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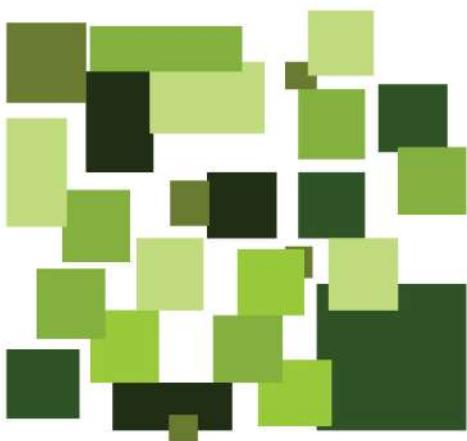
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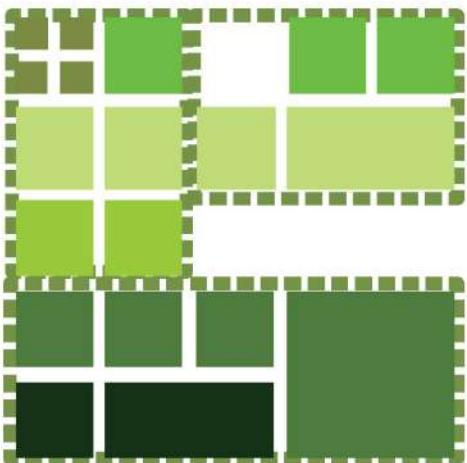
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ORGANIC TOWNS



STRUCTURE PLAN



LOCAL AREA PLANS

1 Introduction

1.1 Local Area Plan

Rinchenthang local area plan is a document which sets out the strategy for accurate planning, and provides a land use planning framework and development controls, for future development of the area within Nganglam municipal authority.

The objectives contained in this local area plan are relevant to the local area and it is consistent with the visions of Nganglam Regional Hub (RH) Development Plan. The plan is an instrumental tool in the implementation of the visions laid out in the RH Development Plan, and the provisions and controls included in the document provides guidance for the assessment of a development proposal within the specific boundary of the local area plan.

Therefore, it is important to understand the vision and essence of the overall RH development plan of Nganglam during the local area planning process. The primary vision of the RH development plan is to accelerate Nganglam as an urban entity to propel the regional economy. It will perform as a conglomerate of business activities which fosters enterprise and create a job market extending beyond its own periphery. The three essential characteristic of this vision can be summarized as follows:

Economic Dependability

The RH development plan adopts the ‘Three sector theory’, in which an economy system is considered dependable, sustainable and reliable when all the three sectors namely; Primary, Secondary and Tertiary sectors play cohesively in an integrated manner.

Sustainability

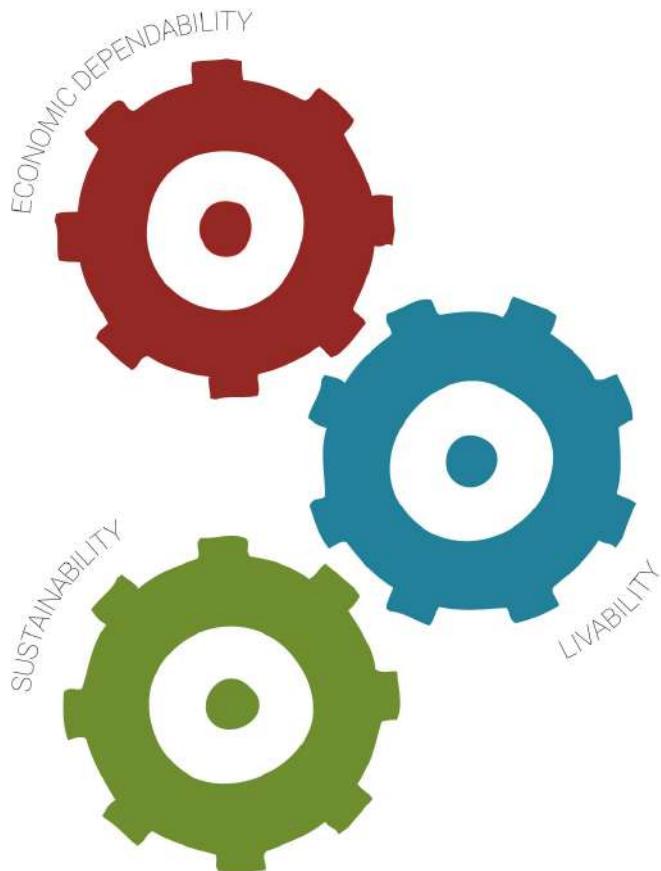
Environmental sustainability implies interaction with the environment to avoid depletion and degradation of natural resources. It aims at the long term environmental quality. Natural resources must be consumed judiciously to ensure replenishment and availability for posterity, and to uphold ecological balance while meeting the growing demand for expansion and consumption.

Livability

In general, livability is fundamentally tied to physical amenities such as parks, green open space, cultural offerings, economic and career opportunities, safe and healthy living environment. The development of Nganglam as a Regional Hub would require addressing the livability factors that add up to community’s quality of life which includes the built and natural environments, economic prosperity, cultural and educational opportunity, social equity, entertainment and recreation possibilities.

The local area plan, within frame work of the RH development Plan, consists of the details about plot reconfiguration and rationalization in the area in order to achieve a planned and desirable urban growth. It establishes possible remuneration for land use charges or other liabilities carried by land owners or the authorities.

The detailed local area plan intends to accommodate the projected population increase, regulate development of land parcels within the area through land use and development controls. It encourages a fair distribution of public infrastructure and amenities, implementation of the precinct plans in the area, and promotes an integrated and efficient transportation system.



Three essential characteristics of the RH Development Plan:

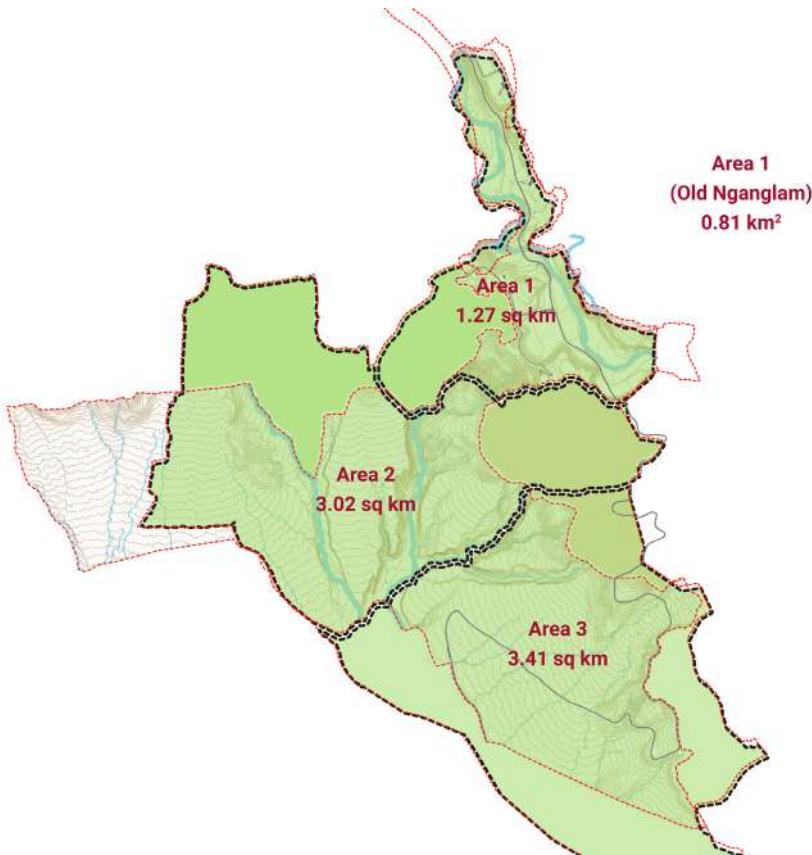
- Economic Dependability**
- Livability**
- Sustainability**



1.2 Objectives

In consistent with the visions laid out in the RH Development Plan, the Local Area Plan of Rinchenthang essentially aims to facilitate and implement the development plan at the local level. The main objectives of the plan can be broadly classified as follows;

- Effective and efficient implementation of the main objectives formulated in the RH Development Plan.
- Prepare and adopt planning principles with consideration to important local factors which are site specific and within the context of Rinchenthang.
- Promote planned urban growth by accommodation of the suitable percentage of the projected population growth of Nganglam in Rinchenthang.
- Provide adequate provision of public amenities and services within convenient and comfortable walking distance from the different parts of the town.
- Reconfigure and rationalize land subdivisions in Rinchenthang to accommodate the proposed urban infrastructure and services through land pooling techniques.
- Integrate and blend effectively the different components of the area into a cohesive and robust urban identity as the regional hub for eastern region.
- Ensure developments at the local level respects and enhances the public realm and human scale.
- Ensure that the local layout is compatible with the existing and surrounding natural features, and to prescribe built form typologies consistent with the proposed precinct plans.
- Develop the area to enhance its image as the urban gateway to Bhutan and the eastern regions.



Proposed three major planning boundary area demarcation

Area 1

Existing Nganglam
Town Nanglashing
Borang Drungkhag area

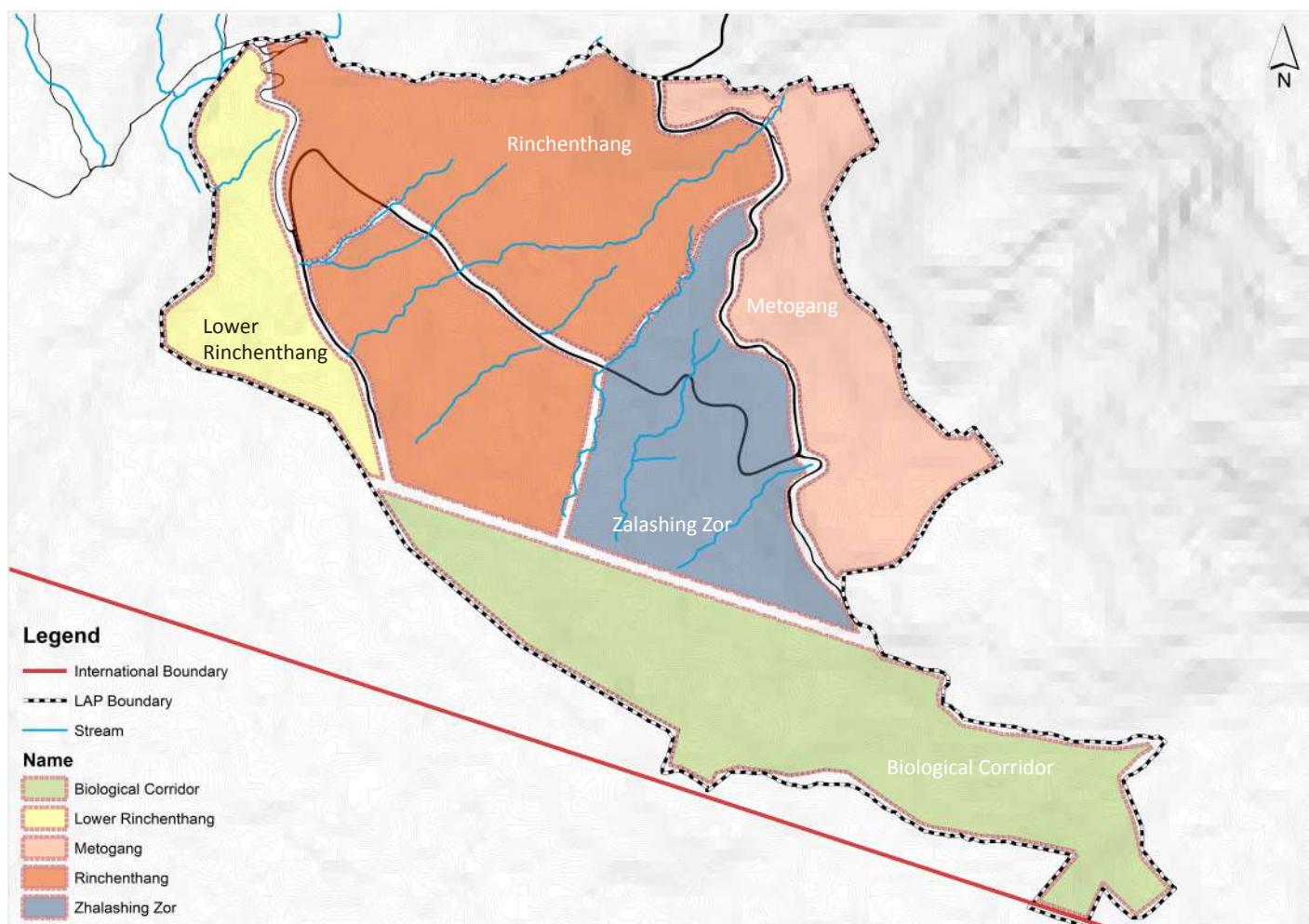
Area 2

Tangzema
Satsalo

Area 3

Dawamey
Tsojab
Sachanglo
Metogang
Rinchenthang

The five zones identified in Rinchenthang for the local area plan



1.3 Planning Boundary

For the purpose of identifying a site for new Nganglam town, the RH boundary area has been sub divided into three different areas. The boundaries of these areas are determined based on the local physiography and major site specific conditions such as rivers, streams, rivulets, gorge, mountain ridges, steepslopes, etc.

The three main areas identified as shown in the corresponding map are;

- The existing Nganglam core area, Nanglashing Borang, Dungkhag Administration complex, Nganglam Higher and Lower Secondary Schools towards the north side which constitutes a total area of 1.27 Sq.Km.
- Tangzema and Satsalo towards the central west and constitutes a total area of 3.02 Sq.Km.
- Dawamey, Tsojab, Sachanglo, Rinchenthang and Metogang towards the southern side adjacent to the international border line and it constitute a total area of 3.41 Sq.Km.

A land suitability analysis matrix used in the RH development plan shows Rinchenthang as the priority area most suitable for new development. Rinchenthang is considered based on the area's high development potential when evaluated against critical factors, which would promote and sustain development in the area, such as;

- Total area available
- Area available for development
- Accessibility
- Connectivity with the old Nganglam town and industrial area (DCCL)
- Proximity to the integrated border check-post
- Existing forest coverage
- Existing situation on environment and human-wild life conflict

Rinchenthang constitutes a total area of 2.8 Sq.km and has relatively flat land with few existing settlements in the area. It is situated in close proximity to the proposed integrated border check-post and acts as an entry point to Bhutan and the eastern regions. The area constitutes a total of 185 plots with an area of 175 acres excluding the large tract of state land. The site area is defined by the subtle and gentle slope spreading towards south east and contains a number of rivulets and on site natural drainage features. Few settlements are concentrated around the existing check post area and Metogang village, and the rest of the area remains uninhabited under forest cover.

For planning purpose, the site area is divided into five zones namely; Rinchenthang, Lower Rinchenthang, Metogang, Zhalashing Zor and Biological Corridor as shown in the corresponding map. Rinchenthang is situated 6.5 Km towards the southern side of old Nganglam town and normally, it takes about 15 minutes by car.



1.4 Planning Process

A detailed contour topography survey map for the Nganglam RH area which shows existing structures, infrastructure and natural features were collected and studied in detail. Land ownership detail and existing land use information were collected from National Land Commission for validation and it was assessed against the land survey map. In the event of discrepancies, clarifications were sought from the National Land Commission and Ministry of Works and Human Settlement.

The land parcels were categorized under different precinct plans, based on the planning concepts formulated in the RH Development Plan, determining permissible plot coverage, setbacks, building height, building and land use, and other relevant development controls.

The proposed precinct plan prepared in the RH Development Plan were carefully studied in reference to the local area, and necessary rectification were incorporated to suit the site specific conditions and local contexts.

The local area plan preparation process involves analytical rationalization and development of land parcels for unified servicing and planned growth. It ensures that land parcels in Rincenthang are put to their highest and efficient use through the adopting of land pooling as the most viable planning tool. Land Pooling, as the most preferred and common land readjustment technique, enables the mobilization of the urban land for development.

It is preferred over other traditional methods because it has proved to be cost effective, while allowing land owners to retain their value added serviced lots benefiting equally. The scheme which is applied in Rincenthang requires consolidation of individual land parcels from which a certain percentage of the total land is deducted for the provisions of public utilities such as roads, footpaths, recreation, drainage, utility services and amenities. The remaining land parcels are reconfigured to efficient shape and sizes and re-allotted with increased land values to their original owners.

This enabled the local area planning process in a participatory and democratic conduct thereby promoting transparency and accountability. The land pooling scheme adopted in Rincenthang is consistent with the Land Pooling Rules, 2009 and a series of exhaustive consultation meetings have been carried out with the land owners and concerned stakeholders. In accordance with National Land Commission's guidelines, the plot reconfiguration is considered to the 3rd decimal place of its area to ensure accuracy during demarcation of plots at the site.

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2 Background

2.1 Nganglam Regional Hub Development Plan

The main principle behind the need for the development of regional hubs was the unprecedented rate of urbanization coupled with exponential population growth particularly in the two major urban centres of Thimphu and Phuentsholing. The rapid growth in the population in these two urban centres is mainly due to the increasing rate of population migration from the eastern region to the western region of Bhutan. Similarly, the incidence of poverty was found to be relatively higher in eastern parts of the country. Therefore, the Regional Hub development has been proposed as the measure to address these issues of rural-urban migration and promote balanced development across all the regions in the country. The development of regional hubs, which is consistent with the Bhutan 2020 vision policy document, will continue the government's commitment to improve the quality of life in rural areas through development of growth centres in the eastern regions. The main objectives of the Nganglam RH Development Plan are;

Objectives

- To promote balanced and equitable regional development so that benefits of economic and social progress is equally distributed across the country.
- To ensure the development of the region in a sustainable manner that will address the economic, social and environmental considerations.
- To establish Nganglam as a regional hub, guided by a shared vision for its development and bring its international reputation as one of the sustainable, dynamic and resourceful regions in the country.
- To create an environment that will ensure the optimum use of the region's potentials and accelerate economic growth in a sustainable manner.
- To provide a flexible framework for adapting to real conditions, emphasizing on issues of local concerns and requirements which allows for introduction of an efficient urban infrastructure and services
- To facilitate a pattern of development, which will accommodate the projected population of the area and create an environment in which people will choose to live and work as a matter of choice.



Nganglam under Pemagatsel Dzongkhag situated in the south-eastern region of Bhutan

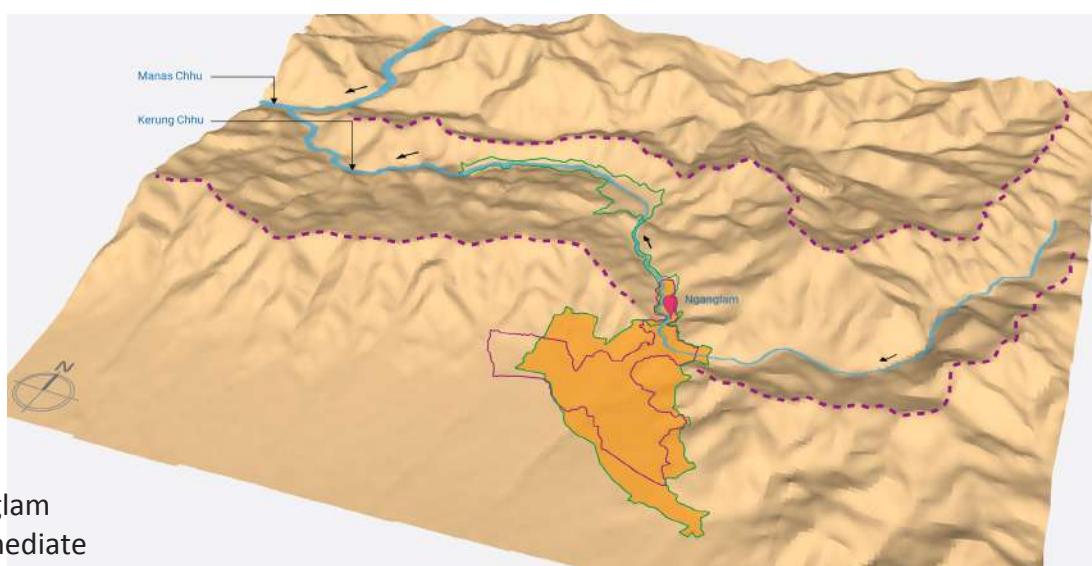
2.2 Physical setting and the region

Nganglam Dungkhag is located in the south eastern part of Bhutan and falls under Pemagatshel Dzongkhag. Pemagatshel Dzongkhag covers an area of about 1022.11 square km, with elevation ranging from 1000 to 3,500 meters above sea level. The region experiences an average annual rainfall of 1500 mm to 3000 mm. 87.65% of the total area is under forest cover, comprising mainly of coniferous and broadleaf species. The climate of the area is hot and humid during the monsoons and moderate cold during the dry season.

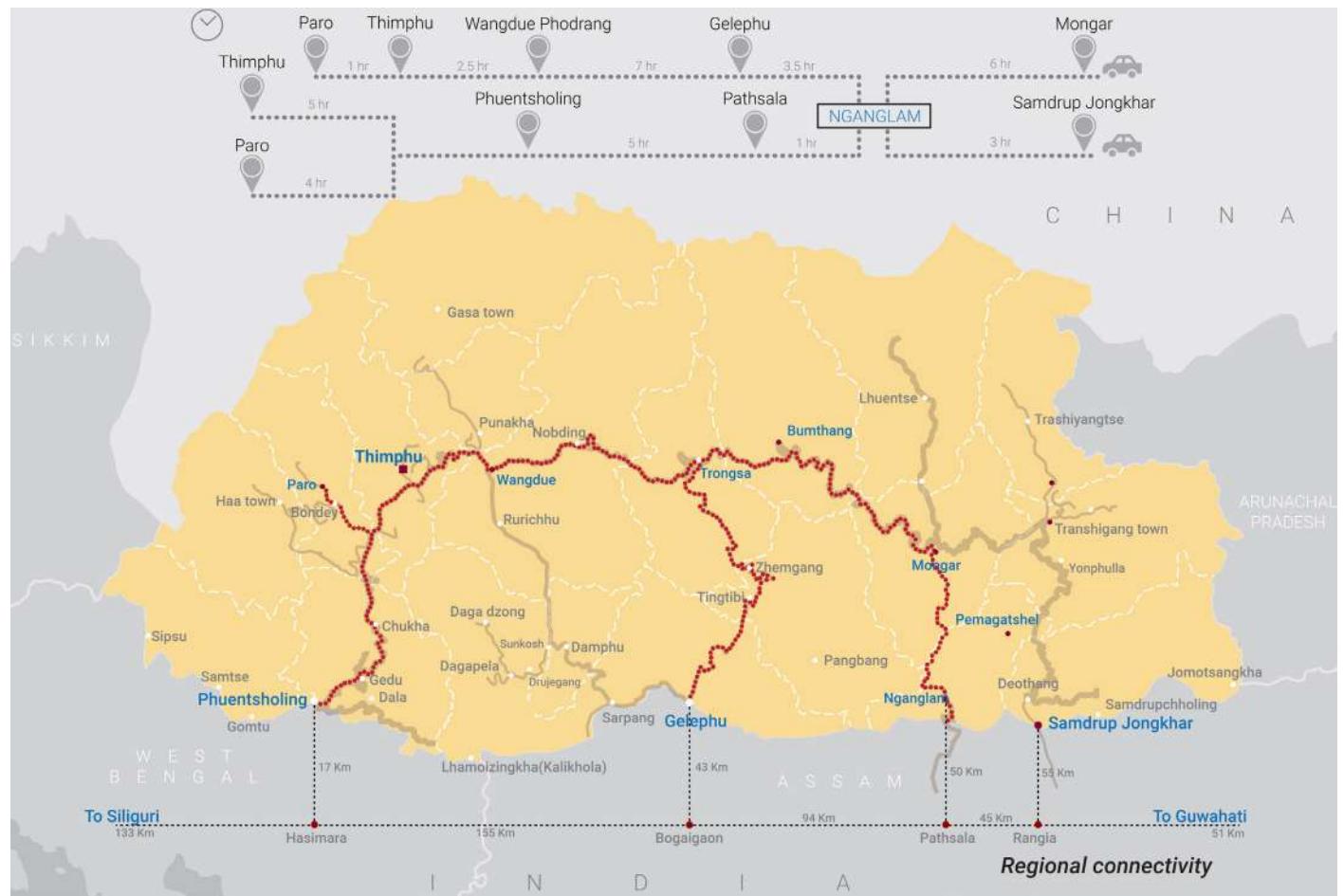
Nganglam Dungkhag constitutes of three gewogs namely Norbugang, Chhokorling and Dechhenling. Nganglam is situated in close proximity to other eastern Dzongkhags which include Samdrup Jongkhar, Trashigang, Mongar, Trashi Yangtse, Zhemgang and Sarpang. It is situated in a strategic location along the India-Bhutan international border and adjacent to the Indian state of Assam.

The figure illustrates a three dimensional model of Nganglam and its surrounding physical environment. Nganglam is situated along the southern foothills of the Himalayas which taper into the Duars of India. The two parallel mountain ridges form the main geographical features which define the valley of Karong Chhu. The valley along the Karong Chhu forms a U-shaped arc before flowing toward east-west corridor where it meets the Kerung Chhu at 'Kurong Chong'. Unlike most rivers in Bhutan, Kerung Chhu is northbound during a substantial course of its length wherein lies the main settlement of Nganglam, identified by the location marker, to the east of Kerung Chhu. The industrial area and mining sites are located further downstream, occupying both sides of the river and forms the northern arm of the proposed thromde boundary.

As per the illustration, the proposed regional hub boundary is indicated by shaded perimeter and the proposed thromde boundary in green lines. The regional hub and the thromde area straddle the ridge which marks the southern edge of the Kurong Chhu valley. While the existing town of Nganglam is situated in the valley to the north of the ridge, the villages of Satsalu, Tangzema and Rinchenthang are located on the gentle slopes along the southern ridge, separated by parallel southbound streams.



Physiography of Nganglam Dzongkhag and its immediate environment



Regional connectivity

2.3 Regional Connectivity

Road

Road is the principle mode of connectivity in the country. Until recently, Nganglam was completely isolated from the other parts of Bhutan and the only road access to the Drungkhag was through India. The construction of three major highways; Nganglam- Pemagatshel highway (120 km), Nganglam-Gyelpoishing highway (74 km) and Nganglam-Panbang highway (55 km), has now connected Nganglam with the rest of the areas in the country. Today, Nganglam is well connected and accessible to all six eastern districts of Bhutan within a day's drive by road.

The construction of these motorable roads has significantly benefited the local residents, tourists and commercial sectors by providing easy access to markets around. Major cash crops including oranges and cement products from the industrial sites are transported along these newly constructed roads to different parts of the country and abroad.

