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Provincial Infrastructure Development Authority (PIDA)
Lumbini Province

Master Plan of Lumbini Provincial Capital City (LPCC)

Deukhuri Valley , Bijauri, Dang, Nepal

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Executive Summary

This "Master Plan of Lumbini Provincial Capital City (LPCC)" is the outcome of the study carried out by SITARA-ECoCoDE-Technocrate JV in agreement with the Provincial Infrastructure Development Authority (PIDA), Lumbini Province, Deukhuri, Dang, Nepal (*Contract No. : PIDA/RFP/2077-78/06*). This comprehensive master plan has been prepared by the team of experts after preliminary desk study, field visits, and detail analysis and brainstorming in a series of discussion meetings with client, local stakeholders and experts. The Consultant started with preparation of a conceptual framework for the study that included the study of local, national and provincial development framework in connection with the regional connectivity. The Consultant collected data, surveyed and consultations with the stakeholders and experts that were analyzed viewing the present planning framework and practice to prepare the Master Plan. The validation were done through different consultation, meetings and workshops with experts and stakeholders.

Lumbini Province having population 44, 99,272 (17.14% of national population) (CBS 2011) covering 109 local bodies in 12 districts occupies 22,288 sq. km of area (15.1% of total area of Nepal) is the 3rd largest province of Nepal. The major cities in this province are Butwal and Siddharthanagar in Rupandehi district, Nepalgunj in Banke district, Tansen in Palpa district, and Ghorahi and Tulsipur in Dang district. The proposed LPCC area is located at the foothills of the Chure hills, Rapti River passing centrally through the site and East-West Highway in Deukhuri Valley. It was formed by combining all areas of the Rapti rural municipality, Gadhawa rural municipality (Ward no 1, 2 and 3) of Dang district and Shitganga municipality (ward no 8 and 9) of Arghakhanchi district with approximately area of 480 sq.km.

Having population of 68,615 (CBS 2011), topography of the LPCC area is mixed with hills, plain area, undulations and rivers. Existing land use in three local levels reveals domination of forest in three sides and followed by agriculture land. Thrust line exists in the site area of LPCC area at ward no. 8 and 9 of Shitaganga area and ward 1 of Gadhawa at Dhodre and Patringa region. The ward no 6 of Rapti Rural Municipality has the highest population density of 576.6 person/sq. km, whereas ward no 9 of Shitaganga Municipality has just 25.97 person/sq. km. of area. The economic base of LPCC area is agriculture and livestock. About 74,790 ha of agriculture land in Rapti rural municipality is irrigated. Praganna irrigation project from Rapti river has covered the southern part of Deukhuri. Irrgation network has been expanded through Badkapath irrgation, Masuriya irrgation and water channeling from small and big rivers. Some small scale industries associated with construction material and agriculture and livestocks have been under operation. Small scale commerical activities have been growing along East-West Highway such as Bhalubang, Shisniya, Maurighat, Pipari, Sagrappur. Bhalubang is considered as an 'enty point' to connect northern districts to Dang. All three territory of LPCC area has numerous public open spaces in different forms for socialization, recreation and sports. Most of the households use piped drinking water and tubewell and most of them drink water directly from collecting different sources without any treatment.

With increase in populaiton, different pattern of growth can be observed in the study area. First, are the inhabitated earlier villages of ethnic groups developed far away from West Rapti River north and south sides, near hills edges. They are small groups of houses clustered around community spaces with road network and hills as edges. Second are linear development pattern following the major road network spreading on both sides for commerical activities mostly

along East-West Highway as well as major north-south roads. Third typology is sprawl development on ad-hoc basis along the road and few in the middle of the agriculture lands, connected by pedestrian ways. With increase in population and demand, small market centres have evolved near to nearby. Visible and memorable man-made element of the site are East-West Highway plus another National Highway linking Bhalubang to Pyuthan. This road section bisect the LPCC area and acts as a spinal cord, connecting villages in the foot hills as well as linear developments to the Highway. In addition to that, bridges over West Rapti River also noticable landmarks. LPCC area is rich in natural elements; water body in the form of Rivers and mountains on all sides with gradually decreasing the elevations till it reaches to the West Rapti River forming a fertile agriculture land specially on both banks of the rivers. The dominant indigenous community in the area is Tharu community living in the flat land, while another rich indigenous community living in the hilly area is Magar. Most of the traditional settlements in LPCC area are located at flood plain on both sides of the Rapti River. In the recent past, new settlements have been developed along East-West Highway and concentrated at various road cross junctions. After calculation of different constrains, the net area available for housing development is comparatively less to the total designated area for capital city development. With the assumptions that current population 65,705 of LPCC will increase to 133, 000 in the year 2031 and 250,000 by 2051 (also adding a floating population of the city 40%,), infrastructure demand has been projected by linking the city population with planning norms and standards, and others in practice focusing physical, social and economic infrastructure.

Two development scenarios were prepared as per suggestions from PIDA and discussion during various stages of the planning process. The scenario is basically based on the multiple analysis and evidences, as carried out. Translating Buddhist philosophy and learning into physical development plan in preparation of comprehensive master plan for LPCC is challenging. Such translation should be 'symbolic' with qualitative meanings. The concept for the design of master plan is derived from principles related to Buddhist learning and teachings. The three key words associated with Buddhist learning and teaching are "Peace, Coexistence and Respect" can be correlated with three development planning goals namely sustainability, conservation (culture, environment and heritage) and adaptation of present day needs and natural resource management and ecological balance. Peace cannot be achieved without socio-economic modernization and improving quality of life of inhabitants. Harmonious coexistence between urban and rural lifestyle is required. Conservation and modernization is possible only with coexistence of nature and human habitat. Respect of nature and culture is also essential. It can be translated into "*panchatatwa*" into as; 1. West Rapti river –water 2. Agriculture land & settlements – earth 3. Forest- fire 4. Mountain- Air and 5. Sky- sky. Moreover, the 'Three Treasures of Buddhism' and 8 'Truth Paths' are translated symbolically into Master Development Plan. Three distinct settlements namely 'Tharu' community around the West Rapit River, newly formed settlements along the East-West Highway and villages outside the LPCC area correspond to 'Buddha,' 'Dharma,' and 'Sangha'. Tharu community is ethnic inhabitant of this place and thus identity of the area. Moreover, it can be further correlate to the three distinct nodes: urban node, cultural node and industrial node. All these different hierarchy of settlements along with various development nodes along the Highway (outside LPCC area) not only symbolize the three treasures but they are also anchored by the West Rapti River. Tharu settlements (traditional) –Buddha; Newly developed towns- Dharma and Neighboring villages outside the LPCC area- Sangha.

The Master Plan proposes nodal concept to ease and balance the development process in future complementary the coexistence between existing natures vs. new development. Such development concept is proposed to conserve agricultural land as well as regularizing of growth and development pattern within such nodes. According the norms, standards and building bylaws have been proposed based on the nodes for the development of city based on the economy, environment, society and the prevailing technology of higher standards. 13 nodes have been proposed for the master plan; One primary node at central location for commercial development, one secondary node for institutional are development, 5 service nodes for local level services, one cultural node for cultural related development, one agricultural node for agriculture related development, one industrial for industrial area development, and one trade and transport node for development of activates in concern to trade and transport. Accordingly, major projects identified for the development of the city has been proposed in tentative location nearby the nodes or public spaces near the nodes as demanded by the local authorities and PIDA. All nodes proposed has relation with surrounding context and linking with major land use activities. With introduction of new land use, the maximum impact is seen in agricultural land and careful planning has been done to avoid change in land use in case of traditional settlement area and commercial area by avoiding roads through such areas. The present 'Bhalubang bazzar' area, which lies across two Highways will be developed as 'secondary node' in future.

A green corridor is conceptualized, connecting the institutional corridor G8 and the other grid G4, with the East West Highway, which links with the forest at the both ends. In terms of use of space, the green corridor can be used for planation of trees (Pipal in relation to Buddha) and water bodies and rest spots at intermediate level so that it could give shade to the travelers and contribute to reduction of temperature**.** The planning of road at Grid G8 i.e. along the institutional zone has been proposed with placement of designed open spaces road and block. The street has been design to focus on the institutional corridor; a building with a central 50 meter wide road, a roundabout and green parks and Landmark Bridge connecting Gadhawa and Rapti emphasizing a commemoratory street that leads to central important government institutions. Tow ends of the street mark the chief minister's office at Rapti at north and the Court at Gadhawa on the southern end. There is a central round about and 10 blocks for other institutional area development for future expansion.

Along with nodal concept grid concept has been introduced to the entire master plan. The major feature of this plan are:

- Major road of 30m and 50m runs throughout the grid as primary road over the 1200mx1200m main block (super block) that includes three 400mx400m neighborhood blocks bisecting with 20m roads. The east-west highway has been best managed to be aligned with the main grid.
- Plenty of opens spaces have been proposed in different location; at least one large community park within a distance of 2-3 km and 100m wide along the either side of Rapti River.
- High-rise development along the river bank after 250 meters of green belt, road and park has been proposed along the both sides of Rapti River. The flood analysis of Rapti River shows that this area is highly vulnerable to flooding, thus a detail study is proposed By the Consultant before implementing this concept.

- A 50 meter wide ring road connecting entire LPCC area has been proposed in the master plan along with different nodes. Similarly, 50m a wide road has been proposed along the both side of Rapti River.
- Six new bridges has been proposed in the Rapti River at different location to connect municipalities and activates lined with different nodes proposed
- Open spaces are proposed at the rood junction of 50 meter and 30 meter wide roads so as to regulate land value at the junction, maintain visual aesthetic and adjust public service in future as a setback.
- Utility corridor or tunnel have been proposed for utility supply lines for the city development. The decision was made as the option offers ease in maintenance, repair and upgrading works and less disruption during disasters like earthquake, flood and also to vehicular and pedestrian movement.
- A setback of 100 meter on either side of Rapti River and 50m on other rivers has been proposed.
- Two new bus parks, two solid waste management sites, two Waste Water Treatment plant, a stadium is proposed selecting the appropriate location. Many public or social spaces were proposed for new development and conservation like Parks, temples, chautaras, ponds, Palace, cremation centers, exhibition centers, data centers, slaughter house, vegetable markets, city hall and etc. according to the population size and the local needs.
- Rapid bus transit is proposed in relation to management of city transportation and traffic.
- In case of informal settlement management existing at the site, few measure have been proposed, however the idea is to upgrade the existing one at the original site.

Accordingly a road section with rapid bus transit system can be a suitable option for the growing LPCC area. Therefore, while preparing this master plan the nodes are the basic concepts. Except west Rapti River, east west highway and the postal roads; we have proposed G1- G12 (north to south) west to east grids with 50 and 30 m roads, river corridors (RRA and RRB) and GA, GB, GC and GD (west to east) north to south as the major paths of the city. The traditional settlements (Tharu basti) inside the Gadhawa and Rapti village, Vulke gaun (the Magar settlements) serves as a major districts of LPCC except the major urban area. Here, the roundabout proposed in Institutional corridor (G8) and the recharge ponds with parks in commercial corridor (G4) with city hall around G6 will serve as a major land mark of the LPCC area. The West Rapti river banks (RR1 and RR2) and the forest lines are the edges of the LPCC.

The LPCC area is vulnerable to hazards such as earthquake, flood and fire and landslide. A preliminary flood analysis based on secondary data has been done. Surrounding forest which itself is an open space that can be useful during certain disasters like earthquake. Numerous Parks, the green belt of 100 meters along the either side of Rapti River bank can be open space for evacuation during disaster like earthquake, fire, excluding flood. Beside there are schools and ward offices premises that can be converted as evacuation shelter for public in different disasters. LPCC has rich and abundant natural resources such as forest and water, which should be managed and conserved. It will improve access to water and its quality for the inhabitants,

help conserve forest and aquatic biodiversity, rehabilitate and conserve cultural and historic sites, and thereby contribute to the promotion of eco-tourism, and ethnic morphology.

For the implementation of capital city project that involves many small and large scale infrastructures, phase wise and multi-year development is recommended where the provincial Government has greater responsibility. However, a partnership approach is required to account the views of the community, private landowners, the business community, and other key stakeholders in a meaningful way through the steering group. It is also important to ensure that sufficient resources, both in terms of finance and personnel, are in place to implement the plan and investigate potential sources of financial and other assistance. Here, capacity bundling of technical personal is the key to smooth implementation of project. It will require combination of different financial model for implementation such as PPP, loans and grants. Foreign direct Investment might be also be required for the development of huge infrastructures. For the implementation of these projects, budget can be secured from funding of local, provincial and central government. For quick housing development, private companies can be motivated.

For the implementation of the master plan, the concept of land pooling has been advised. Land pooling in larger scale will be required to implement this master plan in different phases to achieve the development target by 2031 and 2051. Land pooling is suggested in areas near all nodes and along major development projects suggested in this master plan as an initial initiation to housing development. Since the area is large, there should give a priority starting from primary nodes (commercial area), institution corridor to other service nodes. The major portion of land available for capital city development is very limited within three identified territory, thus flat land around the LPCC area in Deukhuri Valley will be consumed by new development as the planning of capital city will take place. Thus, it is very important for all local levels of Deukhuri Valley to follow the guidelines proposed in this study for sustainable urban development. In addition, a master plan alone does not ensure development of a desirable city. Master plan is only a blue print to guide development, while implementation is crucial aspect to achieve it, so high attention should be given.

Capacity building of respective local authorities, and good governance is of prime importance to achieve it. Thus, a detailed study on local level should be done in all sectors before implementation. The plan proposed here is just indicative but not a detailed study, therefore a detail study should be carried out for the capacity, size, and type of the infrastructure required for the city scale development. Population projected in this study is based on general practice of planning, however cities are dynamic in nature with changing local and climate scenario, so can be the population pull factors. Population growth will be more than the assumed if the service delivery, facilities provided and economic opportunities created are of higher standard and it will be less if the service delivery, facilities provided are of lower standard. Therefore, mid time review should be done for all the planning.

Moreover, A Master Plan of a city is a long-term planning document that provides a conceptual layout to guide future growth and development which is a proposal for population, economy, housing, transportation, community facilities, and land use. An identity of a city is created by people and nature within its territory and its immediate surroundings. A balance in these two elements (culture and environment) is important for sustainably. The master plan proposed the development of urban rural linking roads for societal, environment and economic development as well as conservation of ethnic morphology for which a detail study is required which is not covered in this study. Development of city should respect its local environment and local

dwellers' poor section. Poor are the resources as a labor force, therefore it shouldn't be neglected during the service delivery and housing and infrastructure supply considering the fact that *city shouldn't be just for welcoming to rich and new people.*

Abbreviation

LPCC	:	Lumbini Province Capital City
PIDA	:	Provincial Infrastructure Development Authority
RFP	:	Request for Proposal
LPG	:	Lumbini Provincial Government
VDC	:	Village Development Committee
ADB	:	Asian Development Bank
WB	:	World Bank
KII	:	Key Informant Interview
UNDP	:	United Nations Development Programme
GIS	:	Geographic Information System
NGOs	:	Non-Government Organization
CEO	:	Chief Executive Officer
FDG		Focal group discussion
SDG	:	Sustainable Development Goal
DRR	:	Disaster Risk Reduction
FCT	:	Frontal Churia Thrust
CCT	:	Central Churia Thrust
MCT	:	Main Central Thrust
DOMG	:	Department of Mines and Geology
FCHV	:	Female Community Health Volunteers
SBA	:	Skilled Birth Attendants
RCC	:	Reinforced Cement Concrete
RCPs	:	Representative Concentration Pathways
GLOFs	:	Glacier Lake Outburst Floods
PPC	:	Province Planning Commission
WWF	:	World Wildlife Fund
DEM	:	Digital Elevation Model
GEE	:	Google Earth Engine
EO	:	Earth Organization
COP21	:	21st Conference of the Parties
GCPD	:	Gandhinagar Capital Projects Division
GUDA	:	Gandhinagar Urban Development Authority
CBS	:	Central Bureau of Statistics
DRM	:	Disaster Risk Management

IWRM	:	Integrated Water Resources Management
COS	:	City Development Strategy
TOD	:	Transit Oriented Development
PPP	:	Public Private Partnership
MOEST	:	Ministry of Environment, Science & Technology
NAPA	:	National Adaption Programme of Action
MOHA	:	Ministry of Home Affairs
OPM	:	Oxford Policy Management
UNGA	:	United Nations General Assembly
UNISDR	:	United Nations International strategy for disaster Reduction
UN ESCAP	:	United Nations, Economic & Social Commission for Asia & the pacific

Chapter 1. Contextual Background

1.1 Project Introduction

Lumbini Province (LP) covering twelve districts (6 Terai, 5 Mountains and 1 Himal) occupies 22,288 sq. km of area (15.1% of total area of Nepal) is the third largest province of Nepal. It has Gandaki Province on the east, Gandaki and Karnali on the north, Sudur Paschim Province on the west and India on the south. It constitutes four sub-metropolitan cities, 32 municipalities' and 73 rural municipalities, altogether 109 local bodies. As per 2011 census, this province houses 44, 99,272 population (17.14% of national population) with 884,757 households. The major cities in this province are Butwal and Siddharthanagar in Rupandehi district, Nepalgunj in Banke district, Tansen in Palpa district, and Ghorahi and Tulsipur in Dang district.

After declaration of Deukhuri Valley as the capital of Lumbini province[1] by the provincial assembly meeting, the 'Provincial infrastructure development authority (PIDA)' of Lumbini Provincial Government (LPG) intended to prepare the Master Plan of the provincial capital with all necessary facilities. The authority also plans to work out in detail the proposed institutional zoning.

1.2 Study Area

The proposed Lumbini provincial capital city (LPCC) is located at the foothills of the Chure hills, near the Rapti River and East-West Highway. It was formed by combining all areas of the Rapti rural municipality[2], Gadhawa rural municipality[3] (Ward no 1, 2 and 3) of Dang district and Shitganga municipality[4] (ward no 8 and 9) of Arghakhanchi district with approximately total area of 480 sq.km. The proposed area basically consists of agriculture land, riverbanks and some settlements and rural market centers. Those rural settlements include Laurikot, Anpghat, Bhulke, Jurpani, Kohalawa, Maurighat, Lalmatiya, Ramnagar,

[1]Butwal was declared the temporary capital on January 17, 2018. The provincial assembly meeting of Province 5 endorsed its name as Lumbini (after the holy pilgrimage site of Lumbini, birth place of Gautam Buddha, the founder of Buddhism) and its capital as Deukhuri Valley in Dang district on 6 October 2020.

[2] Rapti rural municipality was formed by combining then existing two village development committees namely Lalmatiya and Sisahaniya and then wards 1 and 2 of Hanshipur village development committee. It was now regrouped into 9 wards

[3] Gadhawa rural municipality was restructured by combining then village development committees namely Gadawa, Koilabas, Gangaparaspur and Gobardiha on 22/11/2073 BS. It has now 8 wards.

[4] Shitaganga municipality in Arghakhanchi district was restructured on 22/11/2073 BS by combining then seven village development committees namely Shitapur, Subarnakhal, Thada, Simalpani, Sidwara, Jukena and Jaluke. It has now 14 wards.

Pipari, Bhagwanpur, Basantapur, Ratnapur, Badhara, Dhaireni, Ghopte, Bhalubang, Pakhapani, Chalte, Chisapani, Rupakot, Devikot, Ghorahibas, Ratamata, Jaluke, Sidhara and so on. It is believed that Rapti Rural Municipality was named after the major Rapti River and its tributaries running from east to west thereby making the whole area fertile (Rapti Rural Municipality, 2076 BS). This river is also considered as 'water storage' of Deukhuri Valley. Yadav (Ahir) community, the original inhabitants of Gadhawa rural municipality found big spots filled with water during animal gazing and they used to call such spots as 'Gadhaha' in their native language (Gadhawa rural municipality, 2075 BS). It is considered that the name 'Gadhawa' is derived from 'Gadhaha.' Also, the well water in other villages used to be thick and it used to call 'Ghahara water' in 'tharu' native language (ibid). Later on, this placed is named as 'Gadhawa.' Only Gobardiha (ward no 1, 2 and 3) is included in the provincial capital city area. Shitaganga municipality is named after its sacred river Shitaganga and Banganga. Situation on the southern part of Agrakanchi district in the Chure region, the earlier seven village development committees (VDCs) namely Sitapur, Subarnakhal, Thada, SImalpani, Sidhara, Jukena and Juluke were mixed to form Shitaganga municipality. Ward no 8 was formed by combining earlier ward no 5 and 6 of Juluke whereas ward no 9 was constituted by combining earlier ward no 1, 7 and 8.

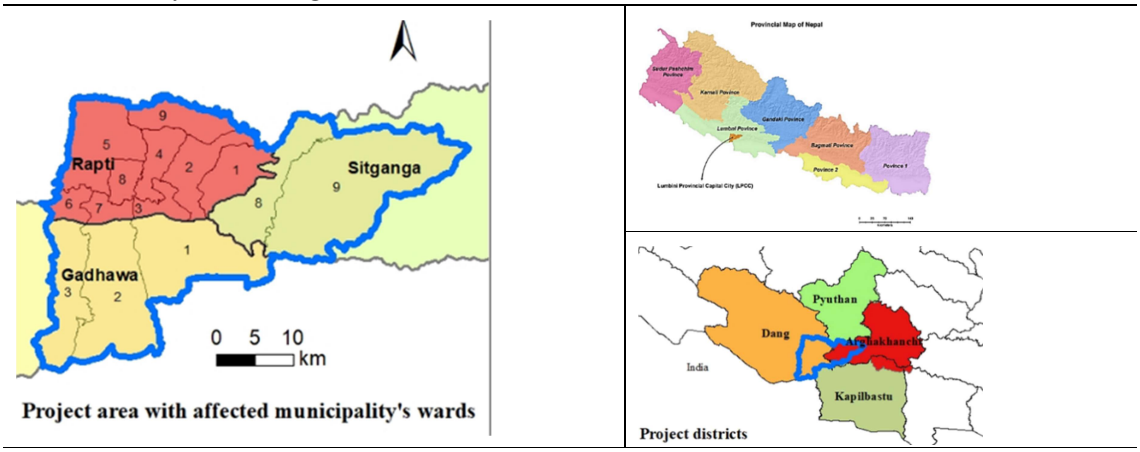


Fig. 1.1 Proposed LPCC area within the framework of districts in Lumbini province

Among these three territory of three different local levels, Rapti rural municipality covering larger area is also densely developed. Ward no 8 (Juluke) and 9 (Siddhara) of Shitganga municipality is basically scattered low density development. Also Gobardiha (ward no 1, 2 and 3) of Gadhawa rural municipality has development along road network. West Rapti River and East-West Highway, running from the center of the study area anchors these three territory.

1.3 Aims and Objectives

The main aim of this assignment is to prepare master plan for LPCC covering about 480 sq. km. area. The specific objectives are threefold:

a) Collection of information for overall planning of LPCC;
b) Preparation of comprehensive master plan of LPCC; and
c) Detailing of provincial institutional area of LPCC.

1.4 Rationale of Study

Planning a new provincial capital city for Lumbini province is essential. Its rationale is multifold. First, new capital city is required for Lumbini province in order to carry out various functions delineated by the constitutions of Nepal 2015[5] effectively and efficiently. To have a well-planned administrative center with modern facilities and technology is necessary to enhance government's efficiency and productivity. New provincial offices including assembly buildings are required, besides housing, commercial and other land uses. Second, the proposed site is strategically located at the center of the province, connected with East-West Highway. Moreover, development of capital in this location makes people living in this province convenient for services. Third, new capital development will support the spirit of new constitution of Nepal, which intends balanced development through decentralization of power and development at province and local levels. It will also act as a catalyst for further growth and development of surrounding areas.

1.5 Study Methodology

1.5.1 Preparation and Contextualization

To fulfill the above mentioned objectives, the investigation were carried out at different steps in a sequential form so that each activity complements the following others. The methodology adopted is participatory approach combining different techniques using both 'top-down' and 'bottom-up' approaches (Fig. 1.2). It uses both qualitative and quantitative data. The 'bottom-up' approach constitutes contextual understanding of local contexts through primary information collection by carrying out ward-wise workshop, focal group discussion (FGD) and key informant interview (KII), and visual survey of the site. The 'top-down' strategy is basically narrow down of the objectives and intentions set at various national, provincial and district level sector-wise documents. It also includes critical review of recently acted various rules and regulations.

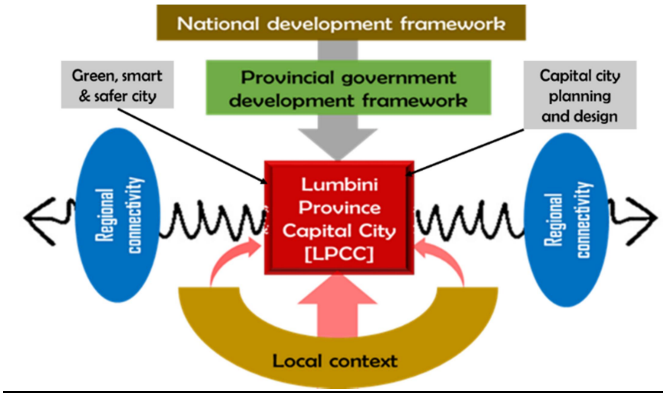


Fig. 1.2 Study approach and methodology

5As per constitution of Nepal 2015, the provincial government will look after infrastructure provisions (road, drinking water, irrigation, electricity, health and education, land recording and management), fees from land and house registration, vehicle tax, entertainment tax, advertisement tax, tax on tourism and agricultural income, service charge and penalties and fines, education and health services, etc. Management of national forest, water resources and ecology within the province, Agriculture and livestock development, factories, industrialization, business, transportation and so on.

After understanding the scope of the work, relevant data and information were collected from various sources. They included national level documents, provincial scale reports and plans and local government's profiles, programs and plans. Also, available maps and study report of the project site and surrounding areas were gathered. All these collected information were quickly reviewed for:

a) A general understanding of the different plans, programs and activities carried out by federal and provincial governments that are directly or indirectly relevant and influential to preparation of master plan of LPCC. Impact of regional connectivity of the newly proposed city will also be comprehended;
b) Identification of key stakeholders and persons at local and provincial levels for KII and FGD while collecting data;
c) Identification of major issues associated with proposed area (local context); and
d) A framework for collection of required information and data and the techniques to be used.

Accordingly, a check list and semi-structured questionnaire survey sheets were prepared for consultation with key stakeholders as well as for KII and FGD during site visit. The semi-structured questionnaire sheet basically has six different questions. They are associated with SWOC (strengths, weaknesses, opportunity and challenges) analysis, drivers of urban growth in the last one decade as well as in future after development of capital city. There was one question regarding major disasters and their implication in each ward in the past. The fourth question is about economic linkages of the LPCC area with immediate surrounding areas and neighboring cities. The fifth issue was about numerous problems faced by each wards and possible solutions to mitigate them. The final one was about vision and essential facilities required for capital city. The intention of site visit was twofold: observing various crucial areas with the study area and collection of ward wise information through workshop.

1.5.2 Date Collection, Survey and Consultation

As per understanding from the earlier stage, detailed data was collected using different techniques. First, secondary data associated with planning, regulation and development of LPCC area were collected. National level documents included Sustainable Development Goals, National Disaster Risk Reduction and Management Policies and Strategic Action Plan (2018-2030), Paris documents (COP21), 15th national development plan (prepared by National Planning Commission), Nepal Labor Migration Report 2020, Nepal Labor Force Survey 2017-'18, Nepal Human Development Report 2020, Nepal economic survey 2020-'21, Nepal Macroeconomic Update 2020, Nepal Development Update 2021, Job Diagnosis Nepal 2020, National Urban Development Strategy 2017 including Planning Standards and Norms 2015.

Provincial and district level information collected comprised of 'Five Year Development Plan (fiscal year 2076-'77 to 2080-'81), policies and program documents prepared by various ministries of Lumbini Province, yearly progress reports and so on. Dang and Agrakanchi district profiles, provincial level sustainable development goals and disaster and climate change study including various sectoral study carried out by ADB, WB and UNDP including other donor agencies were also collected. Similarly, reports of mega infrastructure projects in the vicinity of the study area such as undergoing construction of Bhairahawa regional international airport, Buddhist circuit network in Lumbini, Western regional economic

corridor study, smart city of Tulsipur, integrated urban development project of Nepalgunj and so on were also collected. All the municipal profile of three local governments along with their comprehensive planning documents, yearly plan and budget allocation, progress reports, transportation master plan and environmental and disaster study reports were also gathered during the site visit. In addition to these, available satellite map, geological map and geographical information system (GIS) data were also collected.

Second, primary information of the study area was collected through site visits, surveys, as well as KII and FGD. A meeting with Provincial Infrastructure Development Authority was carried out and with their guidance, various important spots covering almost all wards of the study areas were visited (Fig. 1.3). During the site visits, consultation with local inhabitants were also carried out. Those observed sites included proposed area for institutional zone, various public lands suitable for parks and playground, major roads and bridges connecting surrounding districts, traditional settlements and newly growth areas along the Highway and major road network. In addition to that, some religious spots and lakes and canal were also visited. Extraction of sand, stones and bolder were also observed visiting various sites and discussed with the owners of those industries regarding status and prospects of the business.

During the site visit, workshop at Rapti Rural Municipal was carried out. For quick and effective information collection at ward level, chairpersons and other locals familiar with the ward were invited from all wards of three local governments within the study area. In addition to them, representatives from various agencies such as business houses, local non-government organizations (NGOs), district infrastructure providing offices, disaster risk management offices and so on were also invited.

Potential Institutional Zoning Site

Tharu village within study area

Ward-wise workshop at Rapti Rural Municipal hall

Vast agriculture land along West Rapti River

Religious site

Sand, stone and rubble extracting industry

Fig 1.3a Various potential sites for planning of LPCC

Fig. 1.3b Meetings with different Stakeholders

The workshop was addressed by the chief executive officer (CEO) of Provincial Infrastructure Development Authority (PIDA) and he highlighted the project background and intention of the workshop. The consultant elaborated the information expected from the participants through group discussion and consultation. After that, all the participants were

divided into different groups as per their ward and given few hours for brain storming and discussion among their group members regarding the six issues mentioned in the presentation. They were also requested to write down the outcome of group discussion in the chat paper. Each group was facilitated by consulting team by explaining the questionnaire survey sheets and other issues raised by each group.

During the workshop, groups as per respective wards for formed for discussion and brainstorming on six issues related raised in the presentation regarding the project. The groups were facilitated by consulting team by explaining the questionnaire survey sheets and other issues raised by each group. The outcomes of the group work were then presented and further discussed in the mass. The intention of such presentation was to confirm the fining of each group, as other groups can cross- check their finding and proposals. In addition to that, experts and local politician also shed their views towards the capital city planning. Some of them highlighted the need of understanding local context and their application into planning and designing of the capital city; others focused on the socio-economic modernization and improvement of quality of life of inhabitants. Again, others pointed out the need of conservation of natural resources and cultural heritages of various ethnic groups. Some remaining sites were visited in the late afternoon after completion of workshop. The output of this stage was:

(a) To be familiar with the site context: settlement typology, growth pattern, road network, available public spaces, and diverse types of problems facing by local community in different wards;
(b) To understand expectations of various groups (local leaders, inhabitants, business group, government officials, etc.) including local community and their interest in socio-economic development and facilities; and
(c) To collect various documents from three local governments, PIDI office and networking with local leaders, experts and business group for collection of information in future.

Given the nature and scale, Primary data were also collected until the last phase of the project in successive presentation and discussion meeting regarding the constraints, interest and priority of different stakeholders. Such meetings were done at the site (PIDA Office), Consultants office, and on online platforms as well. Meeting were also done with international consulting team regarding the development of the project and its issues to be address in the project.

1.5.3 Analysis and Synthesis and Findings

All the primary and secondary data collected were critically reviewed and analyzed. Information collected were reviewed and analyzed from three different but interrelated perspectives. First, the contextually of the study area was analyzed disintegrating various data and information of Shitaganga municipality and Gadhawa rural municipality and incorporating information of Rapti rural municipality. A clear picture was observed in the LPCC area in terms of its geography, population status, socio-economic condition, transportation network, water and sanitation, education and health facility, natural resources and environment and disaster risk including housing condition. Second, regional connectivity of the proposed area with surrounding towns especially to major cities and to India were also studied, focusing on economic transaction (trade and commerce), movement of people for

works and time dimension. National and provincial levels plans, programs and policies were also critically reviewed to establish their linkages with local area planning. Various target set at national and provincial levels especially SDGs, DRR and provincial five year development plan were also evaluated. Third, literature review on planning and urban design of capital cities in different parts of the world was also carried out and linked with the planning of LPCC. Some relevant case study analysis was also carried out. Analysis of these information from diverse sources sets the foundation for preparation of comprehensive master plan of LPCC. It also allows to take relevant development scenario in terms of population and density forecast as well as land use provision in the master plan.

After profiling the study area, various information are mapped into different layers: environmental and disaster risk maps, population growth and infrastructure demands, existing settlement patterns, infrastructure situation and past growth trend. Those information in layers of maps were critically related with the risk sensitive land use zoning, particularly identifying hazardous and non-hazardous areas (Fig. 1.4). In high risk areas, new growth were prevent and the existing settlements would be de-density and if necessary would be shifted into safer lands. However, in the medium level risk area, development needs to be regulated through enforcement of National Building Code and continuous monitoring. New growth were proposed in the safer areas with integrated development of buildings and infrastructure in concentrated potential areas in the form of different levels of development nodes. Accordingly, planning norms and building regulations were also proposed. During the study, provincial and local level planning were also reviewed and accordingly incorporated in planning for analysis and identification of different infrastructures required for the city development.

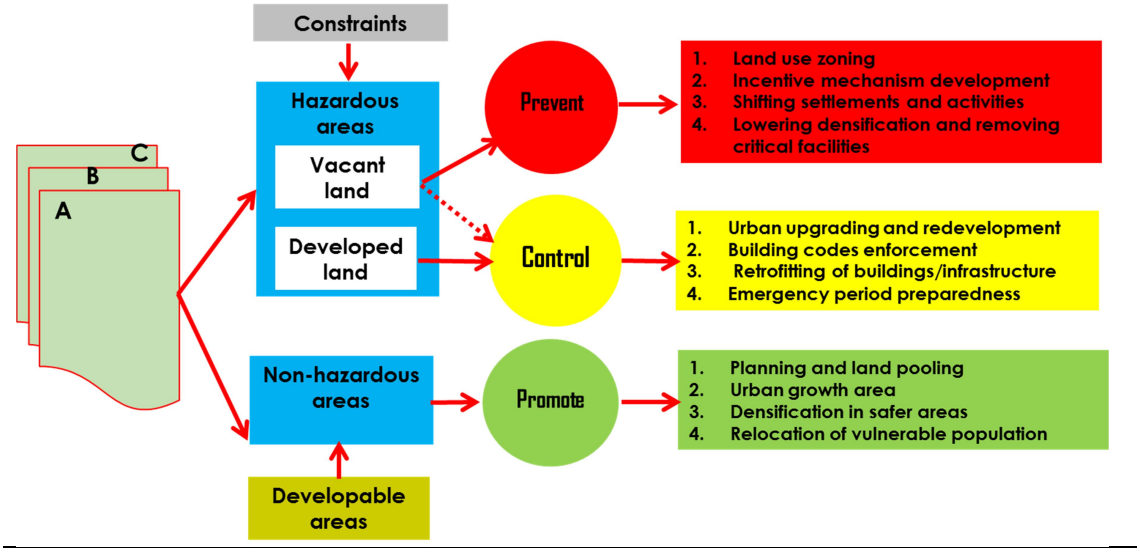


Fig. 1.4 Spatial planning based on risk sensitive land use, population growth and infrastructure demand and existing patterns of settlements and infrastructure

1.6 Scope of Work

The scope of the work is divided into three phases. First is the inception phase, to be familiarized with the existing situation of the study by visiting the site and reviewing various

documents. Existing settlement patterns, growth area, demographic study, socio-economic condition of the inhabitants, existing infrastructure and amenities, mapping of built and natural resources, hazard mapping and so on are expected. Second phase is basically different types of analyses: local context, regional connectivity and features of capital city. The status paper and five year development plan of Lumbini province as well as annual development plans of each local areas were analyzed. A comprehensive master plan of LPCC is prepared based on the planning and design principles set at the end of inception phase and regional analysis of connectivity and socio-economic linkages of the LPCC area with immediately surrounding areas as well as regional nodes. The comprehensive master plan includes broad land use zoning, transportation network and other detailing such as public spaces, parks and recreational areas. In the third phase, detailing of the institutional zone is worked with urban design guidelines.

1.7 Organization of Report

The whole reports is divided into five different chapters, each complementing the previous part. The first chapter is basically the contextual study that includes project background, study area, aims and objectives, scope and limitation of the study, study methodology. The second chapter deal with profiling and mapping of LPCC area including international case study analysis. It comprises of profiling of the study area ranging from physical, socio-economic, infrastructure, housing and risk conditions. It also include case study of Gandhinagar, provincial capital of Gujarat state of India. This profiling along with multiple maps givens a clear picture of the study areas based on multiple evidences.

Chapter three is about analysis of population growth and infrastructure demand in the capital city area for two different years: up to 2030 and between 2031 to 2050. Chapter four deal with strategic spatial planning along with detailing of the Master plan. The chapter presents concepts and strategies required for the development of the master plan, development measures in different sectors and social, physical and economic infrastructures identified for the city development. The last chapter includes conclusion and recommendation related to the project.

Chapter 2. Profiling, Mapping & Case Study

2.1 Profile of LPCC area

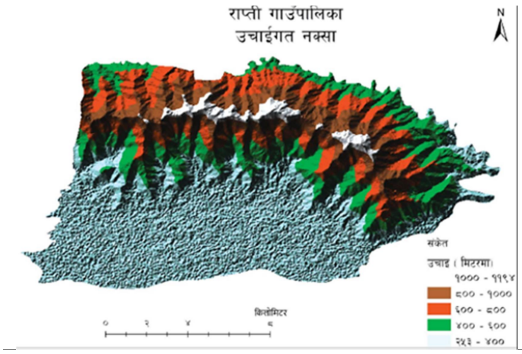
As the proposed LPCC area is distributed over three rural municipalities, preparation of profile of LPCC area is essential to understand local context in detail. It includes major sectors such as topography, land use and geology, population and family structure, economic condition, socio-culture and physical development including forest and environment.

2.2 Topography, land use and geology

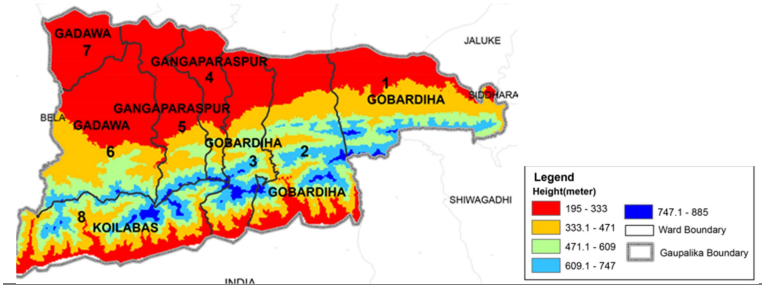
The topography of the LPCC area is mixed with hills, plain area, undulations and rivers. The plain area lies along the banks of the West Rapti River while hills are situated on all three sides except the west. Though the Rapti rural municipality is extended from 'Inner Madhesh' to 'Mahabharat' mountain via 'Chure' region, significant areas lies under 'Chure' with ward no. 2, 3, 4, 6, 7 and 8 on the plain area (Rapti rural municipality, 2076 BS). It has the highest elevation of 1194 m on the northern part and the lowest of 253 m. The slope is gradually increasing from south and east side towards north (Fig. 2.1a) (ibid). Ward no 1, 2 and 3 of Gadhawa rural municipality has majority of area plan with some places with up and down topography (Gadhawa rural municipality, 2075 BS). However, the southern part has 'Chure' mountain ranging elevation up to 885m.The elevation gradually decreases towards the north with elevation between195m to 333m around lands near Rapti River (ibid). Areas on the banks of West Rapti River and other streams have gentle slope less than 5° whereas the slopes gradually increase in ascending order towards the south. Some areas on the south side have slope greater than 40° (Fig. 2.1b). Compared to ward no 1, the remaining two wards have larger areas with steep slope on the southern side. There is a gradual increase in elevation of land topography in ward no 8 and 9 of Shitaganga municipality from west to east side. Lands on the west side have elevation less than 490 m which gradually increases towards east and up to 1400 m on the east side of ward no (Fig. 2.1 c) (Shitaganga municipality, 2076 BS). Significant percentage of land in these two ward have elevation up to 730 m only (ibid). In terms of the slope, both wards have mixed areas with three types of slopes: less than 12°, between 12° to 19° and between 19° to 26° (ibid). Only small area on the eastern side has slope greater than 26° (ibid).

Thus the plain area is limited around West Rapti River, mostly located in the Rapti rural municipality and Gadhawa rural municipality. Little flat land is available on the ward 8 and 9 of Shitaganga municipality, included in the LPCC area. The elevation on the northern side

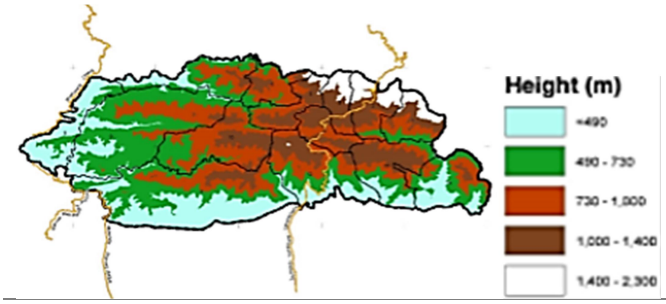
goes up to 1194 m, up to 730m on the east side and up to 333m on the south side. The western part of the LPCC lies flat land of Lamahi municipality.



(a) Elevations of Rapti rural municipality



(b) Elevation of Gadhawa rural municipality



(c) Elevation of Shitaganga municipality

Fig 2.1 Topography and elevation of study area within three different local levels

Existing land use in the three local levels reveals domination of forest, as the study area is surrounded by dense forest from three sides, except on the west (Table 2.1). Rapti rural municipality has 51.84% of its land as forest, whereas the corresponding figures for Gadhawa rural municipality and Shitaganga municipality are 65.27% and 83.14% respectively. In Rapti rural municipality, 43.03 % (69.62 sq. km) area is occupied by agriculture land, majority of them spreading on the northern part of the West Rapti River up to the edges of mountains. There also exist agriculture land on the south side of ward 1, 2 and 3 of Gadhawa rural municipality too. However, available agriculture land in ward 8 and 9 of Shitaganga is limited, as those wards are mostly dominated by mountain and ridges. In addition to these, all three territories have gazing area and orchard and barren land. Finally, the territory included in LPCC of Gadhawa rural municipality is 160.48 sq. km (ward 1, 2 and 3) and of Shitaganga municipality is 158.54 sq. km (ward 8 and 9), which are comparable to total area of Rapti rural municipality (161.79 sq. km).

Table 2.1 Classification of the existing land use in three municipalities

S. N.	Classification	Rapti rural municipality (sq. km)	Gadhawa rural municipality (sq. km)	Shitaganga municipality (sq. km)
1	Agriculture/cultivation area	69.62 (43.03%)	52.02 (14.50%)	97.69 (13.38%) + 0.95 (0.13%) (uncultivated land)
2	Gazing area and orchard	1.65 (1.02%)	10.32 (2.87%)	11.59 (1.59%)
3	Forest	83.88 (51.84%)	234.03 (65.27%)	607 (83.14%)
4	Road network	0.66 (0.41%)	-	-
5	River and water body	1.41 (0.87%)	2.61 (0.73%)	1.80 (0.243%)
6	Barren land/ sand	3.67 (2.27%)	22.31 (6.22%)	9.55 (1.31%)
7	Other (bush, etc.)	0.09 (0.06%)	34.90 (9.77%)	
8	Cliff			1.52 (0.21%)
	Total	161.79 (100%)	358.57 (100%)	730.11 (100%)
			Ward 1: 58.41 + ward 2: 64.48 + ward 3: 37.59 = 160.48	Ward 8: 39.77 + ward 9: 118.77 = 158.54

Source: Department of Survey in Rapti rural municipality, 2076BS; Gadhawa rural municipality, 2075 BS; Shitganga municipality, 2076 BS

Geological condition of LPCC area can be better understood by analyzing larger area, Deukhuri Valley, located in the sub-Himalayan in the mid-western Nepal is about 60 km long in WNW-ESE direction with maximum width of 20 km. Its basin floor mainly consists of terraced and unconsolidated deposits called 'the Dun Gravel' (Sharma, 1990). It is surrounded by 'Churia' range (inner Churia range) on the north (separates from Dang Valley) and 'Duduwa' range (outer Churia range) dividing the Ganges Plan and 'Deukhuri' Valley on the south (Fig 2.2). Westward extension of the two hilly mountain ranges is well known as the Siwalik Hills.

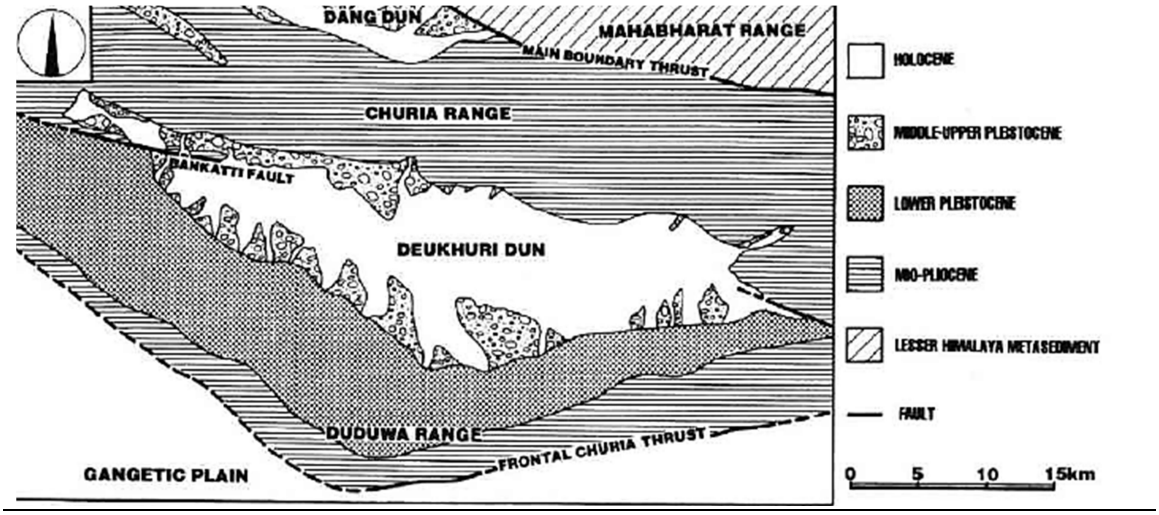
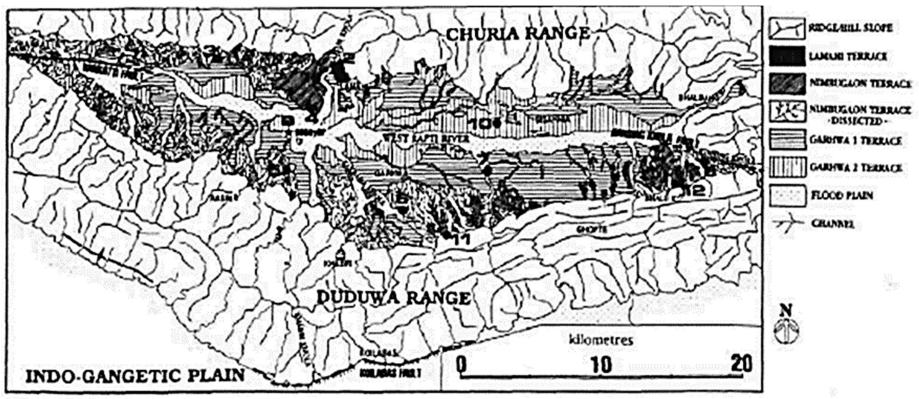


Fig 2.2 Geologic map of the Deukhuri Valley (Dun). Source: Kimura, 1988

Dun Valley are intermontane basins in the Sub-Himalaya,[6] which is a foreland fold-and-thrust zone lying between the Main Boundary Thrust (MBT) and the Frontal Churia Thrust (FCT). It is believed that the east of the Deukhuri Dun, the Siwaliks are dated as 12.5 Ma to *ca* 1Ma (Appel and Rosler, 1994). Also, the Upper Siwaliks is estimated to Early to Middle Pleistocene age.

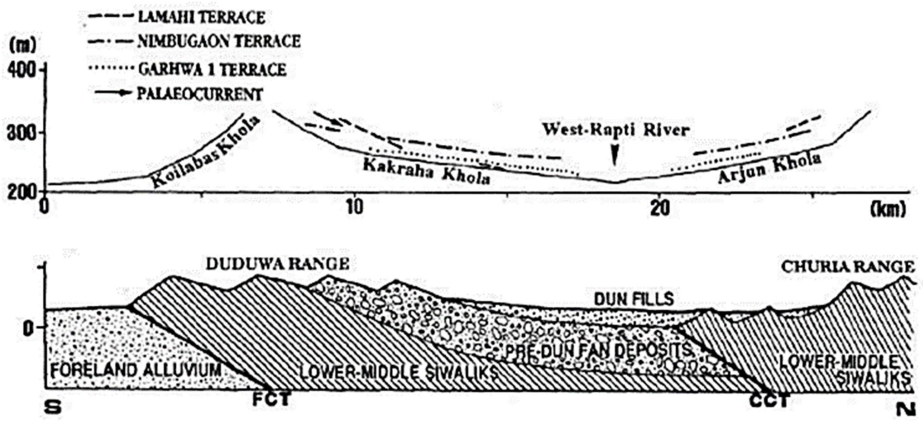
The Siwalik Hills have three different layers: the Lower Siwaliks consisting of siltstone, the Middle Siwaliks dominated by sandstone and the Upper Siwaliks of conglomerate layers in ascending order (Hagen, 1969; Itihara et al., 1972). The Siwaliks around the Deukhuri Dun has two geo-structural belts: the Central Churia Thrust (CCT) and the Frontal Churia Thrust (FCT). There are two fault lines along E-W direction: one on the eastern part of the Deukhuri Dun along the Ransing Khola and another on the western part of the dune around Bankatti village (Department of Mines and Geology, 1982). The southern foot of the Siwalik Hills is regarded as the Himalaya Frontal Fault (HFF) or Frontal Churia Thrust (FCT), the southern most active front of the Himalayan orogenic belt. A reverse fault is observed near Koilabas village, the southern foot of the Duduwa Range.

The Deukhuri dun has fluvial floors divided into four terraces: the Lamahi Terrace, the Nimbugaon Terrace, the Garhwa 1 Terrace and the Garhwa 2 Terrace (Fig. 2.3). The Lamahi Terrace is located around the outlet of the Arjun Khola, which flows from the Inner Churia Range to the Rapti River and scattering along the southern fringe of the dun. The deposits more than 46m thick are buried by younger morphostratigraphic units in the central part of the Valley . They are composed of cobble rich gravel with sandy matrix including pebble and boulder of 1 m in diameter. The deposits are poorly sorted and ill stratified. Lithologic composition shows that the gravels were derived from both the Lesser Himalayan Metasediments and the Siwaliks. The Nimbugaon Terrace is well developed along the south foot of the Duduwa Range and is narrowly distributed along the northern fringe of the dun. The terrace deposits are more than 24 m in thickness, and their base is commonly below the present stream level. The deposits particularly in the central part consist of well-stratified sand layers including thin gravelly beds and organic silt bands. The metasedimentary rocks of the Lesser Himalayan origin accounts for 50-70% of pebble whereas the soft silt-sandstone from the Siwaliks constitute along the margin of the dun.



Geomorphic map of the Deukhuri Dun

[6] The Himalayas are composed of some NNW-SSE striking mountain ranges in a sequential form: the Trans-Himalaya, the Great Himalaya, the Lesser Himalaya and the Sub-Himalaya (Siwalik Hills) from north to south, which is believed to be the products of imbricated thrusts (Seeber et al, 1981; Schelling and Arita, 1991; Kizaki, 1995).



Cross section of Deukhuri Dun

Fig 2.3 Geomorphic map and cross section of Deukhuri Dun (Source: Kimura, 1998)

The Garhwa 1 Terrace on the left side of the West Rapt River is more than 8 m in thickness and their base is situated below the present flood plan (Kimura, 1998). The deposits are normalgrading silty sand, thin gravel beds consisting mainly of sub-rounded cobble. The lithologic composition of the Garhwa 1 Terrace deposits is similar to that of the Nimbugaon Terrace deposits. However, the Garhwa 2 Terrace is developed along the Rapti River consist of fresh yellowish gray to yellowish brown sand of several meter thick and some fragments of woods. Thickness and depositional area of the Garhwa Terrace deposits are far smaller than those of the Nimbugaon Terrace deposits thereby indicating that Garhwa Terraces were evolved as flood plain, which were curved on the Nimbugaon Terrace deposits, in the Holocene.

The N-S profile of the Deukhuri Den indicates that the Lamahi Terrace merges into the Nimbugaon Terrace (Fig. 2.3). The Nimbugaon Terrace deposits are underlain by the Lamahi Terrace whereas the Nimbugaon Terrace, the Garhwa Terraces and the present flood plain are virtually parallel to each other. The morpho-structure of the area around Deukhuri Dun is characterized by a piggyback sequence dominated by the FCT.[7] The hanging wall of the MCT is slipped by creep and the foot wall of the MCT is locked as an asperity (Bilham et al., 1997; Nakata, 1997). The Himalayan great earthquakes are considered to occur on a shallow decolliment, because they gave huge damages to the Himalayan foreland without a surface rapture (Seeber eat al 1981). The main rapture zone of the extent Kangra type earthquake, which is estimated to occur in the western part of Nepal (Bilham et al., 1995; 1997; Pandey et al., 1997) will be located beneath the Lesser Himalaya rather than the Sub-Himalaya.

Geology of Rapti rural municipality consists of two sub-groups: bedrock geology covering about 101 sq. km area and sedimentary succession of about 60 sq. km distribution (Rapti Rural Municipality, 2020). Siwaliks lithounits made up of mainly mudstones and sandstones of varying proportions cover the whole rural municipal area. Lower Siwaliks at the foothill of the Siwalik mountain range is composed of variegated (i.e., pale yellow, orange, gray green, and dark gray) mudstone alternating with medium to fine-grained sandstones, siltstones (Fig. 2.4) (ibid).

[7] This kind of sequential morpho-structure is in common with other dun Valley such as DehraDun in the Garhwal Front in India, the Hetauda Dun in the Central Nepal Front and so on.

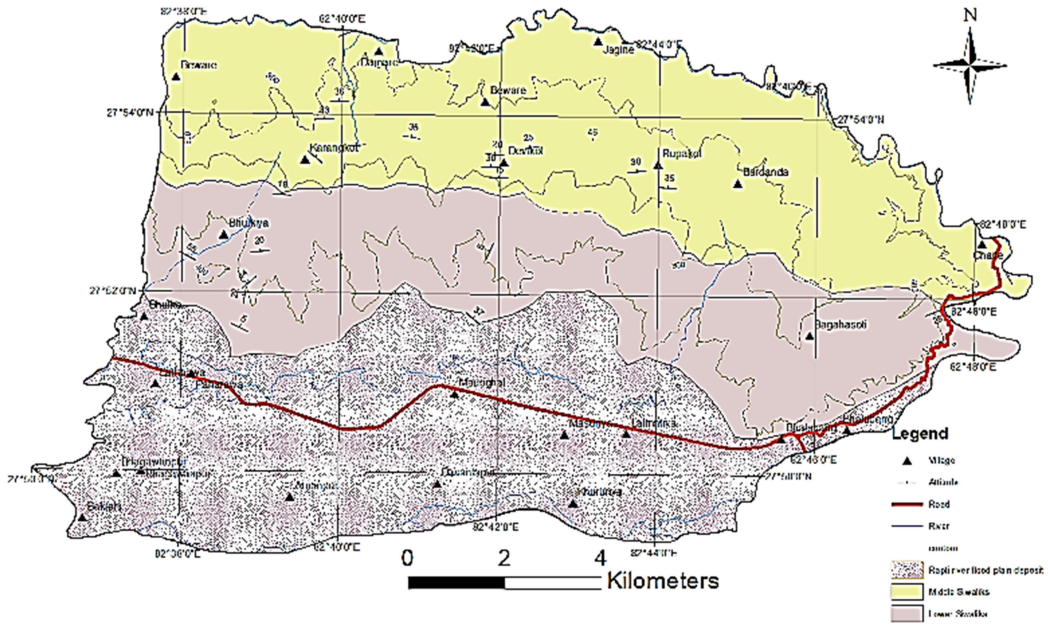


Fig 2.4 Geological map of Rapti rural municipality. Source: Rapti rural municipality, 2020

Sandstone bed is of thinly bedded and spheroidically weathered. The minerals present in sandstone are Quartz, Muscovite, Biotite and Feldspar but presence of Muscovite is higher. It can be seen along the Lalmatiya-Devikot road section and Lathwa-Karnokot road section, south of Devikot village (ibid) (Fig. 2.5) (ibid).

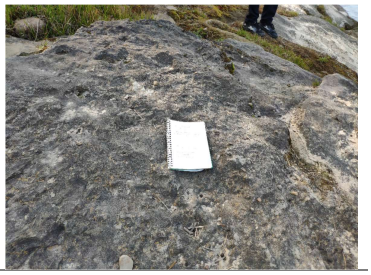
Highly weathered mudstone with few siltstone beds	Variegated mudstone of different colour	Weathered mud stone like soil in nature

Fig 2.5 Characters of Lower Siwaliks strata **Source: Rapti rural municipality, 2020**

The Middle Siwaliks on the northern part of Lower Siwaliks compose of sandstones and mudstones with domination of sandstone (ibid). Sandstone beds are more than 5m thick are massive, calcareous and jointed and fractured. The Middle Siwaliks is well exposed around Devikot, Karanggekot-Bardada ridge road section and Karanggekot-Punkhola Gau section (Fig. 2.6) (ibid).

Massive sandstone bed on Dang – Pyuthan road

Sandstone bounders



Pebbly sandstone beds

Fig 2.6 Characters of Middle Siwaliks

On the north and south sides of West Rapti River is terrace deposit, mainly consists of pebbles of sandstone, quartzite and phyllite. They are sorted, loosely packed, gravel pebble with fine sediments. The southern part has more consolidated gravel bed due to shifting of the River (Fig. 2.7). Extraction of sand, stone and gravel (through crossing machine) can be seen on the southern and eastern parts. All the settlements developed along East-West Highway have terrace deposited floor.

