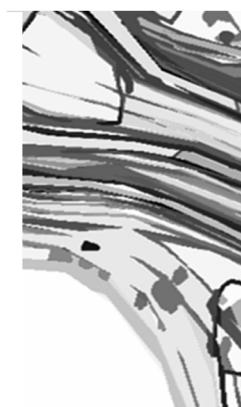
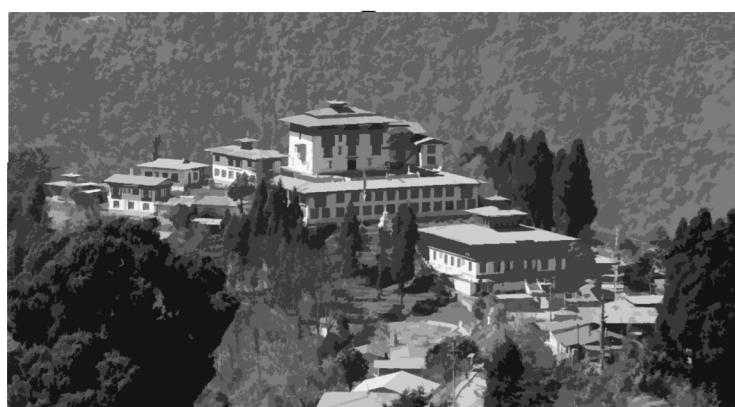


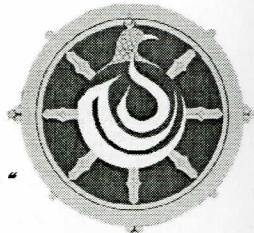
# ZHEMGANG

## Structure Plan 2020-2040





ର୍ୟାଲ ଗୋଭର୍ନ୍ମ ପ୍ରତ୍ୟେକ ଶକ୍ତିରେ ଜୀବନକୁ ଉପରେ  
ROYAL GOVERNMENT OF BHUTAN  
MINISTRY OF WORKS AND HUMAN SETTLEMENT



*"Construction Industry: Solutions through innovation and improved technology"*

MINISTER

## FOREWORD

Zhemgang Dzongkhag lies in the South-central region of the country sharing its border with five other Dzongkhags namely; Bumthang to the north, Trongsa and Sarpang to the west, Mongar and Pemagatshel to the east and the Indian State of Assam in the South. Zhemgang Thromde is located at the north-eastern edge of the Dzongkhag under Trong gewog, with an area of 410.37 acres/1.66 square kilometers. The thromde boundary includes the *existing Zhemgang town* which is located at 111kms by road from Trongsa towards Gelephu and *Tingtibi* which is 35kms further south along Zhemgang-Gelephu Highway.

The Structure Plan for Zhemgang was prepared in 2003 for a period of 20 years (Urban Development Plan for Zhemgang 2003-2023), extending to the then municipal area which encompasses the existing town area and Trong village, RDTC area, Zhemgang school (both lower and upper campus) and Paling area. Three Local Area Plans namely; Trong Village LAP, Town Area LAP and the Paling Area LAP were also prepared as a part of the then structure plan.

However, with the validity of the old plan nearing its completion and the extension of thromde boundary by the Parliament in 2015, it was deemed necessary to review the structure plan. Moreover, there was need to review and amend the land uses according to the hazard mapping produced through the geotechnical study carried out in 2019.

The revised Zhemgang structure plan (2020-2040) is prepared in such a way that Zhemgang and Tingtibi will be developed as complementary towns based on their comparative advantages and, ultimately envisioned to develop Zhemgang thromde into one of the most liveable towns in Bhutan offering unique cultural and nature-based recreational experiences. This plan document is supported by elaborate Development Control Regulation (DCR) to regulate and guide all kinds of developmental proposals. The review of Zhemgang Structure Plan was carried out in close consultation with public and relevant stakeholders and finally approved in the 33<sup>rd</sup> PPCM (Planning and Policy Coordination Meeting) held on 5<sup>th</sup> April, 2021.

We would like to acknowledge the support and cooperation received from Dasho Dzongdag and all other officials of Zhemgang Dzongkhag Administration throughout the plan preparation period. The plan was prepared in-house by Urban Planning and Development Division, Department of Human Settlement. The plan is a dynamic document and has to be reviewed from time to time by the Dzongkhag Administration. The Dzongkhag has to ensure that the plan proposals are effectively implemented as per the structure plan and we would like to urge all the relevant stakeholders to extend your whole-hearted cooperation and support for smooth implementation of the structure plan to realize its vision.

Tashi Delek

(Dorji Tshering)  
Zhabtob Lyonpo

## Table of Content

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	Location and Profile .....	1
1.2	Need for Review.....	2
<b>2</b>	<b>PLANNING CONSIDERATIONS .....</b>	<b>3</b>
2.1	Zhemgang Urban Development Plan 2003-2023.....	3
2.1.1	Concepts and Proposals .....	3
2.1.2	Local Area Plans .....	4
2.2	Trong Subdivision Plan 2016 .....	9
2.3	Geotechnical study 2019 .....	11
2.4	Comprehensive National Development Plan (CNDP) 2030 .....	12
2.4.1	Domestic and International Academic Linkage .....	12
2.4.2	Creation of Holistic Tourism Network.....	12
<b>3</b>	<b>EXISTING SCENARIO.....</b>	<b>14</b>
3.1	Physical Environment.....	14
3.1.1	Climate.....	14
3.1.2	Topography and land features.....	15
3.2	Existing Land Classification.....	17
3.2.1	Plot Ownership.....	17
3.2.2	Land Use Pattern.....	18
3.2.3	Plot Size Classification.....	19
3.3	Existing Built Environment .....	20
3.3.1	Building Typology.....	20
3.3.2	Building Height.....	21
3.4	Existing Infrastructure and Amenities .....	22
3.4.1	Social Infrastructures .....	22
3.4.2	Physical Infrastructures.....	26

<b>4 ANALYTICAL STUDY .....</b>	<b>31</b>
4.1 Demography .....	31
4.1.1 Existing population .....	31
4.1.2 Population projection .....	31
4.2 Land Suitability Analysis.....	32
4.2.1 Slope Analysis.....	32
4.2.2 Geotechnical Hazard Analysis.....	33
4.2.3 River Buffer.....	35
4.2.4 High Tension Buffer .....	35
4.2.5 Suitability analysis.....	36
4.3 SWOT Analysis .....	37
4.4 Socio-economic survey analysis .....	38
<b>5 PROPOSAL FOR ACTION .....</b>	<b>40</b>
5.1 Concept of the Plan.....	40
5.2 Vision.....	41
5.3 Planning principles .....	41
5.3.1 Principle One: A Balance with Nature .....	41
5.3.2 Principle Two: A Balance with Tradition.....	41
5.3.3 Principle Three: Appropriate Technology .....	42
5.3.4 Principle Four: Conviviality .....	42
5.3.5 Principle Five: Efficiency .....	43
5.3.6 Principle Six: Human Scale.....	44
5.3.7 Principle Seven: Opportunity Matrix .....	44
5.3.8 Principle Eight: Regional Integration.....	45
5.3.9 Principle Nine: Balanced Movement.....	45
5.3.10 Principle Ten: Institutional Integrity .....	45
5.4 Proposed Precinct Plan.....	47
5.4.1 Proposed Urban Core .....	47



5.4.2	<i>Proposed Urban Villages .....</i>	47
5.4.3	<i>Proposed Cultural Precinct.....</i>	48
5.4.4	<i>Proposed Institutional Precinct.....</i>	48
5.4.5	<i>Proposed Service Precinct .....</i>	49
5.4.6	<i>Proposed Transport Precinct .....</i>	49
5.4.7	<i>Proposed Industrial Precinct .....</i>	50
5.4.8	<i>Proposed Recreational Precinct .....</i>	51
5.4.9	<i>Proposed Environment Precinct.....</i>	52
5.4.10	<i>Proposed Buffer Zones (BZ) .....</i>	53
5.4.11	<i>Proposed Special Zones (SZ) .....</i>	53
5.5	<i>Population Carrying Capacity .....</i>	54
5.6	<i>Proposed Infrastructures and utilities .....</i>	56
5.6.1	<i>Road Classification .....</i>	56
5.6.2	<i>Pedestrian Pathways .....</i>	58
5.6.3	<i>Parking Facilities.....</i>	59
5.6.4	<i>Proposed Water Supply.....</i>	61
5.6.5	<i>Proposed Sewerage System.....</i>	62
5.6.6	<i>Proposed Solid Waste Management.....</i>	62
5.6.7	<i>Fire Fighting Facilities .....</i>	63
5.6.8	<i>Storm water drainage system.....</i>	63
5.7	<i>Projects of Special significance .....</i>	64
5.7.1	<i>Redevelopment of Zhemgang Urban Core area .....</i>	64
5.7.2	<i>Reconfiguration of Plot within Trong Heritage Village .....</i>	69
5.7.3	<i>Preservation of Zangdopelri view corridor, Tingtibi .....</i>	70
5.7.4	<i>Craft market, Tingtibi .....</i>	71
5.7.5	<i>Site for heavy vehicle parking, automobile workshop and CSI in Zhemgang.....</i>	72
<b>6</b>	<b>IMPLEMENTATION PLAN .....</b>	<b>73</b>



## List of Figures

Figure 1. 1 Location Map of Zhemgang and Tingtibi town.....	1
Figure 1. 2 Map showing the old and new thromde boundary .....	2
Figure 2. 1 Zhemgang Urban Development Plan 2003-2023.....	3
Figure 2. 2 Trong Subdivision Plan .....	9
Figure 2. 3 3-D view of Trong Subdivision Plan .....	10
Figure 2. 4 Hazard map of Zhemgang (left) and Tingtibi(right).....	11
Figure 2. 5 Domestic and International Academic Linkage (CNDP report).....	12
Figure 2. 6 Map showing the future tourism zone (CNDP report).....	13
Figure 3. 1 Image showing the three agro-ecological zones of Zhemgang.....	14
Figure 3. 2 Slope profile of Zhemgang town.....	15
Figure 3. 3 Slope profile of Tingtibi town .....	16
Figure 3. 4 Plot ownership composition of Zhemgang and Tingtibi .....	17
Figure 3. 5 Land User pattern of Zhemgang and Tingtibi .....	18
Figure 3. 6 Plot size classification of Zhemgang and Tingtibi .....	19
Figure 3. 7 Building typologies of Zhemgang and Tingtibi .....	20
Figure 3. 8 Building Height of Zhemgang and Tingtibi .....	21
Figure 3. 9 Amenities within Zhemgang town.....	23
Figure 3. 10 Amenities with Tingtibi town .....	23
Figure 3. 11 Image of Trong village .....	24
Figure 3. 12 Image showing open playground and multipurpose open space at Zhemgang and Tingtibi Respectively .....	26
Figure 3. 13 Circulation network of Zhemgang and Tingtibi town .....	27
Figure 3. 14 Image showing WTP (Slow sand filters) and Clear Water Reservoir at Zhemgang town.....	28
Figure 3. 15 Image showing door to door collection of waste by the Zhemgang thromde. ....	28
Figure 3. 16 Image showing existing fuel station at Zhemgang and Tingtibi town.....	29
Figure 3. 17 Image showing existing vegetable market at Zhemgang town.....	30
Figure 3. 18 Image showing existing parking space at Zhemgang and Tingtibi town.....	30
Figure 4. 1 Slope analysis for Zhemgang and Tingtibi town .....	32
Figure 4. 2 Geotechnical Hazard analysis of Zhemgang and Tingtibi town .....	34
Figure 4. 3 Suitability analysis of Zhemgang and Tingtibi town.....	36
Figure 4. 4 SWOT Analysis for Zhemgang Town .....	37



Figure 4. 5 SWOT Analysis for Tingtibi Town.....	38
--	----

Figure 5. 1 Figure illustrating concept of the plan .....	40
Figure 5. 2 Location of industrial Park, Tingtibi.....	50
Figure 5. 2 Proposed Precinct Plan (Zhemgang) .....	53
Figure 5. 3 Proposed Precinct Plan (Tingtibi) .....	54
Figure 5. 4 Primary Road Section (Zhemgang) .....	56
Figure 5. 5 Secondary Road Section (Zhemgang) .....	57
Figure 5. 6 Tertiary Road Section (Zhemgang).....	58
Figure 5. 8 Proposed Circulation Network (Zhemgang) .....	60
Figure 5. 9 Proposed Circulation Network (Tingtibi).....	61
Figure 5. 10 Plan of the urban core .....	65
Figure 5. 11 Typical Section through Urban Core .....	66
Figure 5. 12 Primary Road Right of Way (ROW) detail.....	67
Figure 5. 13 Images showing example of permeable pavement.....	68
Figure 5. 14 Images showing the example of Open space design with sheds and benches .....	68
Figure 5. 15 Changes after plot reconfiguration of Trong village .....	69
Figure 5. 16 View of Zangdopelri at Tingtibi .....	70
Figure 5. 17 Realignment of Primary Road at Tingtibi .....	71
Figure 5. 18 Location of handicraft .....	71
Figure 5. 20 Map showing the location of the proposed service site.....	72

## List of Tables

Table 2. 1 Development Control Regulations for Trong Subdivision Plan .....	10
---	----

Table 4. 1 Population projection for Zhemgang and Tingtibi town.....	31
Table 4. 2 Slope analysis composition of Zhemgang and Tingtibi .....	33
Table 4. 3 Hazard analysis composition of Zhemgang and Tingtibi town.....	34
Table 4. 4 Suitability analysis composition of Zhemgang and Tingtibi town.....	36

Table 5. 1 Population Carrying Capacity: Zhemgang Town.....	55
Table 5. 2 Population Carrying Capacity: Tingtibi Town .....	55
Table 5. 3 Water demand for Zhemgang and Tingtibi town .....	62

Table 6. 1 Implementation Plan.....	73
-------------------------------------	----



# 1 INTRODUCTION

## 1.1 Location and Profile

Zhemgang Dzongkhag lies in the South-central region of the country sharing its border with five other Dzongkhags namely; Bumthang to the north, Trongsa and Sarpang to the west, Mongar and Pemagatshel to the east and the Indian State of Assam in the South. It has an area of 2421 square kilometers with a population of 17,763 (Male: 9,195 and Female: 8,568) with a total of 3803 households. The Dzongkhag is administratively supported by a Drungkhag in Panbang and eight Gewogs.