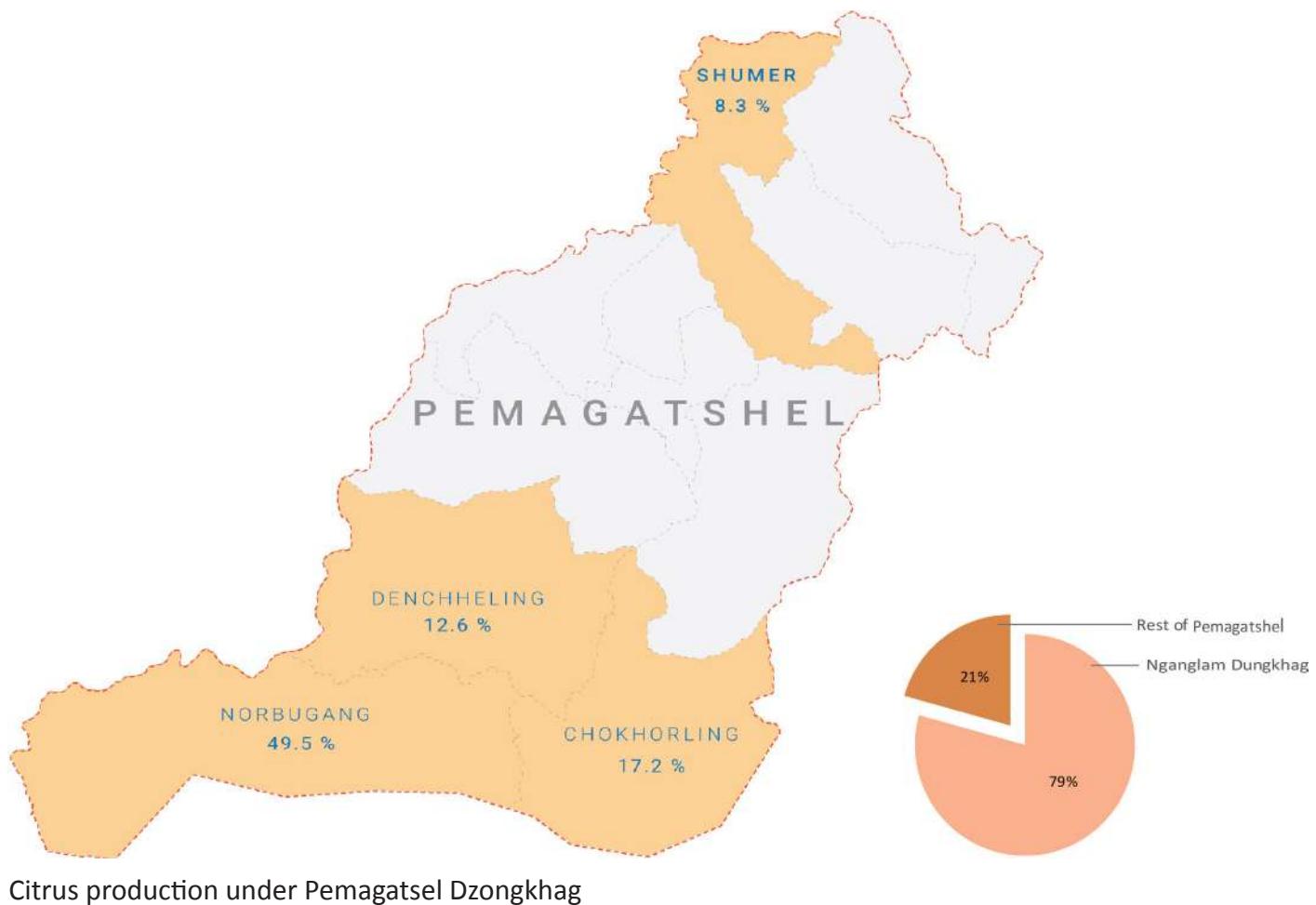
The 38 km long two-lane highway which connects Pathsala town of Assam, India to Nganglam is the main access to Dungsam Cement plant, Bhutan's biggest cement manufacturing unit. While the 29 km long national highway from Pathsala towards Nganglam was completed in 2008, the final work on a Greenfield 9 km road leading right up to the India-Bhutan border was just finished. It was a part of the Special Accelerated Road Development Programme for the North East (SARDP-NE).

Railways

The closest railhead access to Nganglam is through Pathsala which is located 38 km away in Assam, India. This further connects to Guwahati , Dibrugarh, Baongaigaon, Jalpaiguri and other town in the western part of India.

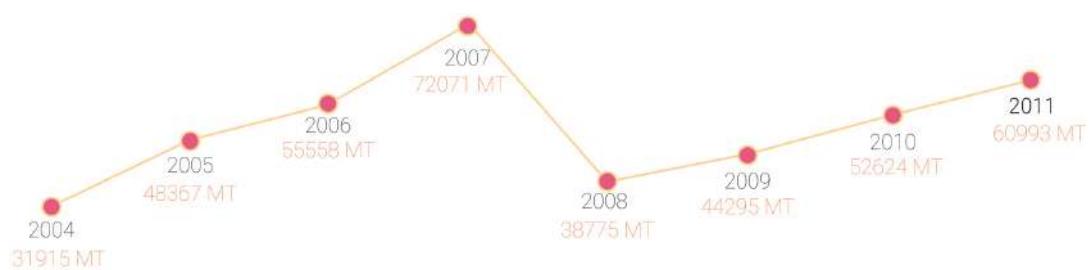
By Air

Closest airports to Nganglam are Gelephu airport (79 km) and Guwahati airport (152 km) in India. since Gelephu airport is currently open to domestic operations, Paro is the only airport in the country which provides direct international access to Bhutan.



Citrus production under Pemagatsel Dzongkhag

Illustration of Citrus production in the country from the year 2004 to 2011



2.4 Potential Economic Sectors

Agriculture and Orange farming

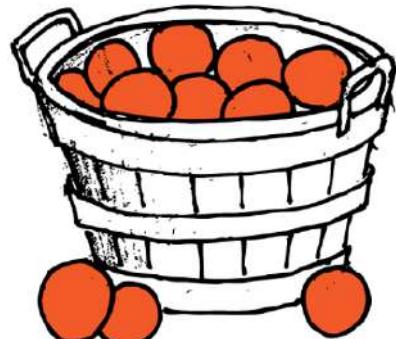
Bhutan is an agriculture based economy and it is the main source of livelihood. Pemagatshel has about 40% of the total land area under cultivation given the comparatively good percentage of arable land. Horticulture has now replaced the traditional agricultural practices of Tseri cultivation and some of the main crops grown in the region include maize, oranges, potatoes and other sub-tropical fruits and vegetables. The favorable climate conditions of the region provide good environment for the production of this wide range of cash crops specially oranges, which are considered as one of the major source of income of the locals in Pemagatshel. Orange is among the most important cash crop that contribute to Bhutan's economy through generating export revenue, income and employment opportunities.

Orange orchards are mainly found in the foot hills at altitudes between 300-1500 m. Orange grow well in warm and humid climates where the average annual temperature is above 15.C, and the frost season last less than 115 days. The area receives an average annual rainfall of over 1,000 mm which favors the orange cultivation.

Export Market

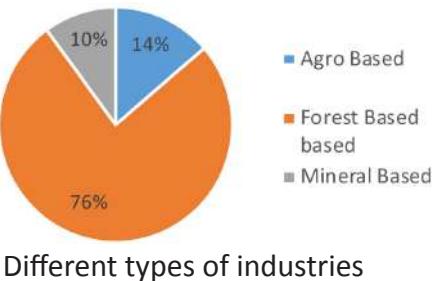
Orange is among the most important horticultural crops in terms of export. About 20,000 metric tons of oranges are exported from Bhutan annually, and in 2014, citrus export accounted for approximately 2% of the total exports from the country. Bhutan exports about 85% of the total orange produced to Bangladesh and the rest to India. About 92% of the total oranges produced are sold in the market through different marketing channels. Only 8% of this total is used for household consumption and 75% of it goes into processing, which add to the total export value. A very high percentage of the orange grower is backyard orange farmers and small orchard owners, and a very small percentage of it is big farmers.

Bhutanese oranges have a high demand in the markets in Bangladesh and India. This demand is attributed mainly due to its distinct seasonal advantages, and a better taste and natural quality than those produced in the neighboring countries. The orange export business generates substantial revenue for the government and hard currency for business houses. Bhutanese exporters have the potential to make high profits by providing fresh, organic and tasty fruits to high-end consumers in Bangladesh and India.



Industries

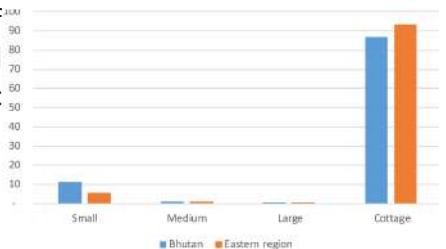
Industries can be broadly classified under three main categories based on the types of manufacturing units, namely; agro-based, forest-based and mineral-based industry. As illustrated in the chart, a majority of industries in the eastern region constitute of forest based industries (76%) and as low as 14% and 10% make up the agro-based and mineral based industry respectively. It indicates that the agro and mineral resources in the region have not been explored to their full potential in spite of their availability.



Different types of industries

Bhutan has rich mineral resources such as dolomite, limestone, gypsum, slate, and coal. Although the mineral resources are available in abundance, the contribution to the Gross Domestic Product of mining to the country's economy is less than 2%. Today, there are 33 mines and 48 quarries operated in the country.

Mineral mining and cement industries is another important source of income generation in the Dzongkhag. Gypsum mining in Khothakpa and Dungsam Cement industry in Nganglam provides significant economic opportunities for the Dzongkhag in terms of employment generation, income of households and local trade and commerce.



Different scales of industries

Kangrizhe and Marungrí Mines

Dungsam Cement Corporation Limited owns two mines at Kangrizhe and Marungrí, which are the main source of raw material such as gypsum and dolomite. The site is spread on 676 acres of land, a part of which is owned by the corporation and partly leased from the government. These mines are located in hilly terrains and therefore require open-cast system of mining and operate using semi-mechanized method.

Kangrizhe and Marungrí Mines under Pemagatsel Dzongkhag



Cement Plant

The minerals production in Bhutan started in 1995 and some of the industrial minerals were processed to produce cement and ferro-silicon for export. According to the Division of Geology and Mines, most of the industrial mineral mining is operated by privately owned companies. The two largest state owned companies are Dungsam Cement Corporation Limited and Penden Cement Authority Limited.

Dungsam Cement Corporation Limited (DCCL)

DCCL is a state owned company incorporated under the Companies Act of Kingdom of Bhutan, 2000. It is a subsidiary company of Druk Holding and Investments. It is a green field cement plant located in Chengkari, Nganglam. It has an installed capacity to produce 3,000 MT of clinker and 4,130 metric tons of cement per day. Currently, operating at 60% of its full production capacity, the plant produces around 80,000 bags of cement per day. About 50 to 60 trucks are used every day to transport the cement from the plant. At full capacity, the plant would provide employment to 420 persons as permanent skilled staff and about 200 outsourced non-skilled staff. The plant has its own residential campus, which has 250 quarters catering 1000 residents.

Export

DCCL, the country's largest cement plant, has announced its entry into the Indian market with its brand Dragon cement. The plant has huge production capacity but given the relatively small local market, the company plans to sell about 70 to 80% of its total production to the Indian markets. One of the primary advantages is the saving out of transportation costs of cement since Pathsala, Assam is located about less than 50 kilometers from the factory. The cement products from the plant are directly transported to godowns in Guwahati, Assam on trucks through Nganglam- Pathsala highway and to Pathsala rail station, which then connects to the different parts of northern India through railway networks.

The company targets to export 80% of its production to India, particularly the markets in Assam, West Bengal, Arunachal Pradesh and other north eastern states. Owing to its initial phase of production and marketing, and in the presence of the existing competitive market, only 35% of the production is currently exported. The northeast region is fast evolving into an international trade hub for Southeast Asian economies with regional players exporting cement to countries like Bangladesh and players across the border coming into the region.

Cement Plant in
Nganglam Dungsam Cement Corporation
Limited (DCCL)



Dungsam Polymers

Dungsam Polymers Limited was established in 2010 as a unit of Druk Holding and Investment under the Companies Act of the Kingdom of Bhutan, 2000. The plant is located on 8.87 acres of land near the existing DCCL plant in Chengkari, Nganglam.

It manufactures Polypropylene woven bags for packaging cement, minerals and agricultural products. The plant has installed capacity 350kg/hr melting output which can deliver one hundred thousand woven fabric bags in a day. It is expected that 80% of the total bags produced will be consumed by Dungsam Cement Corporation Limited, and the remaining will be sold in the domestic and north east Indian market. Currently, the company is in its early stages of the business life cycle.



Dungsam Polymers Limited, Nganglam

Market

The circular woven fabric unit is established for supply of cement bags to Dungsam Cement Corporation Limited and the remaining to domestic and north-east Indian markets. The consumption of bags by Dungsam Cement factory is about 2,400,000 bags per month. The installed capacity of fabric bags is approximately 30, 00,000 bags per month.



Polypropylene woven bags manufactured at the plant

Service - Trade (Import and Export)



Existing Check-Post in Nganglam Drungkhag

India is the biggest trading partner which accounts for about 85% of exports and 75% of imports in Bhutan. This is followed by Bangladesh with a little over 3% of exports and 0.5% of imports in the country. Other trading partners include Nepal and other members of the SAARC, and countries belonging to the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC). The data shows a small increase in the geographical diversification of exports away from India over the past three years. Mostly this has been in the form of an increase in exports to Hong Kong and Japan.

All goods which enter and leave the country have to be declared at the customs offices located at different locations in the country. Currently, there are about 16 designated custom regional offices and check posts at various locations along the border. The main custom check post at Phuentsholing has the highest flow of traffic when compared to other stations, where the traffic is usually concentrated to particular groups of product and are seasonal. However, the existing infrastructures in Phuentsholing have not been able to cope with the increasing volume of flow of goods across the border. There is the need to open new border check posts which will have a significance impact in the southern region of Gelephu, Samdrup Jongkhar and Samtse.

Integrated Check Post



The new proposed Integrated border Check-Post under con-struction in Nganglam

The Integrated Check Posts are envisaged to provide all the facilities required for discharge of sovereign and non-sovereign functions to enable smooth cross-border movement of individuals, vehicles and goods under an integrated complex. These facilitate the processes of immigration, customs, security, quarantine and many more. Nganglam is one of the border towns in the country with high economic potentials. However, the existing outpost at the border lack regional immigration office or check post to facilitate the processes of immigration and custom. The outpost is only authorized to check the permit and keep a track of entries but cannot issue one. These permits are necessary for foreigners who wish to travel into Bhutan, which can only be acquired in Phuentsholing, Gelephu, Samtse or Samdrupjongkhar. The proposal to build an international integrated border gate in Nganglam is currently in progress which would, after its completion, be first of its kind in the country.

The integrated border gate stands along the international border between Nganglam and the Indian State of Assam. The integrated check post will primarily consist of main entry and exit gates, a six-lane road, a truck parking, and offices of Bhutan Animal and Food Regulatory Authority, immigration, police, forest and custom services amongst others.

The Integrated check post with all its services is expected to improve in the efficient delivery of services. More than 200 trucks pass through the main gate every day carrying raw material from India and finished products such as cement to India. This will facilitate trade and commerce in the region in an efficient manner. Additionally, it will contribute to the tourism industry by facilitating an easy access to major tourist destinations including Royal Manas National Park and maintain a tourist flow in the region.

Strategic Location

Eastern region of Bhutan has rich mineral deposits and exquisite agricultural production which have significant impact on Bhutan's trade, export and import market. But high transportation costs within and outside the country and unbalanced trade flows pose major issues since Bhutan's international trade is solely reliant on the port in Kolkata, India through Phuentsholing transit corridor.

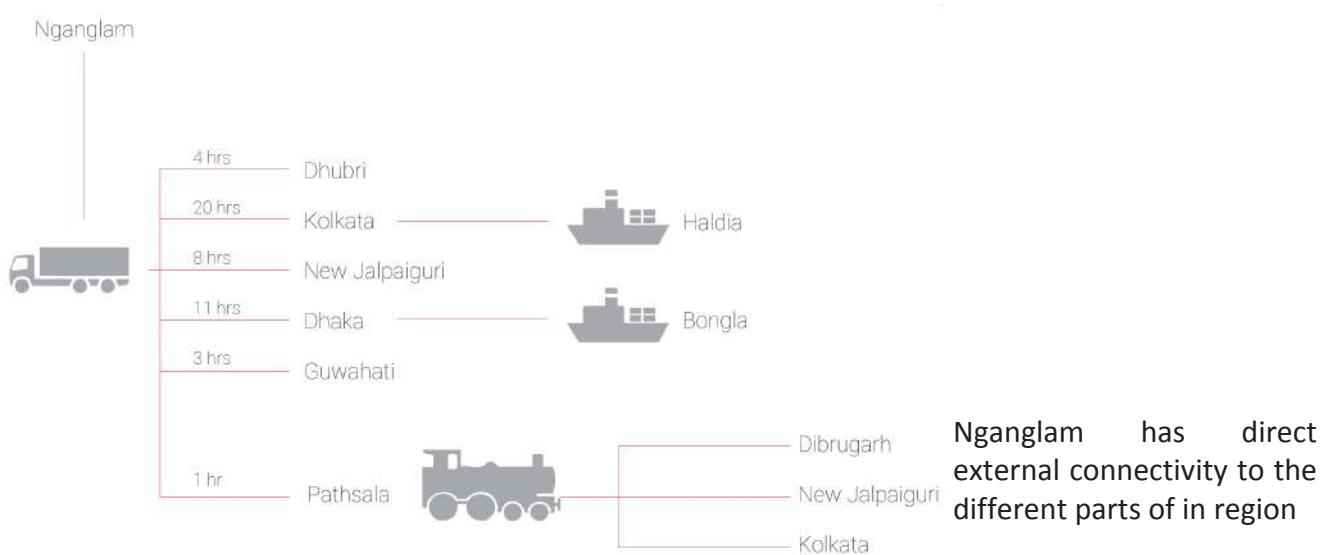
Nganglam is geographically situated in a strategic location in the eastern region with direct internal and external road connectivity. Furthermore, the proposal to connect Nganglam with railhead on the other side of the border in India boosts its potential to become an important hub in the eastern region.

Gypsum mining in Pemagatshel and cement factory in Nganglam has significant impact in the region in terms of socio-economic growth. Nganglam-Pathsala highway has become a major export corridor with 700 trucks plying along it, to ever growing market for cement and agricultural products in north-eastern India. Enhanced logistics services and adequate transportation and storage systems can provide a significant boost to the whole import-export scenario of the country and local economic activities.

Dry Port

Most of the cross border trade in Bhutan takes place in Phuentsholing which acts as a mini dry port. It is the oldest land port in Bhutan which started its operation as a land port since 2003. The mini dry port has greatly improved the logistics system through integrated and proper facilities to the customs authorities, thereby eliminating the current multiplication of site clearances.

Nganglam has the potential for the development of a dry port in the eastern region in the light of increasing growth of intra-regional trade in the country. The increasing business activities and import-export scenario clearly demonstrate the need for improved inter modal freight transportation system in the region. A dry port would not only improve their logistics management systems, but also contribute in the creation of job opportunities and regulating transportation costs.



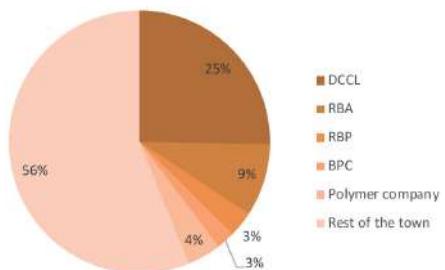
2.1 Demography

The total population for Pemagatshel Dzongkhag for the year 2013 is 37,473. No previous census figure for the population is available as its boundary was reconstituted in the year 2006, with inclusion of Chokhorling, Dechhenling and Norbugang gewogs from Samdrup Jongkhar and Nanong from Trashigang . Nganglam Drungkhag which comprises of Chokhorling, Dechhenling and Norbugang had a population of 4964 in 2005 which increased to 9633 in the year 2013 with an annual growth rate of 8.64%.

Year	Population	Compound Annual Growth Rate
2000	768	-
2005	1018	5.8%
2015	3907	14.4%

Population-Nganglam Thromde

Source: Drungkhag Administration.

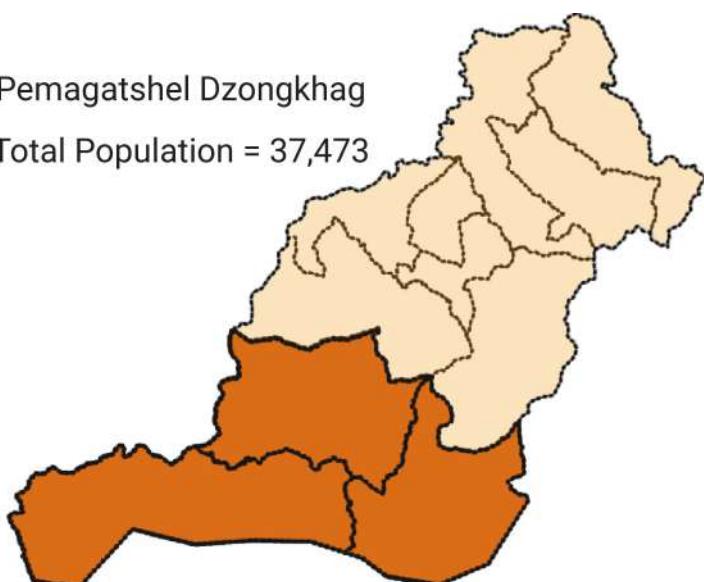


Population distribution within Nganglam Thromde

Considering the population of Nganglam Thromde, which is 5706 for the year 2015, it can be observed that DCCL contributes almost around 25% to this figure while institutions like RBA, RBP and BPC also have a substantial share to it. The growth figures within Nganglam urban area are quite interesting. The total population has almost become 3.5 times in the span of 10 years from 2005 to 2015.

Pemagatshel Dzongkhag

Total Population = 37,473



Population under Nganglam and Pemagatsel Dzongkhag

Nanglam Drungkhag

Total Population = 9633

Location	Details	Population
Nganglam Urban area		3907
	Enumerated in Nganglam	633
	Enumerated outside Nganglam	3274
Surrounding villages		695
DCCL and ancillary industries + BPC		1799
Total Dependant Population		6401

Total dependent population

RH Planning area (2015)

For the purpose of population projection, a figure of existing population living within RH planning area is needed which includes entire Nganglam urban area and a few surrounding village settlements down south along the international border. DCCL and its ancillary industries are located within Thromde boundary and have been excluded from the RH planning boundary. Although the industrial area does not fall within the planning boundary, it has a strong economic and social impact on the urban area due to their close proximity. Therefore, the existing population within these industrial developments has been included for the purpose of population projection. The table below shows the existing dependant population Nganglam.

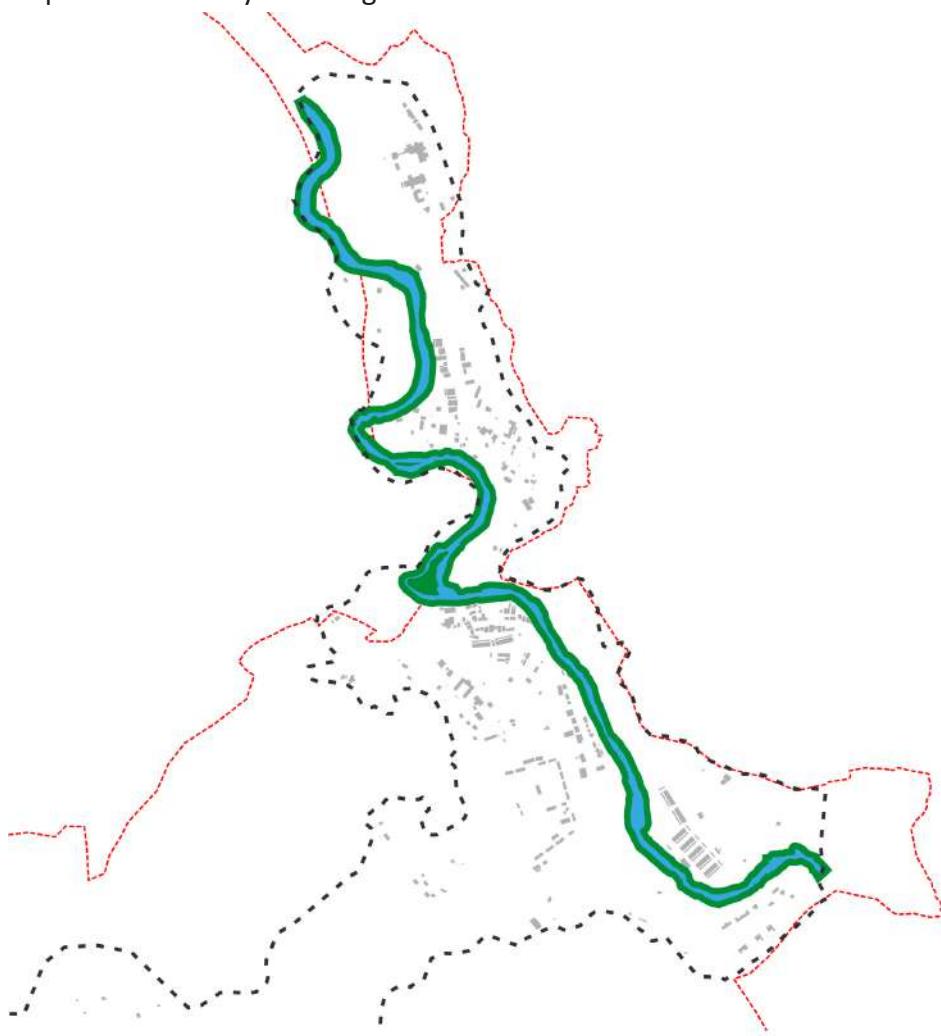
3 Settlement Study

3.1 Settlement Pattern

There are quite a few existing settlements in Rinchenthang towards the areas surrounding Metogang and the current check-post site. Many of the existing settlements are concentrated in the old town which lies in very close proximity to LAP area in Rinchenthang. Similarly, the traditional settlements and agglomerate of small scattered villages such as in Tangzema, Satsalu and Metogang determine the overall character and settlement pattern of Nganglam. Settlements surrounding these villages consist of cluster of houses surrounded by large tract of wetland. The study of predominant settlement clusters reflects the lifestyle of the local people and the understanding about the underlying principles of the rural and urban structure in Nganglam.



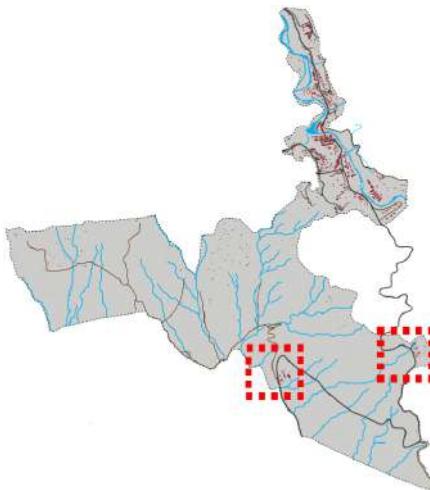
The settlement patterns both in the existing old town and Rinchenthang, in the absence of a formal physical plan, are highway induced developments in patches. The urban fabric consists of uneven grain and coarse texture with many intermediate congested patches. The old town area due to the limited availability of developable land parcels, has resulted in a development of an urban fabric which is congested and haphazard. It also consists of a few large grain and singular built forms. There are only two existing pockets of settlements in Rinchenthang although the area has the most habitable slopes of the valley with large tract of land under forest cover.



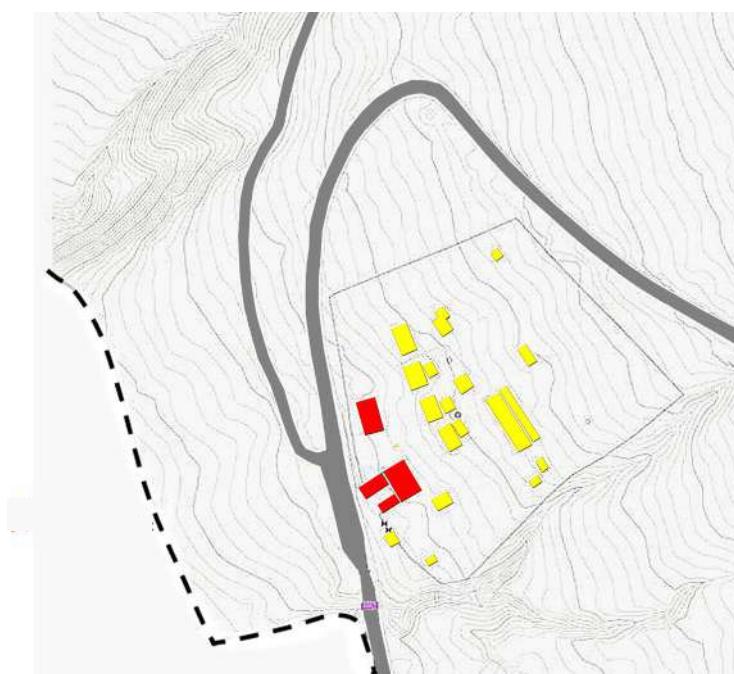
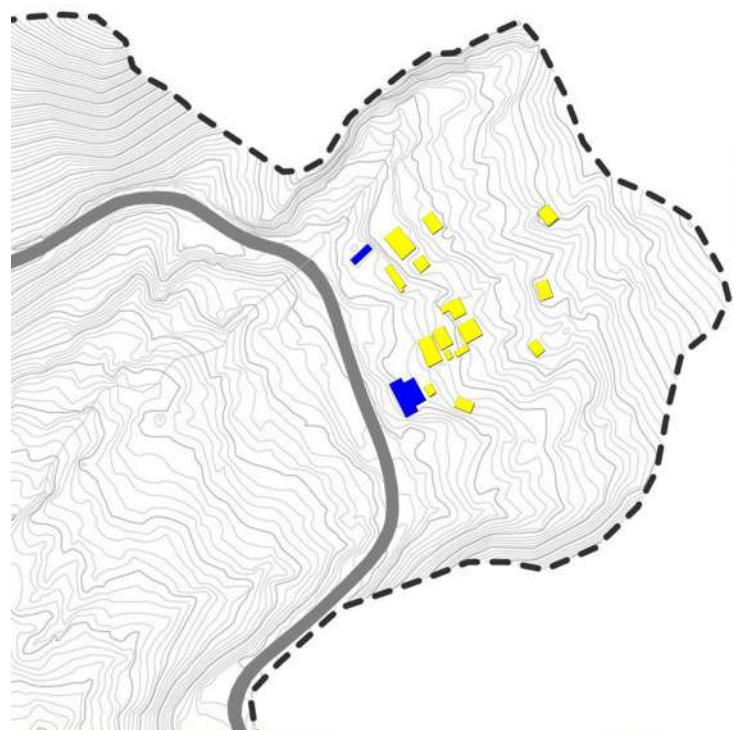
Highway induced liner development in the existing Nganglam town

3.2 Building Use

The building use analysis provides an insight about the socio-economic condition of the town and the pattern of growth of different activities. The existing buildings survey in the old town show about 70% of the buildings are residential, including 14% of the total under mixed-use development, predominantly located along the highway.



