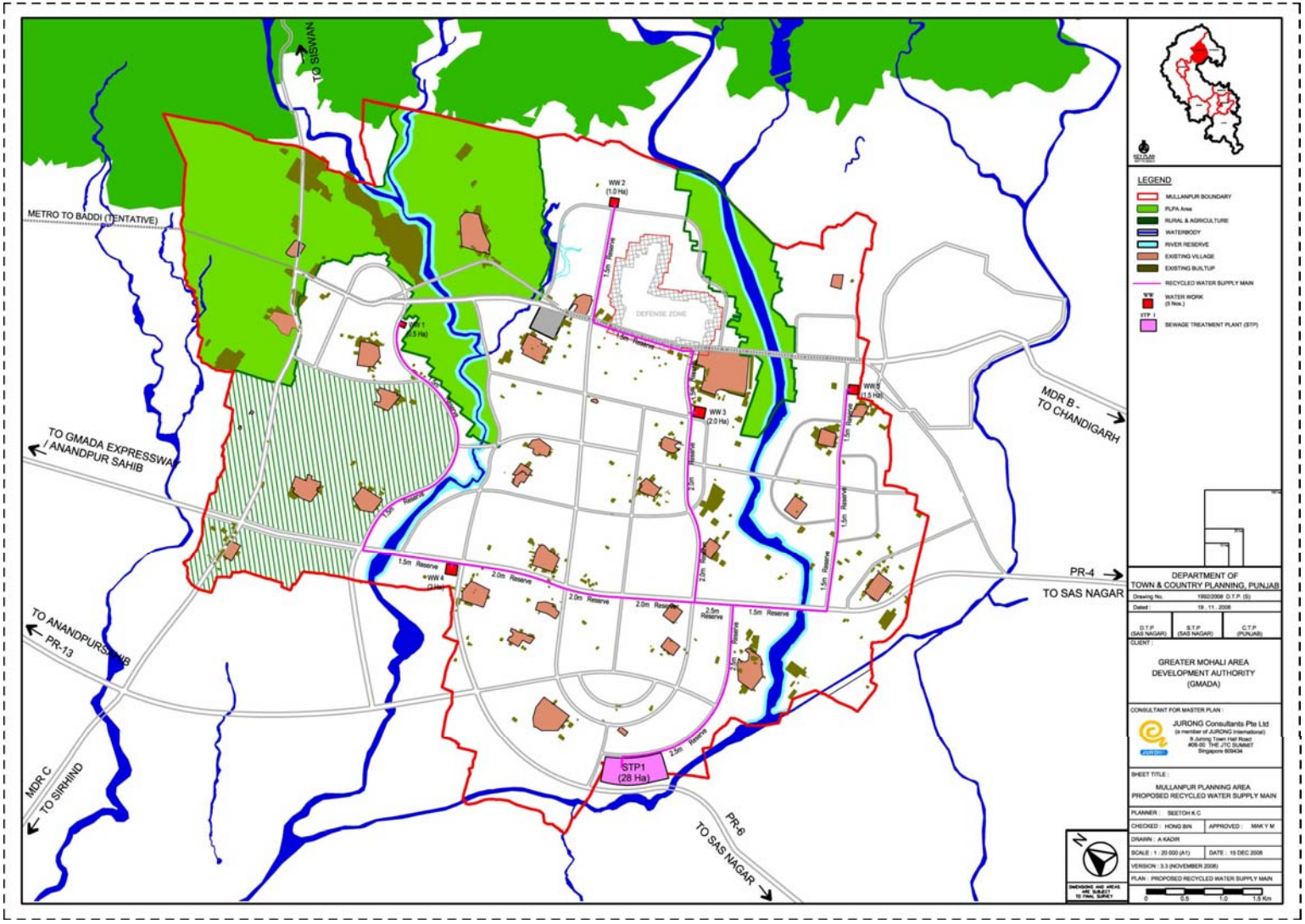


Figure 6.1.4 Proposed Recycled Water Supply Main

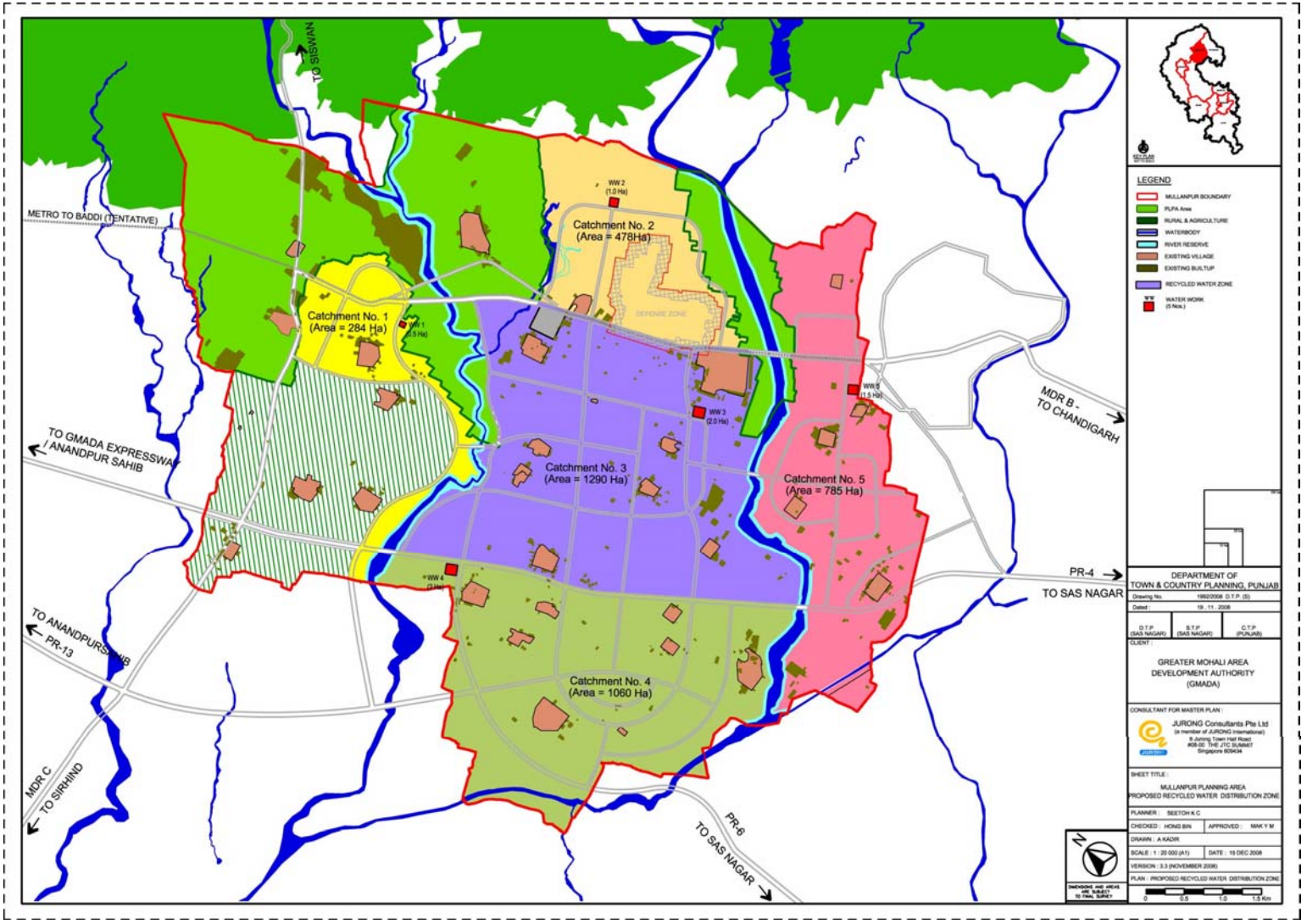


Figure 6.1.5 Proposed Recycled Water Distribution Zone

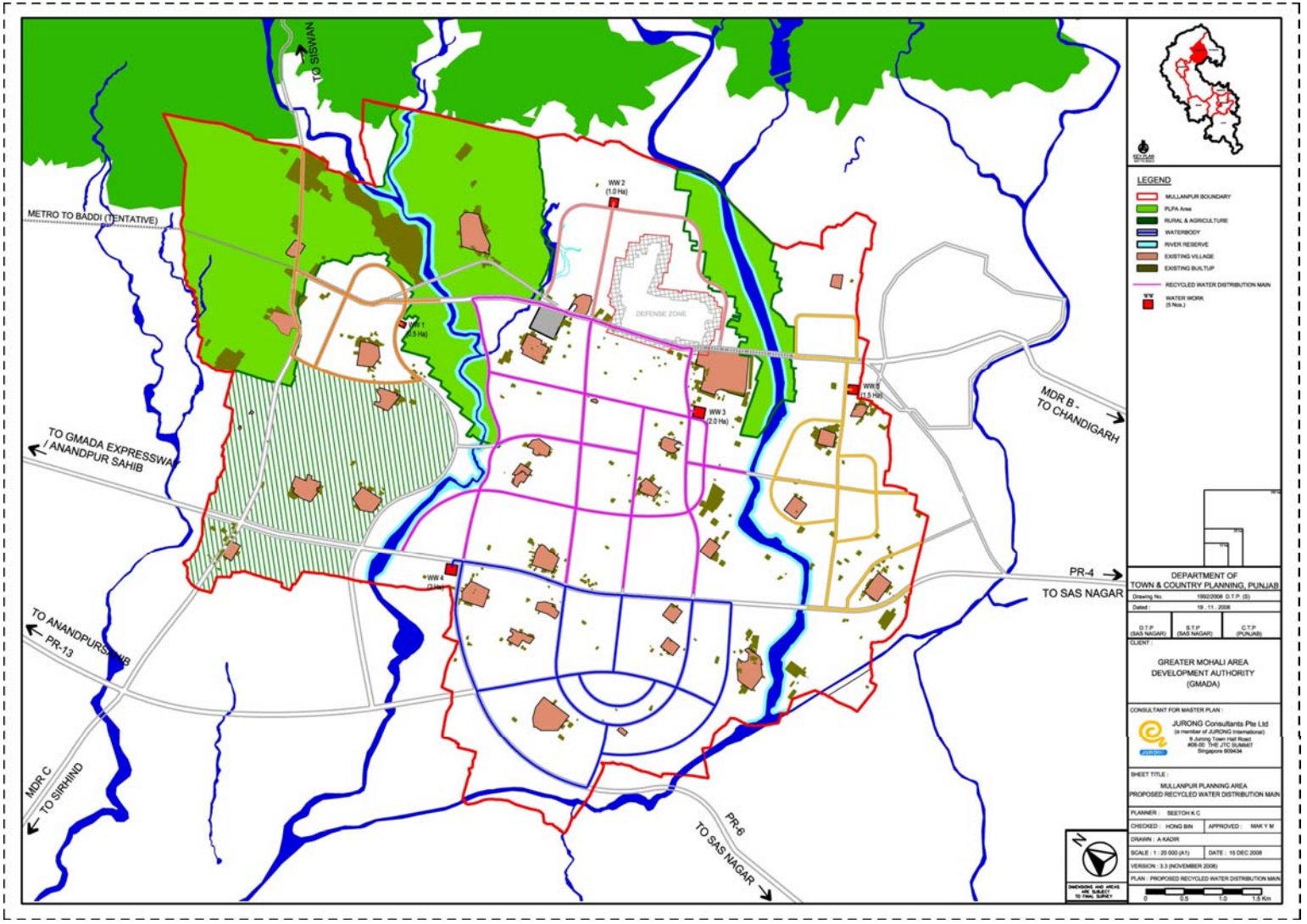


Figure 6.1.6 Proposed Recycled Water Distribution Main

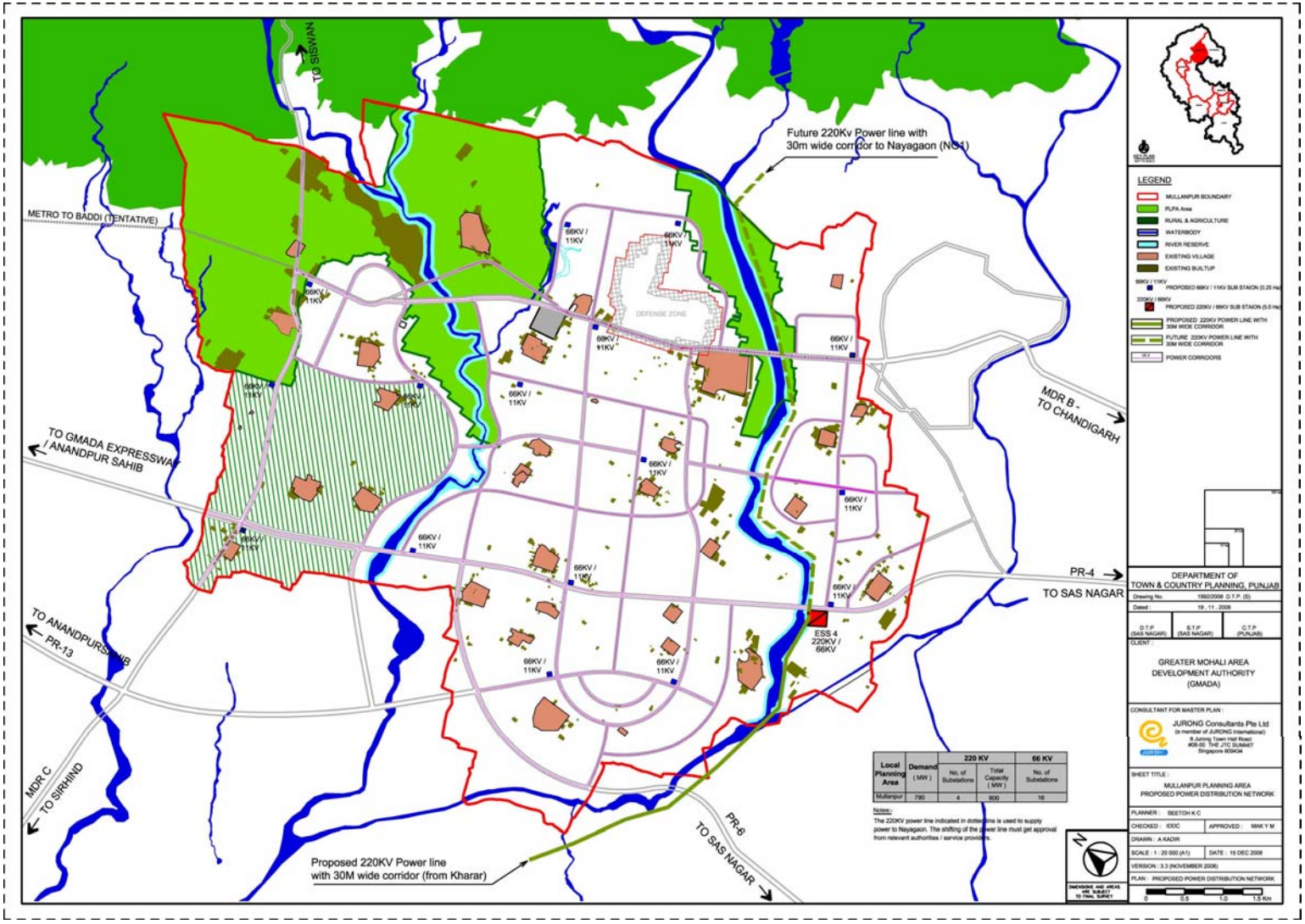


Figure 6.2.1 Proposed Power Distribution Network

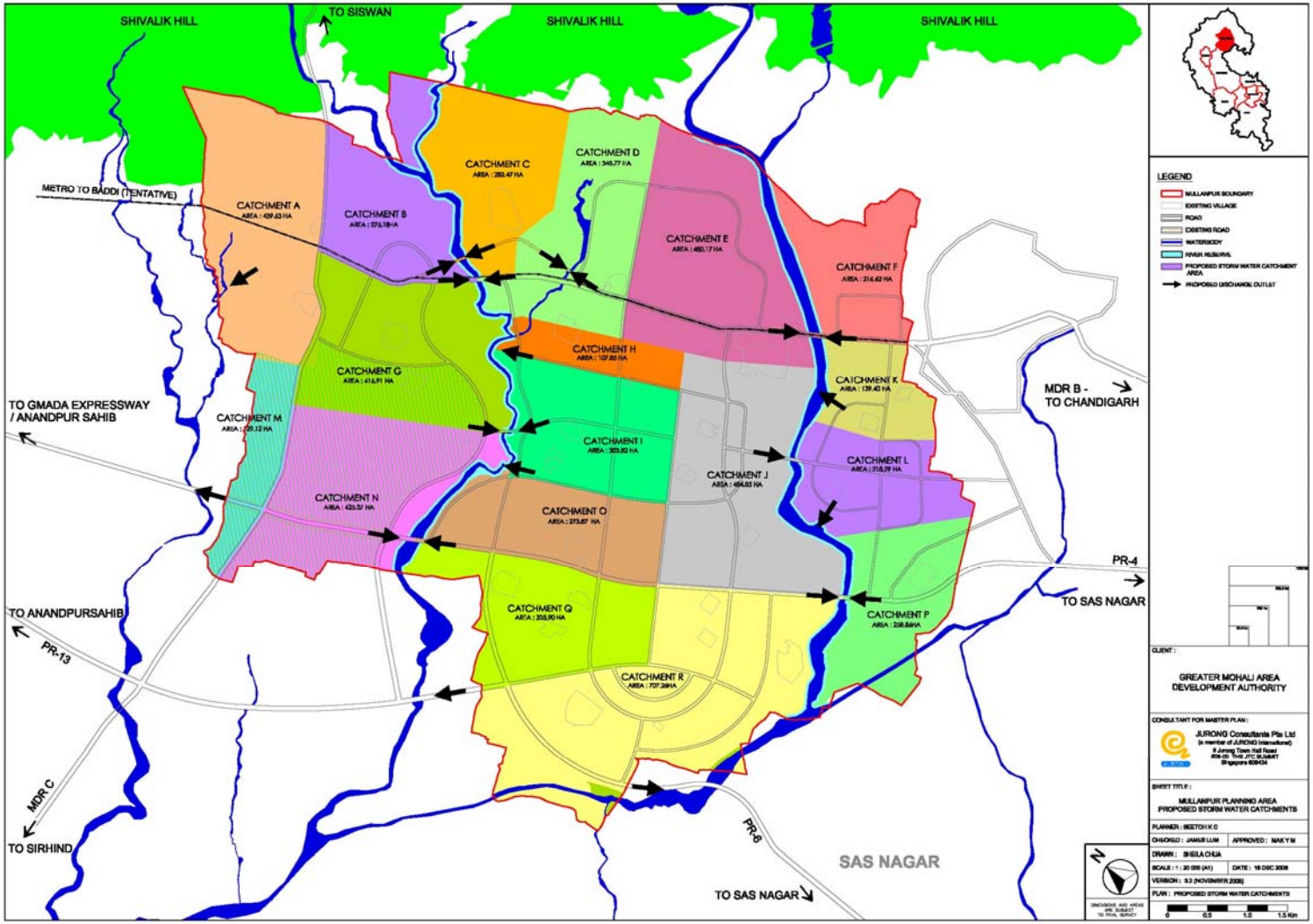


Figure 6.3.1 Proposed Storm Water Drainage Catchment Areas

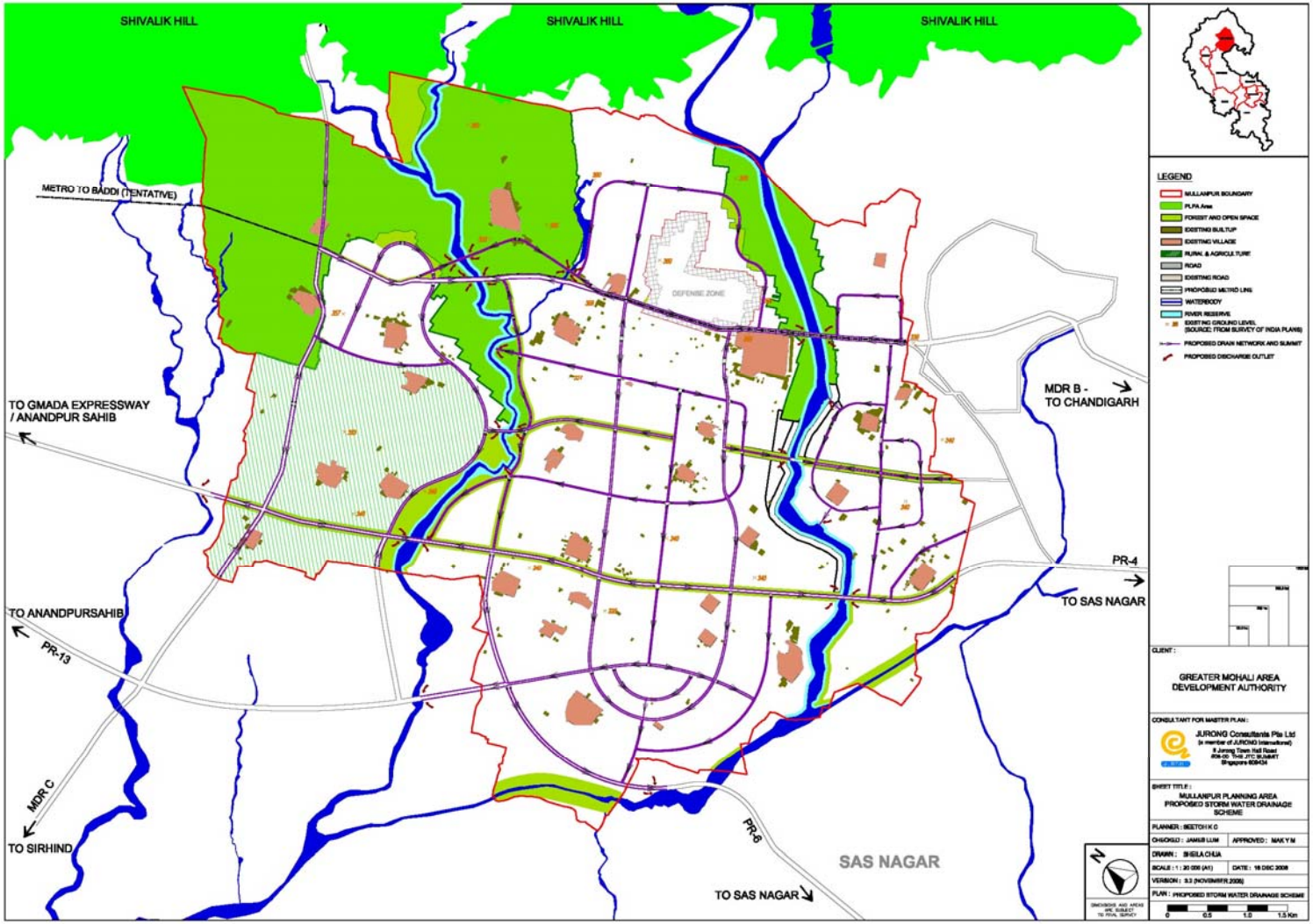


Figure 6.3.2 Proposed Storm Water Drainage Network