Fig 2.7 Terrace deposit of pebbles of sandstone, quartzite and phyllitein northern part of West Rapti River

Simply, geology is the study of the Earth. Generally, geologists study how the Earth works, both today and in the past.

A thrust fault is a break in the Earth's crust, across which older rocks are pushed above younger rocks. Horizontal compressive forces generate thrust and reverse faults, which shrink the crust. Most of these faults deposit older rocks over younger rocks because the hanging wall shifts up relative to the footwall. When previously deformed rocks are thrust faulted, younger over older relationships can arise. The Thrust line exist in the site area of LPCC area at ward no. 8 and 9 of Shitganga area and ward 1 of Gadhawa at Dhodre and Patringa region.

In structural geology, an anticline is a type of fold that is an arch-like shape and has its oldest beds at its core, whereas a syncline is the inverse of an anticline. A typical anticline is convex up in which the hinge or crest is the location where the curvature is greatest, and the limbs are the sides of the fold that dip away from the hinge. Anticlines can be recognized and differentiated from antiforms by a sequence of rock layers that become progressively older toward the center of the fold. Therefore, if age relationships between various rock strata are unknown, the term antiform should be used. Also the anticlinical axis lies at ward 8 and 9 of Shitganga of LPCC area.

A fault is a fracture or zone of fractures between two blocks of rock. Faults allow the blocks to move relative to each other. This movement may occur rapidly, in the form of an

earthquake - or may occur slowly, in the form of creep. Faults may range in length from a few millimeters to thousands of kilometers.

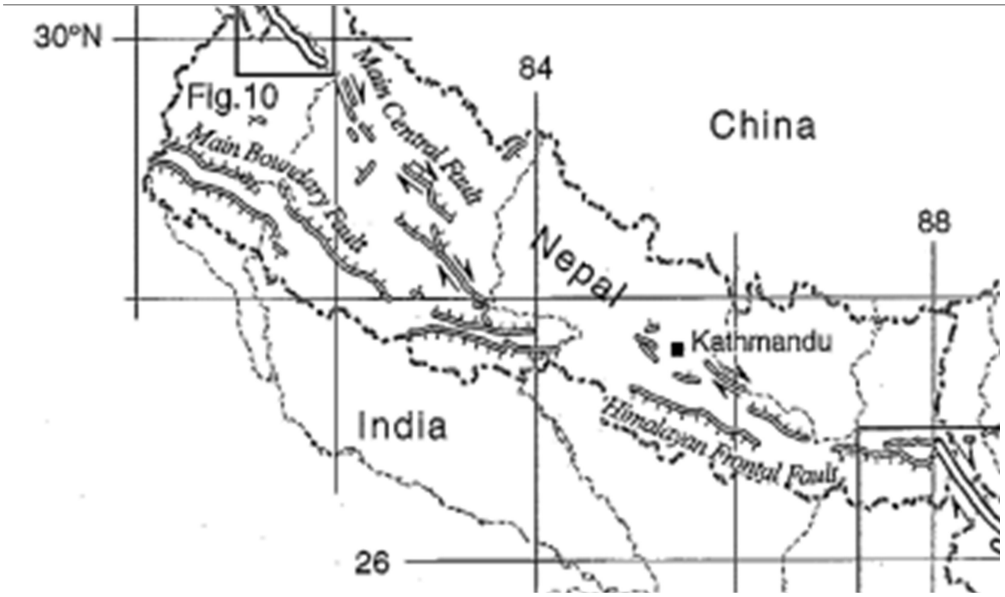


Fig 2.8 a Active faults in and around Nepal Himalaya (Source: Takashi NAKATA and Yasuhiro KUMAHARA)

The Surficial deposits (quaternary – recent) of LPCC area are Alluvium, Boulder, Gravel, Sand, Silt and Clay. It ranges from upper Siwaliks to lower Siwaliks as shown in figure below.

A part of seismic hazard exists in the Rapti and Gadhawa Rural Municipality. MBT lines passes along both sides of Rapti River at Khuriya in Rapti Rural Municipality and area above Malmala in Gadhawa Rural Municipality as shown in the map below. Planning of High-rise buildings, important buildings and evacuation centers at this location is not recommended.

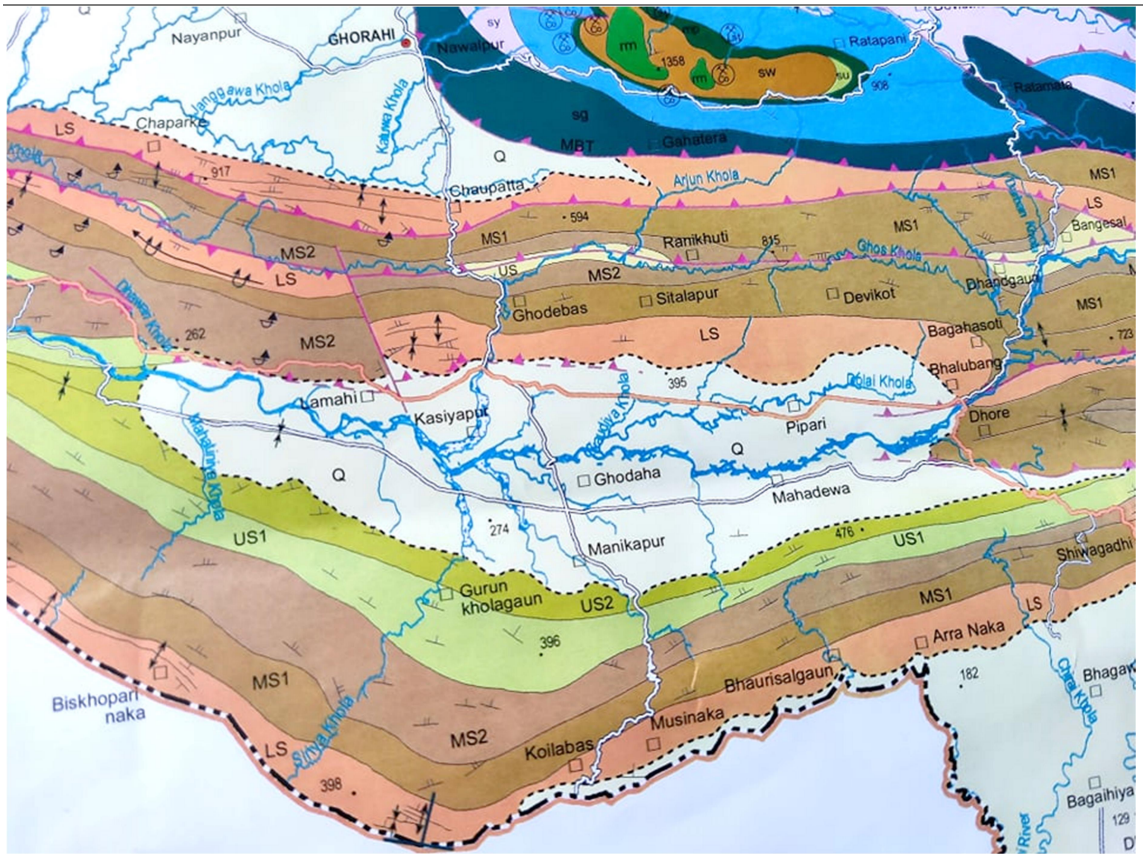


Fig. 2.8 b: Geological Map of LPCC Area (Source: Department of Mines and geology)

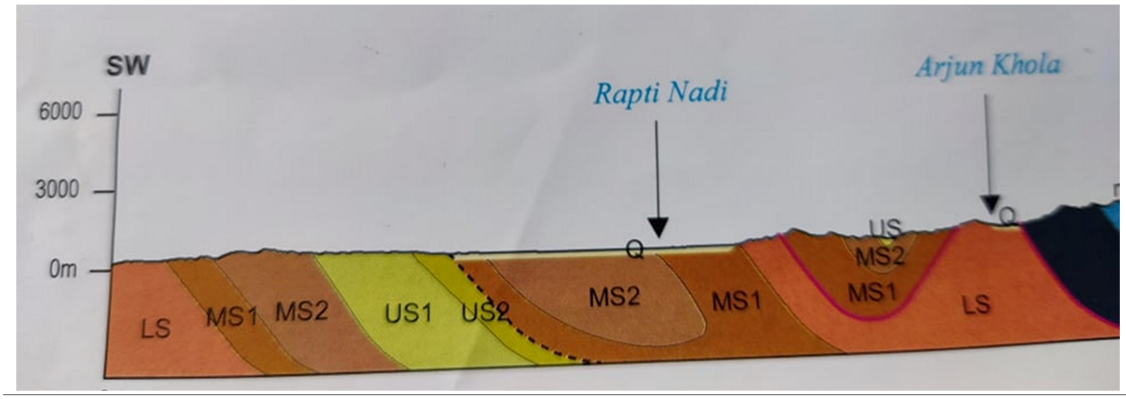


Fig. 2.8c: C/S of Geological Map of LPCC area (Source: DoMG)

2.3 Mines and Minerals

A mineral is a natural substance of inorganic origin with definite chemical and physical properties. Since the beginning of Copper Age mining has become a very important economic activity of mankind. This form of economic activity still contributes a sizable amount to the economic development of countries. The solid crust of the earth is made up of rocks. The rocks, in their turn, can be defined as the aggregates of minerals. The minerals, therefore, are the smallest geological units forming the crust and are themselves substances of inorganic nature. Minerals are, moreover, characterized more or less by their fixed chemical

composition and exhibit perfect geometric shape and have an internal atomic structure. The mineral can be considered as a potential resource for the prosperity of the capital city of Lumbini Province. It is mainly due to Nepal is regarded as the richest in mineral resources. Some resources, like iron, copper, lead, zinc, cobalt, nickel, quartzite, dolomite and limestone are widely distributed across the country. However, these resources have not properly explored as per the need of Nepal due to the lack of capital, lack of technology, lack of skilled human power, lack of access to transportation, and lack of strong government policies towards the extraction of mineral resources. Minerals majorly found at site area or at Dang and Argakhachi districts are Copper (Cu), Cobalt (Co), Lead (Pb), Silver (Ag), Barite, Clay, Phosphorite etc. which are generally termed as Metallic minerals. The major minerals like Limestone and Coal that has the highest potential can be found massively at the region of LPCC and these districts. Different Organizations like Arghakhanchi Cement pvt.ltd. , Sonapur Cement pvt.ltd. , Dang cement Industries, Ganapati Quarries pvt. ltd. has issued the license for the prime locations like Narapani, Gandhari, Kabre, Purandhara, Singha, Saigha limestone deposit. There is disparity between the different types of mineral resources position and utilization in Nepal. Some mineral resources like boulder, sand, gravel, slate, granite and lime stone which do not require more financial resources to explore and exploit are in high use, while other like energy resources and metallic minerals are underutilized. Most of the information on minerals occurrences in the country is still sketchy.

2.4 Population

At present, total population of LPPC is about 68,615 (Table 2.2): 18,232 in three wards of Gadhawa rural municipality, 44,433 of all nine wards of Rapti rural municipality and 5,950 of two wards of Shitaganga municipality (Gadhawa rural municipality, 2075 BS; Rapti rural municipality, 2076 BS and Shitaganga rural municipality, 2076 BS). In the study area, the population of Rapti rural municipality is almost seven fold of Gadhawa rural municipality and of is three fold larger than that of Shitaganga municipality (of wards 8 and 9 only).

Among different wards of three municipalities in the study area, ward no 6 of Rapti rural municipality[8] has the highest population density of 576.6 person/sq. km whereas ward no 9 of Shitaganga municipality has just 25.97 person/sq. km. of area. Though population density in different wards of Gadhawa rural municipality and Shitaganga municipality is low, nonetheless, size of population in these wards is comparative large indicating scattered settlements. Ward no 5 and 9 of Rapti rural municipality have also low population density.

Table 2.2 Population distribution by wards and gender in LPCC area

Municipality/ Rural municipality	Ward no.	HH	Population				Population density (per sq. km)
			Male	Female	Third gender	Total	
Rapti rural municipality	1	1166	2674	2424	7	5105	224.0
	2	1342	3511	3281	0	6792	284.18
	3	1241	3402	3238	1	6641	71.22
	4	1215	3075	2887	0	5962	377.3
	5	756	1963	1939	2	3904	92.5
	6	918	2667	2523	0	5190	576.6

[8] At least one person from 19% of the household has gone to either India or third country for job. Indian markets are famous for labor works. In this area, about 2121 persons have gone to thrid country from 1666 households.

Municipality/ Rural municipality	Ward no.	HH	Population				Population density (per sq. km)
			Male	Female	Third gender	Total	
	7	845	2219	2333	2	4554	548.6
	8	920	2380	2182	0	4562	495.88
	9	360	892	830	1	1723	79.7
Total		8763	22783	21783	13	44,433	274.9
Gadhawa rural municipality	1	1154	2700	3190	0	5890	101
	2	856	2395	2472	0	4867	75
	3	863	2236	2329	0	4565	121
Total (only 3 wards)		2873	7331	7991	0	15322 (18,232 in 2020)	99
Shitaganga municipality	8	671	1275	1591	0	2866	72.06
	9	642	1519	2564	1	3084	25.97
Total		1313	2794	4155	1	5,950	49.01
Grand total		12949	32908	33929	14	65,705 (68,615)	140.97

Note: (a) The population of Gadhawa rural municipality is based on 2011 census and it was assumed that total population of three wards is 18,232 in 2020, as per Health Profile of the same rural municipality at *http://103.233.56.101:5003/profiling/main/gadhawa*
(b) The population distribution of the remaining two (Rapti rural municipality and Shitaganga municipality are based on 2076 household survey, mentioned in their profiles.

Source: Compiled and calculated from Gadhawa rural municipality, 2075 BS; Rapti rural municipality, 2076 BS and Shitaganga municipality, 2076 BS

Different population size and density in the three areas under different local governments, of the LPCC has a lot of significant in preparing comprehensive master plan. Ward 9 of Rapti rural municipality and of Shitaganga municipality are located far away from West Rapti River and East - West Highway.

All three territory of LPCC have population with different ethnic composition[9] (Table 2.3). Gadhawa rural municipality[10] has domination of Tharu community followed by Brahmin, Magar and Kumal whereas Rapti rural municipality has Brahmin/Chhetri followed by Tharu and Magar community. In the case of Shitaganga municipality, the ethnic group includes Magar, Kumal and Kami besides Nepali speaking Brahim and Chhetri. Such ethnic groups having their own lifestyle and housing typology will have a lot of implication in master planning of LPCC. The absentee population (8554)[11] is high in Shitaganga municipality. Out of them 60.7% are in abroad and majority of absentee population are between ten to twenty nine years old.

[9] As per Ethnic (Aadibasi/Janjati Promotion National Academy Act 2058BS, Nepal's ethnic group means those having their own mother tongue, traditional, different cultural identity and social institutional including having (un)written history, altogether 58 caste or community.

[10] In the whole Gadhawa rural municipality, about 45.51% of total population belongs to Tharu community, followed by Cheetri (8.95%) and Magar (8.35%). Similarly, Kumal community has 8.32%, Yadav of 7.72% and Brahmin (Pahadi) of 5.49%. There is also Kami (3.31%), Muslim (3.06%), Dashnami (1.90%), Damai/Dholi (1.72%) and Sarki (1.33%).

[11] Absentee population means those who have gone to other places for work, education, business, treatment, government services or any other purposes and remain absent for more than 6 months.

Table 2.3 Population distribution according to language and ethnic group in LPCC area

Language /caste	Gadhawa RM (Ward no 1, 2 & 3)	Rapti rural municipality	Shitganga Municipality (Ward no 8 and 9 only)
Nepali / Brahmin pahadi	2632	21628	37 + 80 (brahim) + 129+422 (chhetri)
Magar	1522	1349	1337 (8) + 1658 (9)
Kami	603		471+315
Sarki	242		0+155
Kumal	1516		474+187
Damai/Dholi	313		28 + 166
Yadav	1407		
Muslim	558		
Dasami	346		
Tharu	8297	21052	
Abadhi		88	
Urdu		1	
Hindi		39	
Doteli			7 + 31
Gurung		183	383+70
Tamang		13	0
Newari		22	0
Maithali		13	0
Bhojpuri		6	0
Others	789	39	117
Note: For the case of Gadhawa RM, the percentage of different ethnic group of the whole RM is disintegrated into three wards with estimated population of 2020			

Source: Compiled and calculated from Gadhawa rural municipality, 2075 BS; Rapti rural municipality, 2076 BS and Shitaganga municipality, 2076 BS

Most of the people in LPCC area follow Hindu religion. It was found that about 95.66% in Gadhawa rural municipality, 96.38% in Rapti rural municipality and 98.9% in Shitganga municipality follow Hindu religion. Islam in Gadhawa rural municipality, Christian in Rapti rural municipality and Buddhist in Shitganga municipality are the second most followed religion. Population following Kirat and Bahai are found to be rare in the project area. In terms of religion, majority in all the three areas is of Hindu (Table 2.4). There are about 3.06% of population adopting Islam and another 1.16% of population follow Christianity. The corresponding figures for Rapti rural municipality is respectively1.11% and 2.02%.

Surprising, population following Buddhism is small in number in all three areas compared to Islam and Christianity.

Table 2.4 Population distribution according to religion in LPCC area

S. N.	Religion	Gadhawa RM (Ward no 1, 2 & 3)	Rapti RM (All wards from 1 to 9)	Shitganga Municipality (Ward no 8 & 9)
1	Hindu	17440 (95.66%)	42827 (96.38%)	5903 (99.2%)
2	Christian	211 (1.16%)	900 (2.02%)	46 (0.77%)
3	Islam	558 (3.06%)	496 (1.11%)	0
4	Buddhist	11(0.06%)	82 (0.18%)	1 (0.017%)
5	Kirat		2 (0.0004%)	
6	Bahai	2 (0.05%)		
7	Others	9 (0.05%)	126 (0.28%)	0

Note: For the case of Gadhawa RM, the percentage of different ethnic group of the whole RM is disintegrated into three wards with estimated population of 2020

Source: Compiled and calculated from Gadhawa rural municipality, 2075 BS; Rapti rural municipality, 2076 BS and Shitganga municipality, 2076 BS

2.5 Economic condition of LPCC area

2.5.1 Agriculture farming and livestock production and income of households

The economic base of three territory of LPCC area is agriculture and livestock. About 5,866 households in 3,346.78 ha of land produce 9,705.67 metric ton of rice yearly whereas 3,743 household produce 2,790 metric ton of wheat by planting over 1,163.91 ha of land (Rapti rural municipality, 3076 BS). In addition to these, different grains and lintels are also cultivated in this municipality. Major cash crops include turmeric (beshar) (167.45 metric ton yearly), herbal (jadibuti) and ginger (aduwa) in mountain region (300 metric ton yearly) (ibid). In the case of Rapti rual municipality, about 73.07% of total population are directly and actively engaged in agriculture and livestock (ibid). About 4.78% of people are engaged in service and almost same number of population have gone abroad for job (ibid). Only 2.59% of population are engaged in business and another 1.16% population have self-employed (ibid). About7.5% of population do not have any specific profession whereas about 0.92% population are unemployed (ibid). Settlements in Gadhawa rural municipality are also dominated by farming communities producing staple crops like rice, maize, wheat, buckwheat, soyabeans, potatios, lemons, and furits in summer. In winter, they harvest cash crops such as garlic, mustard of wheat, buckwheat, finger millet, barley, soyabeans, sugarcane, cotton and potatos. Plantation of rice, vegetable and fruit is widespread in many parts whereas lintels and cash crops are limited over small land parcels. In Shitaganga municipality too, agriculture sector (70.73%)[12] contributes to economy (Shitaganga municipality, 2076 BS). Only 29.27% population are attracted towards non-agricutlure sector. Out of 6372 housholds (HHs) adopting agricutalue and livestocks, 565 households (8.86% of 6372 HHs) in ward 8 and 477 (7.48% of 6372 HHs) in ward 9 rely on agriculture and livestocks (ibid). This followed by daily worker (306 HHs and 267 HHs in wards 8 and 9

[12] In the whole Shitaganga municipality, out of 9009 HHs, 6372 HHs are engaged in agriculture and livestock followed by 2530 HHs relying on foreign remittance, and 2269 HHs working on daily wages, 1326 HHs in service and only 719 HHs engaging in trade and business. People engaged in high profit profession and productive business is insignificant.

respectively) and remittance from abroad (239 HHs and 81 HHs in wards 8 and 9 respectively) (ibid). Others are engaged in service (80 and 82 HHs in wards 8 and 9 respectively) and trade and bussiness (55 HHs and 29 HHs in wards 8 and 9 respectively) (ibid). There is only 6 HHs in these two wards engaging in industry (ibid).

Households in all three territory of LPCC area engaged in livestock for milk, meat, fertilizer, agriculture work and for transportation. Major domestic animals include buffalo, ox, cow, swine, goat and chicken and duck. Cow and buffalo give milk; oxes are used for land cultivation; and goat, swine, sheep and chiken are raised for meat. In Shitaganga municipality, about 526 HHs (78.4% of total ward population) in ward 8 and another 522 HHs (81.3%) in ward 9 are engaged in livestorck (Shitaganga municipality, 2076 BS). Mjority of them have goats and sheep (467 HHs and 469 HHs in wards 8 and 9 respectively) followed by chicken and duck (416 HH and 434 HHs respectively), cow and ox (251 HHs and421 HHs respectively). Other have buffalo and swine and pigs. Most of the farmers prefer to have goat rearing because there is a good demand of it in the market. Among these two wards, farmer livingin ward 9 have somehow produced milk and other products like ghee, cheese and so on.

In Rapti rural municipality, about 25.73% households earn up to NRs 70,000 annually whereas 14.97% houshold has earning between NRs 70,000 to NRs. 90,000 (Rapti rural municipality, 2076 BS). Similarly, 28.60% household have yearly earning between NRs 90,000 to NRs. 150,000 (ibid). About 6.98% household earn more than NRs 250,000 yearly (ibid). On wardwise, 176 housholed at ward no 2 earn more than NRs 250,000 yearly whereas 345 households at ward no 4 and 7 earn between NRs 150,000 to NRs 250,000 (ibid). Peope in Rapti rual municipality spend about 32.5% of their income on food (Rapti rural municipality, 2076 BS). Expenses on education and treatment is respectively 16.2% and7.1% of their income (ibid). Households also spend about 9.7% of their income for celebration of festivals and recreation activities (ibid).

In Rapti rural municipality, 6.22% households is ‘very poor’ and another 16.49% household is ‘poor’ (Rapti rural municipality, 2076 BS). Economically capable rich households is only 6.88%; the remaining households have’general’ (35.98%) and ‘medium’ (34.63%) economic capacity (ibid). About 15.65% households produce food adequate even for less than three months (ibid). Similarly another 15.54% households harvest crops, enough for three to six months only (ibid). About 4.31% household yield food adequate for one year and another 31.66% produce sufficient food for more than one year (ibid). However, 23.59% households do not harvest any grains and vegetabls (ibid).

As significant municipal area is covered by hills, agriculture land available in Shitaganga municipality is limited. Rice, wheat, maize, barley and potato are cultivated yearly whreas ginger, onion, garlic, pepeer and grains are planted as cash crops (Shitaganga municipality, 2076 BS). In addition to these, there are plantations of vegetable (cabbage, cowly flower, beans, carrots, etc.) and fruit (lenon, orange, banana, mango, guava, pears and papaya) (ibid). Musroom farming, proudciton of different types of oil are also carried out (ibid).

In Shitaganga municipality, majority of the household earn money from foreign remittance followed by selling of domestic animals and daily wages (ibid). It indicates that only few households are engaged in industry and commerce that yield huge profit and create jobs. The

first three items households spend include clothing (dress, shoe,etc.), food and meat, fish and eggs (ibid). Spending in the healt sector comes fourth place (ibid).

About 91.4% (613 HHs) in ward 8 and 88.6% (569 HHs) in ward 9 posses agriculture land. This figure is quite high compared to average 67.7% of HHs in the whole municipality (ibid). Out of households engaging in agriculture, wards 8 and 9 constitutes 10.0% (635 HHs) and 10.9% (690) respectively (ibid). Out of them, about 600 HHs in ward 8 and 533 HHs in ward 9 work in their own agriculture land whereas only 8 HHs in ward 8 and 70 HHs in ward 9 have rented their agriculture land. Similarly, small number of farmers (27 HHs and 87 HHs respectively) use other's lands for agriculture purpose (ibid). Regarding the size of agricutlure land, many of them posses land between 2 ha - 5 ha (253 HHs in ward 8 and 232 HHs in ward 9), followed by 5ha to 10 ha (108 HHs in ward 8 and165 HHs in ward 9), and 1ha – 2 ha (ibid). However, 242 HHs in ward 9 have land bigger than 10 ha (ibid). All the families engaged in agriculture do not cultivate different types of grains, vegetables and furits. Though majority of them produce rice, maize, wheat, barley, nearly half of them only produce vegetables. Number of families producting gruits is significnaly low compared to the households cultivating grains.

In Shitaganga municipality, yearly income of 383 HHs in ward 8 and 296 HHs in ward 9 are sufficient for adequat spending throughout year, whereas the corresponding figures are 60 HHs and 59 HHs having yearly income adequate for spending only 10-11 months (ibid). For 10 HHs and 84 HHs in wards 8 and 9 have yearly income simply adeqaute for spending up to three months only (ibid). However, 66% of HHs in ward 8 and 48.6% HHs in ward 9 have taken some sort of loan from financial institutions, coopearives or other means for carrying out socio-economic and cultural activities (ibid). Such loans have been often taken for household use (79 HHs and 268 HHs in wards 8 and 9 respectively) followed by for treatement (69 HHs and 133 HHs respectively), construction of house or purchasing land (69 HHs and 51 HHs in wards 8 and 9 respectively) (ibid). Few households have taken loan for investment in agriculture (42 HHs and 39 HHs in wards 8 and 9 respectively) and in trade and business (17 HHs and 29 HHs in wards 8 and 9 respectively) (ibid). Majority of these households took loan from individual[13] (103 HHs and 285 HHs in wards 8 and 9 respectively), followed by cooperatives (79 HHs in each wards) and other financial institutions (59 HHs and 49 HHs in wards 8 and 9 respectively) (ibid). The income from remittance is often spent on education followed by household consumption and to pay back loans (ibid). They have also been spent for treatment. Insignificant number of households have used them in investing in business (or agricutlrue) or saving for future needs.

2.5.2 Agriculture firms and cooperatives

In Rapti rural municipality, many private agriculture firms are under operation particularly in ward 4 and some of them scattered in wards 1, 2 and 3 (Rapti rural municipality, 2076 BS). The products from these firms are either locally consumed or taken to Lamahi municipality. Many group and community organizations associated with agriculture and livestock have been registered into Rapti rural municipality. Unfortunately this rural municipality is yet to establish cold storage for production of vegetables, fruits and dairy products. Those products

[13] Unlike in the commercial banks and other financial institutions, one does not need to put mortgage and does not need to engage in long administrative process while taking loan from individuals (despite having high percentage of interest rate). Access to commercial banks and financial institutions is still weak.

particularly vegetables, milk and fruits are taken to local market by farmers at small scale. Daily milk[14] collection is carried out at 'Shirjanshil Youth Milk Collection Centre' (private collection centre) and dairy and sweet shops located at Barakhutti, Pipare, Bhalubang. Such collected milks are sold in local market. Extra available milks after consuming at local markets are sold to 'Uddhamshil Multipurpose Cooperation'in Lamahi. Fruits and vegetables are taken to local market daily for sell. There is no agriculture market nor the concept of 'haat baazar' exisit here. The agriculture products collected by local business persons from villages are sold in the markets near Bhalubang, Pipari, Sishniya, Lalamatiya and Maurighat.

There are at least five agriculture firm in ward 8 and one in ward 9 of Shitaganga municipality.[15] Out of these six number, three are poltry firm and the reaming are associated with buffalo, swine and goat. There are eighteen agriculture coopeative institutes supporting farmers in Shitaganga municipality. Out of them two are located in ward 8 and one in ward 9. Aapchaiur, Bodidamar of ward 8 is identified as 'banana pocket,' whreas Lahape, Satmara, Tinkhande of the same ward is allocated for 'maize pocket.' Similarly, Lamidamar, Pankuri of ward 9 is designated for 'banana pocket' and Siling khola, Lauri of the same ward is designaged as 'lemon pocket.'

The main settlements and market areas for agriculture products in Shitaganga municipality include Thada, Dhore, Tinkhande, Taplolape, Satmara, Aapchaiur, Dasku, Badhidamar in ward 8 and Lamidamar, Pakuri, Lahreni, Aapghat, Kanchaiur, Chahare, Shiddadhara, Laurikot in ward 9 (ibid). There are at least five coopeartive operating in the whole municipality for saving of individuals as well as providing loans for business. However, none of them are located in wards 8 and 9. However, National Micro finance is located in ward 8. In addition to this, there are other two banks: Suryodaya Small Finance and Rastriya Banijya Bank. About 263 HHs (39.2%, out of total ward HHs 671) in ward 8 and 160 HHs in ward 9 have bank account (ibid).[16]

2.5.3 Available irrigation system for agriculture

About 74,790 ha of agriculture land in Rapti rural municipality is irrigated (Table 2.5a) (Rapti rual municipality, 2076 BS). Praganna irrigation project[17] from Rapti river has covered the southern part of Deukhuri. Moreover, irrgation network has been expanded through

[14] About 3544 litre of milk is produce daily in this rural municipality.

[15] There are altogether 47 number of different firms in the whole municipality.

[16] Out of total 9009 HHs in the whole municipality, 4504 HHs (50%) do not have account in any bank.

[17] The Praganna irrigation project is the modernization and combination of six existing irrigation systems that stretched over Rapti rural municipality and Lamahi municipality with the total command area of 5,800 ha. It has three main canals from the Rapti River: Kalapani Praganna, Barakhuti and Majmeriya Kulos. It has also three permanent intakes (Barakhuti Kulo intake, Kalapani Praganna Kulo intake and Majmeriya Kulo intake) on the right bank of the Rapti River just downstream of the Bhalubang river bridge. It has age-old traditions of irrigation water acquisition, water allocation and distribution aiming to enhance basis of livelihoods and economic activity. The fertile land of Rapti river with assured irrigation facility provides enormous opportunity to grow paddy and other crops. The project was rehabilitated in 2002-2007 under the Kuwait Fund for Economic Development.

Badkapath irrgation,[18] Masuriya irrgation and water channeling from small and big rivers. In some cases, boring is used to irrigate agriculture land. Wards 1 and 9 have difficulty in connecting to irrigation system due to its location in Chuire region with small mountains.

Table 2.5a Irrigation projects executed in Rapti rural municipality

S. N	Name of irrigation sources	Places
1	Pragaana irrigation project	Lalmatiya, Sishaniya VDC
2	Badkapath irrigation project	Lalmatiya, Sishaniya VDC
3	Masuriya irrigation project	Lalmatiya VDC
4	Lalmatiya irrigation project	Lalmatiya VDC
5	Sishaniya irrigation project	Sishaniya VDC

Source: Rapti ruralmunicipality, 2076 BS

There have been numerous irrigation projects serving to Gobardiha area. Some of them use electricty and alternative energy (1050 ha) and others were built with joint investment of Care Nepal and Small Farmer Group (Table 2.5b).

Table 2.5b Various irrigation projects serving to the study area of Gadhawa rural municipality

Sn.	Project name	Location/place	Irrigated land area (ha)
Electric and alternative energy used irrigation in the study area of Gadhawa rural municipality			
1	Gobardiha irrigation project	Gobardiha	500
2	Gangaparashpur irrigation project	Gobardiha	50
3	Gobardiha vadkapath irrigation project	Gobardiha	500
Irrigation project completed with joint investment of Care Nepal and Small Farmer			
1	Ghorai irrigation project	Gobardiha	59
2	Supail irrigation project	Gobardiha	150
3	Chisapani irrigation project	Gobardiha	20
4	Mutubhu irrigation project	Gobardiha	20
	Total		1,299

Source: Dang district profile 2071 in Gadhawa rural municipality, 2075 BS

In the case of Shitaganga municipality, about 51.95 ha in ward 8 and 3117.75 ha land in ward 9[19] are irrigated with availability of irrigated land per capita are 0.08 ha per household in ward no 8 and 4.52 ha per family in ward 9 (Shitaganga municipality, 2076 BS). However, huge agriculture land in these two wards are still not connected with irrigation network (ibid). About 2,394.21 ha and 3771.48 ha land in wards 8 and 9 respectively are yet to be irrigated.

[18] Badkapath Irrigation Project located on the left bank of Rapti River in Deukhuri Valley is still under construction. It aims to provide irrigation facility to about 4,000 ha of land in Gadhawa rural municipality. The intake is located on the left bank of Rapti River at about 1.3 km upstream from the East-West highway bridge at Bhalubang. The length of the main canal was proposed as 30 km from the intake to the tail end at Kakrahawa Khola.

[19] In the whole Shitaganga municipality, 6336 HHs have been engaged in 18,177.60 ha of irrigated land with average land her HHs comes about2.87 ha. This figure for unirrigated land comes to 5.42 ha per family.

The correspnding figure of avergae land per family comes to be 3.77 for ward 8 and 5.47 for ward 9 respectively.

2.5.4 Diseases on crops and livestock

Farming carried out in traditonal way in local climate context including external factors cause different type of diseases in grains, vegetabls and fruits produced in all three territory. Rice crops are being suffered from dadhuwa,''maruwa,' 'khaire thople' including 'pat beruwa,''fadke kira,' 'patero' in Rapti rural municipality (Rapti rural municipality, 2076 BS). Maize plants are suffered from 'dabuwa,' 'gawaro,' 'fedaktuwa,' 'kalopoke' (smut); 'dadhuwa,' 'khaire and pahelo,' 'sindhure' in wheat. Local farmes consult agriculture service cenre and agrovet to use effective medicine. Similarly, fruits and vegetabls suffer from canker (dead stem), leaf gall, leaf curl, leaf spot, mildew, root rot, wilt (leaf drop down), stunting (not growing in normal size) and chlorois (discoloration) (Rapti rural municipality, 2076 BS). Major diseases in animal include 'laumule,' 'kassi,''diyosis,' 'bhagute,' 'bruselosis,' ' charchare,' thunelo,' 'khoret,' 'saune,' 'milk fever' and so on (ibid). Many crops are being affected due to different types of diseases in Gadhawa rural municipality too. Common diseases in the crops include 'Gabharo,' 'Akhley,' 'Khaira,' 'Leaf-blast,' 'Daduwa,' and so on (Gadhawa rural municipality, 2075 BS). Diseases common to animals include 'Bhagute,' 'Char-chare,' 'Khoret,' 'Anfex,' 'Darmataitis,' 'Diarieia,' ' Tepworm,' 'Lies,' and so on. In birds, diseases are 'Akcidipesis,' 'Koraiza,' 'Gambaro,' 'CRD,' 'Salmonelasis,' ' Ranikhet,' 'Fubal-fucks,' ec. (ibid). There has been availability of services of quality species of animals and improved breeding in this rural municipality. Like Gadhawa rural municipality and Rapti rural municipality, the farmers in Shitaganga muncipality are being suffered by variety of diseases in agriculture (farming, vegetables, fruits) and livestock.

2.5.5 Trade, Commerce and Tourism Potential

Some small scale industries associated with construction material and agriculture and livestocks have been under operation in Rapti rural municipality. Those factories include mineralwater, crossing and concrete block and girll (23 no) (Rapti rural municipality, 2076 BS). Agriculture based local industries such as oil and rice mills (12 nos), food item (bekari), wooden industries are also in operation in small scale (ibid). Commerical production of cow farming, chicken farming, vegetable farming and bee farming has been intiated. All these local scale industries have been serving to the people of Rapti rural municipality as well as neighbouring villages. Some agriculture producs are exported to markets of surrounding districts in raw form. Small scale commerical activities have been growing along East-West Highway such as Bhalubang, Shisniya, Maurighat, Pipari, Sagrappur. Bhalubang is considered as an 'enty point' to connect northern districts to Dang. Retial shops in these areas sell daily life needed goods. In addition to that, small vehicles also carry daily life goods to different settlements.

Though there has been feasibility study of possible mines and minerals in the rural municipality, no serious efforts have been carried out so far. However, there is huge amount of sand, stone and bolders available at the banks of West Rapti River and other rivers. The Siwaliks have schists, quartzites, fragile and stone, conglomerates, peebles, bounders, sand stone, calcareous, thin lime stone and clay phyllites.

Small artifical ponds are created within Ramjaidi community forest and Ghantadev community forest in ward 1 for promotion of internal tourism. Though development of pisciculture (fish farming) in big ponds for commerical purpose does exist, nonetheless, small and domestic scale, fish farming has been initiated around settlements in Bijauri, Bhanpur, Maurighat.

Rapti rural municipality is also famous for religious and cultural as well as agriculture based tourism. First, the whole Dang Deukhuri Valley can be clearly seen in panaromic view from the surrounding Chuire hills. Second, this area has many ethinic groups like Tharu, Chaudhari, Muslim and so on and they have their own culture, traditional and lifestyle. Hence, this place is also famous for cultural tourist. Third, this rural municipality has many natural spots like Bagasoti, Maccha lake, Devikot, Rupakot, Basantapur and so on. Due to excessive of community forests, many people enjoy picnic and walking within those forests. Bhalubang (ward 1) is considered as enty point to famous religious place 'Swargadwari' (of Pyuthan). In addition to these, there are many others important places for tourism promotion (Table 2.6). Rapti rural municipality has numerous religious and historic monuments and places.[20] As the municipality has mix of Tharu, Magar, Muslim and to some exten Christians, one can find many religious structures associated with them. There are numerous temples in all nine wards. There exists church in wards 1, 3 and 4 and mosque in wards 1, 6 and 9. Communities in this municipality celebrate different types of festivals. Tharu community celebrate 'maghi' festival duing 'maghe sankrati,' 'aastikami' on 'Krishna janmansthami,' and 'gurahi' on 'nagapanchami' day. There are special procession (mela) at pipari of ward 8 during 'shiva-ratri,' 'harse-danda' of ward 2 during 'navaratri,' and Ramghat mela in ward 7 and 'Khauraha baba mela' in ward 5 are famous (ibid).

Table 2.6 Various touristic spots within LPCC area

Sn.	Touristic spots	Importance of place	Daily visitors no
Rapti rural municipality			
1	Bhadradevi temple	Right leg of Satya Devi was fallen in this place as mentioned in Shree Sansthani Bratakatha	100
2	Rupkot mosque, Bhalubang mosque, Bhabanapur mosque	Cultural and historical place	50
3	Shiva temple	Basantapur	50

[20] Khauraha Baba situated at ward 5 has religious as well as touristic importance due to beautiful natural resources, magnificent Shiva temples, attractive lakes, bathing pools, various species of birds, and wildlife. This place is frequented used for picnics and bathing. It is believed that skin-related diseases can be cured by observing this place and taking a bath. Harshe dada, a religious and tourist site in ward 2 is a religiously sacred temple with a lake, forest, and park. It is used for performing religious activities, picnics, enjoying a peaceful environment, and hanging out with friends. The site has been protected for the conservation of wild products and wildlife. Bhadrashidevi temple located in a remote area in Devikot (ward 9). According to legend, Satyadevi's left knee fell in Devikot and Bhadrashi Devi was born. The temple has been worshipped from the 'Satya yuga.' From the hills of Devikot, one can see the snow-capped mountains, hills of the Mahabharata range to the north, the plains of Deukhuri, and even the border area of India to the south.

Sn.	Touristic spots	Importance of place	Daily visitors no
4	Ganesh, Hanuman, Khadgeswori Kaurahababa temple	Bhalubang, Bulke	100
5	Basantapur picnic spot	Religious tourism and picnic spot, Chisopani Nalko	50
6	Bagasoti simshar and chkewa lake at community forest	Bio diversity and touristic picnic spot	50
7	Park in community forest on upper side of Pulchowk	Bio diversity and touristic picnic spot	50
8	Hasedanda touristic spot	Artificial lake and picnic spot	100
9	Rapti river banks	Picnic spot, water spot and religious and cultural place	200
Gadhawa rural municipality (wards 1, 2 and 3)			
1	Kulpani picnic spot (ward 1)	Environmental and natural beauty	
2	Chamere cave (ward 1)	Historical	
3	Janshakti jakhera lake (ward 1)	Historical and natural beauty	
3	Kauraha temple (ward2)	Religious	
4	Jungal kuti (ward 3)	Historical and religious	
4	Hangswore temple (ward 3)	Historical and religious	
Shitaganga municipality (wards 8 and 9)			
1	Baraha area, Satyamahadev cave and Kaseri landslide lie (ward 9)	Religious and touristic	

Source: Rapti rural municipality, 2076 BS; Gadhawa rural municipality, 2075 BS; Shitaganga municipality, 2076 BS

Despite having huge potential for tourism promotion, facilies and amenties available at present for visitors are minimum. Small scale few hotels and lodges nearby Bhalubang, Maurighat, Pipari shisniya, Masuriya areas are providing services and some hotels and restaurants can be seen along East-West Highway. The concept of home stay has initiated recently.

Numerous banks and cooperatives are serving in Rapti rual municipality for financial transctions. Major banks inlcude NIC Asia, Bank of Kathmandu and other development banks whereas cooperatives are running in various wards. Altogether 23 cooperative collect money from individual and use them for loan and investment.

Gadhawa rural municipality is considered rich in its art, culture and language. Culture of tharu community is unique here. They have often made the images of peacock, flower, horse, elephant and so on on the walls of their houses with mud. The utensil made for keeping cloths (Bhauka) and for goods (Dhakiya) demonstrate their traditional skills. They also have decorative door and window further indicate their expertise in carpentering too. Tharu songs and dances including their unique dresses are also famous. In addition to these, wards 1, 2 and 3 comprise of different religious and touristic spots.

Kulpani community forest group has been developing religious and tourist sites in Kulpani (ward 1) for promotion of eco-tourism and protection of forest environment. The group has started construction work in the scenic area 4 km west of Kalakate of Kalakate-Gadhawa road

section while conserving the lake's natural beauty, garden, temple, park, footpath, and wildlife conservation tree tower, and other structures.

Though Shitaganga municipality does not have any famours tourist spots or monuments, nonetheless, the whole municipality mix of different castes and cultures plus its natural resoruces (rivers, mountain, bio-diversity) and climate and natural views can be value added assests for tourism promotion. There exists locally important numerous religious monuments and touristic spots within the municipality. Among them, Baraha area, Satyamahadev cave and Kaseri landslide lie in ward 9 (Table 2.6). However, tourism infrastructure like transportation, hotels and lodges, restaurants, information centre, safety and marketing inlcuding tourist guides are yet to be developed and upgraded.

2.6 Social development condition

2.6.1 Education

The average literacy rate of Rapti rural municipality is 87.14% whereas it is about 63.56% (as per 2011 cenus) in Gadhawa rural municipality[21] (Rapti rual municipality, 2076 BS; Gadhawa rural municipality, 2075 BS). It is 77.0% in Shitaganga municipality. In Rapti rural municipality, either basic schools or high schools exist in all wards, besides madarsha in some places. Six basic schools exist at ward 5 but without a single one in ward 8 (Rapti rural municipality, 2076 BS). Altogether there are 23 basic schools, nine secondary schools and five madarsha (ibid). However, some basic schools have only1 or 2 teachers. All the existing 14 boarding schools are located near East-West Highway in Bhalubang, Lalmatiya, Maurighat, Pipari, Sisahaniya, Pathargadh and Pakhapani. There are also seven higher secondary schools (three of them are private), all located in Lalmatiya. Rapti Technical School has been offering various courses: civil sub-oversear, agriculture JTA, civl engineering plant science (Diploma in agriculture), besides additional progrms such as vetenairy science and optical science. Children development cenres are also operated in community schools to attrack kids before formally joining schools.

Access to the basic schools and high schools is not easy. Students need to spend a lot of time to reach basic schools: 40.34% students arrive their basic schools in less than thirty minutes on foot; 47.16% need at least 30 min to 60 min, and the remaining 12.50% takes more than one hour on foot to attain their schools (ibid). Similar is the situation for reaching secondary schools: 31.88% taking less than thirty minues, 37.82% between 30 min to 60 min and 30.30% students more than one hour (ibid). As Adarsha high school at ward 2 offers education for blind persons, many students from surrounding villages and Lamahi muncipality have admitted to this school. However, these academic institutions mainly basic schools lack minimum infrastructure. Out of 29 basic schools, eleven schools are running in temporary structure and thirteen schools do not have drinking water facilities. Similarly, at least seven schools do not have adequate toilet facility.

In the case of Gadhawa rural municipality,[22] only 66.5% of people livining in wards 1, 2 and 3 can read and write and nearlyone third (31.22%) can not read and write (Gadhawa rural

[21] However, the male literacy rate of 71.51% is much higher than that of female rate (56.40%).

[22] In the whole rural municipality, 46.11% of total population has just completed primary level education. Less than 1% of total population has studied bachelor and master level. It has only 956 persons as educated

municipality, 2075 BS). There were only 38 altogether educational institutions: 5 number for secondary level, 9 schools for basic level and the remaining 24 of primay level (Dang district profile, 2071 BS). There is only four educational schools in Gobardiha: one secondary shcoo, two basic schools and one primary school (ibid). There is no schools for higher education. The existing community schools have been facing multiple problems. Many students either repeat the same class or leave schools before completing primary level education. School drop out rate of ethinic group is comparatively high and their enrolement is also low. In addition to these, the government schools have poor infrastructure, lack of qualified teachers and inadequate budget allocation. This combined with low level of awarness among parents and politiciazion in the schools have further eroded the quality of education.

There are about 86 number of basic and high schools scattered in various wards of Shitaganga muniipality. Among them, five schools (four basic and one high school) are located in ward 8 and another ten schools are operating in ward 9 (Shitaganga municipality, 2076 BS). Almost all of them are basic schools with only two (Shankar Jyoti School and Pankuri School) offering classes up to eight grade. However, between the age 5-35 yr, 903 person have gone to school or college (at present or beofore at any time) another 869 persons have never gone to schools and colleges in ward 8 (ibid). The corresponding figure for ward 9 is 846 persons gone to schools or colleges and another 1067 have never joined schools or colleges (ibid). Those who are studying at present have 697 persons in community or government schools, another 206 persons in private schols in ward 8 (ibid). The corresponding figures for ward 9 are 813 and 33 respectively (ibid). Again, 740 persons in ward 8 and 663 persons in ward 9 between the age 5-35 have gone to schools. But 129 person in ward 8 and 404 persons in ward 9 have never gone to any shcool or college.[23] Major reasons for not joining any academic institutions consititute marriage (348 persons in ward 8 and 179 person in ward 9) and to support household works (223 and 221 persons respectively) (ibid). Other reasons include parents' unwillingness, schools not willing to take admission, started new work, schools located far away from home, very expensive to afford and lack of space. Among the people aged above 10 yr old, 175 person in ward 8 and 125 persons in ward 9 have taken formally or informally skill development training work, whereas 2066 persons in ward 8 and 2307 person in ward 9 have not joined any (in)formal training program (ibid). Most of the training activities are related to mason and carpentering, cutting cloths and dresses and driving.[24] Only few person received technical training on electricity, computer science, engineering design, mechanis and plumbing. Also, training on agriculture and livestock and business related activiteis were very few in number. Those training periods lasted from one months to years, but most of them were betwee two to six months (ibid).

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manpowe. Most of them have studied 'education' followed by 'arts and commerece.' Technical manpower is significantly low, mainly due to lack of technical school.

[23] In the whole municipality, 11,548 or 52.21% people between age 5-35 have not gone to schools or colleges. If significant percentage of youth does not attend education, then the available human resources cannot be productive.

[24] In the whole municipality, 367 persons took skill development training on cloth knitting followed by mason and carpenter training (306 number) and preparing dresses (302).

2.6.2 Health facility

There is only two health centre (with berthing facility) (located in wards 1 and 5) and three community health unit (wards 4, 6 and 9) and two Health Service Centre (wards 2 and 3) in Rapti rural municipality, besides two polyclinic and about 34 medical/drug shop (Rapti rural municipality, no date). Mobile heath clinics have been operated in ward no 2 and 7. Both birthing centre has 32 female community health volunteers (FCHV) with 4 and 3 skilled birth attendents (SBA) (ibid).

Though 43.36% (3800 HHs) housholds require less than thirty minutes to reach health centre, another 30.24% (2650 HHs) households need between 30 min – 60 minutes and the remaining 26.40% (2313 HHs) households require to walk for more than one hour for the service (Rapti rural municipality, 2076 BS). Community health units have been mobiled with required human resources. About five number of ambulance is available. Though 54.72% (4795 HHs) households take first serive from the government heath centres, about 38.05% (3334 HHs) households visit nursing homes, private hospitals or clinics (even in Lamahi, Butawal and Nepalgunj) upon becoming sick. Still 2.37% (208 HHs) households take service from local 'dhami and jhakri,' another 1.21% 9106 (HHs) relying on local herbal and 3.65% (320 HHs) household directly take medicine from the nearby pharmacy without consulting any health experts (ibid).

The major diseses include gastritis, headache and viral influenza. Both health centres have staffs (permanent and contract basis) but lack qualified doctors. There is only five ambulance available for emergency but n hearse van to carry dead body. Fire brigade is also missing in the rural municipality. Out of four health posts[25] in Gadhawa rural municipality, there is only one centre in ward 1 in LPCC area. It also has birthing centre with 30 FCHV and two SBA (Gadhawa rural municipality, no date). If offers family planning using 5 methods (condom, pills, depo, implant and IUDs (ibid).

The major health problems include upperrespiratory tract infection (URTI), fungal infextion (lichen planus) and headache (ibid). Access to basic health servie is difficult. Maternal and child mortality rate is high due to absence of emergency obstetric care. The existing health centres lack qualified doctors and medical staffs whereas medical supply is inadequate. There is no obstetrician or anaesthesiologist in the centres. Those household living in remote areas find it very difficult to reach to the health centre specially during rainy season and at night.

Available health facilities in Shitaganga municipality is not satisfactory. Local people have been using local health centres for services, but treatment of diffeent types of diseases is not possible there due to lack of adequate physical infrasructure, medicine and above all qualified doctors. People often visit hospitals in nearby cities for better treatment. Nonetheless, majority of the pregnant women gave birth in the health centre last year: 71 number in ward 8 and 12 number in ward 9 (Shitaganga municipality, 2076 BS). Many girls in these two wards got first marriage in less then 20 year old (ibid).[26] About 582 girls and 219 men in ward no 8 got married between the age 15-19 whereas the corresponding figures for ward no 9 was 597 and 348 (ibid). Again, 82 girls and 7 man in ward 8 got married in less than 15 year age; it

[25] Other three health post are located in wards 5, 7 (west side) and 8 (south-west side). Access to them from wards 2 and 3 are not easy due to long distance.

[26] In the whole municipality, 51.4% of marriage took place between the age 15 to 19; anyone with less than 20 year cannot get marriage as per prevailing law in Nepal.

was 64 girls and 23 man for ward 9 (ibid). Early marriage has a lot of negative implications: affecting education and health, familty and socio-economi problems. Thirty four females (out of 78) have become mother in less than 19 years in ward 8 whereas eighteen females (out of 27) gave their first birth when they were less than 19 year (ibid).

2.6.3 Public open space and recreation facilities

All three territory of LPCC area has public open spaces in different forms for socialization, recreation and sports. At least fifteen playgrounds, parks, picnic spots or recreation places are found in different wards of Rapti rural municipality (Rapti rural municipality, 1976 BS). They are mostly located in wards 1 and 2 but other wards also have at least one such space. They have been basically used by community; few of them by community forest group (ibid). There are five youth clubs and they organize different games annually. At present Rapti rural municipality has eight different parks, mostly managed by community. They are located in different wards: three parks in ward 1 and the rest in wards 5, 8 and 9. Only Bhalubang pulchok park is managed by Market management committee.

Gadhawa rural municipality consists of different form of public open spaces: large open spaces, school grounds, public 'chautaras' and so on. However, they are disorganized, lack clear boundary and access road and community facilies such as public toilets, hand washing, lighting at night and sheds for protection from rain and sun. Morever, they are not well defined for their usages and lack amenties to attract people and then to egange them. Small parks and informal football grounds exists in different wards. None of public open spaces is planned for recreation with basic public amenties exist at present.

Shitaganga municipality also have numerous parks, playground and chautaras as public open spaces for recreation and sport activities. However, majority of them are not planned, lack basic amenities such as access road, dirnking water, public toilets and fencing. Out of 22 number of playgrounds in the municipality, ward 8 have two different playgrounds: Lahape playground and Tinkhande playground, besides individual playground of schools (Shitaganga municipality, 2076 BS). In ward 9 too, each school has its own playgournd used for different functions. At least four diffeent picnic spots have been identifed in ward 8: Lahape picnic spot (8 ropani land), Badidmar picnic spot (10 ropani land), Satmara picnic spot (8 ropani land) and Tinkhande picnic spot (10 ropani land) (ibid). Shiling khola aakase picnic spot (20 ropani land), Dahaghat picnic spot (4 ropani), Kondra khola picnic spot (7 ropani land) and Baare parkk (10 ropani land) exist in ward 9 (ibid).

2.6.4 Disability and social security

More than thousand person in three territory of LPCC are differently-able in different way. There are 174 persons having speaking defect, 151 with eye defect, and 91 with hearing defect (Table 2.7). Similarly, 378 person have body defect and another 98 with mental disability. Among different type of disability, body defect is the maximum in all three territory, followed by speaking disability and eye problem.

Table 2.7 Population of differently-able persons in three territory of LPCC

Territory	Ward no	Speaking defect	Eye defect	Hearing defect	Body defect	Mental defect	Others
Gadhawa	1-8	197	218	101	268	67	129

Territory	Ward no	Speaking defect	Eye defect	Hearing defect	Body defect	Mental defect	Others
RM[27]		(20.10%)	(22.24%)	(10.31%)	(27.35%)	(6.84%)	(13.16%)
	1-3	93	103	48	127	32	62
Rapti RM	1 - 9	71	30	29	190	56	79
Shitaganga Municipality[28]	8	3	5	3	18	2	1
	9	7	13	11	43	8	5
Sub total		10	18	14	61	10	6
Total		174	151	91	378	98	147

Source: Compiled and calculated from Gadhawa rural municipality, 2075 BS; Rapti rural municipality, 2076 BS; Shitaganga municipality, 2076 BS

People with different status are getting social benefits from the government of Nepal through local governments in LPCC area (Table 2.8). Social benefits are distributed to 1029 senior citizens, 135 'Dalit' senior citizen, 947 single woman, 32 fully disabled and 54 partially disable persons, in Rapti rural municipality (Rapti rural municipality, 2076 BS). In Gadhawa rural municipality (wards 1, 2 & 3), social benefits are also given for 'Dalit' children and 'aadibashi/janjati' (Gadhawa rural municipality, 2075 BS). Some persons have also received medical expenses. Altogether 970 persons are eligible for such benefits: senior citizen (413 person), senior citizen (dalit: 90), Single women (339), aadibahsi/janjati (9), fully disabled (26), partially disabled (28), dalit children (65) and medical expense (467) (ibid). In wards 8 and 9 of Shitaganga municipality, 345 persons received social benefits: 176 person senior citizen, 94 person single woman, 28 fully disabled and 29 dalit children (Shitaganga municipality, 2076 BS). There are 3512 persons getting different type of social benefits in LPCC area at present. The first three dominating group include senior citizen (1618 person) followed by single woman (1380 person) and 'dalit' senior citizen.

Table 2.8 People receiving social security benefits in three different territory of LPCC

Municipality		Ward no	Senior citizen (SC)	SC (Dalit)	Single woman	Vanishing aadibashi/ janjati	Fully disabled	Partially/very incapable	Children (dalit)	Medical expenses	Total (without medical expenses)
Gadhawa municipality	rural	1	127	40	140	9	10	11	33	153	370
		2	155	21	90	0	7	7	19	164	299
		3	131	29	109	0	9	10	13	150	301
Sub total			413	90	339	9	26	28	65	467	970
Rapti	rural	1 - 9	1029	135	947	0	32	54	0	0	2197

[27] In the whole Gadhawa rural municipality, about 2.54% of total population is disable: The figure for wards 1, 2 and 3 are disintegrated from the whole rural municipal data.

[28] About 2.69% of municipal population is differently able. Most of them have disability in body (1.38%) followed by blindness (0.40%) and hearing disability (0.31%).

Municipality	Ward no	Senior citizen (SC)	SC (Dalit)	Single woman	Vanishing aadibashi/ janiati	Fully disabled	Partially/very incapable	Children (dalit)	Medical expenses	Total (without medical expenses)
municipality										
Shitaganga municipality	8	79	0	61	0	8	0	0	5	153
	9	97	0	33	2	20	0	29	11	192
Sub total		176	0	94	2	28	0	29	16	345
Total		1618	225	1380	11	86	82	94	483	3512

Source: Compiled and calculated from Rapti rural municipality, 2076 BS; Gadhawa rural municipality, 2075 BS; Shitaganga municipality, 2076 BS

2.6.5 Drinking water

Safe drinking water is the basis of healthy life. The health status of inhabitants is the reflection of quality of drinking water as well as adoptation of good sanitation and hygienic condition. In Rapti rural municipality, about 44% (3858 HHs) households use piped drinking water whereas 43% (3803 HHs) households drink water from tubewell (Table 2.9) (Rapti rural municipality, 2076 BS). Similarly, about 7.90% (361 HHs) households use water from covered wells or spring and another 5.26% (693 HHs) households use water from open wells and springs (ibid). Most of the households living on the south-east side of Rapti rural municipality have been found using piped water for drinking. However, people living in the middle south side are dependend on tubewell. Interestingly households on the north-west side also use piped drinking water though those settlements are scattered.

Table 2.9 Households using different sources of drinking water in three territory of LPCC area

Territory	Ward no	Piped water	Tube well	Covered well or spring	Open well or spring	Main tap	River/ stream	Other	Not mentioned	Total
Gadhawa rural municipality[29]	1	808	161	68	266	5	42	9	14	1373
	2	71	312	12	599	1	19	4	1	1019
	3	318	208	23	438	15	0	8	18	1028
Sub total		1197	681	103	1303	21	61	21	33	3420
Rapti rural municipality	1-9	3858	3803	361	693		12	35	0	8762
Shitaganga municipality[30]	8	161	51	325	89	5	34	2	4(mineral water)	671
	9	380	0	3	177	23	58	1	0	642

[29] As per population census of 2011, majority of the households (47.42%) in the whole rural muncipal area use tube well or hand pump water for drinking purpose followed by using piped water (25.75%) and open well or spring (20.32%).