Zhemgang town is located 111kms by road from Trongsa towards Gelephu. It is the commercial and administrative center for Zhemgang Dzongkhag. Further south, along Zhemgang-Gelephu highway, at a distance of 35kms from Zhemgang town is the Tingtibi town. Combination of these two towns form the Zhemgang Dzongkhag Thromde, somewhere at the north-eastern edge of the Dzongkhag. Zhemgang town has an area of 274.54 acres while Tingtibi has an area of 135.83 acres, thus summing up to a total area of 410.37 acres/1.66 square kilometers. The planning boundary for this review of Zhemgang Structure Plan extends to the entire Zhemgang Dzongkhag Thromde area.

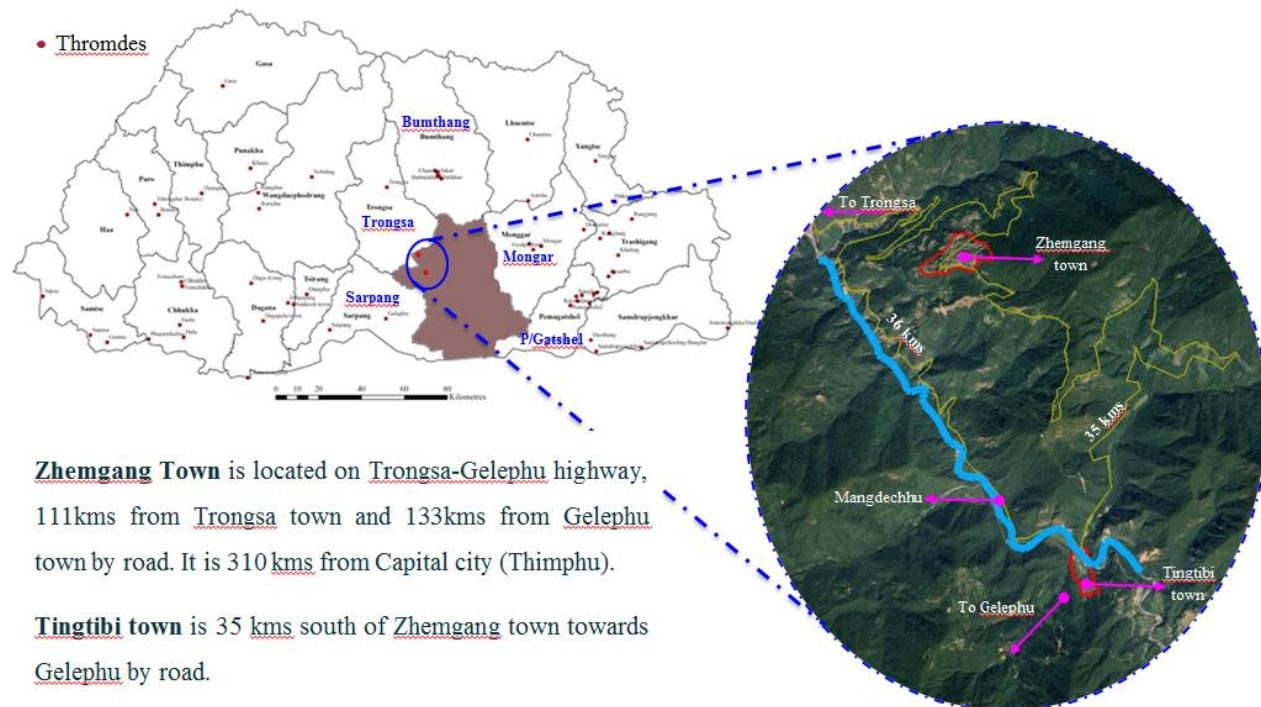


Figure 1. 1 Location Map of Zhemgang and Tingtibi town



## 1.2 Need for Review

The review of Zhemgang Structure Plan is carried out in view of the following:

- The planning boundary of old structure plan does not extend to whole Thromde area. Therefore, the revised plan ensures that it encompasses the entire Thromde boundary including the extended areas, as declared by the Parliament in 2015.
- It is high time that the old structure plan be reviewed because it was prepared in 2003 for a time horizon of 20 years which is almost near completion.
- Geotechnical study result forms one of the indispensable basis for preparation of any plan; however, the old plan was prepared without the geotechnical study. The Department through consultancy service has carried out the geotechnical study of Zhemgang Thromde in 2019 and thus, the revised plan is to a great extent based on the geotechnical study result.
- Since Tingtibi is also included in the planning boundary, the review is intended to come up with more holistic plan wherein Zhemgang and Tingtibi complement each other based on their comparative advantages.

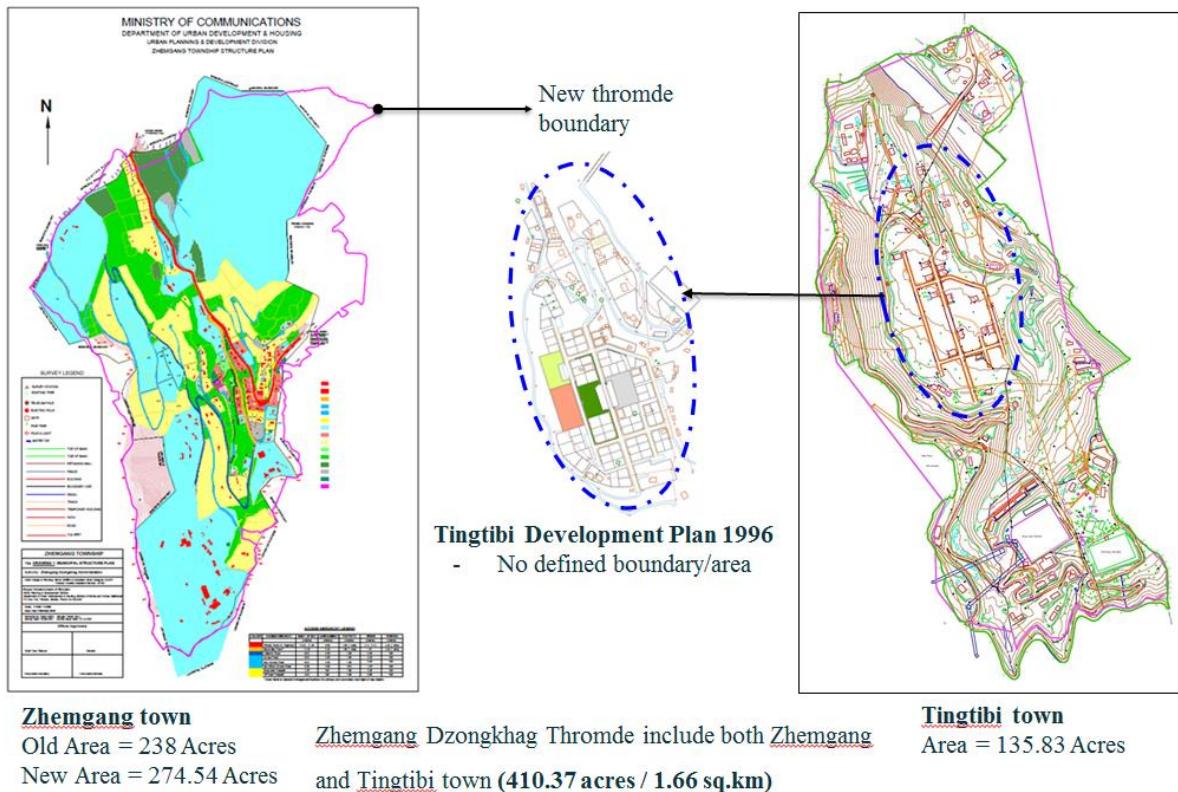


Figure 1. 2 Map showing the old and new thromde boundary



## 2 PLANNING CONSIDERATIONS

### 2.1 Zhemgang Urban Development Plan 2003-2023

The ZUDP was prepared as part of Bhutan Urban Development Project under the World Bank funding by the Ministry of Works and Human Settlement and Consultant Urban Designer Simon Griffiths in the year 2003. ZUDP proposals include the following:

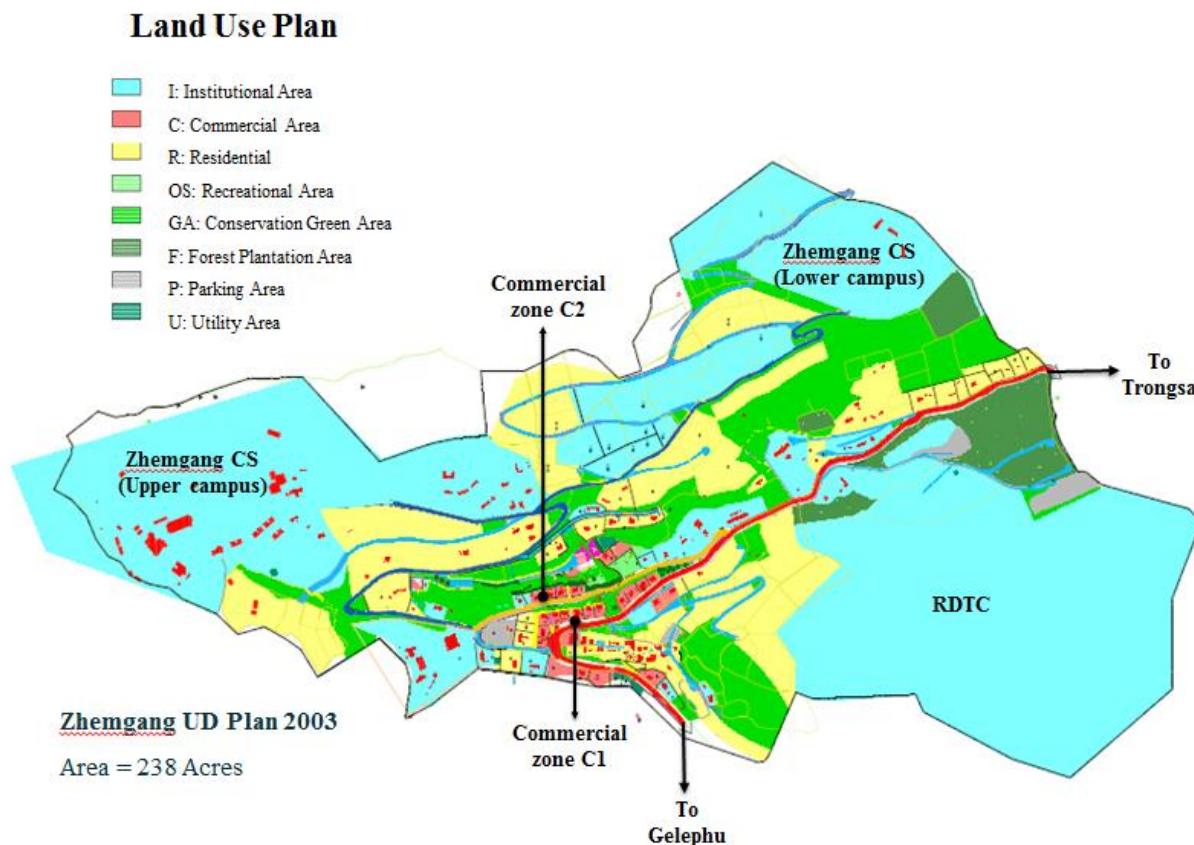


Figure 2. 1 Zhemgang Urban Development Plan 2003-2023

#### 2.1.1 Concepts and Proposals

- **Zhemgang as a service centre**

ZUDP proposes Zhemgang as a service centre for agriculture and education institutions owing to the presence of vocational training institute (RDTC) and the two schools within the municipal boundary.

- **Zhemgang as a Tourist Base**

ZUDP also proposes Zhemgang as a Tourist base as it has the potential for agro & eco and community-based tourism due to its location amongst the three national parks.



However, at the time of plan preparation, this potential was constrained by the lack of infrastructures related to tourism

- **Tingtibi as a District Economic Development Zone**

ZUDP proposes Tingtibi as a District Economic Zone mainly due to the limitations in Zhemgang in terms of expansion area to accommodate the service industries such as the workshops and sawmill, the limitations posed by its natural topography and its apparent lack of easy access to raw materials and markets, Tingtibi has the comparative advantage to develop as a district economic development zone owing to availability of vacant flat area and easy access to raw material and markets to the nearby hinterland villages and Gelephu town.

## 2.1.2 Local Area Plans

The ZUDP divided the municipality into three LAPs and accordingly proposed urban design interventions in each of the three LAPs

### Trong Village LAP

Trong Village is situated at the heart of the town and the village is considered as one of the first settlements in the town. It is one of the most defined and densest residential areas in the town. The village follows the ridgeline ascending from the bus stop in the town area up to the Lhakhang on top of the village. A narrow pathway runs along the ridgeline with houses on both sides of the pathway.

#### Infrastructure Proposals

- **Access Road:** Proposals for access road consisted of a new access road from the highway to the Trong village settlement, a new access road through the village for emergency vehicles and a new access road to the village Lhakhang. Access proposals also included a new access road to the Crematorium and beyond towards Tsothang to serve the future residential areas. Most of the proposed access roads are developed at site.
- **Parking:** Vehicular parking was proposed at the entrance of the village at the north end was proposed but not developed at site.
- **Off-street footpath:** Footpaths connecting the village to the highway and then to the village Lhakhang was proposed and also developed at site.
- **Sanitation:** Public toilet was proposed near the parking at the entrance of the village from the north end but it is not developed.