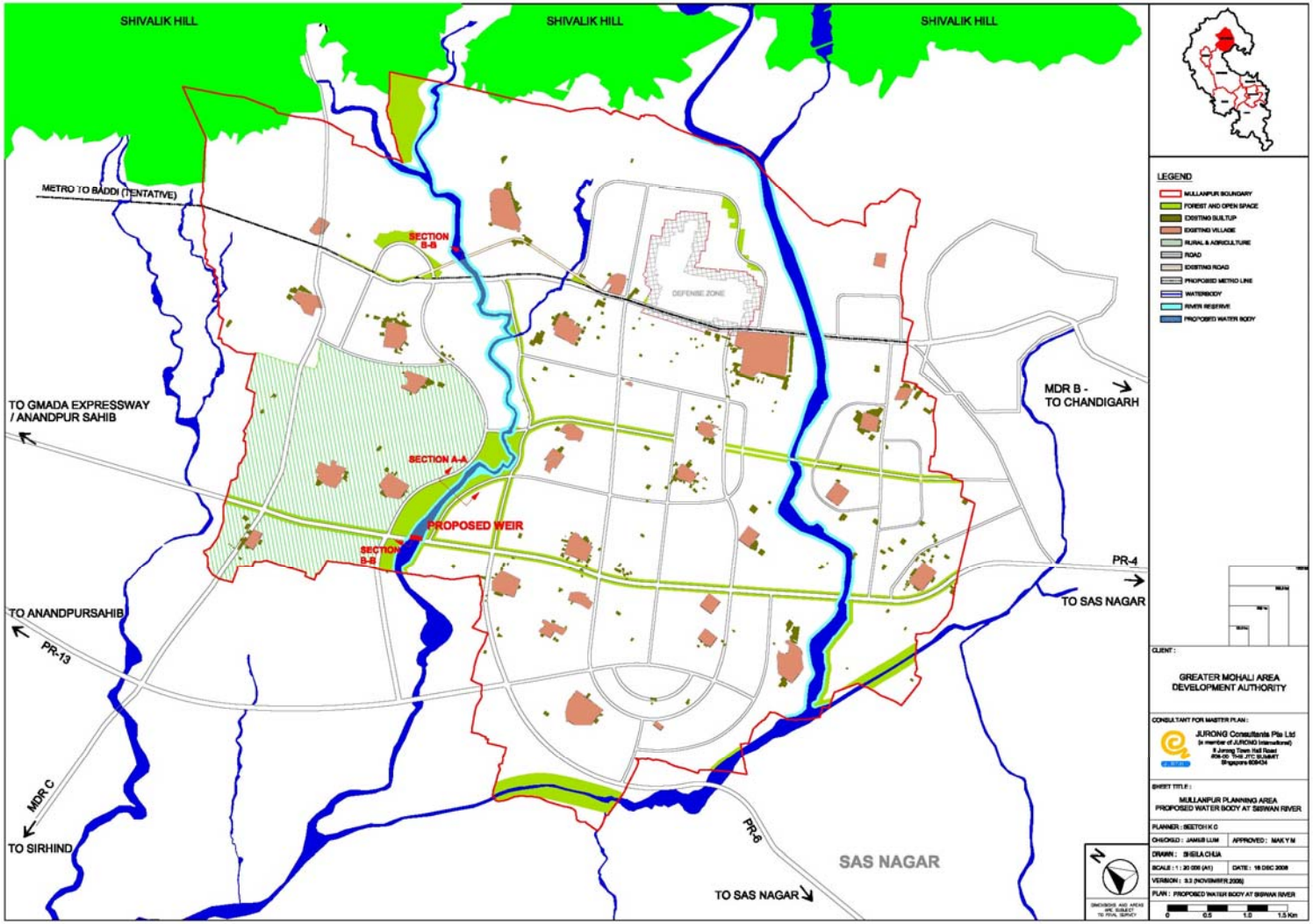


Figure 6.3.3 Proposed Water Body at Siswan River

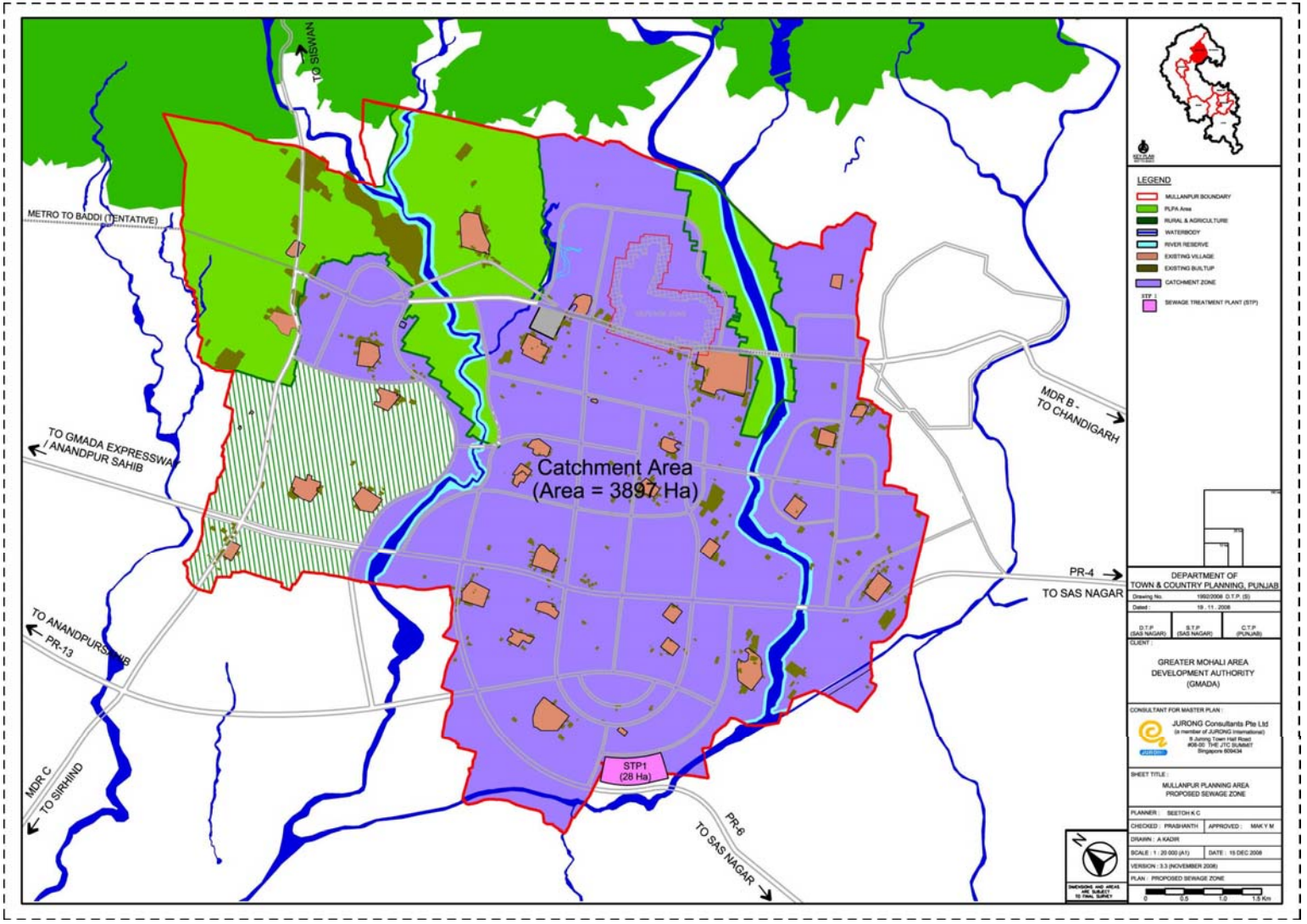


Figure 6.4.2 Proposed Sewerage Catchment

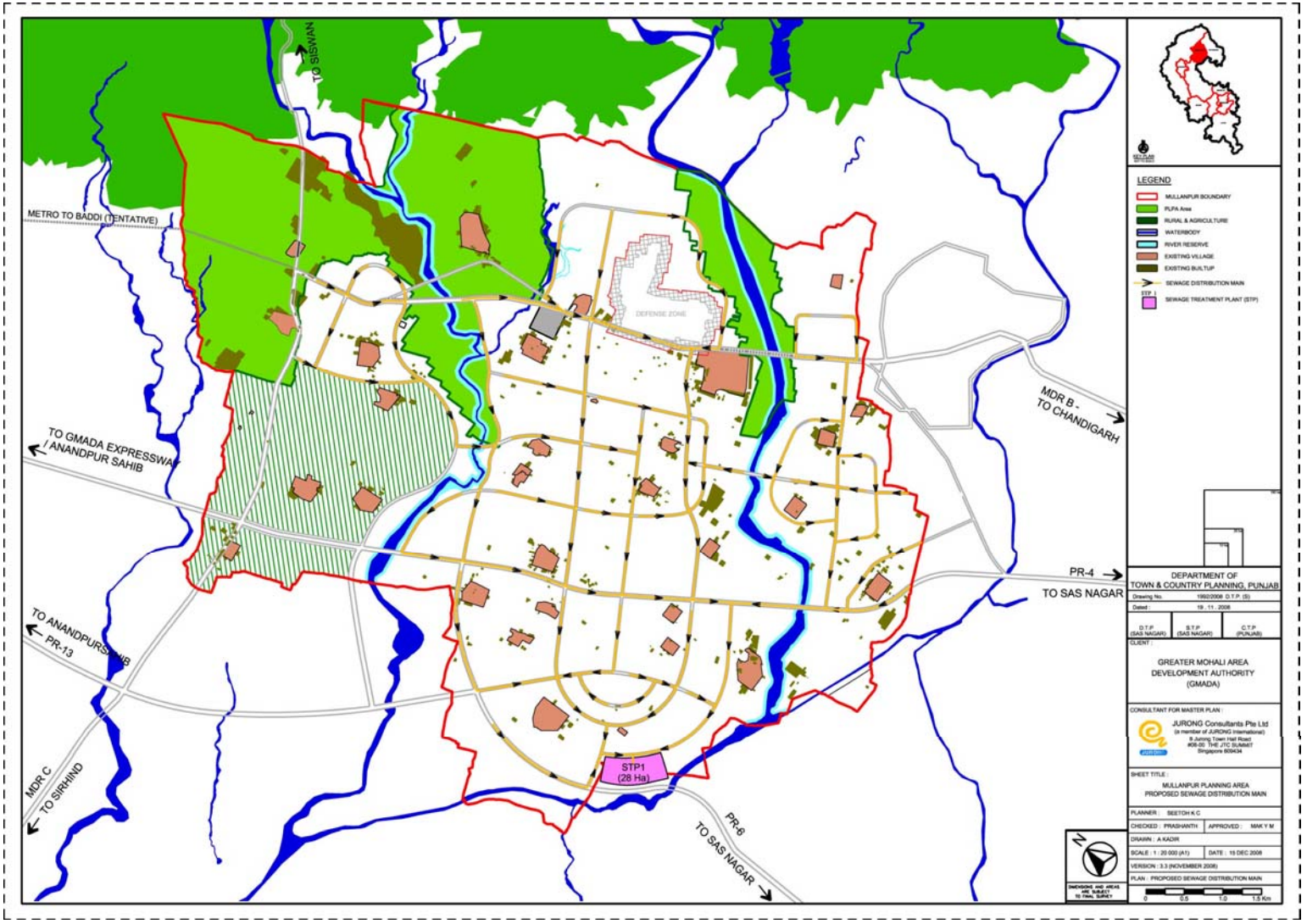


Figure 6.4.3 Proposed Sewerage Network

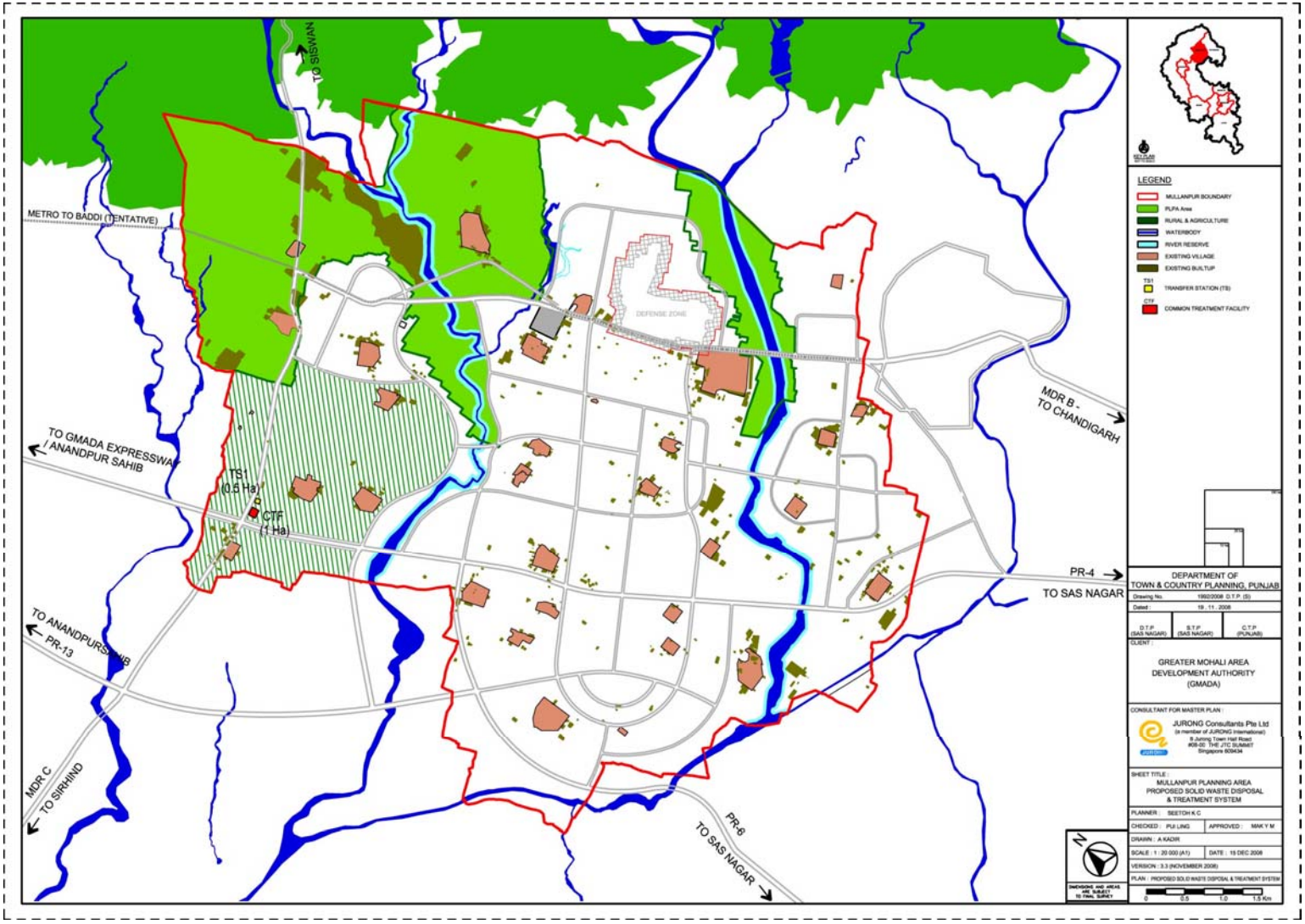


Figure 6.5.1 Proposed Solid Waste Disposal & Treatment System

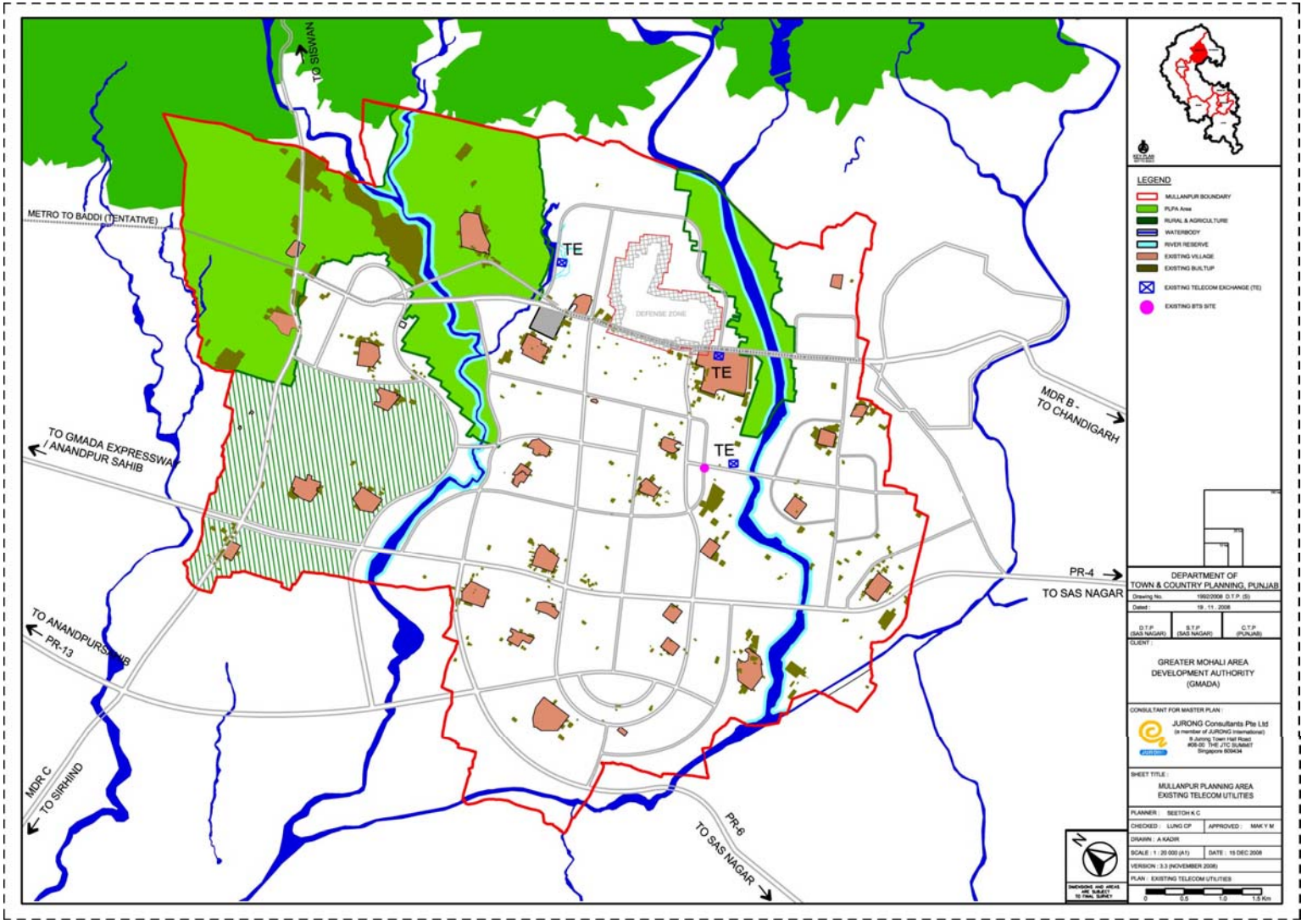


Figure 6.6.1 Existing Telecom Utilities

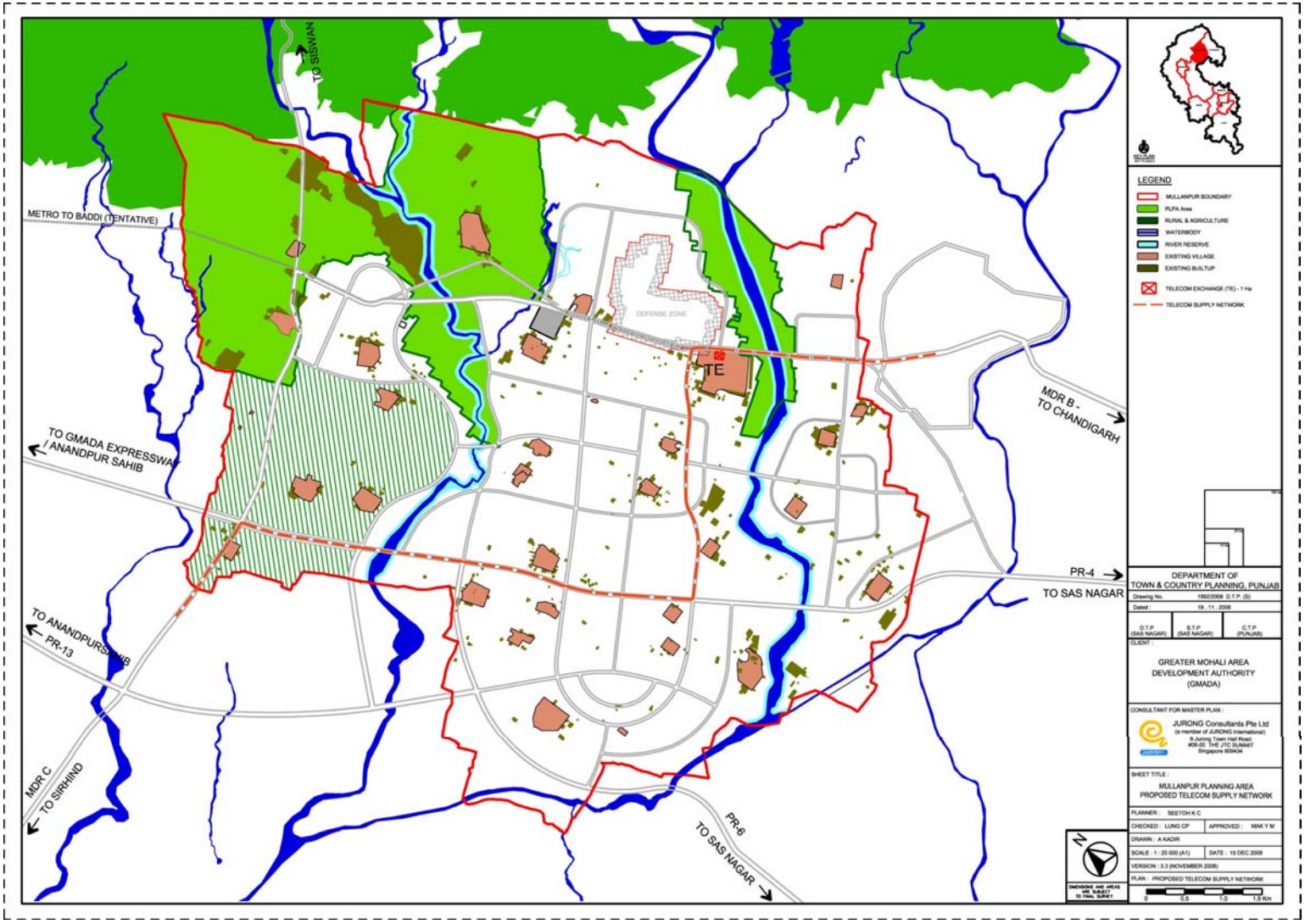


Figure 6.6.2 Proposed Telecom Supply Network

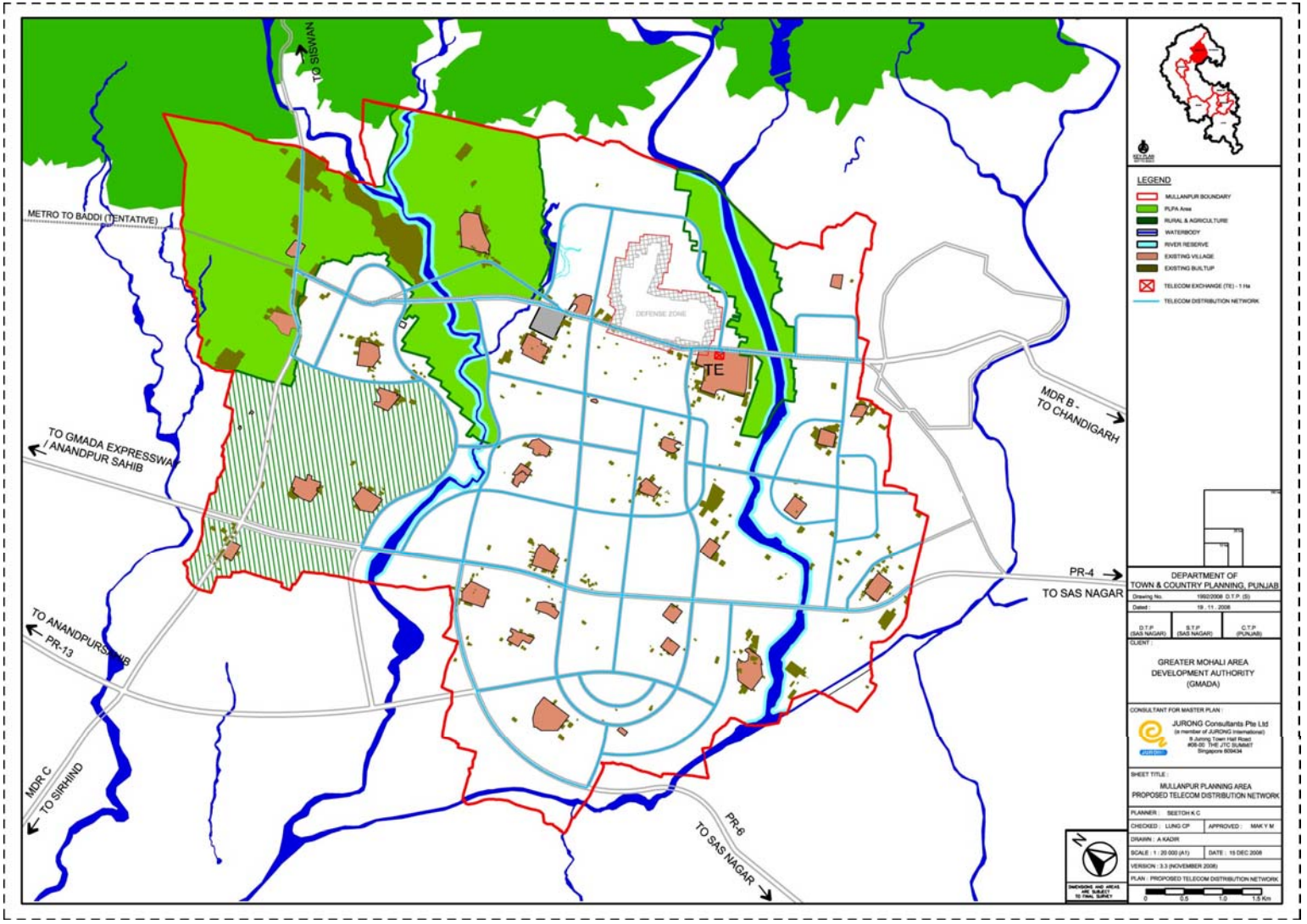


Figure 6.6.3 Proposed Telecom Distribution Network