[30] In Shitaganga municipality, out of 9009 households, 6691 (74.30%) of households use drinking water supplied from piped line and 1113 (12.40%) of household drink water from open wells or springs.

Territory	Ward no	Piped water	Tube well	Covered well or spring	Open well or spring	Main tap	River/ stream	Other	Not mentioned	Total
Sub total		541	51	328	266	28	92	3	4	1313
Total		5596	4535	792	2262	49	165	59	37	13495

Source: Compiled and calculated from Rapti rural municipality, 2076 BS; Gadhawa rural municipality, 2075 BS; Shitaganga municipality, 2076 BS

Out of 3420 HHs in wards 1, 2 and 3 of Gadhawa rural municipality, 1197 HHs are connected with drinking water pipe line whereas 1303 HHs drink water from open well or springs and another 681 HHs still depend on tubewell for drinking water (Gadhawa rural municipality, 2075 BS).

In Shitaganga municipality, 161 HHs and 380 HHs in wards 8 and 9 respectively (out of 671 and 642 HHs) drink water from piped line whereas 89 HHs and 177 HHs in wards 8 and 9 respectively reply on open well or spring for drinking water (Shitaganga municipality, 2076 BS). Also, 53 HHs in ward 8 and 251 HHs in ward 9 have private taps wehreas 99 HHs and 318 HHs in wards 8 and 9 respectively depend on public taps with 64 HHs and 12 HHs in those wards relying on community tap for drinking water (ibid). Only few households depend on neighbour's taps for collecting drinking water. Almost all those households (97.8% in ward 8 and 91.7% in ward 9) drink water directly from collecting different sources without any treatment (ibid).[31] Only few of them use different treatement techniques: boiling, filtering or use of medicine (peeyush) for purifying the water before drinking (ibid).

2.6.6 Toilet and sanitation

Majority of households in the study area have ordinary toilets in their houses (Table 2.10). Still signifiant percentage of households do not have toilets in their houses. Only few houses used flushed toilets connection with public sewer line. In Rapti rural municipality, about 70% HHs have toilets as per standard norms. Out of that 41.01% HHs with septic tanks. Only 3% HHs have toilets connected the sewer line. Also, 25.11% HHs have toilets linked to biogas. Similarly, 21% HHs still use ordinary toilet with shallow pit whereas still 7.8% houses do not have toilets. Villages on the northern part (219 HHs in ward 9) and on the western part (100 HHs in ward 6 and 114 HHs in ward 7) lack toilets in significant number of houses (ibid). Those wards connected to East-West Highway have many toilets connected to sewer line. There are altogether nine public toilets scattered in different wards. There is no public toilets in wards 3, 4 and 6 but ward 1 alone has three numbers and two numbers in ward 2. Out of nine, three are in worse condition.

[31] In the whole municipality out of 9009 households, 6414 HHs (71.2%) drink water directly from the sources without any treatment, which is very vulnerable. Numerous diseases such as derriere, typhoid, stomach warm and so on are due to drinking dirty water. Only27.1% boil water before using and another 1.5% use filter for purifying water.

Table 2.10 Households using different types of toilets in three territory of LPCC area

Area	Ward no.	Flus system linked to sewer line	Flush system with septic tank	Ordinary	No toilet	Not mentioned	Total
Gadhawa RM	1	13	154	390	802	14	1373
	2	43	187	146	641	1	1018
	3	2	167	283	557	18	1027
Sub total		58	508	819	2000	33	3418
Rapti RM	1-9	327	3596 + 2201 (connected to biogas)	1841	685	112 (use community toilet)	8762
Shitaganga municipality	8	0	413	174	82	2 (community toilet)	671
	9	113	383	86	59	1 (community toilet)	642
Sub total		113	796	260	141	3	1313
Total		498	7101	2920	2826	148	13493

Source: Compiled and calculated from Rapti rural municipality, 2076 BS; Gadhawa rural municipality, 2075 BS; Shitaganga municipality, 2076 BS

Out of 3418 HHs in wards 1, 2 and 3 of Gadhawa rural municipality, only 58 HHs have toilets connected to public sewer line and another 508 HHs have toilets with septic tank (Gadhawa rural municipality, 3075 BS). Still 819 HHs use ordinary toilet and above all 2000 HHs have no toilets in their houses (ibid). In Shitaganga municipality, out of 671 HHs in ward 8, 413 HHs have flush toilets linked with septic tanks whereas this figure for ward 9 is 383 HHs (Shitaganga municipality, 2076 BS).[32] However, 113 HHs in ward 9 have flush toilets attached with public sewer line (ibid). Still 174 HHs in ward 8 and 86 HHs in ward 9 use ordinary toilets with only connected to shallow pits (ibid).

2.6.7 Waste management

In Rapti rural municipality, about 89.90% HHs manage their solid waste within their own compound and the reaming households specially located in market and dense area along the Highway use municipal collection (Rapti rural municipality, 2076 BS). Most of the

[32] In the whole Shitaganga municipality, out of total HHs 6640 HHs (73.7%) have flush toilets linked with septic tanks and 21.0% still use ordinary toilet connected to shallow pits. Only 1.5% (138 HHs) have flush toilets connected to public sewer line. Similarly, 46 HHs use community toilets and 292 HHs (3.2%) do not have any toilets and use nearby forest and open farm land for defecation.

households use those waste for making fertilizers and for feeding domestic animals, as most of them are of organic nature (ibid). The remaining waste is either burn out of dumped under ground within their own compound (ibid). Most households in Gadhawa rural municipality simply thrown their solid waste either in the river banks or in the shallow areas, which in most cases are of water sources. Such activities have polluted water sources, besides creating environment pollution. Households engaged in agricutlure utilize their domestic waste for feeding domestic animals as well as put in the vegetable gardens. Households in wards 8 and 9 of Shitaganga municipality use multiple techniques to mange their solid waste. Majority of them (524 HHs in ward 8 and 214 HHs in ward 9) prepare compost fertilizer for agriculture, whereas others (52 HHs in ward 8 and 17 HHs in ward 9) burn their waste within their own compound.[33] Still few households throw them either in the river banks or in public paces or streets. About 81 HHs in ward 8 and 177 HHs in ward 9 thrown their waste in nearby river or streams. Two landfill sites namely Lamidamar landfill site and Myalpokhari landfill site having capatiy of 200 ton and 100 ton have been identified in the municipality.

As Rapti rural municipality is composed of people with different cultural background, their death rituals are also different. Most of the villagers particularly Hindus creaminate along West Rapti Rive banks whereas the Dolahi river, Ghose khola located on the northern part is also used for cremination. The muslim community living in ward 9 use 'karbisthan' in the same ward whereas Tharu community bury the dead body within their own land. Dead bodies are cremenated along West Rapti River in ward 8 Shitaganga municipality. There are many places for such rituals in ward 9: Lamidamar crimination area, Rangsing (Mathura dovan), Pankuri cremination, Shilung khola cremination site, and Naya Basti crimination area.

Still, there is no any well manage practice started for the sewerage management in all three rural/ Municipality.

2.7 Physical development

2.7.1 Transport network system

Various types of road network pass through LPCC area. National Highway (NH01 and NH53) and Postal Highway (NH05) and different type of municipal roads. The annual average daily traffic (AADT) in this road in 2018-'19 was 6952 passenger car unit (PCU) including motorcycle for year 2018/019. Average traffic volume growth rate in the last six years was about 7.38%. About 1.2% (84 PCU per day) of this volume is believed to be the traffic going towards the West using East-West Highway from LPCC area. Among the types of vehicle, the Indian brands have dominated in terms of motorbikes, bus, jeep (Bolero/TATA), trucks/mini trucks and tractors for passenger and goods transportation. The vehicle composition counted for year 2018-'19 reveals the major traffic volume of motorcycle (42%). The NH53 connects Liwang, Madichaur and Darbot to Bhalubang linking to Rolpa, Pyuthan, and Arghakhanchi districts. The six-year traffic volume along NH53 confirms the annual average daily traffic (AADT) of 3042 PCU including motorcycle for year 2018-'19. The vehicle coming to LPCC from northern hill districts can be estimated as 1.2% at present context, which is nearly 37 PCU vehicle per day. The Postal Highway section

[33] Only 4796 HHs (53.2%) in Shitaganga municipality manage their solid waste by making compost fertilizer, another 13.3% manage the waste within their own compound (buried), another 11.9% burn the waste within their own compound. Still 11.1% HHs throw the waste in the rivers or streams.

between Gadhawa and Banwari is black topped but the alignment from Banwari is only at planning stage. It can be one of the major traffic carrying road for LPCC.

During recent visit, a quick vehicle survey[34] was carried out at various locations and questioned with about 50 persons regarding the purpose of their tips. Vehicle counting was carried out four different types of roads within LPCC (Table 2.11). Walking is the most preferred and used trips in rural lifestyle. It is not counted in the survey. Cycle is the mostly used transportation mode in three roads: Bhalubang - Pyuthan, Sisaniya - Karange and Sisaniya - Mhiadewa road. The mostly used vehicle is motorbike or scooter in all four roads. Auto rickshaw and pick up van, jeep or care have also been plying in all the roads. However, microbus has been found only in two roads: Bhalubang - Pyuthan road and Sisaniya - Mhadewa road. Also tipper and truck are found in all roads except for Sisaniya - Karange road.

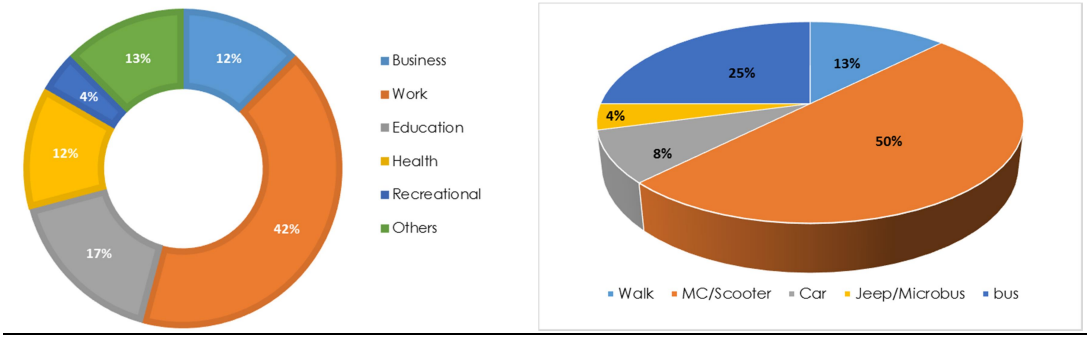
Table 2.11 Average daily traffic at major road (vehicle per hour) in LPCC area

Vehicle type	Kalakate - Gadhawa	Bhalubang - Pyuthan	Sisaniya - Karange	Sisaniya - Mhadewa
Cycle	52	448	696	504
Motorbike/scooter	456	1280	480	320
Auto rickshaw	168	320	352	288
Pick up/Jeep/Car	120	384	96	64
Microbus	0	96	0	32
Bus	16	96	0	0
Tractor	0	64	160	100
Tipper/truck	168	64	0	64

Source: Survey carried out by study team during site visit in 2021

Also, a total of 50 persons were asked about the purpose of their trips from origin and destination. Among them, 42% respondent mentioned the 'work' as primary cause of trip followed by 17% for education and another 12% for health and services (Fig. 2.9. Only 4% mentioned the trip as recreation purpose and the remaining 13% travelled for various purposes such as grocery shot, walking around and so on. The survey data revels that walking is the most preferred mode of trip for going to market centers within wards. About 13% preferred walking for short trip whereas public transport such as bus, microbus and jeep are preferred for long trip. About 25% uses bus but only 4% are using microbus or jeep for the trip. Motorbikes are the most preferred form of private transportation (50% of the respondents) due to convenient trip to any place. Only 8% respondents are using car for longer trips. Tractors are often used for transporting day to day commodities, construction materials and agricultural products from production area to market centers.

[34] Manual vehicle counting method was carried out as a part of traffic volume survey to find out traffic volume and vehicle type.



(a) Purpose of trip (b) Choice of mode of trip

Fig. 2.9 Households purpose and choice of mode of trip in LPCC area

At present, municipal road in Rapti rural municipality is of three types: black topped, gravel road and earthen road. Recent study carried out for preparation of Rapti rural municipality transportation plan reveals that the survey of 247.10 km road network has found only 7.78 km of black topped road, 109.91 km gravel road and remaining 129.51 km as earthern road (Rapti rural municipality, 2018). These road network also includes East-West Highway (15 km) and feeder road within rural municipality. Road density per 1000 population has been found 6.06 km per1000 population and 1.53 km per sq. km area, which are high compare to national figure of 1.91 km per 1000 population and 0.3444 km per square kilometre (ibid).

Among the three territory in LPCC area, transportation network in Rapti rural municipality is comparatively better compared to other two. Still out of total 8763 HHs, 1427 HHs (16.28%) are connected with pedestrian way only to their houses; only 906 HHs (10.34%) are touched by black topped road (Table 2.12) (Rapti rural municipality, 2076 BS). None of the houses in ward 9 is linked with black topped road, as majority of houses are only linked with pedestrian way.

Table 2.12 Household having access to different types of road in LPCC area

Territory	Ward no	Pedestrian way	Earthen motorable	Gravel motorable road	Black topped road	Without road/Other	Total
Rapti rural municipality	1	46	387	360	368	4	1166
	2	89	278	860	64	49	1342
	3	238	409	403	113	75	1241
	4	202	102	729	157	21	1215
	5	167	204	297	64	19	756
	6	138	202	564	0	8	918
	7	111	98	548	3	78	845
	8	162	174	407	137	32	920
	9	274	60	2	0	15	360
	Sub Total	1427	1914	4170	906	301	8763
Shitaganga municipality	8	72	120	446	33	0	671
	9	261	350	29	1	1	642
	Sub total	333	470	475	34	1	1313

Source: Compiled from Rapti rural municipality, 2076 BS; Shitaganga municipality, 2076 BS

There is only 32 km all weather road network in Gadhawa rural municipality. Numerous settlements are being connected through network of different types of roads: black topped (32 km), gravel (105 km), earthern and agriculture road (106 km) (Table 2.13) (Gadhawa rural municipality, 2075 BS).

Table 2.13 Road network available in Gadhawa rural municipality

Road type	Length (km)	Width (m)	Wards linked
Postal Highway	54	6	1 to 7
Secondary Highway	34	8	1 to 6
Black tooped	32	5	1 to 6
Gravel road	105	4	5 and 7
Earthern road	106	4	6 and 7
Total	331		

Source:Gadhawa rural municipality, 2073

In the whole Shitaganga municipality, more than half (52.6%) households have their houses connected with earthern road whereas only 12.6% houses are linked with gravel road (Table 2.13). The houses linking with black top road is only 6.6%, all connected with East-West Highway. Still 27.7%, more than one fourth of houses in the municipality have access with pedestrian way only. In the case of ward 8, out of 671 HHs, only 33 HHs have access to black top road, another 446 HHs connected with gravel road, further 120 HHs linked with earthern road. In the case of ward 9, out of 642 HHs, the corresponding figures are 1 HHs, 29 HHs, 350 HHs respectively. Still 72 HHs in ward 8 and 261 HHs in ward 9 are accessible with pedestrian way only.

Roads in Rapti rural municipality are narrow and their width is insufficient to cross two vehicles from opposite direction at a time. The actual width of feeder road and district road (51.72 km) is very small in comparision to their right of way (ROW). The mettalic roads in Gadhawa rural municipality are 5 m wide wehreas it is just 4 m for gravel and earthern roads. There is only 17 km long ‘gramin’ road: 7 km road from Gobardiha – 2 Bdhara – Lalmatiya – Khumariya – Lalmatiya chod road; and another 10 km road liking Gobardiha – 5 Shishahaniya – 2 Annapurna pipara chowk road (ibid).

n Rapti rural municipality, there is about 1329 motorbike and 94 households have bus in individual or in joint onwership (Rapti rural municipality, 2076 BS). There are 131 jeep and 37 tempo or rikshwa. However, dominating vehcile is bicycle, about 6387 number (ibid). On ward-wise data, bicycle users is dominant in all the wards (Fig. 2.10). In ward 9, only available travel mode is walking, bicycle and motorcycle. In Gadhawa rural municipality, there is only 215 no of private two whellers and seventy number of private four whellers. There is only three number of four wheller of government ownership. Five number of public vehicles are plying in different roads.

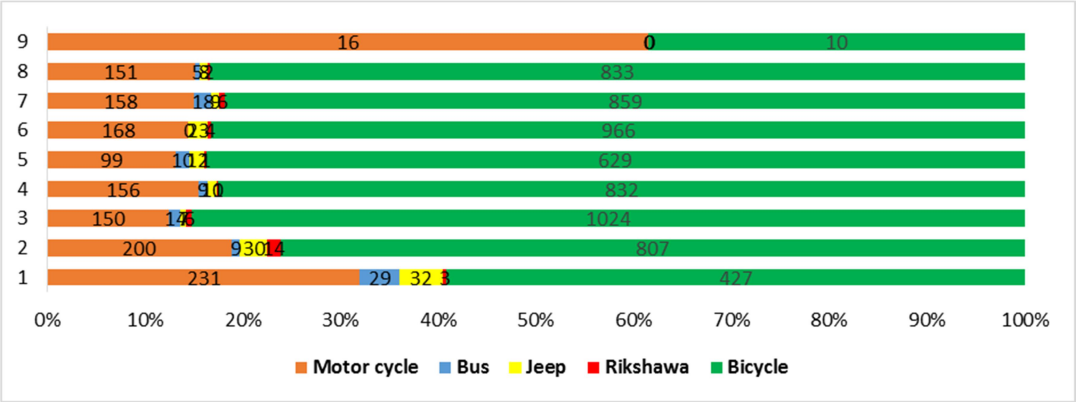


Fig 2.10 Households possessing vehicles in Rapti rural municipality (ward-wise)

Recent study carried out for preparation of Rapti rural municipality transportation plan reveals the cycle ownership of 86% followed by bike ownership of 13.45% (Rapti rural municipality, 2018). Educational trips covers about 61% followed by shopping, agricutlure, business, office and social or recreational trips (ibid). Majority of trips are comuplsory trips and their timing can not be altered. These trips are basically carried out during morning and evening peak hour. Non-motorized travel such as walking and cycling dominates (more than 75%) dominate the overall trips (ibid). Majority of people do walk for agriculture, social and shopping activities and some of them also use cycyle or rickshaw (ibid). Bike carries a significant proportion for social and business trips.

There are public buses, microbuses and jeep plying along East-West Highway. Bus service between Lamahi to Bhalubang is available at the fequency of 15 minutes. Auto rikshaws are available from East-West Highway to villages located on northern and southern parts. In Shitaganga municipality, there are public transportation facility available to link ward 9 with other wards. Bus service is available at Chakla, Lauri Road linking wards 9, 10 and 12 (altogether 28 km) and another route at Dhankhola, Lamidamar, Sisne Road, linking ward nos 1, 9 and 10 and Dang.

There is also a proposal of Rapti Ring Road of about 37.87 km: starting from Pulchowk moves on the East-West Highway and enters to the northern side of the Highway pass through Mukti nagar, Lalmatiya, Bahara Khutti, Masuria, Gaithi, Painsath Nagar, Badi Chour, Pansara, Mahanagad, Simal Khutti, Sundurpir, Naya Gau, Piper Khutti and again join with East –West Highway from Singha enteres to the soutthern settlements Latthahawa, Majheria, Vanpur, Sisania, Jithpur, Basantapur, Katha Ram Nagar, Pakhapani and ents at Pulchowk forming a ring (Fig. 2.10). Though the ROW of the proposed road is 30 , the width of the road is only 7m, (as an agriculture road)[35] aligning mostly with the existing streets and tracks with only 3.5km of new consrution (Rapti rural municipality, 2020). The study reveals no significant impact (minor to moderate, site specific to local, short-term and reversible) with minimal residual effects, except felling of trees (ibid). The development of Rign road also expects to improve socio-economic condition of the villagers (ibid).Majority of land uses along the proposed road alighment are forest and agriculture land.There are few major

[35] In fact there is no provision of environmental assessment for construction of village roads. As the alignment passes from Chure Conservation Area, an environmental impact assessment (EIA) is mandatory as per revised Schedule 2-L-3 to Rule 3 of Environmental Protection Rule, 1997 (first amendement,1999).

infrastructures and productive lands along the road alignment as the most alighment is along forest, barren and public land. It also crosses about eight minor rivers, all stresams and rivulets are ephemeral.

Fig. 2.11 Proposed road network including Ring Road in Rapti rural municipality (Source: Rapti rural municipality, 2018

All the three local goverments have transportantion network improvement programs with opening of new tracks. Rapti rural municipality in its transportation master plan has four different hierarchy (Class A, B, C and D hierarchy)[36] of road network. At least three Class 'A' roads having right of way (ROW) of 15m (with 3m shared cycle track and footpath on both sides with 0.5m median at the centre have been proposed for Rapti rural municipality (Table 2.14). The proposed Ring Road (A01) and other two major municipal roads namely A02 (from aapkholi chowk to Karange road) and A03 (Shree Narayan chowk to Simle Bawari gau road) connect different wards. The existing track (earthern or gravel roads) at present is only about 4m. In addition to these, there are altogether 15 number of Class 'B' roads (B01 to B15 with ROW: 10m) with total length of 46.10 km. At present only 0.7km is black topped with gravelling of 17.70 km and earthen road of 27.70 km. Also 61 number of Class 'C' roads (ROW: 8m) are proposed with total length of 75.05 km: 2.32 km black topped, 44.95 km graveled and remaining 27.32 is earthen and 0.46km is proposed new track. Class 'D' road network (ROW: 6 m) with 145 total number covers 59.86km: 4.53 km black topped, 22.22 km graveled, 27.63 km earthen and 5.48km proposed new track.

Table 2.14 Class A road within Rapti rural municipality

[36] Class 'A' road denotes major collector road, carrying the traffic from major settlements, touristic areas within municipality to the strategic road and provincial linkages. It acts as a major transport corridor. Class 'B' road as secondary type of collector road connects smaller size of settlements with lesser traffic volume. Class 'C' road is residential street linking private property and small industrial or public place. It captures small light vehicles and private cars. Class 'D' road basically serves to individual residential houses and it captures basically private vehicles.

Class	Road name	Ward	Ave. width	BR	GR	ER	Remark
A01	Tundikhel-Lalmatiya-Paschim Chowk-Khururiya-Bhanpur_Jeetpur-Pathhar Gadhawa-Dodhai chowk – Kalapani chowk – Sahid smarak park – Tundikhel – Mahendra Highway	1,2,3,4, 5,6,7 and 8	4m		19.57	11.11	Track to be open 2.92
A02	Aapkholi chowk-Sanighos-Chaupari-Chhauni tole – Karange road	1,2,4,5, 9	4m			22.89	
A03	Shree Narayan chowk-Club ghar chowk-Chauni tole chowk – Simle bawari gaun road	4, 8, 9	4m		1.08	12.23	

Source: Rapti rural municipality, 2019

Shitaganga municipality has also road network improvement plan with all types of municipal roads linking to wards 8 and 9 (Table 2.15). Class 'A' type road connecting wards 8 and 9 is between Pipara to Krishna sen ichhuk marga, about 10 km long. Class 'B' road connects between Dhodare to Lamidamar, covering 9.63 km long earthen road with average width of 4 m. Class 'C' roads passing through wards 8 and 9 of Shitaganga municipality are C001 – Rangakate – Nayabasti – Kharghat and C002 – Sitalpati – Palase – Apchaur. It covers 14.4 km under the earthen road category. More than ten Class 'D' road pass through ward no. 8 and 9 with total length of more than 25km. They are all earthen road. At present, there is one Bus Park at Bhalubang, on the east side of the bridges.

Table 2.15 Various types of road network within wards 8 and 9 of Shitaganga municipality

Class	***Road name***	***Ward***	***Width (m)***	***BR***	***Gr***	***ER***	***Settlements***
A004	Pipara-pawara-Simlpani-Bhedemare-Harre-Shilling khola-Satamara (Krishna sen ichhuk marga)	14, 13, 4,1,2,10,9,8	4	6.07	58.64		Pipara-Pawara_Simlpani-Bhedemare-Harre-Shilling khola-Satmara
B001	Dhodare-Purkishilli ghumaure-Thado khola - Lamidamar	8, 9	4			9.63	Dhodare-Purkishilli Ghumaure-Thado khola-Lamidamar
C001	Rangakate-Nayabasti-Kharghat motor road	9	5			4.24	Rangakate – Nayabasti - Kharghat
C002	Sitalpati-Palase-Apchuar	8,9	5			10.13	Sitalpati – Palase - Apchaur
D001	Satmara krishi road	8	5.5		0.764		Satamara
D002	Milanchowk bata purba jane bato	8	5			0.91	Milan chowk
D003	Tinkhande jholunge pul – Charinge motor road	8	5.52		0.2	2.47	Tinkhande Jholunge pul - Charinge

Class	*Road name*	*Ward*	*Width (m)*	*BR*	*Gr*	*ER*	*Settlements*
D004	Gothki – Mithiaap motor road	9	5			0.9	Gothki - Mithiaap
D006	Chatteban to Bandre – Raktari Badhidamar ring road	8	-				Chatteban to Bandre – Raktari Badhidamar
D008	Lahaveni Lamidamar – Baraha daha motor road	9	5			1.16	Lahaveni Lamidamar – Baraha daha
D009	Kartike – Lauri motor road	9	5			3.541	Kartike - Lauri
D010	Kanachaur-Chidi chaur	8,9	5			14.8	Kanachaur – Chidi chaur
D011	Lakurikot sadak	9	5			3.867	Lakurikot
D012	Asare- Bisvure-Baravure motor road	9					Asare – Bisvure - Baravue
D013	Sittalpati-Dhokhola-Barsenit motor road	9					Sittalpati – Dhokhola – Barseni

Source: Shitaganga municipality, 2019

2.7.2 Energy use

Different form of energy is used for lightining and cooking in the three territory of LPCC area (Table 2.16). In Rapti rural municipality, about 90.68% households use electrictity for lightining, followed by 4.47% HHs consuming solar light and 1.84% HHs still relying on kerosean. Those settlements around East-West Highway are basically connected to national grid of electricity whereas the norther villages particularly of ward 9 and some part of wards 1 and 5 are still dependent on alternative use of energy even for lighting.

Wood is still considered as major enegy source for at least cooking foods. Still 51.74% households use wood for cooking, followed by 31.44% HHs using gas cycliner. About 16.39% households have bio-gas connection in their kitchens. Though majority of villagers cook food on traditional mud built oven, nonetheless, 9.52% HHs have improved smokeless kitchen. Bijauri tole of ward 8 has been identified as 'bio-gas village.' Use of alternative clean energy such as bio-gas, improved oven and solar system is on rise for cooking foods.

In wards 1, 2 and 3 of Gadhawa rural municipality, about 74.90% households use electricity for lighting whereas 11.17% households still rely on kerosene. Use of solar and cow-dung plant is insiginficant. As high as 95.84% households still use wood for cooking. Use of other alternative source of energy for cooking is insificant.

Table 2.16 Households using different energy for lighting and cooking in LPCC area

Territory	Ward no	Electricity	Kerosean	Cowdung gas	Solar	Other	Not mentioned	Total
Use of energy for lighting at houses								
Rapti RM	1-9	7947	161		392	263		8763
Gadhawa RM	1	1000	189	2	30	138	14	1373
	2	758	69	0	11	179	1	1018
	3	802	124	0	1	82	18	1027
Sub total		2560	382	2	42	399	33	3418
Shitaganga municipality	8	550	19	1	89	12		671
	9	148	3	0	445	46		642
Sub total		698	22	1	534	58		1313
Total		11205	565	3	968	720	33	13494
Use of energy for cooking foods								

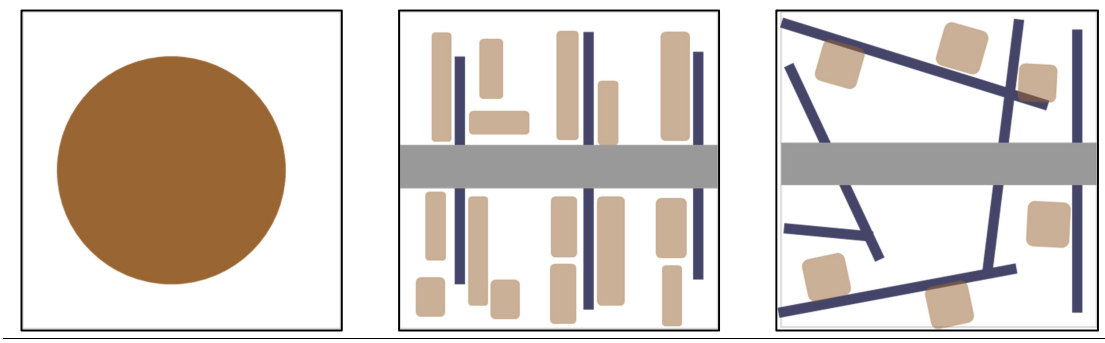
Territory	Ward no	Electricity	Kerosean		Cowdung gas	Solar		Other	Not mentioned	Total
Area	Ward no	Wood	Kerosean	LP gas	Cow dung	Cowdung gas	Electricity	Other	Not mentioned	Total
Rapti RM	1- 9	4534	0	2755		1436	29	9	0	8763
Gadhawa RM	1	1340	1	9	1	8	0	0	14	1373
	2	964	0	6	9	38	0	0	1	1018
	3	974	1	15	0	17	0	2	18	1027
Sub total		3276	2	30	10	63	0	2	33	3418
Shitaganga municipality	8	636	0	33		1	1	0	0	671
	9	639	0	2		1	0	0	0	642
Sub total		1275	0	35	0	2	1	0	0	1313
Total		9085	2	2820	10	1501	30	11	33	13492

Source: Compiled and calculated from Rapti rural municpality, 2076 BS; Gadhawa rural municipality, 2075 BS; Shitaganga municipality, 2076 BS

In the case of Shitaganga municipality, 6022 HHs (66.8%) consume electricity for lighting followed by 28.2% HHs using solar and 2.9% HHs relying on kerosean lamps. Out of 671 HHs in ward 8 and 642 HHs in ward 9, as high as 550 HHs and 148 HHs are connected to electrical grid respectively, whereas the households in those wards using solar are only 89 and 445 respectively. About 8620 HHs (95.7%) still use wood for cooking followed by 4.1% using LP gas. Kerosean and cow-dung gas are not popular in thesedays. About 636 HHs in ward 8 and 639 HHs in ward 9 consume wood for cooking whereas LP gas is being used by 33 HHs and 2 HHs respectively in these two wards.

2.7.3 Settlement pattern and housing development

Though there is no planned or well defined settlement pattern in LPCC area, nonetheless, they can be grouped into three typology based on the nature of their growth (Fig. 2.12). First, earlier villages were developed far away from West Rapti River north and south sides, near hills edges. Those villages inhabitated by ethnic groups have small groups of houses clustered around community spaces with road network and hills as edges. Second, linear development pattern following the major road network. One can see small branches spreading on both sides of the major roads for commerical activities. Such development can be seen along East-West Highway as well as major north-south roads. Third typology is sprawl development on ad-hoc basis. Some of the buildings along the road but others in the middle of the agriculture lands, connected by pedestrian ways.



(a) Agglomoration around hill edge and road

(b) Linear development along the road network

(c) Sprawl and development in the middle of farm land

Fig. 2.12 Exsting Typology of Settlements in LPCC Area

Such formless development is growning based on market demand. With increase in population and hence after demand creation, those settlements have been developed as small market centres serving to nearby villages. Only visible and memorable man-made element is East-West Highway plus another National Highway linking Bhalubang to Pyuthan. This road section bisect the LPCC area and acts as a spinal cord, connecting villages in the foot hills as well as linear developments to the Highway. In additio to that, bridges over West Rapti River are also legibale and acts as 'landmarks.' However, LPCC area is rich in natural elements: water body in the form of Rivers and mountain on all sides with gradually decreasing the elevations till it reaches to the West Rapti River. Mountains with greeneary and forests are connected to water body through strips of greenery spaces and fertile agriculture land specially on both banks of the rivers.

Majority of the people in Rapti rural municipality live in private houses (Table 2.14). About 75.63% households have private ownership whereas 7.97% households do not have house and land in family's name (Rapti rural municipality, 2076 BS). In whole Gadhawa rural municipality, about 97.39% live in their own houses whereas only1.46% household live on rent (Gadhawa rural municipality, 2075 BS). Only 0.18% households live in intuitional housing (ibid). In Shitaganga municipality out of 9009 HHs, 96.5% (8694 HHs) live in their own houses and only192 HHs (2.1%) are living on rent (Shitaganga municipality, 2076 BS). Also, the land ownership of 94.5% of houses built is of private whereas 3.7% HHs are still living in public lands and 0.4% HHs in the land of guthi (ibid). Out of 671 HHs in ward 8 and 642 HHs in ward 9, 662 HHs and 629 HHs are living in their own houses respectively, whereas only 4 HHs in ward no 8 and 9 HHs in ward no 9 live in rented houses (ibid).

Table 2.14 Household living in different houses on ownership basis

Area	Ward no	Private	Rent	Institution	Other	Total
Rapti rural municipality	1 - 9	6628	41	4	0	6673
Gadhawa rural municipality	1	1355	13	1	6	1375
	2	1005	2	0	11	1018
	3	1007	12	2	5	1026
Sub total		3367	27	3	22	3419
Shitaganga	8	662	4	0	5	671

municipality	9	629	9	1	3	642
Sub total		1291	13	1	8	1313
Total		11286	81	8	30	11405

Source: Compiled and calculated from Rapti rural municipality, 2076 BS; Gadhawa rural municipality, 2075 BS; Shitaganga municipality, 2076 BS

In Rapti rural municipality, nearly one third households (33%) of female have house ownership certification (Table 2.15). About 22% households possess land up to 3 kattha,[37] another 29% households have land between 4 to 10 kattha. Similarly, 24% household have land between 11 kattha to 1 bigha[38] and 3% households have land between 1 bigha to 5 bigha. However, 21% household do not have any land in their name. Squatter settlements and temporary living people are seen in different wards of Rapti rural municipality. About 21% of households do not have their land or house ownership certificate. About 1842 household do not possess land ownership certificate. Such household exist in all nine wards: 597 households in ward 3 and 26 households in ward 8.

Table 2.15 Households with female ownership in LPCC area

Area	Ward no	Female ownership on house (HHs)	Female ownership on land (HHs)	HHs without landownership certificate
Rapti rural municipality	1 – 9	14,662 persons (33%)		1842
Gadhawa rural municipality	1	45	136	
	2	30	77	
	3	69	130	
Sub total		144	343	
Shitganga municipality	8	146 (21.75%)		
	9	58 (9.03%)		
Sub total		204		

Source: Compiled and calculated from Rapti rural municipality, 2076 BS; Gadhawa rural municipality, 2075 BS; Shitaganga municipality, 2076 BS

In whole Gadhawa rural municipality about 93.20% male households have house ownership certificate with only 6.36% female households possessing house ownership. It clearly indicates gender inequality and weak women empowerment. In terms of female ownership over land, the figure is only 14.35% households. However, more household have female ownership over land[39] compared to houses. In case of wards 8 and 9 of Shitaganga municipality, 21.75% and 9.03% respectively female households own their houses.

Rapti rural municipality consists of houses built using different building materials and construction technology over different time period. The dominating housing typology is of reinforced cement concrete (RCC) frame structure, covering nearly one third (31.94%) total housing stock (Table 2.16). However, 21.74% of housing is made up of tin whereas 13.98% of houses are load bearing wall system with stone in cement mortar.

[37] 1 kattha =338.62 sq. m

[38] 1 bigha = 20 kattha = 6772.21 sq. m.

[39] The government of Nepal has given discount on land registration fee if the ownership is of female.

Table 2.16 Type of houses in Rapti rural municipality (ward wise)

Ward no	Type of houses								Total
	Stone mud	Stone cement	Wood	Tin	Brick	RCC frame	Thatched	Other	
1	98	481	59	48	38	417	21	4	1166
2	509	663	111	13	29	12	4	1	1342
3	70	6	0	561	52	388	134	30	1241
4	30	9	51	200	330	363	69	163	1215
5	34	4	0	207	29	299	171	12	756
6	6	42	18	257	130	326	79	60	918
7	1	2	1	289	3	476	25	48	845
8	5	0	1	327	9	518	31	29	920
9	84	1225	488	1905	622	2799	540	347	8763
Total	837	2432	729	3807	1242	5598	1074	694	17166
%	9.55%	13.98%	5.57%	21.74%	7.10%	31.94%	6.16%	3.96%	100%

Source: Household survey, 2075 BS in Rapti rural municipality, 2076 BS

Houses in wards1, 2 and 3 of Gadhawa rural municipality[40] have used different building materials and construction technology (Fig. 2.17). Wooden pillar is dominating elements for foundation, as 2466 HHs (out of 3422 HHs) have houses with wooden pillar foundation. In addition to that many houses (of 784 HHs) have foundation of mud bonded brick or stone. Only ten houses have RCC frame structure system.

Majority of houses employ bamboo as outer wall materials (1244 HHs) followed by 722 HHs used mud bonded brick or stone wall. Significant number of households (699 HHs) have their houses with wooden plank as outer wall materials. Again, thatched roof is still a dominating roofing materials in the houses; others have CGI sheets (347 HHs) and tile or slate roofing (169 HHs). Many newly built houses have concrete slab in the roofing.

Table 2.17 Households by building construction characters in Gadhawa rual municipality

Ward no.	Type of foundation of houses						
	Mud bonded bricks /stones	Cement bonded bricks stone	RCC with pillar	Wooden pillar	Other	Not stated	Total
1	132	62	5	1145		30	1374
2	326	7	1	677	5	4	1020
3	326	30	4	644	0	24	1028

[40] In the whole Gadhawa rural municipality, as high as 25.33%, more than one fourth of the total households have been found absent. Those population might have migrated into city centre for education, jobs and other services. Some of them might have gone abroad for work.

Ward no.	Type of foundation of houses						
	Mud bonded bricks /stones	Cement bonded bricks stone	RCC with pillar	Wooden pillar	Other	Not stated	Total
Total	784	99	10	2466	5	58	3422

Type of outer wall								
Ward no	Mud bonded brick/ stone	Cement bonded brick /stone	Wood/ plank	Bamboo	Unbaked brick	Others	Not state	Total
1	132	83	623	219	14	272	30	1373
2	299	32	13	441	2	272	4	1063
3	291	34	63	584	30		24	1026
Total	722	149	699	1244	46	544	58	3462

Roof type								
Ward no	Thatch/ Straw	CGI sheets	Tile / slate	RCC	Wood / plank	Mud	Not stated	Total
1	1006	155	88	83	4	0	37	1373
2	729	62	36	187	1	0	4	1019
3	712	130	45	117	1	0	23	1028
Total	2447	347	169	387	6	0	64	3420

Source: Gadhawa rural municipality, 2075 BS

In Shitaganga municipality, out of 9009 HHs, 7130 HHs (79.1%) are of 'kachi' type, built using weak materials (Table 2.18). Only 8% HHs are living in permanent houses (722 HHs) and 4.8% (436 HHs) still living in temporary sheds (chapros) (ibid). Majority of houses in wards 8 and 9 are built using temporary materials (kacchi): 208 houses (out of 671 HHs) in ward 8 and 584 houses (out of 642 HHs) in ward 9. Only 201 houses in ward 8 and 16 houses in ward 9 are permanently built. Still 61 persons in ward 8 and 30 houses in ward 9 are of shade or temporary nature. About 64% houses in ward 8 and more than half (51.7%) houses in ward 9 were built in the last ten years (ibid). Out of 552 (82.3%) houses (out of 671 HHs) in ward 8 and 408 (63.6%) houses (out of 642 HHs) in ward 9 are of single story only (ibid). Another 113 houses in ward 8 and 213 houses in ward 9 are of two story (ibid). There are only few houses in both wards with greater than two story buildings. Nearly half of the houses (45.45%) in ward 8 and 72.58% of houses in ward 9 have one or two rooms only (ibid). Another 39.2% houses in ward 8 and 21.33% houses in ward 9 have 3-4 rooms (ibid). Only 64 houses in ward 8 and 3 houses in ward 9 have taken 'completion certificate' of their houses from the municipality.

Table 2.18 Type of houses in Shitaganga municipality (wards 8 and 9)

Ward no	Permanent	Semi-permanent	Kacchi (poor material)	Shade/ chapro (temporary)	Other	Total
8	201	200	208	61	1	671

9	16	9	584	30	3	642
Total	217	209	792	91	4	1313

Source: Shitaganga municipality, 2076 BS

Though population growth of Shitaganga municipality is negative, both Rapti rural municipality and Gadhawa rural municipality have experience growth of population. Drivers of such growth are numerous: development of market centres, road network and Highway, besides gradual development of facilities like education and health. In addition to these, development of telecommunication along with internal bus services has also contributed towards the growth. However, present form of development along the road network led by market condition has numerous weaknesses. First, master plan of the whole are with zoning of different uses is yet to be prepared. At present, the growth is market led and haphazard on ad-hoc basis. Such development will definitely create constrain in future for the planned development. Second, the environmental condition of settlements is yet to be improved particularly of solid waste collection and their disposal. Due to hot climate, plantation along the road network and around houses is needed, which is not possible in piecemeal development. Domestic animals such as cow, buffalo, etc. are left in the road and public spaces thereby disturbing the visitors, local communities and their crops. Third, water is essential for growth of any settlement and protection of their sources and network is required. The efforts of the concerned authority has been found inadequate so far. Fourth and last, there is inadequate coordination among different stakeholders on construction of different infrastructure thereby putting a big question mark on their long term sustainability. Construction of road network and installation of different amenities in the absence of master plan cannot be sustainable.

2.8 Natural Resoruces and Forest Environment

Natural resources in the form of forest and river system[41] (water body) are the major assets of LPCC area. It is rich in forest environment and biodiversity. Their benefits are numerous. First, they have maintain ecological balance between nature and human. Such balance is necessary for socio-economic development as well as protection from natural disasters like landslide and flooding. Second, the area comprises of diverse type of trees, medical herbs and grass. It also includes differnet species of wild animals and birds.They have potential of multiple economic benefits for local community, municipality and the nation. Local people gather wood, herbal and fruits for their daily lives. They take their cattles for rearing. Wood can be used for construction as well as interior decoration of rooms. The municipality can utilize those plants for varity of products for expert to surrounding areas and abroad. Many outside tourist visit the area to enjoy biodiversity. The concept of community forest can be effective implemented not only to protect the natural resources and biodiversity but also to engage economically weak families for their livelihood improvement activities. Third, forest and rivers are in fact special type of land use. They add valued to the adjacent areas in terms

[41] The West Rapti River basin has major tributaries as Jhimruk River, Mari River, Arun River, Lungri River, Sit River, Dunduwa River, Sotiya and Gandheli rivulets. Downstream of the confluence of the Jhimruk and Mari Rivers, the river is named the West Rapti River. The source of runoff is due to the monsoon rainfall and ground water (Talchabhadel & Sharma, 2014). Based on the measured data at Kusum hydrological observation station, the average and maximum discharge of West Rapti River have been found 136m3/s and 7279 m3/s

of creating views, natural scenery and micro climate. Those surrouning areas will have higher real estate value.

There are about fourteen community forest in Rapti rural municipality. Communities use these forest for collecting timber (for cooking), construction materials (wood, khar for roof) and grass for domestic animal. Similarly, about one dozen rivers and streeams cross Rapti rural municipality. They have been used for multiple purposes, mostly for irrigation. In addition to irrigation, stone, gravel and sand are extracted from the West Rapti River, Ganaha khola and Rapti small river (branch). Water from Bhulke khola is also used for drinking purpose. Theee are ponds and simshar area. Rapti rural municipality is also rich in wild animals and birds. Kalika community forest in ward 2 has been identified as vulture protection area, link with animal old shelter. Different specis of fish and other water animals have been found. Due to diversity in geography and climate, this area is also rich in herbal plants as well as variety of trees.

In Gadhawa rural municipality alone, out of its total area of 358.57 sq. km. forest alone covers around 234.04 sq. km area, that includes both national forest and community jungle. Due to wide variation in elevation, they have different types of climate and hence diverse biodiversity is possible. These natural resources have multipe dimensions. Wards 8 and 9 of Shitaganga municipalityis also rich in natural resoruces. It comprises of West Rapti river (ward 8) and many natural water elements such as Baraha lake, Baraha simshar area, water fall of Flase river, and small strems such as Amrese khola, Khadka tola khola, Kedeni, Sishne khola in ward 9. Due to its climate, forest in Shitaganga municipality houses different types of plants, trees and fruits. Some harbal plants have also been found. In addition to these, there are also different types of wild animals and birds[42] in the forest. Those wild animals include Musk Deer, Leopard, Jckle, Clouded Leopard, Black Bear, Common Langur, Furit bat, Pangolin, Red Panda and Rufus tailed hare. Among reptiles, common cat snake, common indian monitor lizard and common lizard are easily avaialble. Also aves like spotted dove, red jungle fowl, common peafowl, impeyan pheasant, kalik pheasant, crimson horned pheasant, black patridge, house crow, cuckoo and bulbul also exist in the forest.

[42] Deukhuri Valley in the lower region of Dang district is surrounded by forested Shiwalik hill range. It is connected with Banke National Park in the west and Sohelwa Wildlife Sanctuary in the south. The Valley has about 1,243 sq. km of area with elevation ranging from 200m to 1,000m. The Valley as one of Nepal's important Bird and Biodiversity areas has 'sal' and 'sisoo-khair' dominated forest, with patches of degraded forest (Khanal et al 2017a). Striped hyaena has been found in the northern side of the Valley (ibid). Other wild animals like leopard, cats, sloth bear and golden jackal including different types of honey badger have also been found in the forest (Khanal and Baniya, 2018). Moreover, barking deer, spotted deer, wild boar also exist in the area (ibid). Four-horned antelope (Tetracerus quadricornis) has also been found in this area, outside the protected area (Khanal et al. 2017b). So far around 260 bird species have been found in Deukhuri Valley (Thakuri, 2009). Similarly, about 15 species of snakes have been recorded including spectacled cobra, common krait, banded krait and so on. There exist mugger crocodile[42] in the West Rapti River (Khanal, 2017). Deukhuri Valley is a prime example of biodiversity-rich landscape in Nepal lying outside the protection area. Most of the forested areas in the Valley are under the jurisdiction of the District Forest Office (DFO) but they have not been able to curb the problem of poaching and illegal trade. Poaching and habitat loss due to deforestation and encroachment are the major threats to the wildlife in the area. Forests and grasslands are being degraded by overgrazing, excessive burning, and removal of undergrowth to provide fodder for livestock.

2.9 Climate Change and Disaster Risk

The Lumbini Province has acknowledged disaster risk reduction (DRR) and climate change (CC) as an important development agenda cutting across all the major socio-economic sectors in its five year development plan. Based on district wise climate data (temperature and precipitation) between 1971 and 2014, it was found that all the districts of Lumbini Province experienced increased annual precipitation in winter, pre-monsoon and monsoon seasons with significant variations in monsoon precipitation among the districts (OPM, 2019). There is also a positive trend in the rise of annual minimum temperature as well as maximum temperature in all districts of the Province (ibid). It is forecasted that all districts are expected to have an increase in precipitation and temperature in both Representative Concentration Pathways (RCPs) (RCP 4.5 and RCP 8.5 scenarios) (ibid). These will increase extreme events in future. There is a warm spell duration throughout all districts thereby resulting in likelihood of heat waves, forest fire, pest and diseases increases as well, affecting the entire ecosystem. The districts in the low-lying regions have already suffered from heat waves which are likely to increase more (ibid). Similarly, the projected higher number of wet days is likely trigger flash floods and landslides thus affecting the entire human and natural ecosystem.

Climate change impacts on overall agriculture and livestock system are mainly due to increase in temperature and changing pattern, intensity and shifting of rainfall. Growing number of occurrence of extreme events, drying up of the water sources, people's perception of increased rainfall and changes in rainfall patterns causing rising of incidences of diseases in crops and changing routine activities in gazing, harvesting and storing clearly demonstrate that climate change is causing adverse impacts on agriculture and habitat.

Degradation of the grass land and low grass production have reduced the livestock numbers as well as practiced rotational grazing. Due to depending on rain water, there is always uncertainty in the crops farming. Relying on traditional farming system means poor level of production. In some cases, there is inadequate infrastructure to store them and to take them to the market due to poor access road and absence of cold stores. Farmers engaging in livestock have been found unable to make profit. The dairy product is low, mostly consumed by farmers or customers buying directly from the farm. Local cattle are often used in cow farming, as the improved breed cattle are expensive. Inadequate improved seeds of grass, lack of grass in all seasons and untrained human resources have further destroyed the cattle farming.

Lumbini Province has topography characterized by steep and mountainous terrain in the north, the fragile 'Churia' hills in the center and geology of the Terai is prone to flooding. It is exposed to multiple geo-physical and hydro-meteorological extreme events and climatic[43] and non-climatic hazards, each with the potential to intensify into a disaster. Landslides,

[43] Climate induced extreme events are broadly categorised as (i) hydro-meteorological events such as floods, landslides, hailstorms, thunderstorms, lighting strikes, fog, glacier lake outburst floods (GLOFs), avalanches, severe storms/wind storms and (ii) climatological events like extreme temperatures, droughts, wildfires, and heat and cold waves. Non-climatic hazards are primarily geo-physical events like earthquakes and dry mass movements, including rock slides. Other disasters include epidemics, infection, invasive species, insect infestations and animal stampedes including human induced disasters like road and fire accidents.

flooding, fires, disease outbreaks, road accidents, drought, thunder and dry wind storm are the major hazard events. Such events have adversely affected natural resources, reduced people's livelihood opportunities and the amount of income they generate and exacerbate their suffering. Agriculture is one of the most impacted sectors followed by water resources, ecosystems and human health. Climate change is expected to make hazards and disasters more frequent and severe in future.

Both Dang and Arghakhanchi districts have been affected with loss of lives and properties by multiple disasters in the past (Table 2.19) (MOHA, DesInventar in OPM, 2019). Though epidemics has become a major disaster in both districts, landslide alone killed 75 persons, affecting 10,564 families with loss of NRs. 2.7 million between 1970 and 2018 (ibid). Flood in Dang between 1970 and 2018 killed 75 persons, affecting 67,188 families with estimated loss of NRs. 511.84 million (ibid). In addition to these, both districts have been impacted by other disasters such as cold waves, forest fire, heavy rain, thunderbolt, windstorm and accidents.

Table 2.19 Loss and damage cause by disasters in Dang and Arghakhanchi districts

Disaster type	District	Total death	Missing people	Injured	Affected family	Estimated loss (NRs million)	Remarks
Cold waves	Arghakhanchi	12	0	0	0	NA	1990-2013
Epidemics	Arghakhanchi	44	0	249	15,692	NA	1970-2018
	Dang	393	0	458	3,000	NA	
Earthquake	Dang	0		10	2	NA	1990-2015
Fire	Arghakhanchi	11	0	11	1,733	103.659	1970-2015
	Dang	45	0	29	7,627	232.75048	
Flood	Arghakhanchi	15	11	1	4,202	NA	1970-2018
	Dang	75	17	27	67,188	511.83942	
Forest fire	Arghakhanchi	0	0	1	162	NA	1979-2013
	Dang	2	0	3	22	NA	
Heavy rain	Arghakhanchi	0	0	0	5	2.405	1990-2018
	Dang	1	0	1	13	1.142	
Landslide	Arghakhanchi	75	0	51	10,564	2.7	1970-2018
	Dang	9	1	13	441	NA	
Thunderbolt	Arghakhanchi	0	0	0	6	NA	1990-2013
	Dang	39	0	50	5	NA	
Windstorm	Arghakhanchi	0	0	2	2	NA	2013-2018
	Dang	0	0	12	42	5.091	
Accident	Arghakhanchi	9	0	4	0	NA	2004-2013
	Dang	48	1	3	0	NA	

Source: MOHA, DesInventar in (OPM, 2019)

Three local areas of Lumbini provincial capital city have been impacted by different disasters, as perceived by local inhabitants (Table 2.20) ((OPM, 2019). In the case of Rapti rural municipality, the most devastating hazards are flood, fire and landslide whereas it is drought, crop and livestock diseases and flood in Gadhawa rural municipality (ibid). Landslide, fire and drought are the three major hazards in Shitaganga municipality (ibid). In addition to these, these local areas have been impacted by wind storm, heat waves, cold waves, avalanche, and epidemics including earthquake in the past.

Table 2.20 Top ten hazards perceived by the inhabitants in three municipalities

S.N.	District	Top ten hazards in the last one decade
1	Rapti rural municipality	(i) Flood (ii) Fire (iii) Landslide (iv) Drought (v) Cold wave (vi) Epidemics (vii) Wind storm (viii) Heat waves (ix) Crop and livestock disease (x) Earthquake
2	Gadhawa rural municipality	(i) Drought (ii) Crop and livestock disease (iii) Flood (iv) Hailstone (v) Fire (vi) Earthquake(vii) Heat waves (viii) Epidemics (ix) Landslide (x) Avalanche
3	Shitaganga municipality	(i) Landslide (ii) Fire (iii) Drought (iv) Flood (v) Cold waves (vi) Heat waves (vii) Wind storm (viii) Crops and livestock disease (ix) Epidemics (x) Earthquake

Source: Field survey done for Oxford Policy Management (OPM) (2019).

Another study carried out by Province Planning Commission in 2075 BS has identified occurrence of frequent landslides affecting huge areas in all the three local areas (Table 2.21) (PPC, 2075 BS). In the past, Shitaganga municipality has suffered from 20 landslides affecting 92.43 ha land, whereas Gadhawa rural municipality and Rapti rural municipality felt 9 and 14 times landslide affecting27.88 and 70.55 ha land respectively (ibid).

Table 2.21 Frequency of landslides and affected areas in three municipalities

Local level	No. of landslide	Area (ha)
Shitaganga municipality	20	92.43
Gadhawa rural municipality	9	27.88
Rapti rural municipality	14	70.55

Source: PPC, 2075 BS

The same study has also identified many vulnerable wards and settlements from different type of disaster (Table 2.22) (ibid). Both wards 8 and 9 of Shitaganga municipality are vulnerable to flooding and fire (ward 8) whereas wards 5, 6 and 9 of Rapti rural municipality and ward 3 of Gadhawa rural municipality are vulnerable to flooding (ibid).

Table 2.22 Ward no and settlement vulnerable to different disasters in three municipalities

Local area	Ward no. and settlements	Disaster type
Shitaganga municipality	wards 8 and 9	Flooding
	8 (Jaluke), 9	Fire
Rapti rural municipality	6 (Majeriya, Bhagwanpur, Bagarapur), 8 (Kohaluwa)	Flooding
	9 (Debikot, Muslim tole, Jakine, Shotitole, Lower Ghokkhola and Lama khola	Landslide
	5 (Kalapani, Pahruwa, Lathahawa, Singe)	Inundation
Gadhawa rural municipality	3 (Dhereni, Khirakhal)	Flooding
	1 (Chisapani, Jurauni, Malmala), 2 (Chaffa and	Inundation

	Kalipuruwa)

Source: PPC, 2075 BS

In the year 2017-2018 alone, Rapti rural municipality lost many lives and properties from multiple disaster (Table 2.23) (MOHA, no date). Fire was the major disaster whereas wind storm affected many families. At least 4 persons were killed and another 10 families were affected with estimated loss of NRs 1.07 million (ibid).

Table 2.23 Loss of lives and properties from disaster in Rapti rural municipality in 2017 and 2018

S. N.	Ward no.	Incident date	Incident	Total death (male + female)	Affected family	Estimated loss (NRs in million)	Private house damaged (fully + partially)
1	3	12/10/2017	Fire	1f	2		1 f
2	5	5/14/2018	Wind storm	0	5	0.74	0 + 5p
3	4	6/19/2018	Fire	0	1	0.2	1f
4	4	9/29/2018	Other	3f	1		0
5	1	11/7/2018	Fire	0	1	0.128750	0 + 1p
			Total	4	10	1.068750	2+ 6

Source: Compiled from MOHA, no date

In Gadhawa rural municipality too fire became the major disaster in the same period (Table 2.24) (ibid). The major disaster events were fire, wind storm and snake bite killing two persons (both female), affecting 23 families with estimated loss of NRs. 4.3 million (ibid). At least two private houses were fully damaged and other eight were partially smashed (ibid). In addition to fire, the issues of destruction of natural resources such as rivers and forests are emerging in this rural municipality. There is a gradual destruction of forest due to gradual extension of settlements. Forest fire is frequent. Excess extraction of sands and boulders from rivers mainly West Rapti River in an ad-hoc basis has disturbed ecological balance thereby risking the nearby areas (villages and agriculture lands) land cutting and erosion. Due to weak geological condition and medium level watershed condition, this rural municipality has been suffering from landslide, flood, land erosion and river cutting on yearly basis.

Table 2.24 Loss of lives and properties from disaster in Gadhawa rural municipality in Dang district in 2018

S. N.	Ward no.	Incident date	Incident	Death (m+f)	Affected family	Est. loss (NRs in million)	Injured	Pri. house damaged (fully + partially)	Cattle loss	Displaced shed
1	6	11/18/2017	Fire	0	1	0.1	0	1	0	1
2	1	1/29/2018	Fire	0	1		0	1	0	0

S. N.	War d no.	Incident date	Incident	Death (m+f)	Affecte d family	Est. loss (NRs in million)	Injured	Pri. house damaged (fully + partially)	Cattle loss	Displa ced shed
3	5	2/15/2018	Fire	0	1	0.4	0	1	0	0
4	6	4/14/2018	Fire	0	1	0.35	0	0	1	1
5	8	4/21/2018	Fire	0	2	0.2	0	1	1	2
6	5	5/14/2018	Wind storm	0	7	0.6	0	0 (7 p)	0	1
7	3	5/25/2018	Fire	0	1	0.3	0	1	0	1
8	3	5/29/2018	Fire	1 (f)	5	1.5	0	5	0	3
9	2	5/30/2018	Fire	0	1	0.5	0	1	0	1
10	7	6/11/2018	Snake Bite	1 (f)	1		0	0	0	0
11	5	6/14/2018	Wind storm	0	1	0.1	2	0 (1p)	0	0
12	6	10/28/2018	Fire	0	1	0.25	0	1	0	0
			Total	2	23	4.3	2	12 +8	2	10

Source: Compiled from MOHA, no date

There is possibility of land erosion in some catchment areas of various watersheds (Table 2.25). Out of total area, about 1043 ha has 'very high' risk of soil erosion due to multiple rivers whereas about 1574 ha of land has 'high' risk. However, about 8477.96 ha of land has 'medium' possibility of soil erosion with another 2761 ha land with 'low' risk.