### ***Land use and DCR Proposal***

- **Trong Village Residential Zone (R1):** Owing to the historical and cultural significance of Trong village and some of the buildings within the village, DCR for Trong Village residential zone comprises of a maximum of 2 storey building height, 60% plot coverage, a minimum plot size of 7 decimal and full traditional architectural nomenclatures as per the existing guidelines. As for the heritage structures, a maximum of 2 story building height and existing setbacks and coverage for the buildings and building construction and materials to be as per the recommendation of the MoHCA.
- **Trong Residential Expansion Zone (R2):** The area has moderate slopes and has potential for terraced residential development owing to its proximity to Trong village and town core and its accessibility to services and infrastructures. A shop in the ground floor should be recognized creating a valuable neighbourhood shopping facility. Guided land Development is recommended for planning.

### **Town Area LAP**

#### ***Infrastructure Proposals***

- **Road:** 18-21m ROW road with 6.6m carriageway was proposed along the National Highway, while 15m ROW road with 5.4m carriageway was proposed along the Dzong road.
- **Parking:** Vehicular 2.4 m parallel parking on the shop side for both the roads.  
**Footpath:** 1.8m on-street footpaths, bridge access to the commercial buildings to be considered where required.
- **Sanitation:** public toilet proposed near the vegetable market, on-plot septic tank or communal in case of insufficient space.

### ***Land use and DCR Proposals***

- **Commercial Zone along the National Highway (C1):** Being the commercial core of the town, maximum of 3 storey building height with front setback of 1.5m and side setback of 2 m is permitted.
- **Commercial Zone along the Dzong Road (C2):** a maximum of 3 storey building height is permitted with 2m setback from the plot boundary.



## **The Paling Area LAP**

### **Paling Residential Area (R9)**

Due to its good potential for terraced residential development with a slope gradient of approx. 22%, a shop on the ground floor is allowed subject to land use compatibility. Guided land development is the recommended method for planning

### **Infrastructure Proposals**

- **Vehicular road access (SRD3):** 6m ROW access road is proposed for the area with 3.5m carriageway
- **Pedestrian access (SF.1):** Existing pedestrian access is to be upgraded to 3m ROW and 1.8m pathway. It would provide school children with a safe and direct route from the town to the lower secondary school

### **Paling Institutional Area**

Although the plan proposed for allocation of land for institutional establishments such as the Animal Husbandry, Forest office, BDFC, BCCI, BPC, etc., through land acquisition, only the Animal husbandry, BPC and NRDL are allocated land for their establishment in the proposed Paling Institutional area.

### **Open Spaces**

- Existing Archery ground and Pavilion (OS1): although the plan proposed for the retention of the existing archery ground and pavilion in the existing location near the Dzong, the Dzongkhag Administration has relocated the archery ground to the northern end of the Thromde in two locations, one in the Rabday land and other in the RDTC land.
- Public Park Recreational area (OS2): a new public park has been proposed between the Dzong road and vegetable market. It is to be developed as a garden meeting place to relax for market users.
- Town Centre Children's Park (OS3): An area of approx. 1527 Sq.m is proposed for children's park located below the Dzong road and north of the OS2. It is proposed to be developed as a safe place to play for children residing in the town centre and of market users. The park is to be planted with shrub vegetation, tree shades and garden planting and facilities such as traditionally made bench seating, tree seats, children's play equipment are to be installed. The park has been developed as proposed with children's play equipment.



- Public seating / recreational area (OS4): a linear recreational space outside the shops proposed to be a popular meeting place for the local residents and people visiting the shops. It is proposed in an existing vacant government land of approximately 556 m<sup>2</sup> area.

### **Conservation Green Areas (GA)**

These are environmentally sensitive areas such as steep slopes stabilized by vegetation cover that requires enhancement and protection from erosion and damage. These are predominantly government land. Another area below the Dzongkhag guest house near the residential area (R9) has been designated as conservation green area. The area below the Dzongkhag guest house is to be maintained as green open space as per His Majesty's royal command.

### **Forest Plantation Area**

These are forest reserves in a “no development zone” that require protection against damage to be preserved as part of the municipality’s unique environmental heritage. Development in these areas requires no objection certificate from the following authorities such as the Department of Forestry, The National Environment Commission, Urban Planning and Development Division and Zhemgang Dzongkhag Administration.



## Other Proposals

- **Relocation of Animal Husbandry:** from the town core to the Paling Institutional Area due to incompatible land use in close proximity to the Dzong as well as rural service related to livestock in the town core.
- **Relocation of the fuel Station:** to be relocated from the town to a site 1km towards Gelephu due to aesthetic inappropriateness being located at the entrance of the town, congestion issues and limited expansion space. New site is to be acquired from private individuals
- **Site for Automobile Workshop:** a site was selected in Tarala (4km towards Gelephu) and reasons of contamination risk of land and Mangde chhu given for its undesirability within the town through private land acquisition.
- **Relocation of divisional DOR office from Tingtibi to Zhemgang (I17 & I18):** Although an area of 1.68 acres was proposed to be retained for future use of DOR in the existing PWD area, and area of 1.76 acres has been registered under DOR ownership.
- **Overnight Bus and Truck Parking Area:** is proposed in a vacant site above the DOR area (I18) for accommodating 9 trucks and 3 buses in an area of approx. 825 Sq.m due to its easy accessibility from the highway. Currently the site is registered under DOR ownership.
- **New Forest Plantations (F2 and F3):** new forest plantation (F2) proposed above the new truck parking and along the highway below the DOR site (F3).
- **Crematorium:** to be identified outside the municipal boundary by the Dzongkhag administration as the land use is not compatible with the existing surrounding residential and institutional land uses.
- **Dratshang Relocation:** The plan hints at the possibility of relocating the monk's residence above the Forest Range office and DOR site in an area of 3 acres. However, today 11 acres of land has been allocated for Dratshang Rabday in the proposed area.



## 2.2 Trong Subdivision Plan 2016

The Trong Subdivision Plan was prepared in 2016 in pursuant to His Majesty the King's Command in September 2014 to preserve Trong village as a Heritage Village and to provide each household with a plot of land as incentive.

The plan consists of creation of 27 residential plots of 7 decimals each for the 27 households of Trong Village in two separate locations, one below the Wamptakpa Road and the other near NHDC Colony the Royal Guest House. The plan proposed small pockets of open spaces, children's park, Sewerage System with communal septic tank, Drainage Networks, Fire Fighting.

Owing to the challenges posed by the relatively steeper site terrain, the Subdivision Plan area is mainly serviced with a network of 2m footpaths. However, common car parking spaces are proposed along the Wamptakpa road at different sections.



Figure 2.2 Trong Subdivision Plan



Table 2. 1 Development Control Regulations for Trong Subdivision Plan

DESIGNATED LAND USE	AREA (sq.m)	MAX. COVERAGE	MINIMUM SETBACK	MAX. HEIGHT	COMMENTS
RP-1 Below Wamptakpa Road	364.217	35	3 m on front and back 3m on one side and 5m on the other side	2	The maximum height is exclusive of the ground floor if it is required to be constructed in split levels
RP-2 Near NHDC colony	364.217	35	3m on 3 sides and 5m on the side accommodating the septic tank	2	



Figure 2. 3 3-D view of Trong Subdivision Plan



## 2.3 Geotechnical study 2019

Geotechnical study result forms one of the important bases for preparation of any plan. It was carried out for Zhemgang and Tingtibi Thromde in 2019. The main purposes of conducting a geotechnical investigation are:

- i. To evaluate the suitability of the site for the proposed project;
- ii. To obtain physical and mechanical properties of the subsurface materials (i.e. soils and rocks), in order to determine their suitability as they may affect the construction and performance of the project;
- iii. To enable safe and economical design of the project components; and
- iv. To identify any potential problems or difficulties with the ground conditions that may affect construction or performance of the proposed project.

The study result shows that for Zhemgang, 53% (147 acres) fall under low hazard zone, 37% (103 acres) under medium hazard and only 10% (26 acres) under high hazard zone. Similarly for Tingtibi, the low, medium and high hazard areas are 31% (42acres), 22% (29 acres), and 47% (63 acres) respectively.

Infrastructure development works may be carried out in low hazard areas with some geotechnical measures and normal engineering practice. In case of medium hazard, developmental activities may be allowed but only after carrying out proper remedial measures as proposed in their report. High hazard zones are recommended to be developed in to green belt, however, in case of unavoidable circumstances to construct in such high hazard area, a separate ‘Site Specific Geotechnical Report’ and ‘Geotechnical Letter of Assurance’ be prepared by a competent Geotechnical Engineer.

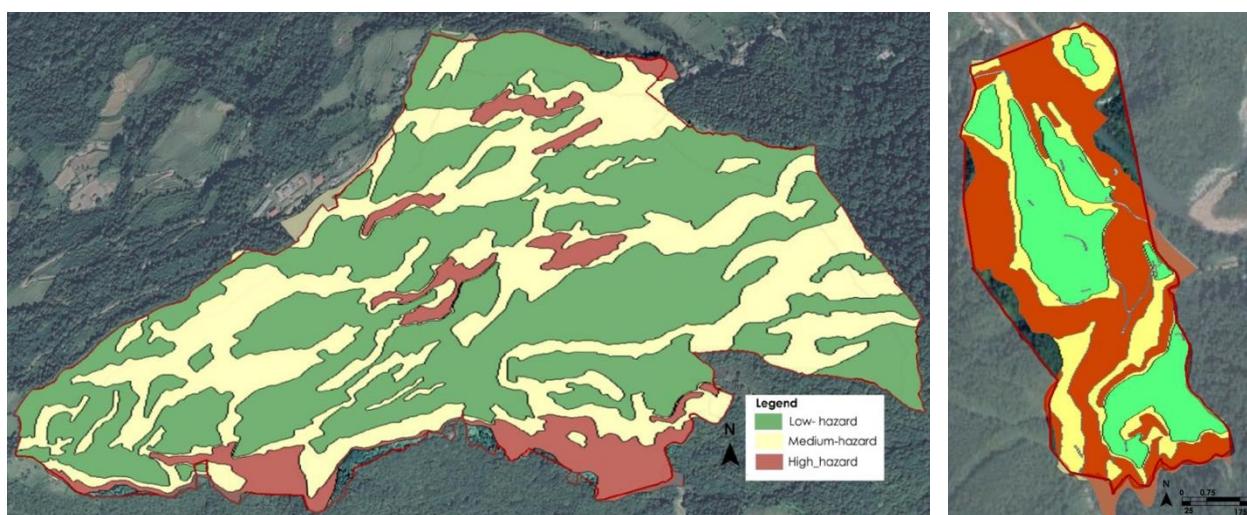


Figure 2. 4 Hazard map of Zhemgang (left) and Tingtibi(right)



## 2.4 Comprehensive National Development Plan (CNDP) 2030

CNDP is the spatial development plan encompassing the entire national territory. This plan is first of its kind which attempts to envisage the national spatial structure in terms of its coherence with the socio-economic development and sector strategies formulated by the Royal Government of Bhutan. The plan ultimately aims to promote well balanced development between the urban and rural area across the entire country.

### 2.4.1 Domestic and International Academic Linkage

CNDP (2030) identifies academic potential in the south-central region of the country since this region of the country has no academic institutions. A research Centre for material engineering, natural resource management, or emerging agriculture was assessed to be required in Zhemgang District as there is already well established agriculture institute, Rural Development Training Institute (RDTI) within the Thromde area. However, a detailed assessment/study needs to be carried out to propose for agriculture/mineral engineering research institute.

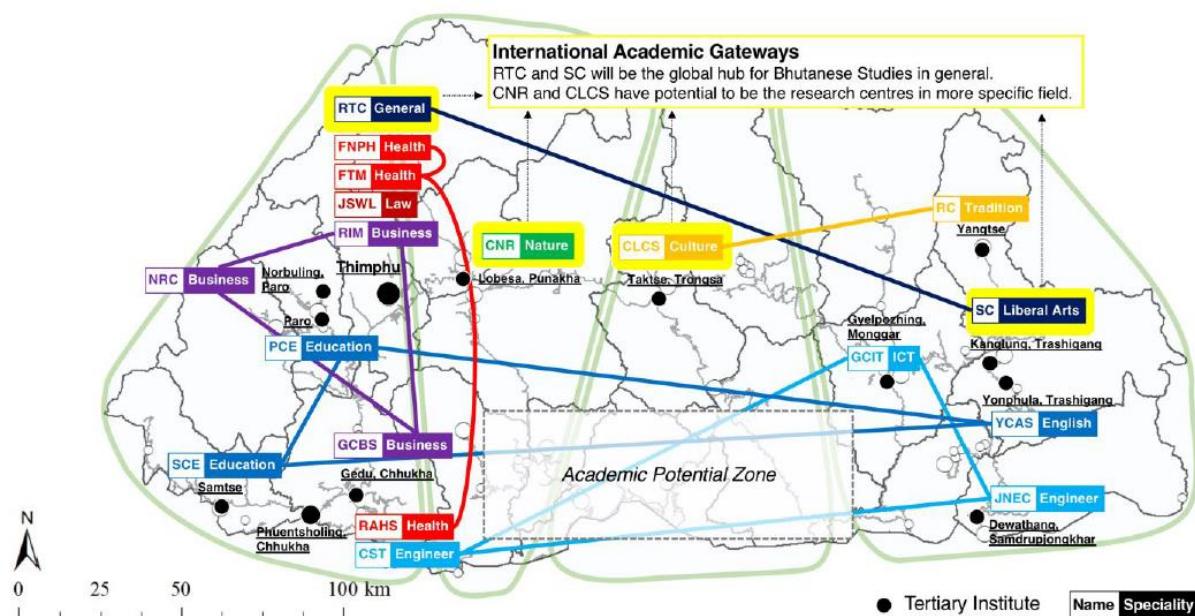


Figure 2. 5 Domestic and International Academic Linkage (CNDP report)

### 2.4.2 Creation of Holistic Tourism Network

The direction of tourism development in Bhutan is sustainable tourism, such as nature tourism, agro-tourism, specific and special place tourism, wellness tourism, and eco-tourism, which is in line with the “High Value, Low Impact” policy. Each destination is clearly characterized by its tourism resources and the potential to encourage international tourists



to stay longer and become repeat visitors. CNDP identifies this central zone comprising Bumthang, Trongsa and Zhemgang districts as the culture and nature experience destination.