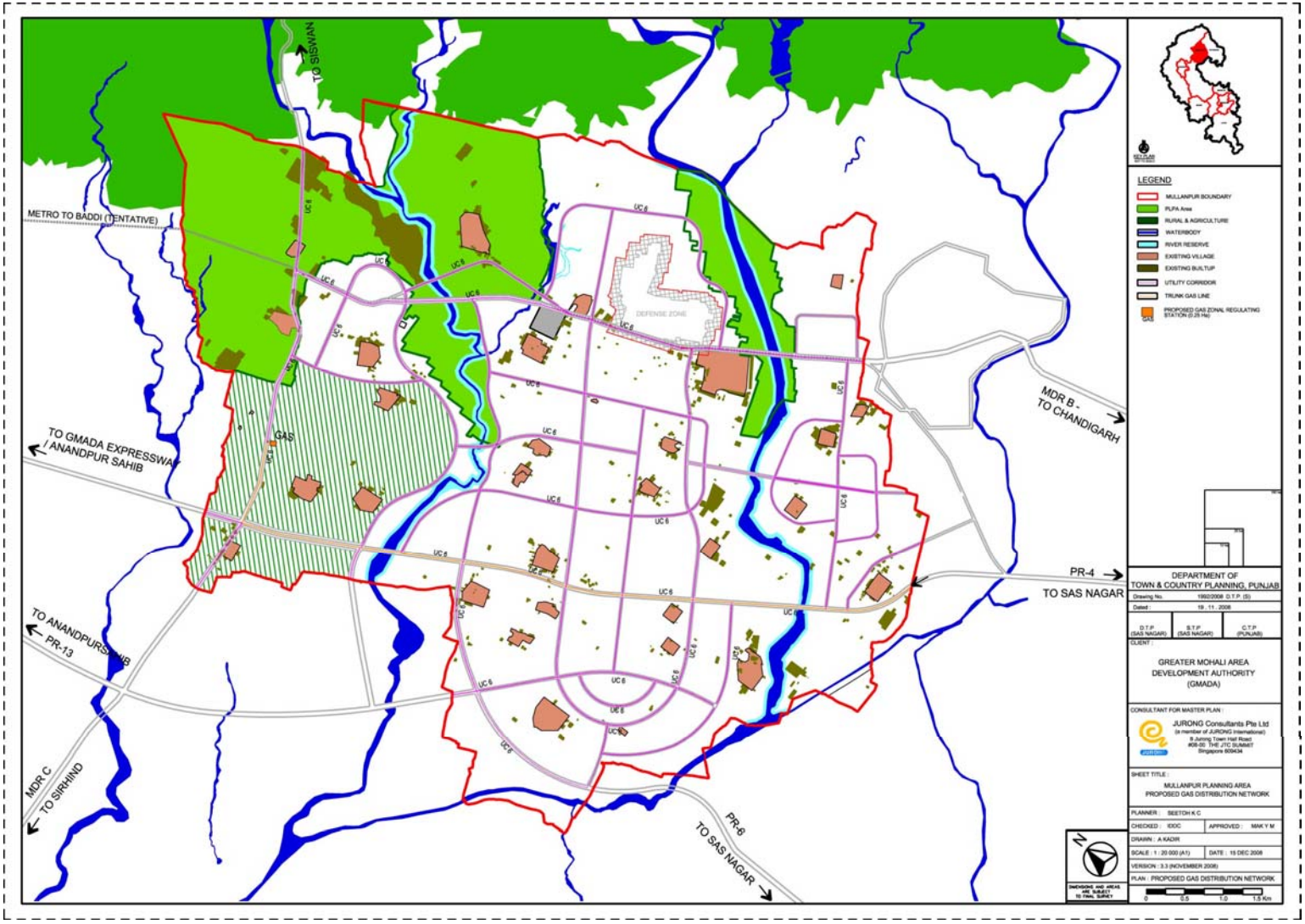


Figure 6.7.1 Proposed Gas Distribution Network

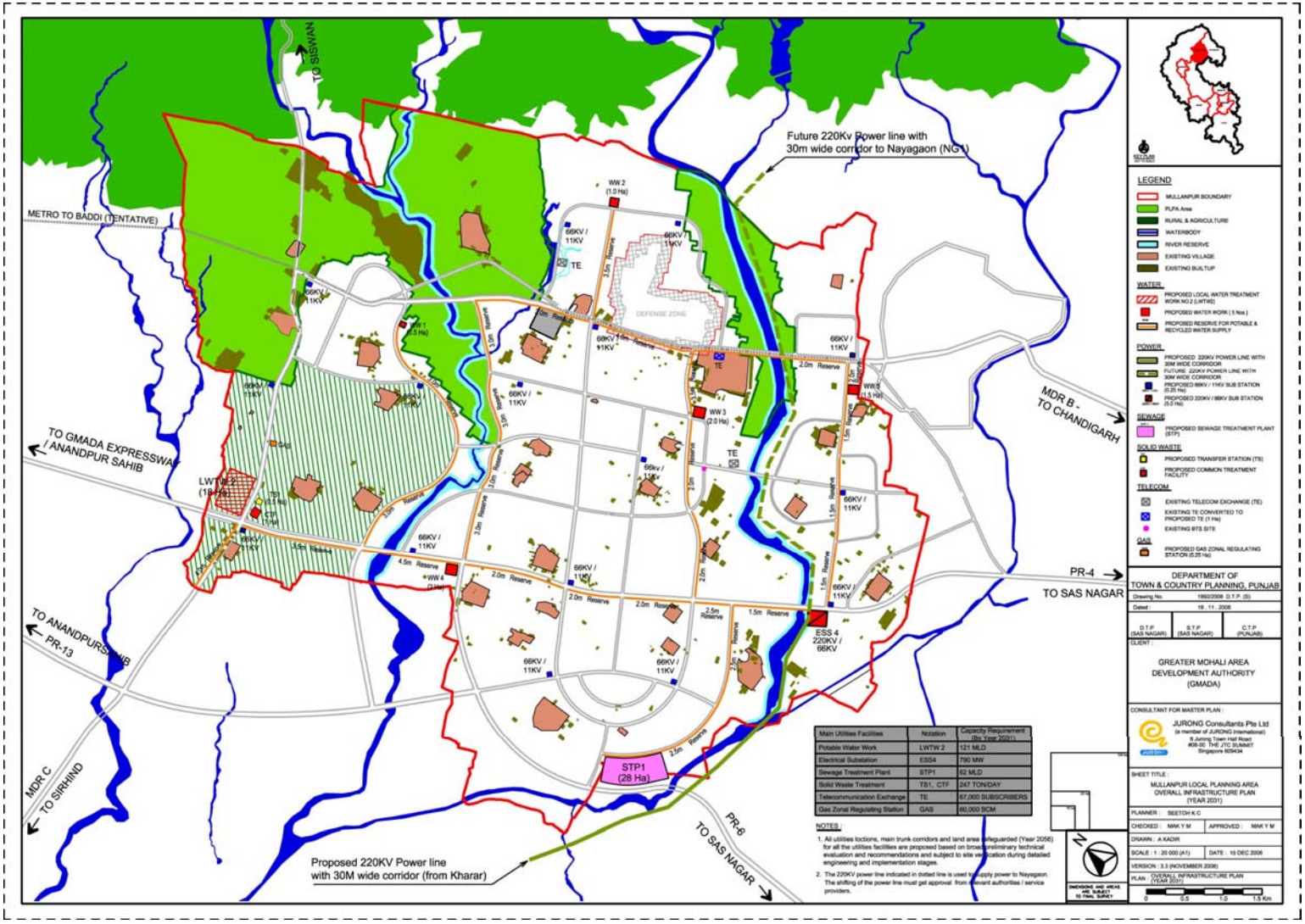
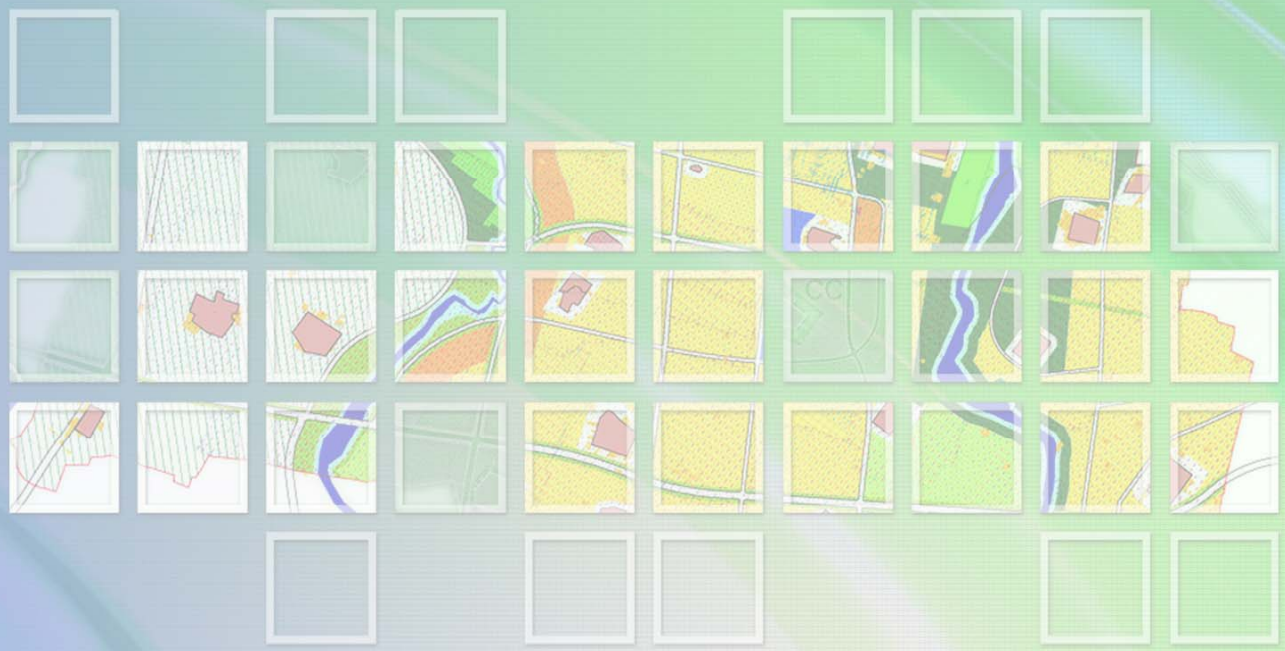


Figure 6.8.1 Overall Infrastructure Plan (Year 2031)

MULLANPUR LOCAL PLANNING AREA

GREATER MOHALI REGION, PUNJAB (INDIA)



Chapter 7

IMPLEMENTATION & PHASING

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7. IMPLEMENTATION AND PHASING

7.1 Land and Development Policy

The rivers are important assets of the area. A river without water is not as exciting as one with water. Equally, a river with blue rather than brown water is aesthetically more pleasing. At the present time, the rivers are dry for most part of the year. A first task of the land and development policy is to address the water issue: how to bring and keep the water in the rivers. This will involve re-examination and re-negotiation of the water supply arrangements to the area. It will require the construction of dams in appropriate location to keep the water in.

While it is a challenge to create permanent water bodies, it will also present opportunities to harness engineering and technological innovations including water recycling technologies. The issue of water supply, catchment and management requires detailed technical investigation and expertise that is beyond the scope of the present master plan. It is recommended that GMADA commissions specialized studies in this direction. Here, the government's role remains initiatory, while the main developments will be carried out by the private sector.

A market-oriented, entrepreneurialism approach to development is adopted. It is assumed that apart from essential services, much of the Mullanpur Local Planning Area development will be carried out by the private sector.