Similarly, there are only two settlement clusters that can be found in Rincenthang which are situated along the highway in Metogang and the existing check-post area. These two settlements consist of predominantly residential use and less than 5% which constitutes of commercial use in Metogang. The existing check-post area accommodates residential housing colonies for the security personals and civil servants. Few institutional buildings of public and semi-public use can be found within the security check post compound.



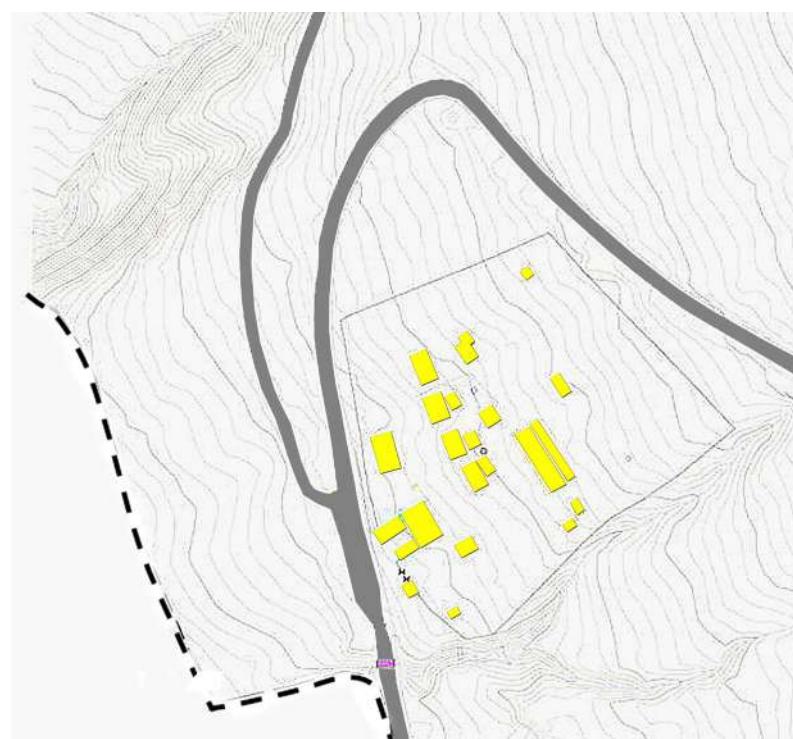
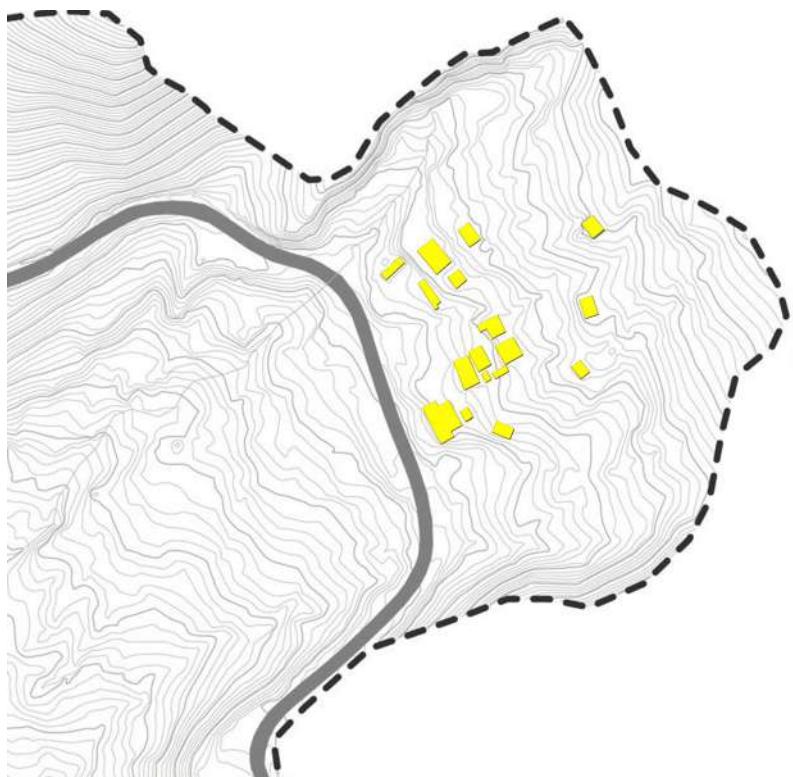
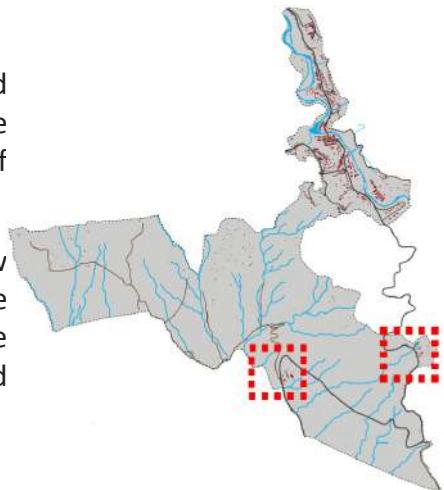
Legend

- Residential
- Commercial
- Public & Semi-Public

3.3 Building Intensity

In general, settlement pattern in Nganglam shows many interspersed development along the main movement spine. As illustrated in the RH plan, the settlements in the old town area consists of buildings of varying heights ranging from single storey up to five storey (G+4).

Currently, Rinchenthang is sparsely populated with few houses and low density development in Metogang and security check post compound. The settlement clusters in Rinchenthang consists of uneven grain and coarse texture of mainly single storied houses, which include both temporary and permanent structures.



Legend

Ground Floor (G)

3.4 Building Typology

The building typologies of any settlement are a function of its site forces, aesthetic spectrum of communities, their financial status and particular requirements of habitat.

The study of building typology and morphology provides vital insight into the likes, dislikes and preferences of the community which may be extended into the proposal for new development. It also helps in critical appraisal of building types which helps in formulation of development control regulations to check malpractices and facilitate in building a good image of the city.

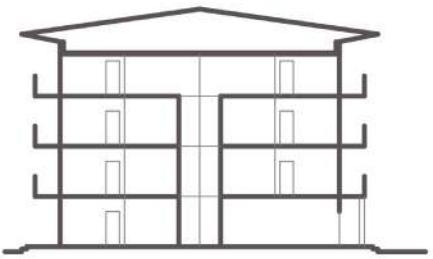
The study of building typologies also include the existing built forms in the selected areas within the old town and the surrounding villages given their close proximity to Rinchenthang and the relatively small site area. Overall, the old town area and the proposed new LAP area in Rinchenthang share certain similarities in terms of the existing building typologies while the neighbouring villages of Tangzema and Satsalu have its distinct building typologies as illustrated in the following sections.



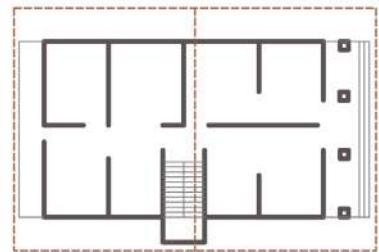
Type-I:

G+2 and higher, medium to large grain and singular form

Recent development in the core of old Nganglam town has been in the form of large-grained four storied structures (G+3), often capped with an attic which serves as an additional floor. These buildings occur as self-contained structures with a singular form as opposed to building types which comprise of a group of structures with one main unit and its auxiliary structures.



Such buildings along the main road are characterized by commercial spaces on the ground floor combined with colonnaded veranda in the front which are often narrow and not particularly useful in providing an interactive edge between exterior and interior spaces. Other instances of the same type occur in inward clusters such as near the Guru Rinpoche statue or the WAPCOS office building near Drungkhag premises or the staff quarters of DCCL. The veranda element is absent in these cases. The balconies in the front façade in some of these buildings are found to be aesthetically unappealing. It has been observed as a common trend, in these new developments, where Bhutanese architectural features have been applied superficially and therefore, does not bend very well with the structure.



Typical Layout and Section of the structure

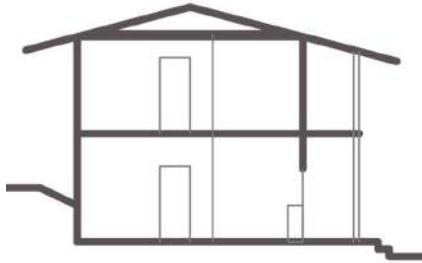


Apartment Blocks
(G+2 and above)
in Nganglam

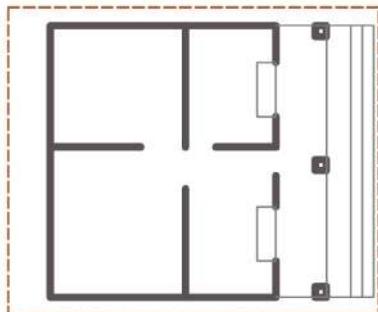
Type-II:

G+1, small to medium grain and varying form

These buildings are mostly medium in terms of building grain and occasionally, with small grain. Likewise, building form is more commonly singular and in some cases the building has a composite or plural form.



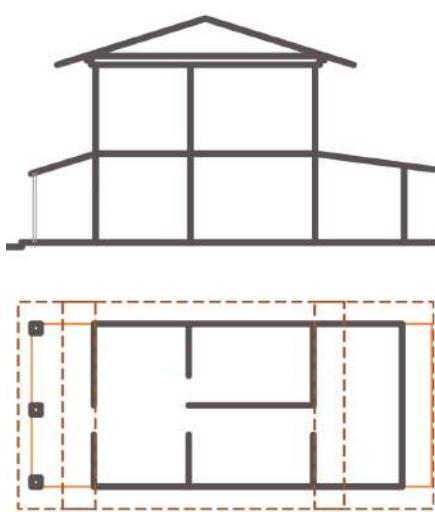
This building type occurs sporadically, throughout the old town area and displays a lot of variation in building form through differential use of architectural features and building materials. However, there is no pattern in these variations and for the same reason they have been grouped together as type-II. The interplay of architectural elements such as the balcony, colonnaded veranda and the roof of buildings of type-II influences the building morphology.



Typical Layout and Section of the structure



Some of the examples of Type-II structures in Nganglam



Typical Layout and Section of the structure

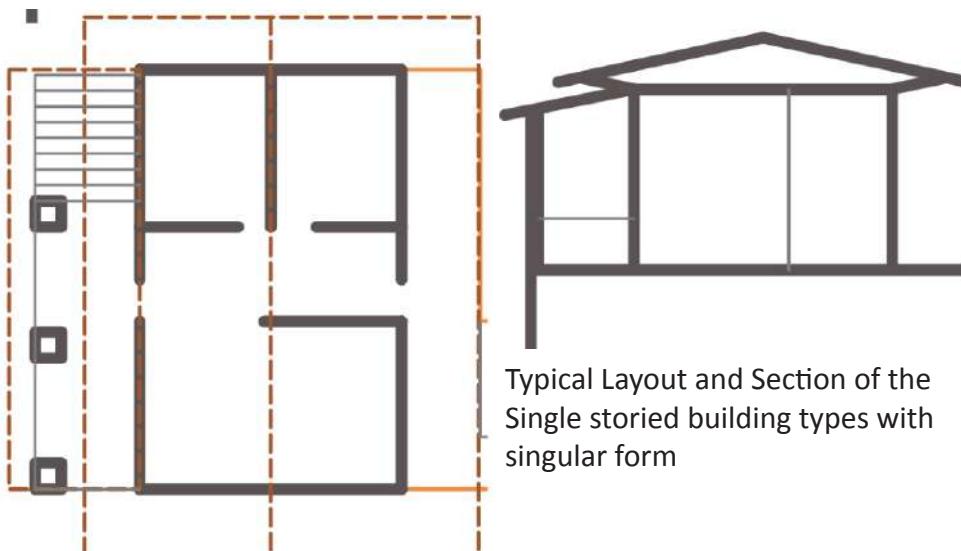


Type-III a:

Single-storeyed, small grain, singular form

This building type occurs most frequently in the old clusters of the urban core of Nganglam. The grain size is small and building form is predominantly singular. Exceptions to this form include the clustered setting of Metogang village where the building form is plural.

Variations in this building type include houses with veranda or shop in the fronts.

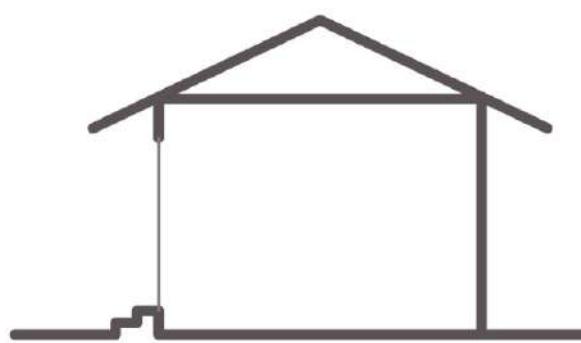


Examples of Type-III structures as seen in Metogang village

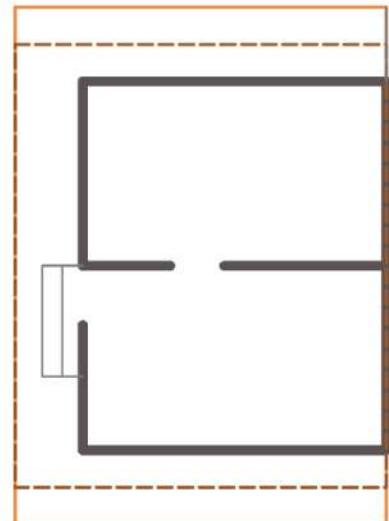
Type-III b:

Single-storeyed, small-to-large grained, row-housing type form

Owing to its industrial context, Nganglam has housing colonies with detached, single-storied units. These buildings have been classified as a separate building type because of their even grain and peculiar building form. The accentuated pitch of the roof sets it apart from typical Bhutanese buildings.



Typical Layout and Section of Single storied row housing

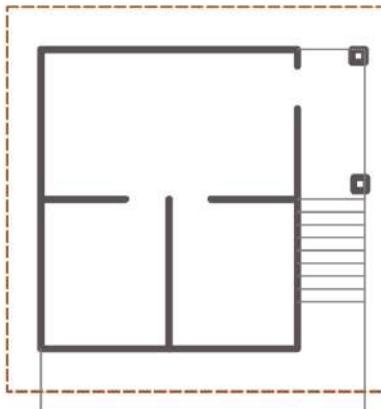
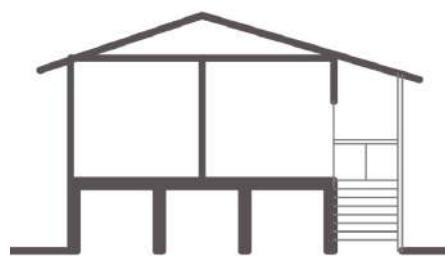


Examples of Single storied building types in a row housing

Type-IV:

Single storied, medium-to large grain buildings on stilts

Houses in rural settlements such as Satsalu and Tangzema occur as single-storied structures elevated on stilts. These houses have unique roof patterns in the form of gablet roof.



Typical plan and Elevation of Single storied building on stilts

Examples of this type of building structures are commonly found in the villages of Tangzema and Satsalo

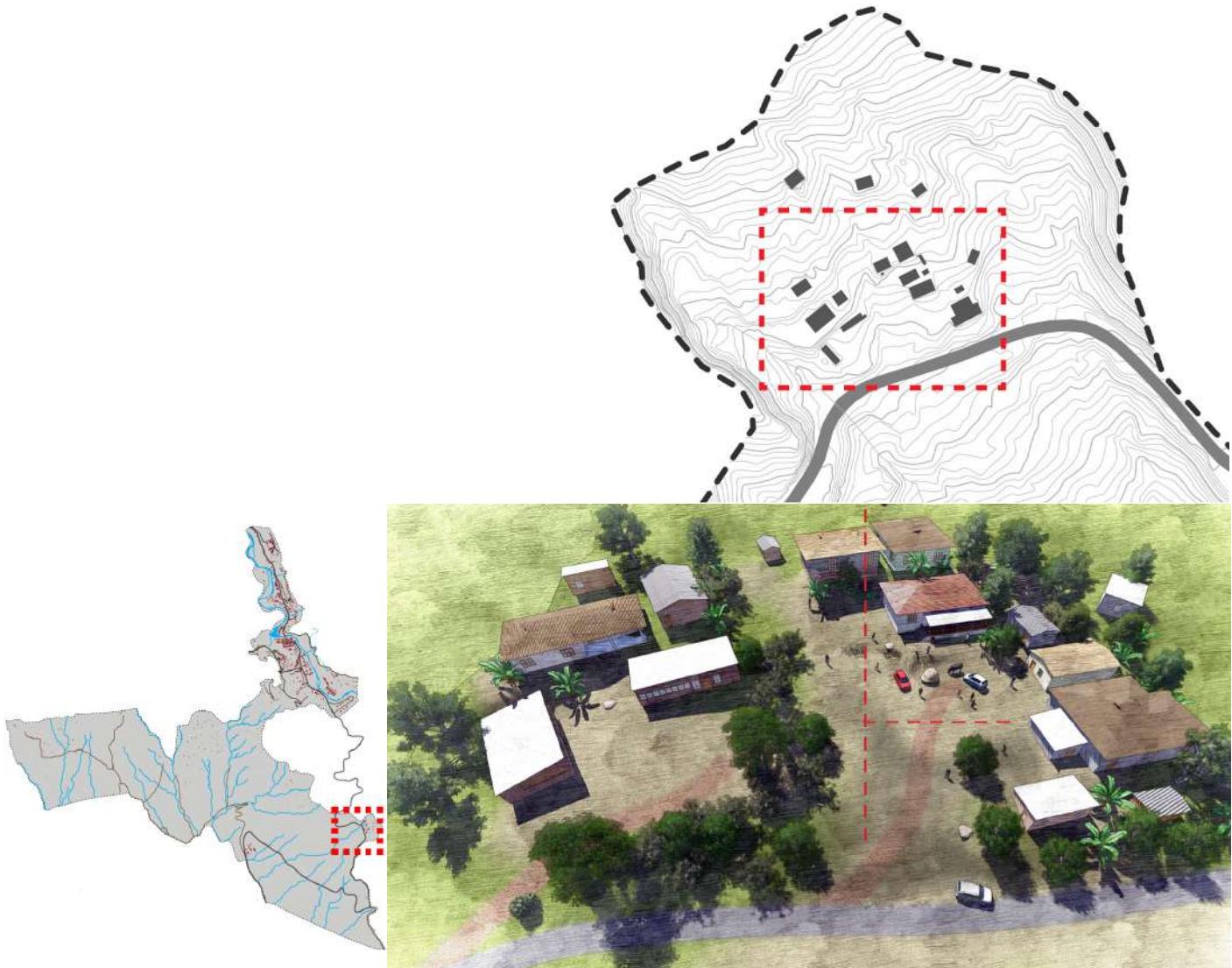


3.5 Cluster Study

The old Nganglam town and the surrounding villages within the thromde have varying settlement patterns and cluster forms which are unique to the cultural and environmental context of Nganglam. The settlement clusters within the town areas generally mixed use due to the nature of the development which is induced by the highway. On the contrary, the settlement clusters found further away from the highway are exclusively residential in terms of their land use. The settlements clusters in the surrounding villages of Satsalu and Tangzema are distinct and different from the town clusters in terms of their built form and building typology which is mainly influenced by their agrarian settlement character.

Metogang

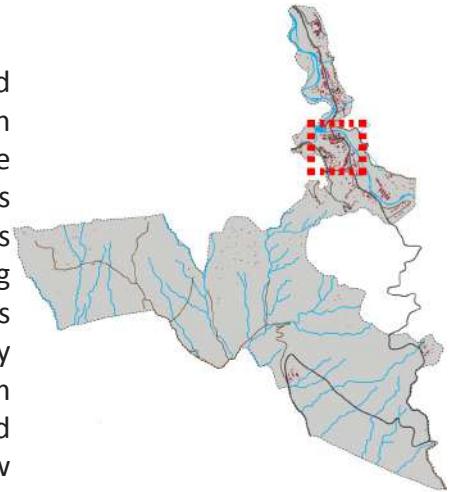
Metogang is relatively an isolated village cluster in which few dwelling units arranged in a terraced formation. Each household occupies one or two terraces with multiple single storey structures dispersed around a private open space. Cattle sheds, barns, toilets and timber stockpiles for each household are housed in separate structures within the plot premise. Open spaces cater to activities such as kitchen gardening, drying spices and grains, play area for children and parking where there is vehicular access. There exist no pronounced boundaries between individual properties which are threaded together by a shared footpath. In general, cluster found in this area are of mixed typology with varying building form and materials.



Old Town Area

The old town of Nganglam constitutes of a stretch of unplanned and organic settlements along the highway, in the form of ribbon development, which is induced by the national highway. Within these 'highway clusters' development consists of a group of mixed use units with interactive edges along the highway. The building typology is characterized by the commercial establishments in the front side facing the highway, and residential units towards the back of the buildings without any enclosures or attached open spaces. Compact temporary structures and hutments combined together in some of the areas form an organic and continuous built form along the main roads. Wedged between the highway and other prominent precincts, these clusters grow organically in interstitial spaces and show a fragile image.

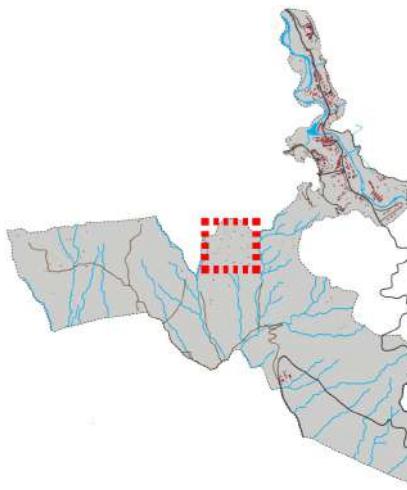
The area has a mix of apartment blocks, single and double storied structures dominated with mixed use and commercial activity. The apartment blocks have colonnaded verandahs on the ground floors which fail to create an interactive street edge. The front edge of the building remains active with activities such as parking, loading and unloading bays and open spaces in front of the plots. Single and double mixed use structures are developed around a shared open space.



Bazaar Area in existing Nganglam town

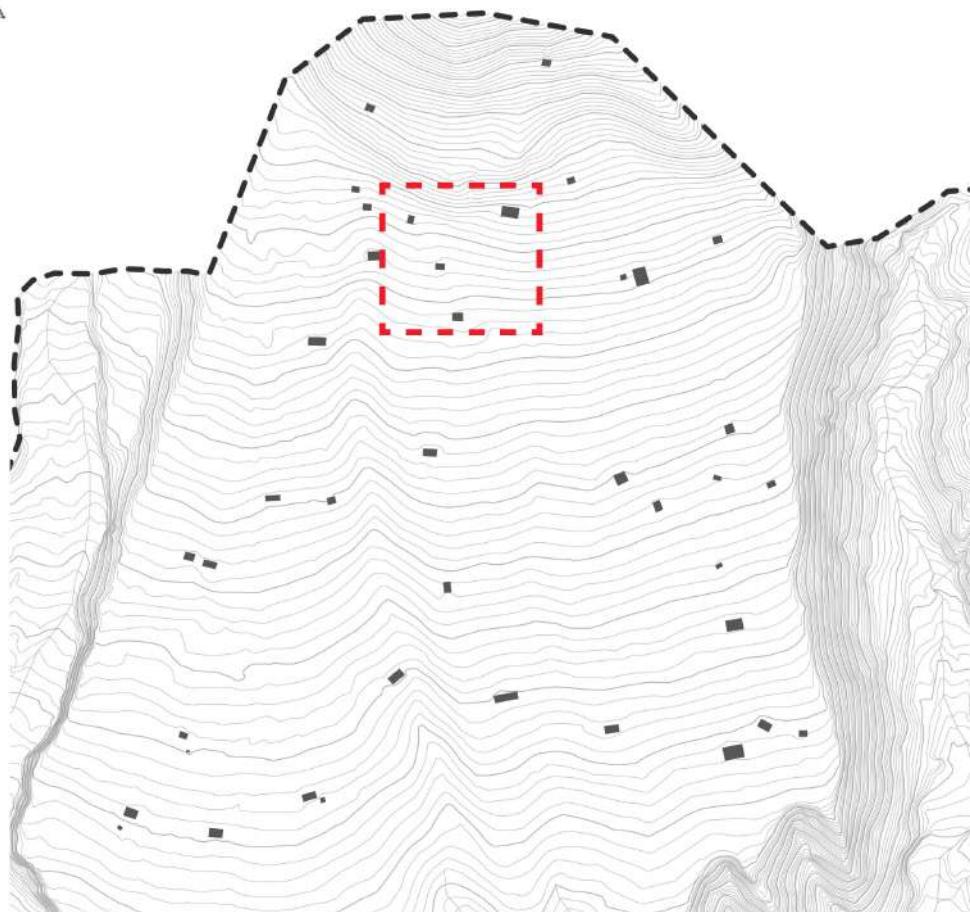


Mixed Use clusters along the Highway in the urban core area of Nganglam



Satsalu

The settlement cluster surrounding the villages of Tangzema and Satsalu consists of single detached houses with corresponding farmlands resulting in a sparse grain with large open space. The residential houses are surrounded by large open space on all four sides with household activities spilling out into these spaces which are then connected by narrow footpaths. Small vegetable gardens and betel nut plantations near the houses give way to larger farms with cereal crops resulting in a progressive transformation of built form to open space. The settlements clusters in these villages are characterized by unique building typology of single storied semi-permanent structures raised on stilts.

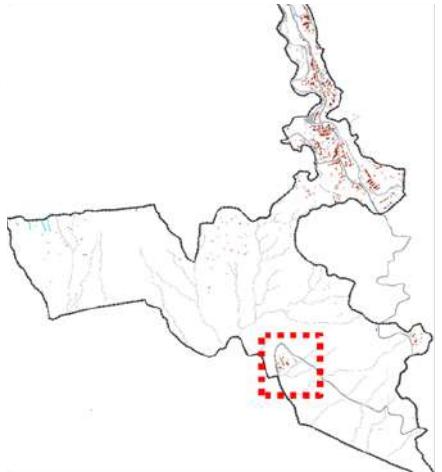


Unique building typology of Single storied houses built on stilts in the villages surrounding Tangzema and Satsalu



Existing Check Post Area

The existing check-post area consists of single storied both permanent and temporary structures of institutional and residential use. Right at the entrance of the security premise, the building cluster consist of government offices such as the Department of Immigration, Bhutan Agriculture and Food Authority, Department of Forest and Parks Services, and Royal Bhutan Police. The overall cluster within the premise consists of uneven grain and coarse texture of single storey structures without any well defined communal space. The mix of detached single dwelling and barrack housing with large grain behind the government offices accommodate RBA and RBP personnel. In some of the dwelling units, the houses have the kitchens and toilets in separate blocks in close proximity.