Zhemgang has been an unexplored area for tourists because of its isolated location and protected area. However, it has a landscape with traditional culture, rich flora and fauna, hot springs etc., which attract many tourists. Hence, it is expected that tourists arriving in Bumthang will visit Zhemgang for an eco-trail connecting Sarpang, namely, from Thrumshingla National Park to Manas National Park. Zhemgang will be a significant base on this spectacular eco-trail.

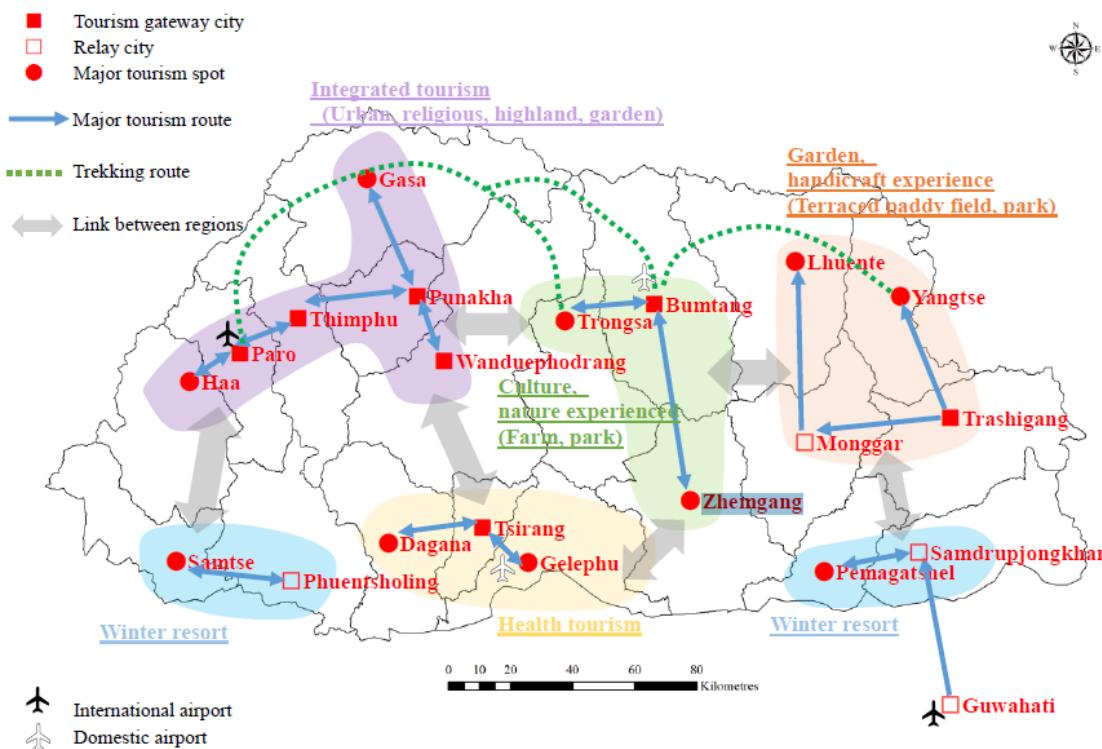


Figure 2. 6 Map showing the future tourism zone (CNDP report)



### 3 EXISTING SCENARIO

#### 3.1 Physical Environment

##### 3.1.1 Climate

Zhemgang Dzongkhag experiences a broad climate ranging from sub-tropical in the south to alpine in the far north. The altitude of southern part of Zhemgang on Indian plains are as low as 100m while those high peaks on the northern boundaries to Bumthang and Trongsa are as high as 4500m. The monsoon starts from May and lasts till September.

The Zhemgang town is located at an altitude of about 1754-2117 meters above sea level with an average temperature of 3-4°C in winter to 27°C in summer. The annual precipitation of the town is about 1500mm. The elevation of Tingtibi ranges from 520 meters to 697 meters above the sea level. The average temperature ranges from 17-32°C. Since it has sub-tropical micro-climate, the annual precipitation of the area ranges from 2000-4000mm.

Zhemgang Dzongkhag is divided into three geological zones; i. Highly erodible sediments in the south, ii. Well-developed soils in the middle, and iii. Hard rocks and young soils in the north. Zhemgang is traditionally divided into three agro-ecological zones (Khengrig-Nam-Sum); i. Upper Kheng (*Phikhor-Bardo* and *Shingkhar*), ii. Middle Kheng (*Nangkor-Trong* and *Nangkor*), and iii. Lower Kheng (*Tamachok- Bjoka*, *Nangla*, *Phangkhar* and *Goshing*). Both Zhemgang and Tingtibi town fall under the Middle Kheng of the three agro-ecological zones.

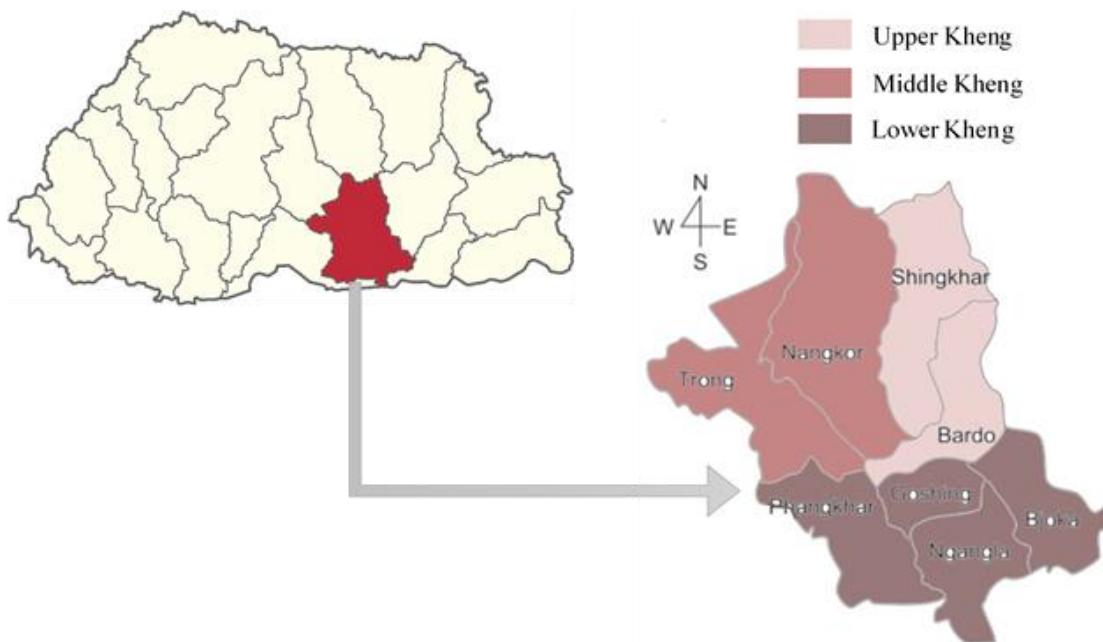


Figure 3. 1 Image showing the three agro-ecological zones of Zhemgang



### 3.1.2 Topography and land features

The Zhemgang town is situated on a high ridge overlooking the Mangduechhu Valley, predominantly orientated on a southwest-facing slope. The entire Zhemgang town falls within the Mangduechhu watershed catchment area due to the numerous small tributaries in the area. The topography of Zhemgang town is characterized by dissected mountain ranges, steep slopes, narrow valleys, and little flat land while Tingtibi is characterized by river plateau basin surrounded by ridges. The slope profile of Zhemgang and Tingtibi town is shown in the figures below. As evident from the figures, Tingtibi has a relatively flat terrain compared to Zhemgang town.

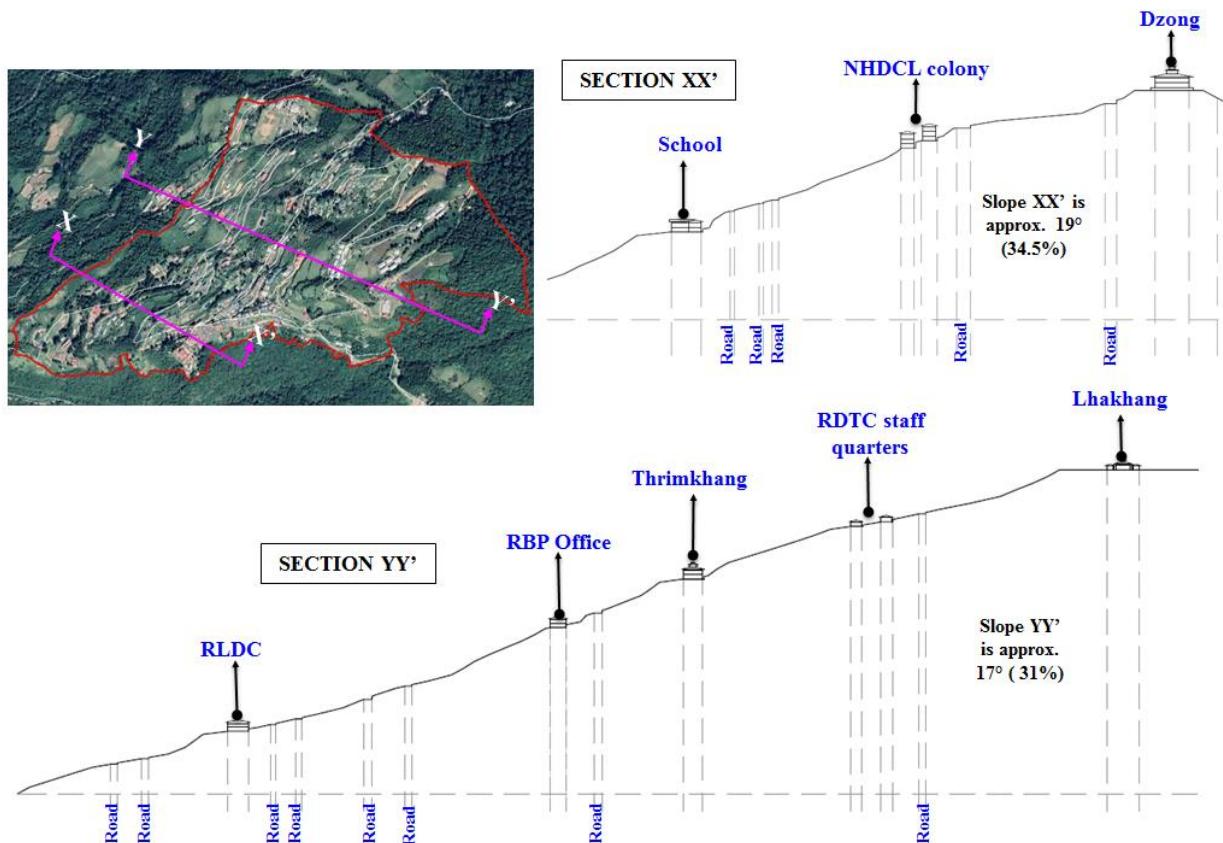


Figure 3.2 Slope profile of Zhemgang town



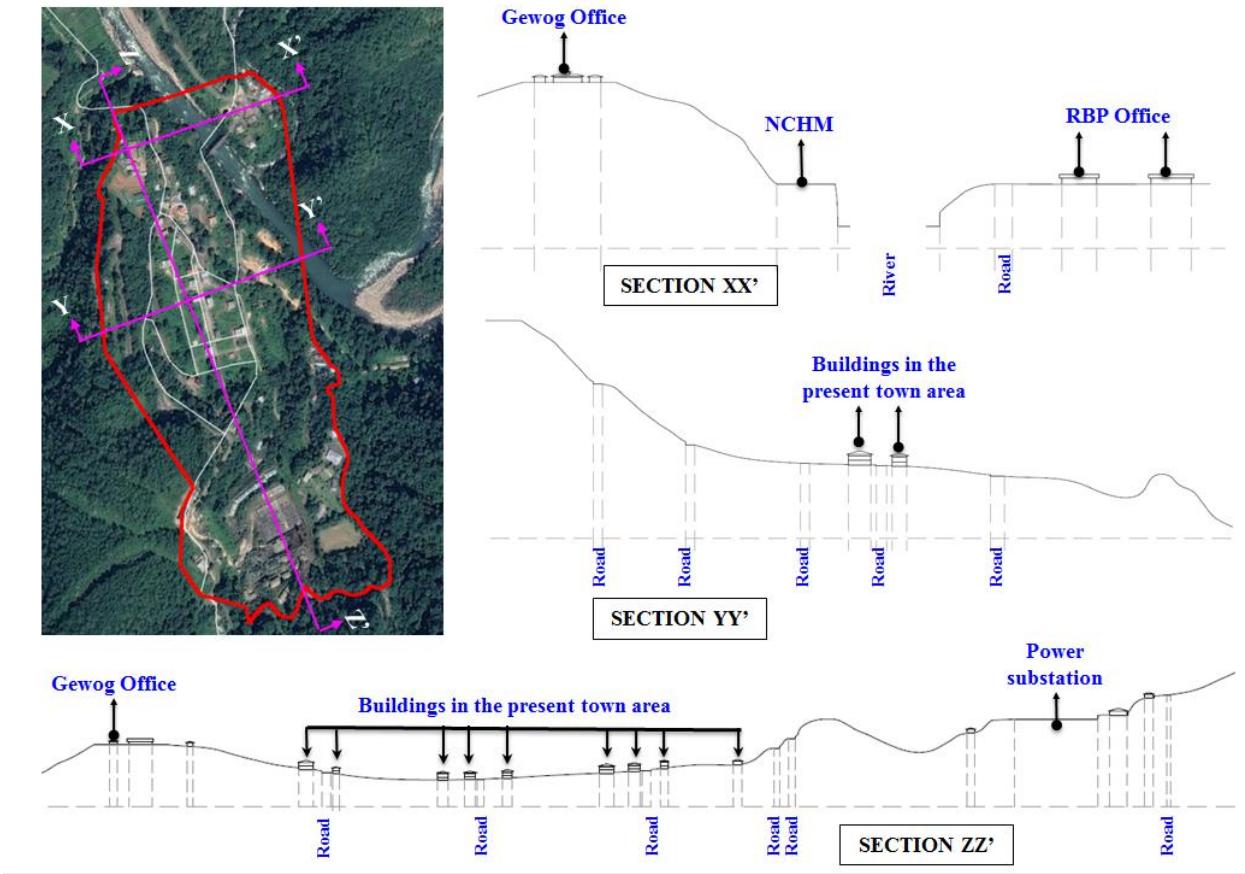


Figure 3.3 Slope profile of Tingtibi town



## 3.2 Existing Land Classification

### 3.2.1 Plot Ownership

In Zhemgang town, there is a total land of 274.54 acres. Of these a total of 139.27 acres are owned by the government institutions. The private plots hold the second largest of the total land comprising of 25% followed by 16% unregistered State land which are comprised mostly of steep slopes, gullies and forest plantation. 5% registered under religious body (Dratshang and community land) and 3% registered under corporation.