Table 7.1: Land Use Acquisition Based on Entrepreneurialism Approach

Land use	Acquisition	Development	Operations & Maintenance
Residential	Public / Private-Sale of Site/Auction	Public / Private	Public / Private
Commercial	Public / Private-Sale of Site/Auction	Public / Private	Public / Private
Institutional (Regional Scale)	Public/Private (depending on kind of facility)	Public/Private	Pubic / Private
Institutional (Neighbourhood Scale)	Public / Private	Public / Private (BOO/BOOT)	Public / Private
Open Spaces/Green Areas	Public-private	Public / Private	Public / Private
Road/Transport Infrastructure	Public	Public /Private (BOO/BOOT)	Public / Private

The entrepreneurialism approach has also been a dominant approach in many former industrial cities and successful world cities such as London, New York and Tokyo, becoming the mainstream of modern urban policy planning. The aim is to foster and encourage local economic development.

The role of the local authority is intrinsically initiatory, facilitating and pro-economic growth, trying to initiate and facilitate economic growth rather than control and manage it. It will aim to make full use of market mechanisms to achieve public goals with less public intervention and expenditure. It will project Mullanpur as an attractive place to live, work and invest. It will encourage private sector to take a lead in the urban spatial developments by introducing new modes of regulatory measures to stimulate private innovation and strengthen market functioning based on long-term vision. It will review bureaucratically-determined practices that are driven by rules and regulations and which are slow to respond to new demands that arise towards and enabling government. A strong and coherent leadership played by

local government is crucial for the entrepreneurial approach in spatial development.

Without exception, the planning standards and guidelines as set out in the Punjab government Gazette (Extra) Jan 20, 2006 (PAUSA30, 1927 SAKA) shall be observed in this master plan. There shall be no development on the land affected by the Punjab Land Preservation Act (PLPA), 1900. In other words, no development is permitted to encroach into PLPA land.

In keeping with the vision of Mullanpur as an eco-town, the qualities and special characteristics of a 'good eco-living environment' will be developed. Some examples are the green structure, the biological diversity, the cultural and historic value of the built environment and other eco-cycles of renewable energy such as solar and wind energy usage and low carbon impact development and effluent discharge. These qualities must be taken into consideration when discussing and implementing Mullanpur's future urban developments. Details of the development control regulation and FSI are contained in the accompanying Development Control Regulations Report.

7.2 Development Phasing

It is proposed that the 6123.7 ha site be developed in phases as it is neither feasible nor desirable to develop the entire site of 6123.7 ha simultaneously. A phasing plan will be designed to ensure that the development of the various land uses within the township is well coordinated. This will permit more cost effective use of existing and proposed investments in implementation of infrastructure.

7.2.1 Principles of Phasing

- To allow growth to take place incrementally over time. This is done in order to minimize the need for concentrated investment and mega form solutions at any stage of the township development. In addition, incremental development provides flexibility in terms of phasing, sizes of phased packages of development, and minimizes the heavy front-end costs where they are not required.
- To recognize that growth takes place by small increments as and when resources are available.
- To provide a greater degree of choice of site layout at each stage of growth.
- To encourage variety and plurality in investment and participation in the township development, both from public and private aspects. There are opportunities for both large projects taking up several building blocks as well as small projects, which may occupy only one block. Hence, providing a spectrum of different projects sizes at any one time gives equal opportunities for small as well as large investors/developers to participate actively.

7.2.2 Sequence of the Development Phases

This will permit more cost effective use of existing and proposed investment in infrastructure as well as taking into consideration the adjacent development opportunities and impact particularly from S.A.S. Nagar and Chandigarh.

Starter projects of sufficient size are needed as catalysts to overcome the force of inertia. These developments should demonstrate financial and environmental viability. The starter projects should establish the eco-development and architectural standards expected. Like in any other parts of the world, it is not unusual that industries will be the catalyst for growth and will be developed first. In line with this, the prominent developments that have been earmarked to be implemented in the 1st phase include:

(a) Health Village;
(b) Knowledge Village – Educational Institution;
(c) R&D Cluster (in the form of Business Parks).

These developments have potential to spearhead IT industry growth, medical and educational tourism. An appropriate quantum of commercial space for retail, leisure and entertainment along the main water body and the other areas (town centre, major roads) can proceed but their development will have to keep pace with the market demand and also in tandem with other infrastructure developments within Mullanpur.

The phase 1 start up area would be concentrated in the industrial parcel, starting at the north-western part of Mullanpur (i.e. the Health Village and park 6 for eco-tourism) and south-western part of Mullanpur (i.e. parcel for educational institution and R&D Hub) including some of the commercial uses along the main arterial road and water body that run through the area including the commercial nodes at strategic transportation nodes. It is proposed that the rest of the residential development logically proceed from the north-eastern to the south-western and progressively from the east to west. The start-up area boundary was drawn up taking into consideration the mix of land use types, the proximity to the existing highway and built up areas, and the ease of infrastructure connections.

With the completion of the first phase, there will be sufficient residential population and workers to justify the commencement of the administrative, entertainment, commercial and institutional elements within the main regional centre. Infrastructure and utilities development such as roads, electrical substations, sewers, bridges, etc. should be built and laid first because of the long lead time of 1 to 2 years to construct these. However, these provisions should be scheduled to tie in with the development phasing to reduce the high capital outlay and holding cost.

MULLANPUR LOCAL PLANNING AREA

GREATER MOHALI REGION, PUNJAB (INDIA)

Chapter 8

SPECIAL & DETAILED DEVELOPMENT CONTROL REGULATIONS FOR MULLANPUR

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8 SPECIAL AND DETAILED CONTROLS FOR MULLANPUR

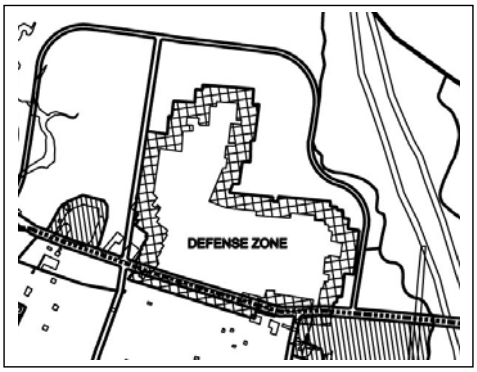
In addition to the common development control parameters applicable to the whole of the GMADA, special and detailed controls are applied to specific area within the Mullanpur Local planning area. These are illustrated in *Figure 8.1- 8.5* and *Table 8.1*.

8.1 Development constraint Zone around the Special Use Zone

There is an Air Force station and installation within the Mullanpur area (Air Force Station Mullanpur). As per the Gazette of India No 4 – New Delhi, February 25 – March 3, 2007, the Ministry of Defence in exercising the powers of Section 3 and 7 of the Works of Defence Act, 1903 found it expedient to impose restrictions, upon the use and enjoyment of land in the vicinity of the Indian Air Force and Installations.

As per the Annexure A of the same Gazette, no building or structure shall be constructed, created or erected or no tree shall be planted on any land within the limits of 100 meters fro the crest of the outer parapet of the Indian Air Force Mullanpur station.

Figure 8.1: No Development Zone



The 100 meters no development zone is depicted in hatched lines in the figure 6.1. It extends across the road. Unauthorized developments within the 100 meters will be required to be relocated in the future as and when the Air Force implements the Act.

8.2 Development constraint zone – within PLPA

Without exception, there shall be no development on the land affected by the Punjab Land Preservation Act (PLPA), 1900. The areas falling within the PLPA in the Mullanpur master plan are clearly indicated in the land use master plan and are per Government of India notification 39/15/99 –Ft. III/ 15852 dated 04/11/99. All development must start beyond the PLPA land. In other words, no building is permitted to encroach into PLPA land. The boundary of the PLPA is shown in the master plan. Any developments proposed or shown within the PLPA land has to be verified with the Department of forest and wildlife (forest branch).

8.3 Intensity of development and Building Height Control

8.3.1 Special and detailed controls for Mullanpur (overall)

As Mullanpur is situated at the foothills of the Shivalik hills and in a highly sensitive ecological area, it is the planning intention to have developments slope away from the base of the hills in a manner in which views from the top of the Shivalik hills can still be maintained.

Except where the land is proposed for plotted developments which is controlled up to a 3- storey height (maximum), the rest of the developments such as group housing, institution, mixed use, IT parks and recreation use are required to adhere to the height controls subject to clearance from Air Force Authorities.

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Table 8.1: Intensity of development (overall)

Land use	FAR
Mixed Use	1.75
Industry / Business park	1.75
Institution	1.00
Group Housing	1.75
Plot Housing	1.65

Without exception, the planning standards and guidelines as set out in the Punjab Government Gazette (Extra) Jan 20, 2006 (PAUSA 30, 1927 SAKA) shall be observed in this master plan.

Specific land uses in Mullanpur

Leisure and Recreation use

o Land parcels designated for leisure and recreation could be tendered out to the private sector for such development. As per the Punjab Government Gazette (Extra) Jan 20, 2006 (PAUSA 30, 1927 SAKA), leisure and recreation infrastructure may include amusement park, open-air theatres, theme parks, stadium and sports grounds etc. but not shopping malls, cinema halls, multiplexes and the like. Golf course, stadium and sports facilities including chalets, camping grounds, parks and a variety of leisure and recreation spaces in and around the water edge are proposed to enhance Mullanpur's attraction as the 'playground' of GMADA. Many of the leisure and recreation sites are located on the fringe of Mullanpur LPA. Request to allow possible some minor extension into adjoining agriculture land may be considered on a case to case basis.

For leisure and recreation usage, the following minimum area and development norms apply:

Table 8.2: Proposed Guidelines for Recreational and Sports Activities

	Recreational Activities	Sports Activities
Minimum size (acres)	10*	10
Floor Area Ratio (FAR)	5%	2%
Ground Coverage (%)	3%	1%
No. of Storeys	2	2
Height (feet)	28	28
Hard Surface	10%	5%

- Except for golf where the prescribed norms shall apply.

Some norms for the recreational facilities include:

1. **Golf course**: 2X18-hole course: (minimum 150 ha approximately);
2. **Spa village**: approximately 0.4 ha, could be larger if we have a cluster (1 ha);
3. **Turf club**: 80-90 ha approximately including area for grandstand, etc for 5000 horses;
4. **Lifestyle sports hub** including aquarium, etc - approximately 35-50 ha;
5. **Indoor stadium** – approximately 1.0 ha;
6. **Sports stadium** – approximately 5.0 ha;

Eco - Park

o Eco-tourism is a priority area. Eco-parks with nature camps, eco-friendly accommodation, trekking and nature walks, herbal eco-tourism, visitor interpretation centres, adventure sports, etc. is being proposed at the foothills of the Shivalik hills, adjacent to the Defense site and on land not affected by the PLPA and Forest Act. It is the intention to keep this area ecologically friendly. As such development on these areas should be kept to a minimum. Permitted uses within the eco-park will include trails, shelters from rain, nursery, camp sites, toilets, boardwalks, etc. Permissible floor area ratio is 2%. Ground coverage of 1% and hard surface should not exceed 5%. Buildings should be low rise of up to 2 storeys only. Minimum area shall be of 10 acres and approach road should not be less than 60 feet.

Health Village

- Health Village. The Health Village offers a medical community complete with specialty hospital, outpatient facilities, pre- and post-operative care, rehabilitation and long-term care facilities, hospice and diagnostic laboratories, healthcare commercial services with emphasis on nutrition, wellness and fitness. It aims to provide a unique healthcare environment for the sick as well as the healthy. The Health Village is home to medical, dental, nursing and allied health schools. It takes advantage of Mullanpur's scenic landscape and extensive leisure and recreation offering to provide quality health care and fitness services and an integrated centre of excellence for clinical and wellness services, medical education and research.
- As the health village is located north of MRDB – and next to the Shivalik Hills, the intensity of the development should be low at FAR of 1.0.
- The space standard for a hospital for regional catchment in the health village is 5 acres and approach road should not to be less than 60 feet. Area for Medi-City / Health Village is 10 Acres and utilization shall be 60% Medical, 30% Residential, and 10% commercial on the pattern of IT Park.

High Technology Parks / IT Parks

- Industrial- This will largely be high technology, value-added kind of industrial development in the form of Science Park, Business Park and R&D parks. The target industries include education and knowledge industry (Knowledge Village). Spaces and facilities including post-operative care and hospice will be provided to support medical tourism.
- Permissible FAR is 1.75 Site coverage is 35% (maximum) with minimum of 20% green open space. Landscaped plans are to be submitted for each campus development.
- Minimum area shall be 10 acres and approach road should not be less than 60 feet.