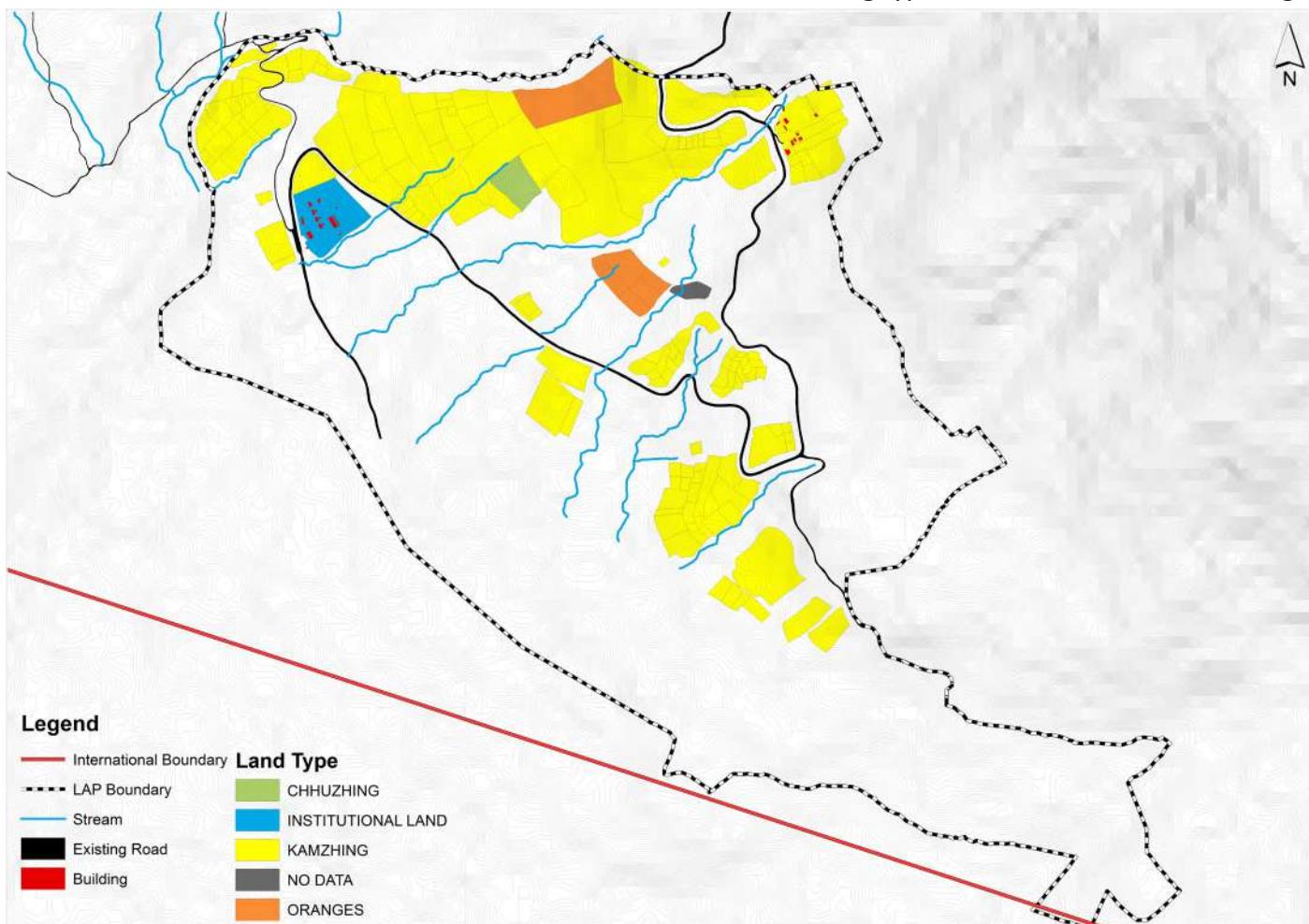
4 Existing Scenario

4.1 Existing Land-Use

The existing land use in Rinchenthang, as shown in the table below, includes 176 plots with non-agricultural use constituting about 23% of the total area. This includes land use under kamzhing and institutional which add up to an area of 160 acres of the total area. There are only two pockets of land with seven plots which fall under the orchard use, adding up to only 2% of the total area in Rinchenthang. There is a consolidated pocket of wetland (chhuzhing) under single ownership with an area of 2.3 acres which is surrounded by kamzhing. As high as 75% of the total area measuring 517.5 acres is state owned land which currently falls under forest cover and natural vegetation.

Land Type	Number of Plots	Area (Acre)
Chhuzhing	1	2.385
Institutional	1	5.911
Kamzhing	175	154.643
Orange	7	10.738
No Data	1	0.864
Total	185	174.541

Existing types of land-use in Rinchenthang

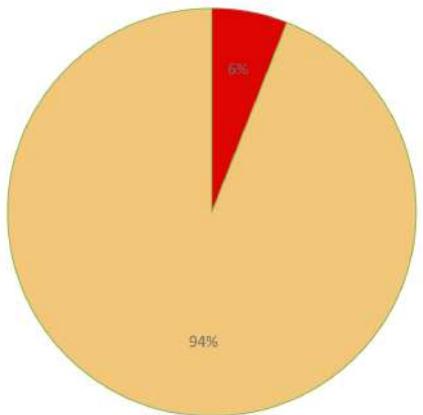


4.2 Plot Size Classification

Rinchenthang consists of a total of 185 plots with an area of 174.5 acres excluding the state owned land. The existing land holding pattern is primarily dominated by the individual and private ownerships under kamzhing, institutional and agricultural uses. A large stretch of the total area in Rinchenthang is under the government's ownership which is currently left as a green area with heavy natural vegetation. The plot sizes under Rinchenthang local area plan is broadly classified under two categories, plots measuring above and below 13 decimals.

In accordance with the local government act of Bhutan, 2009, section 273 (t) under powers and functions of Thromde administration, it states that 'minimum plot size in potential growth areas of Thromde shall be 13 decimals (before land pooling) whereas in areas where local area plan exists, minimum plot sizes shall be as specified in the approved local area plans.

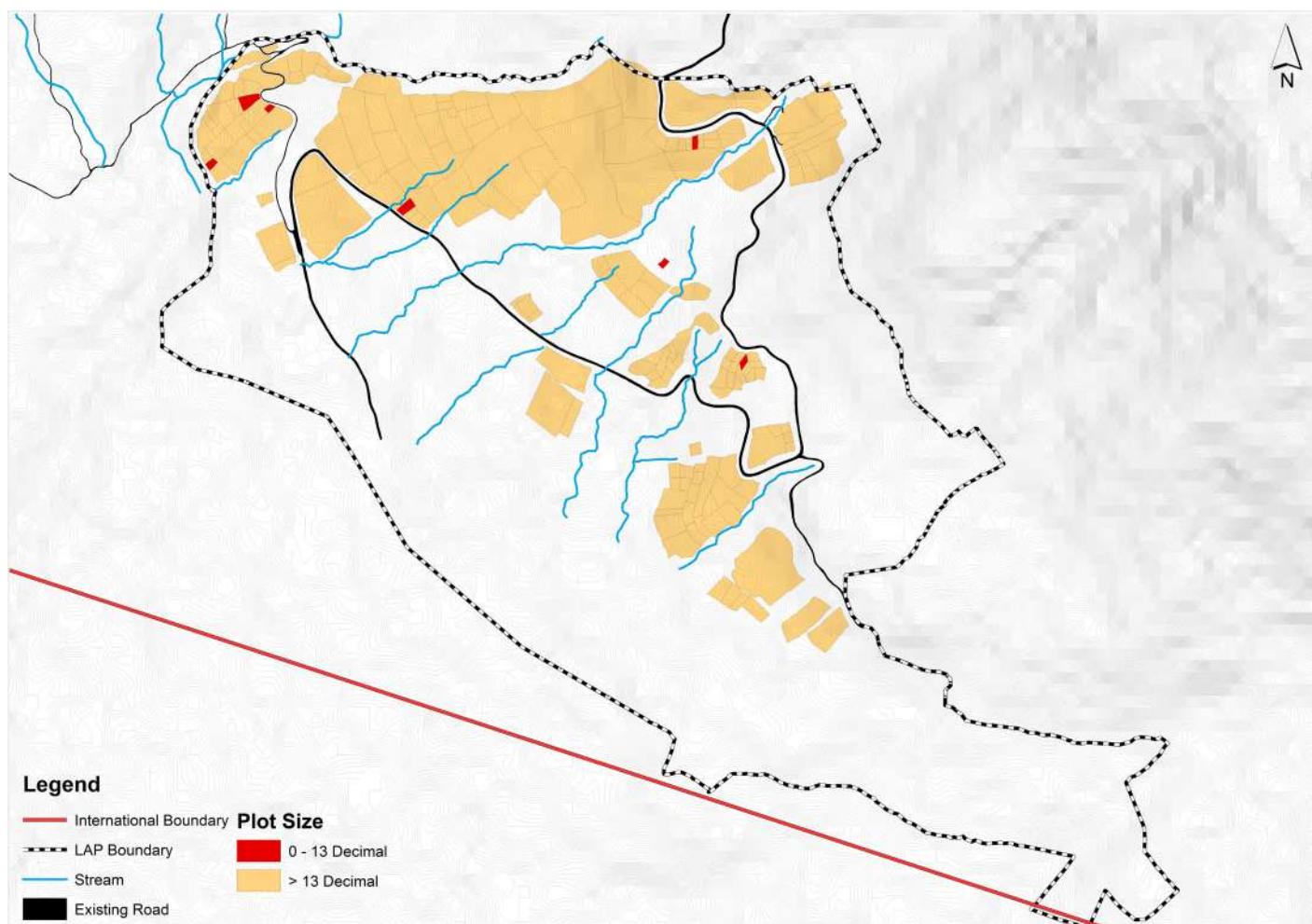
There are 175 plots measuring above 13 decimal and only 10 plots which measures below 13 decimal.



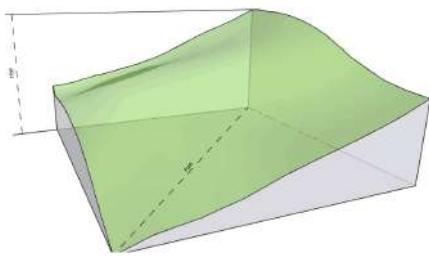
Area ■ below 13 decimal ■ above 13 decimal

Plot size classification in percentages

Plot Size	Number of Plots
Below 13 Decimal	10
Above 13 Decimal	175



4.3 Slope Analysis



The magnitude or size of the gradient is termed as slope and it is one of the most widely used of surface attributes, therefore basic knowledge about how it is developed and its characteristics is important.

Slope stability analysis is used in the assessment of the safe design of a man made or natural slope and the equilibrium conditions. Slope stability is the resistance of inclined surface to failure by sliding or collapsing. In general terms, slope of a terrain or surface is the amount of rise (change in elevation) over run in some direction, usually the direction for which the rise over run is greatest (steepest path along the surface). The slope value developed with Geographic Information System application is the ratio of the rise over run (tangent value/ function) calculated in radian (degree) or percentage.

Therefore, depending on the steepness of a slope or terrain, the areas can be broadly classified under four main categories;

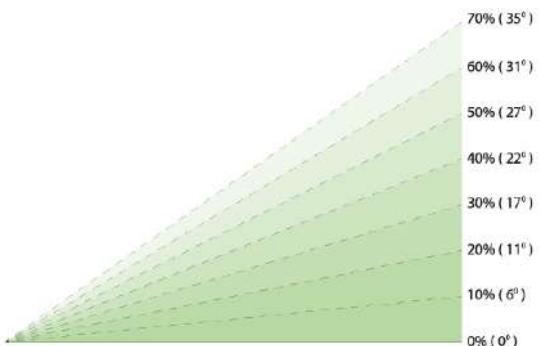
Slope types	Gradient in percentage
Flat terrain/ gradual slope	Less than 10%
Moderate slope	10% to 20%
Steep slope	20% to 30%
Very steep slope	30% and above

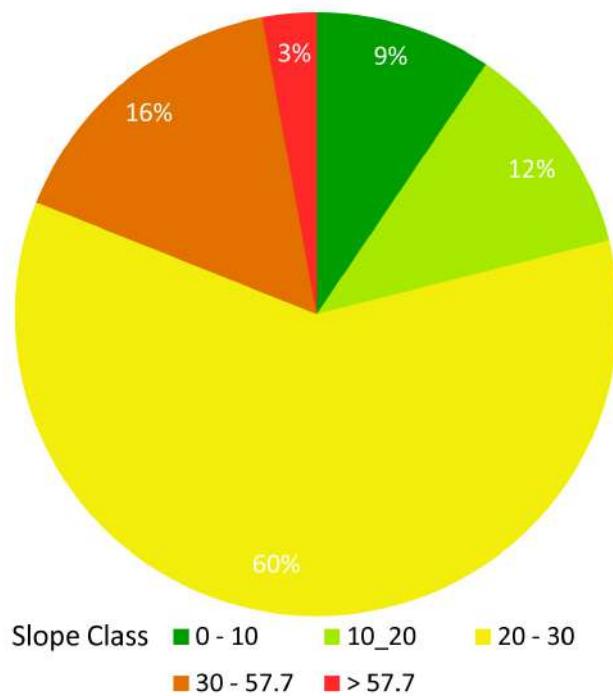
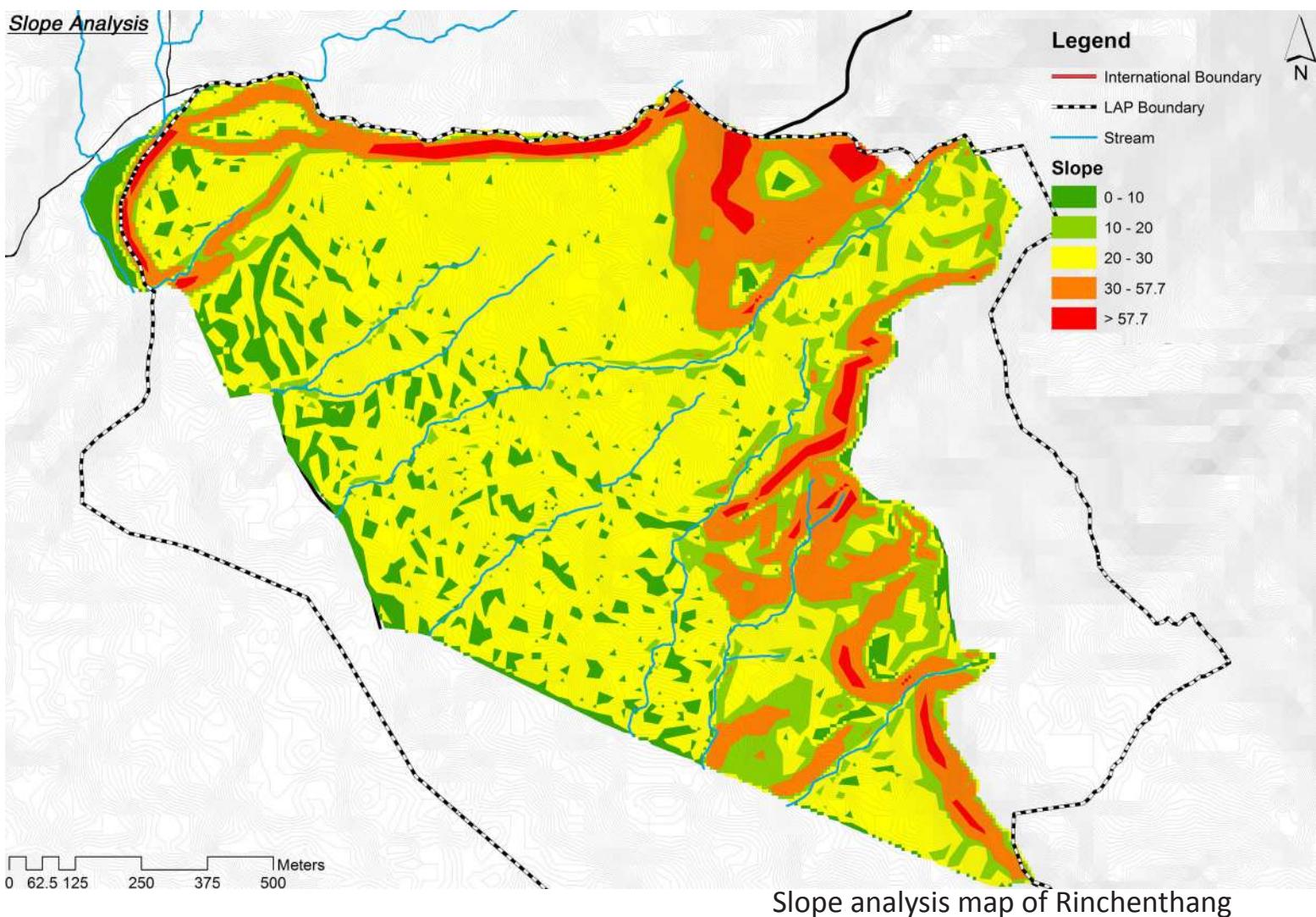
The prevailing spatial planning guideline for human settlement in Bhutan allows areas within the slope range of 30% and below as suitable for development.

The different areas under Rinchenthang local area plan, based on the slope suitability analysis, can be classified as follows;

Slope	Area (Acre)	Area (Sq.m)	Remarks
0 - 10	36	147144	Based on available survey data under LAP
10_20	44	179164	
20 - 30	228	921843	
30 - 57.7	61	247683	
> 57.7	11	44530	
Total	380	1540364	

The classification of the total area based on the primary slope analysis

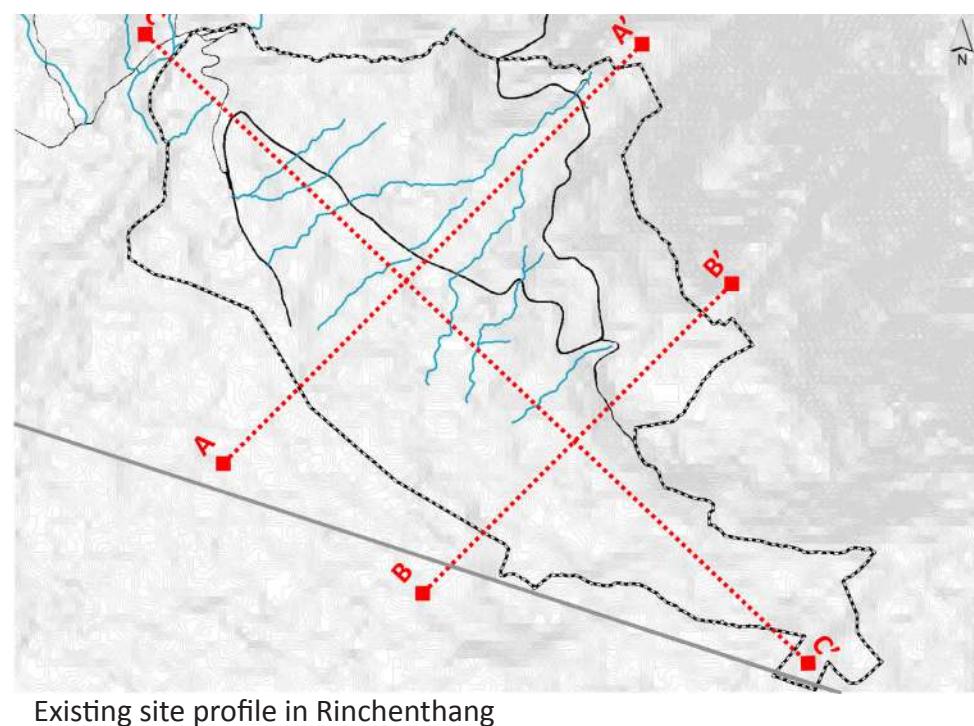


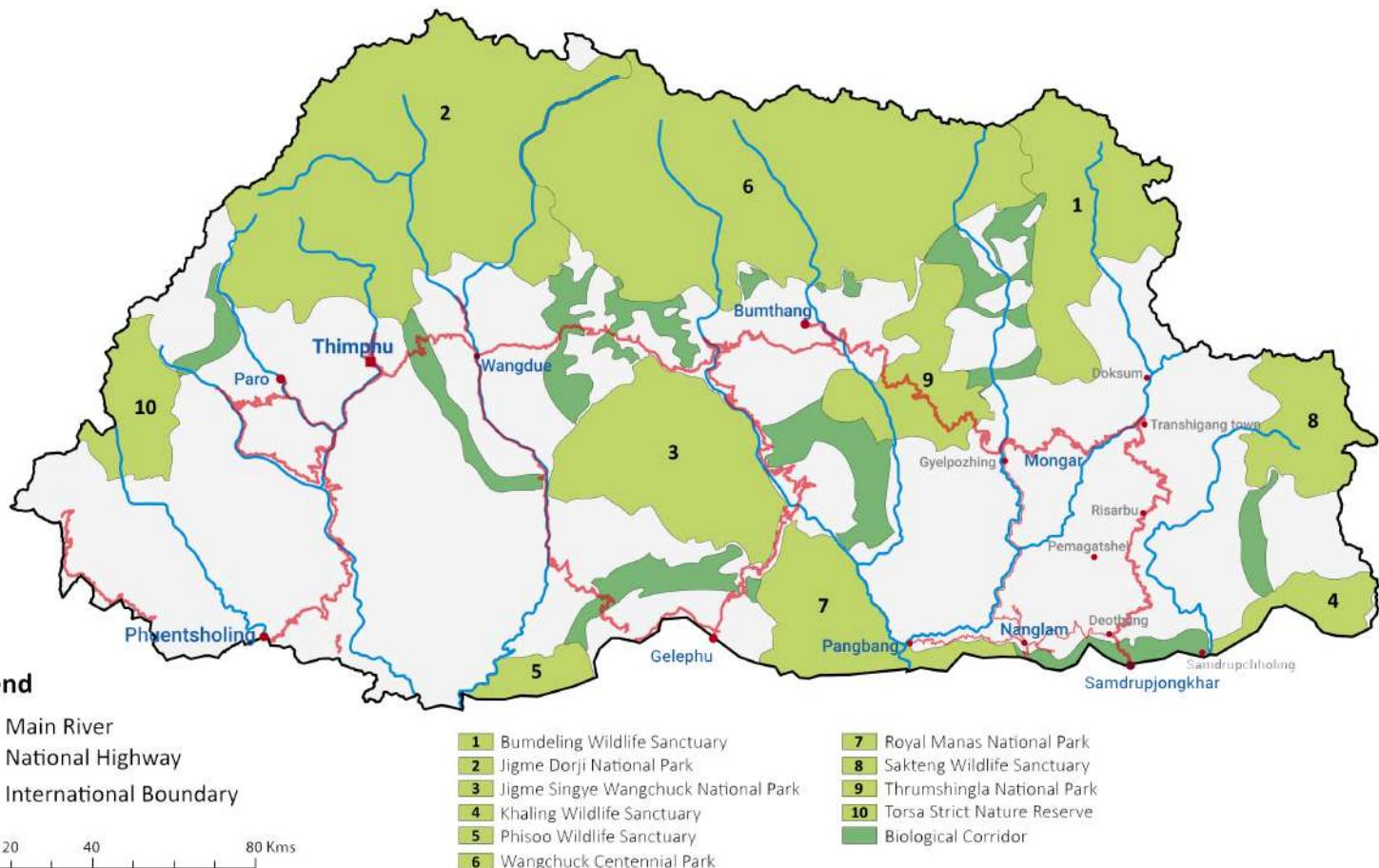


Percentage break-up of
the area under different
slope classification

The slope classification table shown above and the corresponding analysis map show that a very high percentage of about 80% of the total area in Rinchenthang falls under moderate and gradual slope category. This slope category constitutes of about 300 acres of land mainly under state owned and private land holding. About 16 % (61 acres) of the total area falls under steep slopes and only 3% (11 acres) under very steep slopes.

The typical site sections below show the existing land profile of Rinchenthang which includes the most habitable slopes of the valley with large tracts of gentle slopes extending towards south west. These gentle slopes are covered with heavy vegetation and constitute a few pockets of settlements which are scattered in Rinchenthang. The slopes are drained by several minor streams which merged together as they flow towards further south.