ZHEM GANG			TINGTIBI	
Land use	Area(a cres)	No.	Area(a cres)	No.
Private	67.97	233	11.28	68
Government	139.27	26	24.9	13
Corporation	7.17	22	14.5	8
Religious body	14.64	7	0.46	1
state	45.5	-	84.69	

Out of 135.83 acres of total land in Tingtibi, 24.9 acres are owned by the government institutions. The private plots hold the second largest of the total land comprising of 25% followed by 16% unregistered State land which are comprised mostly of steep slopes, gullies and forest plantation. 5% registered under religious body (Dratshang and community land) and 3% registered under corporation.

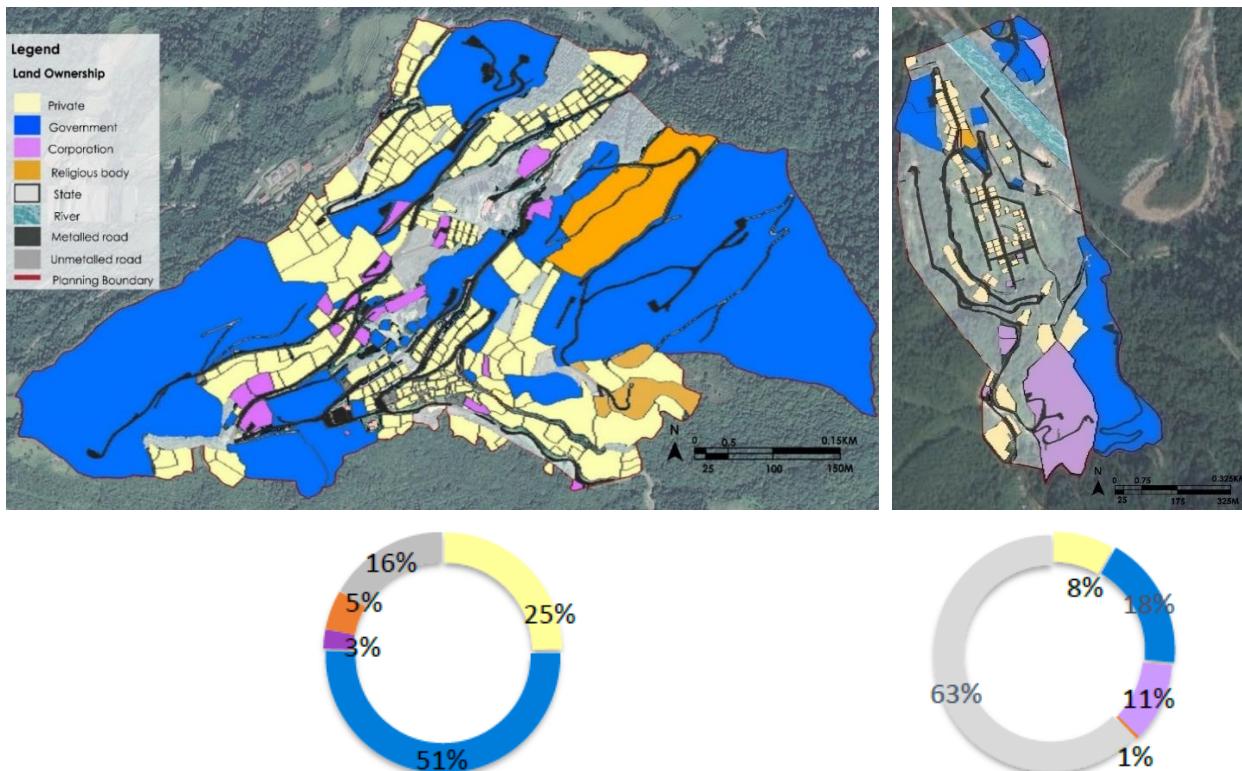


Figure 3.4 Plot ownership composition of Zhemgang and Tingtibi



### 3.2.2 Land Use Pattern

The study of land use plays an important role as it gives the whole details of how the land is used and what are the various components which accumulate to consume the land and make it functional. It also gives an idea as to how various land uses are inter-related and in what percentage they are distributed.

The most predominant land use is *Institutional* with more than 69% of all land in Zhemgang Town falling under it. Residential land constitutes 26% which is followed by Commercial comprising 3% which is mostly located in existing core town and kamzhing comprising of 2 % located above water treatment plant.

Similarly, for Tingtibi town, the most prominent land use is Institutional land comprising of 67% followed by Kamzhing with 21%. The commercial land use constitutes about 6%, located at the existing town core which can be attributed mostly to the small sized plots in the town core. The residential land comprises of 6 % mostly located below gup office.

Land use	ZHEMGANG		TINGTIBI	
	Area(acres)	No.	Area(acres)	No.
Residential	2.79	21	59.2	205
Institution	31.5	12	158.20	46
commercial	2.9	37	5.87	29
Kamzhing	9.54	13	5.7	7
Oranges	3.11	7	-	-

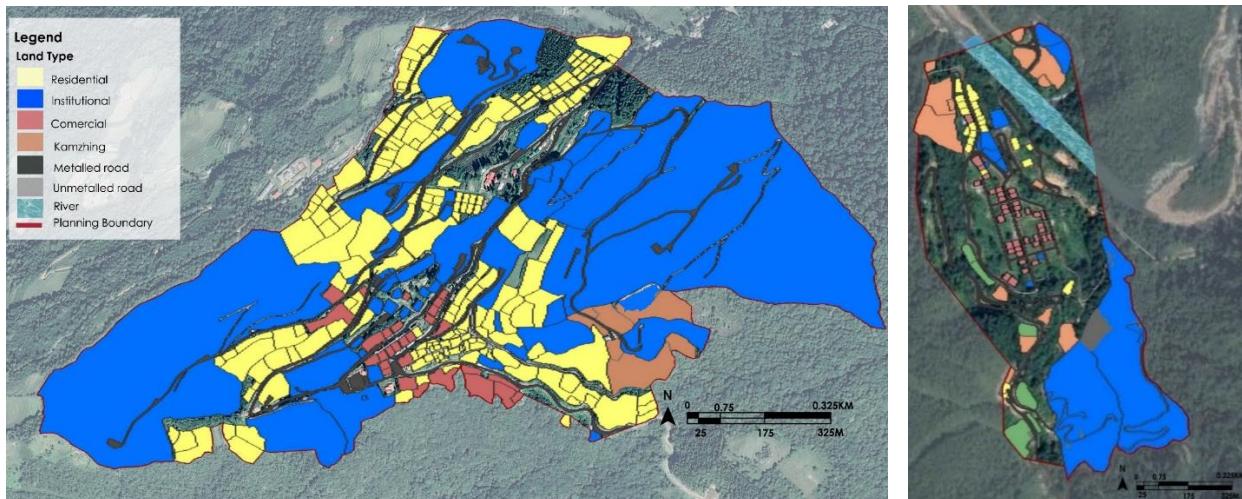


Figure 3. 5 Land User pattern of Zhemgang and Tingtibi



### 3.2.3 Plot Size Classification

The plot size analysis of all registered plots in Zhemgang town shows that majority of the plot constituting 95% of all plots or 219.9 acres have sizes greater than 13 decimals while only 2. % have sizes between 10 to 13 decimals and 2% or 5.17 acres of land have sizes less than 10 decimals. Since the whole of Zhemgang is located on slope, it is good to have plots with sizes more than the standard urban plots. This is also critical if Land Pooling scheme is to be employed for detailed local area plan preparation.

The majority of the plot in Tingtibi constituting 98% of all plots or 57.26 acres have sizes greater than 13 decimals while only 1% or 12 numbers of plot have sizes between 10 to 13 decimals and another 1% or 41 number of plots have sizes less than 10 decimals.

Plot Sizes (dec)	ZHEMGANG		TINGTIBI	
	Area (acres)	No	Area (acres)	No
<10	5.179	75	3.28	41
10-13	3.99	35	2.4	12
>13	219.9	178	57.26	37

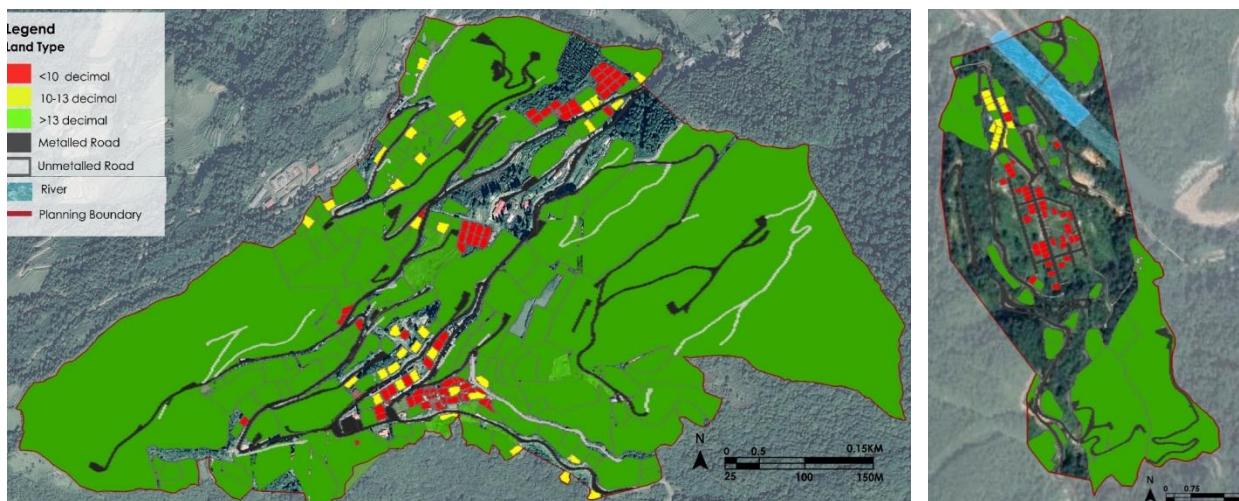


Figure 3. 6 Plot size classification of Zhemgang and Tingtibi



### 3.3 Existing Built Environment

#### 3.3.1 Building Typology

Most of the habitable structures in Zhemgang town are permanent buildings which are earmarked in red colour as shown in the map below.

The traditional and vernacular structure in Trong village and other traditional structure with ekra wall are also categorized under permanent structure, with this the permanent structure constitutes of 47%. Semi-permanent structures consist of about 9% of all structures while temporary structure comprises 44%. However, the temporary structures comprise of mostly animal sheds and ancillary structures like kitchen and toilets. These ancillary structures are mostly present in Trong village settlements and old DOR housing colony.

Meanwhile in Tingtibi town, there are 203 structures wherein the permanent structure constitutes of 45%. Semi-permanent structures consist of about 46% of all structures while temporary structure consists of 9%. However, the temporary structures comprise of mostly animal sheds and ancillary structures like kitchen and toilets.