Transport Hub

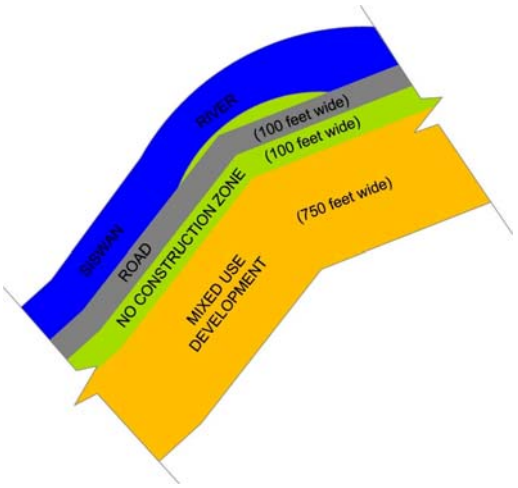
- The transport hub of about 15 ha situated along the MDR B at Mullanpur is planned as a multi-modal.
- In the future, if the metro materializes, a Metro station shall be located here. Appropriate commercial quantum up to the maximum 10% of permissible FAR, is allowed within the transport hub and the commercial use should be ancillary to the transport hub use. The ancillary use shall consist of transit hotels, restaurants, malls, shops and offices catering to transport related companies and tour agencies.
- Provision should be made for a safeguarded access (20m minimum) into the transport interchange from this north-south arterial road.

8.3.2 Special and detailed controls along the Siswan River

As the Mullanpur local planning area is traversed by 2 rivers, it is the planning intention to capitalize on the scenic qualities of the river and the water body during the rainy season. At the time of planning, the various agencies are already thinking of ways to bring water back to these rivers so as to enhance the waterfront / riverfront developments there. As this local planning area is envisaged as an eco-town with resort housing and recreational activities, the key node for the development will be centered along the banks of the rivers into a vibrant `linear activity' node for jogging, al-fresco dining and colourful youthful activities.

The manner in which the mix-use strip along the Siswan River is to be developed is shown in the following sketch.

Figure 8.6: Special and detailed controls along the Siswan river.



- For the Mixed use strip of 750 feet measured from the eastern banks of the Siswan River. However the development is restricted by the prescribed site coverage and building setback controls.

- Mixed use zone shall be for commercial use, institutional use and residential. Commercial use is allowed within this mixed use zone but the activities allowable within this mixed use belt should be sensitive to the overall theme for the Mullanpur area which is for eco-tourism and resort living.

- A 100 feet wide road will need to be provided next to the river, in order for the residents and tourists to enjoy the river. It is proposed that a meandering 100 feet road be aligned to hug the river banks as much as possible.

- Likewise another 100 feet strip of Green Belt (no construction zone) must be set aside for landscaping, walkways and promenades. Car parking is allowed within the Green Belt (no-construction zone) but it should not exceed 50% of the site and encroach onto PLPA or land under Forest Act. A good balance of hard & softscape is important to ensure the outdoor activities can be carried under sufficient shading. Open footpaths between properties are to be paved and linked. Ample trees should be planted within this zone to provide shades for the car parking lots and to soften the environment. The development potential of the entire 100 feet strip of Green Belt (FAR) can be transferred to the adjacent mixed use zone belonging to the same owner. For the above developments, it must not be on land affected by the PLPA and/or the Forest Act.

- No high fencing to enclose the green Belt (no construction zone) as this strip should be made accessible and enjoyed by the public by walking along the river front.

- For the mixed use strip along the MDR B, there is no requirement for a setback of 100 feet of no construction zone. However, the buffer setback from the road will still apply. The width of the mixed use strip east of the Defense Installation up to the PLPA boundary (near UT boundary) shall comprise of 2 bands of approximately 750 feet wide to the south measured from the proposed road widening line and 1500 feet to the north.

8.3.3 Open space, parks and green connectors along specific routes

- The “ribbon” Green and Activity Connectors are a crucial concept in the urban design of the Mullanpur eco- city. The intent is to generate activity and is an identifiable feature to this town to have a different ambiance as compared to the other local planning areas. The intent is to create green walkways and cycle paths around the local planning area so that the entire LPA is connected by green connectors and is linked to the river front promenade of the 2 rivers. A 30 meters green corridor is being proposed along the major roads. 100 metres river front green promenades are also proposed along the banks of the Jainti Devi Ki Rao river. These green connectors will be visually exciting, providing a pleasing environment to further enhance the status and class of this Mullanpur local plan.

- Buildings facing the Green/activity Connectors need to have a setback line of at least 5 metres from the edge. Within this 5 metres setback, structures that contribute to the overall ambience of the environment e.g. covered pavilions, decorations, identity motif walls, etc. can be permitted. Rear and side setbacks are also 5 metres at the very least.

- Within each green connector, there shall be hardscape and landscape that will harmonize the landscape of the Connectors. Connecting footpaths, signage, the types of trees and softscape shall be identical for each stretch of the connectors.

- A small quantum of commercial activity (0.5%) can be allowed within these green connectors for the enjoyment of the residents such as ice cream and drinks kiosks, newsstands, fresh flower stand, activity playgrounds for children, picnic grounds, shelters and toilets. Such ancillary structures found within the green connectors should be quality and sound structures. No make shift sheds are to be allowed. In addition, these commercial activities must not be developed on land under PLPA or Forest Act.

8.3.4 Setback From Roads

- All buildings are to be setback from roads as per the buffer guidelines.

- For buildings fronting the MRD B (a 60m wide road), area is safeguarded for the proposed metro line at the centre median of the road. This stretch begins from Chandigarh, past the Defense installation and subsequently, runs along the northern edge of the road at certain stretches. A 15m green buffer setback is being proposed. On both sides of the road, no building shall be constructed within this 15 m green buffer as it is the safeguarded metro setback line.

  Note: If any land notified under PLPA or Forest Act, any color / Zoning has been avariciously shown in the Master Plan has to be ignored. The area as per Land Records notified under PLPA or any Forest Act shall prevail and not the color / zoning in this Master Plan.

8.3.5 Transfer of Development Rights (TDR)

It is necessary to speed up the process of development. For that, the development of public utilities such as roads, parks, green belts etc., should be done on top priority which will encourage the urbanization. To make it realistic, it is necessary that the land falling under roads, parks and green belts should be transferred to Urban Development Authorities. To acquire this land, the prevalent way adopted till date, is the cash payment of land acquired and 2nd option is to get the land through land pooling scheme which has been approved by the Govt.. To speed up the development process and to protect the interest of land owners, the land owners may be given 3rd option in addition to above two options i.e. transfer of development rights on the pattern of Maharashtra.

Under this scheme if land owner transfers the land falling under roads, parks, green belts etc., to the concerned Urban Development Authority, he/she shall be entitled for additional FAR @ 1:1. No CLU, EDC, Licence/permission fees shall be charged on this FAR. The land owners according to their own choice can sell it in total or in parts to any other person. The record regarding TDR shall be maintained by the concerned Urban Development Authority on the pattern of Mumbai (Maharashtra). With this the farmer/land owners shall have 3rd option in addition to cash compensation and land pooling. To generate the value of TDR in the market, the present practice vide notification no. 17/17/01-5HG2/7623 dt.19.9.07 for additional FAR on additional payment shall, in area under GMADA jurisdiction, stop immediately. GMADA shall come out with detailed guidelines on operation of TDRs.

Mega/super Mega projects in which more than 1.75 F.A.R for commercial or more than 2.0 FAR for Group Housing is permissible or have been allowed shall also have to purchase additional FAR from land owners. This FAR shall be purchased from within same Local Planning

Area in which it is to be used. The non Mega projects shall also be entitled to purchase additional FAR on similar pattern. The development projects (Roads, Park, Green belts etc.), to be under taken by the Urban Development Authorities, shall be announced from time to time and TDRs shall be usable from such projects alone. The TDRs shall not be transferable from one Local Planning Area to other Local Planning Area.

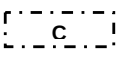
8.4 PROPOSED LAND USE LEGEND & ZONING INTERPRETATION FOR MULLANPUR LOCAL PLANNING AREA OF GMADA

S/No.	Proposed GMADA Zone	Uses	Examples of Development
1	**Residential** 	These are areas used or intended to be used mainly for residential development. Student hostels may be allowed subject to evaluation by the Competent Authority (CA).	Residential developments include: 1. Flat 2. Public Housing 3. Apartments 4. Townhouse 5. Semi-Detached House 6. Detached House 7. Retirement Housing 8. Hostel (eg. for working women, students & youths) 9. Social infrastructure such as schools dispensaries, hospital, and police posts etc. 10. Stand alone education institutions as per Periphery Policy
2	**Mixed Use** 	These are areas where commercial, institutional, residential, hotels, offices, hospitals, marriage palaces, use is allowed.	
3	**Commercial** 	These are areas used or intended to be used mainly for commercial development.	1. Retail shopping 2. Office 3. Convention/ exhibition centre 4. Commercial school (such as private coaching centers, training centers, tuition centers etc.) 5. Bank 6. Market/ food centre/ restaurant 7. Cinema 8. Entertainment 9. Hotel 10. Recreation club 11. Marriage Palaces

S/No.	Proposed GMADA Zone	Uses	Examples of Development
4	**Industry-Technology and R&D**	These are areas used or intended to be used mainly for business park operations.	1. Business Park 2. Knowledge Park 3. Science Park 4. Laboratories 5. Media hubs
5	**Industry and Warehouse**	These are areas used or intended to be used for clean industry, light industry and warehouse uses.	Developments for: 1. Computer software development 2. Knowledge Park 3. Distribution services 4. Assembly and repair of computer hardware and electronic equipment 5. Printing, publishing and allied industries 6. Packing of dried foodstuff 7. Warehouse except for storage of chemicals
6	**Health & Medical Care** H	These are areas used or intended to be used mainly for medical services.	1. Hospital 2. Polyclinic 3. Clinic/ Dental Clinic 4. Veterinary Clinic 5. Nursing Home 6. Maternity Home 7. Family Welfare Centre 8. Dispensary 9. Medi-city / Health Village
7	**Educational Institution** E	These are areas used or intended to be used mainly for educational purposes including tertiary education.	1. Kindergarten 2. Primary School 3. Secondary School 4. Junior College 5. Institute of Technical Education 6. Polytechnic 7. University 8. Religious School/ Institute 9. Foreign School 10. Special Education School (eg. School for the Disabled)
8	**Place of Worship** W	These are areas used or intended to be used mainly for religious buildings.	1. Gurudwara 2. Temple 3. Mosque 4. Church