**BB'****AA'****CC'**



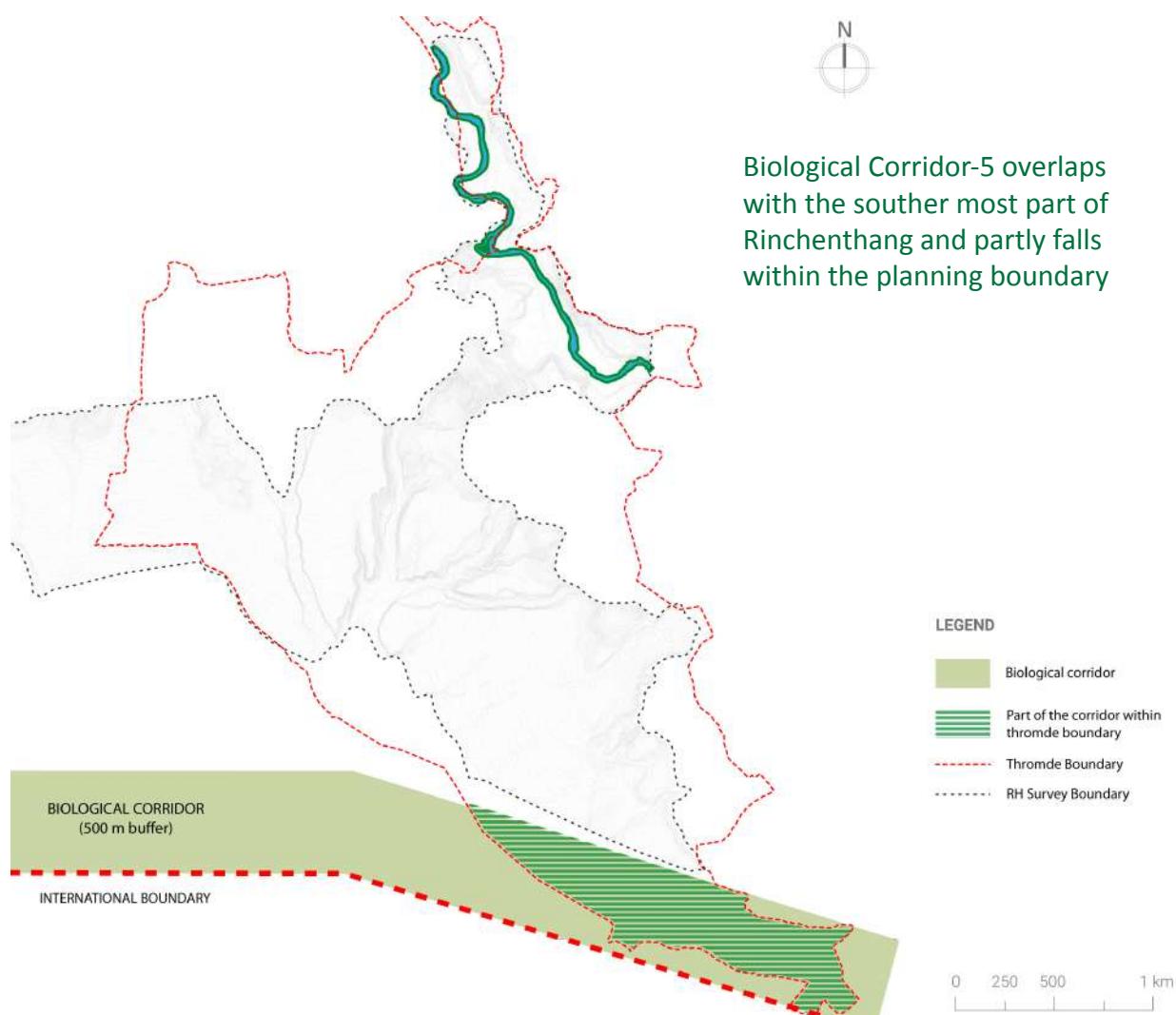
Protected areas within Bhutan

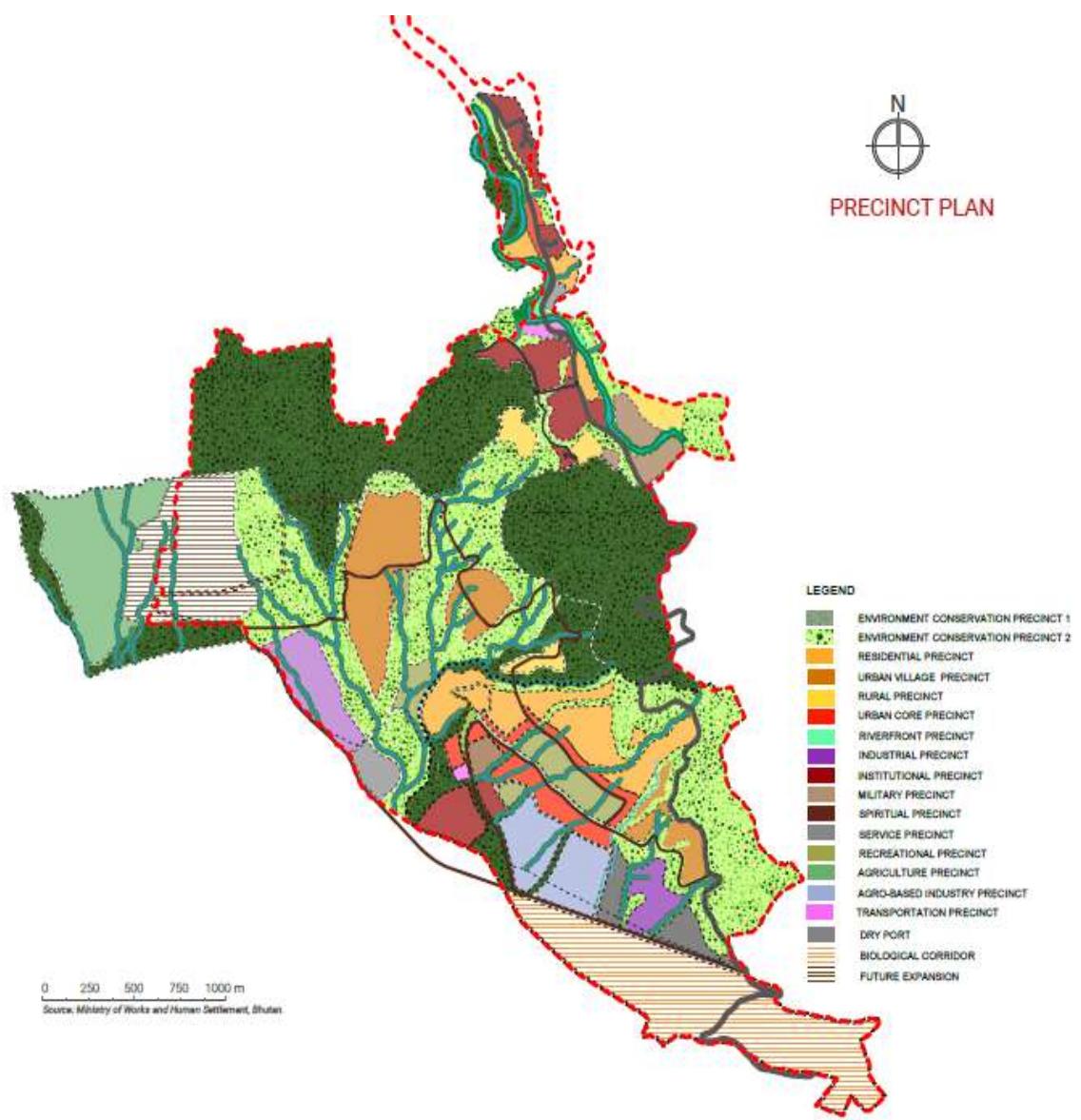
4.4 Biological Corridor

The area demarcated for Nganglam regional hub development is flanked by protected areas which include the Royal Manas National Park in the west and Khaling Wildlife Sanctuary in the east. These protected nature preserves are interconnected by the Biological Corridor 5 (BC-5) which is about 49 km in length and covers an area of approximately 212 km². This corridor is important for the movement of around 20 medium to large mammal species including animals such as tiger, gaur, elephant and rhino.

The national highway leading towards Nganglam town and industrial area from the international border in the south stretches perpendicular to the biological corridor. Also, about 6 kilometers long Nganglam-Deothang highway falls within the biological corridor demarcation.

One of the major issues concerning the biological corridor is the segment of its area towards the south which extends beyond the area demarcated for the establishment of new Nganglam town. Although Nganglam town planning began from 2009 with the new master plan being approved in 2012, its implementation was stopped after more than half of the area identified for the new town fell under the biological corridor. A total of 124 acres (0.50 km²) of land registered under the ownership of 51 private plot owners fell within this corridor. Several rounds of discussions were held among the concerned authorities to deliberate on this matter and a final consensus was reached where a minimum of 500 meters buffer zone on either side of the international boundary shall be maintained.





5 The Proposal

5.1 Structure Plan

Nganglam Structure Plan serves as a medium to translate the vision into an applicable spatial plan which responds to the needs and aspirations of citizens. It acts as a blue-print for preparation of its constituent local area plans which in turn lay down definitive and exhaustive guidelines for development.

The structure plan is built on a precinct-based approach as opposed to a zoning-based approach often endorsed in the conventional planning methodology which delineates areas based on land-use. Precincts on the other hand, are identified through urban design surveys which divide the city into perceivable districts based on typical characteristics of each district. These character districts form the basic unit of planning for the town.

The concept of precincts is well-established in the prevailing urban planning process in Bhutan. A typical household in Bhutan derives its livelihood from different sources. The same family may be-engaged in agriculture, renting out a portion of their house, running a provisions store in the ground floor and weaving their own textile. A precinct-based approach acknowledges this diversity of activity and multitude of building-use. It brings compatible activities together in a manner which enriches the life of the city. A precinct-based proposal will be reflective of the Bhutanese way of life, responsive to the social, political and cultural make-up of the community.

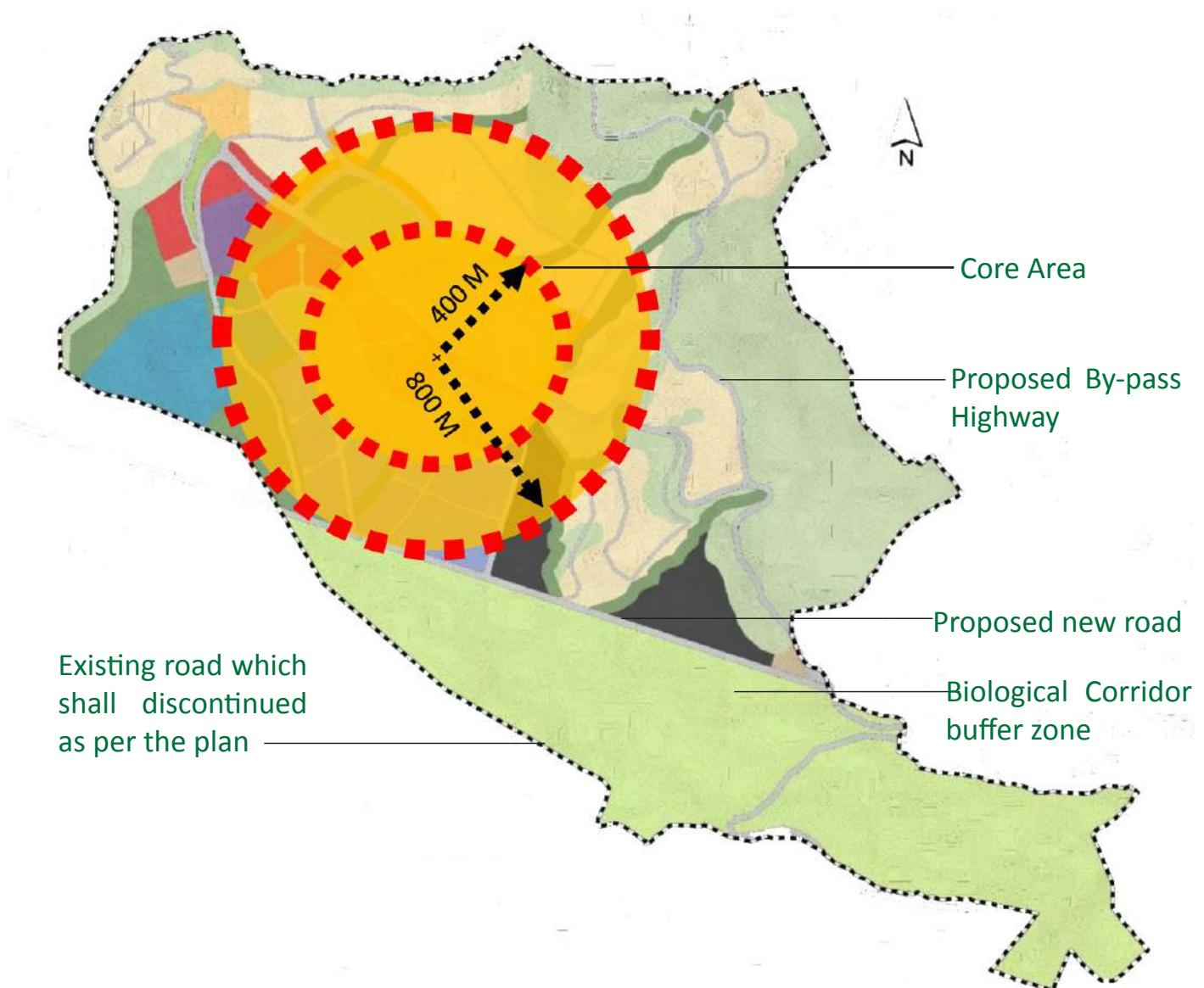
A precinct plan gives more flexibility than the conventional land-use plan however, it is to be understood that every precinct has a dominant activity and other activities are supportive to it. The support activities are governed by the main activity and therefore, only a limited number of support activities may be allowed within a precinct subject to their compatibility with the main activity. The proposed precincts have been demarcated with a scientific temperament and rationale with due regard to the Bhutanese lifestyle.

5.2 LAP Planning Principles

The Local Area Plan of Rinchenthang has been formulated around the following main principles;

Concentrated Development

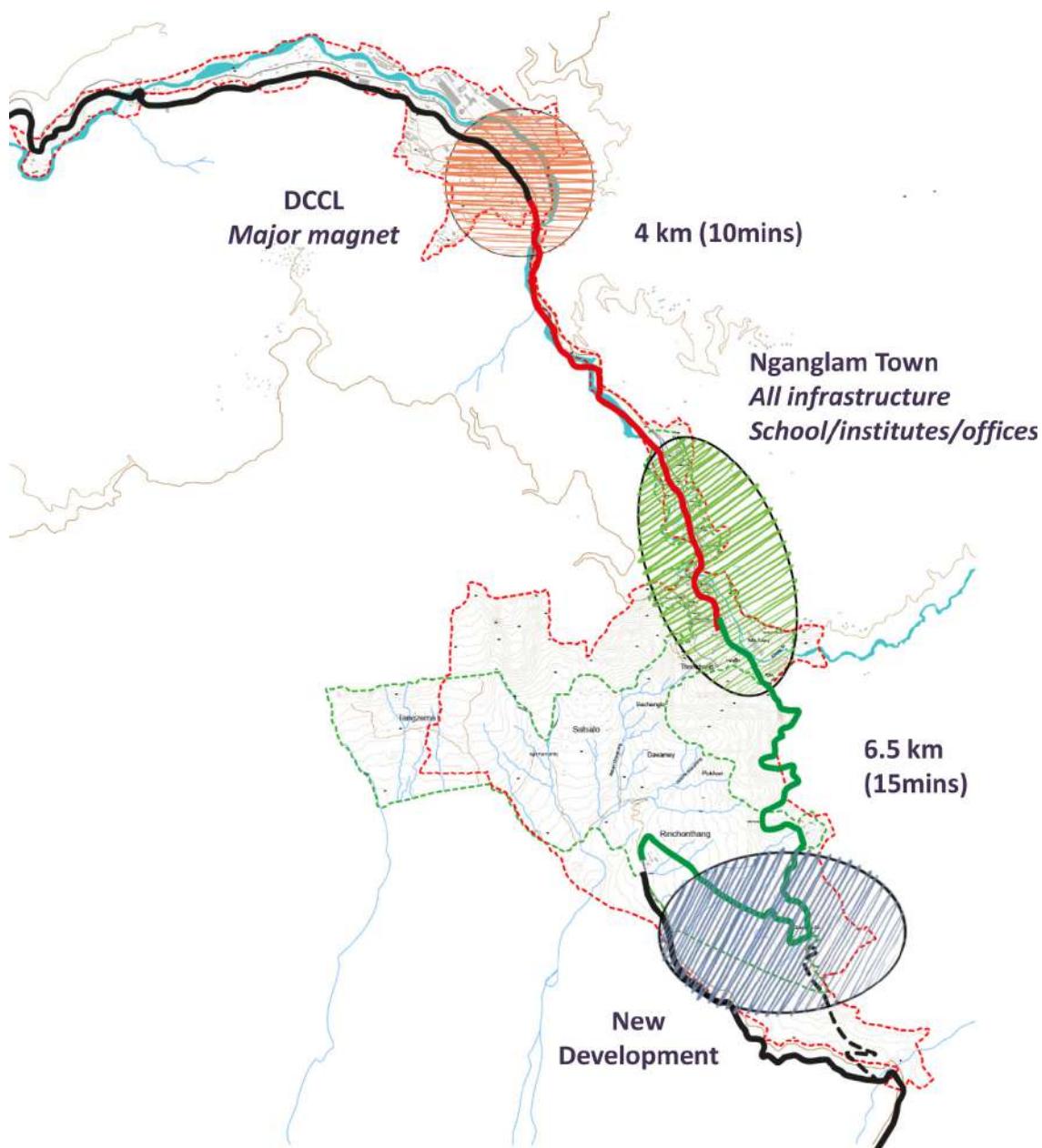
In line with the sustainable development goals, the proposal encourages a compact and concentrated development with a small built footprint and efficient circulation. Rinchenthang is situated in close proximity to the biological buffer zone and the new development will make efficient use of the existing movement corridors thus minimizing on the construction of new roads and restricting on the traffic in the buffer areas. This will also minimize impacts on the flora and fauna in the forested areas which are in close proximity to the site. The proposed compact neighborhood will accommodate a wide range of building and land uses within 5 to 10 minutes of walking distances.



Connectivity

The proposed new township in Rinchenthang will effectively serve as a twin township to the existing Nganglam town and a robust connectivity will allow smooth and efficient interoperability of activities in the two towns. Also, the new development will be conveniently connected to the other neighboring areas of Tangzema, Dawmey and Satsalu however, the new proposed township in Rinchenthang must stay clear of heavy vehicle traffic.

It will adopt the principles of walk-able neighbourhood through connected streets and pedestrian networks with the objective to ease movement as comfortably and conveniently as possible. The areas will be connected through different modes of transportation services including non-motorized transport system within Rinchenthang.



The development in the region will take place in three zones;

The DCCL area

The core Nganglam town

The New Nganglam town

Economy

The developments will take advantage of the integrated border check post and the dry port services as proposed in the local area plan. Rinchenhang area will serve as an economic zone to compliment the vision of Nganglam as the regional economic hub through the inclusions of economic infrastructures and services such as dry port, incubation centre for agriculture, ware houses, cottage industries for packaging, truck transit hub, auction yards, workshops and repair centers, etc. The proposed commercial and retail services in the development will enable Rinchenhang as a planned and self sustainable neighborhood.



A wide range of economic activities and retail services that will take place in the new development will boost the economy of the area.

A typical layout of the Agro-Based Industry Precinct and its related infrastructures as proposed in the plan



Greens and Recreational Space

The green network of the RH Development area must be preserved and extended into Rinchenthang local area plan. It will form as an integral part of the recreational precinct proposed in the RH development plan with the objective to offer a city level public space for everyday interaction and activity for urban residents. The proposed green open space and natural landscape in the core area of Rinchenthang will act as the main organizing element of different developments in Rinchenthang. It is integrated into the built fabric and connected through a network of green corridors formed out of existing rivulets and minor streams.

The bold and consolidate green open space in the core area will add to the visual amenity of the area and it is intended to form a thriving public realm through the inclusion of recreational places (passive and active), and social spaces for leisure and outdoor activities to cater to the needs of the local residents and regional visitors alike.

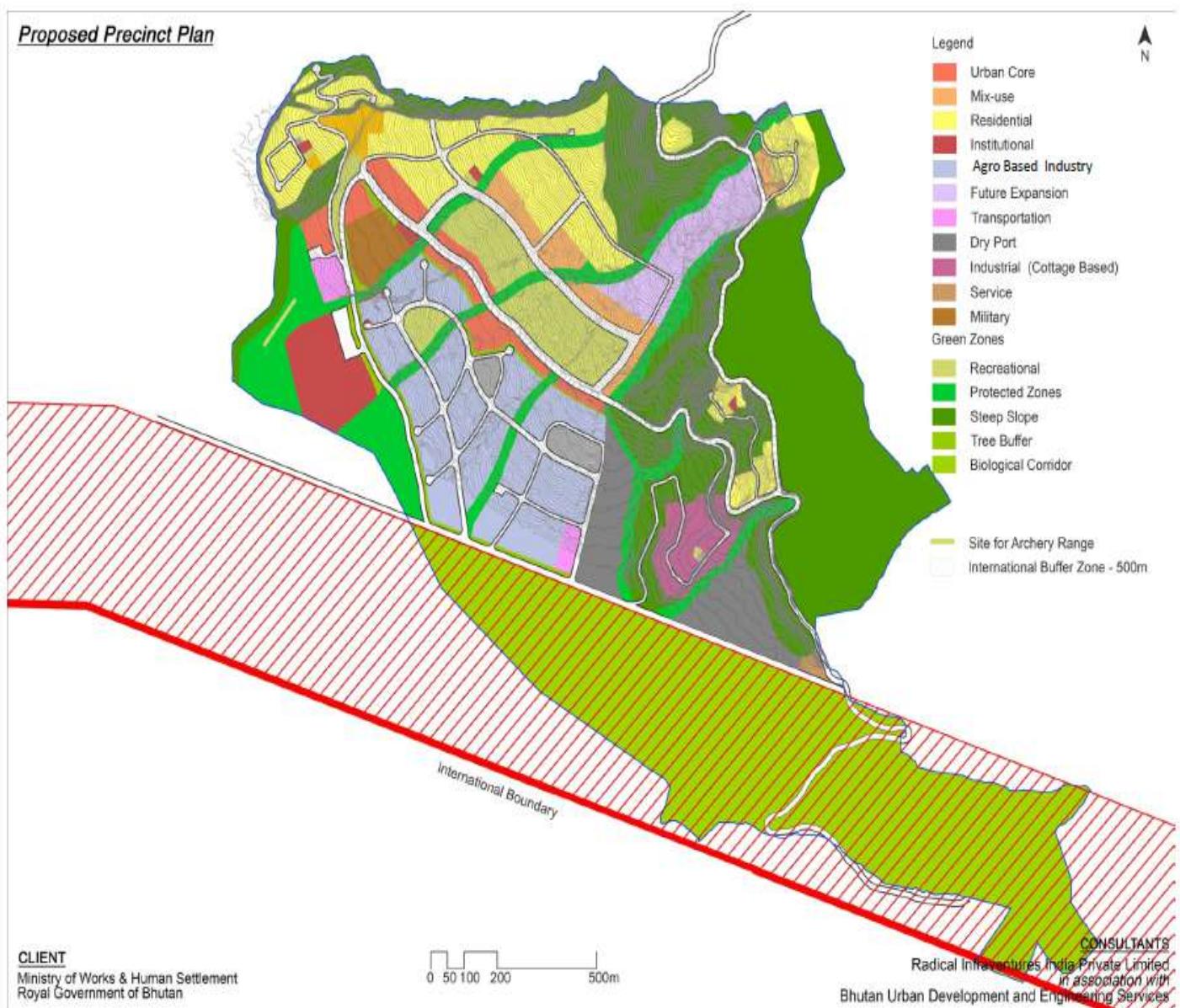
The landscape elements act as a filter or protection against both man-made and natural climatic conditions such as noise, dust, hot sun and strong winds.



A typical section through the core area in the proposed new development



Proposed Precinct Plan



5.3 Precinct Plan

The different land uses proposed in Rincenthang Local Area Plan is consistent with the overall precinct plan formulated in the Regional Hub Development Plan. It is guided primarily by the visions and planning principles envisaged in Nganglam RH Development Plan

The proposed plan consists of seven major precincts with distinct land uses, which complements the broad precinct plan formulated in the master plan. The seven major precincts in the local area plan can be broadly categorized as follows;

Agro Based Industry Precinct

The Agro-Based Industry Precinct is proposed towards the subtle plains of lower Rincenthang. One of the key areas of growth which the development plan will cater to is agriculture. Nganglam will serve as a facilitator for farmers where they have access to various resources such as a wholesale market for farm produce, cold storage and warehousing infrastructure, marketplace for agricultural equipment, seeds, fertilizers, pesticides and other supplies, auction yard for livestock, veterinary hospital, technical resource centre, financial products etc. Farmers will also depend on Nganglam for shopping, recreation and other household needs.

The precinct is conceived as one self-sufficient agricultural based business area, strategically located, along the southern periphery of the new development area. It shall accommodate permanent whole sale market zone along with ample space for temporary activities and occasional events. It is located along the proposed by-pass which provides an easy accessibility and connectivity for the local population as well as the outsiders.

Industrial Precinct

The new development interventions intend to strengthen Nganglam as regional hub through the inclusion of industrial and manufacturing units of various scales. The precinct will constitute of light and minor industries. Area surrounding lower Zalashing Zor will accomodate agro and forest based industry to household cottage industries. Many of these industries have improved their processes considerably and it may be accommodated within residential zones because it is not unpleasant from the perspective of noise, odor or smoke.

Whereas medium scale processing plants and large scale cement based industries will be situated on the far western edge of Rincenthang, the precinct designated in isolation from the main residential areas. It is directly connected through the main by-pass to cater to the heavy traffic from industrial and service areas.

Dry Port Precinct

The proposal of such large scale economic activities demands efficient supporting services in the form of a logistic hub. Being a border town, Nganglam also cater to export and import services. It therefore becomes pivotal to have a border custom station with all the necessary infrastructure to cope with the volume, particularly for the eastern region .

A Dry Port is thus, proposed to be situated on the far western edge of the new development. It lies in isolation from the main residential areas being directly connected through the main by-pass to cater to the heavy traffic coming to and from it.

It will function as an intermodal terminal which will service the region connected with one or several ports by rail and/ or road transport and offer specialized services between the dry and various destination. The proposed activities in the dry port zone will constitute, but not limited to; container terminal (handling, deposit and storage), container service centre (packing, repair, maintenance), areas for inspection (customs), Gate-in and Gate-out operations, logistics service facilities, truck parking, service centre (washing, fuel and oil supply), etc.

Open Space and Recreation Precinct

The urban green open spaces are carefully planned within five to ten minutes (400-800m) walking distance from majority of residential neighborhood and other important establishments. The green open space networks are useful for visual amenity, recreational use and wildlife corridors while they act as a filter or protection against noise, dust, hot sun and strong winds. The extensive use of trees along movement corridors, green networks and water bodies would complement the hot and dry sub-tropical climate of Nganglam.

The precinct intends to offer a city level public space for everyday interaction and activity for city residents. The public open space and recreational precinct is proposed to consist of open areas as well as buildable public zones.

The major existing perennial streams and rivulets are preserved and will form the integral part of natural drainage systems in Rinchenthang. The main stream is channeled to create water bodies and ponds in the proposed public open space in the core area. The public open space and park system will include ecological green belt, forest reserves, passive and active recreational spaces (parks and playgrounds), artificial ponds, and a network of greenways connecting larger open spaces. Also, the use of natural landscape allows it to act as one of the main organizing elements of different development in Rinchenthang.

Residential Precinct

The new development in Rinchenthang will include both medium and low density development under two distinct precincts. Medium density development includes Mixed use and high intensity development along the primary roads to accommodate public semi-public activities and community amenities along with local level retail activities and shops. The residential precincts also include provision for social housing targeted for low and middle income groups.

Low density development intend to conserve the existing rural character of the town. The precinct is situated amidst forests, and has been envisioned as a sparse agriculture based low density residential development characterized by large plots with typical farmland typology.

Urban Core Precinct (Commercial)

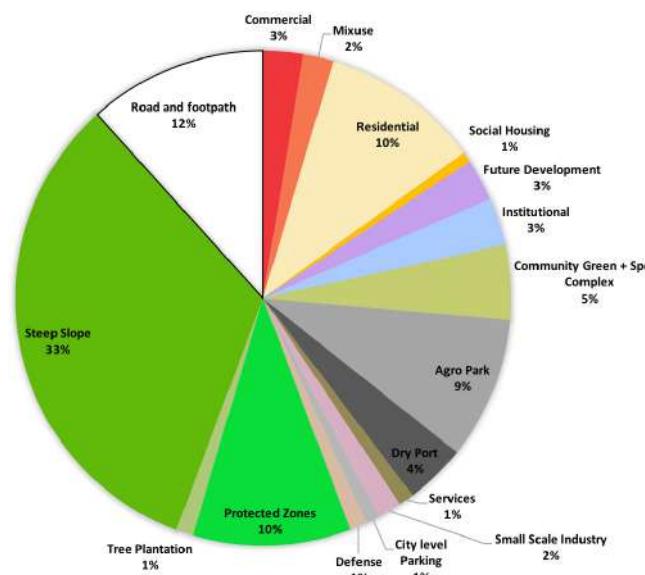
As a natural phenomenon, highest concentration of activity particularly the retail and commercial core take place naturally along principal routes or points of convergence such as cross roads. It is usually the most important and active precinct.

The commercial zone for Rinchenthang is proposed along the existing principal route which also takes advantage of the relatively flat terrain and topography suitable for high intensity development on either side of the road. The proposed commercial spine will be within the walking distance from residential neighborhoods and industrial establishments which will include town level commercial activities such as shopping arcades, retail, department stores, restaurants, cafeterias, office spaces, cinema halls, food courts etc.