Typology	ZHEMGANG		TINGTIBI	
	Nos	%	No	%
Permanent	271	47	91	45
Semi- Permanent	52	9	19	46
Temporary	259	44	93	9

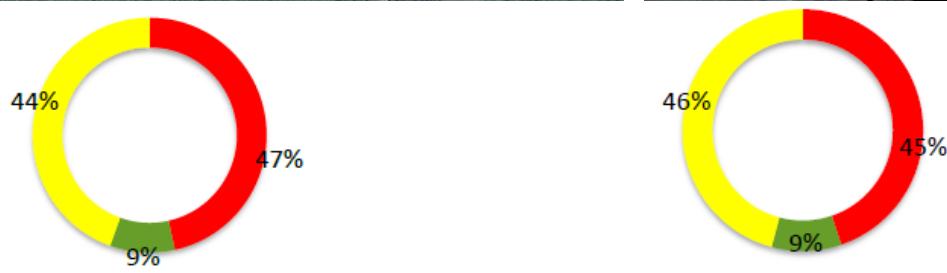
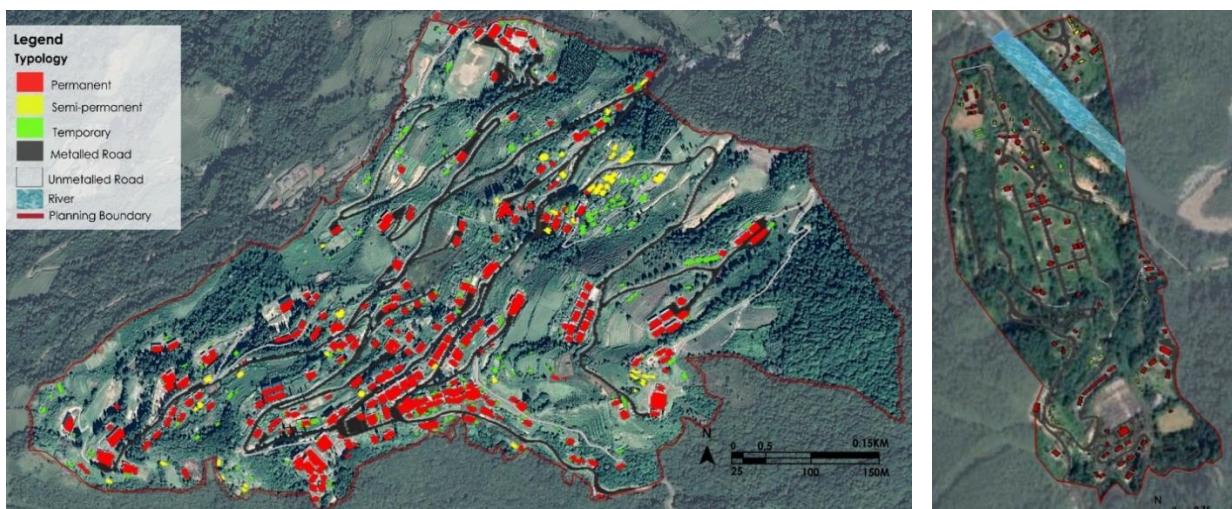


Figure 3.7 Building typologies of Zhemgang and Tingtibi



### 3.3.2 Building Height

The building height is an important consideration in planning as it can strongly influence the character and the image of a place. It also has a direct impact on the intensity of development in an area. Consequently, building height needs to be properly managed.

Out of 582 buildings in total, 84 % of all structures are of one floor and accounts for habitable spaces as well as store, garages, toilets and animal shed. It is followed by two storied structures comprising about 13% of all structures while 3 % are 3 storied buildings. There are 2 buildings which are more than 3 floors. There are about 3 structures with attic in Zhemgang town. Similarly, there are 2 structures with attic in Tingtibi town. About 3% of the structures in Tingtibi town are of 3 storied followed by two storied structures comprising about 11%. Rest of the structures are of one storied which comprises about 85%.

Height	ZHEMGANG		TINGTIBI	
	Nos	%	Nos	%
G	487	84	172	84.7
G+1	73	13	22	10.8
G+1+Attic	2	0.3	2	1
G+2	17	3	7	3.5
G+2+Attic	1	0.17	-	-
G+3	1	0.3	-	-

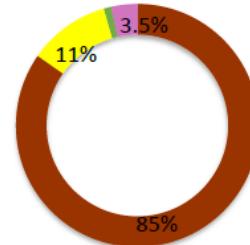
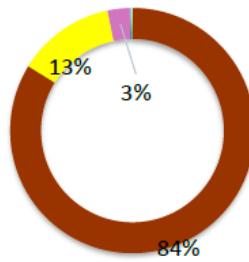
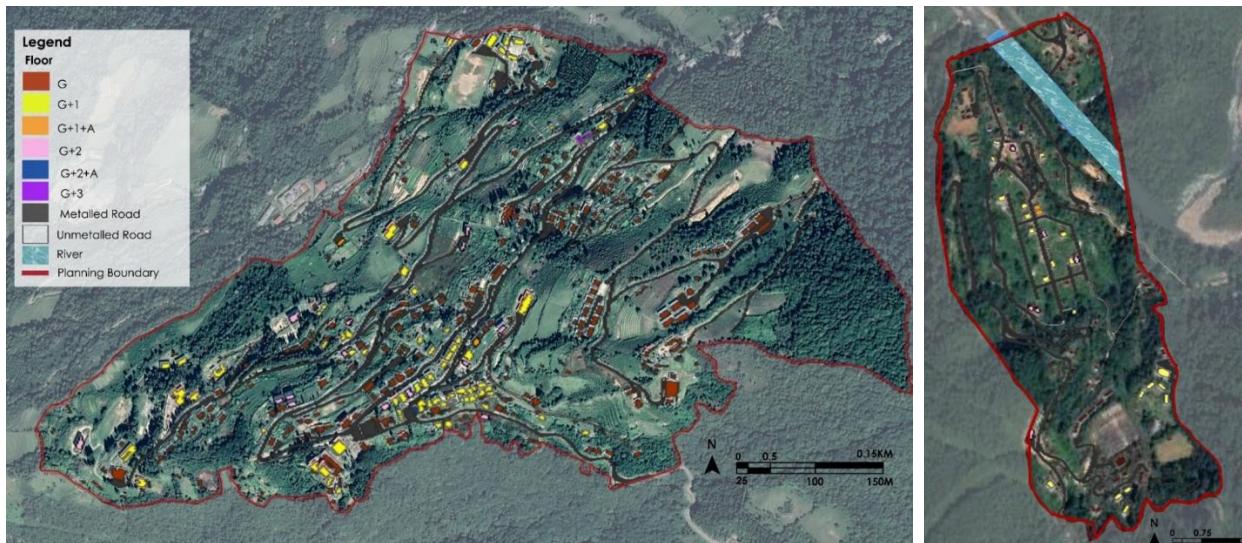


Figure 3. 8 Building Height of Zhemgang and Tingtibi



## **3.4 Existing Infrastructure and Amenities**

### **3.4.1 Social Infrastructures**

Social infrastructure is the interdependent mix of facilities, places, spaces, services and network that maintain and improve the standard of living and quality of life in a community. Moreover, it will also include any infrastructure that goes beyond basic economic functions to make a community an appealing place to live in. It is of utmost importance to provide the social infrastructures in order to:

- Improve health and wellbeing
- Encourage social inclusion
- Provide access to facilities and services
- Enhance economic development
- Create sustainable communities

#### **Institutional Establishments**

Owing to its strategic location, Zhemgang is found to be an ideal location for institutions and offices with regional interests. Though such interests are constrained by the limited space, a number of offices have already been established. About 70% of the total of 274.54 acres land constitutes of institutional establishment. These institutions include Dzongkhag Administration, Dratshang, Royal Guest house, Royal Bhutan Police, Bhutan Power Corporation, Lower and Higher Secondary School, Bhutan Post Office, Dzongkhag Court and Rural Development Training centre.

Whereas for Tingtibi 32.8% of the total 135.83 acres of land constitute institutional establishment. These institutions include Gewog office, Tingtibi lower secondary school, Bhutan Post office, Metrological office, Bhutan Power Corporation and institutions such as Royal Bhutan police, DOR and forest office is located at entrance of Tingtibi town.

The presence of these national level and regional level institutions at Zhemgang and Tingtibi can be seen as a great advantage for such a small town. These strengthen the economic base, ensuring an inflow of capital as well as add vitality to the area.



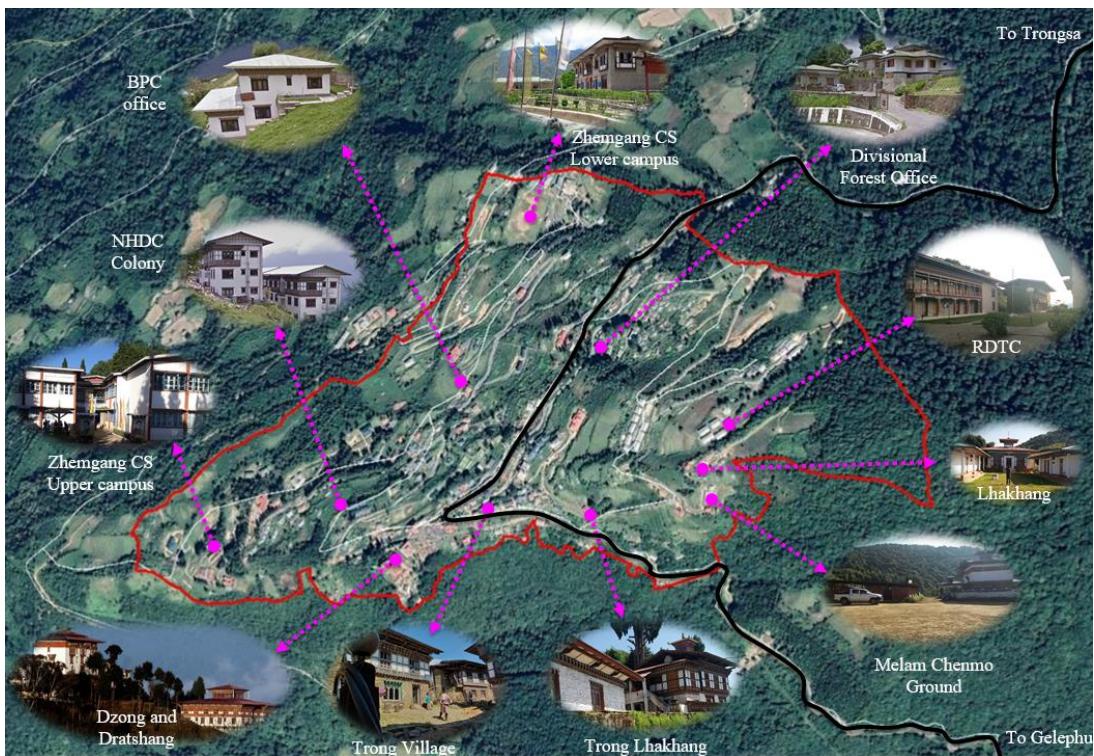


Figure 3. 9 Amenities within Zhemgang town

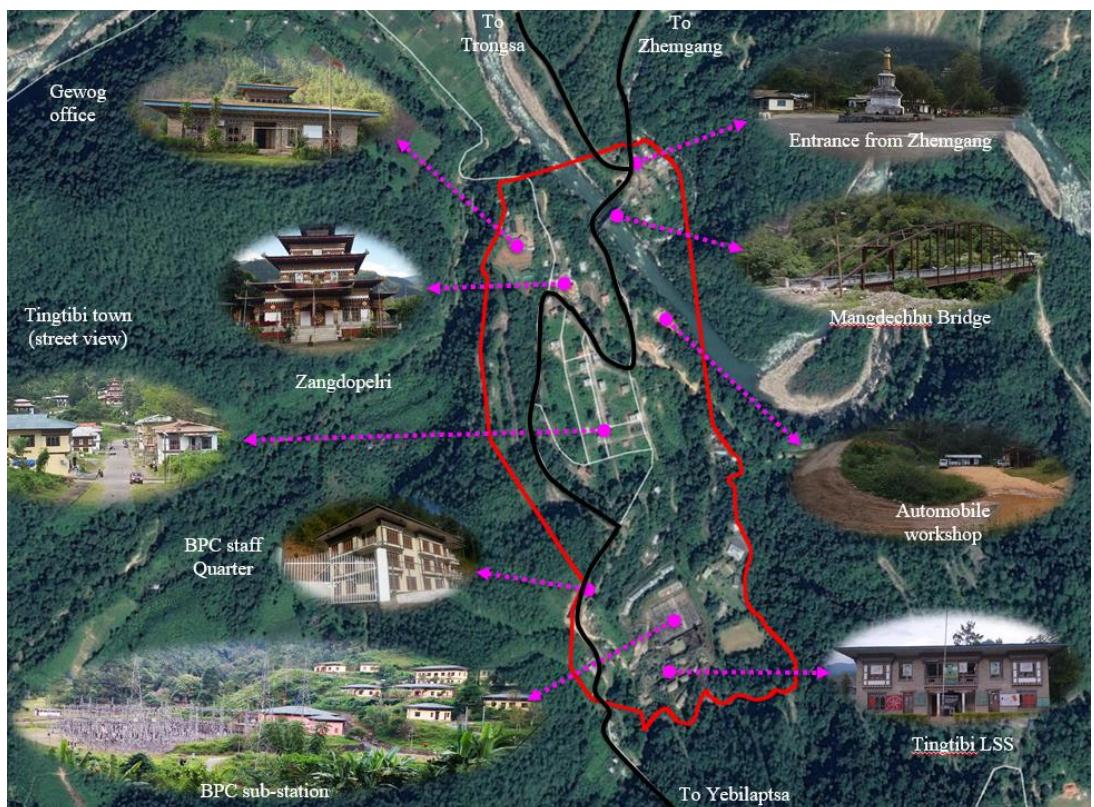


Figure 3. 10 Amenities with Tingtibi town



## Dzong

Religious and heritage assets provide the inhabitants with both passive as well as spiritual, forms of recreation. They are special as they offer peace and a serene ambience. Thus, it is

important to assess the present scenario of the heritage structures, which are an integral part of this religious and traditional society. The Dzong is situated on top of the hillock. In 1655 AD, the Dzong was built on the site of a hermitage that was completely destroyed by two fires and an earthquake. Following the creation of Zhemgang Dzongkhag in 1963 the Dzong was restored. There is also a Monastery (Dratshang) with a Lam Neten and monk body within the Dzong premises.



## Trong village

Trong village is believed to be the first settlement within the Zhemgang Thromde and it is located at the heart of the town. The village is located approximately about 230 m up the ridgeline from the Dzong and has a Lhakhang at the top of the village. The houses are built along the ridgeline on either side of a narrow road that has been implemented as part of the Trong Village LAP for firefighting and emergency purpose. The Trong village is characterised by its dense and clustered residential development with most houses attached to each other. The households within the village represent the largest proportion of the original inhabitants of the town.