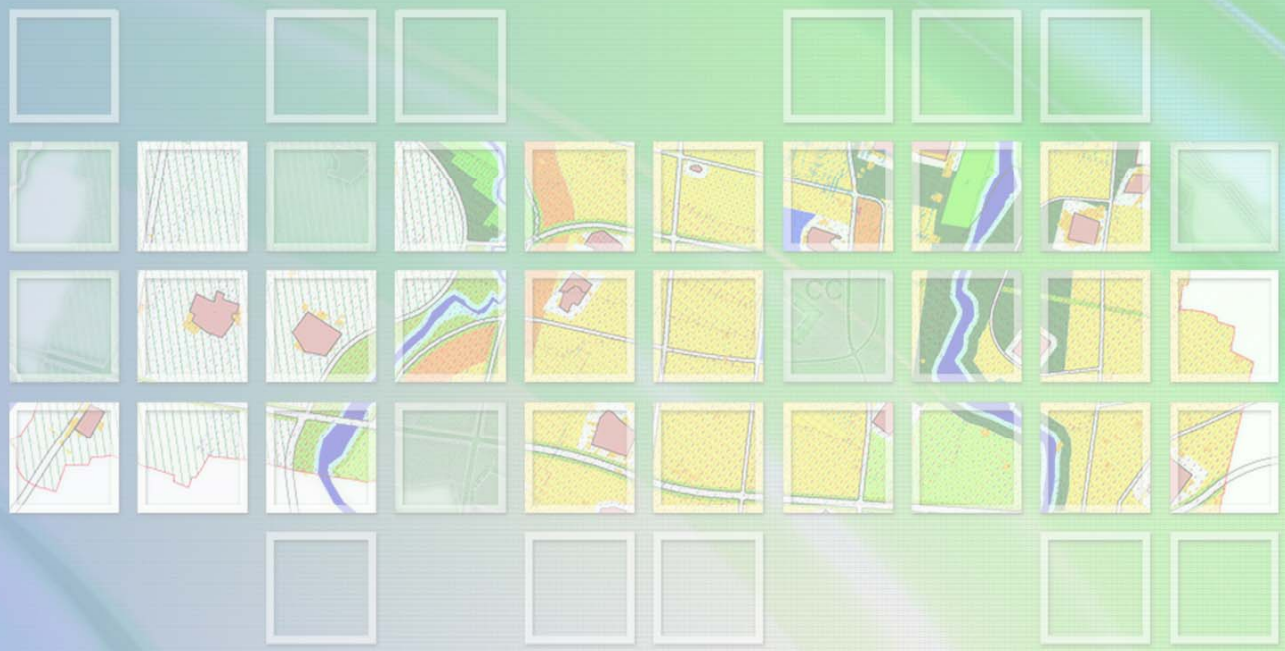
S/No.	Proposed GMADA Zone	Uses	Examples of Development
9	**Civic & Community Institution** CC	These are areas used or intended to be used for civic, community or cultural facilities or other similar purposes.	**Civic Institutions** 1. Courts 2. Government Offices 3. Foreign Mission/ Chancery 4. Police Station 5. Fire Station 6. Prison 7. Reformative Centre 8. Disaster Management Center **Community Institutions** 9. Association premises 10. Community Centre/ Club 11. Community Hall 12. Welfare Home 13. Child care Centre 14. Home for the Aged 15. Home for the Disabled 16. Workers' Dormitory 17. Facility Centre **Cultural Institutions** 18. Television/ Filming Studio Complex 19. Performing Arts Centre 20. Library 21. Museum 22. Arts Centre/ Science Centre 23. Concert Hall 24. Socio-cultural complex
10	**Open Space**	These areas are used or intended to be used as open space and no commercial activity is allowed.	1. Forest reserve 2. Wooded area 3. Swamp area 4. Natural open space 5. Public promenades 6. Outdoor Pedestrian Malls
11	**Park**	These are areas used or intended to be used mainly for parks or gardens for the enjoyment of the general public. It includes pedestrian linkages.	1. National Park 2. Regional Park 3. Community Park/ Neighborhood Park 4. Park Connectors 5. Zoological Gardens, Botanic Gardens, etc.
12	**Sports & Recreation**	These are areas used or intended to be used mainly for sports and recreational purposes.	1. Sports Complex/ Indoor Stadium 2. Swimming Complex 3. Golf Course 4. Golf Driving Range 5. Recreation Club 6. Campsite 7. Water Sports Centre 8. Adventure Camp 9. Theme Park 10. Turf Club 11. Cricket Club
13	**Water body**	These are areas used or intended to be used for drainage purposes and water areas such as reservoirs, ponds, rivers and other water channels.	1. River 2. Major Drain & Canal 3. Reservoir 4. Pond

S/No.	Proposed GMADA Zone	Uses	Examples of Development
14	**Drainage Reserve**	These are areas safeguarded for the river / water channels during the wet season.	
15	**Road**	These are areas used or intended to be used for existing and proposed roads.	1. Expressway 2. Major Arterial Road 3. Minor Arterial Road 4. Collector Road 5. Primary Access Road
16	**Transport Facilities**	These are areas used or intended to be used mainly for the parking of vehicles and transport facilities including garages.	1. Car Park 2. Heavy Vehicle Park 3. Trailer Park 4. Bus Depot/ Terminal 5. Transport Depot 6. Train Marshalling Yard/ Depot 7. Driving Circuit/ Test Centre 8. Petrol Station/ Kiosk
17	**Metro Line**	These are areas safeguarded for the future Metro Line linking Mullanpur to Baddi.	Railway
18	**Utility Source Plants** ***U1*** *– Water* ***U2*** *– Power* ***U3*** *– Sewerage* ***U4*** *– Solid waste* ***U5*** *– IT & Communications* ***U6*** *– Gas* ***U7*** *- Drainage* **U#**	These are areas used or intended to be used mainly for public utilities and telecommunication infrastructure, including water works, sewage disposal works and other public installations such as electric substations.	1. Electric Sub- & Grid stations 2. Gas Fired Power Station 3. Raw & Local Water Treatment Works 4. Sewage Treatment Plant 5. Sewage Pumping Station 6. Incineration Plant 7. Landfill Site 8. Transfer Stations 9. Treatment Storage & Disposal Facility 10. Telecommunications Station
19	**Utility Corridors** ***UC1*** *– Water* ***UC2*** *– Power* ***UC3*** *– Sewerage* ***UC4*** *– Solid waste* ***UC5*** *– IT & Communications* ***UC6*** *– Gas* ***UC7*** *- Drainage* **UC #**	These are corridors used or intended to be used for utility services lines.	1. Water main trunk 2. Power corridor 3. Gas pipelines 4. Telecom main trunk
20	**Airport**	These are areas used or intended to be used for airport or airfield purposes	1. Airport 2. Airport related facilities
21	**Burial Ground**	These are areas used or intended to be used for burial or cremation purposes.	1. Cemetery 2. Crematorium

S/No.	Proposed GMADA Zone	Uses	Examples of Development
22	**Rural & Agriculture** 	These are areas used or intended to be used mainly for agriculture purposes and includes plant nursery. Also for areas to be left rural and not needed by 2031.	1. Agrotechnology Park 2. Aquaculture Farm (eg. Aquarium fish) 3. Plant nursery 4. Hydroponics Farm 5. Agriculture research/ experimental station 6. Floral mile (ie, nursery cum wholesale centre)
23	**Reserve Site** 	These are areas where the specific use has yet to be determined. Interim uses that are compatible with the uses in the locality may be allowed subject to evaluation by the CA.	Nil
24	**Special Use** 	These are areas used or intended to be used for special purposes.	1. Military 2. Strategic installations
25	**Existing Residential** 	These are current housing areas conveyed by GMADA to be left untouched.	
26	**Existing Built-up** 	These are current built-up areas other than residential uses which have been conveyed by GMADA to be left untouched.	
27	**Existing Village** 	These are villages which have been conveyed by GMADA to be left untouched.	
28	**Existing 132 Kv Lines**	These are above ground power lines to be left untouched.	
29	**Existing 220 Kv Lines**		
OTHER ANNOTATIONS (to be used in conjunction with land use zones)			
	Subject Planning area boundary		
	Other Planning area boundary		
	2.8	Maximum Permissible Plot Ratio/ Floor Space Index	
	Conservation Area		
	Monument		

MULLANPUR LOCAL PLANNING AREA

GREATER MOHALI REGION, PUNJAB (INDIA)



Chapter 9

CONCLUSION

CONCLUSION

The land use, transportation, infrastructure plans and proposals outlined in the preceding chapters of this report will provide GMADA with the necessary information and tools to make its vision a reality. A micro-scale study of individual LPAs assist in achieving a more integrated approach to development plans, where LPAs complement each other. For Mullanpur, the concept of regional Recreation Centre and eco-town is visionary and if successfully implemented, will boost GMR's reputation in being the first sustainable city in Punjab and/or India. The usage of GIS techniques in preparing the land use plans is something to applaud as it moves GMR to a higher level of technological marvel.

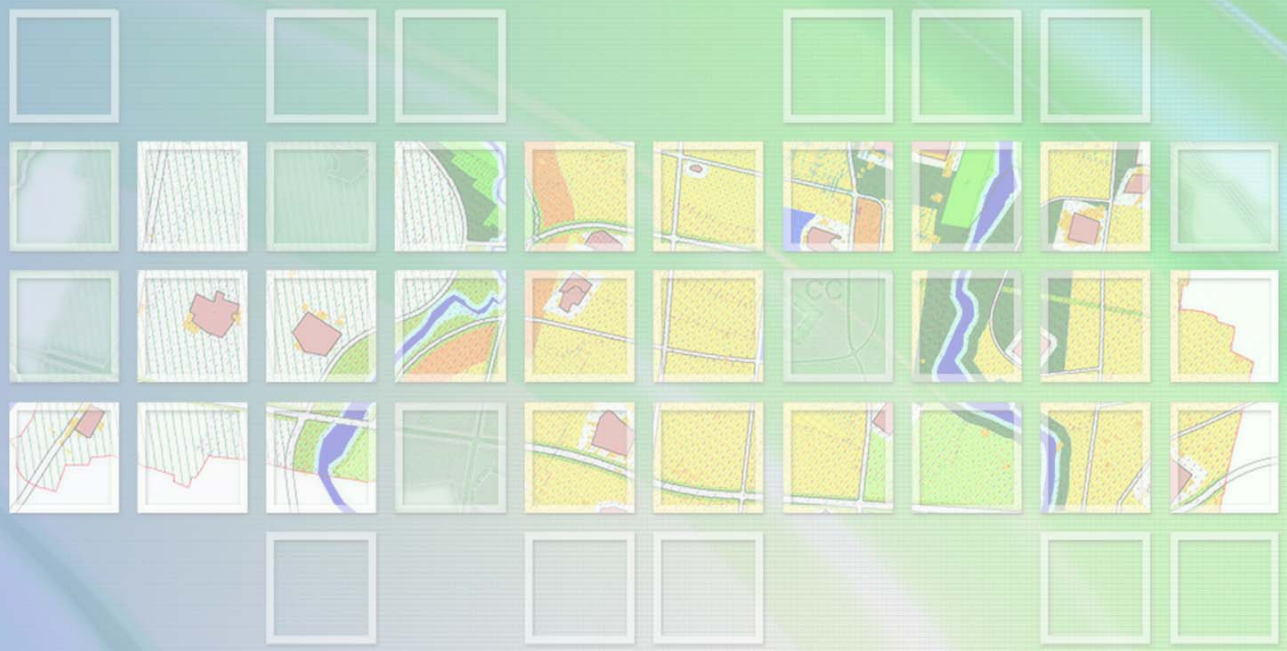
While it is JURONG's aim to equip GMADA with a comprehensive list of guidelines, it also aims to provide the flexibility needed to meet the changing demands and expectations of the years to come. It serves as a broad guideline to facilitate innovative and imaginative developments so as to welcome investments from both public and private sectors.

Mullanpur's almost untouched environment would require major investments in the first phase of the implementation. The flow of investments is expected to trigger developments, which in turn, would determine the quality of living in Mullanpur. The government and related agencies play a vital role in ensuring that a coordinated approach exists in infrastructure development and maintenance. It is for this reason that a strong public-private partnership is required to make Mullanpur a desirable place to work, live and play for all residents, non-residents and tourists.



MULLANPUR LOCAL PLANNING AREA

GREATER MOHALI REGION, PUNJAB (INDIA)



ANNEX

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ANNEX 1

Annex 1: Summary of Planning Vision and Objectives for Mullanpur LPA

Ecological / Recreational Township	• *Prime area for tourism, leisure and recreation, resort and lifestyle living.*
Economic Catalyst	• *Leisure and recreation, new knowledge and health industry to fuel the economy: Eco-tourism, Health Village, Knowledge Village, Sports, Leisure & Recreation Development, Waterfront Commercial / Lifestyle Development.*
Social Infrastructure	• *A greater choice of affordable and good quality housing including waterfront housing and more medium and low density housing;* • *A wide spectrum of community facilities to meet the overall demand.*
Recreation and Environment	• *A quality live, work, play and learn eco-environment through land use optimization, preservation of heritage, accentuation of the natural assets of the area, planning of a green open space / pedestrian network and respect for sustainability principles.*
Urban Structure and Management	• *Organized and effective setting for living comfort and growth that is in harmony with its environment and nature.*
Transportation	• *A well connected transportation network to ensure maximum accessibility and linkages to commercial, residential, recreational areas and key activity nodes.*
Utilities	• *Innovative and ecologically-sensitive utilities provision and construction.*

ANNEX 2

Annex 2: Provision of social facilities for Mullanpur LPA

Social Facilities	Provision Standard	Area Required (ha)
Commercial		
Informal Market	1 for 1000 DU	8
Institutions		
Community Centre	1 per 15,000 DU	0.8
Library	1 per 50,000 DU	0.3
Parks and Gardens		
Town Centre Garden	1 per 10,000 DU	16
Sports and Recreation		
Swimming Complex	1 per 20,000 DU	3
Recreation Club	1 per 10,000 DU	1.8
Multi- Purpose Hall	1 per 10,000 DU	0.8
Transport		
Bus Interchange	1 per 50,000 DU	2
Health Care Facilities		
Nursing Home	1 per 10,000 DU	1.6
Family Care Centre	1 per 10,000 DU	1.6
Hospital – 100 Beds	1 per 20,000 DU	0.8
Miscellaneous		
Veterinary Dispensary	1per 20,000 DU	0.06
Police Post	1 per 20,000 DU	0.2
Fire Station	1 per 40,000 DU	1
University Campus	1 per city	20
Cremation Ground	1 per 200,000 DU	1