Table 2.25 Possible land erosion land area in different watershed zone at Gobardihi (wards 1, 2 & 3) of Gadhawa rural municipality

S. N.	Watershed name	VDC (then)	Possible area of land erosion (ha)					
			Very low	Low	Medium	High	Very high	Total
1	Dhan Khola	Gobardiha	0	504	1143	299	0	1946
2	Malmala	Gobardiha	0	822	630	551	409	2412
3	Bahuwa Khola	gobardiha	0	173	1918	315	634	3040
4	Bhauri Tal	Gobardiha	0	273	4.96	126	0	403.96
5	Supauila Khola	Gobardiha	210	753	3759	283	0	5005
6	Gaila river	Gobardiha	0	236	1023	0	0	1259
		Total	210	2761	8477.96	1574	1043	14065.96

Source: Gadhawa rural municipality, 2075 BS

In recent years, Rapti rural municipality has been facing soil erosion along the West Rapti River thereby affecting the adjacent settlements.[44] In addition to that, human and property has

[44] River bank erosion and entry of uncontrolled flood was the major problem of the Deukhuri Valley in general and Praganna irrigation area in specific. With the entry of uncontrolled flood flow and erosion of canal bank, the Kalapani Praganna Kulo had gradually enlarged and converted to the small water canal (sano nadi). The flood events of 1978, 1984, 1989, and 1997 are still in the memory of local residents that had captured a lot of cultivated lands and destroyed the irrigation networks. The right bank of the river from Bhalubang to Balarampur had been eroded every year and hundreds of bighas of land had already been converted to river bed. Farmers with their own resources and technology had protected the river bank erosion in several instances, but efforts could not help with harsh regime of the Rapti River. With the implementation of Praganna Kulo

been lost due to lightning, forest fire and electricity current. The negative impact of climate change on agriculture, the major source of livelihood of the community has been gradually observed. There are always high risk of soil erosion and inundation: Bhalubang and Machhital of ward 1, Kathaha area of ward 2, Khururiya area and Basantapur of ward 3, Bhanpur and Anahanpur of ward 7, Bagrapur of ward 6. Similarly, areas like Shisaniha west, Yekanta basti Kumletol, Muktinagar of ward 2 are also in risk zone. There is risk of fire in wards 1 and 9 particularly of settlements in the hilly region and those surrounded by community forest. In the past three years, the flooding killed two person in ward no 1 and additional three persons lost their lives due to electric current. Also, landslide and soil erosion damaged the temporary earthen roads in wards 1 and 9.

Most of the disasters namely flooding, landslides, inundation, lightening and pandemic have been occurred from the month of Jestha to Shrawan or Bhadra (rainy season). However, forest fire and house fire often occur in the months of Falgun, Chaitra and Baishak (dry and windy season).

During the same period, Shitaganga municipality also suffered from fire, wind storm and landslide affecting 15 families with estimated loss of NRs. 9.07 million (Table 2.26) (ibid). Ten houses were fully destroyed and other one partially damaged by disaster. The disaster event also killed seventeen cattle in this municipality in two year of period.

Table 2.26 Loss of lives and properties from disaster in Shitaganga municipality in 2017 and 2018

S. N	War d no.	Incident date	Incident	Affected family	Estimate loss (NRs in million)	Injured	Private house damaged (fully + partially)	Cattle loss	Displac ed shed
1	7	10/26/2017	Fire	1	1.6	0	1	2	1
2	7	1/15/2018	Fire	1	1.2	0	0	0	1
3	11	4/21/2018	Fire	8	5.0	0	6	15	6
4	14	5/14/2018	Wind storm	1		2	0 (1 p)	0	0
5	2	7/27/2018	Landslid e	1	0.7	0	1	0	0
6	10	9/21/2018	Animal Incidents	1		1	0	0	0
7	6	11/13/2018	Fire	1	0.4	0	1	0	1

Irrigation Project in 2002 a planned river training works has been initiated. The project aimed to protect the irrigation command area along the right bank of the river from Bhalubang to Ghumna. This project had constructed about 11 km long embankment dykes and 32 spurs along the right bank from the intake of Kala Praganna Kulo. The embankment has motorable road on the top and studs on the river side. In addition, Janata Ko Tatbandha Project has also been implemented in Rapti river since 2066/67 fiscal year. This project aimed to construct about 10 km long embankment with adequate spurs and studs. Up to now about 3.50 km embankment has been completed from Badhara to Kalipurwa and the project is continuous. Badkapath irrigation project implemented in conjunction with Praganna irrigation project has also constructed embankment at the left bank of the river up to Badhara aiming mainly to protect its main canal. The performance of these constructed embankments is very good and functioning well despite maintenance at vulnerable locations.

8	4	11/23/2018	Fire	1	0.175	0	1	0	0
			Total	15	9.075000	3	10 + 1	17	9

Source: Compiled from MOHA, no date

Due to weathering, Lower Siwaliks are in the form of residual soil, less permeable and can be easily eroded by rain. Most of the past settlements took place in the foothills of Middle Siwaliks and landslide risk is low. However, shallow landslides are seen around newly developed roads. Debris flows from excavated materials are stored on the downslope. Poor road drainage has caused water seepage causing shallow failure. Several shallow landslides can be seen along the Lalmatiya-Devikot and Lalmatiya-Karanggekot road section.

Settlements around river edges, existence of mountains, extraction of sand, stone and gravel from the river on ad-hoc basis all have increased the risk of land slide, soil erosion and flooding and liquefaction in case of big earthquake. Only Gadhawa rural municipality has one fire fighter and the remaining two lack such facilities and need to depend on neighboring municipalities in case of fire disaster. Out of ten local levels in Dang district, only four have fire service (Radio Nepal, 2021).

Flood and Landslide Hazard

Recent study carried out by USAID (2019) for middle Rapti Watershed Profile[45] reveals that Khururiya to Bhalubang is highly vulnerable to the flood and the area from Bhaluwang to upper stream of the river is less vulnerable with few events of flooding (USAID, 2019). The settlement areas at Khuriya and Bhalubang will be more affected by flood compared to upper stream. As the river is meandering downstream from Bhalubang to lower sections in Rapti rural municipality and Gadhawa rural municipality towards west, the flooding intensity will increase in Gadhawa rural municipality particularly ward nos 1, 2 and 3. Moreover, majority of river banks of West Rapti River have flooding vulnerability while considering 100 year of flood (Fig. 2.13).

[45] Flood Mapping for the Rapti River has been done using secondary data (World Wildlife Fund for Nature (WWF), Hydroshed Void-Filled Digital Elevation Model (DEM)) using Google Earth Engine (GEE), Open software, to process the satellite generated DEM data to obtain flood inundation area through data coding method in Google Earth Engine for a return period of 100 years. The Earth Observation (EO) domain can provide valuable informative products that can significantly reduce the cost of mapping flood plain and improve the accuracy of mapping and monitoring systems. In this study, WWF Hydro shed Void-Filled Digital Elevation Model (DEM) data was imported in GEE and further coded and digitalized to predict flood inundation areas for a period of 100 years. It involved assessing of a 100 year flood events from 2021-2121 spread over the West Rapti River. The Google Earth Engine gives a high true positive accuracy ranging from 71–90% and overall accuracy in the range of 74–89%. In short, observations in GEE can be used as a rapid and robust hindsight tool for mapping flood inundation areas, training AI models, and enhancing existing efforts towards flood mitigation, monitoring, and management

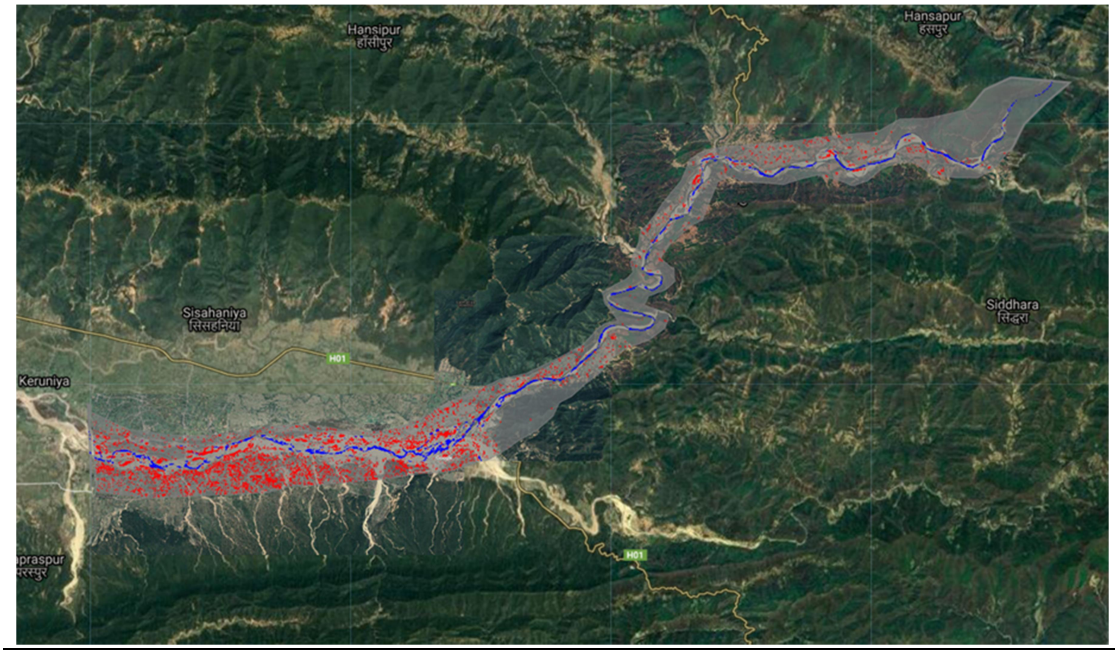


Fig. 2.13 Flooding mapping considering 100 year (Source: MoUSAID, 2019)

Again, the same study also revealed many landslides prone areas within the study areas, both in Rapti rural municipality and Gadhawa rural municipality (Fig. 2.14). In Rapti rural municipality, the western part of riverbanks have high flooding vulnerability compared to the middle and east part. Again, the southern bank of the River lying in Gadhawa rural municipality is more flood prone.

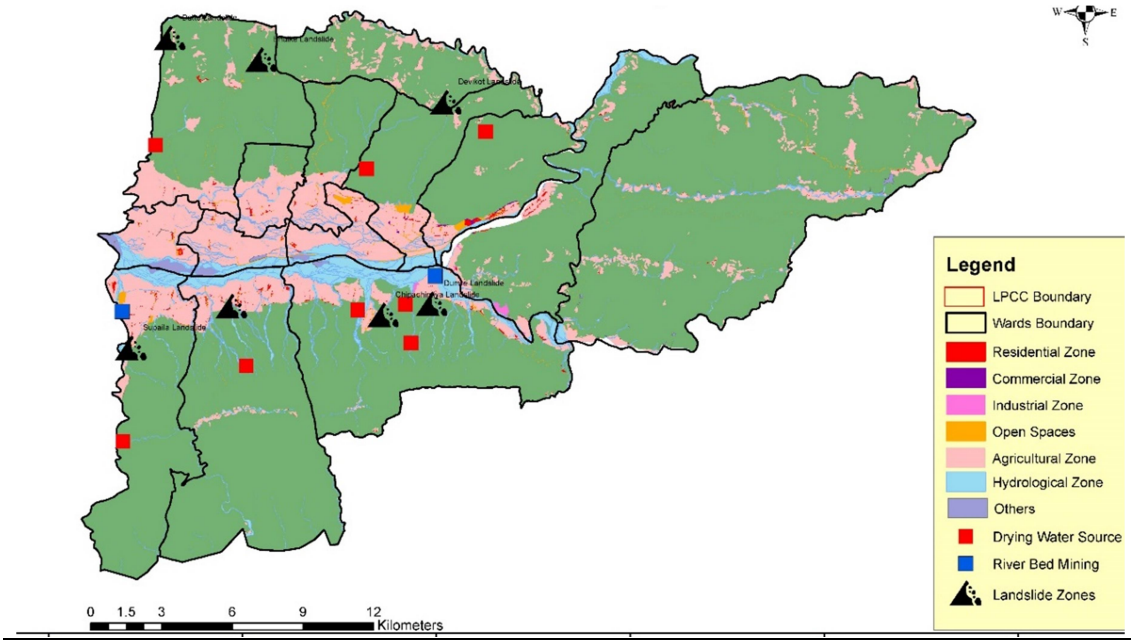


Fig. 2.14 Flood and landslide hazard area in central major part of LPCC area (Source: Modified form MoUSAID, 2019)

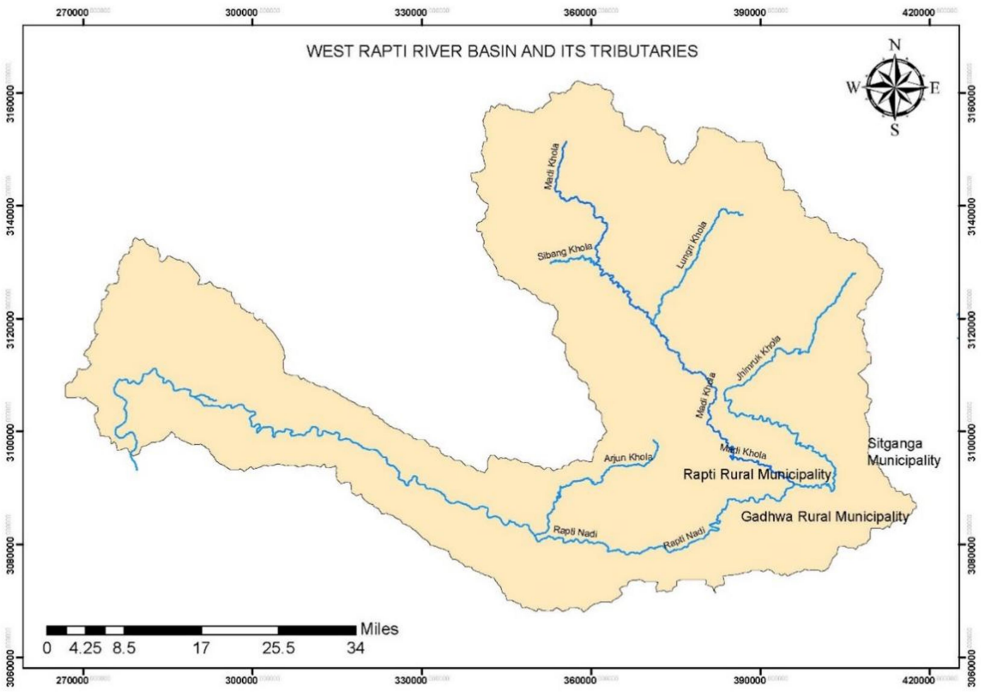


Fig. 2.15 Rapti River Catchment Area (6456 Sq. km. 600km length)

Sloped Vulnerability

While analyzing the slop angle of the LPCC area, majority of mountain areas particularly on the northern side (Rapti rural municipality) and southern part (Gadhawa rural municipality) have sloped between 30° - 40°, not suitable for any sort of habitation (Fig. 2.16). Similarly, the Shitaganga municipal area (ward nos 8 and 9) have majority of mountainous topography having sloped higher than 30°.

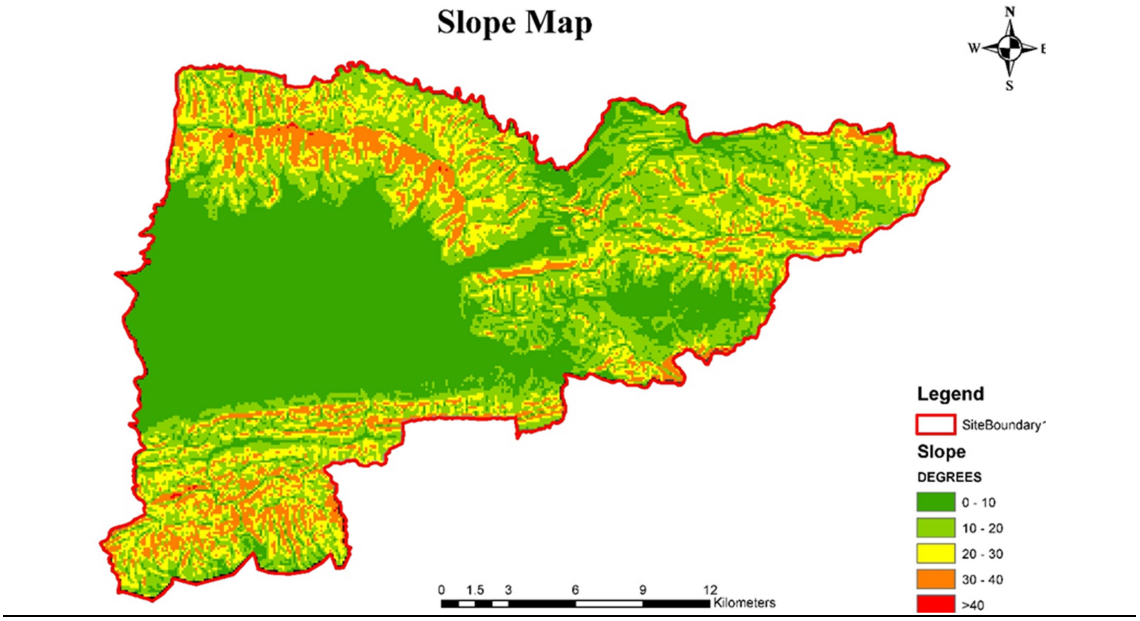


Fig. 2.16 Sloped of the LPCC area

2.10 Ethnic Morphology

LPCC are consist of different ethnic groups. Tharu, Magar and other ethnic groups like Nepali, Sarki, Kumal, etc. The dominant indigenous community in the area is Tharu living in the flat land, while another rich indigenous community living in the hilly area is Magar.

The local vernacular architectural housing belong to Tharu community. The community is rich in culture and lives in community of small groups with row housing ranging from 20 to 50. Indigenous settlements such as Tharu settlement exists in Gadhawa and Rapti Rural Municipality (Fig. 2.17). Such settlement has its own distinct architectural features and is based on traditional cultural practices. The settlements are built of mud, bamboo sticks and are single story thatch or tile roof structures. There is no clear division of room inside the building but spaces for different functions are separated. One of distinct feature of such building is use of maximum use of outdoor space. The entire plot can be categorized into different zones according to use - housing, vegetable garden, cattle section, and drying section. Toilets are also placed outside of building.

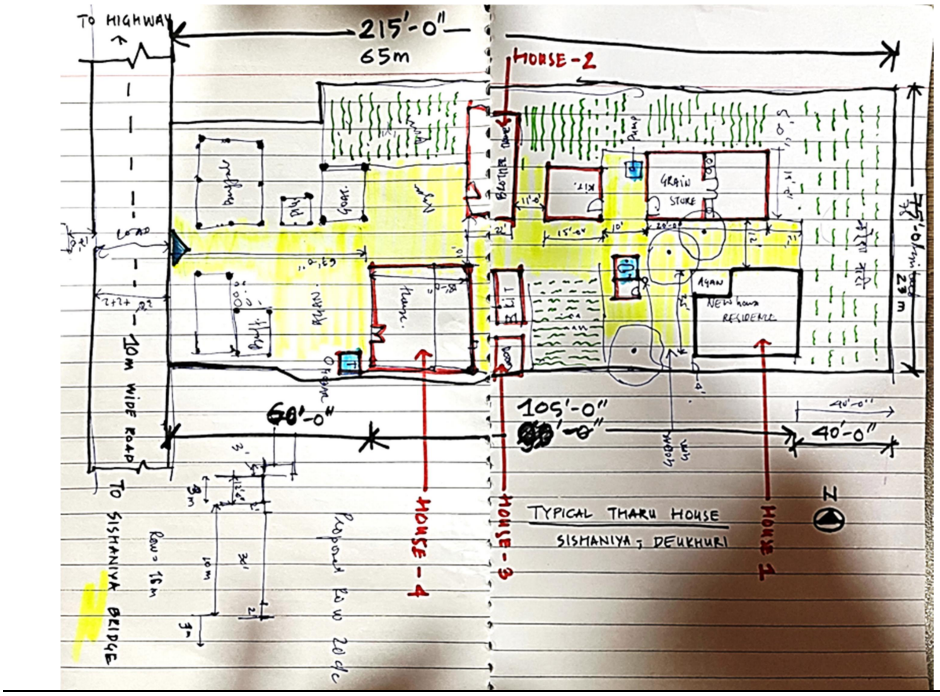


Fig. 2.17 Typical Tharu house layout in Gadhawa area

With modernization, housing needs and culture, attitude towards housing is changing in the traditional settlement. Such changes is visible in current incremental development in the settlement as well in individual housing plots. For instance, shown in figure below from site study, the plot consist of four different houses. One of them is concrete building built to adapt to modern needs and also for security purpose from fire and theft. These houses belong to four families and four cattle raring hut can be seen in the front area, while any remaining large section of large is for vegetable gardening.

Indigenous settlement bear identity of the place is closely related to conservation of tangible and intangible heritage of the area. Tharu community has very rich cultural identity, and protection of its architectural identity is a most for the purpose. This is also important from the perspective of protecting right of indigenous people and improve tourism development prospect in the area.

Fig. 2.18 Typical Tharu Settlement outdoor and indoor spaces with different uses

2.11 International experience in planning of provincial city; case of Gandhinagar, Gujarat, India

After bifurcation from Bombay state in 1960, the Gujarat state came into existence. Existing Ahmedabad city functioned as a temporary capital but it was not suitable for the provincial capital because of its old and congested urban fabrics. Hence, Gandhinagar[46] was planned with ideas of Mahatma Gandhi (and named after him) just 22 km north of the west bank of

[46]The capital city was developed by the State government via bulk land acquisition from farmers at cheap prices using eminent domain. All land development and disposal were through state allotments and auctions. Initially, the reserve price was kept low to encourage people to move to the city, so did not fully recover land and infrastructure costs.

the Sabarmati River as a new provincial capital (Kalia, 2004) by Gandhinagar Capital Projects Division (GCPD) of the state's public works Department (Fig. 2.19) The project area spans 57.38 sq. km and has a planned area of 42.88 sq.km. Town roads divide the area into 30 sectors, most of them are 1000m X 75m in size and 75 ha in area (Byahut, 2019). Each residential sector was planned for 70,000 people, containing schools, shopping, health clinic, library, playgrounds, parks, and other facilities. Internal streets are looped and curvilinear, and residential streets are cul-de-sacs. All streets are aligned at 30° N-W and 60° N-E to avoid direct glare of morning and evening sun while driving. The Gujarat Assembly building is in the center of the city to make it close to all the residents. A separate zoning is proposed for Capitol Complex, government offices, light industries, civic center, institutions and commercial activities. A City Centre and a Zonal District Centre for every 4-5 residential sectors were planned to accommodate large civic and cultural amenities and businesses. The planning has significant percentage of land dedicated for greenery in the form of central vista, ornamental gardens, regional greens and a new urban forest created by planting 4 million trees (Chaudhry et al., 2011).

To establish and maintain a separate identity for the new city, the surrounding area of about 39 villages were brought under a Periphery Control Act (as in Chandigarh) that permitted new development of farm houses only. A combination of variety of densities are proposed: up to 250 pph in government housing clusters, 100 to 150 pph near government offices and industries, and 50-100 pph in peripheral area and high class residential areas. The overall average density is about 100 pph with the spacious character of the city. The Capital Complex, the City Centre and larger office and commercial areas have taller buildings (up to 9 stories) whereas residential areas have generally 2-3 story high structures. Initially, the city was planned for 150,000 residents, but in 1974, the target population for 2015 was expected to 350,000. In 1991, the city had a population of 123,359, which increased in 2001 to 195,985 and in 2011 to 206,167 (GOI, 2011). A significant number of people live in Ahmedabad but work in Gandhinagar due to connectedness and a short commute distance.

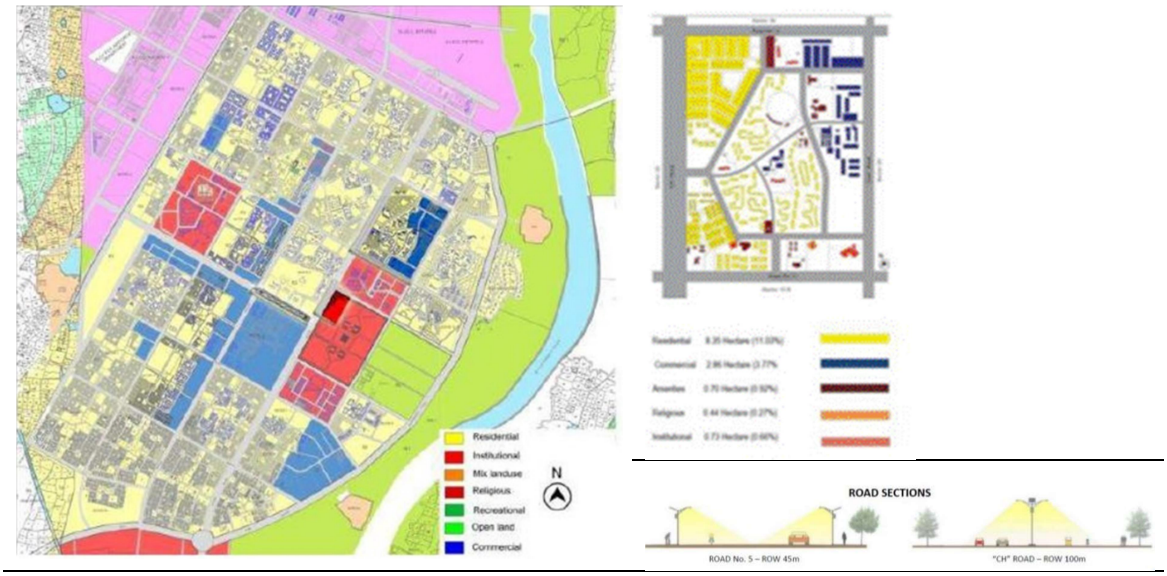


Fig 2.19 Proposed Gandhinagar new town for Gujarat

The city plan was implemented by the Gandhinagar Capital Projects Division (GCPD) of the state's public works department in 1964. The first phase was completed with eight residential

sectors in 1971 and administrative functions moved to the Capitol Complex. GCPD's role was to develop public buildings, commercial areas, and housing as well as manage the water supply, sewage, and drainage facilities. The river being the border on the east, and the industrial area to the north, the most logical future physical expansion of the city was

Despite a planned city, it has felt numerous weaknesses during the course of development. First, the newly developed area is monotonous and lack of vibrant city life. The reasons are numerous. First, the focus of planning was on provincial administrative functions and housing for government employees. In the absent of adequate retail, commercial, economic, cultural or entertainment development, the economy did not diversity to attract businesses or people (Dikshit 1993; GUDA, 2001). Only 20% of planned commercial areas were developed even after four decades and most of it away from populated areas (ibid). Second, the spatial placement of road network, building uses and their densities has mismatch. The sectors were inward looking with the backs of small homes facing main Town Roads whereas many large road facing and corner lots remain vacant. Location of shopping area with high retail potentials has low visibility and accessibility. As retail activities are not allowed along Town Roads, the streetscape has become dull and monotonous during daytime and deserted and unsafe at nights. Town roads with high speed traffic became physical, visual and psychological barriers for different neighborhoods and sectors as well as for pedestrian and bike riders. A separate bicycle and pedestrian network system for each neighborhood, proposed in the original master plan was never implemented. Separation of movement and accessibility did not allow Town Roads to develop as vibrant social spaces, nor as urban economic generators (Mehaffy et al. 2010). Informal development of retail activities could be seen in the neighborhoods. Third, large plots dedicated for commercial, industrial, institution, public and undefined uses remain undeveloped, and vast open spaces also remain ideal, ill maintain and underused. Negligence of spaces between houses but simply plantation on ad-hoc basis did not create a pleasing residential environment. Informal shops came out near large institutional and government areas, along Town Roads and intersections, and in residential areas, thereby creating parking problem street encroachments and traffic congestion. Fourth, efforts were made to diversify land use activities between Gandhinagar and Ahmedabad in 1990 by establishing an electronics industrial estate, the info-city complex and several colleges and corporate offices, with limited impact due to conceptualization of Gandhinagar's existence in isolation from Ahmedabad in the original master plan. Newly proposed activities were found inconsistent with the periphery control imposed when the city was built. Fifth, lack of private sector participation in Gandhinagar's development did not allow a private land market to develop within the city. The peripheral surrounding the city came under intense development pressure thereby causing haphazard growth in the villages nearby. As Gandhinagar New Capital Periphery Control Act enforced in 1960 intents to maintain pristine rural surroundings within a 5 mile radius, conversion of agriculture lands into urban use was prevented thereby causing no land development for decades. As a result, there was artificial land scarcity, high prices and illegal development in villages and near highways.

Recognizing regional growth pressures and constrained development conditions under Gandhinagar's original Master Plan, the state constituted the Gandhinagar Urban Development Authority (GUDA) to prepare a comprehensive, long range, statutory Development Plan under the Gujarat Town Planning and Urban Development Act to transform Gandhinagar from an administrative capital to an economically and culturally

vibrant city and promote regional growth particularly in the area outside the city. The study consists of land redevelopment especially of vacant lots, street facades, and urban design and built for and detailed area studies of various sectors and fast-growing villages (GUDA, 2001). Urban design scenarios were generated to anticipate the character of the resultant built form for various areas to formulate place-based regulations (GUDA 2001b). It was published in the State Gazette and enforced in 2003 after two rounds of public review and modifications (Fig. 2.20). The plan introduced retail and mixed use development along select Town Roads and densification by private sector infill development on larger vacant lots. The Town Road grid was extended south and south-west towards Ahmedabad. Three types of residential zones were delineated outside Gandhinagar: 495 ha as R-5 (medium density residential zone along main growth corridors), 90 ha as R-6 (low density residential towards the River Sabarmati) and 875 ha as R-7 (medium density village expansion zone around seven fast growing nucleus villages to facilitate affordable housing for villagers and migrants). Planned density at saturation is 300 pph for R-5, 27 pph for R-6 and 312.5 pph for R-7. Institutional and large recreational regions were planned along the river to encourage institutional, corporate and recreational uses. A no development zone was proposed along the river and canal edge with minimum intervention that allowed only specific low-density activities. The Periphery Control Act was partially repealed to allow for new growth (GOC, 2003). Seven villages were identified as nucleus villages due to their high growth, strategic location near highways, proximately to Gandhinagar city, village infrastructure and market demand.

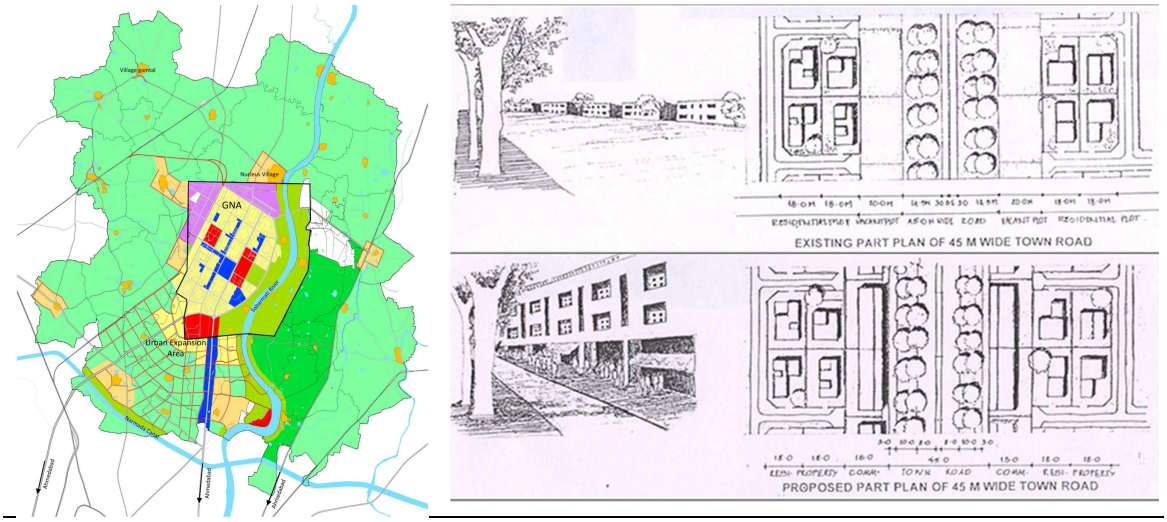


Fig 2.20 Urban design intervention for making new town vibrant and functional

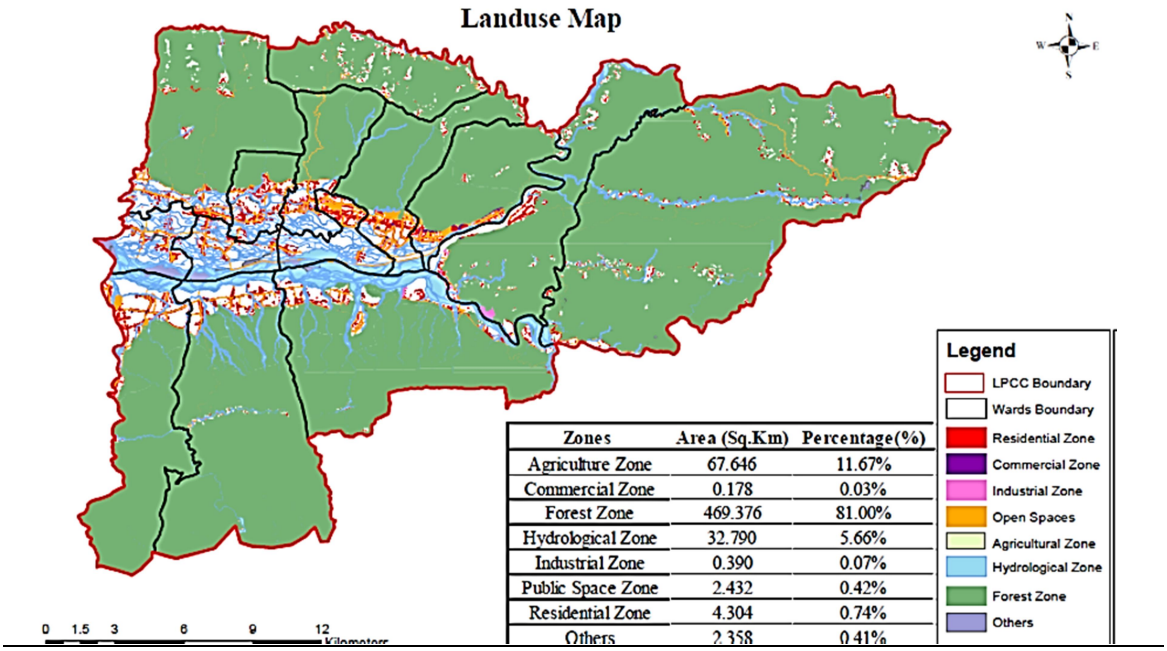
Land readjustment process was adopted with average contribution of 30-40% of original land for road network, open spaces, parks and other amenities including affordable housing. Unlike in the previous case, local land owners acted as a development partners this time. Placed based regulations replaced the earlier rigid building bylaws to achieve vibrancy and vitality, while retaining its distinct identity as a clean and green city with generous space standards and a sector-type character. Both Gandhinagar city and urban expansion areas were categorized into broad land use zones and sub-zones based on the existing built form character and predominant uses, proposed uses, and urban design considerations. Several urban design studies such as streetscapes and building heights and bulk provided a visual

representation of the form and character. To make streets livelier the new plan envisages retail and other non-residential activities along select Town Roads and new service roads are introduced to provide access to the infill retail and mixed use areas. Town road (45m to 100m wide) are redesigned to accommodate existing trees, access roads, wide sidewalks, medians, curbs, roadside parking and space for informal activities. A built-to-line is prescribed at the road edge for infill areas.

Chapter 3. Urban growth and demand projection

3.1 Urban growth trend

Most of the traditional settlements in LPCC area are located at flood plain area on both sides of the Rapti River in Rapti rural municipality as well as in Gadhawa rural municipality. In the recent past, new settlements have been developed along East-West Highway and concentrated at various road cross junctions (Fig. 3.1). Majority of the settlements lie within Rapti rural municipality whereas the villages at ward nos 8 and 9 of Shitganga municipality are scattered with low density.



Zones	Area (Sq.Km)	Percentage(%)
Agriculture Zone	67.646	11.67%
Commercial Zone	0.178	0.03%
Forest Zone	469.376	81.00%
Hydrological Zone	32.790	5.66%
Industrial Zone	0.390	0.07%
Public Space Zone	2.432	0.42%
Residential Zone	4.304	0.74%
Others	2.358	0.41%

Fig. 3.1 Urban growth trend : ribbon type development guided by road network

3.2 Risk Sensitive Zoning

Based on the secondary data and consultation with local inhabitants during ward level workshop, a general map of risk sensitive zoning is prepared (Fig. 3.2). Accordingly, the flood plan area on both sides of West Rapti River along with landslides spots on both north and south sides mountain are the high risk zone. Agriculture lands adjacent to flood plain areas are medium risk zone whereas the plain areas beneath the mountains on both Rapti and Gadhawa rural municipalities have comparatively low risk.

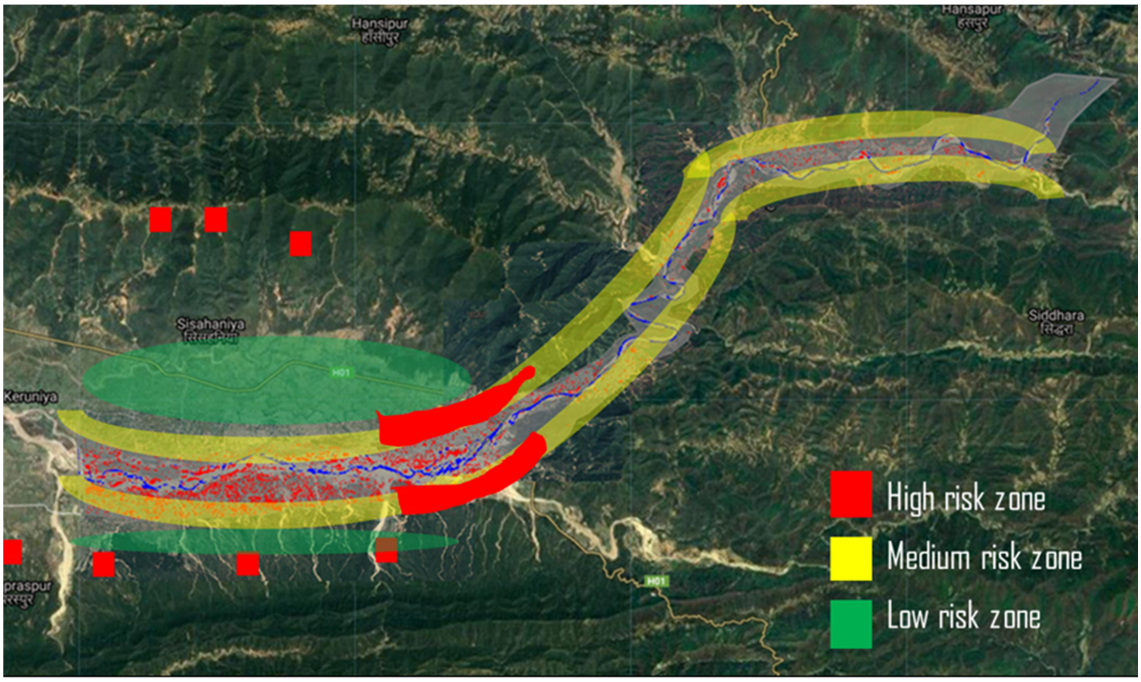
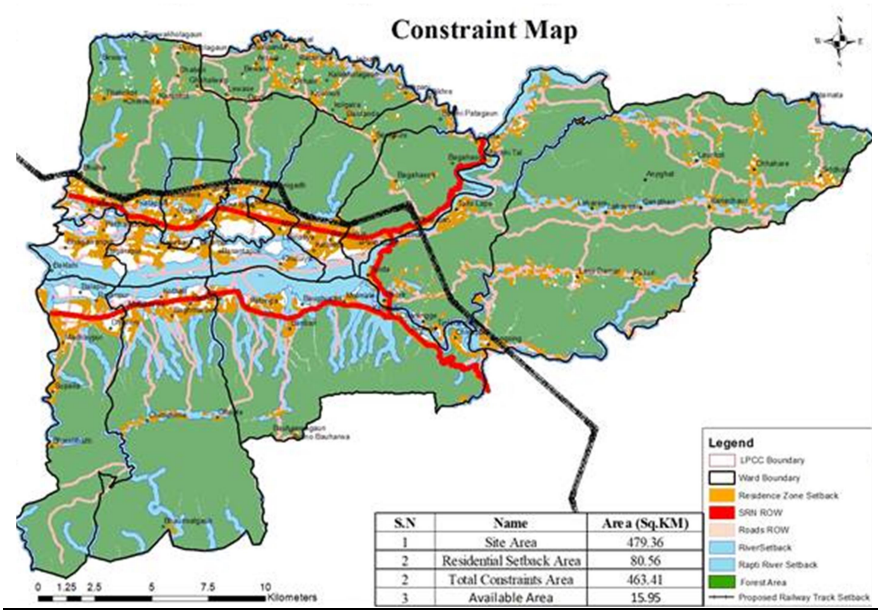


Fig. 3.2 Risk sensitive land use zoning

3.3 Developable area

Developable area is calculated by deducting all constrains such as forest, river setback, road right of way and set back, existing settlements and so on. Available developable areas mainly available in Rapti rural municipality and the agriculture lands on both sides of West Rapti River (Fig. 3.3).



S.N	Name	Area (Sq.KM)
1	Site Area	479.36
2	Residential Setback Area	80.56
2	Total Constraints Area	463.41
3	Available Area	15.95

Fig. 3.3 Developable area available after deducting all types of constraints

3.4 Population Growth Projection

Population of a city is usually broken down into two categories; the residents, who permanently reside in the city for a considerable period of time and are part of official population count, and the floating types, who are in the city but do not live permanently and are not counted for the official census.

The residing population of a city can be sub-classified into two groups, one who permanently resides in the city for a considerable period of time such as ten to fifteen years, and the another include population such as students, transferable government employees, who might live for two to three years in a given area, as per their requirements, but are replaced by an equal number of new population for the same purpose after their departure. Thus, at any given time the number of people under this category remains more or less the same.

Population growth is calculated combining different data and information. Annual population growth of Lumbini Province (1991-2001), Dang district (2001-2011) and Rapti rural municipality (2011-2018) was analyzed (Table 3.1). Among them, the highest population growth of Dang district, 1.8% is considered for population projection of LPCC area for the year 2031. It is assumed that the population growth will increase after 2031, as most of the provincial capital infrastructures will be established by then. Hence, annual population growth of 2.4% is assumed for LPCC area between 2031-2041 and then for the next 10 years, the growth will be only 2.2%. With these assumptions, the LPCC area has 65,705 population which will be increased to 82,855 in the year 2031 and 130,564 by 2051.

Table 3.1 Population projection for LPCC area

Annual population growth of Lumbini Province between 1991-2001	1.37%
Annual population growth of Dang district between 2001-2011	1.8%
Annual population growth of Rapti rural municipality between 2011-2018	1.23%
Annual population growth of LPCC area between 2018-2031	1.8%
Hence, the population projection of LPCC for 2031 = 65705 X (1+(1.8/100))13 =65705X1.26102 = 82,855	1.8%
Annual population growth of LPCC between 2031-2041	2.4%
LPCC 2041 = LPCC 2031 X (1+(2.4/100)) 10 = 82,855 X (1.024)10 = 105,031	
Annual population growth of LPCC between 2041-2051	2.2%
LPCC 2051 = 105031 X (1+(2.2/100))10 = 105031 X1.2431 = 130,564	
Hence, LPCC 2018 = 65,705 LPCC 2031 = 82,855 LPCC 2051 = 1,30,564	

The floating (float and move) population is a group of people who reside in a given population for a certain period and for various reasons, but are not generally considered part of the official census count. Such population is difficult to forecast. The number of floating population largely depends on the livability of location. A livable environment is a sum of physical environment, social environment, availability of employment opportunities and services available. That means the service delivery and the infrastructure supply system of a city is a prime concern for such people. The favorable the service and infrastructure condition, the higher is the population and Vice versa.

The floating population, on the other hand, of a city consists of two types. The first ; is those who visit a place regularly but do not stay in that area permanently or long enough to be considered official, such as a person working in a city for a job for short time. The second type consists of visitors or guests who might live for a small span of time, but their time of stay and their next visit are not predictable, like tourists and seasonal visitors.

In this forecast, for the permanent population, CBS and the rural/ municipality data has been taken as reference. To forecast the floating population, it is difficult because it's a virgin city and there is no any footprint for tourism or any industry like construction, therefore we have considered it from our past experience and with some assumptions based on the city size and proposed projects in the master plan.

The existing housing number in LPCC area is around 25,000 for a population of 68000. Let's assume that floating population of the city be 40 percent. Thus the total population for 2031 and 2051 will be133, 000 and 250,000 respectively.

3.5 Infrastructure Gap and Projection

Infrastructure demand for LPCC area in 2031 is projected by linking the city population with urban planning norms and standards 2015, prepared by the government of Nepal. As the population of LPCC area will be less than 100,000 in 2031 but nearly 0.13 million in 2051, required infrastructure for that level of population is listed focusing physical, social and economic infrastructure (Table 3.2).

Table 3.2a Physical Infrastructure projection

Types	Norms	Standards	For 2021		For 2031,	For 2051,	Remarks
			Existing	Gap			
Road	7 km/sq.km	763.04 km	501km	262 km	763.04 km	763.04 km	
Water Supply System (with storage and treatment facilities)	80% HHs have metered connection and distribution	Quantity: 80-100 lpcd	80*69317 = 55453600	nil	6,628,400 (80xpopulation in 2030)	1,30,56400 (100xpopulation in 2050)	
	Treatment Plant (lab, dosing and guardhouse) with storage facility: Reservoir (24hr requirement)	2 ha/ site (Storage capacity: 25% of the total treatment capacity)	None	3 no (2 ha per site)	3 no (2 ha per site)	3 no (2 ha per site)	Assuming one is sufficient for each site
Sanitation (Sewerage System)	Treatment plant	0.2 hectare/MLD – 0.75 Hectare/Mld 2.5 ha – 3.5 ha per site	none	3 no. (2.5 ha – 3.5 ha per site)	3 no (2.5 ha – 3.5 ha per site)	3 no (2.5 ha – 3.5 ha per site)	Assuming one is sufficient for each site
	Provision of public latrines (male, female, disabled)	1/2000 passerby at a distance of 500 m	1	13*3=39	100 (assuming 30 km of public transport route)	160 (assuming 30 km of public transport route)	To be Updated for 2031 & 2051 after getting road data for different years
Drainage	Storm water drainage	Storm water drain and safely disposal	none	1002 km			As above
Solid Waste	Transfer Station	1 Transfer Station for 1 city if the final disposal is more than 10 km	no	2	2	2	One separate transfer station is required for Shitaganga due to difficult topography
	Sanitary Landfill Site/ solid waste management site	Sanitary Landfill Site: Medium (> 25 and < 500 tons per day)	no	1	2	2	Rapti and Gadhawa
Electricity Supply	National grid supply line	Power access to 100% coverage.	90.68	9.32%	100%	100	
Source refer and updated : DUDBC, 2013							

Similarly, there will also be social infrastructure gap in LPCC area in 2031 and 2051 (Table 3.2). There will be demand of numerous social infrastructure such as institutional, health facilities and many others.

Table 3.2b Social Infrastructure Projection

Types	Norms	Standards	For 2021		For 2031	For 2051	Remarks
			Existing	gap			
Educational Institution	Primary/ basic level	1 per 3000 population at a distance of 0.4–0.8 km – 0.2 ha per site	59	nil	**28**	44	
	Higher Secondary	1 per 7500 population at a distance of 30min in public transportation – 0.65 ha per site	63	nil	11	17	
	Graduate/ Post graduate	1 per 25,000 population at a distance of 45min in public transportation	1	3	3	5	
	University	1 per 40,000 population at a distance of 1hr in public transportation	0	2	2	3	
Health Institution	Primary Health Care Center	1 per 20000 population (5-15 beds): 0.04 / site	?	4	4	7	
	District Hospital	1 per 50000 population (25-50 beds): 1.3 ha/ site	?	1	2	3	
	Zonal Hospital	1 per 100000 population (50-100 beds)	none	NA	NA	1	
Open Space	5% of total sub metro city area		Gadhawa-4 Rapti -15 Shitganga-8				
	Neighborhood park with play	1 @ 800 population (1 ha per site)		86	104	163	
	Local Park	1 @ 10000 population (1 ha per site)		7	8	13	New to be planned
	Community Park	1 @ 20000 population (2 ha per site)		4	4	7	
	Parade Ground	1 @ each city		1	1	1	
	Zoo park /Specialized Park			1	1	2	One park in 2031
Library	Community Level	1 per 10,000 population (0.5 ha per site)	Not identified	7	8	13	
	City Level	1	Not identified	1	1	1	
Fire Stations	City level service	1 fire station @ 100,000 population (10,000 sq. m per site)	no	1	1	1	
Security	Police Post	1 per 10,000 population (0.1 ha per site)		7	8	13	

Types	Norms	Standards	For 2021		For 2031	For 2051	Remarks
			Existing	gap			
	Police Station	1 per 40,000 population (0.5 ha per site)		2	2	3	
	Headquarter	1 per 100,000 population (1 ha per site)		1	1	1	
Religious Institutions	Cremation areas, cemetery / burial ground	1 (0.5 ha per site)	6 sites in Shitaganga, river banks in Rapti & Gadhawa	Nil	3	3	One electric cremation is required for each territory
Art Gallery/museum	City Level	1 (0.5 ha per site)	none	1	1		
	National level	1 (0.5 ha per site)		NA	NA	2	
Old age, orphanage, center for disabled	City and community level	1 per 20,000 population (0.3 ha per site)	none	4	4	6	
Exhibition Centers	City Level	1 per 50,000 population	none	1	2	3	
Source: DUDBC, 2013							

In terms of economic infrastructure too, LPCC needs many infrastructure by 2031 (Table 3.2c). The city will need sport activities, town halls, vegetable market and bus terminals in future.

Table 3.2c Economic Infrastructure Projection

Types	*Norms*	*Standards*	*For 2021*		**For 2031**	**For 2051**	*Remarks*
			Existing	*Gap*			
Hall	City Hall (Multipurpose)	1 per 10000 population (0.2 ha/site)	none	7	8	13	
	City level	1 per 100000 population (2 ha/site)	none	NA	NA	1	
Sport complex	City level (football ground, volley ball, swimming pool etc.)	1 per 50000 population (1-3 ha/site)	none	1	2	3	
	Regional level	1 per 100000 population (3 ha/site)	none	NA	NA	1	
Movie Hall	City and local level	5 seats per 1000 population	none	2	2 (200 seats)	3 (200 seats)	
Vegetable Market	Neighborhood level	1 wholesale, 1 retail and 1 Slaughter House for 2 neighborhood (0.5 ha per site)	1 each (Bhaluwang, Sishaniya, Maurighat, Lalmatiya, Sgrapur, Pipari , Gadhawa , Shitganga)	11 slaughter houses 3 market 11 retail	14 slaughter house 14 whole sale 14 retail	22 slaughter houses 22 vegetable markets 22 retails	
Transportation system	Bus station		32				
	Parking Space	1 Parking lot for 3000 population (0.04 ha per site)	none	22	28	44	
	Intra City Bus, Inter City Bus Terminal (within the city) 1	1 parking lot for 100 buses and 100 trucks (4 ha per site) 1 parking lot for 100 buses (2 ha per site)	1(Gadhawa) 1 Bhalubang Sishaniya Lalmatiya Hasipur 1 and 2	None	2	2	
	National Airport	National Airport 134-227- national airport	none	nil	nil	nil	Dang and Bhairahawa airport
Source: DUDBC, 2013							

The above tables in this section summarizes the projects required for the establishing of the city in social, physical and economic aspects as per the prevailing norms and standard developed in the country for urban development context. However, such standards should be flexible as per local context and need upgrading maintaining minimum standard needs for the project. Some of major projects required has been summarized below:

Table 3.3 Summary of Major Projects

Sn.	Major Infrastructure projects	Projected for 2031	For 2051
1	University	2	3
2	Post Graduate College	3	5
3	Primary health post	4	7
4	Hospital	2	3
5	Bus Terminal Intra city	1	1
6	Bus Terminal Inter city	1	1
7	Water treatment plant	3	3
8	Sewer treatment plant	3	3
9	Waste management site	2	2
10	Community Library	8	13
11	Central level library	1	1
12	City level Museum	-	2
13	Exhibition and city hall	2	3
14	Fire station	1	1
15	Orphanage, old age home	4	6
16	Movie hall	2	3
17	Security police post / Beats	8	13
18	Police station	2	3
19	Stadium	2	3
20	Neighborhood park	104	163
21	Community park	8	13
22	Zoo/specialized park	1	2
23	Vegetable Market centers		
24	Slaughter house		
25	Cemetery	6	6

3.6 Major Public Open Areas and the Settlements

The study area comprised of many public open spaces of varying size and shapes. They have been used either for recreation activities or remain open without any major land use. It can and should be used for disaster events.

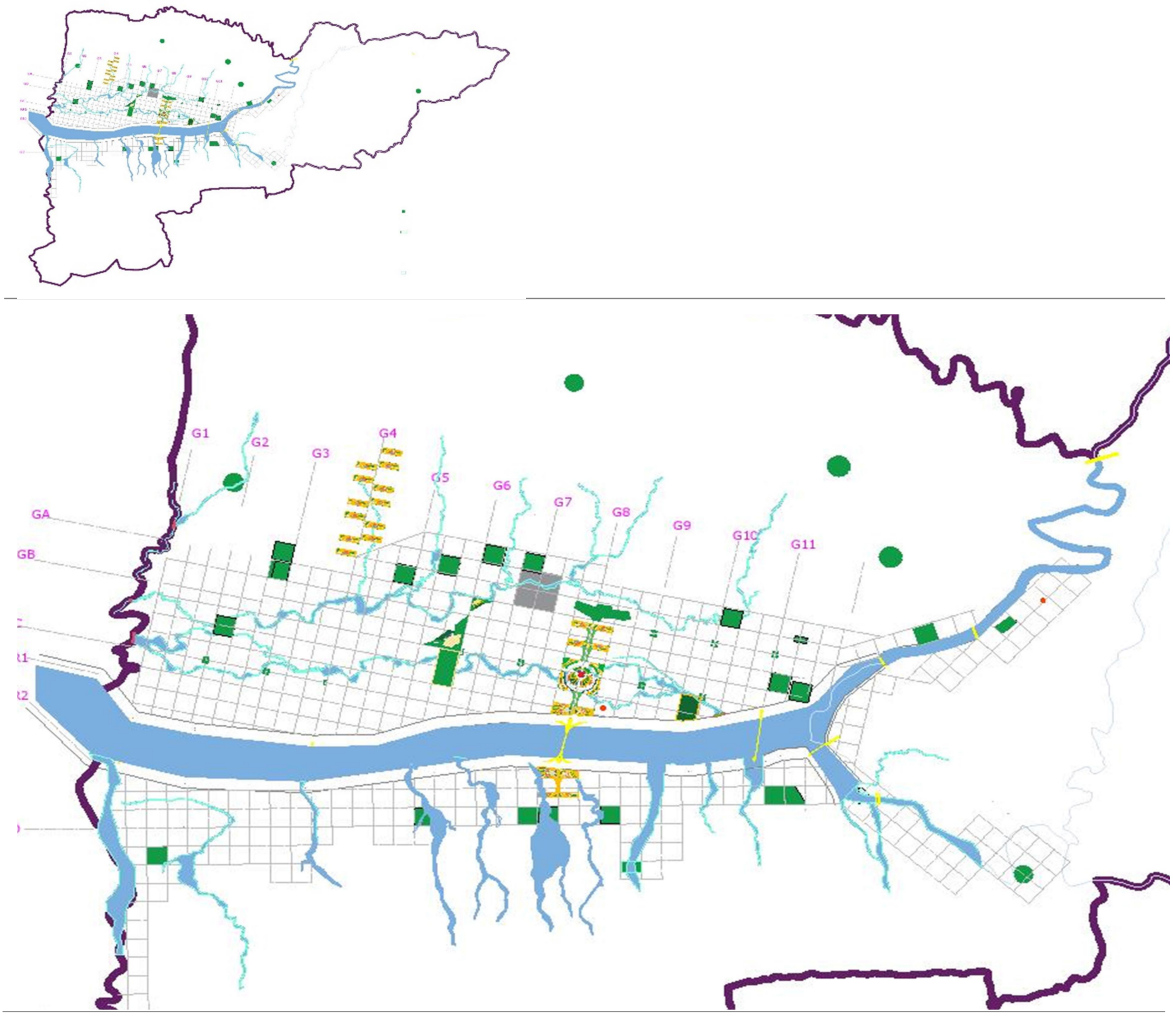


Fig. 3.4 Proposed Public spaces

Lalmatiya Ground

It is biggest open space in Rapti Rural Municipality. The space is open and currently being used as ground. A high tension line is passing through the ground. The area is around 50-60 Bigha (Fig. 3.5). Ward office is nearby the site. This space is also useful for community use. Given the existence of high tension line the space can be carefully used during emergency period avoiding the area occupied by high tension, since the space is large. This space is important for conservation given its one of largest open space currently. It can also be used for community gathering.