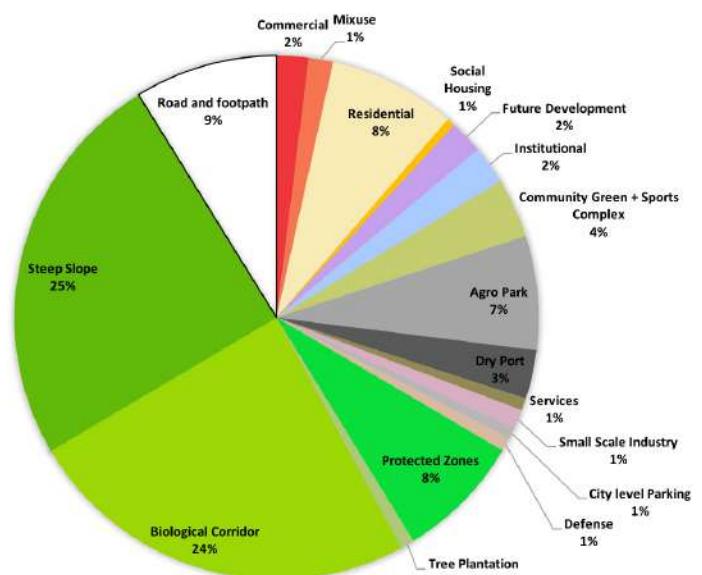
The urban core extends along primary roads, around the proposed central open green and recreational area. It is characterized by mixed use buildings including commercial zones, public places, plazas, etc. Easy connectivity and accessibility from all the other parts of the new development enhances its feasibility. Appropriate way finding system and street furniture have been proposed to enhance its legibility

Landuse	Sq.m	Acre	Percentage (%)
Commercial	55411.288	13.692	3
Mised Use	42011.042	10.381	2
Residential	220942.518	54.596	10
Social Housing	14513.423	3.586	1
Future Development	58297.007	14.406	3
Institutional	65987.716	16.306	3
Community Green and Sports Complex	103491.587	25.573	5
Agro Based Industry Precinct	197552.513	48.816	9
Dry Port	84573.832	20.899	4
Services	21046.042	5.201	1
Industrial (Cottage Based)	33633.818	8.311	2
City Level Parking	18515.121	4.575	1
Defense	23920.966	5.911	1
Protected Zones	218925.456	54.098	10
Tree Plantation	23712.768	5.860	1
Steep slope	693145.870	171.280	32
Road and Footpath	247812.798	61.236	12
Total	2123493.765	524.727	100

Proposed Land Use distribution in Rinchenhthang as per the precinct plan



Including the biological buffer zone



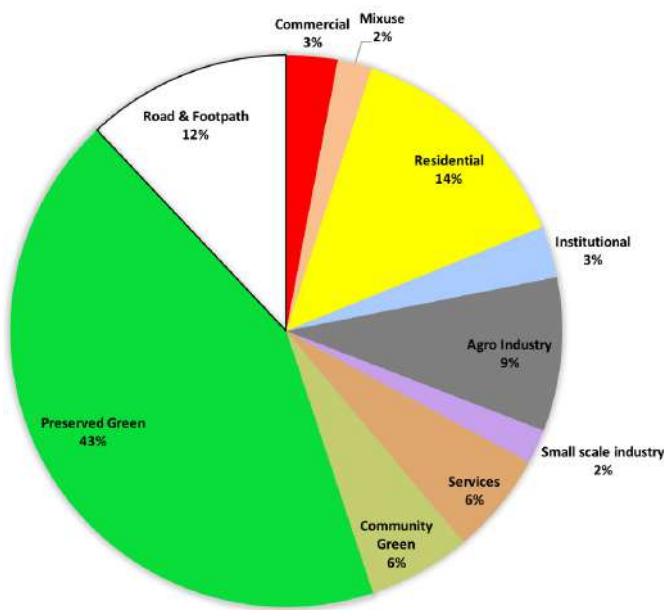
Excluding the biological buffer zone

5.4 Proposed Land Use Distribution

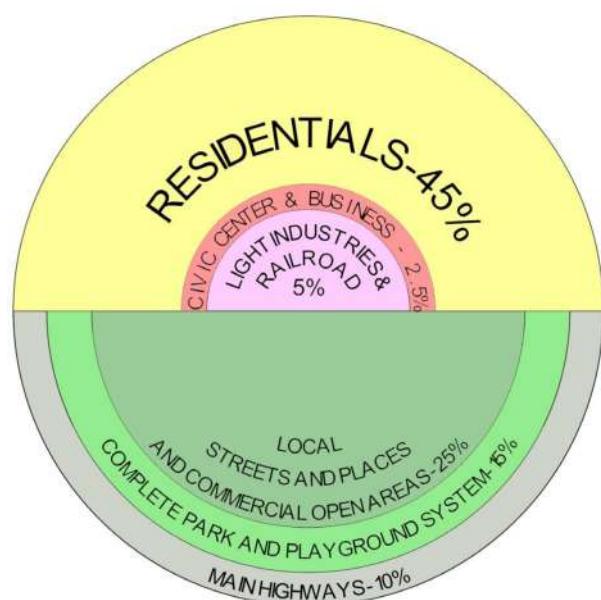
There is no one standard rule which will guide in the allocation and distribution of land uses of towns and cities. However, study on this subject has proposed a rough approximation, based on study of conditions in existing communities, of what are reasonable percentages to allow in the land use pattern of a predominantly residential neighborhood. The following diagram provides a basic guideline which indicates the proportions allotted to different uses in a predominantly residential community with an area of approximately 2.5 Km² or 640 acres.

There are some variations in the percentage of land allocated for different uses in the local area plan as compared to this basic guideline since the broad objectives of the plan to develop Nganglam as a regional hub. As per the land use distribution in the local area plan, a relatively high percentage (46%) of the total area falls under the biological corridor and natural steep slopes which is restricted to development. Only about 6% of the total area is allocated for parks and recreational spaces including the protected zones such as streams and rivulets. The land uses allocated for residential and industrial use are 16% and 18% respectively. The land use allocated for residential is primarily based on to meet the projected population capacity of Rinchenthang as stated in the RH Plan. The land use distribution also shows a similar percentage of land allocated to industries in Rinchenthang which complements the broad objective of Nganglam as the regional economic hub of eastern Bhutan.

Comparative study of the proposed land-use in Rinchenthang and land use distribution pattern in a predominantly residential neighborhood



Proposed Land use in Rinchenthang



Land use distribution in a predominantly residential neighborhood

5.5 Plot Reconfiguration

Illustration of reconfigured plots in Upper Rinchenthang



Plot reconfiguration plan



Precinct plan

Land Pooling percentage calculation for Upper Rinchenthang

		Sq.m	acre	
1	Total Project Area	374855.568	92.63	
2	Total Registered Land	331615.568	81.94	
Total (Registered Land + Road)		331615.568	81.94	
3	Total State Land	43240.000	10.68	
Land Excluded from Land Pooling				
4	Under Steep Slope	17675.574	4.37	
5	Stream Buffer	25895.177	6.40	
Total		43570.751	10.77	
Total Area Under Land Pooling		331284.817	81.86	
Proposals Considered for Land Pooling				
7	Proposed Road + Footpath	42937.096	10.61	
11	Kindergarten	1000.000	0.25	
12	Community Space / Children Play Are	905.595	0.22	
13	Parking	0.000	0.00	
15	Service Plots	550.163	0.14	
Total		66323.114	11.22	
Area to be returned to the landowner		264961.703	70.65	
Land pooling Percentage		0.200		
				20

Land Pooling percentage calculation for Lower Zalashing Zor

	Sq.m	acre	
1 Total Project Area	45538.389	11.25	
2 Total Registered Land	46223.189	11.42	
Total (Registered Land + Road)	46223.189	11.42	
Land Excluded from Land Pooling			
4 Under Steep Slope	0.000	0.00	
5 Stream Buffer	0	0.00	
	0	0.00	
Total	0.000	0.00	
Total Area Under Land Pooling	45538.389	11.25	
Proposals Considered for Land Pooling			
6 Proposed Road	5082.274	1.26	
7 Off-Street Footpath	377.047	0.09	
8 Service Plots	200.016	0.05	
9 Parking	348.819	0.09	
10 Community Open Space	500.005	0.12	
Total	6508.161	1.61	
11 Area to be returned to the landowner	39030.228	9.64	
12 Land pooling Percentage	0.14291592		
		15	

Illustration of reconfigured plots in Zalashing Zor



Plot reconfiguration plan

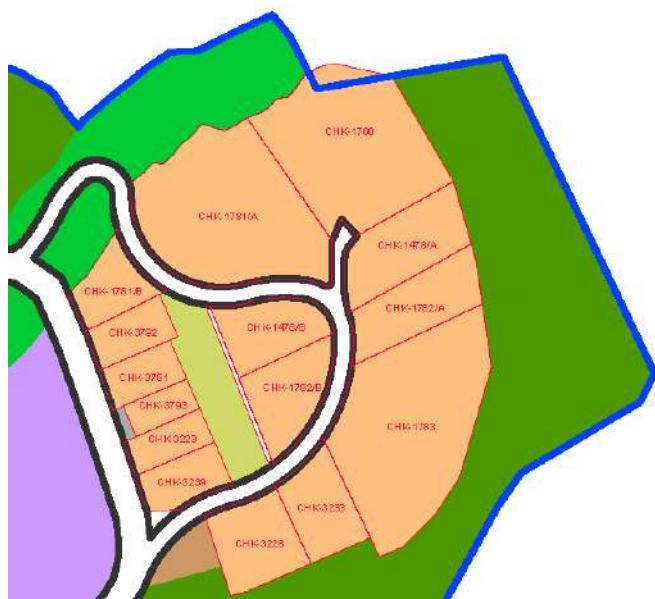
Land Pooling percentage calculation for Upper Zalashing Zor

	Sq.m	acre	
1 Total Project Area	21206.190	5.24	
2 Total Registered Land	20339.498	5.03	
Total (Registered Land + Road)	20339.498	5.03	
Land Excluded from Land Pooling			
4 Under Steep Slope	0.000	0.00	
5 Stream Buffer	0	0.00	
	0	0.00	
Total	0.000	0.00	
Total Area Under Land Pooling	21206.190	5.24	
Proposals Considered for Land Pooling			
6 Proposed Road	1595.724	0.39	
7 Off-Street Footpath	231.025	0.06	
8 Service Plots	214.849	0.05	
9 Parking	194.459	0.05	
10 Kindergarten	623.179	0.15	
11 Community Open Space	407.071	0.10	
Total	3266.307	0.81	
12 Area to be returned to the landowner	17939.883	4.43	
13 Land pooling Percentage	0.154026127		
		15	

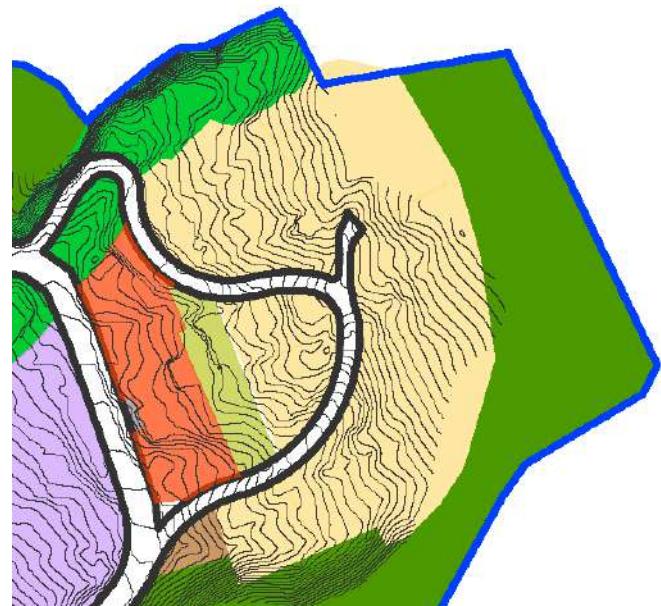


Precinct plan

Illustration of reconfigured plots in Metogang



Plot reconfiguration plan



Precinct plan

Land Pooling percentage calculation for Metogang

		Sq.m	acre	Remarks
1	Total Project Area	33499.303	8.28	
2	Total Registered Land	33487.7334	8.28	
Total (Registered Land + Road)		33487.733	8.28	
Land Excluded from Land Pooling				
4	Under Steep Slope	0.000	0.00	
5	Stream Buffer	0	0.00	
		0	0.00	
Total		0.000	0.00	
Total Area Under Land Pooling		33499.303	8.28	
Proposals Considered for Land Pooling				
6	Proposed Road	2630.344	0.65	
7	Off-Street Footpath	156.976	0.04	
8	Service Plots	524.133	0.13	
9	Parking	188.979	0.05	
10	Kindergarten	0.000	0.00	
11	Community Open Space	1531.458	0.38	
Total		5031.889	1.24	
Area to be returned to the landowner		28467.414	7.03	
Land pooling Percentage		0.150208778		

Land Pooling percentage calculation for Lower Rinchenthang



Plot reconfiguration plan



Precinct plan

Land Pooling percentage calculation for Lower Rinchenthang

		Sq.m	acre	Remarks
1	Total Project Area	58509.908	14.46	
2	Total Registered Land	55506.677	13.72	
	Total Area Under Land Pooling	58509.908		
Proposals Considered for Land Pooling				
7	Proposed Road + Footpath	8925.645	2.21	
11	Kindergarten	1000.000	0.25	
12	Community Space / Children Play Are	1332.055	0.33	
13	Parking	444.6343	0.11	
	Total	11702.334	2.89	
	Area to be returned to the landowner	46807.574		
	Land pooling Percentage	0.20000603		
		20		

5.6 Density Pattern

Population Density is a measurement of the number of people living per unit of an area and it is essentially used as a measure to generate a critical mass of people able to support urban services such as public transport, local shops and schools. The population density of a given area may be regulated by the plot sizes, building heights and ground coverage as prescribed in the development control regulations and planning guidelines.

Based on the proposed plot reconfiguration, precinct plan, and development controls provision in the local area plan, Rinchenthang has a population carrying capacity of 14,867, and provides an estimated of 3,300 residential dwelling units.

Based on the calculation shown in the table below, the net population density in Rinchenthang local area plan is calculated at 323 persons per hectare.

Net density and population carrying capacity of Rinchenthang Local Area Plan

Rinchenthang LAP	Commercial	Mixed Use	Medium Density	Low Density	Industrial (Cottage Industry)
Developable land					
Net developable area (Sq.m.)	55411.288	42011.042	218942.378	48648.723	33292.150
Net developable area (acres)	13.692	10.381	54.102	12.021	8.227
Ground coverage (%)	60	50	50	30	35
Ground coverage (sq.m.)	33246.773	21005.521	109471.189	14594.617	11652.253
Permissible no. of floors	4	3	3	2	2
No. of residential floors	1	2	3	2	1
Total residential built-up (m ²)	33246.773	42011.042	328413.567	29189.234	11652.253
Efficiency (80%)	26597.418	33608.834	262730.854	23351.387	9321.802
Average apartment size (m ²)	120	130	130	130	130
No. of apartments available	222	259	2021	180	72
Household size	4.5	4.5	4.5	4.5	4.5
Population accommodated	997	1163	9095	808	323
Gross density (persons/Ha)					
Net density (persons/Ha)	180	277	415	166	97

5.7 Street and Traffic Proposal

Roads and Streets provide access to buildings and services to them, but they also function as very important public spaces within towns and cities. In addition to its primary function for the circulation of vehicular traffic, it also serves as a public domain that accommodates diverse activities such as walking, cycling, play, entertainment, and social interaction.

Streets are considered multi-functional spaces and therefore, to avoid conflict between different uses, it is essential to design streets for all uses and users.

The street networks and circulation system in Rinchenthang is proposed in accordance with the existing topography and site conditions, and in reference to the prevailing guidelines such as Urban Roads Standards 2002 and Spatial Planning Standards, Bhutan.

Road Classification	Right of Way (ROW)	
	Minimum	Ideal
Primary Road	15 M	18 M
Secondary Road	10 M	12 M
Access Road	6 M	8 M

Urban Roads Standard 2002

The proposed street and road networks consist of different types of road sections which ensure the integrity of the road hierarchy and for efficient circulation system. All the classes of roads are essential components of the town level road networks, providing access to the residential neighborhoods and commercial centre. The proposed road networks can be classified into five major types of road sections considering the streets in terms of vehicular capacity and character of the place being serviced by the proposed road, as follows;

Typical road sections according to Bhutan Spatial Planning Standards

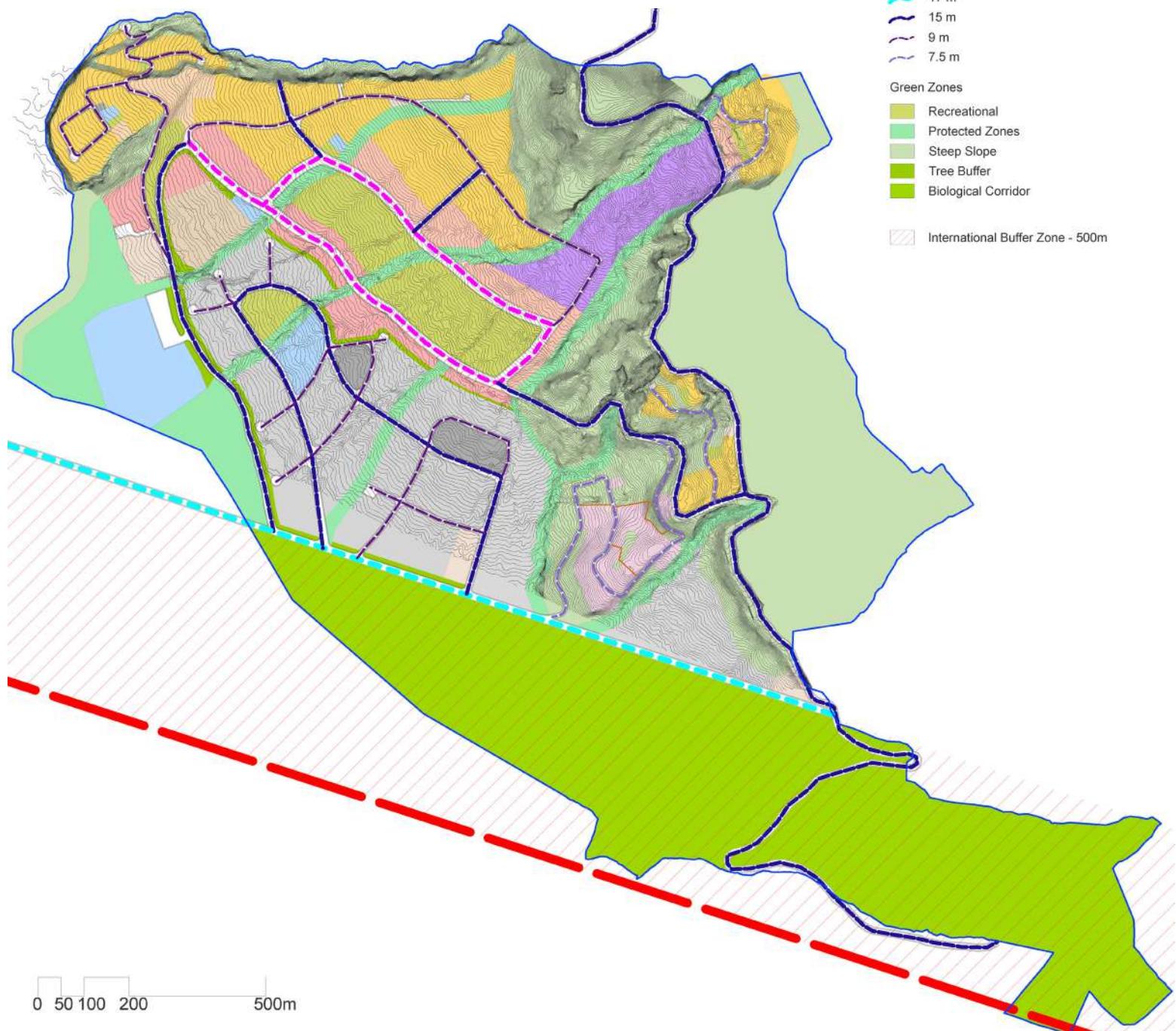
Sl.No	Type of road section	Recommended use			Lanes (n)	Carriageway (m)	ROW (m)
		Primary	Secondary	Tertiary			
1	Four lanes, high pedestrian density, cycling lane	•			4	13.20	24.50
2	Four lanes, high pedestrian density	•			4	13.20	23.00
3	Four lanes	•			4	13.20	19.20
4	Two lanes, cycling lane, parking on both sides	•	•		2	11.60	21.10
5	Two lanes, cycling lane, parking on one side	•	•		2	9.10	18.00
6	Two lanes	•	•		2	6.60	12.00
7	Two lanes, parking on one side	•	•	•	2	9.10	12.70
8	One lanes, parking on one side, footpath on both sides			•	1	5.80	9.40
9	One lanes, footpath on one side			•	1	3.30	5.40

Legend

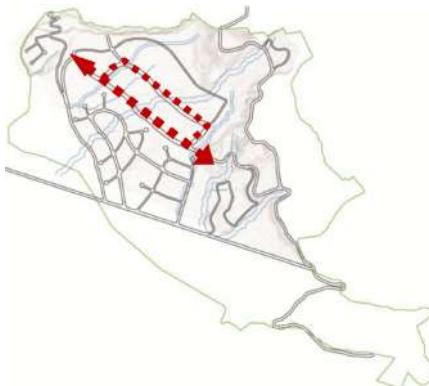
- Commercial
- Mix-use
- Residential
- Institutional
- Future Expansion
- Services
- Small Scale Industrial

N

Road hierarchy in Rinchenthang as per the proposal

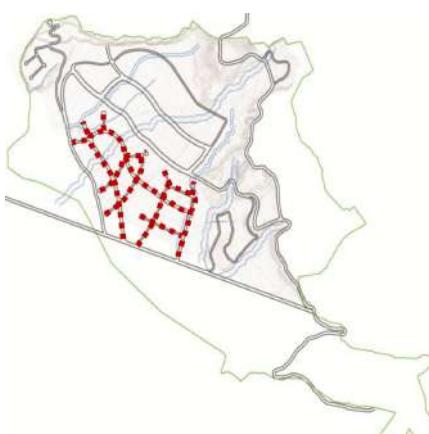


Commercial Streets (Primary Road) – 24 meters



The commercial street forms a loop in the core area along which, high intensity commercial activities and mixed use provides active street frontages. The street gives an enclosure to the recreation and public green open space in the centre of the town. The street connects to the main roads and also serves as thoroughfare traffic connecting the western parts of Nganglam including Tangzema, Dawmey and Satsalu.

The road is proposed along the high pedestrian activity and therefore, the proposed road will include a clearly designated lane for walking, cycling, bus drop-off, on-street parking bays and carriage ways. The street has a Right of Way of 24 meters which constitutes of 4 lanes with 2 in each direction and separate lanes for cyclist and pedestrian on either sides



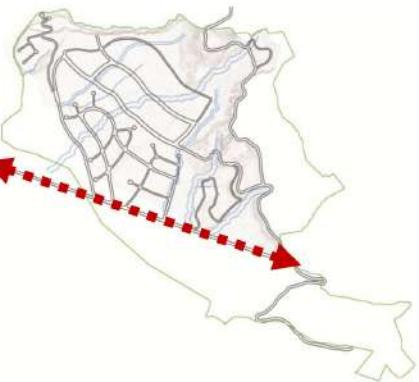
Industrial Streets (Primary and Secondary)

The industrial street will constitute of two major types of roads within the agro-industrial precinct which will be entirely dedicated to heavy traffic related to industrial uses only. It will consist of primary road and secondary roads of 15 meters and 9 meters Right of Way respectively. The Right of Way will include two way lanes for truck movement and a pedestrian walkway one side. The secondary roads will give access to all the internal plots within the agro-industrial precinct and plot level parking.

Biological Corridor Road (Primary Road) – 17 meters

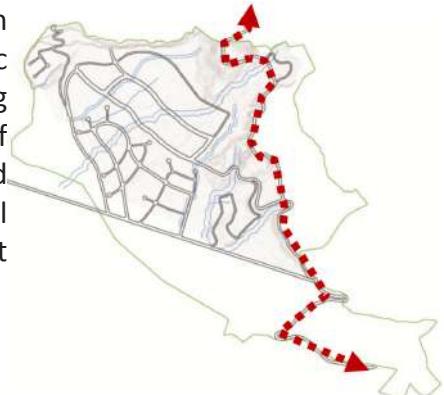
The commercial street forms a loop in the core area along which, high intensity commercial activities and mixed use provides active street frontages. The street gives an enclosure to the recreation and public green open space in the centre of the town. The street connects to the main roads and also serves as thoroughfare traffic connecting the western parts of Nganglam including Tangzema, Dawmey and Satsalo.

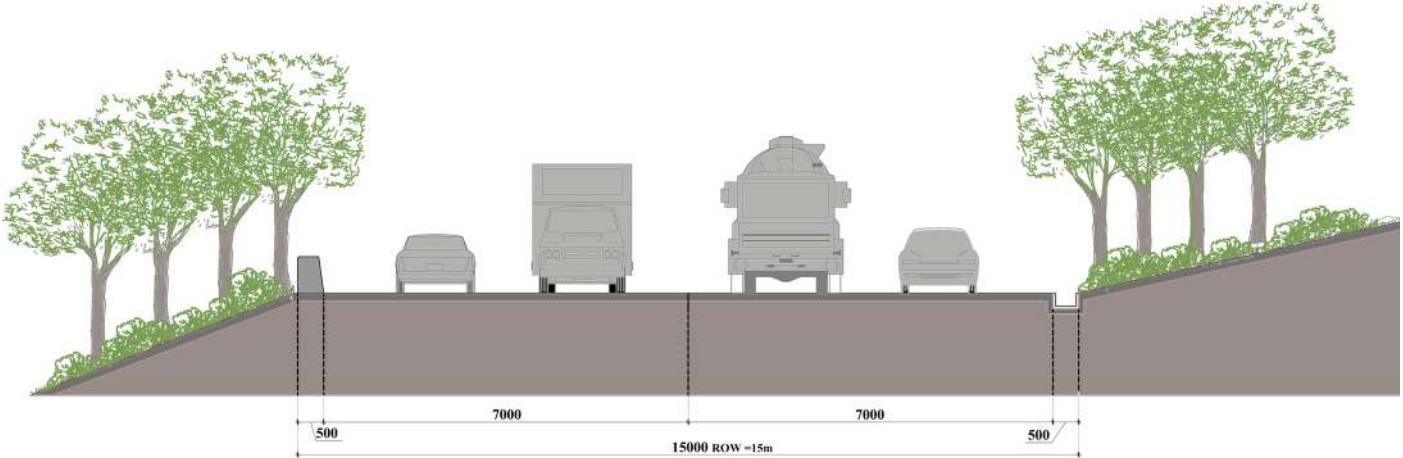
The road is proposed along the high pedestrian activity and therefore, the proposed road will include a clearly designated lane for walking, cycling, bus drop-off, on-street parking bays and carriage ways. The street has a Right of Way of 17 meters which constitutes of 4 lanes with 2 in each direction and separate lanes for cyclist and pedestrian on either sides



National Highway (Primary Road) – 15 meters

The main roads are the primary distributors or arteries of the town which provides connections across towns and facilitates an efficient flow of traffic movements. The national highway will be a continuation of the existing highway and connect to the by-pass road on the eastern periphery of Rinchenthang. The road section will have 15 meters Right of Way and constitute a 4 way lanes with 2 lanes in each direction. The road shall accommodate heavy industrial traffic in designated lanes along with light passenger vehicles.

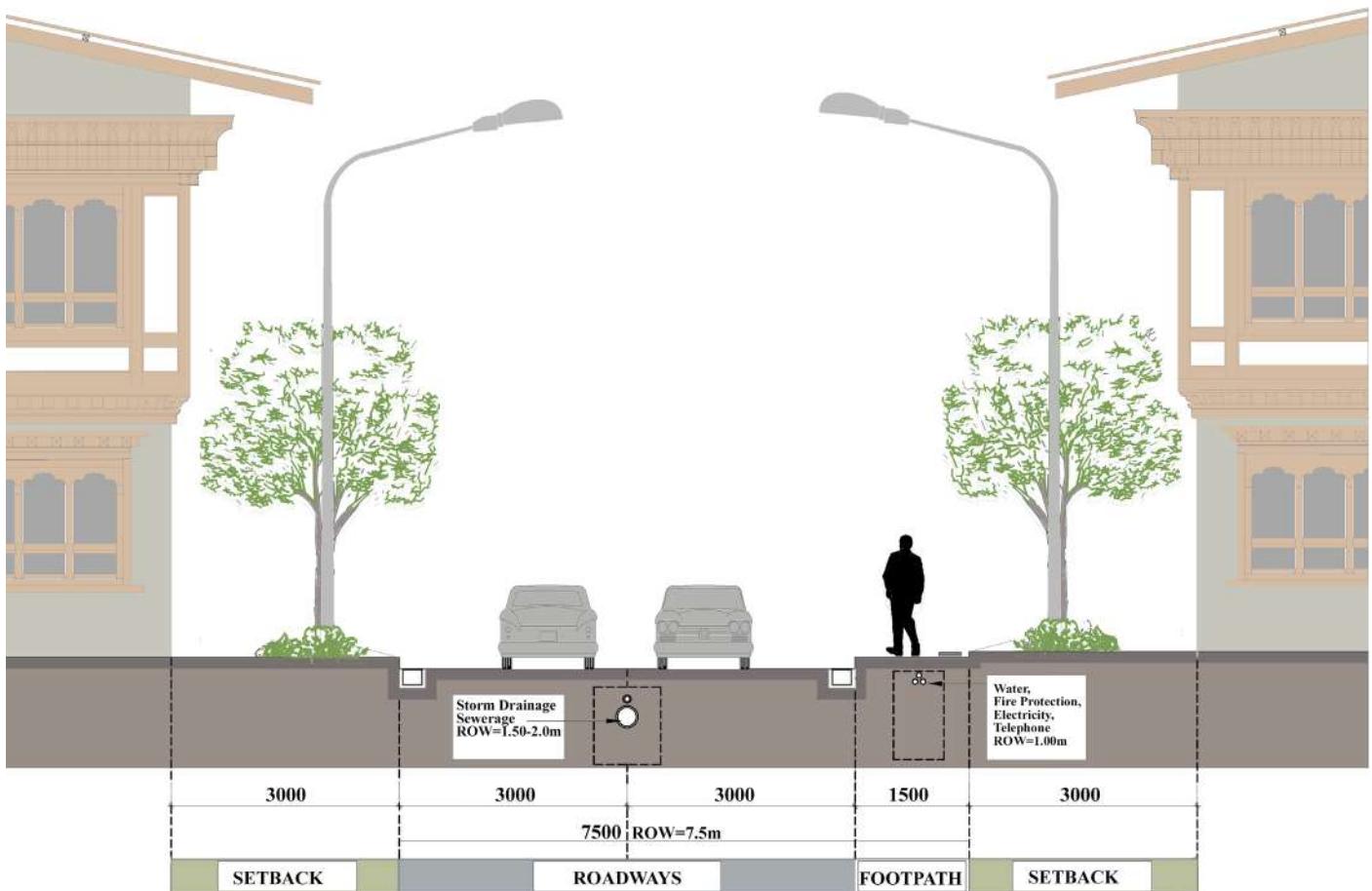




Residential Streets (Secondary and Access road)

Residential streets will function as access roads which will connect residential neighborhoods and these roads are intended to carry moderate level of local traffic originating from residential plots to the main roads. Residential streets shall encourage different traffic calming measures and clearly demarcated lanes for walking and cyclist towards creating a pedestrian friendly environment. The residential streets include three main types of road sections with different Right Of Way as follows;





7.5m-ACCESS ROAD

5.8 Pedestrian Facility and Traffic Calming

For streets to function as public and social places for the people, vehicular traffic must be slowed and give priority to pedestrian. A good planning is required particularly in the areas where main traffic routes cross major pedestrian routes. Wide and well landscaped crossings, with the floorscape, lights, and other devices that define the crossing area are generally the most appropriate solutions. Streets need to be designed in a way which will encourage drivers to drive with caution.