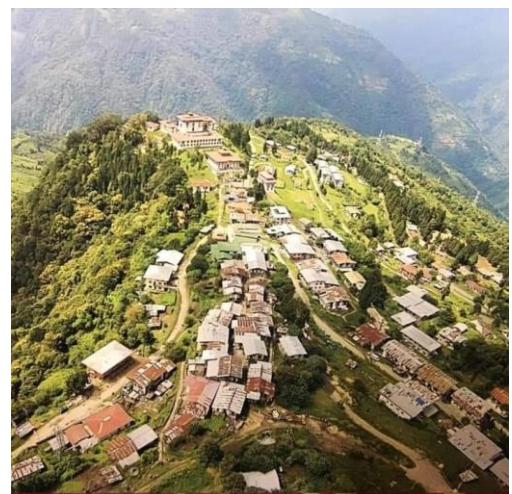


Figure 3. 11 Image of Trong village



Trong Village is believed to first settle sometime in the 16th Century when Lama Shang established his hermitage on the outcrop presently occupied by the Dzong. In addition to its unique history surrounding Lama Shang, the buildings are a treasure-trove of Bhutanese architecture due to which the village was declared a “heritage village” in 2003 as per the recommendation in the Zhemgang Urban Development Plan 2003-2023. With the command of His Majesty, the King during his visit to Zhemgang Dzongkhag in 2014, the village was preserved as a heritage village. The residents willing to preserve their houses were granted a plot each as kidu and allotment was carried out based on the Trong Subdivision Plan prepared in 2016.

### **Trong Lhakhang**

The two-storey TrongLhakhang is located above the Trong village, overlooking the magnificent Zhemgang Dzong. The villagers seek the protection of Palden Lhamo Remati in difficult times, or when people have some projects to accomplish. The temple is a traditional Bhutanese stone structure with an enclosed flagstone courtyard. There are also other community Lhakhang located above the existing water treatment plant.

### **Recreational Spaces**

The existing recreation spaces in Zhemgang comprises of the two children’s park, the two archery ranges and the games and sports facilities in the two schools. As for Tingtibi, there seems to be no developed recreational space other than the Zangdopelri. The recreational open spaces proposed in the plan are mostly not developed and hence the towns lacks in presence of green open spaces that could serve to all age groups.

Zhemgang, though being a settlement embedded within a forest landscape, lacks organized and defined open spaces. Most of the existing open spaces within Zhemgang Thromde are incidental, disjointed and rather loosely organized in the fabric. In case for Zhemgang town, the existing open space which acts as children’s playground below ECCD are hardly used due to lack of direct access to the park and also the footpath leading to the park are not maintained properly.

The existing forest along the steep slopes forms an integral part of the existing open space system within the town. These densely vegetated patches of slopes need to be identified and efficiently compounded with the existing open space system. There is a need to recognize and re-design the existing open spaces as well as identify the open space within the residential area.





*Figure 3.12 Image showing open playground and multipurpose open space at Zhemgang and Tingtibi Respectively*

### 3.4.2 Physical Infrastructures

#### Circulation Network

The primary national highway, the road to Trongsa and Gelephu Dzongkhag forms the major spine of Zhemgang as well as Tingtibi town. Road leading to the institutions and public facilities are black topped. However, the existing roads are narrow while other access roads leading to adjoining Gewogs and hinterland villages are un-metalled. The metaled road within the Thromde constitutes 20.7 kms in distance while un-metalled road constitutes 13.8km.

Network of off-street pedestrian pathways connecting the nearby residential area to the town core and institutions have been developed in Zhemgang Thromde as part of the structure plan implementation. The off-street footpaths are seen in abundance which are used as short-cuts owing to its steep topography. However, most of the footpath needs to be enhanced and managed well.

For Tingtibi the primary road to Trongsa and Gelephu Dzongkhag forms the major spine of the town, with roads branching at intervals and act as primary road. All the institutions and public facilities like Dzongkhag Administration, Dratshang, and existing are black topped. However, the existing road is narrow while other access roads leading to adjacent gewogs and hinterland villages are unmetalled.

The metaled roads within the Thromde constitute 14 km while un-metaled road constitutes 2.92 km.

Network of off-street pedestrian pathways connecting the nearby residential area to the town core and institution have been developed as part of the structure plan implementation.





Figure 3. 13 Circulation network of Zhemgang and Tingtibi town

### Water Supply

The water supply network for Zhemgang town comprises of two water source, namely Dechengang stream and Sershong stream. Dechengang stream is 5kms from the town with Reservoir (capacity-140 cum) and has a yield of 2lps (can serve about 700 persons which is not adequate to cater the demand of the town. This scheme was constructed in the year 2003-2004 funded by the World Bank. Existing Raw Water Main pipe is 100mmdia which connects to the WTP. The water treatment plant is located above the Trong village in Tshothang.

Water supply to service area is supplied entirely by gravity flow and most of it is under intermittent water supply. The water treatment plant is a conventional process- slow sand filtration and chlorinating with capacity of 0.75 MLD. The Reservoir tank capacity is 253.5 m<sup>3</sup> capacities with distribution network of 50mm dia, 80 mm dia and 100mm dia GI. Pipes.

The town also has an additional source (Sershong-I) with a yield of 1 lps (can serve 350 persons) and is being connected to the water treatment plant through a 100mm HDPE pipeline.

In 2014-2015 - Construction of collection tank at the existing intake (at source Sershong -I) to accumulate the water from three other sources (existing source Sershong -I and the 2 new sources (Sershong chu and Bokcer chu) and relaying of 90mm dia. HDPE pipes to connect these 3sources.





**Figure 3.14 Image showing WTP (Slow sand filters) and Clear Water Reservoir at Zhemgang town**

The main challenges are: -

Drying of water sources, low efficiency of the treatment plant and frequent breakdown of cesspool.

### **Sanitation**

In Zhemgang Thromde, majority of the population depends on an individual onsite septic tank and soak pit. All household and institution depend on an individual onsite system (Septic tank and soak pit) which is periodically cleaned with the assistance from Dzongkhag Administration.

With the increase in population, there is a need to re-conceptualize the sewerage system Zhemgang by construction of new sewer lines and communal septic tanks especially for Trong area and in Tingtibi area owing to the relatively smaller plot sizes.

### **Solid waste management**

Solid waste from Zhemgang town is collected, transported and dumped in an open landfill located, about 3km from the town towards Tingtibi. The solid waste management system is run efficiently by the municipality with door-to-door collection thrice a week for Zhemgang and twice a week for Tingtibi town. There is a lack of waste segregation at the moment.



**Figure 3.15 Image showing door to door collection of waste by the Zhemgang thromde.**



## **Drainage**

The storm water drainage system of Zhemgang and Tingtibi town consists of a natural drainage system, together with constructed open drains. The existing drainage along the paved road is served by lateral, mainly constructed open drain. There is no proper storm water drainage system beyond the immediate vicinity of individual houses. Consequently, storm water often follows the nearest road or the natural depressions making its way down to the main rivers. This is undesirable and risky situation which is compounded by the area's topography and land forms.

## **Fuel Station**

The Existing fuel station in Zhemgang town is located at the end of existing Thromde Boundary along Trongsa/Gelephu highway. Since the fuel station is located away from settlement and also there is scarcity of suitable land, it will be retained in the existing location. As for Tingtibi the Existing fuel station is located below the town away from the settlement. Since both the existing fuel stations are located away from settlement, they will be retained in the current location.



*Figure 3. 16 Image showing existing fuel station at Zhemgang and Tingtibi town*

## **Vegetable market**

The existing one-storey vegetable market structure is built below the Zhemgang town core, adjacent to the Children's Park. The vegetable market sheds are constructed for the sale of vegetables and meat items. However, at the moment the market is non-functional as the vegetables are mostly sold from the retail outlets in the town core. There is no vegetable market in Tingtibi, the retailers sell vegetables in the shops or sell outside the shops.





Figure 3.17 Image showing existing vegetable market at Zhemgang town

### Parking

The parking for both heavy and light vehicle parking is constructed at the core of the town, below the Trong village. Most of the vehicles are parked along the road which causes traffic congestion. As for Tingtibi town, there is adequate parking constructed at the core of Tingtibi town.



Figure 3.18 Image showing existing parking space at Zhemgang and Tingtibi town



## 4 ANALYTICAL STUDY

### 4.1 Demography

#### 4.1.1 Existing population

The Zhemgang Thromde has not seen growth in the population over the years. The population in Zhemgang Town was 2332 in 2005 and it has decreased to 2177 in 2017. Similarly, in 2005 Tingtibi had a population of 675 which has dropped to 534 in 2017(PHCB 2005, 2017). However, it will be inaccurate to conclude that there is a decrease in the overall population in Zhemgang Thromde based on the population data of the two years that are a decade apart.

#### 4.1.2 Population projection

Therefore, the population projection for the plan period 2020-2030 has been assumed to be the same. This is also based on the assumption that within the time period of 2020-2030, the proposal as per the CNDP such as improvement in agricultural techniques/methods and other proposals shall be initiated that will also have influence on the growth. The population is projected to grow at a constant rate of 1. 95 percent (national average urban growth rate) annually till 2040.

The total projected population in Zhemgang Thromde in 2040 is 3289, an addition of 578 people. Assuming densities of 120 persons per hectare, an additional area of 11.90 hectares would be required to accommodate the additional population in 2040.

*Table 4. 1 Population projection for Zhemgang and Tingtibi town*

Population projection for Zhemgang				Population projection for Tingtibi		
Sl.No	Year	Growth rate	Population	Year	Growth rate	Population
1	2020	0.00%	2177	2020	0.00%	534
2	2030	0.00%	2177	2030	0.00%	534
3	2031	1.95%	2219	2031	1.95%	544
4	2032	1.95%	2263	2032	1.95%	555
5	2033	1.95%	2307	2033	1.95%	566
6	2034	1.95%	2352	2034	1.95%	577
7	2035	1.95%	2398	2035	1.95%	588
8	2036	1.95%	2444	2036	1.95%	600
9	2037	1.95%	2492	2037	1.95%	611
10	2038	1.95%	2541	2038	1.95%	623
11	2039	1.95%	2590	2039	1.95%	635
12	2040	1.95%	2641	2040	1.95%	648



## 4.2 Land Suitability Analysis

Land suitability analysis is carried out to identify developable land available within the proposed town area. Topography, climate, availability of natural resources and existing settlements are the major determinants for the suitability assessment for any settlements. Land on steep slopes and cliffs, under forest cover, under river protection zones and environmentally fragile areas are identified and marked for protection. While such areas are not suitable for urban development, they can form part of the town's open space system that would ultimately help to improve the quality of urban life. A land suitability analysis entails carrying out the following analyses.

### 4.2.1 Slope Analysis

The slope analysis studies the surface of the land and groups land parcels under different slope categories. This is useful to identify areas that are suitable for various developments or more importantly to help designate appropriate land uses.

In this analysis, land with slopes between 0 and 30% have been considered suitable for development while any land with slopes greater than 30% shall be considered only for restricted development, as is the practice in the country.

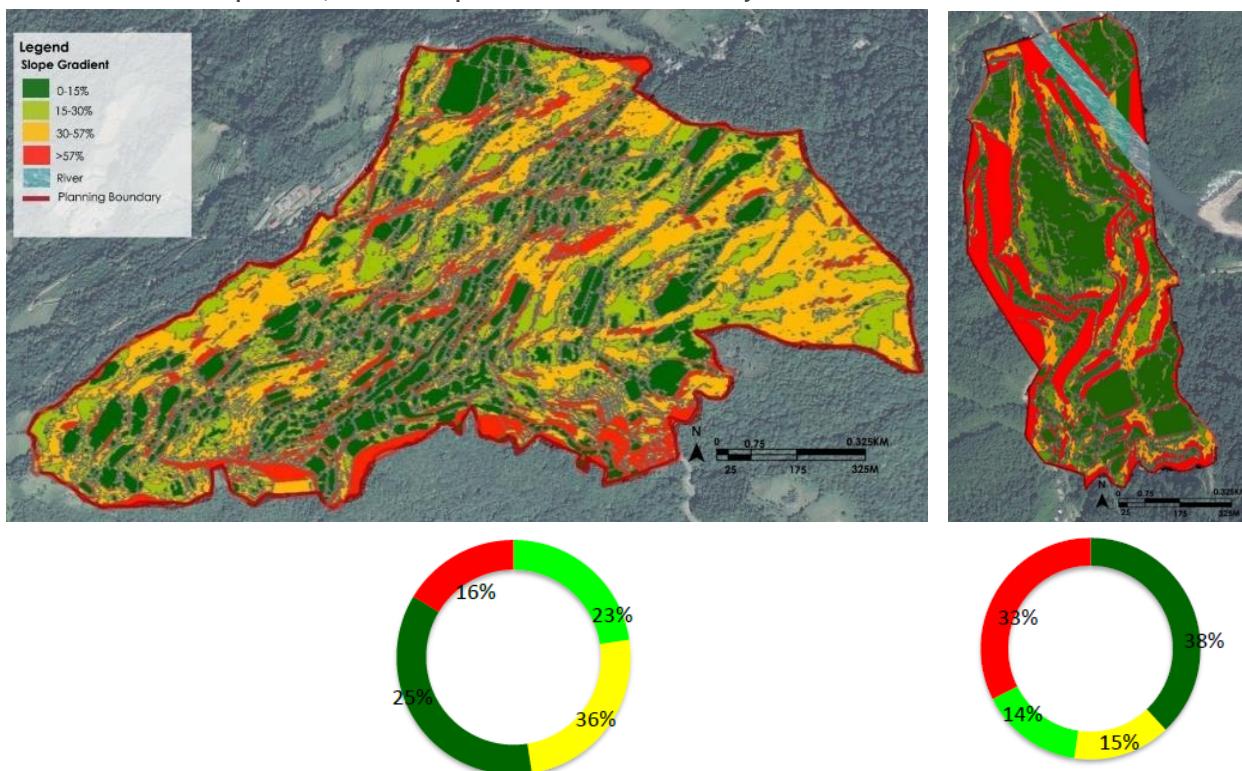


Figure 4. 1 Slope analysis for Zhemgang and Tingtibi town



*Table 4. 2 Slope analysis composition of Zhemgang and Tingtibi*

Slope	ZHEMGANG		TINGTIBI	
	Area (acres)	%	Area (acres)	%
0-15%	61.3	23	51.7	38
15-30%	67.2	25	19.4	14
30-57%	97.87	36	20.5	15
>57%	48.06	16	44.12	33

The analysis found that 52% (145.9 acres) of the site has slopes greater than 30% which will mainly be maintained as protected areas and only restricted development would be permitted.