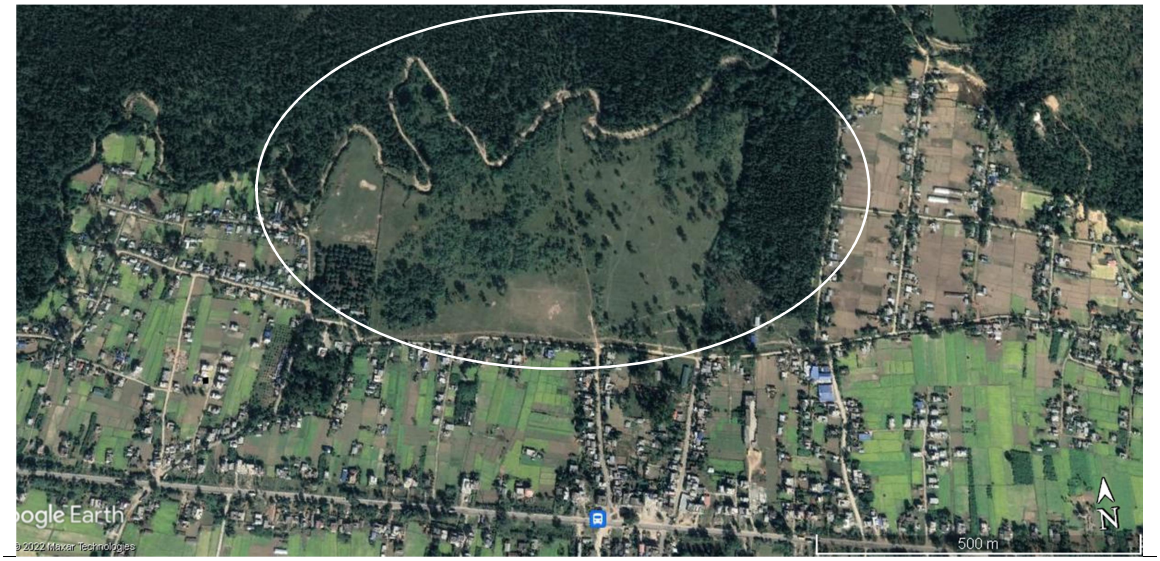


Fig. 3.5 Lalmatiya ground (proposed for institutional zone)

Shree Chaur

The ground is located in Rapti ward 3 is about 10 Bigha in area (Fig. 3.6). It contains a small Shiva temple, a water tank tower and forest. Currently Rapti technical school locates near this area. It is one of central large open space located in Rapti rural municipality. It can be used for emergency use during disasters such as earthquake.

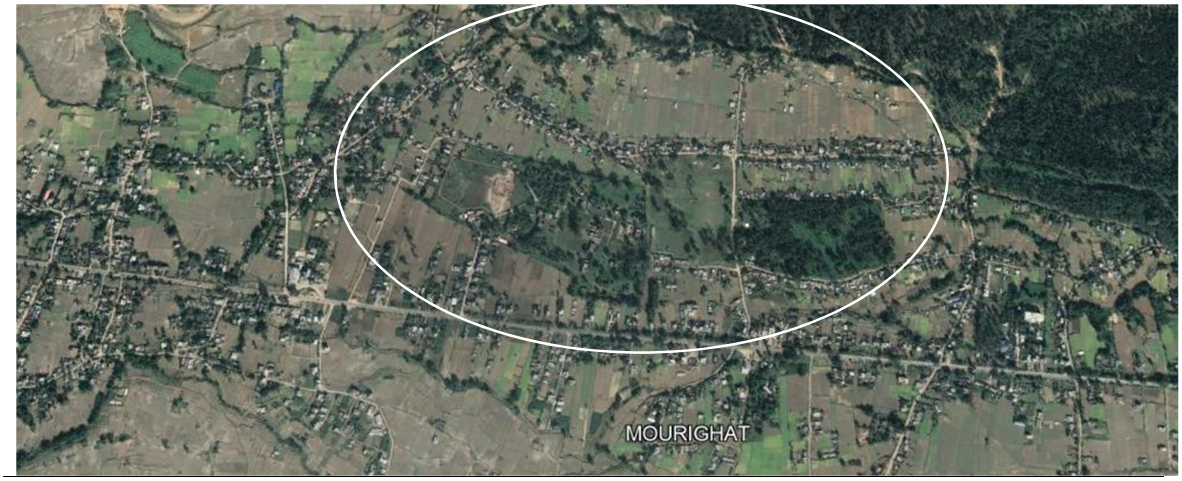


Fig. 3.6 Shree chaur ground at ward 3 of Rapti rural municipality

Pakhapani

An open space of 6 Bigha land is available at Pakhapaani with a lake. The place is currently being used as playground. It consist of Shiddheswro Shiva temple too. The lake can be used for rainwater harvesting, while the entire area can be developed as Community Park.

Dhodre

An open space of 27 Bigha and more is available at the bank of Ransing River and Dhodre village. The open space can be developed as Recreation Park. An irrigation dam of Badkhapath project lies here as well along with stone crusher industries. A High tension line

also passes through this area. Since the place lies in flood plain, it can be used for recreational and temporary use, and agricultural propose.

Bhulke Gaun

The village lies in Ward 5 of Rapti Rural Municipality at mountainous region. It is a traditional Magar village, thus can be used for tourism development. One of attraction of the place is Baraha temple for the local surrounding the area which also consists of five traditional taps.

Kulpani Park

Kulpani Park built within kulpani temple territory used for recreation purpose in Gadhawa ward no 1 (fig. 3.7). The park is a locally managed religious forest by local consumer committee. It is being developed for religious tourism and recreational tourism. The area of the forest is about 436.2 hectare. The consumer group has been working for the conservation of lake's natural beauty, garden, temple, park, footpath, and wildlife conservation tree tower, and other structures. This public space is important from the perspective of tourism development and conservation of natural resources within the region.

Fig. 3.7 Kulpani recreation area

Harshe Dada

Harsheda, a religious and tourist site located in Ward No. 2 of Rapti Rural Municipality. Located north of Lalmatiya Chowk. The site has a religiously sacred temple with a lake, forest, and park. The site has been protected for the conservation of wild products and wildlife. Donors have also built various physical structures in the area, which are free to enter. The road leading to the Harshedada religious and tourist site, about 1 km north of Lalmatiya Chowk, has been blacktopped in the budget of the village Municipality and ward office. Harshedada is a religious and tourist destination for performing religious activities, picnics, enjoying a peaceful environment, and hanging out with friends.

Fig. 3.8 Harshe Danda site located near Lalmatiya

Bhadrashidevi temple

The Hindu temple is located in a remote area in Devikot, Rapti rural Municipality ward no 9 at about eight kilometers east of the East-West Highway. According to legend, Satyadevi's left knee fell in Devikot and Bhadrashi Devi was born. According to temple priest Lila Bahadur Karki, Bhadrashi Devi has been worshiped in Devikot since the Satya Yuga. The view of Deukhuri Valley can be seen from Devikot. From the hills of Devikot, one can see the snow-capped mountains, hills of the Mahabharata range to the north, the plains of Deukhuri, and even the border area of India to the south.

Khauraha Baba

Khauraha Baba is situated on the northern side of Kalapani village of Rapti rural Municipality ward no 5 at 1.5 km north of Sishniya Bazaar. This place is traditionally considered important from a religious point of view and in recent times, it has become an attractive place for tourism. The site, which is home to beautiful natural resources, magnificent Shiva temples, attractive lakes, bathing pools, various species of birds, and wildlife, is frequented by domestic tourists for picnics, and bathing for health benefits. It has been believed that skin-related diseases can be cured by observing this place and taking a bath. The place is being developed as picnic spot as well by forest division.

Chapter 4. Strategic Spatial Planning

4.1 Concept Evolution and Development

As Lumbini Province[47] was named after the Lumbini, the scared place of birth of Gautam Buddha, the comprehensive master layout plan of Lumbini provincial capital city should have some symbolic representation associated with it. Lumbini is one of the holiest places of one of the world's great religions. It has been enlisted into the UNESCO's world heritage site.

Buddhist Philosophy to Geometrical Form with Symbolic Meaning

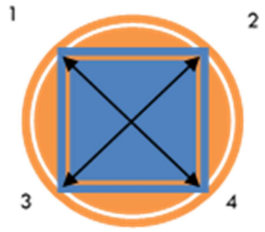
Buddhism or Buddha's teaching is associated with phenomenological aspect of philosophy and the therapeutic aspect of psychology with little resembling to religion. It is described as psychotherapy (applied psychology), since the teaching includes the mind and mental states to deal with the problem of disease and cure, disturbance and adjustment. It's a system of philosophy coordinated with a code of morality, physical and mental. Among many school of thoughts, three majors namely Theravada (Hinayana), Mahayana and Vajrayana are still practices in various parts of the world.[48] They are unified by certain common doctrinal and textual facts. They accept the early sermons of the Buddha, the Four Noble Truths and the Eightfold Path, the doctrine of mutual dependence or dependent co-arising, and the lack of a self or substance at the core of individual existence, the doctrine of no-self. They consider Buddha as only master and take refuge in Buddha, the Dharma and the Sangha. They believe in three ways of attaining 'bodhi' or Enlightenment, according to the ability and capacity of each individual – (a) as a disciple (sraavaka), (b) as a Pratyeka-Buddha and (c) as a Samyak-

[47] The Provincial Assembly adopted Lumbini Province as the permanent name by replacing its initial name Province 5 on 6 October 2020 and Deukhuri was declared the state capital of the province.

[48] Buddhism is being practiced in four different ways in the present world: (a) religious Buddhism, (b) academic Buddhism, (c) cult as Buddhism, and (d) traditional Buddhism teaching of Shakyamuni Buddha. The essences of Buddhist teachings lie in simple, ordinary guidelines that help us live our lives in harmony with ourselves, others, and our environment. Buddhists and Practitioners are not a matter of following monastic order and worshiping Buddha and Bodhisattvas; it is experience, in particular the experience of feeling dependent upon the universe. Increasingly, many are studying Buddhist principles for use in business management techniques and conflict resolution. By far the vast majority see Buddhist philosophy and meditation as a means of attaining good mental and physical health, personal fulfilment and satisfaction

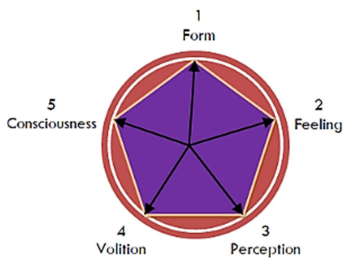
sam-Buddha (perfectly and Fully Enlightened Buddha). Hence, the number '3' has symbolic meaning in Buddhist philosophy. The discourse Buddha delivered inc the Deer Park at Sarnath after his enlightenment known as 'The Setting in Motion of the Wheel of the Law' revolves around the doctrine of 'The Four Noble Truths,' which is the fundamental teaching of Buddhism (Table 4.1). They are: (a) The Noble Truth of Suffering 'dukkha', (b) The Noble Truth of the Cause of Suffering 'Samuda', (c) The Noble Truth of the End of Suffering 'Marga', and (d) The Noble Eightfold Path 'Nirodh'. In fact, the first three of the Four Noble Truths expound the philosophy of the Buddha, while the fourth (the Eightfold Noble Path which is a code of morality-cum-philosophy) serves as a means to the end. Therefore, the number '4' is also considered as 'pure' in Buddhism.

Table 4.1 Relationship of geometrical form and its symbolic meaning for Four Noble Truths

	(a) Suffering as imperfect, stressful, or filled with anguish, which contribute to the anguish of the fact that all things are impermanent, including living things like ourselves.
	(b) Attachment means thirst and form desire, clinging, greed, craving, or lust. As the world and people are impermanent and no separate, people are clinging to things, each other, and ourselves, in a mistaken effort at permanence.
	(c) Overcoming of attachment refers to the letting go of clinging, hatred, and ignorance, and the full acceptance of imperfection, impermanence, and interconnectedness.
	(d) There is the path called Dharma or Middle Way, which is understood as meaning the middle way between such competing philosophies as materialism and idealism, or hedonism and asceticism.
Square – pure form (4 sided)	

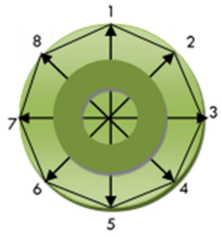
The concept of 'Dukkha' can be viewed from three different perspectives: (a) dukkha as ordinary suffering – physical and mental suffering due to not getting what one desires, separation from beloved ones and pleasant conditions including old ages, sickness, death and so on, (b) dukkha as produced by change such as a happy feeling, a happy condition in life, and so on, and (c) dukkha as conditioned states – the concept of individual or as 'I' which in rapid and habitual combinations, come mistakenly to be regarded as an individual and indivisible 'self.' The whole field of living experience can be defined in terms of the five Aggregates (skandha) or the twelve bases of Consciousness as (Table 4.2): (a) Form – made up of the four elements namely earth, water, fire and wind, (b) Feeling – can be pleasant, unpleasant or neutral – on twelve basis of consciousness, (c) perception – is related to the six external objects and is the act of recognizing and naming any particular feeling, (d) volition – is the reaction of the will to the six objects, whether good or bad, and (e) Consciousness – is the reaction or response that occurs to stimuli from one of the six organs or one of the six corresponding external phenomena.

Table 4.2 Relationship of Geometrical Form and the Five Aggregates

	1. Form	4 great element			
	2. Feeling	12 basis of consciousness	Internal 1. Eye 2. Ear 3. Nose 4. Tongue 5. Body 6. Mind	External 7. Sight 8. Sound 9. Smell 10. Taste 11. Touch 12. Mental object	
	3. Perception	6 external objects			
	4. Volition	Reaction of will to 6 objects			
	5. Consciousness	13.Visual 16.Gustory 14. Auditory 17. Tactile 15. Olfactory 18. Mental			Transitory – perceptual changing
Pentagon – (5 sided)	5	18	6	6	

The Noble Truth of the End of Suffering is Nirvana. It is the destruction of desire and the basic passions which are carving, hatred and delusion. The destruction of the passions neutralizes actions and prevents them from yielding any result. It is also the disappearance of the five aggregates and the end of painful rebirth. Secure from birth, disease, old age and death, Nirvana is supreme happiness. It can be achieved through the Noble Eightfold Path. The eight division, which fall into three sets, should not be considered sequential stages, but interrelated aspects of an integrated whole, each strengthening and reinforcing the others (Table 4.3). Morality (sila) comprises of Right Speech, Right Action and Right Livelihood. It aims is to avoid any action which might harm someone else. Mediation (Samadhi) consists of Right Exertion, Right Attentiveness and Right Concentration. It helps to fix the mind on one point. Wisdom (Panna) consists of Right Aspiration and Right Understanding. It is the ultimate and main element of the Path. The practice of concentration is not adequate in purifying the mind, wisdom is also necessary to ensure quiescence, peace and Nirvana. Thus, Buddha's teaching contains three major points: discipline, meditation and wisdom. Wisdom is the goal and deep meditation or concentration is the crucial process towards achieving wisdom. Discipline through observing precepts, is the method that helps one to achieve deep meditation; wisdom will then be realized naturally. The basis of Buddhism is enlightenment achieved through learning and cognition, not faith. It is the state of absence in which desire, hatred and attachment is distinguished, a state of a person reposing on himself, withdrawn from the stress and movement of phenomena.

Table 4.3 Noble eightfold path into three sets

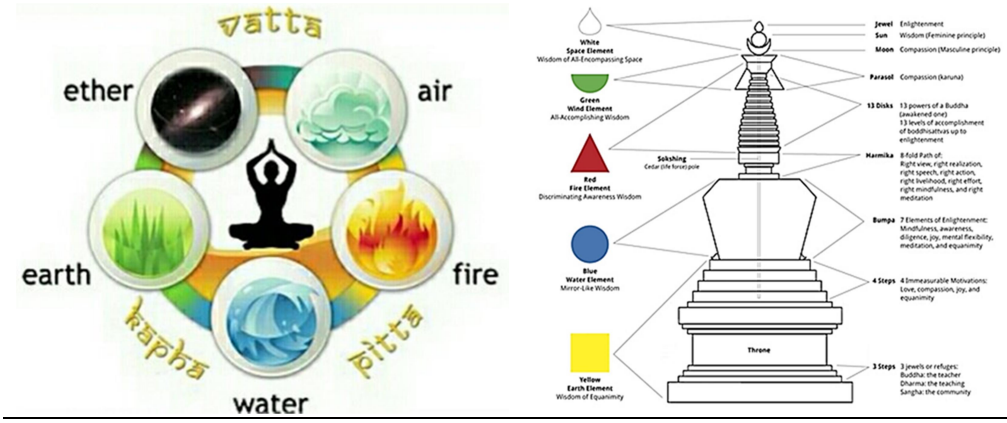
	Morality/Sila	1. Right Speech 2. Right Action 3. Right Livelihood	
	Samadhi/Mind	4. Right Exertion 5. Right Attentiveness 6. Right Concentration	
	Wisdom/Insight	7. Right Aspiration 8. Right Understanding	

Pure form – Octagon (8 sided)	3	8	0

Five forces of nature

According to an ancient eastern thought, there are five basic elements or forces of nature which compose the Universe. These five forces often known as 'Pancha Mahabhootas.' They are five great basic physical elements, which according to Hinduism, is the basic one of all cosmic creation. These elements are Earth, Water, Fire, Air and Ether (or Sky). These elements having different characteristics account for different faculties of human experience. In Ayurveda, the body of human is said to be made of the five elements.[49]

The depiction of these elements in tattoo art design appears as a column of separate symbols which represent each of these five elements. At the base is a square, which represents the Earth element. Then, there is Circle symbolizing the Water element. The triangle denotes for the Fire element and upturned and open crescent for Air. A dot suspended above the crescent represents the Ether or Sky. Such identical form is also seen in the graphic representation of the Stupa (Fig. 4.1).



(a) Five basic elements of human life as 'Pancha Mahabhootas'

Symbolic meaning of Stupa resembling to Pancha Mahabhootas

Fig. 4.1 Correlation between Hinduism and Buddhism

4.2 Development of Master Plan

Two development scenarios were prepared as per suggestion and discussion during various stages of the planning process. The scenario is basically based on the multiple analysis and evidences, as carried out in previous chapter.

4.2.1 Planning Philosophy

Translating Buddhist philosophy and learning into physical development plan in preparation of comprehensive master plan for LPCC is challenging. Such translation should be 'symbolic' with qualitative meanings. The three key words associated with Buddhist learning and teaching are Peace, Coexistence and Respect and it can be correlated with three development planning goals namely sustainability, respect of conservation (past heritage) and

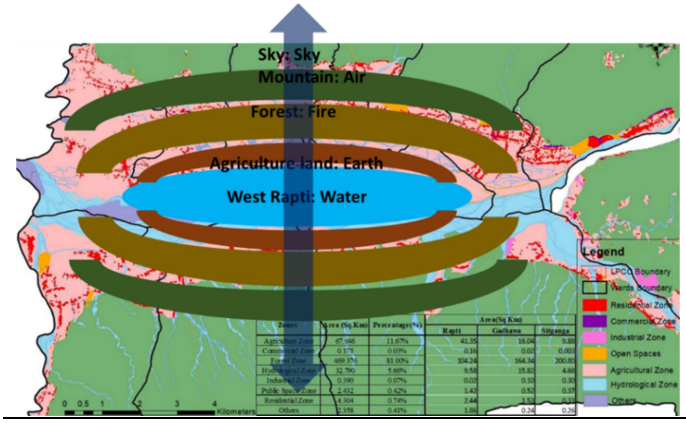
[49] Carvaka did not accept the Ether as a basic element, because it is not tangible and hence consider only four basic elements.

adaptation of present day needs and natural resource management and ecological balance (Table 4.4). Peace cannot be achieved without socio-economic modernization and improving quality of life of inhabitants. Harmonious coexistence between urban and rural lifestyle is required. Conservation and modernization is possible only with coexistence of nature and human habitat. Respect of nature and culture is also essential.

Table 4.4 Correlation between Buddhist learning and development planning

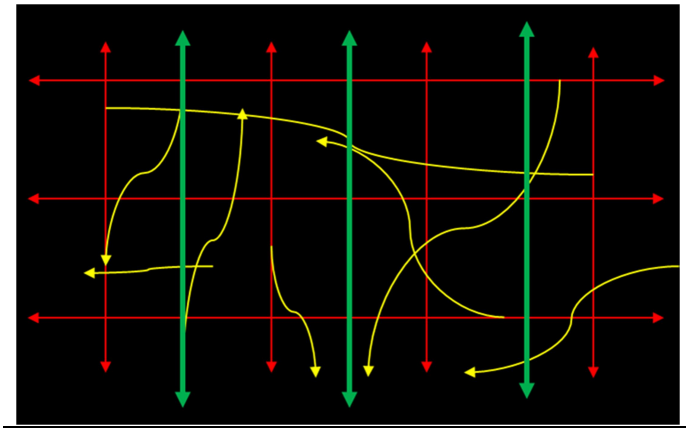
Peace	Socio-economic modernization	Sustainability
Co-existence	Nature and human	Conservation and modernization
Respect	Nature and culture	Natural resource management & ecological balance

LPCC area is rich in natural resources and comprises of river, agriculture land and mountain. The west Rapti River is the back bone of the inhabitants. It can be correlated with 'Water' of the five basic elements (Fig. 4.2a). Agriculture land along with newly developed area along the East-West Highway corresponds to 'Earth' whereas the forest acts as 'Fire' of the basic elements. The peripheral mountains resembles to 'Air' and finally the 'Sky.' To strengthen this cycle or linkages, major road network as well as greenery network are developed towards north-south direction so that all these five elements are physically, visually and psychologically visible and accessible (Fig. 4.2b).



West Rapti river	Water
Agriculture land & settlements	Earth
Forest	Fire
Mountain	Air
Sky	Sky

(a) Correlating five basic elements of life with the landscape of LPCC area

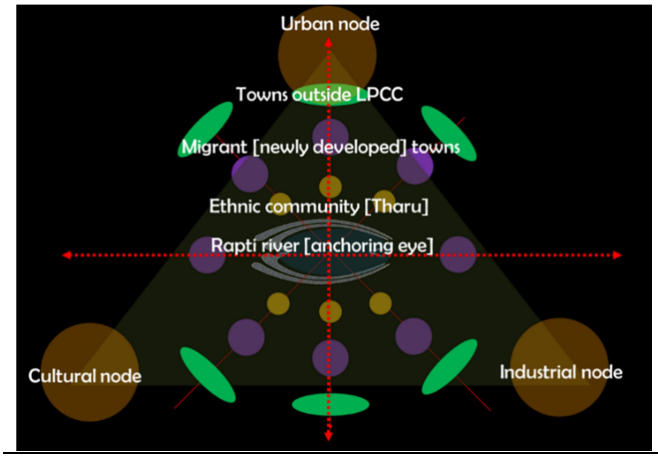


Physical, visual and psychological axes

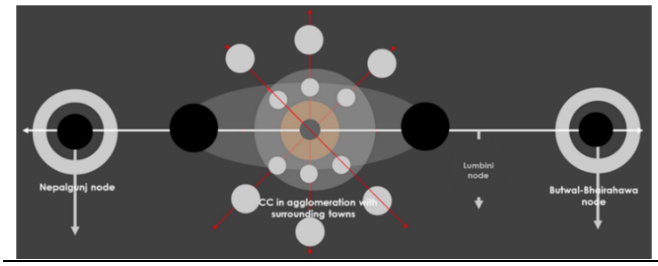
(b) Strengthening the five element cycle through major transportation and greenery/open space network

Fig. 4.2 Translating five basic elements of life into physical plan of LPCC

Moreover, the 'Three Treasures of Buddhism' and 8 'Truth Paths' are translated symbolically into master development plan (Fig. 4.3). Three distinct settlements namely 'Tharu' community around the West Rapti River, newly formed settlements along the East-West Highway and villages outside the LPCC area correspond to 'Buddha,' 'Dharma,' and 'Sangha'. Tharu community is ethnic inhabitant of this place and thus identity of the area. Moreover, it can be further correlate to the three distinct nodes: urban node, cultural node and industrial node. All these different hierarchy of settlements along with various development nodes along the Highway (outside LPCC area) not only symbolize the three treasures but they are also anchored by the West Rapti River.



Tharu settlements (traditional)	Buddha
Newly developed towns	Dharma
Neighboring villages outside the LPCC area	Sangha



Dense nodal development along the East-West Highway along with hierarchy of villages within and outside LPCC area, anchoring by the West Rapti River as the central spine

Fig. 4.3 Resembling various settlements (traditional and recently development along with outside villages) as three treasure of Buddhism and eight truth path

The present landscape of LPCC area is still of rural character dominated by agriculture land, forest and river system. Based on the past trend of population growth, it is assumed that the population growth up to 2031 will be moderate and after that it will be high till 2051, as most of the infrastructure needed for capital city would have developed by 2031.[50]

In order to conserve the natural resources and landscape, it is decided to encourage compact development around certain strategic locations only in the concept of 'development growth nodes' and the remaining peripheral huge areas, mostly dominated by agriculture and forest

[50] Development trends of two years namely 2031 and2051 are taken due to multiple reasons. First, SDGs, SFDRR and Cop 21, these three important international development agenda were set for 2030. The government of Nepal has committed to all these three agendas and have formulated its national development framework accordingly. Second, it will take around a decade to develop infrastructure required for the capital city. Third, recently the government of Nepal carried out a study which revealed that the national population will grow up to 2050 and then will start declining.

will be preserved (Fig.4.4). One primary node is proposed at the center location of LPCC area above the Highway. Among other areas, this location has multiple advantages: nearby from the Highway, still virgin lands for planning and centrally located so that inhabitants from different parts of the LPCC can conveniently visit the area. The present 'Bhalubang bazar' area, which lies across two Highways will be developed as 'secondary node' in future. This area has at present already developed as commercial area due to junction of two major roads. However, this area has land constraints for future growth. Numerous scattered traditional settlements on north and south sides of the West Rapti River at present lack minimum services. So, numerous 'territory nodes' are proposed to cater these population. In addition to these, some 'territory nodes' proposed at the east and west sides are mainly associated with facilities related to agro based industries, transportation and industrial activities.

The intention of nodal development approach is to achieve integrated development (housing and infrastructure) for balanced development as well as for utilization of limited resources. All those nodes are carefully proposed in the safer areas. Two development years are taken assuming that basic infrastructure of capital city would be completed by2030 and till that time the demand of infrastructure would be normal due to low population growth. However, once all these infrastructure are built, the population growth would be accelerated and hence require more lands for population growth and infrastructure demand. Primary nodes basically located away from the East-West Highway also has adequate virgin land for planned development. It basically comprises of financial institutions, major commercial and business hubs along with hotels and tourism related facilities, all supported by wider road network. Moreover, it also comprises of plazas and public open spaces with pedestrian friendly street network. This zone will be free from polluting land use activities. Similarly, secondary nodes mainly consists of commercial and business activities but with institutional zone. Both primary and secondary nodes will also have high and medium level housing and even private houses. However, tertiary nodes are of different natures. They comprise of various facilities such as recreation, industrial, agriculture promotion and cultural activities. In addition to these, territory nodes are proposed in rural areas for daily life activities so that they do not need to travel other areas even for small daily needed activities. Such planning approach results in comfort and convenient to all city inhabitants, prevent unnecessary movement and hence pollution and comminuting time.

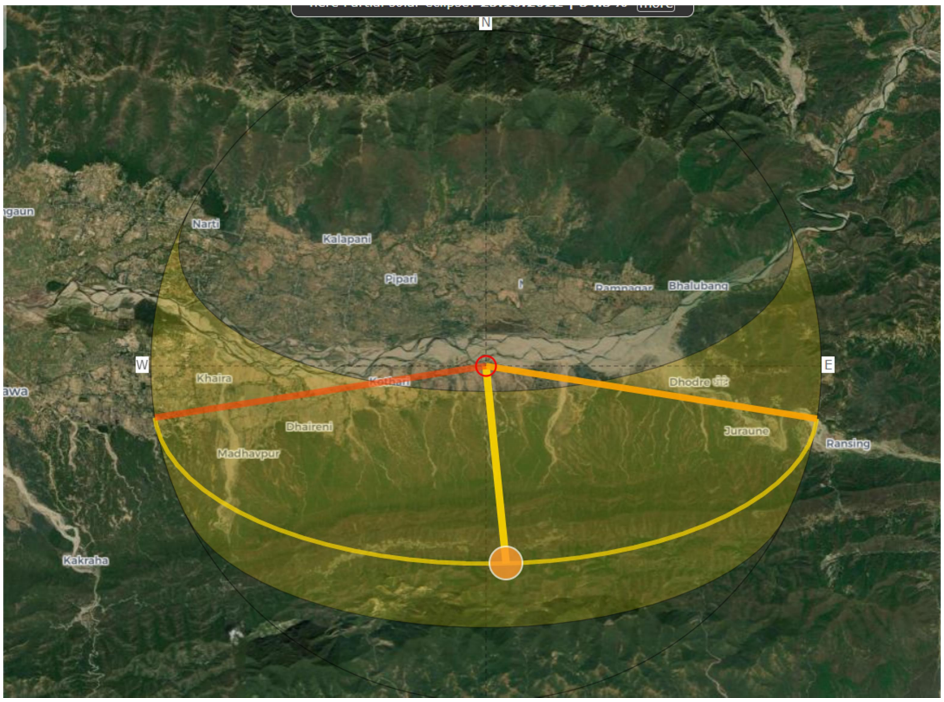
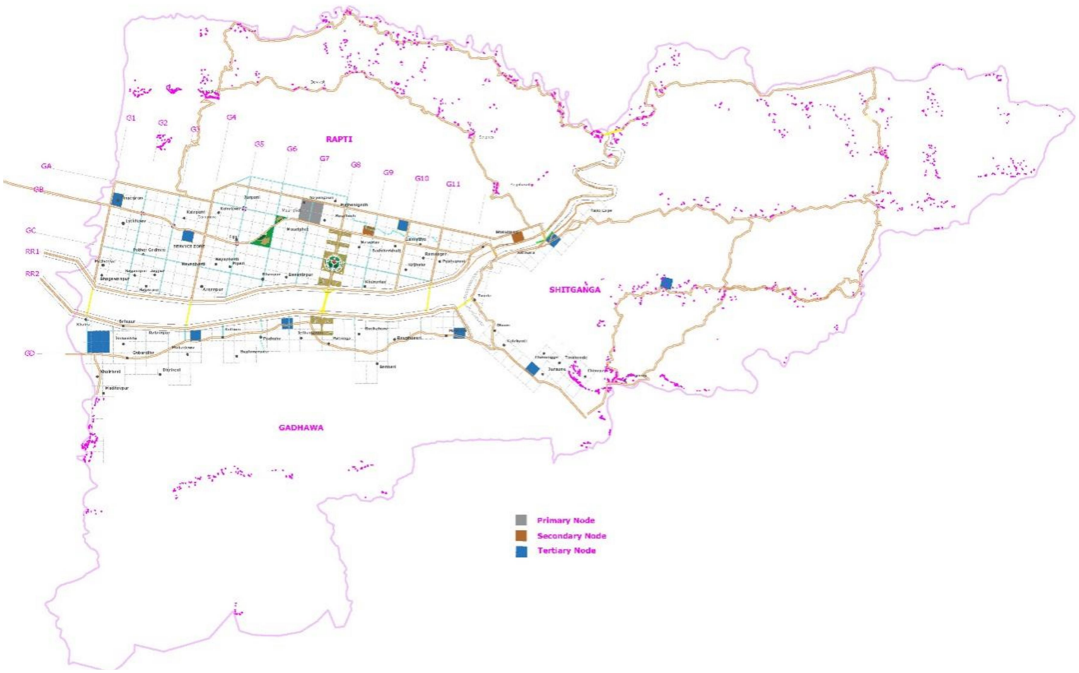


Fig. 4.4 Solar analysis of LPCC Site

The solar analysis shows that the site orientation is tilted little towards west side, keeping building parallel to the East-West Highway leads to availability of sun light in the almost all sides at least one time in a day.



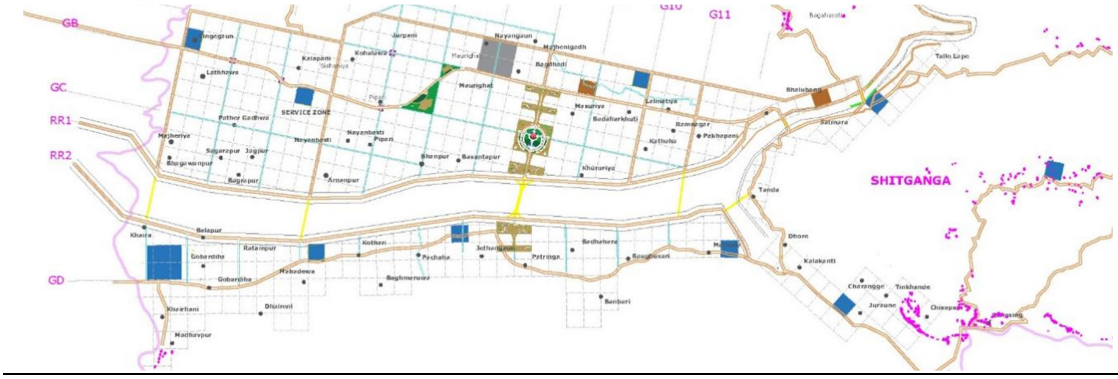


Fig. 4.5 Proposed various nodes as desirable development growth centers.

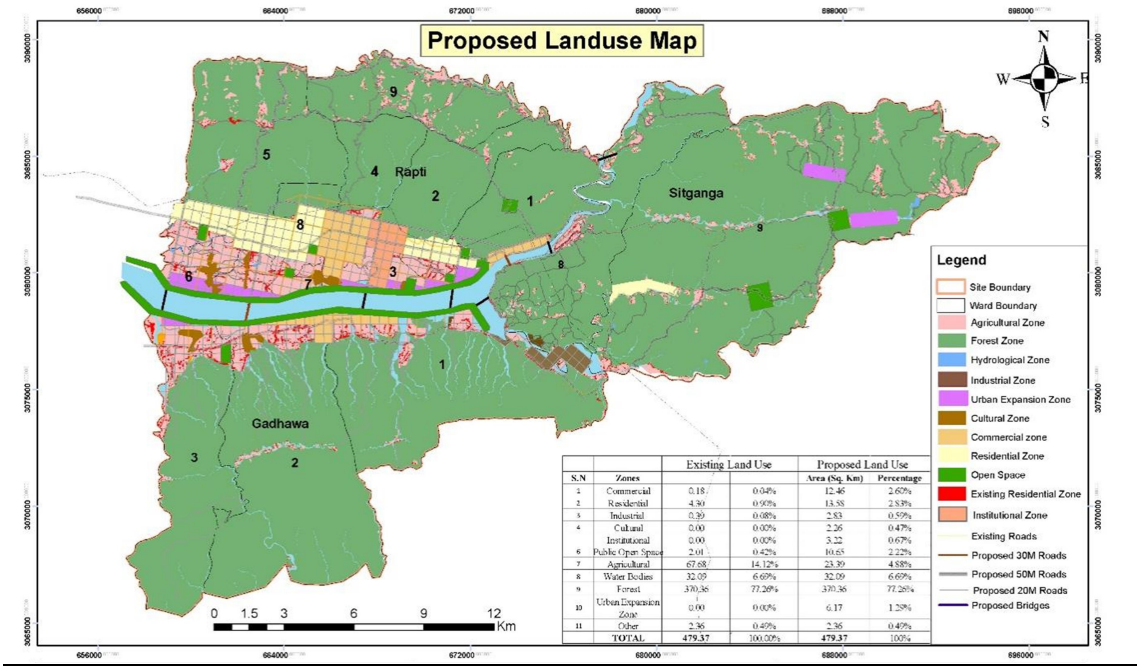
With such development, the proposed land use plan for LPCC area is given below (Fig. 4.5). The central axis – the West Rapti River is surrounded by greenery and marsh lands, followed by vast agriculture lands (on both sides) with existence of traditional settlements, mainly dominated by residential use. Institutional development is between Maurighat and Lalmatiya supported by commercial development. Sishaniya and Pipari will have mix use of mainly commercial, institutional and entertainment activities. Major land use includes commercial, institutional, residential, open spaces and industrial area (Fig, 4.5).

4.2.2 Grid Concept in Planning

Entire LPPC are excluding forest area has been planned with a macro grid of 400 meter by 400 meter and a gross density of 60 dwelling per hectare, is based on a broad set of research projects and historical cases. The size has been determined with discussion with the PIDA and international Consultant appointed for the advisory and local Government. The grid has been proposed for flat land of the site and at the hilly region where major settlements can be seen. Although the concept of grid in hilly region may be difficult to implement, it is proposed to find best possible way to achieve the result through detail study.

Roads of width 20 meter, 30 meter and 50 meter has been proposed through these grid. All primary roads have been proposed as 50 meter road. The design has endeavored best to fit the existing 50 meter highway to fit into the grid. Along the Rapti River bank a road of 50 meter has been opposed on each side which will also act as buffer zone along with green belt of 100 meter on either side of the road. The surrounding roads to the hilly region has also been proposed as 50 meter wide with a view to develop tourism in the area in future.

30 meter road has been proposed at the interval of 1200 meter through the grid layout. Such road will act as secondary road. Similarly, 20 meter road has been proposed for remaining grid lines.



S.N	Zones	Existing Land Use		Proposed Land Use	
				Area (Sq. Km)	Percentage
1	Commercial	0.18	0.04%	12.46	2.60%
2	Residential	4.80	0.90%	13.38	2.83%
3	Industrial	0.89	0.08%	2.83	0.59%
4	Cultural	0.00	0.00%	2.26	0.47%
	Institutional	0.00	0.00%	3.22	0.67%
6	Public Open Space	2.01	0.42%	10.65	2.22%
7	Agricultural	67.68	14.12%	23.39	4.88%
8	Water Bodies	32.09	6.69%	32.09	6.69%
9	Forest	370.36	77.26%	370.36	77.26%
10	Urban Expansion Zone	0.00	0.00%	6.17	1.28%
11	Other	2.36	0.49%	2.36	0.49%
	TOTAL	479.37	100.00%	479.37	100%

Fig. 4.6 Proposed land use plan for LPCC area

The proposed nodes located on both sides of West Rapti River results not only supporting existing indigenous settlements but also cause balance development of the whole area (Fig. 4.7).

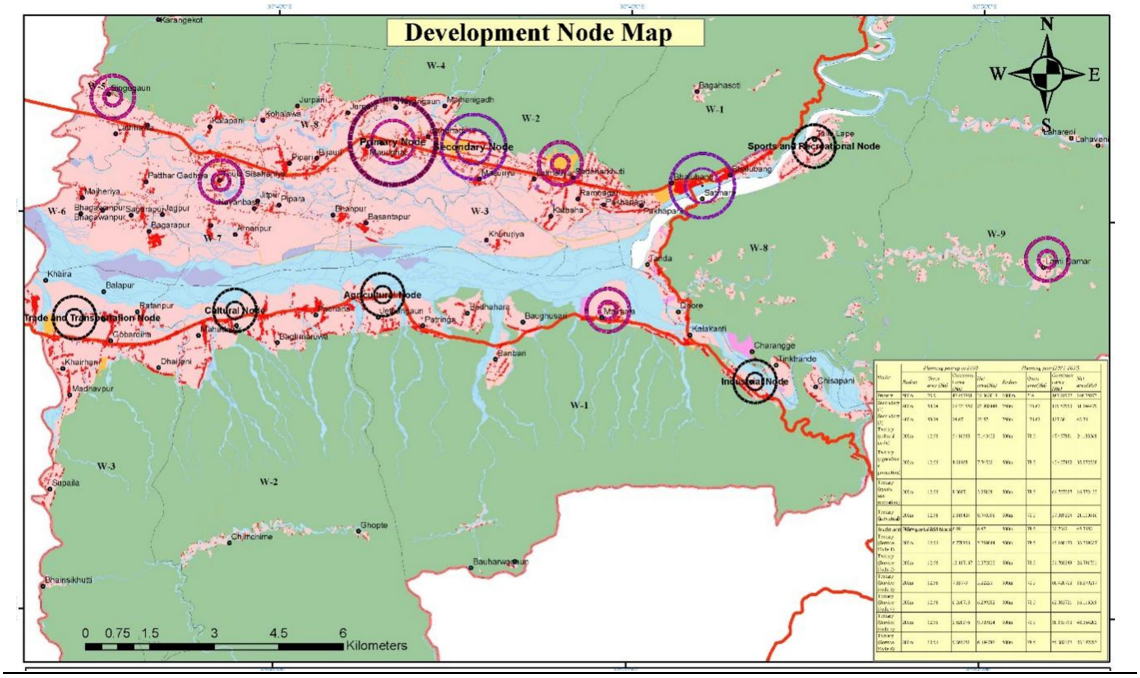


Fig. 4.7 Proposed nodes along with existing settlements

All nodes will be developed in relation with surrounding context and linking with major land use activities (Fig. 4.8).

Fig. 4.8 Proposed planning within nodes

Table 4.5 LPCC Nodes with area calculation for new development

Sn	Nodes	Location		Land use		Planning year up to 2030				Planning year (2031-2050)				Remarks
		Name	Rural/ Municipality	Existing	Proposed	Radius (m)	Gross area (Ha)	Constraint area (Ha)	Net area (Ha)	Radius (m)	Gross area (Ha)	Constraint area (Ha)	Net area (Ha)	
1	Primary	Maurighat	Rapti	Agriculture/ residence	Commercial	500	78.50	47.46	31.04	1000	314.00	167.25	146.75	
2	Secondary	Baghdadi, Majhenighat, Masuriya	Rapti	Agriculture/ residence/forest/commercial/	Institution/ Commercial/ Residence	400	50.24	26.33	23.91	750	176.62	115.58	61.04	
3	Tertiary (cultural)	Mahadewa	Gadhawa	Agriculture/ residence	Cultural/ Residence	200	12.56	5.42	7.14	500	78.50	47.46	24.19	
4	Tertiary (agriculture promotion)	Jethan Gaaun	Gadhawa	Agriculture/ residence/mining//industrial/river bed	Agricultural services/ Residence	200	12.56	4.81	7.75	500	78.50	43.43	35.07	
5	Tertiary (sports and recreation)	Lhafe	Shitganga	Agriculture/ residence/ River bed	Sports & recreational services/ Residence	200	12.56	9.31	3.25	500	78.50	61.73	16.77	
6	Tertiary (industrial)	Juraune	Gadhawa	Agriculture/ residence/industry/ riverbed	Industrial	200	12.56	3.82	8.74	500	78.50	57.39	21.11	
7	Trade and Transportation	Gobardiya	Gadhawa	Agriculture/ residence/industry/ riverbed	Trade/services/ Residence	200	12.56	6.09	6.47	500	78.50	32.73	45.77	
8	Tertiary (Service Node 1)	Singe	Rapti	Agriculture/ residence	services/ Residence	200	12.56	6.77	5.79	500	78.50	45.16	33.34	
9	Tertiary (Service Node 2)	Kalapaani/ Sishaniya	Rapti	Agriculture/ residence	services/ Residence	200	12.56	10.19	2.37	500	78.50	51.71	26.79	
10	Tertiary (Service Node 3)	Badaharkhuti, Lalmatiya	Rapti	Agriculture/ residence	services/ Residence	200	12.56	7.34	5.22	500	78.50	60.42	18.08	
11	Tertiary (Service Node 4)	Bhalubang	Rapti	Agriculture/ residence/ forest/river bed/commercial	commercial/ services/ Residence	200	12.56	6.26	6.30	500	78.50	62.38	16.12	
12	Tertiary (Service Node 5)	Pachaha	Gadhawa	Agriculture/ residence	services/ Residence	200	12.56	2.62	9.94	500	78.50	30.14	48.36	

Sn	Nodes	Location		Land use		Planning year up to 2030				Planning year (2031-2050)				Remarks
		Name	Rural/ Municipality	Existing	Proposed	Radius (m)	Gross area (Ha)	Constraint area (Ha)	Net area (Ha)	Radius (m)	Gross area (Ha)	Constraint area (Ha)	Net area (Ha)	
13	Tertiary (Service Node 6)	Lami Damar	Shitganga	Agriculture/ residence	services/ Residence	200	12.56	5.87	6.69	500	78.50	55.30	23.20	
	Total						266.90	142.28	124.62		1354.12	830.67	516.59	

Here the net area available for development of housing for 2031 and 2051 is 124.62 ha and 516.59 ha. However after calculation of different constrains, the net area available for housing development is lesser. The constraints taken consideration are as follows:

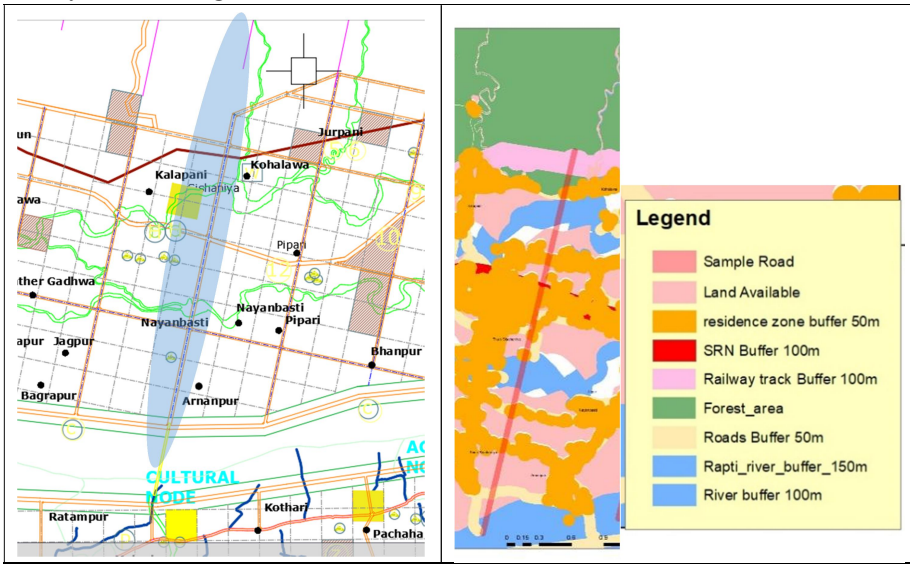
Table 4.6 summary of different constraints

Sn.	Constraints	Constraints Distance (m)
1	Rapti river	150
2	Other river	100
3	Pond/lake	50
4	Strategic road	50
5	Railway	50
6	Residence Cluster	25

4.2.3 Change in Land use

With introduction of new land use, the maximum impact is seen in agricultural land and careful planning taken been done to avoid change in land use in case of traditional settlement area and commercial area by avoiding roads through such areas.

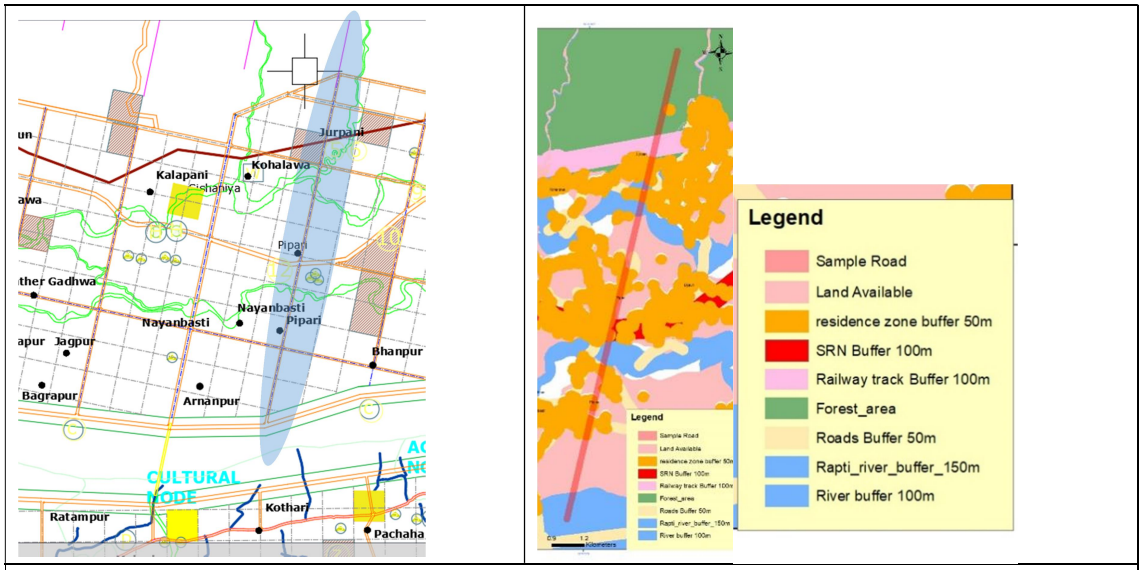
Two roads of 50 meter and 30 meter along north south at Sishaniya has been taken for analysis of change in land use with introduction to road as follows



Sn	Area	Sq.m	Sq. Km	Percentage
1	Agricultural	147828.427	0.148	80.0
2	Forest	19799.600	0.020	10.7
3	Hydrological	8630.490	0.009	4.7
4	Public Land	1168.153	0.001	0.6
5	Residential	3215.681	0.003	1.7
6	Other	4035.310	0.004	2.2
	Total	184677.661	0.185	100.0

Fig. 4.9 Figure showing change in land use at raod of 50 m along Gird G4

In this road, a maximum of 63 percent of agricultural land has been converted to road. Only .03 percent of commercial zone and 3 percent of residential area will be affected.



Sn	Area	Sq. m	Sq. Km
1	Agricultural	143440.544	0.143
2	Commercial	60.365	0.0001
3	Forest	51942.410	0.052
4	Hydrological	8003.873	0.008
5	Public Land	7074.877	0.007
6	Residential	5426.678	0.005
7	Other	9159.290	0.009

Fig. 4.10 Figure showing change in land use at Raod of 50 m along Gird G4

In this road, a maximum of 80 percent of agricultural land has been converted to road. Only 2 percent of residential area will be affected.

4.2.4 Housing

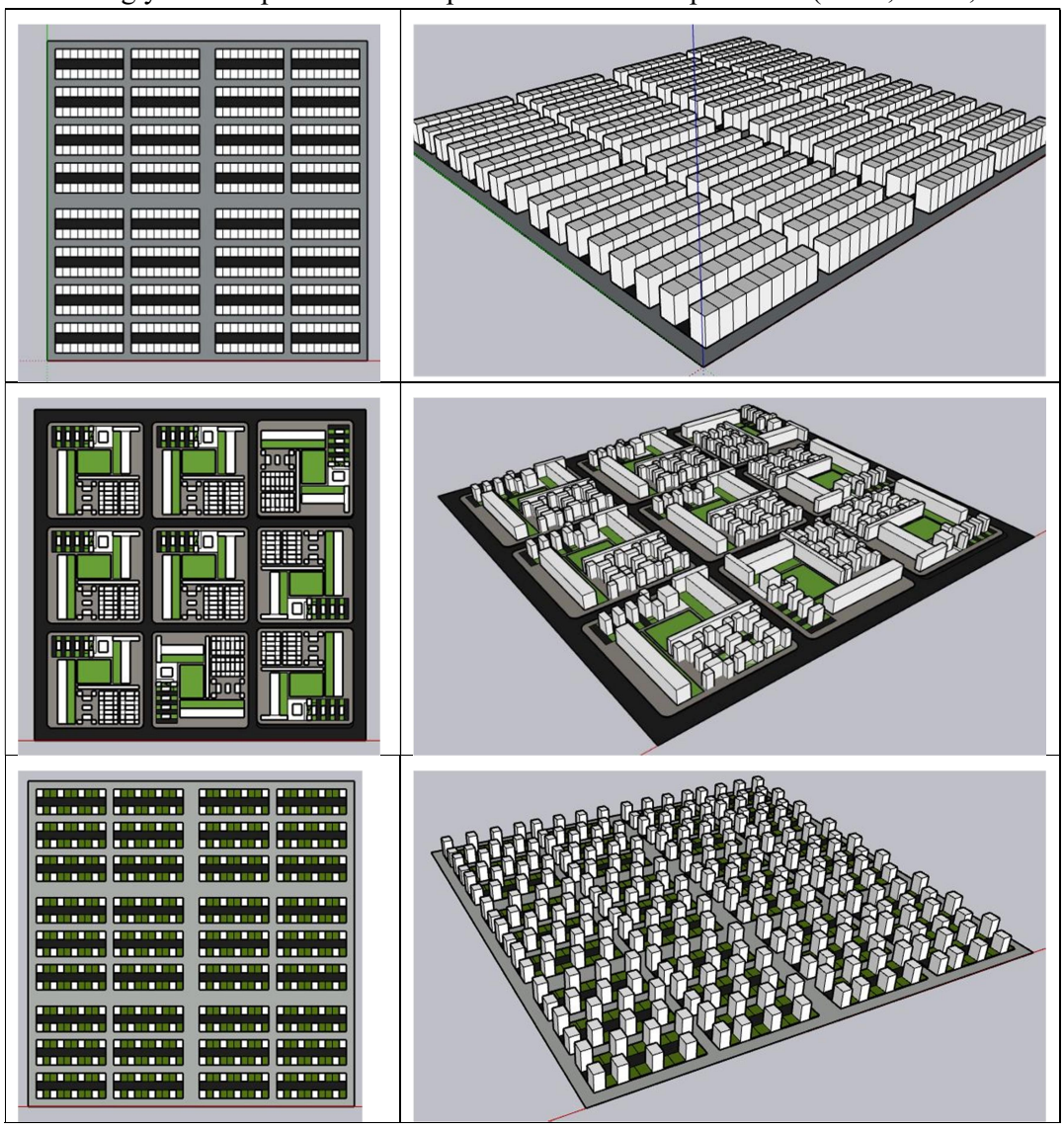
Housing is one of the basic needs for new population of a city or new city to be established. In LPCC area Existing housing will be insufficient for the new population growth and floating population. Thus, it has to be addressed through different planning tools. One of the popular model for housing development in Nepal is land pooling. The master plan proposes a regular grid of 400x400 meter for housing development with 50 meter wide road within 1200x1200 meter grid. The Consultant proposes different single unit and apartment building type of housing for the LPCC at different locations. Single unit residential housing have been proposed along the east west highway mostly on the eastern side with low flood risk. Similarly, medium rise apartments along the Rapti River in different locations as per suggestions by PIDA. For the housing development, the consultant propose Land pooling and house pooling method for block housing, or super block. As the land plots are of different sizes in the area mostly small parcel or very large parcel, implementation of such methods is crucial to achieve uniformity landscape within different land uses.

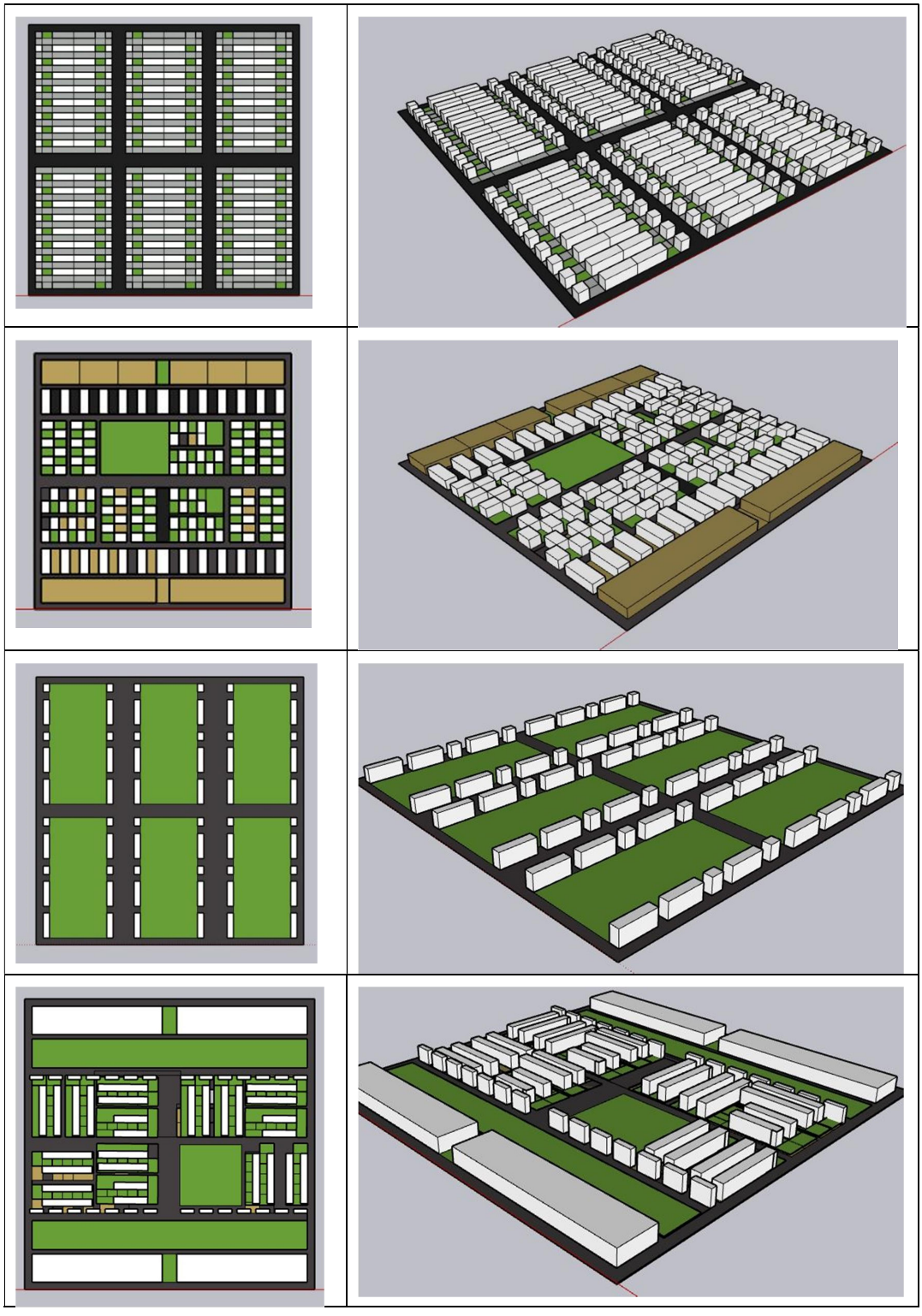
The existing housing number in LPCC area is around 25,000 for a population of 68000. Let's assume that floating population of the city be 40 percent. Thus the total population for 2031 and 2051 will be133, 000 and 250,000 respectively. As per this assumption, housing deficit for the year 2031 and 2051 will be 5000 and 30,000 respectively and will require an area of 85 ha and 500 ha. (Taking plot size of 10 Dhur and 40 % buildup area). However, the available land is less (Table 4.4). Thus, low density housing is not possible and high density housing is required. Thus, second option for master plan has been explored in which mixed use medium rise apartments has been explored.

In similar fashion, the demand of land for institutional area besides housing will increase with increase in population.