Different traffic calming measures through the arrangement of building, spaces and active street frontages can act as a natural traffic calming measure and result in a safe and pleasant environment for pedestrians and cyclists.

On-street parking with widened carriageway which allows room for street trees and gives pedestrian greater freedom of movement.



The proposed pedestrian facilities includes pedestrian refuge island, curb design, wide and bold crossings, designated lanes for pedestrian and cyclist. Neck-downs and curb extensions can greatly improve pedestrian visibility and reduce crossing distance.



Proposed pedestrian facilities and traffic calming measures along different road section in the town



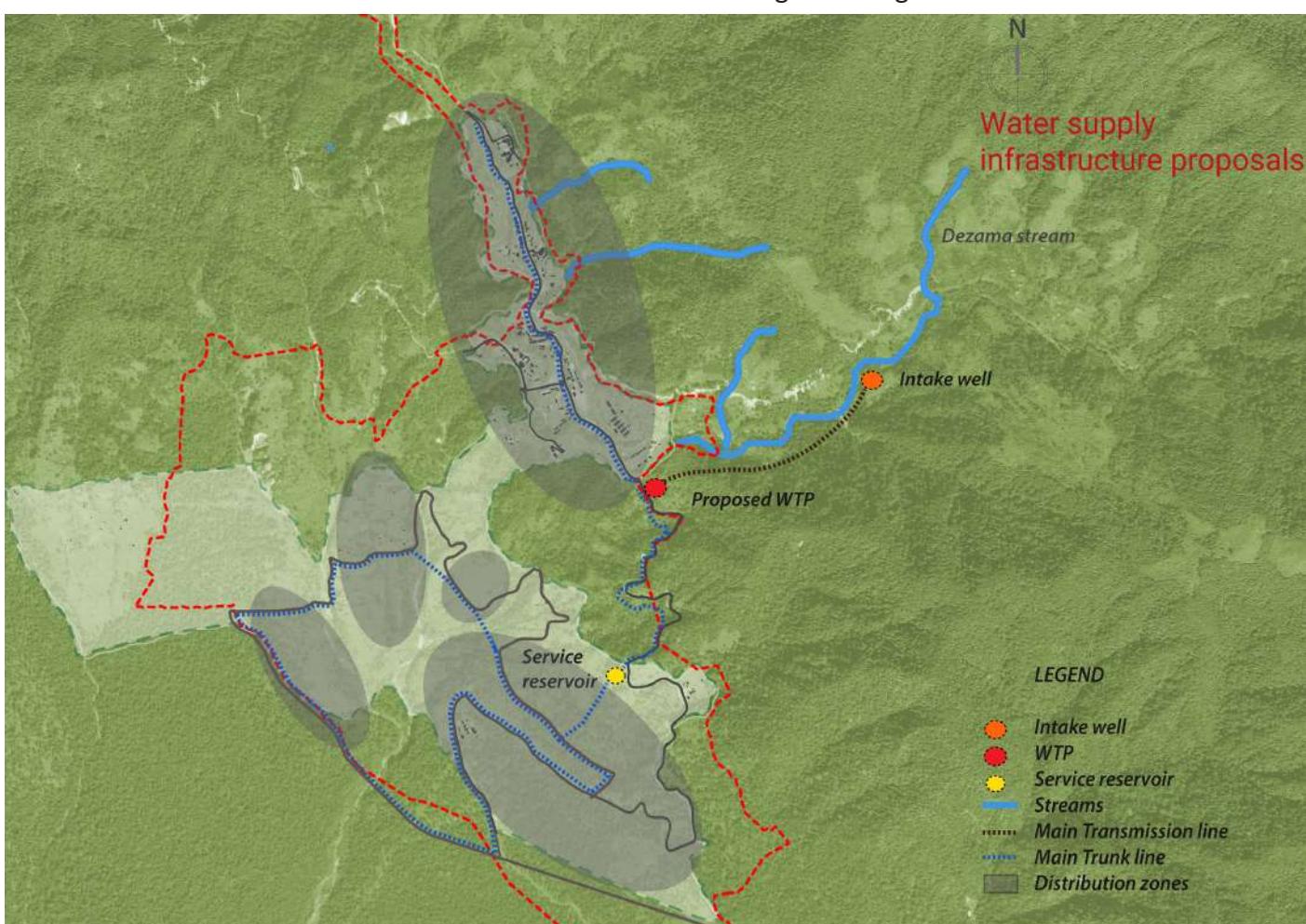
5.9 Water Supply

The existing water supply in the town is through four different streams including Tshaktsari, Kalapani, Khalaktangzor and Dezama. Each stream caters to the water requirement of different areas as per its location. There is an intake well along the stream Dezama at a distance of 2.2 km from the main road. It was constructed under earlier water supply scheme but was later abandoned. Currently it is non functional and the infrastructres are in ruin due to frequent land slides in the area.

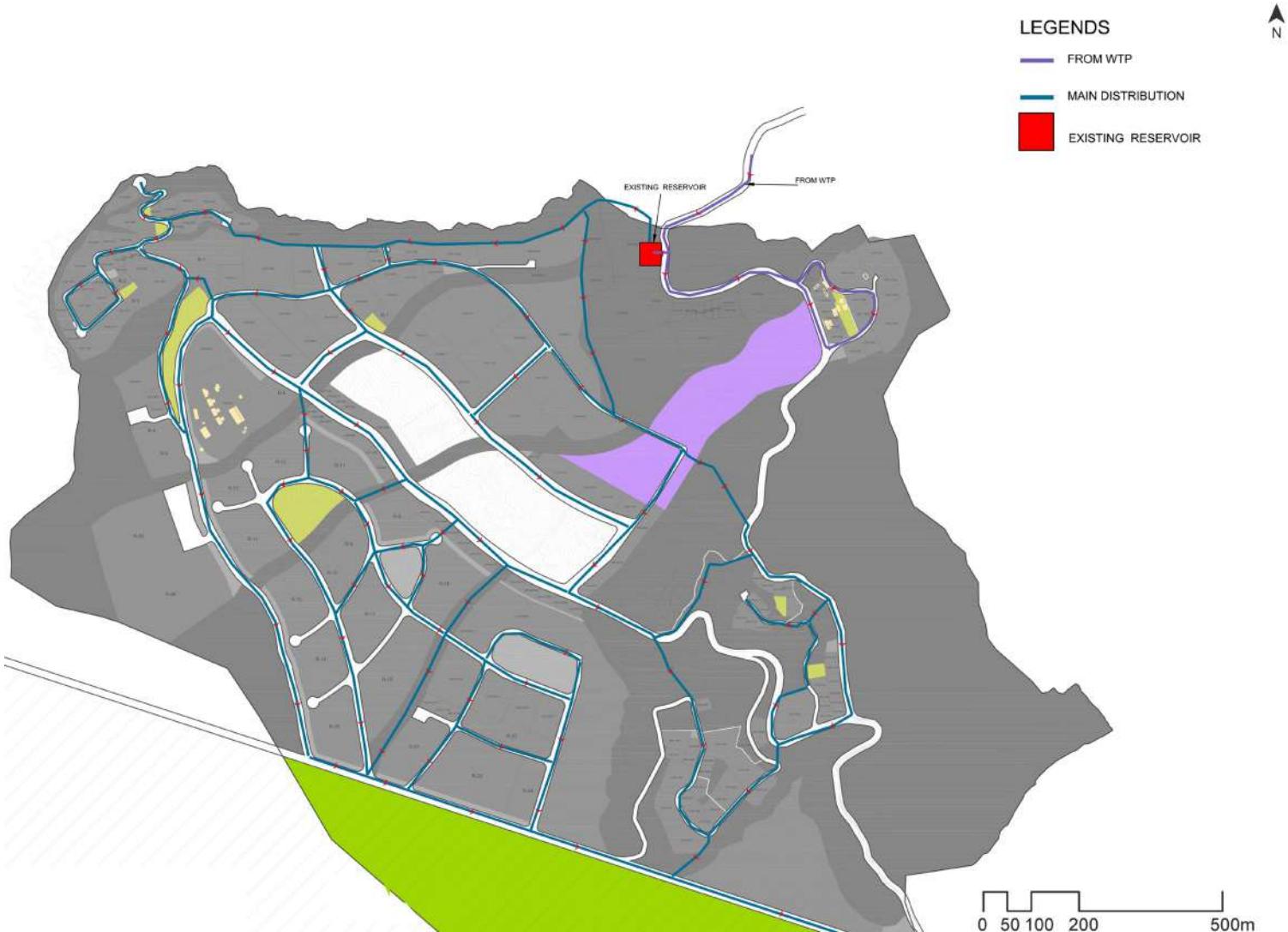
Water supply projects may be designed to meet requirements over a twenty year time period after their completion. There are no integrated water supply and distribution system in the whole of Nganglam. The proposal includes renovation of this intake well and augmentation of its capacity to cater to the needs of the projected population of the old as well as the Rinchenthang township. Water from the main source will be transported to the water treatment plant (WTP) through main transmission line. WTP has been proposed on a site of 0.34 hectares which is located along the main road adjacent to the RBA campus at an elevation of approx. 2,000 feet.

At this elevation, the distribution system can maximize the use of gravity flow mechanism and efficiently feed into both the old town and new township in Rinchenthang. The treated water from WTP shall be first transported to an existing reservoir, located below the main road in Metogang and then it will be supplied to different zones. The main trunk line shall extend along the proposed primary road to form a loop within the proposed development area. Water will be supplied to service reservoirs placed in different locations within the LAP through an integrated distribution network.

Proposed water supply infrastructures for the town



Proposed Water Supply Network

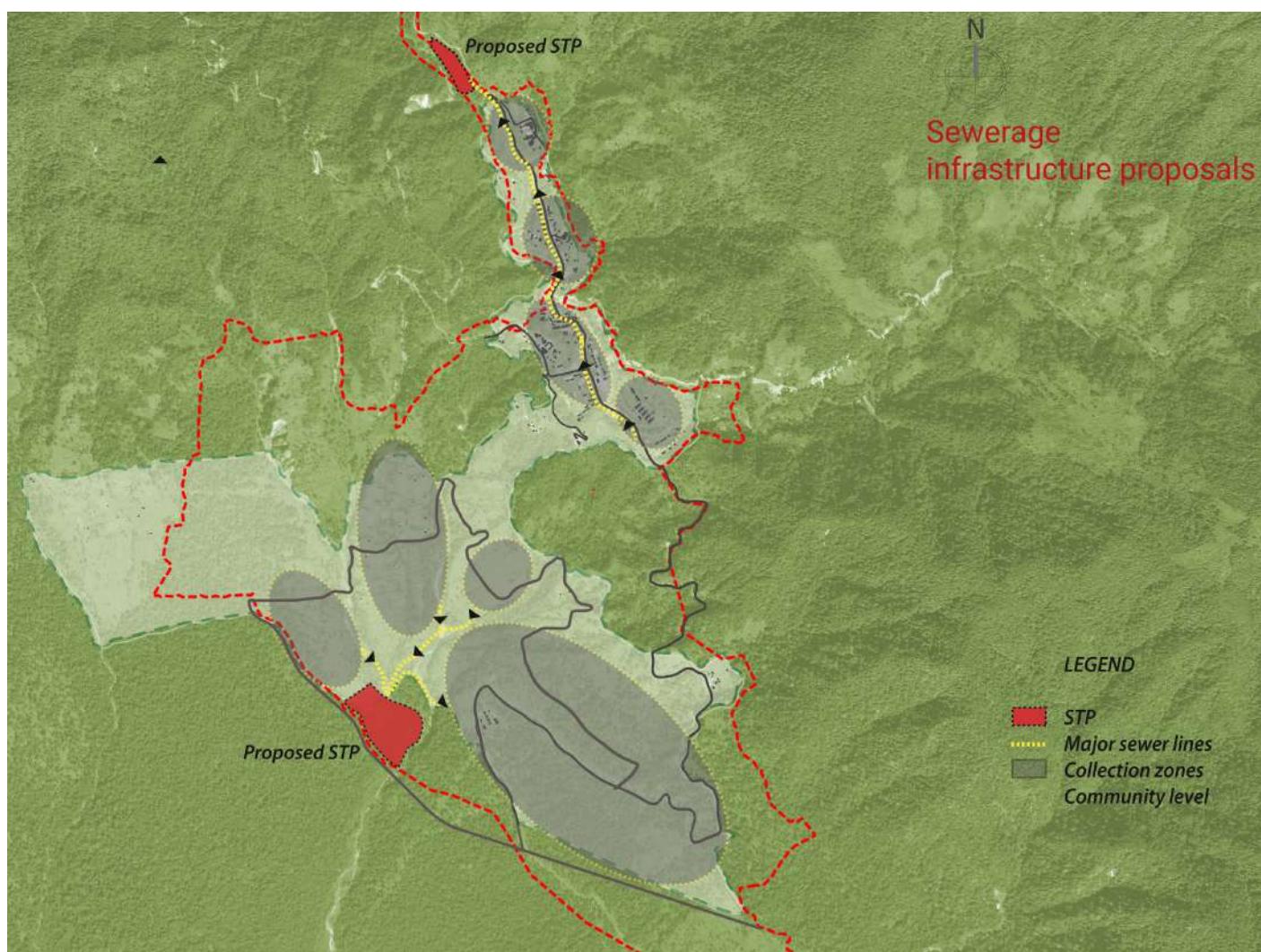


5.10 Sewerage System

At present, the town does not have any organized sewage collection or treatment system. Population relies on individual septic tanks and soak pits while Institutional campuses have their separate septic tanks. For the new development, an integrated sewerage system is proposed. The collected sewerage from different development zones would be taken to the proposed STP which is located in the identified service precinct. Centrally placed and equidistant from the collection zones, it sits at a lower elevation than its surroundings which make it ideal for a gravity based system. The main sewer lines run along the primary roads leading up to the main treatment plant. The secondary sewer network originating from the individual plots will feed sewage to the main sewer lines which will further drain out towards the plant.

Normally, sewerage projects may be designed to meet the requirements for a span of thirty year time period. Sewage flows for the design of sewers will include peak factors. As per planning standards, 80% of the water supply is expected to reach the sewers. However, the sewers should be planned for a minimum waste water flow of 100 liters per capita per day. The minimum size (diameter) of sewers lines in urban areas should be 200 mm.

Proposed Sewerage infrastructures for the town



Proposed Sewerage System Network



5.11 Fire Safety

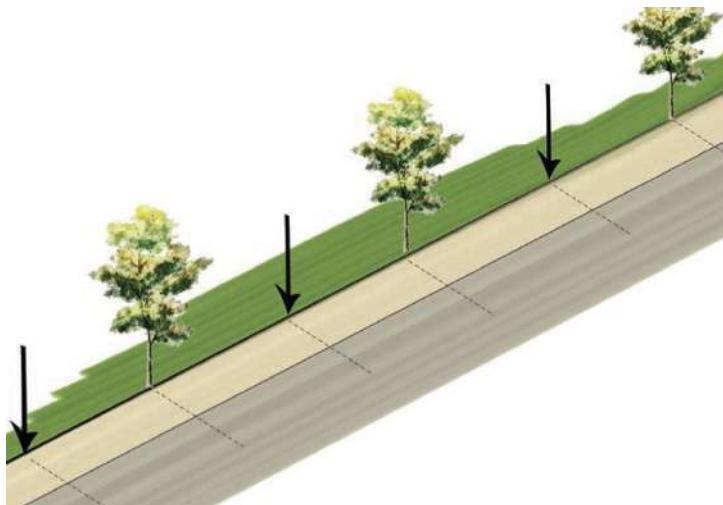
The water reservoirs proposed in Rinchenthang shall also cater to the fire safety requirements of the town. It is proposed that a network of water supply is established to enable the setting up of on-street ‘Fire-Hydrants’, especially in the urban core and other important public areas

It is proposed that fire hydrant system be installed in all the residential neighbourhoods. The system shall be installed along the roads through a dedicated 6 inch primary pipeline for water supply. This main fire safety water line will be connected to a storage reservoir and water will be discharged at a constant pressure with the help of a jockey pump of 10 HP, 10.8 cu m at 70 m head, main electrical pump of 137 cu m at 70 m head and a backup diesel pump of 137 cu m at 70 m head. The source of water for storage reservoir will be the main water supply reservoir.

A 3 inch pipe hydrant valve and a hose box shall be installed at a variable distance of 60 to 120 meters depending on the settlement pattern. Given the mountainous topography and the issues of accessibility in some areas, it is advisable to employ ‘Firefighting Bikes’. These fire fighting bikes are increasingly becoming popular in many countries in the region and they are found to be efficient for various reasons during fire hazard and emergency situations. Fire fighting bikes can carry wide range of equipment from simple fire extinguishers to jet guns with hose rigs. They are prompt and reduces the emergency response time, and also ensure service delivery to the most remote locations of the town.

5.12 Street Lighting

Lighting needs of pedestrians are different from those of vehicular traffic and therefore need to be designed and integrated within the overall lighting strategy for the street. This would help the safety of pedestrians on the pavements after dark.



High Mast Lighting (30 M tall) – are inefficient as too much light is dispersed into the night sky (causing light pollution) and not much light reaches the ground level.

Mid-Mast Lighting (10-12 M tall) – are appropriate for most arterial and subarterial streets. For wide streets with high pedestrian or commercial activity, Mid-Mast lighting may be combined with Pedestrian Scale lighting to create additional security and comfort.

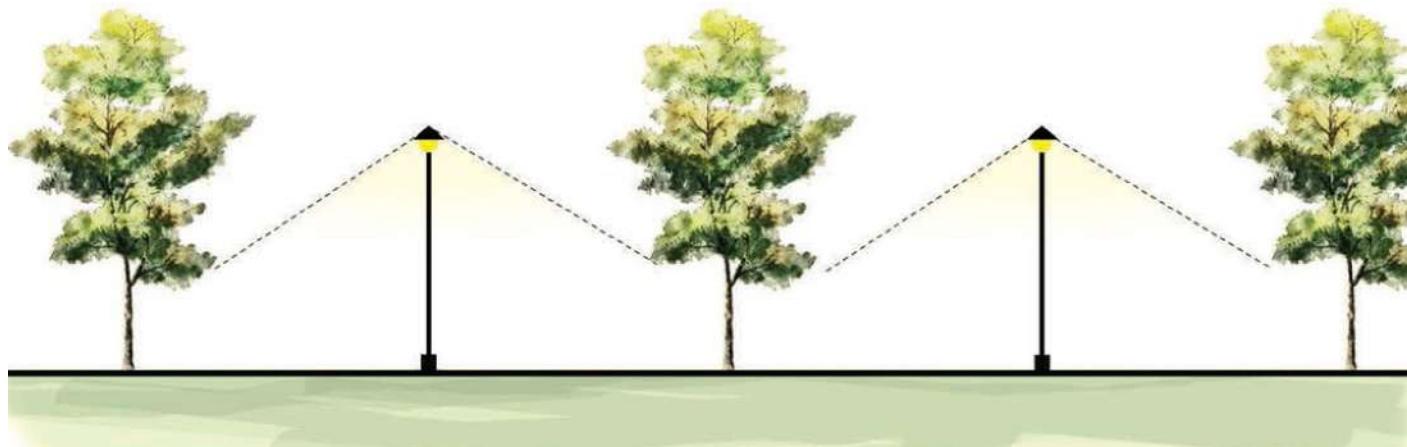
Low-Mast or Pedestrian Scale Lighting (3-5 M Tall) – illuminate pedestrian walkways and provide supplemental light for the sidewalk.

Approx. 30 lux level is suitable for non-shopping areas and 20-25 lux level for shopping areas.

Street Lighting must not pollute the environment, i.e. no night sky light pollution.

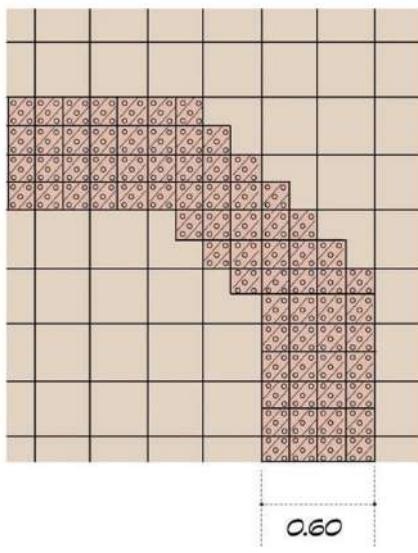
Energy Efficient fixtures should be used that are durable, efficient and inexpensive.

During the installation and placement of the street lights, adequate gaps and spacing from the tree canopies should be maintained to ensure that performance of lighting is not compromised.



5.13 Guidelines for Street Scapes

It is important that the built-environment is designed barrier-free and adapt to fulfill the needs of all people equally. An inclusive design would imply planning for people with varying abilities and disabilities. It aims to provide better infrastructure and street furniture to all kinds of users and make streets barrier-free and accessible to all.



Street furniture

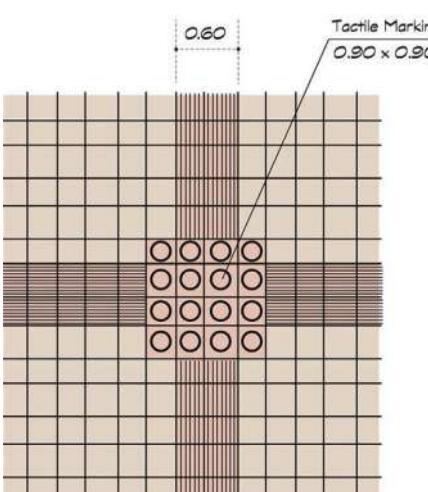
Street furniture (bus stops, benches, mail boxes, lampposts, telephone booths, public toilets, etc.) should be located which allow the free movement of all people without any obstruction. Textural changes in the footpath surface help visually impaired people to identify the location of public amenities.

Resting Facilities

Level rest areas with seats are helpful for all pedestrians, especially for those with mobility problems. Resting spaces with benches should allow a minimum of 1.20 m of adjoining space for a wheelchair.

Signs

All types of signages should be visible, clear, and well lit at night. Signage on the pedestrian path are obstructions and needs to be detectable. Tactile warning markings should be provided on the ground around the obstruction to overcome them. The warning markings should extend over a width of at least 0.60 m outside the projected area at the base of the object. The color of signs should contrast with the surrounding surface so as to be clearly distinguishable.

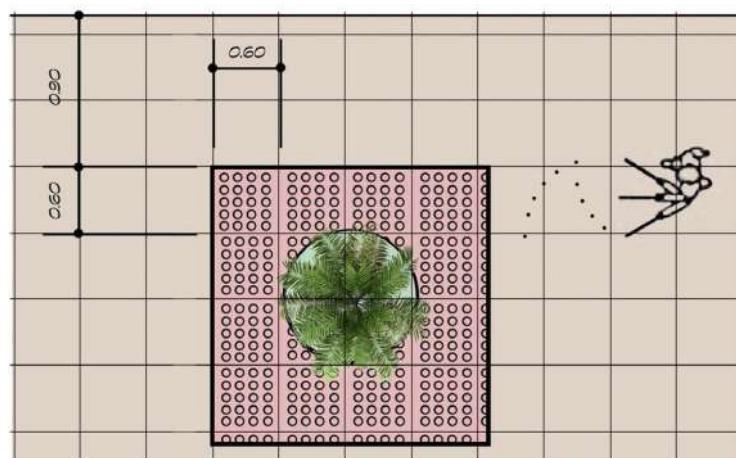


Guide Strips

A guide strip is a line constructed on the road surface to facilitate and guide the pedestrians with visual impairments on the streets. Guide strips should be laid in simple and logical manner, and should not be located close to manholes or drains in order to avoid confusion.

Tactile Marking

Tactile markings on the pedestrian route should be placed on guide strips where alternative routes exist or at a junction of guide strips and other major pedestrian crossings. They are also used to inform pedestrian about the obstructions on their paths.



5.14 Way Finding System

Wayfinding system help inform people of their surroundings in the (unfamiliar) built environment and it is important that it shows clear information at strategic points that will guide people into the right directions. Complex structures in the built environment are interpreted and stored by the human memory. Distances, locations and time may be remembered differently than as they appear to be in reality.

- An effective wayfinding system is based on human behavior and consists of the following characteristics:
- Do not make them think- Create a comprehensive, clear and consistent visual communication system with concise message.
- Show only what is required- Show information which is relevant to the space, location and / or navigation path.
- Remove excessive information - Remove unnecessary elements to create a clear visual environment ahead.
- Following the typical Bhutanese architectural elements, wayfinding signage could be designed and can be used at different locations as per their requirement.



Celebratory Gateway Banners- These would be used for advertising cultural events and also function as gateway to the location where the events are held.

Sinage- These are basic sinages which help locate ammenities such as restroom, parking, access, etc. to the users.

Information Kiosks- These would provide information to the visitors regarding historical and cultural significance of certain places in the area.

Bike and Pedestrain Direction Marker- These would provide information such as distance to destination and locate the availabilty of ammenities to bikers and pedestreians.

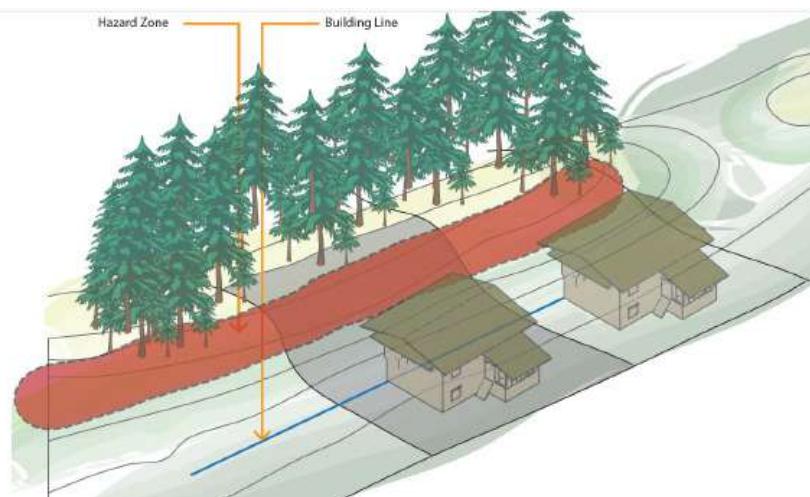
Map- These would help visitors to locate themselves and find directions to their destination.



6 Development Control Regulations

The development controls prescribed here shall be read in conjunction with the provisions of the prevailing planning guidelines and standards such as Bhutan Building Rules, 2002, Bhutanese Architecture Guidelines 2014, and the Spatial Planning Standards, 2016. The general guidelines for development which apply to all the precincts within the local area plan are listed as follows;

- The maximum permissible plot coverage shall be within the set back rules as prescribed in this regulations, and balconies (not enclosed/ roofed) projecting up to 1.2 m from the ground floor external wall face shall be permitted. Such projections/structures shall not cover the septic tanks.
- No permanent construction shall be permissible on areas designated as high hazard. In plots where high hazard zone overruns the allotment, any modification of slope may be allowed only after due considerations of soil stability and site drainage conditions. However, the area may be used for non-building activity like vegetable farming or gardening.
- Existing buildings situated in the high hazard zone should be employed with hazard mitigation techniques wherever feasible.
- All buildings must be designed and built according to the principle and technique prescribed by the Bhutanese Architecture Guidelines to preserve and promote the traditional architectural character of the buildings and towns.
- The orientation of a building must preferably be such that its longitudinal axis is perpendicular to the gradient of the contours.
- The color of buildings and roofing sheets are important consideration from the viewpoint of the Bhutanese architectural identity. Bright coloured buildings and reflective roofing sheets should be highly discouraged. It is recommended that the roofing sheets are painted or coated in pastel green or brick red. The exterior walls must be painted in white, mud color, or cream color as prescribed by the Building Color Code of Bhutan 2014.



6.1 Residential Precinct - Medium Density

Total Area: 65 Acres

SALIENT FEATURES

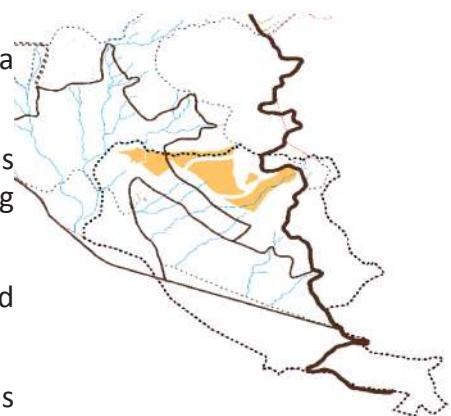
The development has been defined as the medium density residential area with intermittent green open spaces.

A mixed use, medium intensity, linear strip development along the roads is proposed to accommodate public and semi-public activities including community amenities.

The mixed use development will also include local level retail shops and services.

A consolidated land parcel, within the precinct in lower Rinchenthang, is reserved for low and middle income group housing.

The outer edges of the precinct are naturally demarcated by a belt of steep slopes and heavy vegetation.



Range of use	
Permissible	Residential Local level retail shops and services Utilities Social housing Community Facilities Community greens
Non- Permissible	Industrial Large scale commercial establishment Night time recreation activities

Proposed Built Form	
Plot Area (Sq.m)	a. \leq 526.1 b. 526.2 – 1052.1 c. $>$ 1052.2
Ground Coverage	a.50% b.45% c.40%
Building Height (Max.)	G+2 (Three floors)
Building Typology	Singular
Building setback (Min.)	3m on three sides and 5m on one side
Density	High

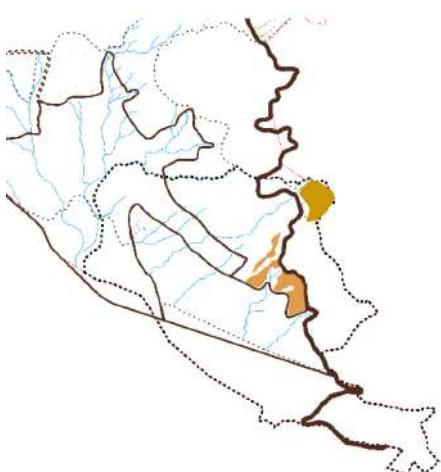
Special Remarks

Institutional uses in a minimum of 1000 Sq.m. plot may be permitted.

Resorts, Service apartments and lodging facilities in a minimum of 2500 Sq.m plot may be permitted

6.2 Residential Precinct - Low Density

Total Area: 12.9 Acres



SALIENT FEATURES

Proposed low rise, low density development interspersed with agricultural land to blend with the surrounding wetlands and green network.

The proposed development pattern is to keep the character of the place intact through the blend of the urban form with its terraced fields.

Developable parcels would be accessible through the secondary road network.

Streams and the forest belt running along the periphery demarcate the edge of the precinct.

Range of use	
Permissible	Residential Utilities Community Facilities Community greens
Non- Permissible	Industrial Any commercial uses including retail outlets, shops, ware house and night time recreation centers shall not be permitted.

Proposed Built Form	
Plot Area	a. ≤ 1011.7 b. >1012
Ground Coverage	a.30% b.25%
Building Height (Max.)	G+1 (Two floors)
Building Typology	Singular, composite, Plural
Building setback (Min.)	3m on three sides and 5m on one side
Density	Low

Special Remarks

a. Minimum plot size for uses like, educational institutions and office buildings shall be 1000 Sq.m.

b. Resorts, Service apartments and lodging facilities in a minimum of 2500 Sq.m plot may be permitted.

6.3 Urban Core Precinct

Total Area: 25.6 Acres

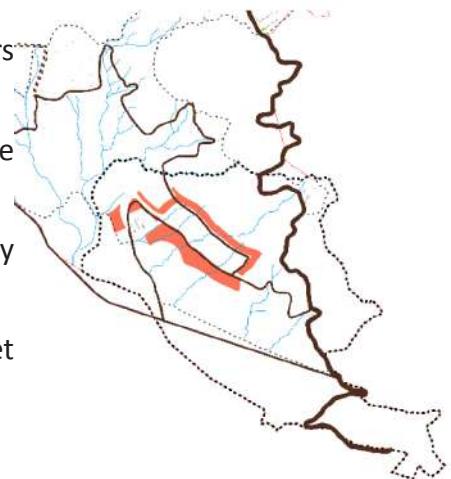
SALIENT FEATURES

The urban core will accommodate highest concentration of different layers of activities along principal route forming a loop.

The urban core extends along high street giving an enclosure to the proposed public open space and recreational area in the centre.

The core area will be within the walking distance and conveniently accessible from all the other parts of the new development.

Redesigning of pedestrian crossings, traffic calming, signage and street furniture will altogether enhance the user's safety and convenience.



Range of use	
Permissible	Commercial Residential Mixed Use Public utilities Hotels Restaurants Plazas Community Facilities Community greens
Non- Permissible	Industrial

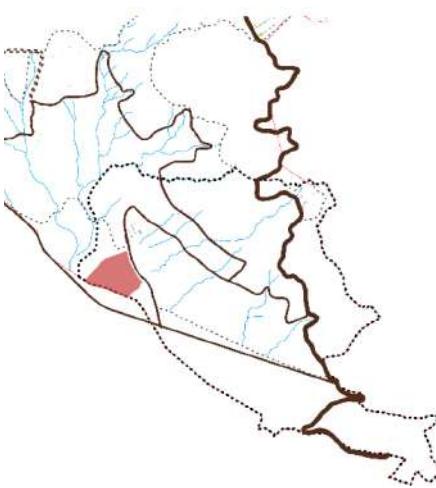
Proposed Built Form	
Plot Area a.	a. \leq 526.1 b. 526.2 – 1052.1 c. $>$ 1052.2
Ground Coverage	a.50% b.60% c.50%
Building Height (Max.)	G+3 (Four floors)
Building Typology	Singular, Plural, Composite
Building setback (Min.)	Front: 2m on the front Sides: 3m and Rear: 5m
Density	High

Special Remarks:

In the case of commercial buildings cantilevered balconies shall be allowed only at the rear side.

6.4 Institutional Precinct

Total Area: 25 Acres



SALIENT FEATURES

The earmarked institutional precinct in lower Rinchenthang shall be planned as medium density development.

The institutional precinct shall be composed of introvert development with independent internal open spaces and movement networks.

The precinct is proposed within the walkable catchment area to local facilities and residential neighborhood.

The area is primarily connected through the principal route to the town abutting from the proposed biological corridor road.

The preserved parallel green networks and rivulets running from north through to the south of Rinchenthang and the forest belt demarcate the precinct's edge.

Range of use	
Permissible	Educational and training institutes Health care centers Utilities Convenience Store Staffhousing
Non- Permissible	Industrial Commercial activities

Proposed Built Form	
Plot Area	> 1000 Sqm.
Ground Coverage	30%
Building Height (Max.)	G+2 (Three floors)
Building Typology	Singular,
Building setback (Min.)	3m on three sides and 5m on one side
Density	Medium

Special Remarks:

Residential and other activities incidental to the main institutional use, provided not more than 10 % of the site shall be used for such activities.

6.5 Agro Based Industry Precinct

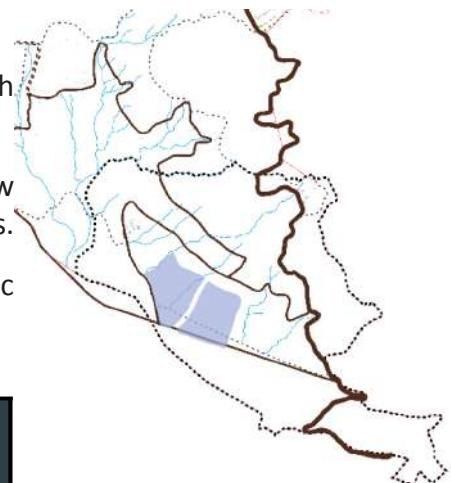
Total Area: 60 Acres

SALIENT FEATURES

The precinct will serve as the large scale business district dealing with agricultural related infrastructures.

The business district is proposed along the southern periphery of the new development area with sufficient buffer from the residential neighborhoods.

It will be accessed from the BC road designated for heavy industrial traffic for easy accessibility and efficient connectivity.



Range of use	
Permissible	Banks/ credit societies Seeds/ farm supply center Knowledge center Wholesale market Warehouse, Cold storage, Caretaker's Quarter Auction/ fair ground Workshops Veterinary hospital Parking Utilities
Non- Permissible	Residential Large scale industrial

Proposed Built Form	
Plot Area	> 1000 Sqm.
Ground Coverage	30%
Building Height (Max.)	G+1 (Floors)
Building Typology	Singular, Plural, Composite
Building setback (Min.)	3m on three sides and 5m on one side
Density	Low

6.6 Industrial (Cottage-based) Precinct

Total Area: 7.5 Acres



SALIENT FEATURES

The precinct is located at a relatively isolated area on a higher elevation towards Zalashing Zor.

The industrial precinct within the local area plan will primarily accommodate minor and small agro-based cottage industries.

Residential uses may be permissible in the area for the workers and individual plot owners to reside near their work place.

However, a sufficient green buffer zone as proposed in the plan is very essential between the precinct and the dry port.

Range of use	
Permissible	Small scale cottage industry Small Scale manufacturing and processing units Residential Community amenities Green buffer
Non- Permissible	Large factory based industry Auto workshop

Proposed Built Form	
Plot Area	a. ≤ 1011.7 b. > 1012
Ground Coverage	a. 35% b. 25
Building Height (Max.)	G+1 (Two floors)
Building Typology	Singular, composite, Plural
Building setback (Min.)	3m on three sides and 5m on one side
Density	Low

6.7 Dry Port Precinct

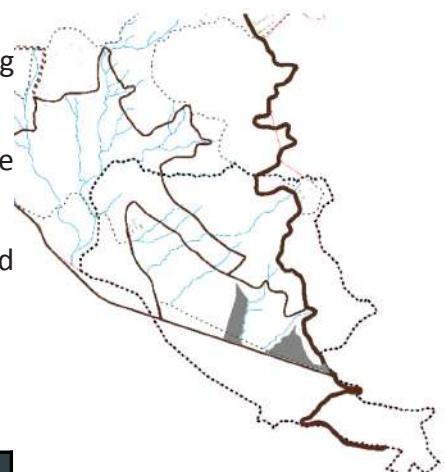
Total Area: 21 Acres

SALIENT FEATURES

The proposed dry port is situated towards the western end of Rinchenthang which is relatively isolated with no existing settlements.

Carefully planned green buffer will be necessary to contain the negative impact of noise, odor or smoke to neighboring settlements.

The area will have direct access from the proposed biological corridor road which is designated to heavy industrial traffic.



Range of use	
Permissible	Trade and commerce Logistic services Transportation related activities Utilities Green buffer
Non-Permissible	Residential Retail activities Industrial

Proposed Built Form	
Plot Area	> 1000 Sqm.
Ground Coverage	20%
Building Height (Max.)	Single storied
Building setback (Min.)	3m on three sides and 5m on one side
Building Typology	Singular
Density	Low

6.8 Open space and recreational Precinct

Total Area: 25.5 Acres



SALIENT FEATURES

The open space recreational precinct will primarily constitute of public assets and activities of local and national significance

The precinct intends to offer a city level public space for everyday interaction and activity for city residents.

The land parcels on either sides of the stream shall be linked with pedestrian bridges, integrating the passive and active recreational developments.

Through the use of natural landscape, it shall act as one of the main organizing elements of different development in Rinchenthang.

Range of use	
Permissible	Parks and gardens Public library Sports complex Outdoor sports Open Air Theater Jogging Tracks Parking Urban Art / Sculptures Plazas Open exhibition areas
Non-Permissible	Any other land use which are not consistent with and/ or, activities not related to the enhancement and protection of open space and recreation precinct.

Proposed Built Form	
Plot Area	-
Ground Coverage	10%
Building Height (Max.)	G+1 (Two floors)
Building setback (Min.)	-
Building Typology	Singular
Density	Low

6.9 Service Precinct

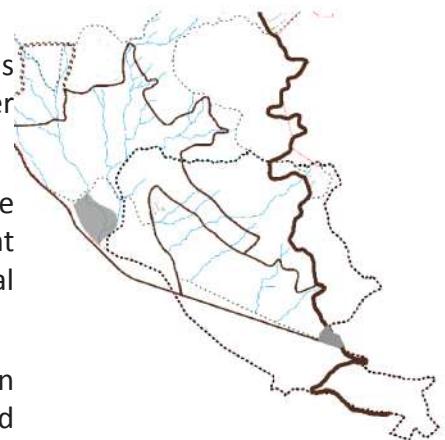
Total Area: 11.3 Acres

SALIENT FEATURES

Service precinct will include wide range of services, because of which it is strategically located along the main industrial area, and away from inner city development.

Parcel below Rinchenthang is identified as suitable location for sewerage treatment plant, which will take advantage of the favorable gradient of the natural topography to support gravity flow from the residential developments in the vicinity.

The primary access to the service precinct will be through the extension of the proposed biological corridor road originating from the by-pass road entering the city.



Range of use	
Permissible	Sewage treatment plant Water treatment plant Waste Collection Electric substations Incineration plants Public utilities Fuel station Gas agency
Non-Permissible	Any other land use not related to city services

Proposed Built Form	
Plot Area	-
Ground Coverage	-
Building Height (Max.)	Single storied
Building setback (Min.)	-
Building Typology	Singular
Density	Low

Special Remarks:

The minimum plot sizes for industrial use such as fuel station and gas agency shall be 1000 Sq.m

7 Investment Plan

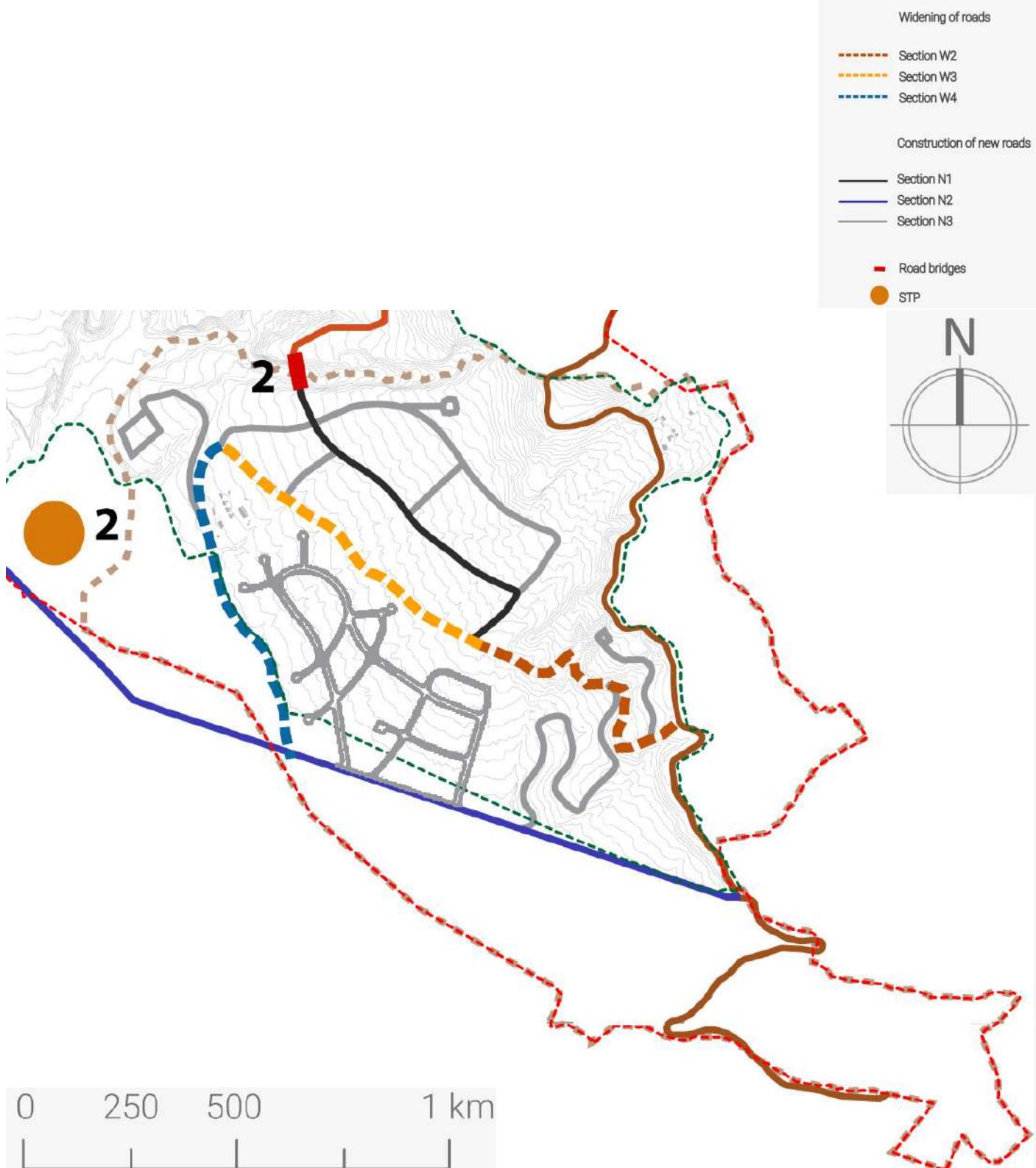
The success of any urban development plan depends on the ease with which it can be implemented. An investment plan is an instrumental tool which will ensure the success and efficient implementation of the urban development activities as prescribed in the plan in a planned and coordinated approach.

It can serve as a guideline to plan resources judiciously and address the infrastructure and service needs of the growing population. Also, it helps the various line departments to plan and execute different projects with better coordination, efficiency and transparency. Alongside this process, the implementing authority should also stress on the issues of maintenance along with the provision of new infrastructure; on the possibilities for multi-year budgeting for infrastructure projects, and on technological advances for creating a pool of smart infrastructure.

This investment plan for Rinchenthang local area plan provides a broad outlay of projects based on preliminary description of its components. It has been prepared in three different phases based on the development needs of the town, and its corresponding cost estimates for the implementation of the development activities.

The summary of the total investment required and its distribution in three phases are illustrated as follows and the details for the same have been outlined in the following sections.

INVESTMENT SUMMARY	
Total Investment	Nu. 1067.74 Million
Investment in Phase 1 (2016-2021)	Nu. 359.52 Million
Investment in Phase 2 (2021-2026)	Nu. 255.83 Million
Investment in Phase 3 (2026-2035)	Nu. 452.4 Million

Map showing proposed infrastructure works

7.1 Road Infrastructure

The proposals for road infrastructure aims at improving the vehicular accessibility and walkability within the town and to establish a robust connectivity will allow smooth and efficient interoperability of activities in the two towns. It will adopt the principles of walkable neighbourhood through connected streets and pedestrian networks with the objective to ease movement as comfortably and conveniently as possible.

ROAD INFRASTRUCTURE						
Sl no	Component	Proposed length (in mts)	Estimates total cost (Nu)	Investment Phase 1	Investment Phase 2	Investment phase 3
1	Widening of Roads					
a	Section W2	835	5218750	5218750		
b	Section W3	912	9120000	9120000		
c	Section W4	956	5975000	5975000		
2	Construction of new roads					
a	Section N1	1122	23225400	23225400		
b	Section N2	2098	28952400	28952400		
c	Section N3	2269	31312200		31312200	
3	Footpaths					
a	Section W3	1368	3693600	3693600		
b	Section W4	956	2581200	2581200		
c	Section N1	2244	6058800	6058800		
d	Section N3	5370	14499000		14499000	
	TOTAL	18130	130636350	84825150	45811200	

7.2 Storm Water drains

The objective is to manage surface runoff efficiently, especially at the time of high precipitation. It is important to have proper drainage system as otherwise it can adversely affect the performance of roads in a variety of ways, like that of, reduction of pavement and subgrade strength, inundation of road surface, loss of vehicle control, embankment erosion, loss of slope stability and deterioration of the movement corridor.

STORM WATER DRAINS						
Sl no	Component	Proposed length (in mts)	Estimates total cost (Nu)	Investment Phase 1	Investment Phase 2	Investment phase 3
1	Drainage network					
b	Section W2	835	920170	920170		
c	Section W3	1824	2010048	2010048		
d	Section W4	1195	1316890	1316890		
	TOTAL	3854	4247108	4247108		

7.3 Water Supply

The objective of the proposed water supply system is to ensure a continuous supply of clean drinking water for the whole town. The town is divided into two main hydraulic zones — the existing town and new town. Priority works include augmentation of source, retrofitting of intake works and construction of a water treatment plant. The storage system and distribution network may be taken up subsequently. The plan stresses on maximizing gravity flow, ensuring adequate and equitable supply to all households and establishments at an optimum pressure.

WATER SUPPLY						
Sl no	Component	Proposed capacity (mld)	Estimates total cost (Nu)	Investment Phase 1	Investment Phase 2	Investment phase 3
1	Storage & Treatment					
a	Renovation of the intake well	4	12000000	12000000		
b	Construction of WTP	4	12000000	12000000		
Sl no	Component	Proposed capacity (mld)	Estimates total cost (Nu)	Investment Phase 1	Investment Phase 2	Investment phase 3
2	Distribution network					
a	Raw Water mains (200 mm dia DI pipe)	2215	2519828.3	2519828.3		
b	Water supply trunk line (110 mm dia HDPE pipe)	4179	11166288	11166288		
				Along section W3,W4,N1		
	TOTAL	6402	37686116.3	37686116.3	0	

Notes: Cost of secondary distribution lines are not included in the estimates, as the network would depend on the overall design of the system

7.4 Sewerage

The main objective of the proposed sewerage system is to ensure an efficient wastewater disposal for the whole town. The thromde area is divided into two parts by a prominent ridge. The area north of the ridge includes the existing Nganglam town which has a dedicated sewerage system with a proposed STP. The area south of the ridge includes the new development in Rinchenhang. The STP for Rinchenhang has been located at the lowest available level. The locations of the STP has been proposed based on their elevation, requirement of land and proximity to a water body.

SEWERAGE & SANITATION						
Sl no	Component	Proposed capacity (mld)	Estimates total cost (Nu)	Investment Phase 1	Investment Phase 2	Investment phase 3
1	Sewerage Treatment Plant					
a	STP 2 (located in the service precinct)	2	12900000	12900000		
Sl no	Component	Proposed length (mts)	Estimates total cost (Nu)	Investment Phase 1	Investment Phase 2	Investment phase 3
2	Sewerage network					
a	Sewer trunk line (110 mm dia HDPE pipe)	3140	32970000	32970000		0
	TOTAL		45870000	45870000		0

Note: Cost of sewerage collection lines are not included in the estimates, as the network would depend on the overall design of the system.

7.5 Agro Park

Strengthening the economy is one of the main focus of the project and efforts have been made to include proposals that contribute to this objective at different levels. The proposal to establish an Agro-Park aims to encourage agro-based business activities while harnessing the potential of the region. It comprises of wholesale market areas, cold storage and warehouse facilities along with the provision of technical and financial assistance from the related institutions.

AGRO-PARK						
S No	Component	Proposed Length (in mt)	Estimated total cost (Nu)	Investment in Phase 1	Investment in Phase 2	Investment in Phase 3
1	Site infrastructure					
a	Construction of Internal roads	3090	31981500	31981500		
b	Construction of footpaths	820	3744120	3744120		
c	Construction of drains	4635	5107770	5107770		
S No	Component	Proposed Area (in Sqm)	Estimated total cost (Nu)	Investment in Phase 1	Investment in Phase 2	Investment in Phase 3
d	Parking	12000	15726000	10484000	5242000	
e	Site development	15000	13450000	9450000	4000000	
2	Other infrastructure*					
a	Banks credit societies, seeds/farm center, knowledge center, workshops, warehouses, Cold storage facilities, Vet hospital	94100	141150000		70575000	70575000
TOTAL		211,159,390.00	60,767,390.00	79,817,000.00	70,575,000.00	

7.6 Dry Port

Export and import are one of the very important components of the economy of the country as well as the region. The improvement in the existing logistic and custom facilities would ensure easy and smooth transaction of goods which will have a direct impact on the existing trade scenario. The provision of a dry-port in Nganglam shall reduce dependency on Phuentsholing dry-port to a great extent while cutting down on heavy transportation costs involved. The proposal includes the provision of warehouses, container terminal, logistic service areas, workshops, etc.

DRY-PORT						
S No	Component	Proposed Length (in mt)	Estimated total cost (Nu)	Investment in Phase 1	Investment in Phase 2	Investment in Phase 3
1	Site infrastructure					
a	Construction of internal roads	750	17250000	11500000	5750000	
S No	Component	Proposed Area (in Sqm)	Estimated total cost (Nu)	Investment in Phase 1	Investment in Phase 2	Investment in Phase 3
b	Parking areas	6500	8518250	4586750	3931500	
c	Site development	12280	20345000	19845000	500000	
2	Other infrastructure					
a	Warehouse/ logistic facilities, Container terminal, container service center, Inspection area, Administrative building, Workshops, Truck terminus	57200	114400000	57200000	57200000	
TOTAL		160,513,250.00	93,131,750.00	67,381,500.00	0.00	

7.7 Industrial Precinct

The development of industrial area within the context of Nganglam Regional Hub Development Plan, has been envisaged to boost the manufacturing sectors in the eastern region. The proposal has been conceived to accommodate industrial units of different types and scales based on the availability of resources.

INDUSTRIAL PRECINCT						
S No	Component	Proposed Length (in mt)	Estimated total cost (Nu)	Investment in Phase 1	Investment in Phase 2	Investment in Phase 3
1	Site Infrastructure					
a	Construction of internal roads	2142	22169700	11819700	10350000	
b	Construction of drains	2142	2360484	1258484	1102000	
S No	Component	Proposed Area (in Sqm)	Estimated total cost (Nu)	Investment in Phase 1	Investment in Phase 2	Investment in Phase 3
c	Parking (truck parking)	5921.7	7760387.85		7760387.85	
d	Site development	32186	20065000		16065000	4000000
TOTAL		52,355,571.85	13,078,184.00	35,277,387.85	4,000,000.00	

7.8 Special projects

The local area plan includes various projects of local and regional significance with specific objectives. Some of the important projects in Rinchenthang and their cost estimates are worked out as follows;

SPECIAL PROJECTS					
Sl no	Component	Esitmates total cost (Nu)	Investment Phase 1	Investment Phase 2	Investment phase 3
	Regional Hospital	439010000			439010000
	Higher Secondary School	309890000			309890000
	Police station	41320000		41320000	
	Cultural and Communities Centre	65150000		65150000	
	Social Housing	299830000			299830000
	Kindergarten	27540000		27540000	
	Vegetable market	10330000	10330000		
	Sport Complex +Active & Passive recreation	77990000			77990000
	Fuel/Gas station	9580000	9580000		
	TOTAL	425270000	19910000	27540000	377820000

8 Appendices