4.2.5 Neighborhood Planning

A regular grid of 400m X 400m is taken for pedestrian comfort and convenient and accordingly various possible development scenarios are presented (4.11a, 4.11b, and 4.11c)





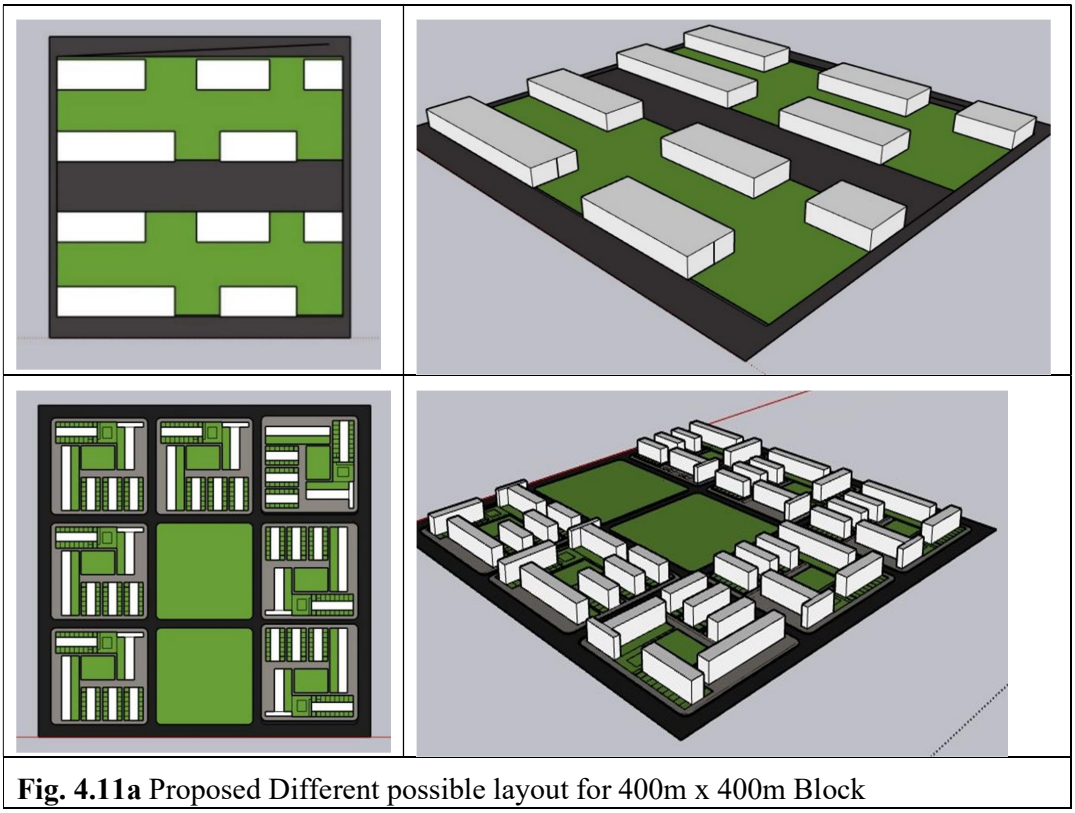


Fig. 4.11a Proposed Different possible layout for 400m x 400m Block

A variety of block detailing is required to adjust the local context and demand. Some of them may have high rise structure with sufficient greenery whereas other may have medium level density with mixed use.

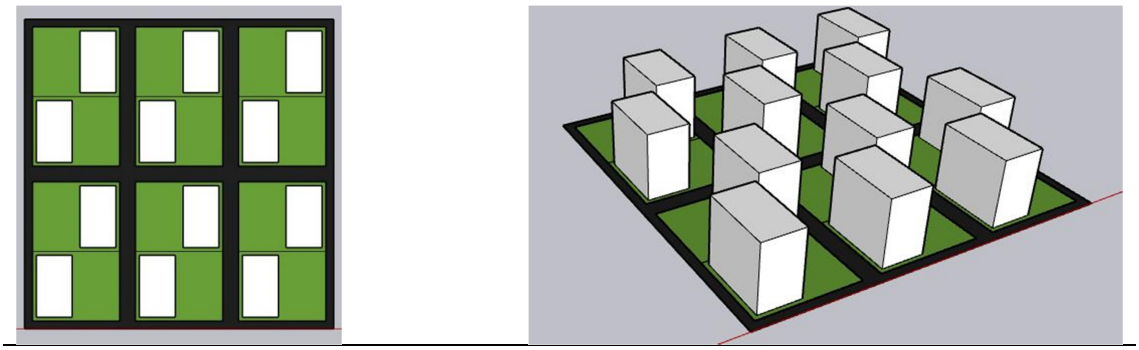


Fig. 4.11b Proposed layout for high-rise zone

A conceptual level development of the proposed node is given below. It has combination of many uses.

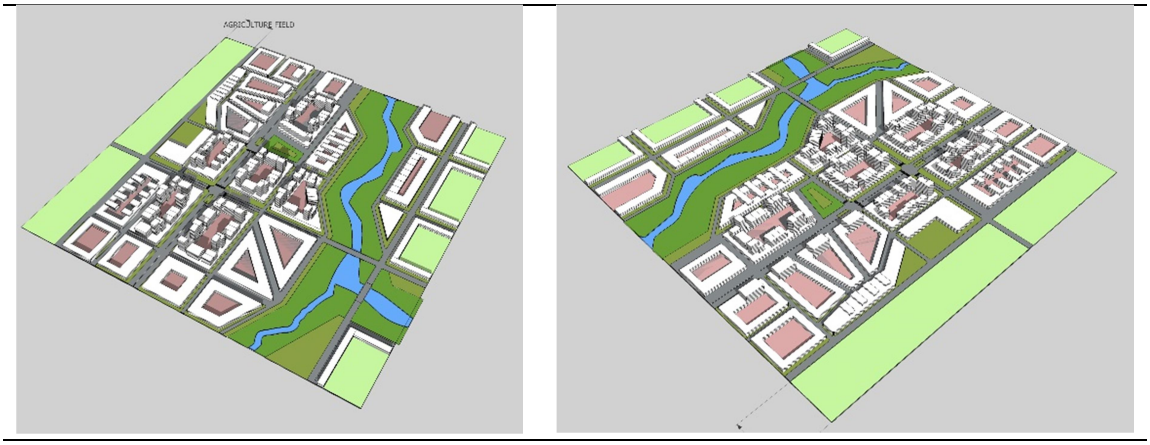


Fig. 4.11c. Conceptual development of proposed node

4.2.6 The G8 planning (Institutional Corridor)

The planning of road at Grid G8 i.e. along the institutional zone has been proposed with placement of designed open spaces road and block. The street has been design to focus on the institutional area building with centrally wide 70 meter road, a roundabout and green parks and Landmark Bridge connecting Gadhawa and Rapti. The design pattern follows also across Rapti River in Gadhawa as well. This propose is to emphasize on the street is to make a commemoratory street that leads to central important government body. This starts with top from the chief minister's office at Rapti and end with the Court at Gadhawa. There is a central round about and 10 [illegible] institutional area for further expansion.

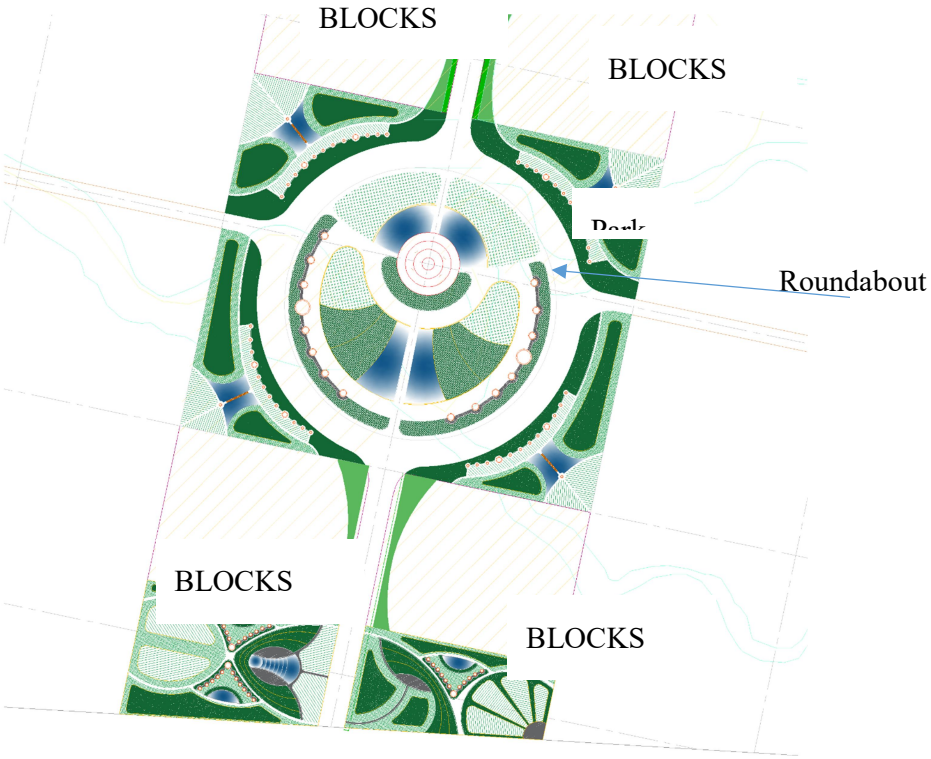


Fig. 4.12: Round about Detail at G 8 (Institutional Corridor)

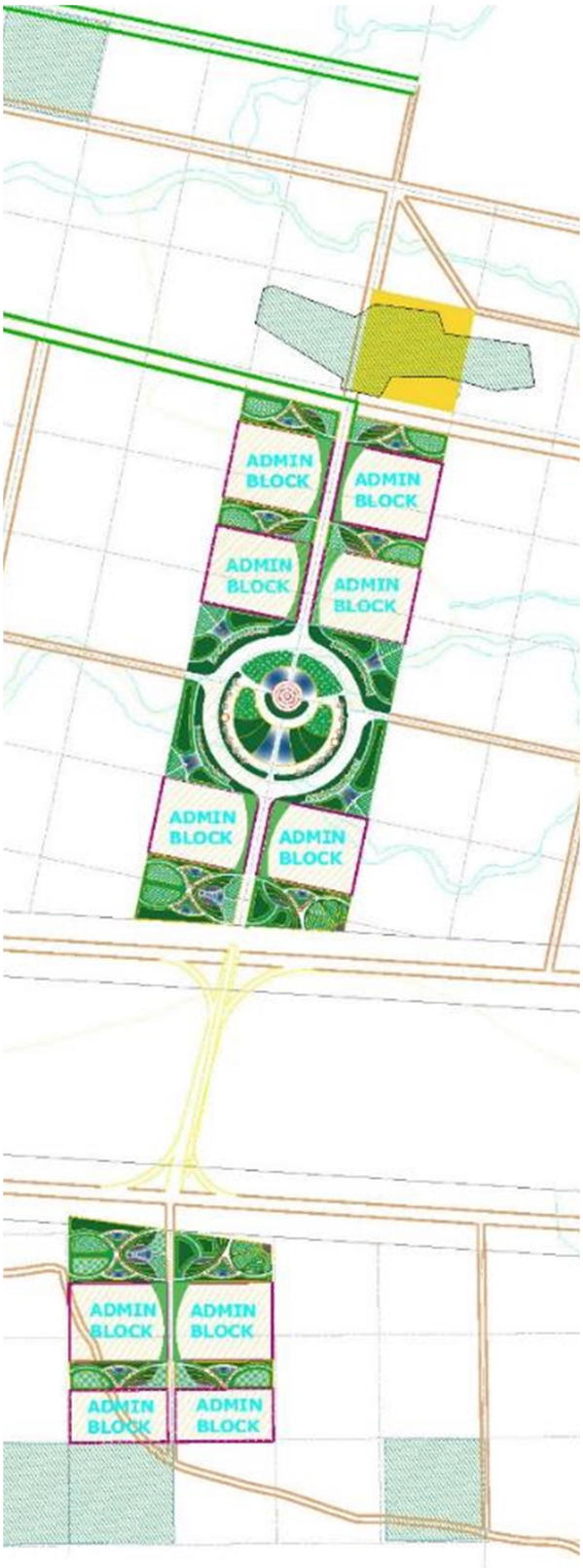
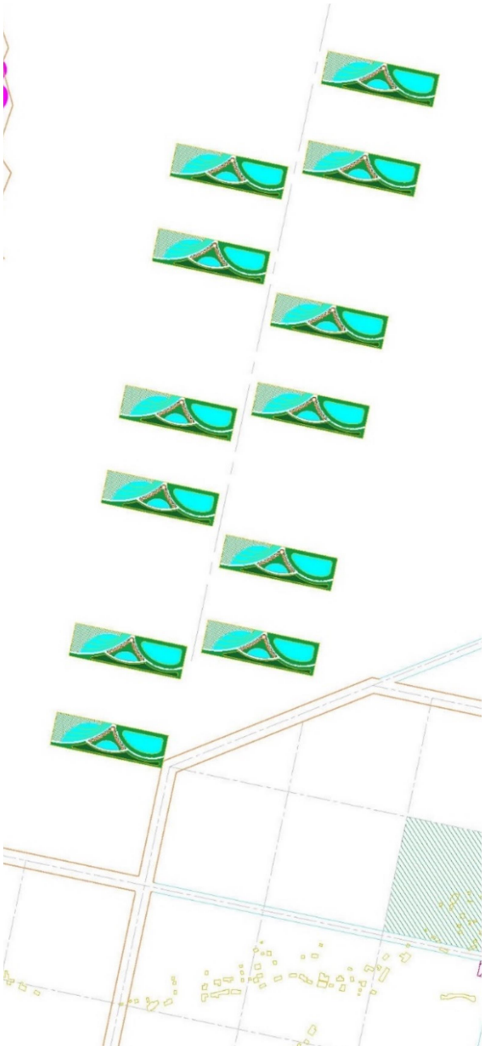


Fig. 4.13a : Street Design along Grid 8

4.2.7 The G4 planning (Recharge Ponds and parks Corridor)



Recharge ponds along the grid 4 at the forest area has been proposed. Such recharge ponds will hold rain water during the rainy season help to infiltrate into the ground. The ponds are also useful to hold the CO2 from the forest. Siltation also occurs in such ponds from the surrounding forest area which act as good fertilizer for agricultural purpose. This particular area with recharge ponds can be developed as park suitable for picnic spot for economic sustainability.

4.2.8 Open Space Planning

Opens spaces have been proposed in different location along the entire site. As per current norms and standard, many large and community open spaces have been proposed in this master plan. The consultant proposes at least one large community park within a distance of 2-3 km. Besides green belts proposed along the Rapti River are also part of open space. It is also advised to crate open space at nodes of the proposed grid so that the prime land can be used for public benefit and commercial benefit. It will also ease extension of public road if required in future or for any other future public uses.

Major planning proposal for the open space for LPPC are with respect to tourism and commercial development proposed is creation of recreational parks and riverside development.

Fig. 4.13b Recharge Pond at forest area along grid 4

4.2.9 Recreational Park

A substantial area (32.79 sq. km.) in LPCC area is covered by water body. Besides Rapti River tributaries crisscross the central located flat land of LPCC area originating from surrounding hills. All these tributaries require minimum setback for any development to avoid risk of flooding. Such area can be utilized in different ways for community use. One of such uses is building recreational park where water bodies are of significant part (Fig. 4.14 a, b.c). Such parks will not only beautify entire city but also add economic value to the city.

Major objectives of Recreational Park are:

- To create accessible new city water front
- Enhance the river environment
- Improve cultural and historical connection with river
- To create storm water runoff conveyance system that provides an alternative to storm sewage

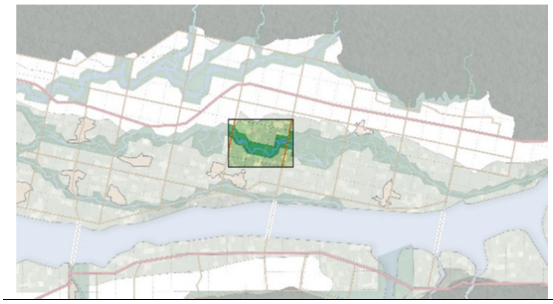


Fig. 4.14a Location of recreation park

Fig. 4.14 b Inner streams and creeks around Maurighat area

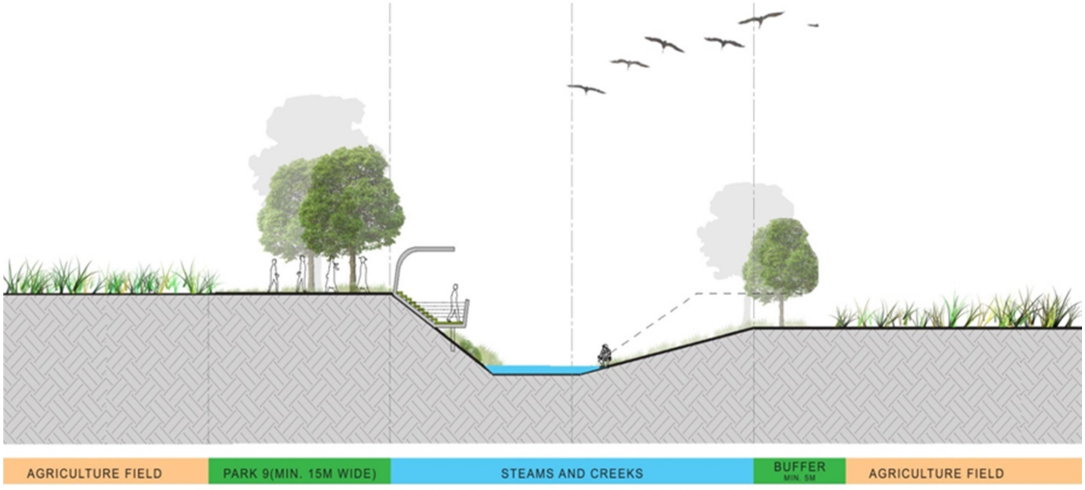


Fig. 4.14c Cross section showing water body and surrounding parks

Fig. 4.14 d Detailing of water body and surrounding areas

4.2.10 Riverside Development

Rapti River flows central to LPCC area. The section of Rapti River at Rapti and Gadhawa is catchment area, thus is intersection is huge. A Set back of 100 meter on each side of River at Rapti Rural and Gadhawa Rural Municipality is proposed (Fig. 4.15 a,b,c). This leaves a lot of riverside area for development. The Consultant proposes riverside development along the bank of the river at both sides. The riverside can be used for recreational development combining bank protection measures with designs that will also support flow of people as shown in figure below.

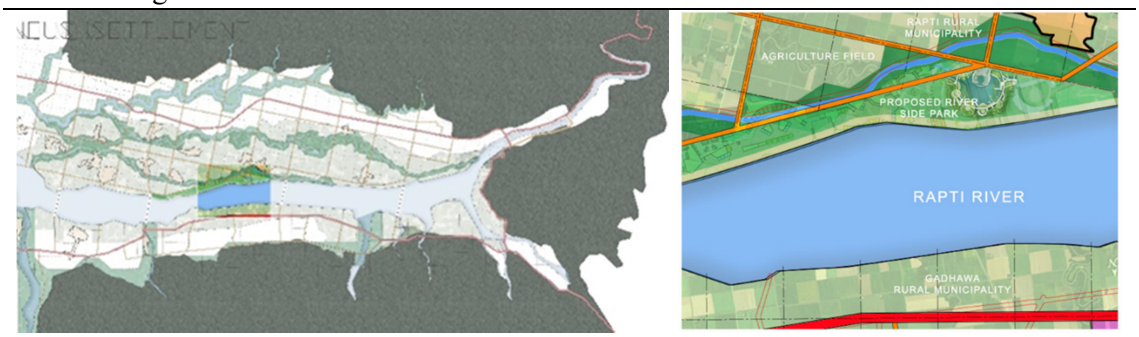
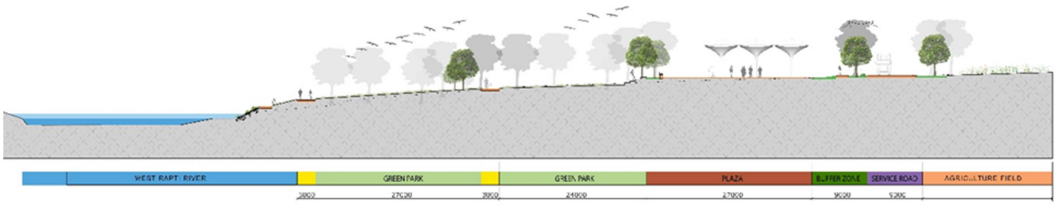


Fig. 4.15 a Location of riverfront development



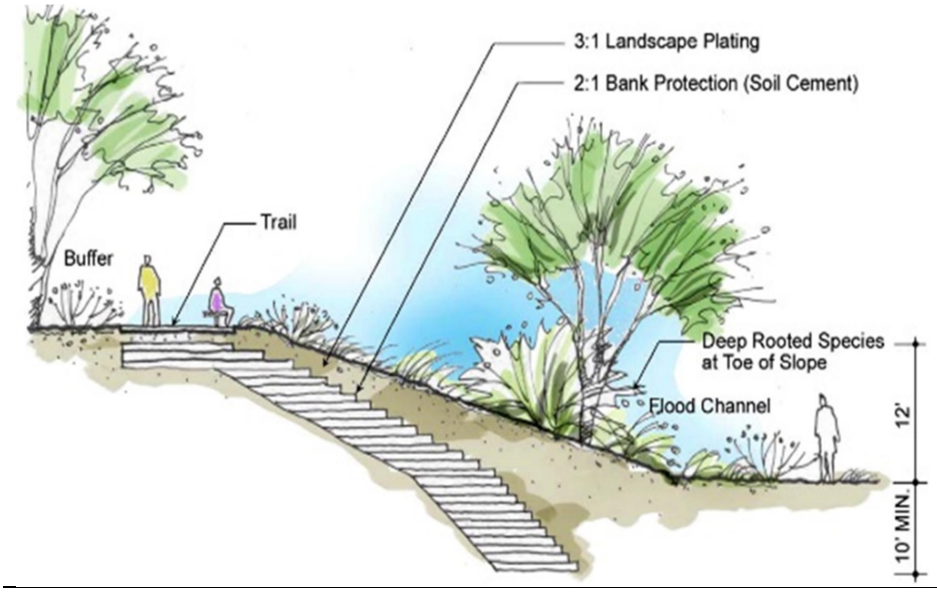


Fig. 4.15b Cross section of riverfront development

Fig. 4.15c Typical Bank protection between flood channel and buffer

4.2.11 Master Plan

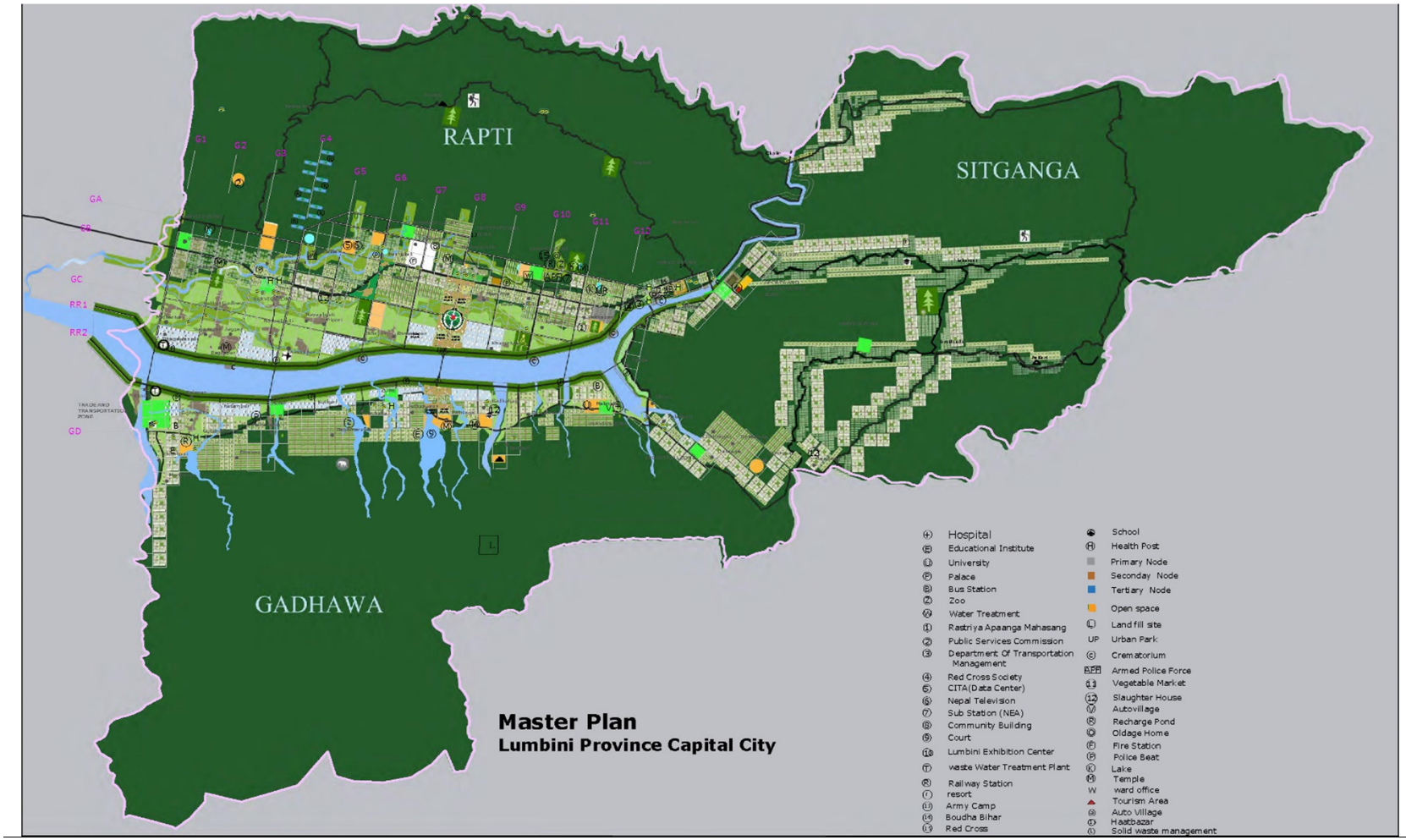


Figure: 4.16 Master plan based on development scenario two

Few planning concepts suggested by PIDA during various level of discussion has been incorporated in this master plan which is development of high rise buildings along Rapti River bank located within LPCC area (Fig. 4.14). Others include followings:

a) Domestic airport along the bank of West Rapti River, after constructing retaining wall along the river and available huge public land to be utilized for airport;
b) Wide roads (ROW-50m) along both sides of Rapti River and linking them to the East-West Highway
c) High rise housing and commercial development along both sides of West Rapti river system
d) VIP residential /housing on both sides of the existing East-West Highway.
e) Institutional zone with many open spaces, which is connected to the East-West Highway by 50m wide road connecting to Gadhawa through a new proposed bridge.

The major element of this plan are:

a. The overall planning is done in 400x400 grid surrounded by 30meter of road throughout the central area for development of the LPCC. A road of 50 meters runs throughout the grid as primary road over the 1200x1200 main grid that includes three 400x400 blocks. The east-west highway has been best managed to be aligned with the main grid. Development types of housing development in the development area has been proposed in each block.
b. Large central park is proposed in LPCC planning area that lies adjoining Rapti River. It will have huge image of Buddha as central attraction that can be viewed from sky as an iconic image of the city. The park will be large open space for the inhabitants of the city that can compose various activities for socialization and can be connected with the commercial and recreational area proposed along the river side development.
c. River side development along the entire Rapti River has been proposed which include 100 meter of green belt from Rapti River, followed by 50 m wide road and 100 wide park along the entire Rapti River on both sides of the river.
d. High-rise development along the river bank after 250 meters of green belt, road and park has been proposed along the both sides of Rapti River. The flood analysis of Rapti River shows that this area is highly vulnerable to flooding, thus a detail study is proposed By the Consultant before implementing this concept.
e. A Ring road Connecting Gadhawa, Shitaganga and Rapti Rural Municipality has been proposed in the master plan along with different nodes has been proposed.
f. The master plan include a small domestic airport proposed at the river bank side at the western side of Rapti Rural Municipality. As the site chosen is at flood plan, a detail study is required to study its feasibility.
g. The concept of Development Nodes proposed for the planning of the LPCC area is retained as it has been proposed in original concept.
h. Seven new bridges has been proposed in the Rapti River –one at western side of Sishaniya , two at eastern side of Sishaniya, one connecting Gadhawa with East west highway and two at Shitganga Side. They have been proposed to connect the Rapti rural municipality or the central area of LPCC across the Rapti River or Gadhawa rural Municipality and Shitaganga Municipality. These bridges will connect three development nodes i.e. Agricultural, cultural and service node at Gadhawa rural Municipality and Recreation node of Shitaganga Municipality.

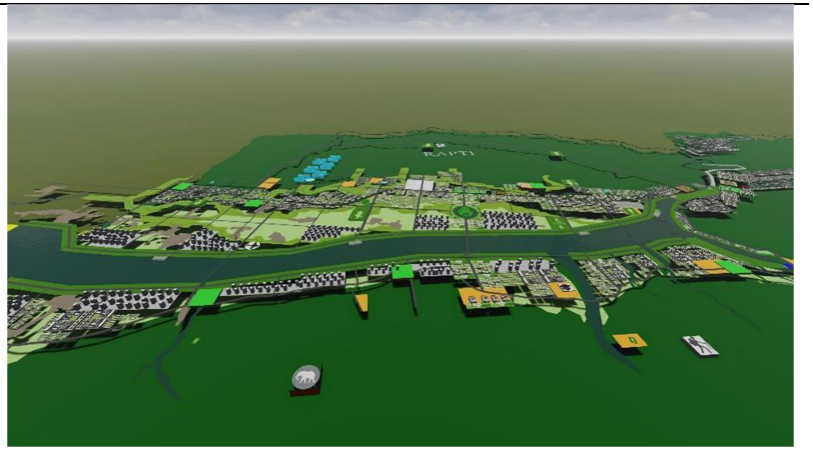


Fig. 4.17 The planning is based on maximum utilization public space along the Rapti River and residential zone above highway. Other land use include conservation of traditional settlement and development of central park and riverside development.

4.2.12 Spatial relationship Different Layers of Government Services

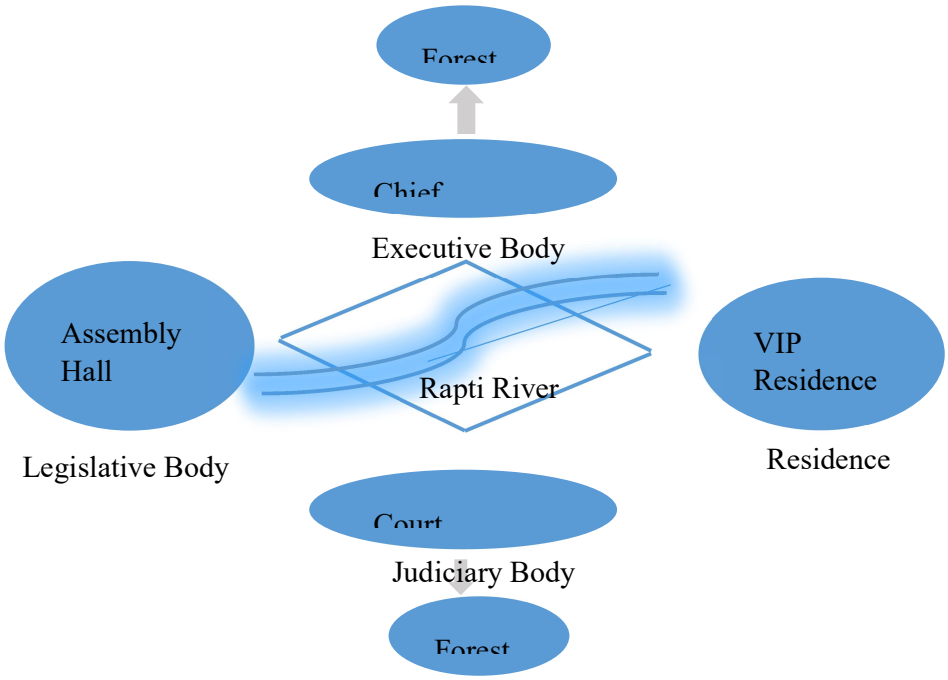


Fig 4.18 Positioning of Different Layers of Government Services

Above flow chart show the relationship of different layers of Government bodies and its facilities location. In the master plan along north and south direction lies the forest, followed by chief minster office, Rapti River, Judiciary Body and again by forest. On the western part of master plan lies Legislative body at Rapti Municipality and Government Staff Building lies on the eastern part of Master Plan that is at Shitganga Municipality. Thus the four elements are spatially connecting each other forming trapezoid.

On the Master Plan, the chief minister's office that lies in institutional zone along the grid 8 followed by a signature bridge across the Rapti River and Judiciary court at Gadhawa side. Along this grid a landmark is proposed that will symbolize the capital city.

4.2.13 The Swastika Pattern

A concept of swastika is proposed for the Master Plan. The symbol that is recognized as auspicious pattern is an ancient Hindu and Buddhist symbol. For a capital city where Buddha was born and which is habituated by majority of Hindu people, a pattern that relates to both religion represents harmony between the two religions and close relation to Buddha.

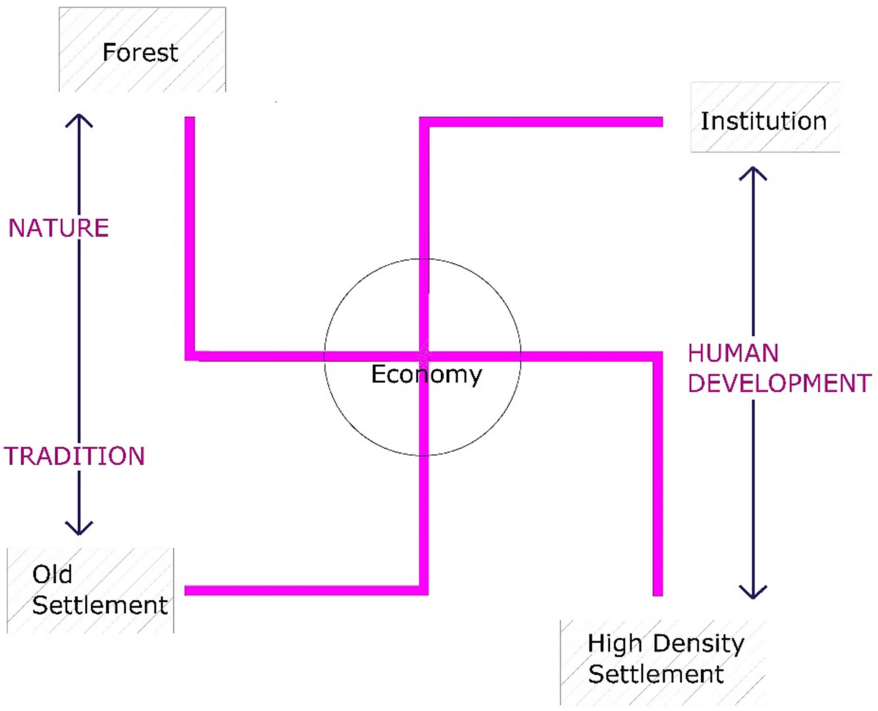


Fig 4.19 Swastika pattern connecting different areas showing connection between human development and nature

A Road of 50 meter is proposed in order to form a pattern of swastika along the entire shape in the Master Plan. A green belt of 10 meter has been proposed on either side of the 50 meter road. The continuous belt on the either side of the road will give form of swastika on plan. In terms of use of space, this belt can be used for planation of trees (pipal in relation to Buddha) and water bodies and rest spots at intermediate level so that it could give shade to the travelers and contribute to reduction of temperature.

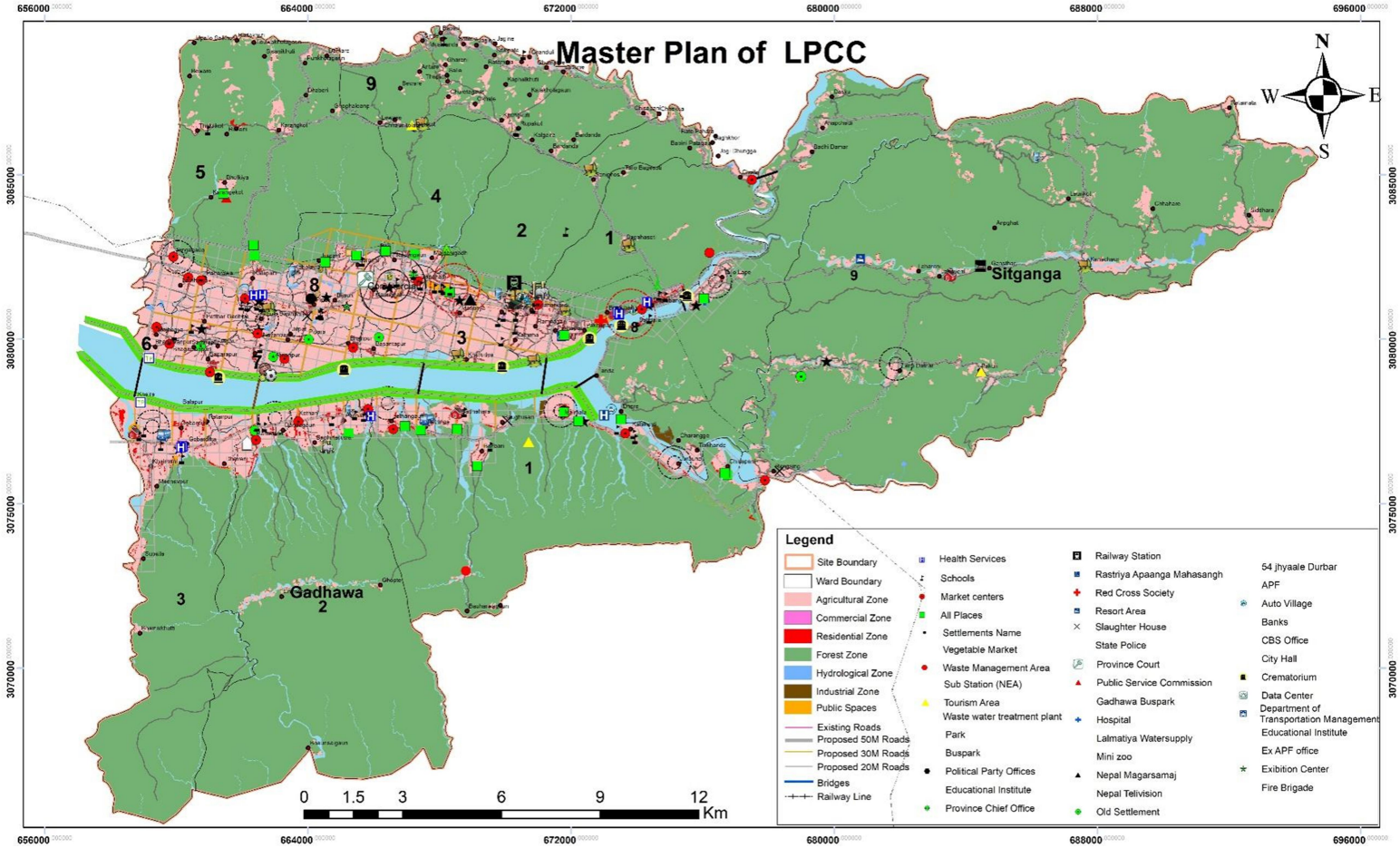


Fig. 2.20 Master plan of LPCC Are

4.2.14 Junctions

Open spaces are proposed at the rood junction of 50 meter and 30 meter wide roads. It will serve following benefit to the city and local people

- Land price will be regulated to some extend as the prime land will not be used for commercial space but as shared space. Thus development gain is distributed to all people to some extent.
- The cross section will be wide and visually pleasing
- In future such space can be used for public services such as metro stations
- Extension, repair and maintenance of infrastructures at the junction will be eased

However, it is important that the surrounding plots have no direct access to the open space, else the purpose development gain will go the surroundings plots only and land price cannot be regulated, as they can use the public space at the side of their plot for commercial benefit.

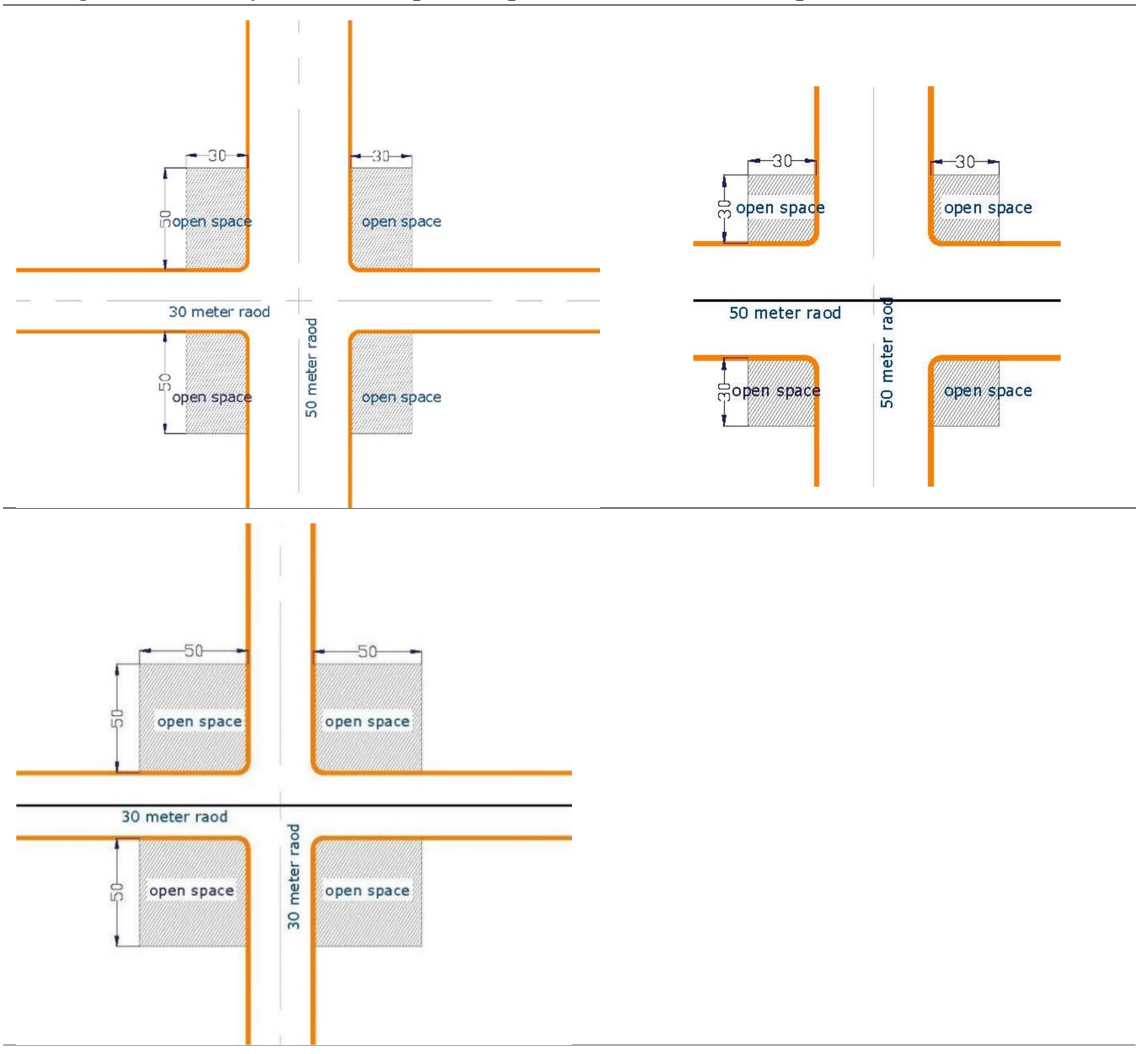


Fig. 2.21: Open spaces at the junction of roads for public use

4.3 Urban Design

The city can be described by its own image of legibility ('the ease with which its parts can be recognized and can be organized into a coherent pattern') and imageability ('that quality in an object which gives it a high probability of evoking a strong image in' the observer') , which is the quality of the city and it can be visualized with five elements as described by The Image of the City (Lynch, 1960).

Urban road are major aspect of urban design that contribute to sustainable urban management. It is important that a city is walkable and desirable by pedestrians and habitants. Accordingly a road section with rapid bus transit system can be a suitable option for the growing LPCC.

4.3.1 Nodes

Nodes are the strategic foci into which the observer can enter, and which are the intensive foci to and from which he is travelling. They may be primarily junctions, places of a break in transportation, a crossing or convergence of paths (Lynch, 1960, p. 47).

Here in LPCC we have proposed following locations as the nodes;

- Primary nodes (Commercial node; Maurighat area)
- Trade and Transport node (west of Gobardiha area)
- Institutional node (Baghdhadi, Shreechaur area)
- Cultural Node (Mahadeva area)
- Agriculture node (Jethangaun Area)
- Industrial Node (Kalakate Area)
- Education, Sports and recreational node (Satmara and Laphe area)
- Tourism nodes (Devikot, Kulpani, Jogikuti,)
- Service nodes (Singe Gaun, kalapaani, Masuriya, Lalmatia, Bhalubang, Malmala, and Lamibagar)

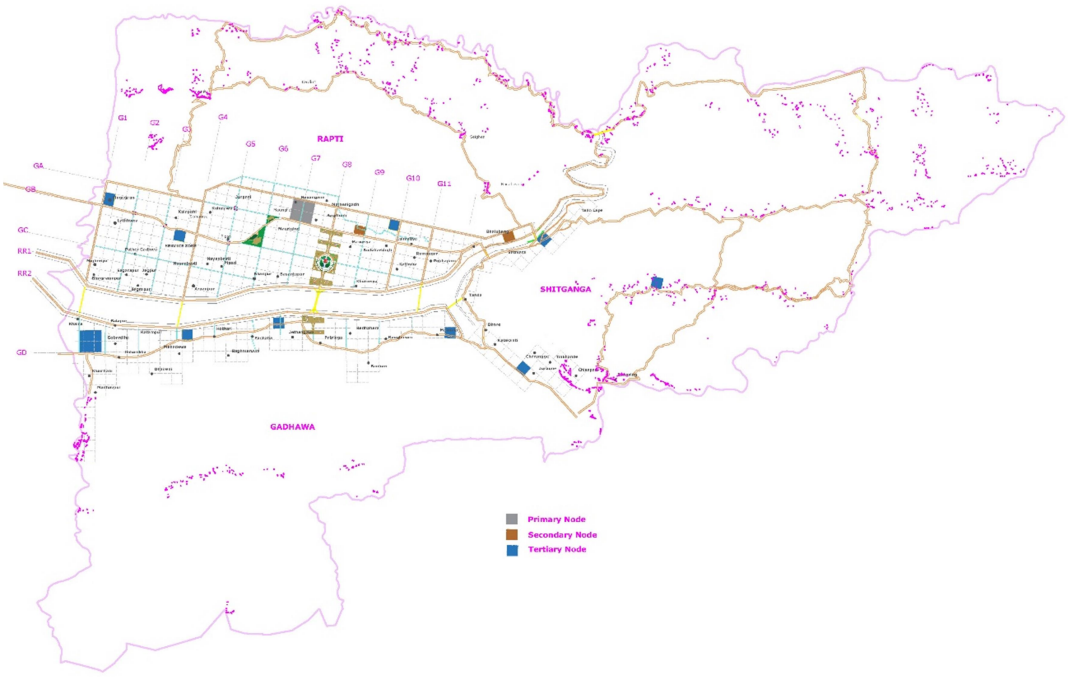


Fig. 4.22 Master plan showing Nodes

4.3.2 Paths

Paths are the channels along which the observer customarily, occasionally, or potentially moves. People observe the city while moving through it, and along these paths the other environmental elements are arranged and related (Lynch, 1960, p. 47).

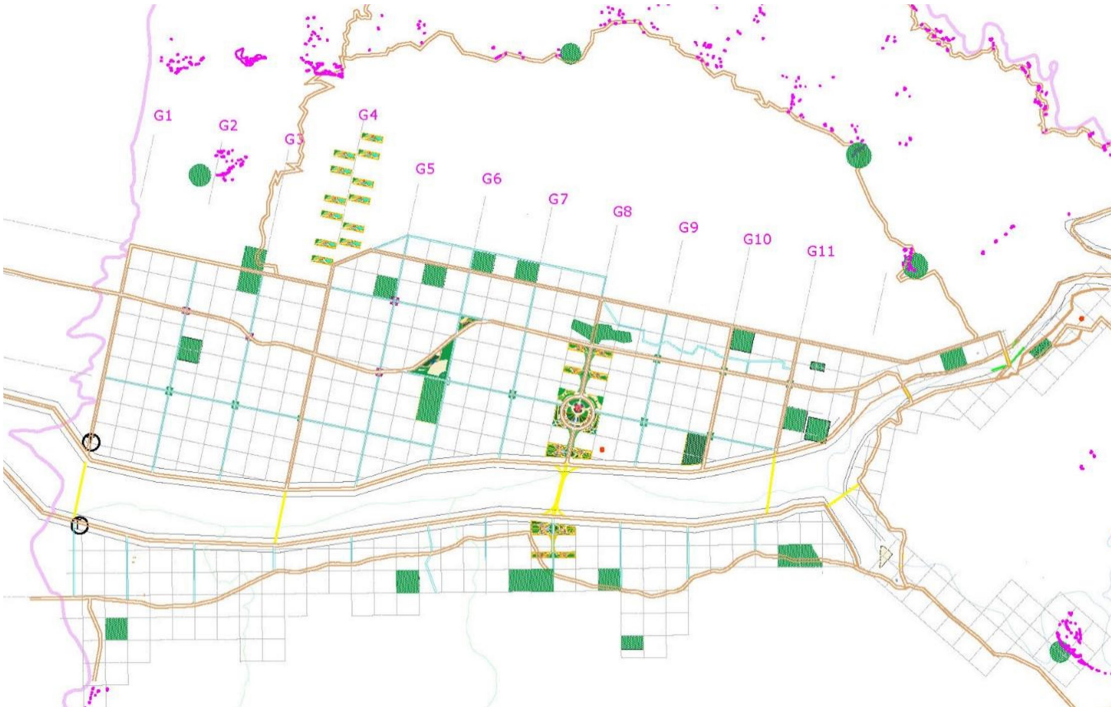


Fig. 4.23 Plan showing different roads in central area a path

Here in LPCC, except east west highway and the postal roads; we have proposed G1- G12 (north to south) west to east grids with 50 and 30 m roads and GA, GB, GC and GD (west to east) north to south are the paths of the city.

4.3.3 Districts

Districts are the relatively large city areas which the observer can mentally go inside of, and which have some common character (Lynch, 1960, p. 66). The characteristics that determine districts are thematic continuities which may consist of an endless variety of components (Lynch, 1960, p. 67).

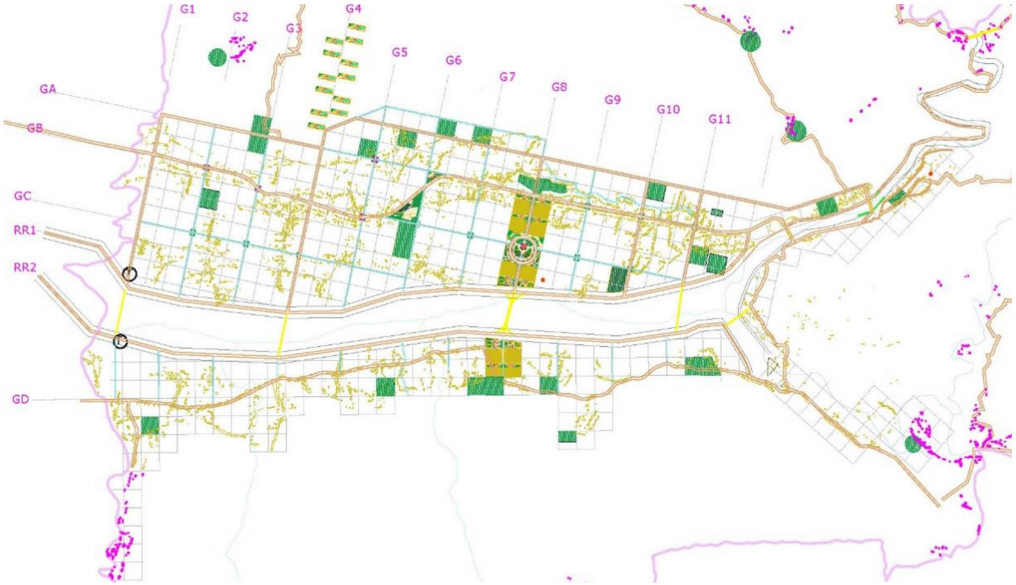


Fig. 4.24: Fig showing settlement areas in master plan indicting different districts

The traditional settlements (Tharu basti) inside the Gadhawa and Rapti village, Vulke gaun (the Magar settlements) are the major districts of LPCC except the major urban area.

4.3.4 Landmarks

Landmarks are point references considered to be external to the observer. They are more easily identifiable, if they have a clear form; if they contrast with their background; and if there is some prominence of spatial location (Lynch, 1960, pp. 78–79).

Fig. 4. 25 ; Map showing planning layout along G8

Here, the roundabout proposed in Institutional corridor (G8) and the recharge ponds with parks in commercial corridor (g4) with city hall around G6 will be the major land mark of the LPCC area

4.3.5 Edges

Edges are linear elements not considered as paths: they are usually, boundaries between two kinds of areas. They act as lateral references. Those edges seem strongest which are not only visually prominent, but also continuous in form and impenetrable to cross movement (Lynch, 1960, p. 62).

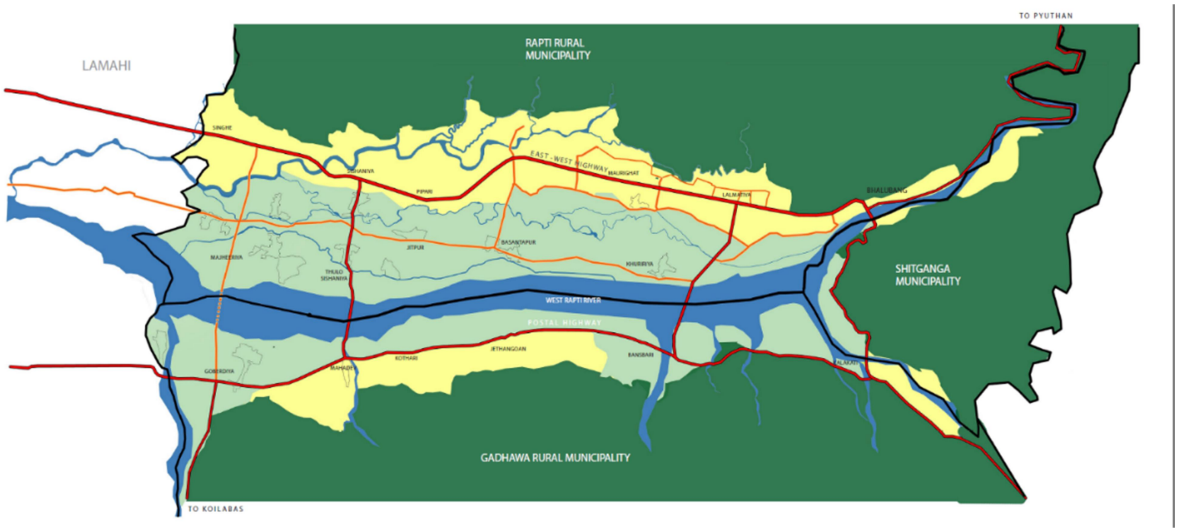
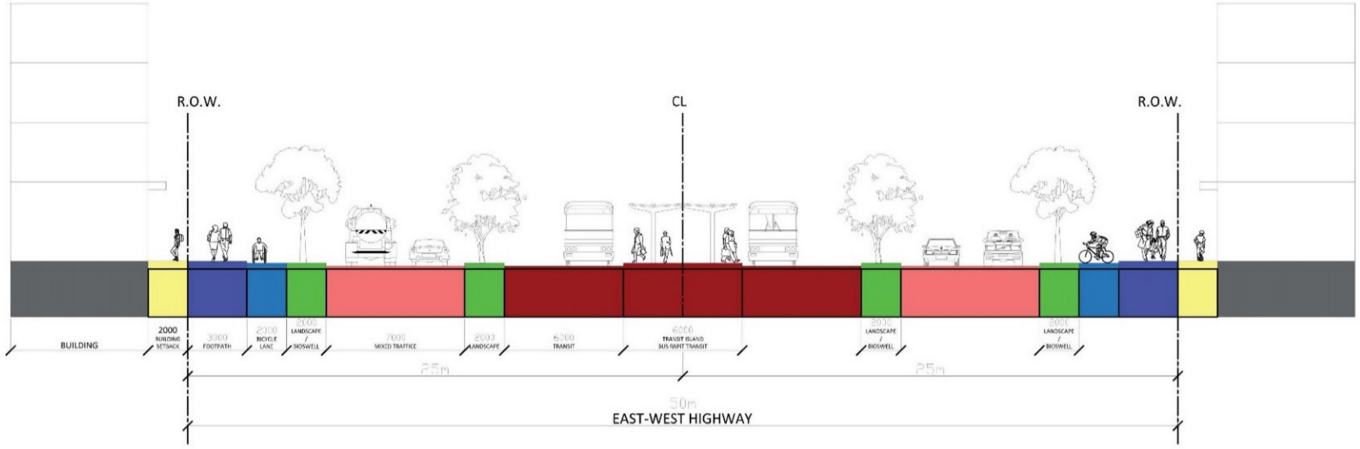


Fig. 4.26: Map showing The West Rapti river banks (RR1 and RR2) and the forest lines are the edges of the LPCC



SECTIONAL DETAIL OF PROPOSED DEVELOPMENT ALONG EAST-WEST HIGHWAY.

REFERENCE OF BUS RAPID TRANSIT LINE IN BANGKOK.

BIO WELL TO CATCH STORM WATER DURING MONSOON SEASON.

Fig. 4.27 Urban Development along major junctions of EW highway after introduction of Multi-modal transport system with segregated lanes for Regional bus transport and urban mix- transport for the proposed Capital City of Lumbini Province.

Fig. 4.28 Possible road junction along the EW highway after introduction of Multi-nodal Transport system with different lanes.

4.4 Infrastructures and Networks

The master plan proposes nodal concept for development and planning of the entire LPCC area, it can be assumed that such concept will take time implement. However, for establishing capital city in the LPCC area, certain local institution and project area are immediately required to be identified as demanded by the local authorities and PIDA. The Consultant proposes a tentative site for such projects in different open spaces available in the LPCC area.

An underground utility (electricity, gas, telephone, internet, fiber, cable television, liquid petroleum, water, sanitary sewer and etc.) tunnel or utility corridor is proposed for the entire city area to manage the aesthetic view of the city as well as proper maintenance of the utility lines. To avoid the possible disruptions caused by disasters such as earthquake, utility corridor or tunnel safest options for utility supply lines. It also offers ease in maintenance, repair and upgrading works. With such layout, service lines such as gas, water, sewer, electricity, telecommunications cable can be distributed to entire site without any disruption to vehicles and pedestrian traffic above ground.

Due to the nature of these services, regular inspection, repair, maintenance, or replacement are necessary, and therefore accessible utility tunnels are preferred instead of direct burying of the services in the ground. Utility tunnels range in size from large enough to accommodate the utility being carried, to very large tunnels that can also accommodate human and even vehicular traffic.

The advantages of utility tunnels are the reduction of maintenance manholes, one-time relocation, and less excavation and repair, compared to separate cable ducts for each service. When they are well mapped, they also allow rapid access to all utilities without having to dig access trenches or resort to confused and often inaccurate utility maps.

The greatest advantages is public safety. Underground power lines, whether in common or separate channels, prevent downed utility cables from blocking roads, thus speeding emergency access after natural disasters such as earthquakes, hurricanes, and tsunamis. When using road-based utility tunnels, they can be located under walking paths which means roads do not need to be dug up and can be laid with concrete similarly to highways to last longer.

The following are the features of utility networks in common ducts or tunnels;

- Higher initial capital cost for construction of tunnels
- Easy location of infrastructure
- Fast maintenance and replacement
- Less road works and traffic
- No manholes on roads. Single manhole for all infrastructure
- Easy to coordinate between different infrastructure
- Easy upgrading and expansion of infrastructure
- Easy access to maintenance
- Dramatically reduced future-maintenance costs
- Shared initial capital costs between infrastructure providers
- Reduced impact from outages
- High aesthetic value because no overhead power lines

- Increased cooperation and collaboration with infrastructure providers
- One-time relocation
- Reduced excavation and labor costs
- Increased public safety
- Manholes can also be removed from roads

In relation to LPCC planning, a detailed study and in depth analysis of the costs of construction, maintenance and emergency repairs of utilities and facilities associated with overhead versus underground utilities is required for the selection and implementation of such concept to find most cost-effective outcome, while maintaining a reliable level of service adaptable for the location and purpose. Some example of tunnel or corridor utility line can be seen below.

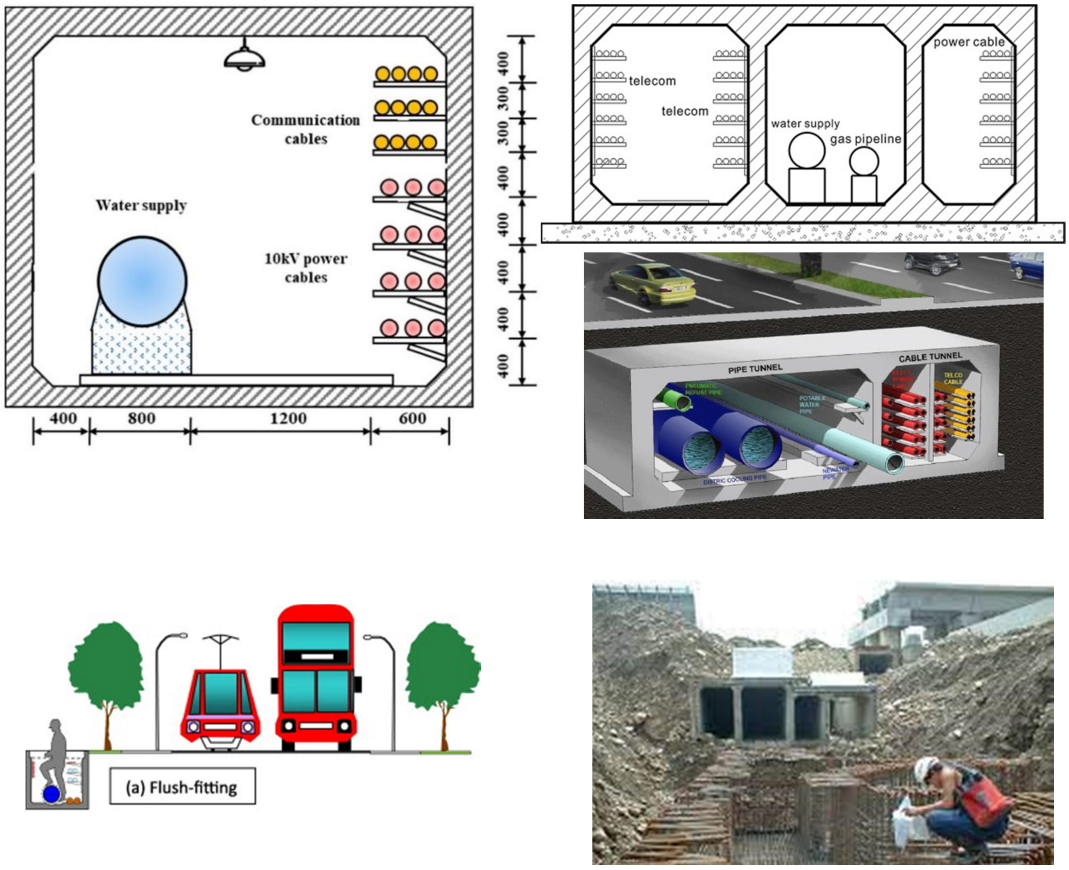


Fig. 4.29 Some Examples of utitliy tunnel from different projects

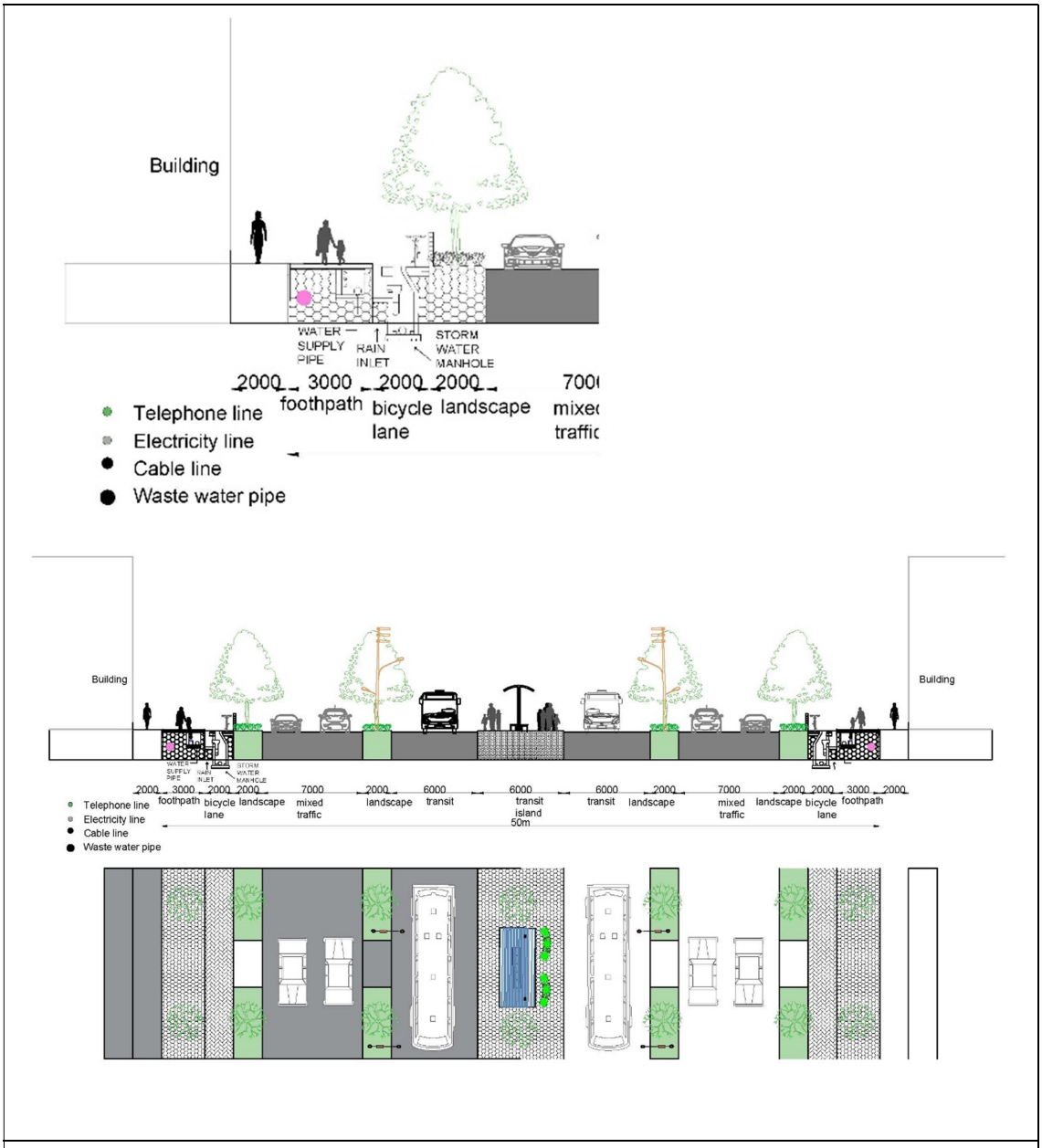


Fig. 4.30 Possible Tunnel Layout for LPCC along entire road for utitlity services. Above style Utility tunnels can be made at the center of 50 meter road or at footpath, while along footpath for other smaller width road.

4.4.1 Transportation Planning

Road transportation is the primary mode of transportation in the provincial capital. There is no any alternative except the improvement of road network in a sustainable way at the moment. The transport Network in provincial capital need to be update and new network need to be developed by 2031 to meet population and economic activities of the capital. The road network shall be developed considering improved transport linkages and accessibility to goods and services. The following factors are considered to determine sustainable way of providing transport facilities.

- Increase network connectivity that is more roads that connect different area allows more direct travel thereby reducing amount of travel
- High density urban development such as increased number of people or jobs per unit of land area increases the proximity of common destinations, thereby increasing demand for walking, cycling and transit.
- Mixed Land use that is locating different types of activities such as shops and schools within or adjacent to residential neighborhoods reduces the amount of travel required to reach common activities.
- The existence and quality of walking and cycling facilities can have a major effect on accessibility by non-motorized mode.
- The promotion of alternative more Bus system or BRT system can increase people's mobility that vehicle mobility.

4.4.2 Improvement of Road Network

Strategic Road and Urban Arterials

These roads are thorough traffic usually on a continuous route and connect the provincial capital with other part of country. Current strategic roads running through or connected to the provincial capital are Mahendra (East West) Highway (NH01), Postal Highway (NH05), NH53 connect Liwang, Madichaur and Darbot with the provincial capital at Bhaluwang, and NH71 that connect Bhaluwang with Kharwang of Baglung District through Arghakhanchi and Gulmi district (Fig. 4.15a). The right of way for these roads are 50 m and typical section is given in figure below (Fig. 4.15b). The construction and maintenance of these roads falls under responsibility of Department of road of federal government.

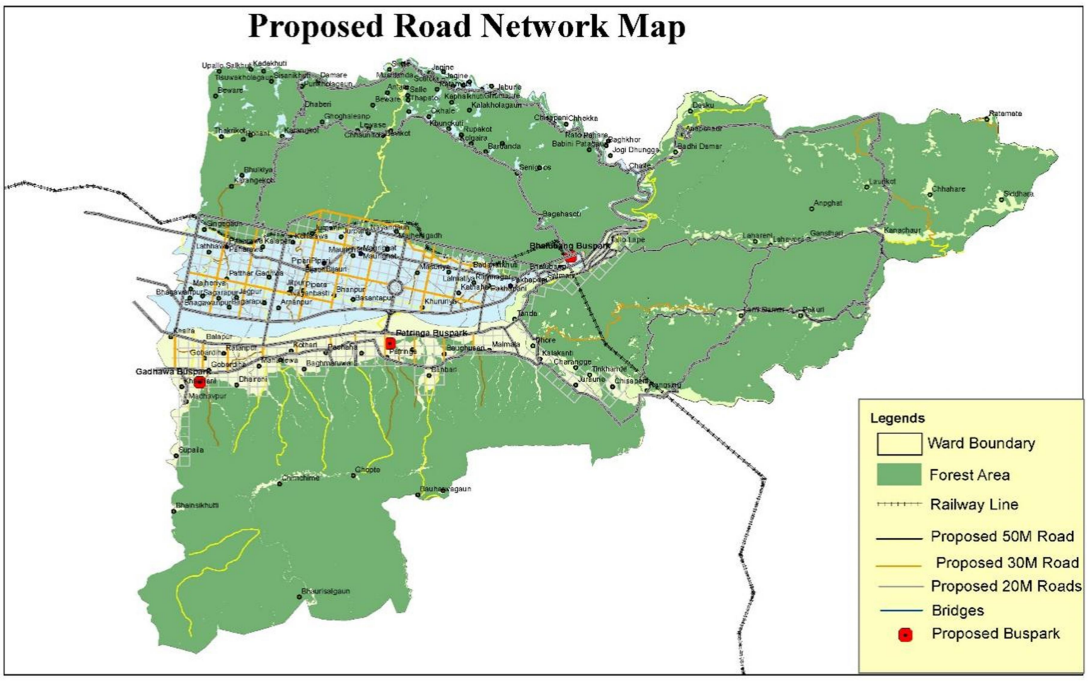


Fig. 4.31 Strategic road and urban arterials

Also, two north south road connecting proposed cultural node at Sisaniya and Mahadewa and also road connecting Institutional node at Lalmatiya and service node at Bansbari is proposed

to be of Arterial standard with 50 m proposed right of way. These two road connect the two strategic road Mahendra (East West) highway and Postal highway. Typical section is given above in figure. Also by 2051, additional North-South road connecting Maurighat and Jethangoan may require to meet business and commercial activities between north and south of West Rapti River.

Urban Sub Arterials

These are roads of somewhat lower level of travel mobility than the arterial roads. These road provided access to adjoining area more than arterial roads. Parking loading and unloading are usually restricted and regulated (Fig. 4.31a,b). Pedestrians are allowed to cross only at intersections or at the designated crossings. The roads to be upgraded or constructed are:

- A road through Jitpur, Basantapur, Khurirya, which is parallel to East west highway
- North south road through Majheriya to Goberdiya
- Parallel road East west highway through Maurighat to Bhaluwang, both side of East West Highway

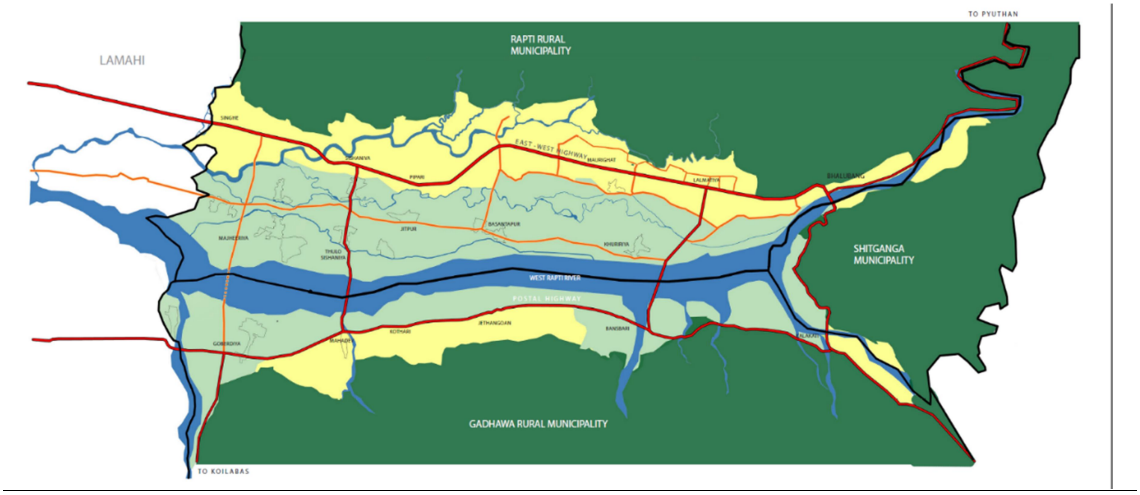


Fig. 4.32a Urban arterial road

Fig. 4.32 b Proposed road section of ROW = 30 m within city area

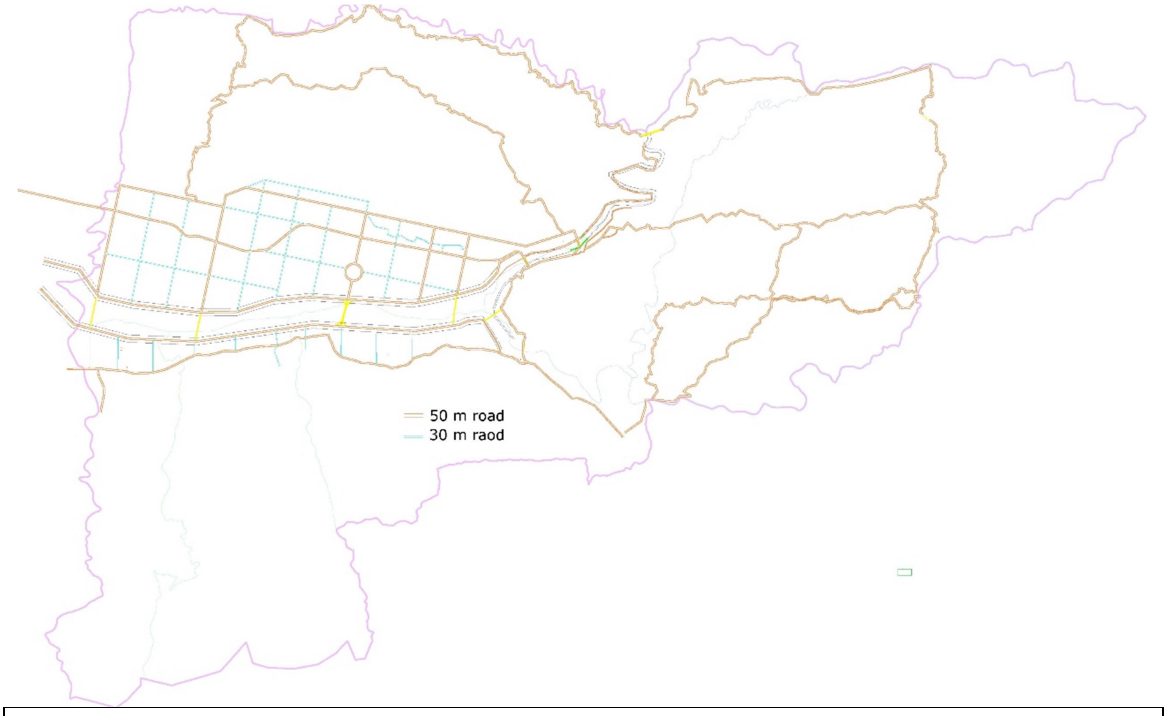


Figure 4.32c Map showing 50 Meter Road Plan

Urban Collector Roads

A collector road is one intended for collecting and distributing the traffic to and from local roads and also for providing access to arterial/sub-arterial road. They may be located in residential neighborhoods, business areas and industrial areas (Fig. 4.33 a, b). Normally full access is allowed on these roads from abutting properties. Plan and Typical section of Collector Road is shown in the figure given below:

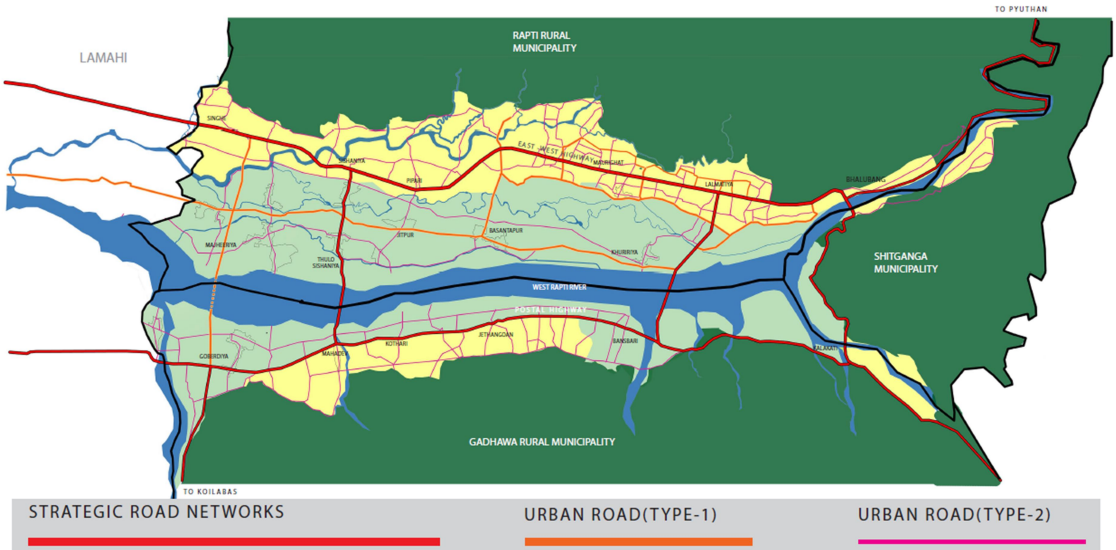


Fig. 4.33 a Urban collector roads

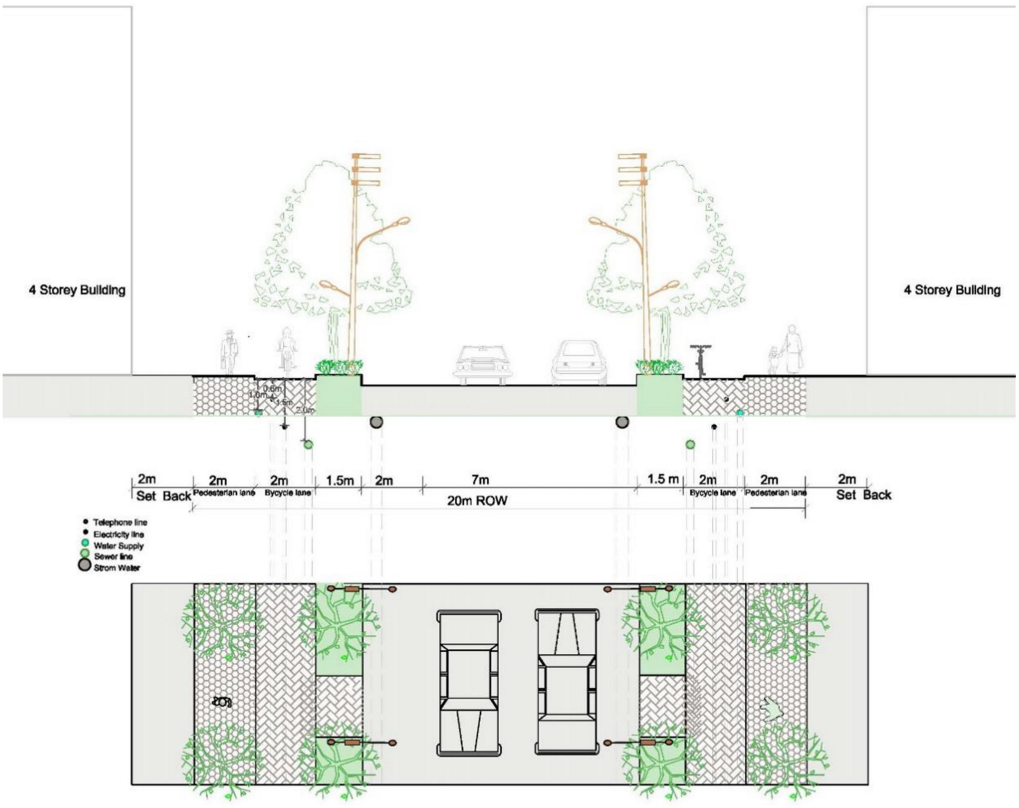


Fig. 4.33 b Street section of road with ROW = 20m within city area

Fig 4.33 c 30 Meter Road Plan

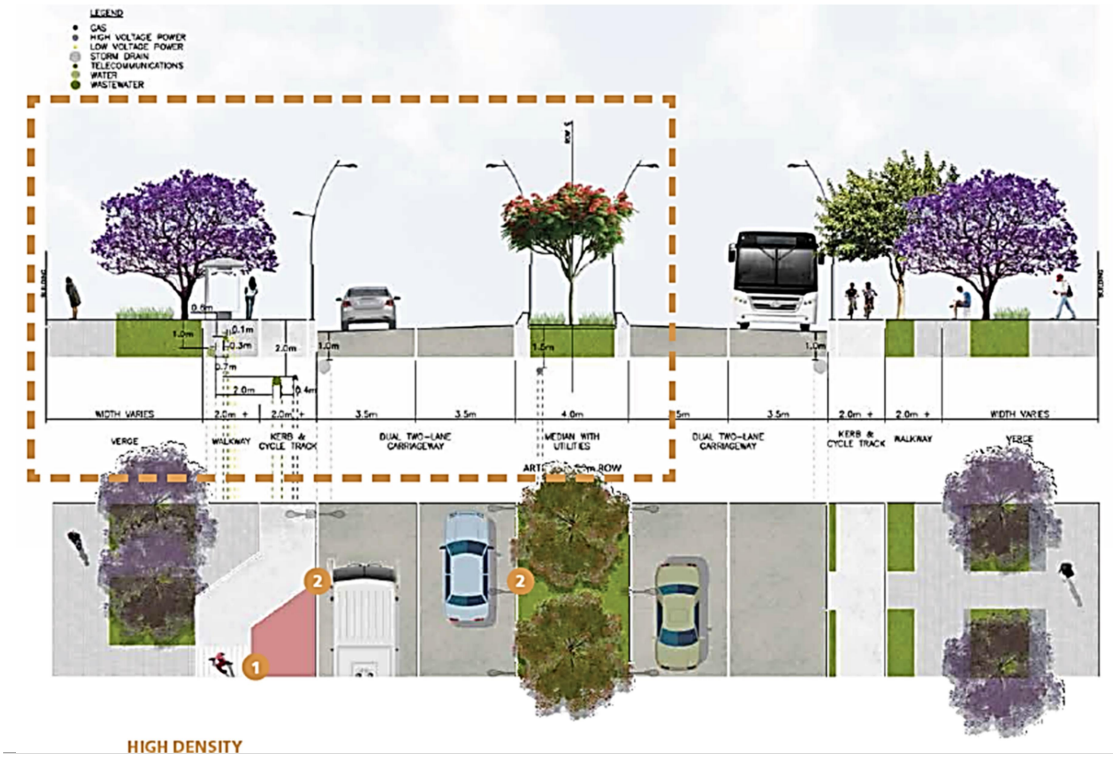


Fig. 4.34 Strategic road section in the settlements

4.4.3 Public Transportation System

As per population forecasting of the city, the primary node will have population density of 200 – 250 people per hectare, secondary node will have population of 150 – 200 people per hectares and tertiary node will have population density of 100 – 150 people per hectare. A population density of between 30 and 100 people per hectare is suitable as a Transit city. The higher urban density will allows the frequency of trips to increase as the buses fill up faster and more often. This decreases the travel time for passengers and further improves the transport mode's level of service.

- It is impossible to cope with the increased traffic by focusing solely on the road system in the future where there will not be space to develop new roads. Therefore, without public transport it would be impossible to deal with the increase in traffic.
- Use of private mode such as cars and motorcycles are used by females, students and elderly people are very less. Therefore, there are a considerable number of people who cannot make trips due to the non-availability of public transport
- Since there is no public transport available in the city except for the para-transit system such as auto rickshaw, which remains an informal mode and is actually used as public transport.

Bus system is the most conventional type of public transport that can serve as the public transport. Initial cost is relatively low; therefore, it is easy to introduce especially in small-sized cities such as those with a population of less than a million. But because it is a road-based system, operation punctuality is always dependent on the road conditions. To avoid this, there are several bus priority measures that can be implemented such as the bus lane. Low emission vehicle or electric vehicle are proposed to operate along the bus route. The

stops are spaced at the rate of 300 to 500 m on average. One of the most popular types of electric buses nowadays are battery electric buses. They have the electricity stored on board the vehicle in a battery and can range over 280 km with just one charge

Possible routes for operation of public transport corridor are prepared according to the following viewpoint:

- It represents either strategic road or arterial and sub arterial road which is planned according to planned development of city
- It constitutes a main structure of urban roads or ring roads that supports urban structures of city.
- It has a consistent relationship with the future urban structure framework.

The following bus routes can be operated:

- Ring road - Circular route covering three municipalities.(Purple Line)
- Route 1 – Circular route through east west highway and postal road (Green Line)
- Route 2 – Circular route along the proposed ring road in River Corridor (Red Line)
- Route 3 – Bus route from Pakhapani to Mahadewa to Bhaluwang

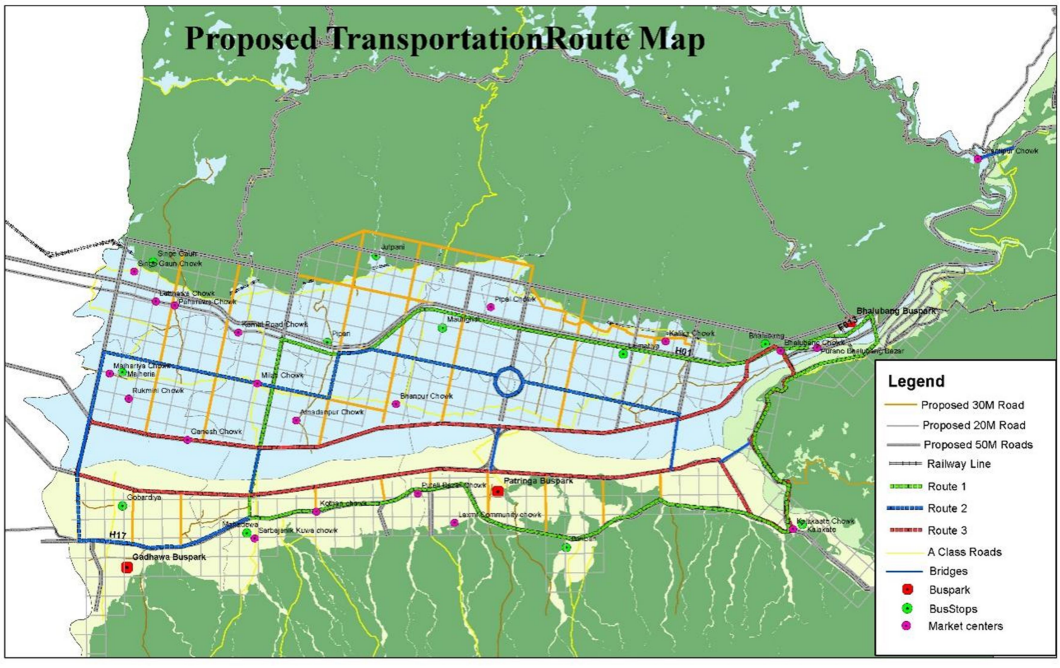


Fig. 4.35 Public transportation system

4.4.4 Traffic Management Measures

It is necessary to develop the various supporting measures that will enable the road and public transport to work effectively and safely. Especially, it is important to develop mode interchange areas as convenient transfer points with such facilities as bus stops, well designed cycle route, and a well-designed pedestrian environment. The various traffic management measures for the road safe and efficient movement of traffic are:

- Parking policies and measures

- Pedestrian environment development and side walk
- Separate cycle lane for major roads.
- Restructuring of para-transit such as auto rickshaw. They can be operating in narrow road such as class C and D roads as described by Municipal Transport Master Plan.
- Various traffic safety measures such as speed limit, segregating pedestrian/cyclist and vehicle, pedestrian overpass or underpass, driver's education, street light etc.

4.4.5 Sewerage and Drainage

Water Treatment plant is proposed at the western part of the site, Rapti Rural Municipality and Gadhawa rural Municipality. The location is selected as the natural flow if the drain can be accumulated at this sport for water treatment. A tentative flow pattern of drain is shown in the figure below.

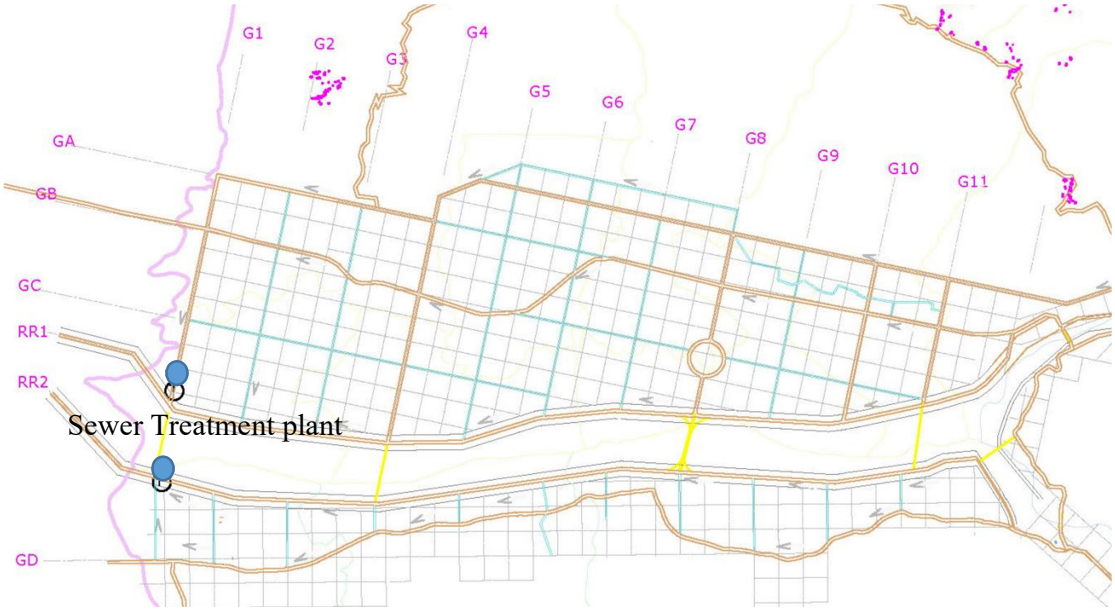


Fig 4.36 Network showing road, sewerage and drainage

Health facilities

A site for a hospital has been proposed at Laphe in ward 8 of Shitganga. It is assumed that the project will enhance economic viability of the area around the Bhalubang. A large open forest area is available around at Laphe near to the Bhalubang.

4.4.6 Educational institution

Current Rapti technical School has be proposed to be shifted to Gadhawa at 3. Area for two new universities have been proposed in LPCC area, one at ward 9 of Shitganga Municipality and one at Gadhawa Rural Municipality. Since large open spaces are required for educational facilities, the sites has been proposed tentatively in available area proposed in the map. It is expected that such projects will revive the area around the site gradually in future.

4.4.7 Social spaces

Parks

Many community parks have been proposed in the master plan. The Consultant proposes development of a comparatively large community park at few kilometers apart-23-4 kilometers. The Master Plan show four larger park for the purpose, while a green belt of 100 meter along the Rapti River on either bank can is also open space that can be developed as private or public community park in future.

Similarly, entire LPCC area is surrounding by forest area on the northern, eastern and southern side. The community and private forest can be managed as park for community use and resource management.

Temples

Religious opens spaces around the LPCC has been proposed to be conserved. In case of temples with large open spaces, certain spaces can be used for public services without hampering the temple periphery and its cultural aspect.

Chautaras

Chautaras are traditional community space used as resting spot under a large tree. Chautaras are important public space in the recent days too. These spaces can be used as resting spots for city dwellers and passersby for streets. Such spaces useful to create livable built environment and thus can be used a part of public space in city development as well. It is proposed to conserve and build new ones wherever possible.

Fig. 4.37 traditional Chautara at site

Palace

Conservation of 55 window palace at Gadhawa, Mahadewa is proposed. The palace is one of the unique local cultural feature belonging to Tharu community, thus can be converted into a museum or a cultural center for cultural tourism development in the capital city. It was constructed by the politician Mr Parashunarayan Chaudhary.

Fig. 4.38 55 Window palace at site

Cremation Centers / Ghats

Cremation centers are the religious sites. It has very important cultural aspect. There are different way to establish the cremation centers. During this study we have found more than six such cremation centers. We kept these spaces as where it was. We recommend for further detail study to these area and design them providing modern amenities concerning health hazard and pollution.

Following are the list of different projects allocated to different favorable sites within LPCC area. It is advised to place the infrastructure and services as indicated by nodal concept, however, due to land issues following sites have been proposed for immediate use.

Table 4.7 list of different projects identified with PIDA

Sn	Name	Status (Existing/ Proposed)	Locations		
			Municipality	Ward	Settlement
1	Waste water treatment plant	Proposed	Gadhawa	3	Gobardiya
		Proposed	Rapti	6	Bhagwanpur
2	Water treatment plant				
	Sishaniya Water supply	Existing/Proposed	Rapti	8	Sishaniya
	Lalmatiya Water supply	Existing/Proposed	Rapti	2	Lalmatiya
	Gadhawa Water supply	Proposed	Gadhawa	2	Pachahah
	Shitganga Water supply	Proposed	Shitganga	9	Laurikot
3	Solid Waste Management site	Proposed	Gadhawa	1	Bauharwa Gaun
		Proposed	Shitganga	8	Mathillo Lhafe
4	Bus park	Existing	Rapti	1	Bhalubang
		Proposed	Gadhawa	3	Gobardiya
		Proposed	Gadhawa	1	Malmala
5	Educational Institute				
		Proposed	Gadhawa	1	Badhahara(East side of Kulpani)
		Proposed	Shitganga	9	Rangsing
		Proposed	Shitganga	9	Lahaveni
6	Rapti Technical School	Proposed	Gadhawa	3	Gobardiya
7	Mini zoo	Proposed	Gadhawa	3	Baghnath Kuti
	Mini zoo	Proposed	Rapti	2	Harse Dada
8	Park				
		Proposed	Shitganga	9	Kanachaur
		Proposed	Rapti	1	Baghasoti
		Proposed	Rapti	3	Khururiya
		Proposed	Rapti	7	Badka Sishaniya
		Proposed	Rapti	1	Ramnagar
		Proposed	Rapti	1	Siddheshwor Shiva Mandir
		Proposed	Rapti	1	Pakhapani
		Proposed	Rapti	9	Devikot
9	Hospital	Proposed	Shitganga	8	Lhafe
10	Tourism area	Proposed	Shitganga	9	Pakuri/Dhada khola

Sn	Name	Status (Existing/ Proposed)	Locations		
			Municipality	Ward	Settlement
		Proposed	Rapti	9	Devikot
		Proposed	Gadhawa	1	Kulpani
	55 jhyaale Durbar	Existing	Gadhawa	3	Gobardiya
11	Police/ Army/APF				
a	APF	Existing	Rapti	2	Lalmatiya
b	State police	Proposed	Rapti	1	Bhalubang
c	Army Camp	Proposed	Rapti	4	Majhenigadh
12	Old Settlement	Existing	Rapti	3	Basantapur
	Old Settlement	Existing	Rapti	7	Arnapur
	Old Settlement	Existing	Rapti	8	Pipara
	Old Settlement	Existing	Gadhawa	2	Mahadewa
	Old Settlement(Magar Basti)	Existing	Shitganga	9	
13	Crematorium	Existing	Rapti	6	Rapti river
		Existing	Rapti	7	Rapti river
		Existing	Rapti	3	Rapti river
		Existing	Rapti	1	Rapti river
		Existing	Rapti	1	Rapti river
		Existing	Shitganga	8	Rapti river
14	Department of Transportation Management	Proposed	Gadhawa	1	Pakhapani
15	Sub Station (NEA)	Proposed	Rapti	2	Lalmatiya
16	Community Building				
	Nepal Magarsamaj	Proposed	Rapti	8	Pipari
	Rastriya Apaanga Mahasangh	Proposed	Rapti	1	Pakhapani
	Ex APF office	Proposed	Rapti	8	Jurpani
	Exhibition Center	Proposed	Rapti	8	Pipara
17	Red Cross Society	Proposed	Rapti	1	Bhalubang
18	CITA/Data Center	Proposed	Rapti	8	Jurpani
	Public Institutes				
	Public Service Commission	Proposed	Rapti	5	Karangekot
	Nepal Telivision	Proposed	Rapti	8	Jurpani
	City Hall	Proposed	Rapti	2	Lalmatiya
	CBS Office	Proposed	Rapti	2	Lalmatiya
	Provincial Court	Proposed	Rapti	4	Maurighat
	Fire Brigade	Proposed	Rapti	2	Lalmatiya
	Province Chief Office	Proposed	Rapti	3	Baghdadi
19	Political Party Office	Proposed	Gadhawa	1	Malmala
20	Banks	Proposed	Rapti	8	Maurighat
21	Vegetable Market	Proposed	Rapti	2	Back side of ward office
22	Slaughter House				
	1	Proposed	Rapti	8	Kohalewa
	2	Proposed	Gadhawa	1	Badahara Buaraha khola

Sn	Name	Status (Existing/ Proposed)	Locations		
			Municipality	Ward	Settlement
	3	Proposed	Shitganga	9	Rangsing
23	Auto Village	Proposed	Gadhawa	1	Dhodre
24	Historical Market	Proposed	Rapti	1	Bhalubang
25	Sports ground	Proposed	Rapti	7	Basantapur
26	Commercial/Buisness Hub	Proposed	Rapti	1	Pakhapani
27	Haat bazaar	Proposed	Rapti	2	Back side of ward office
28	High class residence	Proposed	Shitganga	9	Nayabasti
29	Resort	Proposed	Shitganga	9	Silingkhola
30	Bhalubang Bouddha Bihar (Gumba)	Proposed	Rapti	1	Bhalubang (Pulchowk)
31	Industrial Area	Proposed	Gadhawa	2	East side Lakhpati Community Forest
32	Province Women and Childrens Hospital	Proposed	Gadhawa	1	Dhodre

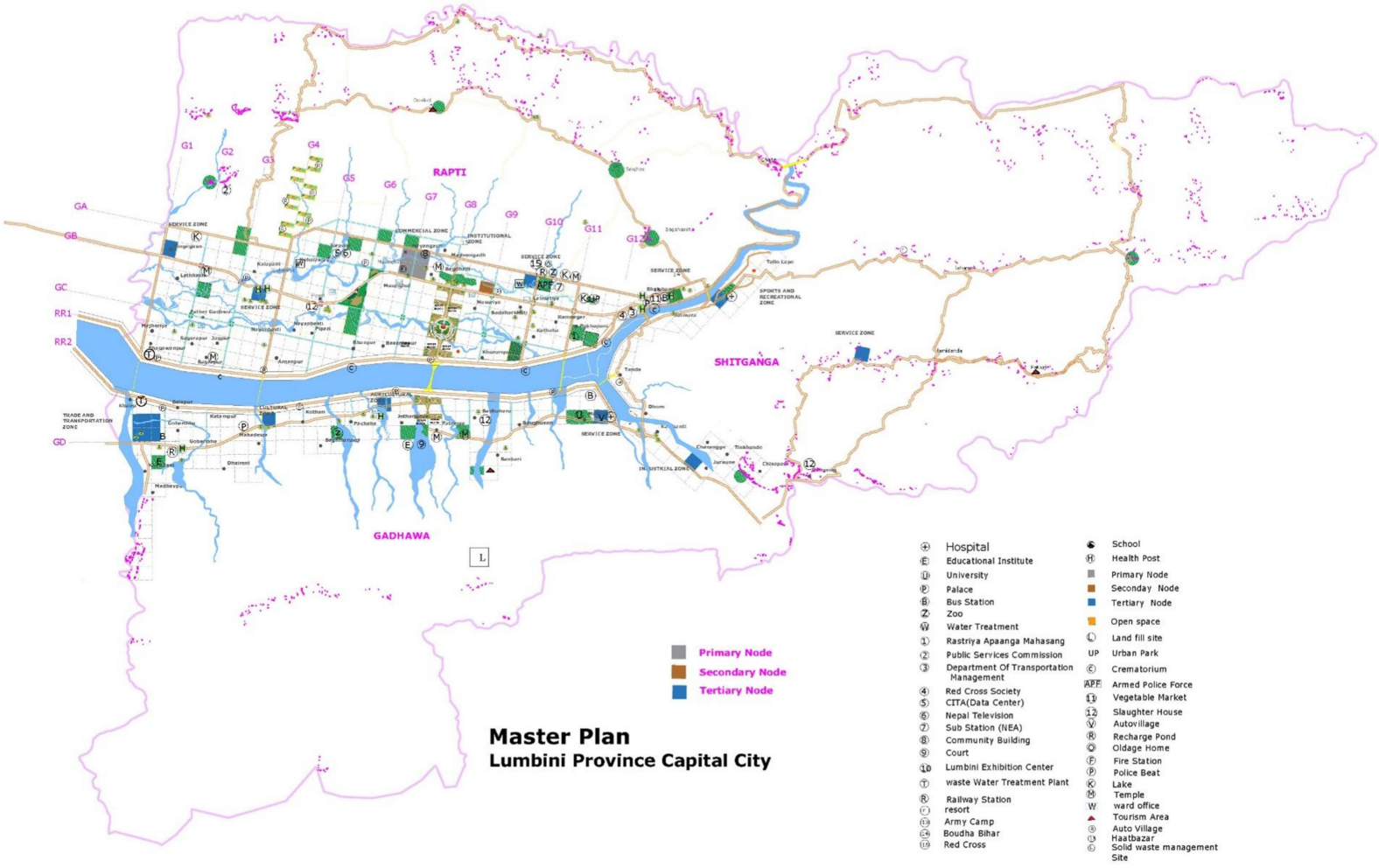


Fig 4.39 Proposed Maps with proposed infrastructures

4.5 Environment and DRM

20 large and medium sized public open spaces have been identified in the LPCC area. Conservation of such open spaces and is important from the perspective of environmental and disaster risk management. Few public service infrastructures have allocated in these open space in such a way that it will also be helpful for the conservation of the open space as well.

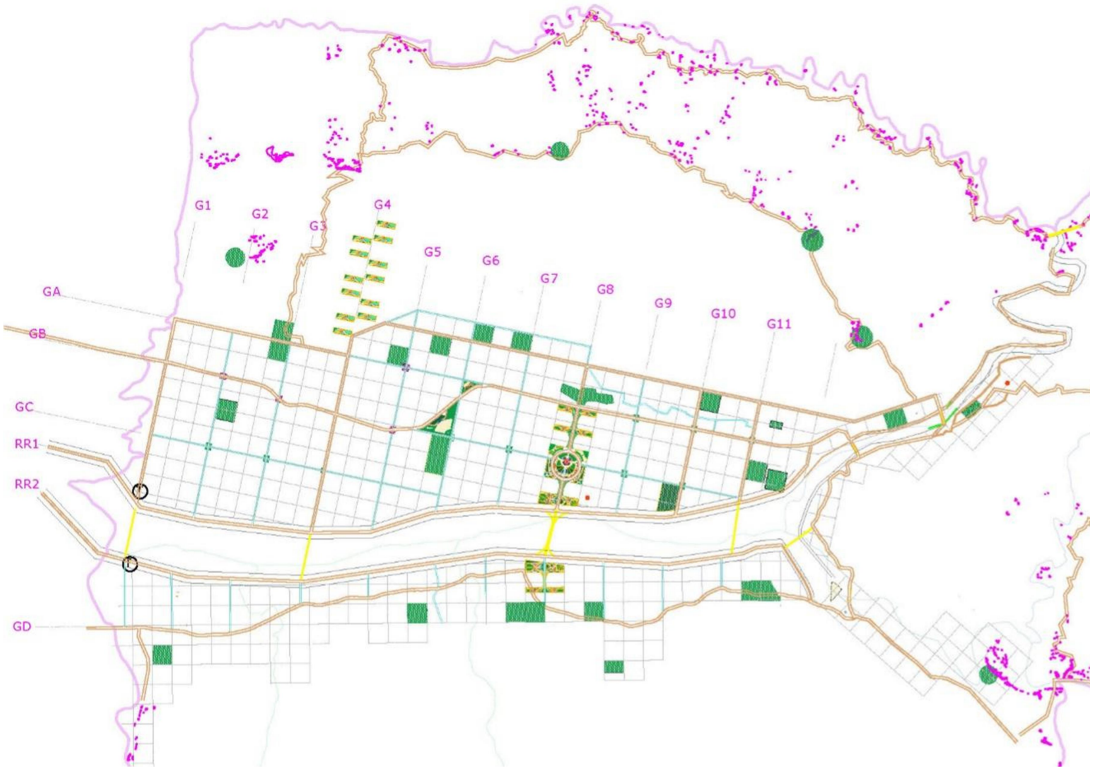


Fig 4.40 Open spaces within LPCC

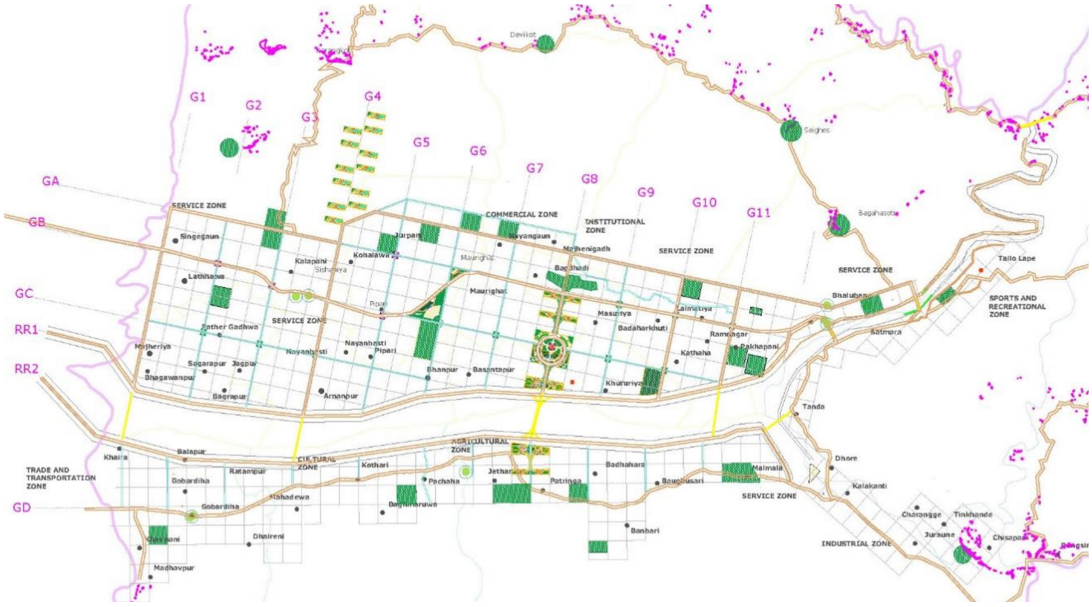


Fig 4.41 Evacuation Route,

Evacuation Centers

Entire LPCC area is surrounded by Forest which itself is and open space that can be useful during certain disasters like earthquake. Parks have been proposed at a distance of 2-3 km in the master plan which can be designated as evacuation space or shelter to be made. A green belt of 100 meters has been proposed along the entire Rapti River bank. It can be another open space for evacuation during disaster like earthquake, fire, excluding flood. Beside there are schools and ward offices premises that can be converted as evacuation shelter for public in different disasters.

The proposed road network can be used as evaluation route for different block along the entire grid while considering 1200x1200 block a cluster.

Few Measures for Disaster Risk Reduction are proposed here;

- The flood and hazard mapping done in this study is based on available secondary data (Fig. 2.8). For the implementation of large scale projects such as, Master Plan of LPCC, that has greater impact in coming decades, a detail study for based on primary data obtained through field survey is necessary to achieve accurate result and is recommended.
- The area covered by flood plan shown in the analysis are vulnerable to the flood are not recommended for purpose of settlement. These area can be used for recreational and agricultural.
- Building embankment at the bank of Rapti is advised where high density of flood events are seen in the analysis. It includes areas such as Khuriya and Bhaluwang.
- Developing new settlements at the hilly region of the LPCC is not recommended. These area are weak in structure and with high slopes in scattered nature (Fig. 2.9, 2.10) and prone to landslides.
- For the seismic vulnerability, a detail study should be carried out regarding the fault line.
- Risk sensitive land use planning should be prepared based on detail study and primary data
- Land slide hazard mapping should be done at local level
- Proposed land use and zoning practices must be enforced
- Safety measure should be taken at community or institutional level for the protection of life and property from lightening disaster. Building permit system should incorporate this chapter as well.
- Fire safety measure should enforced for public buildings.
- Building codes and standards are to be enforced.
- Bridges should be designed to withstand earthquake.
- To adapt to the climate change, the change in pattern of current agricultural crops production should be studied through primary survey and thereby recommend crops that can adapts to the changing climate to protect the livelihood of farmers and for improvement of agricultural yield in the area
- Protection of water resources is recommended at different location

4.6 City and Resource Managements

4.6.1 Natural resources conservation

Goal

In the territory of the Lumbini Province capital city there are plenty of natural resource, and it should be manage well with a goal to maintain and enhance natural resource and watershed ecosystem. The objective of the natural resources management and conservations should be;

- To protect and increase water availability, water quality in the streams and rivers,
- To conserve forest and aquatic biodiversity,
- To rehabilitate and conserve cultural and historic sites,
- To promote eco-tourism,

Activities

Activity-1: To protect and enhance water resources in the watershed,

- Undertake various measures to protect and increase water availability in the rivers and streams:
- Implement Integrated Water Resources Management (IWRM) measures to protect, enhance and conserve water availability;
- Promote total sanitation and discourage open defection with the implementation of adequate public toilets;
- Prevent disposal of solid waste in and around water bodies;
- Regulate river bed mining and excessive exploitation of natural resources;
- Protect and manage wetlands in the entire area;
- Construct water harvesting dam/reservoirs at suitable locations;
- Construct and maintain river protection works along the rivers such as Rapti, Ransing, Singe Khola, Sit Khola and others,
- Construct series of check dams along with bio-engineering works on small streams especially in Gadwa RMP wand no 7,8 and 9; such as Dhan Khola, Malmala Khola ,Bahuwa Khola, Supaiya Khola, and Karaudi Khola, Kalapani Khola, Dolai Khola, Bhulkiya Khola, Masitaal Khola and others in Rapti RMP.
- Establish the system of regular water quality monitoring and evaluation;

Activity-2: To conserve forest and aquatic biodiversity,

To protect and enhance forest and biodiversity is essential and it could have following activities;

- Perform forestation works in regular basis on the upper as well as lower areas especially in grass lands and barren lands;
- Strengthen existing Forest Users Groups with appropriate training on conservation, utilization and management of forest resources;
- Control and regulate encroachment to the forest and public lands from deforestation, grazing, mining, agriculture and commercial activities;
- Promote to develop green corridors along both banks of Rapti river;
- Protect biodiversity through the inventory of aquatic as well as terrestrial resources;

- Promote income generating activities to local poor to reduce the pressure on forest encroachment;

Activity-3: To rehabilitate and conserve cultural and historic sites,

The study of the ethnic morphology is of prime concern of any city. LPCC is rich in culture and historic sites. It should be protected and enhance. The culture and history should be tie up with the economy. The nature is the resource and the culture is the process/ method of the resource utilization, thus it should tie up simultaneously. Following activities could adopt to rehabilitate and conserve cultural and historic sites;

- Prepare and implement restoration plans for historic sites such as Devikot with the implementation of tourism infrastructure such as cable car, trekking steps, trial bridges etc;
- Prepare and implement conservation plan for the Tharu, Magar and other culture like Chaudhary village, Magar village etc.
- Rehabilitate and renovate existing temples, Chautara (Bar-Pipal tress), ghats and other heritage sites;

Activity-4: To promote eco-tourism,

- Explore, diversify and implement the eco-tourism products of the area such as adventure sports, birds watching, sightseeing, river boating etc;
- Develop botanical garden with the selection of site specific botanical species as a model in the Province;
- Develop zoological park (zoo) covering at least 50 ha of land with appropriate facilities;
- Identify and implement trekking routes with the development of infrastructures such as steps, culverts, suspension bridges etc.;
- Promote agriculture tourism in Tharu community area with the introduction of organic farming and composting.

4.6.2 Waste Management

Solid Waste Management

Sold waste management in a city is a crucial aspect to achieve sustainable urban management and development of a city. The sector impacts directly on the quality of urban life and services. A city with quality solid waste management can ensure better health and habitat for urban population such as quality of drinking water, maintain hygienic urban environment for living. Thus, a thorough study to prepare solid waste management plan and its implementation is a must for new and existing city.

Solid waste management includes management not only include management of solid waste but also waste water treatment before letting them out into urban environment. Management of such waste involves raising awareness at grass-root level and participation of individual household for the successful management of solid waste. Following activities are recommended for the solid waste management of Capital City

- Raise awareness at household and school level for the segregation of waste at household level, and for concept of reuse, recycle, reduce and refuse.

- Establishing regulations for the segregation and management of solid waste at local level,
- Segregation of waste at household level should be encouraged such as through distribution of wet and dry bins to households,
- Subsidizing households for the making fertilizers to make organic waste such as motivate or promote private companies in such works
- Capacity building of local level for sustainable disposal of different waste or solid waste management through collaboration with private sector for sustainable landfill development and management, and for collection of door to door waste
- Development of electric dead body incineration for the city

Two solid waste management sites are proposed, one at the Gadhawa Rural Municipality and another at the mid of Rapti Rural Municipality. Transfer stations as per the requirement from the detail study could be established at the city core. These sites have been tentatively proposed, just as a favourable location for the purpose.

Sewer Management

For the sewerage management identify core areas of city, which are suitable for sewerage network system and rest by onsite sanitation system. The onsite sanitation system should be accompanied by faecal sludge management if seemed necessary. Similarly, a detailed study to identify inundated/water log area of the core city is needed to propose appropriate storm-water management system. A detailed Assessment of present and future wastewater production (flows and pollution loads) from domestic, institutional, commercial and industrial sources based on representative measurements should be studied and recommend the types and size of treatment needed.

Two waste water treatment sites are proposed; one at the Gadhawa side (at and around Gobardiya) and another at Rapti side (at and around Bhagwanpur, Majheriya) at the bank of west Rapti River as the sites are at lowest level and is easily accessible through transportation.

4.6.3 Economic Measures

Primary sector is the main sector of economy of LPCC. Within primary sector, agriculture, specifically production of paddy and vegetables, has significant contribution. Generally, farmers export food grains, like paddy to Rolpa and Pyuthan districts. These two districts are major export destinations of LPCC region. Vegetables are exported during winter season whereas imported during summer season. There are 15 crosser firms in this region, which export almost 200 tripper sand and crossed stone each day. Rapti River is main source of extracting such river-based products. Secondary sector (industrial sector) and tertiary sector (service sector) are not developed properly. Industrial goods are being imported from Butwal, Bhairahawa and Krishnanagar.

In future, with the development of infrastructure and increase in population, there will be decrease in size of agricultural land. To protect agricultural land, some legal provisions, that avoid land fragmentation, should be made. Basically, land registration tax and related capital gain tax can be used as instruments to avoid land fragmentation. But, at the same time, there

is potential of industrial development. LPCC region is transit point to the western part of the Province. So, there is possibility of developing LPCC region as economic hub. There is potentiality of developing agriculture-based industries (like food processing industries), tourism industry and industries based on river-based materials (like block industries and hume pipe industries). Furthermore, paper industries and furniture industries have also potential in this region. With the increase in population and economic activities, industrial environment will be improved in near future.

With the increase in investment in infrastructure, demand for both skilled and unskilled labor will be increased. Thus, in future this region will be attractive for employment opportunities in construction industry. Increased employment will lead to increase in income of people.

There is the possibility of expansion of tourism industry in this region. Some locations having future tourism potential include Naumure hydropower dam area, Karunge dada area, Bhulke area, Bhadrashidevi Mandir (where it is assumed that right leg of goddess Satyedevi was decayed), Kalakate area (where it is assumed that Gorkha military killed black people in war during unification period. There is a spot, in this area, containing three big stones, where Gorkha military were supposed to cook food after defeating foreign military), and so on. Furthermore, this region is transit point for the people who travel to Sworgradwari. If tourism related infrastructure are constructed, people who want to travel to Sworgadwari may stay few days in LPCC region. Furthermore, better infrastructure and facility may also help to attract tourists visiting Lumbini. For this, hotels providing quality service is necessary. There is also potentiality of rafting in Rapti River.

LPCC region is almost unexploited. Based on the vision of Lumbini Province, it can be used. Until now, agriculture is major component of its economy but in future there is potential of developing service sector as well as industrial sector. For this, proper planning is necessary.

4.6.4 Slums and Informal Settlements

The UN Habitat Program of 1995 defines informal settlements as residential areas where a group of housing units has been constructed on land to which the occupant has no legal claim, or which they occupy illegally. Informal settlements are unauthorized and unplanned settlements areas where housing is not in compliance with current planning and building regulations. Based on this definition the informal settlements can be categorized into four groups as slums, informal settlements, and landless settlements and bonded labor settlements.

a. Slums:

Slums are legal but overcrowded, under serviced settlements. They are normally found in the center of the cities but can also present at rented land, in the urban periphery. They are unplanned settlements, very old and not compliance with current planning and building regulations. These are settlements that lack access to basic services characterized, in part, by the lack of access to clean water and exposure to unsanitary conditions with excrement and open sewage pooling along unpaved walkways. As pointed out in HABITAT (2003), the term ‘slum’ is a “general context to describe a wide range of low-income settlements and/or poor human living conditions”. Meanwhile, squatters are people who occupy land or buildings without the explicit permission of the owner (HABITAT, 2003).

In planning cities it is important to consider that slum are integrated or upgraded and new ones are not avoided. It includes providing for basic services such as housing, streets,

footpaths, drainage, clean water, sanitation, and sewage disposal. In addition to basic services, one of the key elements of slum upgrading is legalizing or regularizing properties and bringing secure land tenure to residents.

Ultimately, upgrading efforts aim to create a dynamism in the community where there is a sense of ownership, entitlement and inward investment in the area.

Relocation is often considered as solution to slum and squatter, however, it is not the ultimate solution to the problem. Resettling slum residents far from their original homes and job opportunities is not usually viable. The economic and social disruption costs are too high.

Slum upgrading is important so that people have a fundamental right to live with basic dignity and in decent conditions. If slums are allowed to deteriorate, governments can lose control of the populace and slums become areas of crime and disease that impact the whole city. Slum upgrading benefits a city by:

Fostering inclusion. Slum upgrading addresses serious problems affecting slum residents, including illegality, exclusion, precariousness and barriers to services, credit, land, and social protection for vulnerable populations such as women and children.

Promoting economic development. Upgrading releases the vast untapped resources of slum dwellers that have skills and a huge desire to be a more productive part of the economy, but are held back by their status and marginality.

Addressing overall city issues. It deals with city issues by containing environmental degradation, improving sanitation, lowering violence and attracting investment.

Improving quality of life. It elevates the quality of life of the upgraded communities and the city as a whole, providing more citizenship, political voice, representation, improved living conditions, increased safety and security.

Providing shelter for the poor. It is the most effective way to provide shelter to the urban poor at a very large scale and at the lowest cost.

In addition, slum upgrading is:

Affordable; Slum upgrading costs less and is more effective than relocation to public housing. Developing land with basic services costs even less.

Flexible; it can be done incrementally by the city and by the residents at a pace that is technically and financially possible for both.

Viable; the poor can and are willing to pay for improved services and homes.

Some ideas that shape the policy framework for a successful slum upgrading programme

1. Accept and acknowledge slums and their importance.

Achieving a city without slums begins with a shared understanding that slums and their residents are an integral part of the city, and that slum residents have a right to the city and to its services.

2. Political will and leadership makes slum upgrading possible.

Both national and local governments must provide the vision, commitment, and leadership required to sustain nationwide upgrading.

3. Include the slums in the city's plans.

Create a strategy and plan how to transform slums as part of the core business of managing and improving the city and its economy. An effective tool to define these plans is to carry out a City Development Strategy (CDS) to identify city priorities, lead to producing a workable plan for the upgrading programme.

4. Mobilize partners.

Partnership is important to successful upgrading. Successful slum upgrading is a highly participatory endeavor. It is also very comprehensive and complex, needing coordinated inputs from many local government agencies as well as those from outside the public sector.

5. Provide security of tenure.

Secure tenure is at the very center of slum upgrading. Without some form of legal tenure security the situation of slum residents and their neighborhoods is uncertain: they could be removed at any time. People who fear eviction will not invest in their houses. They will invest, however, once they have a sense of permanence and realize that they can sell their house and recoup their investment. Furthermore illegality and informality make them susceptible to exploitation, corruption and extortion.

6. Plan with, not for, the slum communities.

Residents are the main partners of slum upgrading programs. Because their futures are directly affected by the decisions, and because they can help in the upgrading process, it is necessary that they be fully informed and actively involved.

7. Ensure continuity of effort over time and institutionalize the programme.

Upgrading is an incremental, but sustained process. When slum upgrading is municipal a core operation, it produces cohesion, coordination, and increases efficiencies in service provision.

8. Allocate budget, design subsidies, and mobilize public and non-public resources.

Stable and consistent national and local budgetary allocations are needed for slum upgrading. Large-scale upgrading programmers need central government support backed by corresponding national budgetary allocations, subsidy policies and human resources.

9. Find alternatives to new slum formation.

Upgrading existing slums and preventing new slums are twin objectives of Cities without Slums policy. Until land and housing policies are changed to eliminate barriers for the poor, new slums will continue to occur. Therefore, cities need to introduce proactive measures for producing viable alternatives to slums.

10. Invest in community infrastructure.

It is important to invest in a community infrastructure that helps build community cohesion. Investing in infrastructure demonstrates a government's commitment to an area and brings dignity back to a neighborhood. If a government invests poorly, people will not respect the infrastructure.

b. Informal Settlements:

They are not landless people but occupying the government and public lands. They are socially accepted but do not have the legal right. Informal settlements are a common phenomenon in Nepal. Increasing urban land and house prices are contributing to the growth of squatter settlements.

Slums and squatter settlements are often located in ecologically sensitive and marginal areas such as riverbeds, forest, lowlands, and flood-prone areas and are thus vulnerable to natural hazards. Several dimensions of poverty that impact upon the vulnerability of the urban poor can be identified:

Property rights and security of tenure: Without secure tenure and land title documents, squatter residents can be subject to harassment by the authorities and access to public services, credit and livelihood opportunities are limited (UN-HABITAT, 2010: p.9). Fear of eviction is a key factor preventing investment in structures and housing improvements (Bajracharya et al., 2015: p.25).

Access to infrastructure and public utilities: The provision of water and sanitation is not sufficient to meet the demands of rapid urbanization and that impacts directly to this informal settlement.

Health: As a result of inadequate water and sanitation facilities, waterborne epidemics occur regularly, affecting the poor and marginalized the most. Overcrowding has increased vulnerability to communicable diseases. Old age, Poor, children and women are particularly vulnerable.

Social exclusion: There is a strong sense of social exclusion amongst informal, squatter and slum communities. They are often treated as temporary settlers and outsiders - the lack of tenure and the inability to obtain election cards deprives them of the right to participate in political processes.

Crime and violence: There is an absence of the rule of law in slums, along with a lack of social protection mechanisms and isolation from other settlements.

Informal settlement upgrading includes improving access of this communities to basic physical and social infrastructure, economic opportunities, tenure rights, information and institutions, focusing on the poor and achieved with the active involvement of slum communities during the planning, implementation, monitoring and management process, and through contribution of part of their own resources required for development, operation and maintenance. Informal settlement upgrading as a process of intervention in the physical, social, economic and juridical structure of an existing human settlement that was formed through spontaneous mechanisms and unplanned processes of land occupation.

c. Landless Settlements (Sukumbasi Basti):

They are landless people occupying the government land, forestland, or public land. The land has been occupied illegally. They are unplanned and often without basic services.

d. Bonded labor Settlements (Kamaiya Basti):

“Kamaiya” is the term for agricultural workers or tenants of farmland working on farm or in house as labor in the verbal or written agreement with landowner of Terai areas of Mid and Far Western Development Regions of Nepal.

Based on above condition, it is advised that slums and squatters in LPCC, which is estimated development scenario. Their presence should be accepted and should be integrated into city development concept. It is recommended to integrate them into their current site rather than relocating them into another place, since it will be time consuming and extra resource for relocation will not be required. Land should be provided to them according to current rules and regulations with allocation of sufficient budget for integration.

4.6.5 Challenges of City and City Identity

A city is a large human settlement and generally have extensive systems for housing, transportation, sanitation, utilities, and land use, production of goods, and communication and facing big challenges.

The UN assessments that 55% of the global population lives in urban areas – a number that is projected to rise to 68% by 2050. With some exceptions, cities are expected to become bigger and more numerous. As urbanization speeds up, the biggest challenges opposing the future of cities:

1. Environmental threats

Rapid urbanization, which strains basic infrastructure, coupled with more frequent and extreme weather events linked to climate change is exacerbating the impact of environmental threats. Common environmental threats include flooding, landslide, heat waves and epidemics. Owing to the physical and population density of cities, such threats often result in both devastating financial loss and deaths. Making cities more resilient against these environmental threats is one of the biggest challenges faced by city authorities and requires urgent attention.

2. Resources

Cities need resources such as water, food and energy to be viable. Urban sprawl reduces available water catchment areas, agricultural lands and increases demand for energy. While better application of technology can boost agricultural productivity and ensure more efficient transmission of electricity, cities will continue to struggle to provide these resources to an ever-growing urban population. Beyond these basic requirements, haphazard growth will see the reduction of green spaces within cities, negatively affecting livability. As fresh water becomes scarce and fertile lands diminish, food prices may escalate, hitting the poorest hardest.

3. Inequality

When it comes to both the provision of basic resources and resilience against environmental threats, the forecast is uneven for different groups of urban inhabitants. As the number of urban super-rich grows, many cities will also see increased numbers of urban poor. The widening gap between the haves and have-nots will be accentuated in the megacities of the future. Such inequalities, when left unchecked, will destabilize society and upend any benefits of urban development. There is a critical need for policy-makers to ensure that the fruits of progress are shared equitably.

4. Technology

Technology will be increasingly used in the development and running of cities of the future. Smart planning used in Singapore can harness solar energy for use in housing estates and create man-made wetlands for ecological balance. Smart mobility technology can alleviate traffic gridlocks which plague many cities.

The use of environmental technologies which can cool buildings more efficiently or run vehicles that are less polluting will also lead to better future cities. Installing sensors in the homes of ageing seniors living alone can connect them to the community and summon help when they are unwell or hurt.

However, technology can exclude urban inhabitants who cannot afford it or lack the capability required for its adoption. As future cities become more digitized, care must be exercised to prevent the emergence of a new form of social divide rooted in the technological.

5. Governance

Future cities offer immense possibilities to enrich the lives of their inhabitants even as the challenges are stark. To make the best out of inevitable urbanization, good governance is imperative. Cities will increase in size and their populations become more diverse. Governing these cities will, therefore, be progressively complex and require the most dedicated of minds.

6. **Identity**

A city-region's identity is its DNA: a unique, inherited collection of assets, history, traits, and culture that distinguishes it internally and externally, and has the potential to unite people and place.

The identity of a city defines by natural, Geographical and cultural products and social life of the area. Continuously changing and regenerating cities loses their readabilities and their citizens live perception. In those societies the feelings of the inability to be belonged to that city or to own that city grow. As a result of this, it becomes more difficult to preserve the historical – cultural heritage, local originalities and city identities in that city. Components Forming the City Identity are as follows:

- Physical structure of the city.
- Socio – economic structure of the city,
- Cultural accumulation or structure of the city,
- Historical development of the city,
- Spatial characteristics of the city,
- Formal and visual characteristics of the city,
- Life style and life quality of citizens,
- Functions of the city,
- Physical environment and social behavior relation of the city,
- City – nature unity,
- Urban substructure,
- Urban typology

A city's **identity** can be compared to that of a person's identity. Everyone has their own genetic makeup, character, and lived experience that define them as an individual. Based on this identity, people choose to represent themselves through their personal **brand** in how they

dress and what stories they tell. People have **reputations** based on how they are perceived by others, which may not be realistic of their qualities. People's **visibility** depends on how many know them and what social circles they move in. Building and projecting a clear and accurate global identity requires intentional, collective effort among all regional stakeholders based on evidence and common objectives.

Urban Identity

Urban identity can be defined as the process of interaction between people and places, where humans describe themselves in terms of belonging to a specific place (Hidalgo and Hernandez, 2001).

Architectural Identity

There are certain main categories under which architectural identity can be classified: aesthetics, function, historical and urban context, human impact and representation. Architecture is part of the concept of identity, as such, the impact of changes in buildings and places on communities are critical to maintain this identity. Architectural identity is a cultural phenomenon that can help integrate the progression of social life into a dialogue between past and the future (Humeyra, 2012).

Urban Morphology

Urban morphology is the study of the appearance of a city. It is a combination of physical description, gradual formation, and the interaction between the components of the urban tissue. It defines specific compounds and urban places, such as streets, squares, and other public spaces. Morphology is the science that investigates the form, shape, external structures, and arrangement of matter (Madanipour, 1996). Urban morphology is divided between several fields of knowledge. Its theoretical aspects are related to urban geography, history, and architecture.

The Aesthetic Value

The aesthetics of the past are appreciated for their own sake. Old buildings and towns are valued because they are intrinsically beautiful 'antique' or simply because they are old and scarce. Nevertheless, Lynch (1972) warns of the 'dogma about the intrinsic goodness of old things'. Given the blandness of much of the contemporary architecture, historic buildings are often more interesting than 'post-industrial 'offices, houses and shopping centers. Historic buildings and areas have picturesque qualities; they are redolent of a period of genuine craftsmanship and individuality that has been lost in modern industrialized building products and systems of construction. The old city exemplifies human scale, care, richness and diversity that are lacking in the modern, plastic, machine-made city with its repetitive components and large scale projects (Appleyard, 1979).

Accordingly, the image of the city can be considered as one of the most important key concerns both for city identity as well as city branding.

Maintaining good Governance is key to preserve the morphology of existing or new cities. It is crucial that the urban morphology planned in the Master plan should be preserved by the Government in future so that to preserve the aesthetics of city through preservation of open spaces, its link to other opens spaces and public and historical buildings and settlements. A city without diversity in physical environment cannot grow to be resilient to disasters and

sustainable. Thus, in case of LPCC, to establish a new town as a provincial capital, it shouldn't forget the identity of Bhalubang, mainly the Tharu and Magar culture, the natural resources, and its functions in the past. A detailed study should be carried out in this regard to preserve its identity.

4.7 Infrastructure Management

In the present days, management is more important than the development or planning. Therefore the city could be better managed by providing the sufficient and efficient infrastructures. By the sufficient and efficient infrastructure, the service delivery could ease. Easy service delivery makes the city people happy. Happier the people, more will be the output.

Here we have proposed the infrastructure based on the prevailing norms and standard and the best examples of other cities similar to our culture and traditions.

4.8 Tourism Development

Tourism development is one of major economic revival approach for the city and for infrastructure development. It is also important to protect the identity of the capital city as cultural city. The local community of LPCC area are rich in culture and intangible heritage. The master plan has proposed a cultural museum and culture zone for the conservation of cultural area. Besides, a setback of 100 meter wide bank along the both sides of Rapti River has been proposed after 50 meter wide road as green space. This belt can also be used through guidelines for urban recreational and cultural activities for tourism development. The temple area like Devikot, Jungle kuti, Shiva mandir, Kulpani etc and the traditional settlement area like Vulke gau and Tharu villages are the major places for tourism attraction. Similarly, the new locations of uphills in Shitganga and Rapti like Devikot etc can be developed as a tourism destination by providing new recreational infrastructures like cable car, Homestay, Zipline, hiking, resorts, parks and etc.

4.9 Transit Oriented Development in Planning

The concept adopted in the planning taken consideration to make a city more livable for its residents and more attractive to new businesses. Urban development considered a sustainable planning vision such as considering a multi-modal transportation system, mixed-use development and green space. New development should provide residential, commercial, institutional, educational etc. Transit oriented development (TOD) is one of the most successful approach for urban and transport sustainability. Careful coordination of urban structure around the public transport is TOD. TOD also control urban sprawl by concentrating the activities at a node or along a public transit corridor thereby increasing the efficiency of land utilization. TOD is a way to merge together transport engineering and planning, land-use planning, and urban design to solve urban problem.

The following points are considered for the consideration of TOD in urban and transportation planning.

(a) Development of development nodes such as commercial, institutional nodes along the major transport corridor where public transport route can be developed. At the present bus transport has been proposed.

(b) Locating new settlements to prospective transit line. Development of residential settlement around the Bus corridor that maximize access to public transport in a residential area.
(c) Main points of attraction like shopping centers have been located near bus stops so that it can easily accessed through public transport
(d) Mixed land use such as commercial plus residential, institutional plus residential housing and shopping in close proximity, and accessible public spaces were considered.
(e) Land use planning and urban design were done to improve the accessibility for non-motorized traffic (Cycle lane and foot path provided in roads to promote non-motorized traffic). A neighborhood layout which facilitates walking trips, offering a variety of available routes and shortening travel times for pedestrians.
(f) Promote job centers and housing within the development which reduce commutation and also a public transit makes easily available for the residents.
(g) Intermediate transport modes such as auto rickshaw to connect to the main public transit

4.10 Economic Growth Analysis

City are an integral part of the local economic landscape. A significant and increasing proportion of the rural population lives in these locations, which also host a very large share of local non-farm activity. The employment opportunities, standard of living are therefore important dimensions of local economic development. Economic activity is closely interrelated to the surrounding village economy through consumption, production, employment and financial linkages, and various types of economic and social service provision. The nature and extent of economic linkages between city and their hinterland, and between the former and the wider economy, constitute key factors shaping local development dynamics and potential. Hence, policies and interventions aimed at developing the local economy must account for existing patterns of interaction between the village and city economies, and seek to reinforce synergetic links and mitigate adverse impacts arising from resource flows and exchanges between both types of locations. Identified economic growth sectors of LPCC area are;

- Agriculture

Villages and cities are dependent on agricultural products for their growth and survival. In addition, the economy in villages, as in cities, depends on agricultural production activities for creating jobs.

Economic and physical bonds between rural areas and city centers, and between small towns and larger towns in a region, facilitate not only dynamic relations and the possibility of growth and diversity in regional, but also distribution of revenues through agricultural development.

The LPCC area consists of Terai region and some Mountainous region. Due to this diverse topography, there is wide possibility of producing diverse types of agricultural goods, like food grains, pulses, oilseeds, cash crops, spices, fruits and vegetables.

But, in the process of urbanization as a capital city, the agricultural activities will slow down due to change in land use activity. Thus the contribution to the economy by agricultural sector obviously decrease.

- Industries

The close links that exist between small towns and rural environments can contribute in the development of rural industries, particularly handicraft and native industries, bring diversity to rural economy, and influence economic bonds between small and larger towns. On the other hand, development of small towns also improves the distribution of industries. In fact, strengthening industrial development in small and middle towns, as well as linking such programs to the surrounding rural areas through encouraging trade and the like, is the best way of transferring the benefits of modern industrialization to villages. Moreover, it could lead to the emergence of an efficient locational organization in developing countries

According to MOF (2020), till mid-March 2020, the proposed investment in Lumbini Province was Rs. 223 billion, which is 9.1% of total proposed investment. Thus, the proposed investment in Lumbini province over the time is relatively low. Such share of other provinces over the same period of time was higher. And within this province the investment in Dang and Argakhachi districts is lower than other district in this industrial sector.

There are 15 crosser firms in this region, which export almost 200 tripper sand and crossed stone each day. Rapti River is main source of extracting such river-based products. Secondary sector (industrial sector) and tertiary sector (service sector) are not developed properly. Industrial goods are being imported from Butwal, Bhairahawa and Krishnanagar.

Therefore, in the course of establishing the area as a provincial city, the industrialization should be promoted. For this the small scale / cottage industries should give high priority enhancing the local technology and resources.

- Trade, service and Market Centers

Since Lumbini Province is rich in terms of fertile land and have many industries that produce diverse types of manufacturing goods. So, there is big potential of both agricultural and manufactured goods in this province. The goods produced in this province are being supplied throughout the country and nearby cities of India. Trade and Export Promotion Center (TEPC) (2019) has identified the paddy, rice, wheat, maize, Maida (refined wheat flour), aata (wheat flour), suzi (semolina), chokar (bran), pulses, fish, milk, egg, chicken, banana, potato, mango, bael juice, sugar, cement, noodles, herbs, alcohol, limestone, clinker, brick, cardboard, tourism, education and health service as the products that can substitute import and have inter-provincial trade potential.

From the position of rural economy, city as centers for trade markets, play an essential role in bringing strength and sustainability, as well as development, to agriculture, setting a basis for various economic activities in the area, and augmenting local revenues.

    - Surrounding village's centers and the nodes within LPCC play a crucial role in marketing agricultural products of rural areas.

- The surrounding village centers and the nodes are counted as a center for purchase and redistribution of agricultural products part of which is consumed within the cities and the rest exported to larger cities towards east west corridor.
- Via this LPCC, rural products could be exported to not only the other regional towns, but also the largest cities.
- Low-priced goods suitable for low-income classes are exported to the villages.
- Rural-agricultural products would bring about the establishment of large reputable companies and factories in cities, along with the wholesale of foodstuffs.

Overall, creating market centers with a suitable hierarchy aimed at development is an element of sustainable development. LPCC can play a significant role in the establishment of this hierarchy in that they can fill the gap between villages and large cities, and distribute marketing as well as distribution centers on a local scale.

With the increase in investment in infrastructure, demand for both skilled and unskilled labor will be increased. Thus, in future this region will be attractive for employment opportunities in construction industry. Increased employment will lead to increase in income of people.

- Tourism

This province is popular for religious tourism. There is potential for both domestic and international tourism.

There is the possibility of expansion of tourism industry in this region. Some locations having future tourism potential include Naumure hydropower dam area, Karunge dada area, Bhulke area, Bhadrashidevi mandir (where it is assumed that right leg of goddess Satyedevi was decayed), Kalakate area (where it is assumed that Gorkha military killed black people in war during unification period. There is a spot, in this area, containing three big stones, where Gorkha military were supposed to cook food after defeating foreign military), and so on. Furthermore, this region is transit point for the people who travel to Sworgradwari. If tourism related infrastructure are constructed, people who want to travel to Sworgadwari may stay few days in LPCC region. Furthermore, better infrastructure and facility may also help to attract tourists visiting Lumbini. For this, hotels providing quality service is necessary. There is also potentiality of rafting in Rapti River.

Local tourist as well as international tourist flow can be promoted by the construction of tourism infrastructures and promoting the local areas.

Moreover, LPCC region is transit point to the western part of the province. So, there is possibility of developing LPCC region as economic hub. There is potentiality of developing agriculture-based industries (like food processing industries), tourism industry and industries based on river-based materials (like block industries, electric pole, precast slabs and Hume pipe industries). Furthermore, paper industries and furniture industries have also potential in this region. With the increase in population and economic activities, industrial environment will be improved in near future. Until now, agriculture is major component of its economy but in future there is potential of developing service sector as well as industrial sector. For this, proper planning is necessary.

Table 4.8 Tentative Cost Estimate of the Project

Sn	Name	Status	Locations			Unit	Qty	Rate	Amount	Remarks
		(Existing/ Proposed)	Municipality	Ward	Settlement					
1	Physical Infrastructure									
a	Road with sewerage & drainage	Upgrading /proposed	R/G/S	all	All wards	Km	282	100,000,000.00	28,200,000,000.00	
b	Waste water treatment plant	Proposed	Gadhawa	3	Bhagwanpur	Nos	2	1,000,000,000.00	2,000,000,000.00	
c	Sishaniya Water supply	Existing/Proposed	Rapti	8	Sishaniya	Nos	4	250,000,000.00	1,000,000,000.00	
d	Bus park/Proposed	Existing	Rapti/Gadhawa	1	Bhalubang/Malmala/Gobardiya	Nos	3	100,000,000.00	300,000,000.00	
e	Solid Waste Management site	Proposed	Gadhawa	1	Bauharwa Gaun	Nos	2	100,000,000.00	200,000,000.00	
f	Industrial area development	Proposed	G/S			Nos	1	1,000,000,000.00	1,000,000,000.00	
g	Sub Station (NEA)	Proposed	Rapti	2	Lalmatiya	Nos	1	500,000,000.00	500,000,000.00	
2	Institutional									
a	Educational Institute	Proposed	R/G/S	1	Jethangaun	Nos	3	1,000,000,000.00	3,000,000,000.00	
b	School strengthening	proposed	R/G/S			Nos	60	2,000,000.00	120,000,000.00	
c	Sports Complex	Proposed		1		Nos	1	500,000,000.00	500,000,000.00	
3	Tourism									
a	Park	Proposed	Shitganga	9	Kanachaur	Nos	20	500,000,000.00	10,000,000,000.00	
b	Mini zoo	Proposed	Gadhawa	2	Baghmaruwa	Nos	1	500,000,000.00	500,000,000.00	
c	Tourism area promotion	Proposed	R/G/S	9	Pakuri	Nos	6	100,000,000.00	600,000,000.00	
d	Bouddha Bihar	Proposed	Rapti	1	Bhalubang/Pulchowk	Nos	1	3,200,000.00	3,200,000.00	
e	Resort	Proposed	Shitganga	9	Silingkhola	Nos	1	550,000,000.00	550,000,000.00	
f	Sports Ground	Proposed	Rapti	7	Sishaniya	Nos	1	100,000,000.00	100,000,000.00	
4	Security									
a	APF	Existing/Proposed	Rapti	2	Lalmatiya	Nos	1	500,000,000.00	500,000,000.00	
b	State police	Proposed	Rapti	1	Bhalubang	Nos	1	500,000,000.00	500,000,000.00	
c	Police Beats	Proposed	R/G/S	14		Nos	20	50,000,000.00	1,000,000,000.00	
d	Army Camp	Proposed	Rapti	4	Majhenigadh	Nos	1	500,000,000.00	500,000,000.00	
5	Community Building									
a	Nepal Magarsamaj & Others	Proposed	Rapti	4	Nayagaun	Nos	5	10,000,000.00	50,000,000.00	

Sn	Name	Status	Locations			Unit	Qty	Rate	Amount	Remarks
		(Existing/ Proposed)	Municipality	Ward	Settlement					
b	Rastriya Apaanga Mahasangh	Proposed	Rapti	1	Pakhaoani	Nos	1	10,000,000.00	10,000,000.00	
c	Exhibition Center	Proposed	Rapti	8	Pipara	Nos	1	100,000,000.00	100,000,000.00	
d	City Hall	Proposed	Rapti			Nos	1	500,000,000.00	500,000,000.00	
e	Red Cross Society	Proposed	Rapti	1	Bhalubang	Nos	1	10,000,000.00	10,000,000.00	
f	Sanchar Gram	proposed	Shitganga	8	Jurpani	Nos	1	10,000,000.00	10,000,000.00	
g	Old age Home	proposed	Gadhawa			Nos	1	500,000,000.00	500,000,000.00	
h	Orphanage	proposed	Gadhawa			Nos	1	500,000,000.00	500,000,000.00	
i	Training centers	proposed	Shitganga			Nos	1	500,000,000.00	500,000,000.00	
j	Ghat	Existing/Proposed	R/G/S			Nos	3	10,000,000.00	30,000,000.00	
k	CITA/Data Center	Proposed	Shitganga	8	Jurpani	Nos	1	100,000,000.00	100,000,000.00	
6	Public Institutes									
a	Public Service Commission	Proposed	Rapti	5	Karangekot	Nos	1	100,000,000.00	100,000,000.00	
b	Province Television	Proposed	Rapti	8	Jurpani	Nos	1	200,000,000.00	200,000,000.00	
c	City Hall	Proposed	Rapti	2	Lalmatiya	Nos	1	200,000,000.00	200,000,000.00	
d	CBS Office	Proposed	Rapti	2	Lalmatiya	Nos	1	100,000,000.00	100,000,000.00	
e	Provincial Court	Proposed	Rapti	4	Maurighat	Nos	1	100,000,000.00	100,000,000.00	
f	Province Chief Office	Proposed	Rapti	1	Baghdadi	Nos	1	100,000,000.00	100,000,000.00	
g	Political Party Office	Proposed	Rapti	1	Malmala	Nos	1	100,000,000.00	100,000,000.00	
h	Ministries and other offices	Proposed	R/G/S			Ls	1	10,000,000,000.00	10,000,000,000.00	
i	Fire Brigade	Proposed	Rapti	2	Lalmatiya	Nos	1	100,000,000.00	100,000,000.00	
7	Market									
a	Vegetable Market	Proposed	R/G/S	14	All wards	Nos	10	10,000,000.00	100,000,000.00	
b	Slaughter House	Proposed	R/G/S			Nos	3	50,000,000.00	150,000,000.00	
c	Commercial hub	Proposed	Rapti	1	Pakhapani	Nos	1	10,000,000.00	10,000,000.00	
d	Haat Bazaar	Proposed	Rapti	2	Back side of ward office	NOs	1	10,000,000.00	10,000,000.00	
8	Health									
a	Hospital	Proposed		8	Lhafe	Nos	1	500,000,000.00	500,000,000.00	

Sn	Name	Status	Locations			Unit	Qty	Rate	Amount	Remarks
		(Existing/ Proposed)	Municipality	Ward	Settlement					
b	Health Posts	Proposed	R/G/S			Nos	14	50,000,000.00	700,000,000.00	
c	Province Women and Childrens Hospital	Proposed	Gadhawa	1	Dhodre	Nos	1	500,000,000.00	500,000,000.00	
10	Transportation								-	
a	Bus /Charging Stations	Proposed	R/G/S			Nos	15	10,000,000.00	150,000,000.00	
b	Provincial DoTM	Proposed	Rapti	2	Lalmatiya	Nos	1	100,000,000.00	100,000,000.00	
c	Auto Village	Proposed	Gadhawa	1	Dhodre	Nos	1	5,000,000.00	5,000,000.00	
12	Miscellineous									
a	Others	Existing/Proposed	R/G/S			Ls	1	500,000,000.00	500,000,000.00	
	Total								67,108,200,000.00	

4.11 Implementation Plan

For the implementation of capital city project that involves many small and large scale infrastructures, phase wise development is recommended where the local Government has greater responsibility. Provincial Government should take a leadership role in ensuring the implementation of the planned actions. It will be necessary for Provincial Government personnel to assist in the setting up of the steering committees and continue to guide, manage, and monitor the process, providing administrative back-up and other support. However, a partnership approach is required to account the views of the community, private landowners, the business community, and other key stakeholders in a meaningful way through the steering group.

It is also important to ensure that sufficient resources, both in terms of finance and personnel, are in place to implement the plan and investigate potential sources of financial and other assistance. The local Government should improve its technical and human resource capacity for successful implementation of the capitals city project.

It will require combination of different financial model for implementation such as PPP model, and loans, grants. Foreign direct Investment might be also be required for the development of huge infrastructures such as roads, and buildings. For the implementation of these projects, budget can be secured from funding of local, state and central government. For quick housing development, private companies can be motivated.

At present context of urban development in Nepal, land pooling is one of effective tool for housing development. For the implementation of the master plan, the concept has been advised. Land pooling in larger scale will be required to implement this master plan in different phases to achieve the development target by 2031 and 2051. Land pooling is suggested in areas near all nodes and along major development projects suggested in this master plan as an initial initiation to housing development.

Fig 4.41 Master Plan with tentative areas for land pooling

4.12 Priority Ranking

The projects project for the development of capital city can be implemented in different phases upto 2051. It is assumed that basic infrastructure should be implemented before 2040 and other in later years to come as per demand. The consultant proposes to prioritize economic development activities and immediate road infrastructure development as initial projects. Land pooling projects can be implemented along with these projects so that housing development is initiated for the migrating population. Priority social infrastructure that support economic development and job creation should be priority such as university and health sector. It will also improve the quality of life of local people. Meanwhile other projects can be implemented as per need s and demand of local people.

Table 4.9 Project priority and ranking

S. no.	Projects	2025	2031	2035	2041	2051
1	Physical Infrastructures					
	Roads					
	50 Meter road					
	30 meter road					
	20 meter road					
	Drainage					
	Sewer					
	Telecomuunication					
	Land pooling					
	Waste water tretment plant					
	Solid waste managemetn site					
2	Social Instutions					
	Police stations					
	University					
	Colleges					
	Hospital/halth posts					
	Institutional area					
	Market/Slaughter house					
	Auto village					
	Others					
	Institutional Buildings					
	Fire Brigade					
	ZOO					
	Parks					
3	Economic/tourism					
	Industrial AREA					
	resorts					
	Tourism area promotion					
	Sports comples					

4.13 Investment Plan

Based on this development framework, LPCC along with local and provincial governments can now focus on development of various nodes through investment in infrastructure. Donors can also focus on investment in infrastructure development as per this planning framework. It is suggested to prepare local area planning of various development nodes through land pooling techniques.

To make necessary infrastructure in future, a huge amount of investment in necessary. Traditionally, public sector was responsible for such investment. However, inefficiency in public spending, like increase in cost, delays in planning and construction, safety problems and lack of innovation and technological advancement; poor management of public enterprises; and increased fiscal and debt crisis are contributing to promote private sector's participation in infrastructure projects. Nowadays, public private partnership (PPP) has become popular alternative method of procuring public services and infrastructure. PPP acknowledges and structures the role of government in order to meet social obligations and ensure successful sector reforms and achieve public investment. There are different types of PPP model. The common types involve: service contract, management contract, lease contract, concession contract, private finance initiative and joint venture. Based on the necessity and resource availability, the Lumbini Province can also choose appropriate model of PPP.

- Responsibility of all implementing body should be clear and taken separately
- A strong development authority like PIDA would be the better implementation institutions
- Multiyear or Phase-wise development of Infrastructure is ideal strategy to adopt for large projects
- Establishment of Steering committee with inclusion of stakeholders is essential for monitoring and public audit
- All Financing Tools in proper project should be used
- Part of the budget from central and Provincial, Municipal government should be used for the service delivery
- Private sector investment with encouragement is essential for housing and industrial sector
- Public Contribution should be used for the small scale infrastructure and service delivery so that the ownership issues can be addressed.
- Local economy growth with plenty of subsidy mechanism is of prime concern to make the economy sustainable and al

Chapter 5. Concluding remarks

5.1 Conclusion

- A master plan of a city is a long-term planning document that provides a conceptual layout to guide future growth and development which is a proposal for population, economy, housing, transportation, community facilities, and land use.
- The master plan proposes nodal concept for to ease and balanced the development process in future balancing the coexistence between existing natures vs. new development due to establishment of institutions.
- Norms and standard for the housing and infrastructure is prepared based on the economy, environment, society and the prevailing technology of higher standards.
- Here, the floating population assumed is about 40 % of the projected population and the infrastructures are proposed are for the metropolitan city like.
- The major portion of land available for capital city development is very limited within three identified territory, thus flat land around the LPCC area in Deukhuri Valley will be consumed by new development as the planning of capital city will take place. Thus, it is very important for all local levels of Deukhuri Valley to follow the guidelines proposed in this study for sustainable urban development.

5.2 Recommendation

- A master plan alone does not ensure development of a desirable city. Master plan is only a blue print to guide development, while implementation is crucial aspect to achieve it. Capacity building of respective local authorities, and good governance is prime to achieve it. Thus, a detailed study on local level should be done in all sectors before implementation. The plan proposed here is just indicative but not the detailed study therefore detailed study should be carried out for the capacity, size, and type of the infrastructure.
- The land pooling techniques could be helpful to acquire the lands for institutional buildings, residential housing and the infrastructures. Since area is large, there should be priority for the area to carry out for land pooling starting from the primary area (commercial zone, institutional zone) to other service nodes.
- Population projected in this study is based on general practice of planning, however cities are dynamic in nature with changing local and climate scenario, so can be the population pull factors. Population growth will be more than the assumed if the service delivery, facilities provided and economic opportunities created are of higher standard and it will be less if the service delivery, facilities provided are of lower standard. Therefore, mid time review should be done for all the planning.

- Since the capital city boundary delineate dis just for the planning proposes for the time, the master plan should extended on the west side of this LPCC area to control the haphazard development.
- Land use should be in line with the green concept,
- Resource optimization should be focused for the Economic growth,
- Proper urban rural linkage establishment is of prime importance for balancing the society, environment and economy.
- Since the culture and the environment are the basic things to protect during the development process of a city, ethnic morphology should be studied in detail in the development process of this Valley.
- Poor are the resources as a labor force, therefore it shouldn't be neglected during the housing and infrastructure supply. City shouldn't be just for rich.

Chapter 6. Annexes

- **References**
- **Meeting Minutes**
- **Drone Survey Report**

Annex 1: Key references

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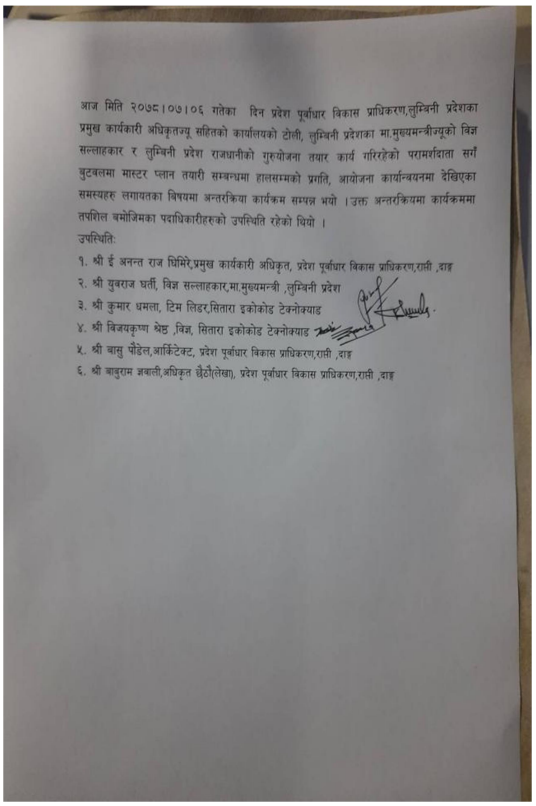
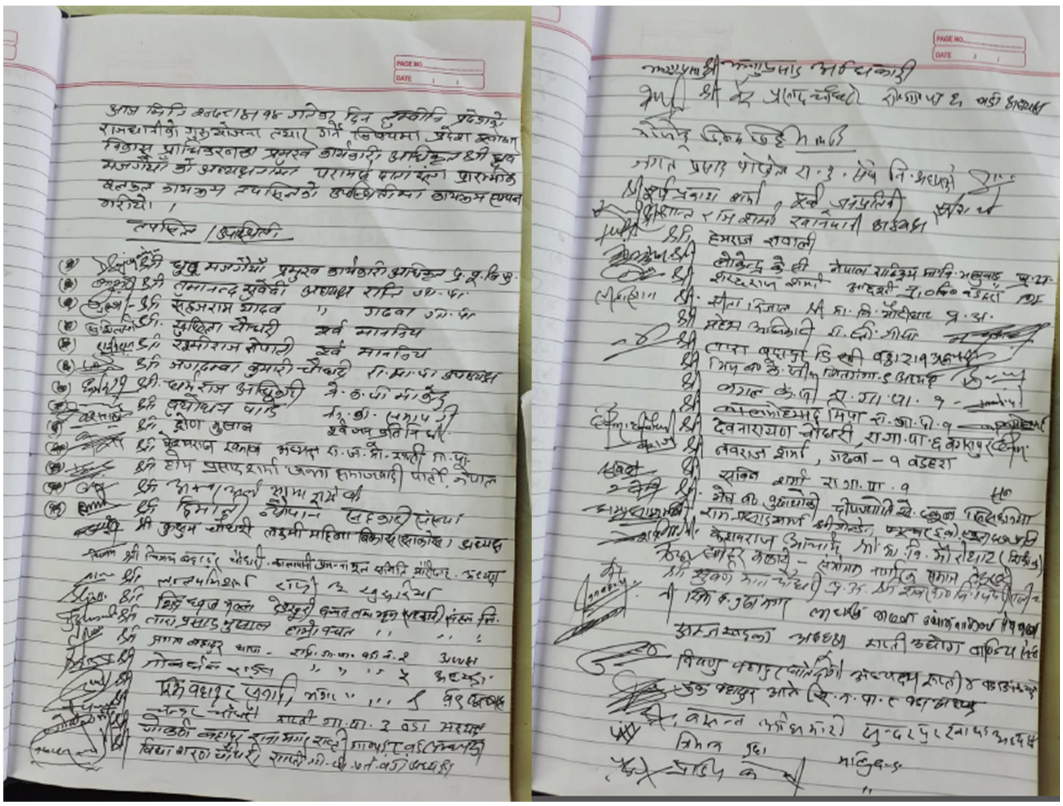
Annex -2: Meeting minutes

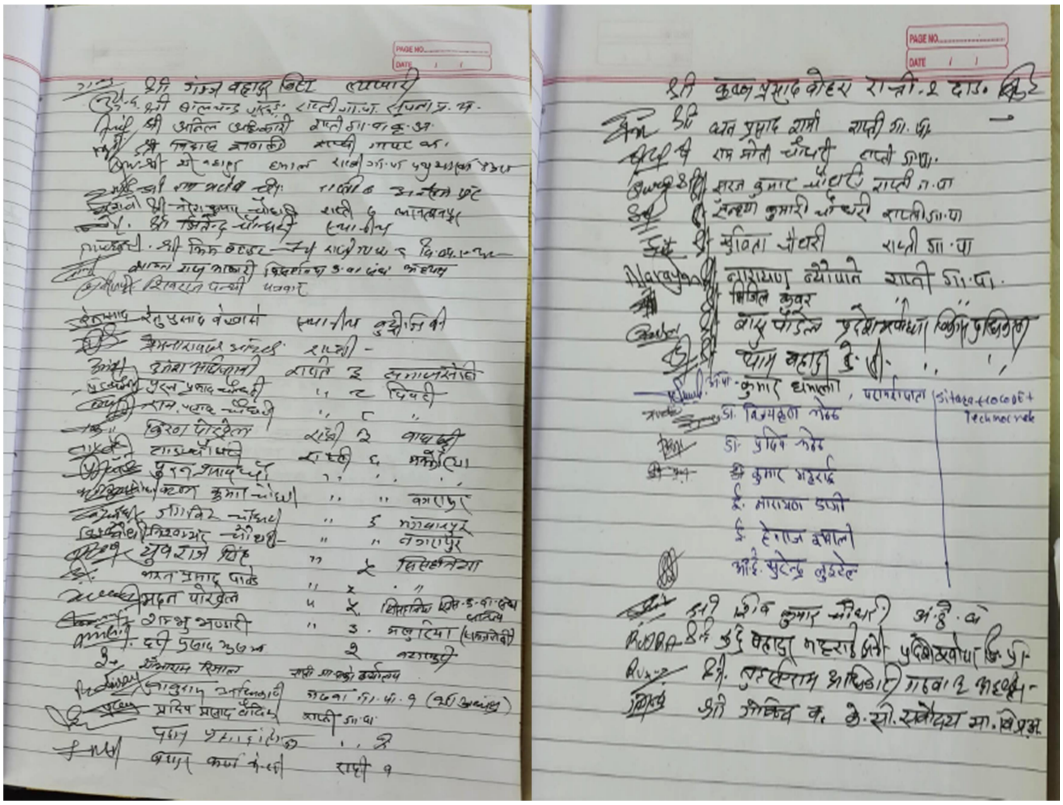


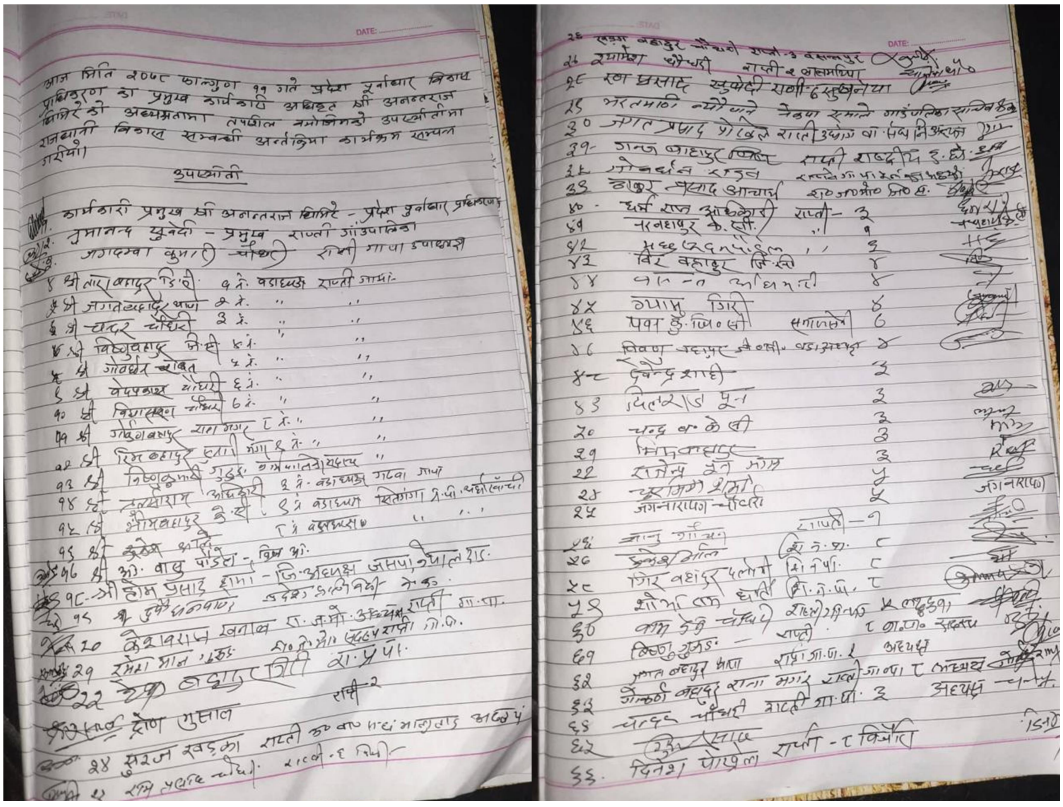
आज मिति २०७८।०७।०६ गतेका दिन प्रदेश पूर्वाधार विकास प्राधिकरण,लुम्बिनी प्रदेशका प्रमुख कार्यकारी अधिकृतज्यू सहितको कार्यालयको टोली, लुम्बिनी प्रदेशका मा.मुख्यमन्त्रीज्यूको विज्ञ सल्लाहकार र लुम्बिनी प्रदेश राजधानीको गुरुयोजना तयार कार्य गरिरहेको परामर्शदाता सर्ग बुटवलमा मास्टर प्लान तयारी सम्बन्धमा हालसम्मको प्रगति, आयोजना कार्यान्वयनमा देखिएका समस्याहरु लगायतका विषयमा अन्तरक्रिया कार्यक्रम सम्पन्न भयो ।उक्त अन्तरक्रियमा कार्यक्रममा तपशिल बमोजिमका पदाधिकारीहरुको उपस्थिति रहेको थियो ।

उपस्थिति:

१. श्री ई अनन्त राज घिमिरे,प्रमुख कार्यकारी अधिकृत, प्रदेश पूर्वाधार विकास प्राधिकरण,राप्ती ,दाङ
२. श्री युवराज घर्ती, विज्ञ सल्लाहकार,मा.मुख्यमन्त्री ,लुम्बिनी प्रदेश
३. श्री कुमार धमला, टिम लिडर,सितारा इकोकोड टेक्नोक्याड
४. श्री विजयकृष्ण श्रेष्ठ ,विज्ञ, सितारा इकोकोड टेक्नोक्याड
५. श्री बासु पौडेल,आर्किटेक्ट, प्रदेश पूर्वाधार विकास प्राधिकरण,राप्ती ,दाङ
६. श्री आबुराम अवाली,अधिकृत छैठौ(लेखा), प्रदेश पूर्वाधार विकास प्राधिकरण,राप्ती ,दाङ







DATE: ....

६६. लाल चन्द्र गुरुङ - सूचना प्रविधि अधिकृत
६८ निर्मला गिरी नायब सु. राप्ती गा.पा.
६९ खिमा भट्ट प्रा.स.
७० बिस्ना गिरी खा.पा.सु.
७१ - शिव कुमार चौधरी राप्ती गा.पा.
७२. ई. सगम गौतम Civil Engineer/GIS Expert
७३. Ar. रन्जित काफ्ले Architect.
७४. ई. कुमार थापा Urban planner

आज मिति २०७८ साल पौष महिनाको १८ गतेका दिन लुम्बिनी प्रादेशिक राजधानी गुरु योजनाको प्रारम्भिक प्रतिवेदन को प्रस्तुतिकरण दाङ, राप्ती थवांग स्थित पौवा होटलको सभाहलमा तपसिल बमोजिमको उपस्थितिमा सम्पन्न गरियो

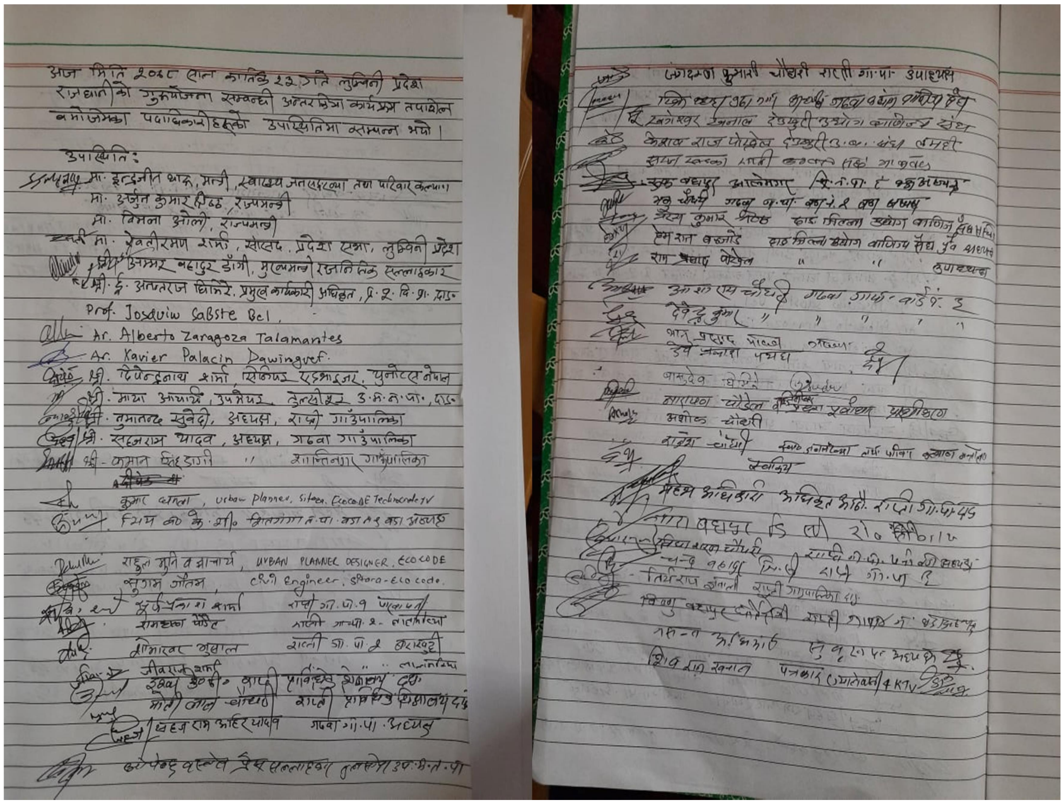
तपसिल

1. अनन्त राज घिमिरे CEO PIDA
2. गंगाराज पुन मगर Architect
3. रमेश शर्मा Civil Engineer PIDA
४ नारायण पौडेल Civil Engineer PIDA
५ सुमन डि सी " " PIDA
६. नविन बस्नेत Light Driver PIDA
७ बासु पौडेल Architect PIDA
८) गुणानन्द त्रिवेदी राप्ती गा.पा. अध्यक्ष राप्ती गा.पा.
९) कुमार थापा Urban planner Consultant
१०.
१०. सुगम गौतम Civil engineer/GIS Expert Sitara-Ecocode-Technocrate-JV.
११ प्रदिप श्रेष्ठ Transport Engineer Consultant
१२. कमल प्रसाद तिमल्सिना ED SITARA.
१३ विजय कृष्ण श्रेष्ठ
१४. रन्जित काफ्ले Architect Sitara-Ecocode Technocrate JV

आज मिति २०७८ फाल्गुन १० गते लुम्बिनी प्रदेशको प्रदेश सदरमुकाम गुरुयोजना निर्माणको Design Report को प्रस्तुति र छलफल कार्यक्रम PIDA लुम्बिनी को कार्यालय दाङमा परामर्शदाता SITARA-ECODE-Technocrate JV, PIDA Lumbini र Expert को बिचमा गरियो।

उपस्थितिहरु :

सि.नं.	नाम	पद/कोन
१	ई. अनन्त राज घिमिरे	प्रमुख कार्यकारी अधिकृत (PIDA)
२.	अमर बहादुर डाँगी	प्रमुख राजनीतिक सल्लाहकार, मुख्यमन्त्री कार्यालय
३.	श्रीधर शर्मा पौडेल	उप-प्रमुख जिल्ला समन्वय समिति दाङ.
४.	गिरीराज पौडेल	प्राविधिक विज्ञ (PIDA)
५	रमेश शर्मा	पूर्वाधार विकास शाखा प्रमुख
६.	वासु पौडेल	प्राविधिक आर्किटेक्ट.
७	कुमार थापा	अर्बन planner Consultant
८	सुगम	
९	रन्जीत	



आज मिति २०८० साल कार्तिक २३ गते लुम्बिनी प्रदेश राजधानीको गुरुयोजना सम्बन्धी अन्तरक्रिया कार्यक्रम तपशिल बमोजिमका पदाधिकारीहरूको उपस्थितिमा सम्पन्न भयो।

उपस्थिति:

मा. इन्द्रजीत थारु, मन्त्री, स्वास्थ्य जनसङ्ख्या तथा परिवार कल्याण
मा. अर्जुन कुमार के.सी., राज्यमन्त्री
मा. बिमला ओली, राज्यमन्त्री
मा. रेवतीरमण शर्मा, सांसद, प्रदेश सभा, लुम्बिनी प्रदेश
श्री अम्बर बहादुर डाँगी, मुख्यमन्त्री राजनीतिक सल्लाहकार
श्री ई. अनन्तराज घिमिरे, प्रमुख कार्यकारी अधिकृत, प्र.रु.वि.प्रा. दाङ
Prof. Josquin Sabste Bel.
Ar. Alberto Zaragoza Talamantes
Ar. Xavier Palacin Dawinguef.
श्री. देवेन्द्रनाथ शर्मा, सिनियर एडभाइजर, पुनोटस नेपाल
श्री. माया आचार्य, उपमेयर, तुलसीपुर उ.म.न.पा., दाङ
श्री. तुमानन्द सुवेदी, अध्यक्ष, राप्ती गाउँपालिका
श्री. सहजराम यादव, अध्यक्ष, गढवा गाउँपालिका
श्री. कमान सिंह डाँगी ,, शान्तिनगर गाउँपालिका
कुमार वाग्ले, Urban Planner, Sitara. EcocodE Technocrats
[illegible] के.सी. भितगंगा न.पा. वडा नं. ४ वडा अध्यक्ष
राहुल मुनि वज्राचार्य, URBAN PLANNER DESIGNER, ECOCODE
सुगम गौतम, Civil Engineer, Sitara-Eco code.
सूर्यप्रकाश शर्मा राप्ती गा.पा. १ [illegible]
रामकृष्ण पौडेल राप्ती गा.पा. २ [illegible]
[illegible] राप्ती गा.पा. ४ [illegible]
जीवराज शर्मा ,, ,, [illegible]
[illegible] राप्ती प्राविधिक शिक्षालय दाङ
मोतीलाल चौधरी राप्ती प्राविधिक शिक्षालय दाङ
सहजराम अहिर यादव गढवा गा.पा. अध्यक्ष
उपेन्द्र वस्नेत प्रेस सल्लाहकार तुलसीपुर उप.म.न.पा.

जगदम्बा कुमारी चौधरी राप्ती गा.पा. उपाध्यक्ष
[illegible] गढवा गाउँपालिका [illegible]
हि. खगेश्वर खनाल देउखुरी उद्योग वाणिज्य संघ
केशव राज पोखरेल देउखुरी उ.वा. संघ [illegible]
[illegible]
[illegible] बहादुर आलेमगर शि.न.पा. ६ वडा अध्यक्ष
मधु चौधरी गढवा न.पा. वडा नं. ४ वडा अध्यक्ष
श्रेयस कुमार श्रेष्ठ दाङ जिल्ला उद्योग वाणिज्य संघ सचिव
हेमराज बजोड दाङ जिल्ला उद्योग वाणिज्य संघ पूर्व अध्यक्ष
राम प्रसाद पोखरेल ,, ,, उपाध्यक्ष
आशाराम चौधरी गढवा गाउँपालिका वडा नं. ३
देवेन्द्र कुमार ,, ,, ,, ,,
भानु प्रसाद पोखरेल [illegible]
डेप्रे [illegible]
वासुदेव घिमिरे [illegible]
नारायण पौडेल [illegible] प्रशिक्षक
अशोक चौधरी
राकेश चौधरी [illegible]
[illegible]
महेश अधिकारी अधिकृत अधि. राप्ती गा.पा. [illegible]
नारा बहादुर डि.सी. [illegible]
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चन्द्र बहादुर [illegible] राप्ती गा.पा. ३
तिर्थराज [illegible] राप्ती गाउँपालिका [illegible]
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[illegible] अधिकारी [illegible] अध्यक्ष
शिव राज खनाल पत्रकार [illegible] 4 KTV