The areas greater than 30% slope is not suitable for development due to reasons such as; development on these slopes involves cutting of slopes and dense forest which will gradually degrade the slope characteristics, affecting the soil stability and increase surface runoff. As the proposed town falls under watershed area, it is essential to protect the natural forestland.

Therefore, the net area available for effective development including those under institutional ownership is 48% (128.5 acres) for Zhemgang.

Meanwhile for Tingtibi town, 49% (64.62 acres) of site has slopes greater than 30% which will maintain as protected areas and 51% (71.12 acres) is available for development including those under institutional ownership.

#### **4.2.2 Geotechnical Hazard Analysis**

Comprehensive geotechnical study for Zhemgang Thromde was carried out in 2019 to understand the stability of all land within the Thromde. The objectives of the Geotechnical Investigations were to assess the geological stability and geotechnical feasibility of the area identified for the proposed development plan and map different levels of hazards; highlight the potential adverse impacts of the development project on the geological stability/geotechnical conditions; and to provide appropriate recommendations and mitigation measures. In order to achievement the above objectives, the Geotechnical Investigation (GI) works consisted of data collection encompassing geology, soil conditions, topography, hydrology, land-use, and other geotechnical aspects that could impose risk to the township development. Based on the data collected and site investigation, maps of geology, engineering geology, geomorphology and slope were prepared to show different hazards. In addition, the engineering properties of the surface soils were studied through trial pits, lab and field tests. Similarly, the quality of the rocks and rock slopes were assessed through standard rock quality rating systems.



Finally, a multi-hazard map for the Thromde was prepared which shows three classes of hazards, namely low, medium and high. The areas of the low hazard are considered to be more or less safe zones and suitable for all kinds of development. About 53% or 147 acres of the land in Zhemgang town fall under “low hazard”. These areas are relatively flat (0 to 20° slope) and free from geologic hazards so no mitigation measures are necessary for their development. However, normal engineering standards must be followed in these areas also. About 37% or 103 acres of the mapped area falls in the medium hazard zone. Construction for the development of infrastructure can be allowed in this medium hazard zones after carrying out the proper remedial measures. Only 10% OR 26 acres of the mapped area in Zhemgang town area falls in high hazard zone.

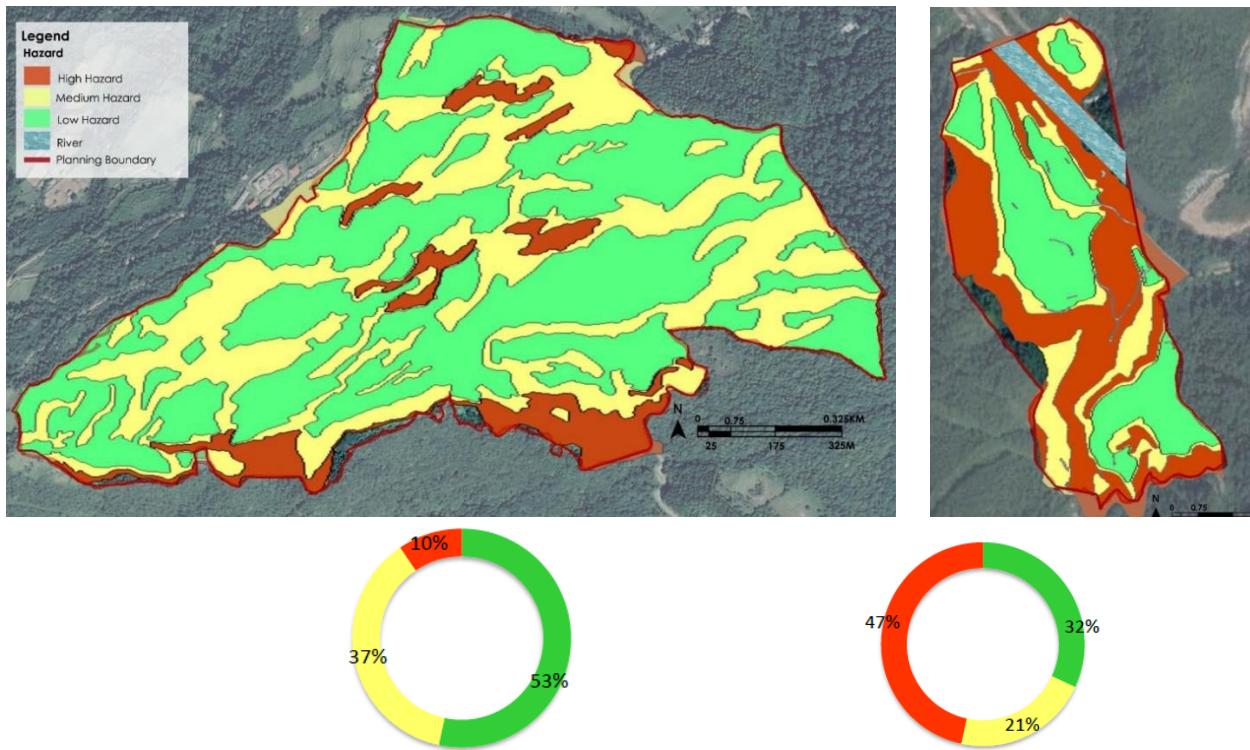


Figure 4. 2 Geotechnical Hazard analysis of Zhemgang and Tingtibi town

Table 4. 3 Hazard analysis composition of Zhemgang and Tingtibi town

Hazard	ZHEMGANG		TINGTIBI	
	Area (acres)	%	Area (acres)	%
Low	147.46	53	43	32
Medium	102.59	37	28.9	21
High	26.29	10	62.7	47



#### 4.2.3 River Buffer



Mangdechhu runs at the base of Zhemgang Thromde and cuts through Tingtibi Thromde boundary. For any planning purpose, there is a need to retain 30 metre river

buffer and 15m stream buffer in order to protect the river ecosystem and to mitigate the risks associated with flooding. Hence, a river buffer of 30 metres on both side of the river comprising of 2.53 acres of land has been set aside for the Mandechhu River in Tingtibi.

#### 4.2.4 High Tension Buffer



Due to the location of BPC substation and High-Tension line within the Thromde boundary in Tingtibi, there is a need to retain buffer from the High-Tension lines in order to avoid the negative effects associated with living under the high-tension lines. The area under High Tension line in Tingtibi amounts to 2.53 acres of land.



#### 4.2.5 Suitability analysis

The preceding analyses help to determine the areas that are suitable for development. These are the areas that are arrived at after identifying areas that fall either on steep slopes, environmentally sensitive areas or within flood protection areas along the rivers. Such studies are very critical, especially for places like Zhemgang which have steep slopes. In case for Tingtibi which have rivers running along its boundaries. Further, parcels of land have to be maintained as either green areas or open spaces for public safety and convenience reasons.

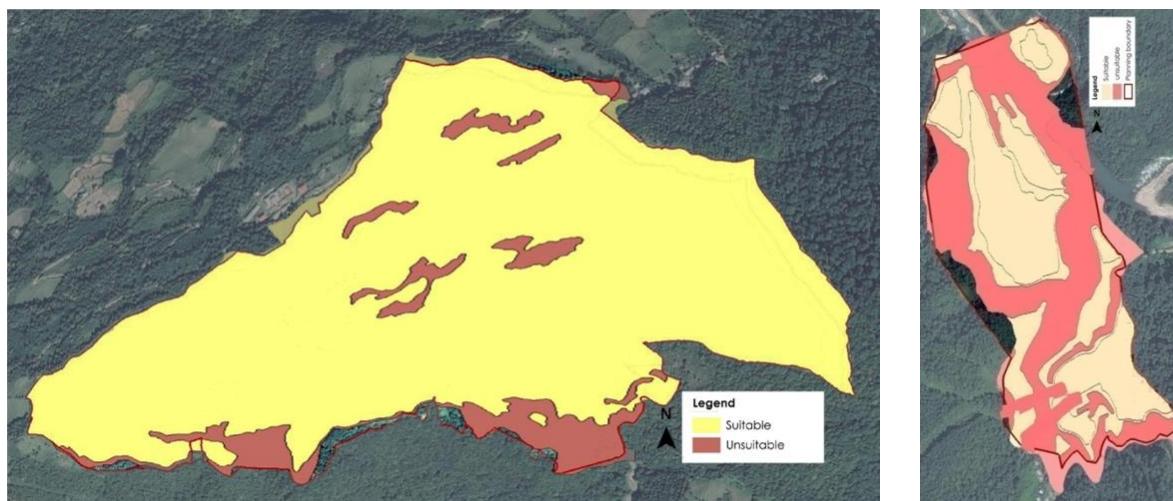


Figure 4. 3 Suitability analysis of Zhemgang and Tingtibi town

Table 4. 4 Suitability analysis composition of Zhemgang and Tingtibi town

Land Suitability	ZHEMGANG		TINGTIBI	
	Area (acres)	%	Area (acres)	%
Suitable	250.05	90	68.97	51.2
Unsuitable	26.29	10	65.63	48.7



### 4.3 SWOT Analysis

SWOT analysis identifies various strengths, weaknesses, opportunities and threats within the planning boundary which is basically the amalgamation of all the studies and analysis carried out pertaining to that area under plan preparation. As such, all the proposals including the concept of the plan and planning principles are developed based on the SWOT analysis. It is carried out separately for Zhemgang town and Tingtibi as they are located 35kms apart although they are under same Thromde boundary.

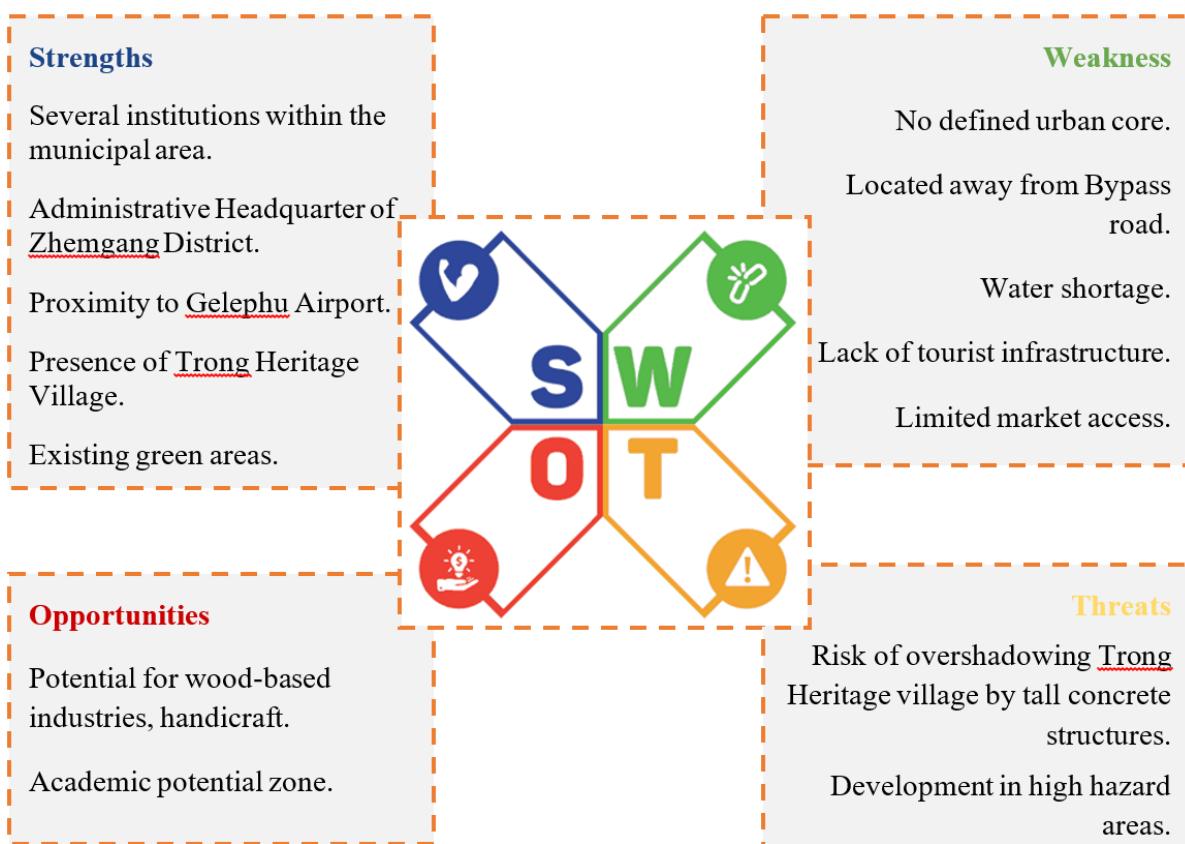


Figure 4. 4 SWOT Analysis for Zhemgang Town



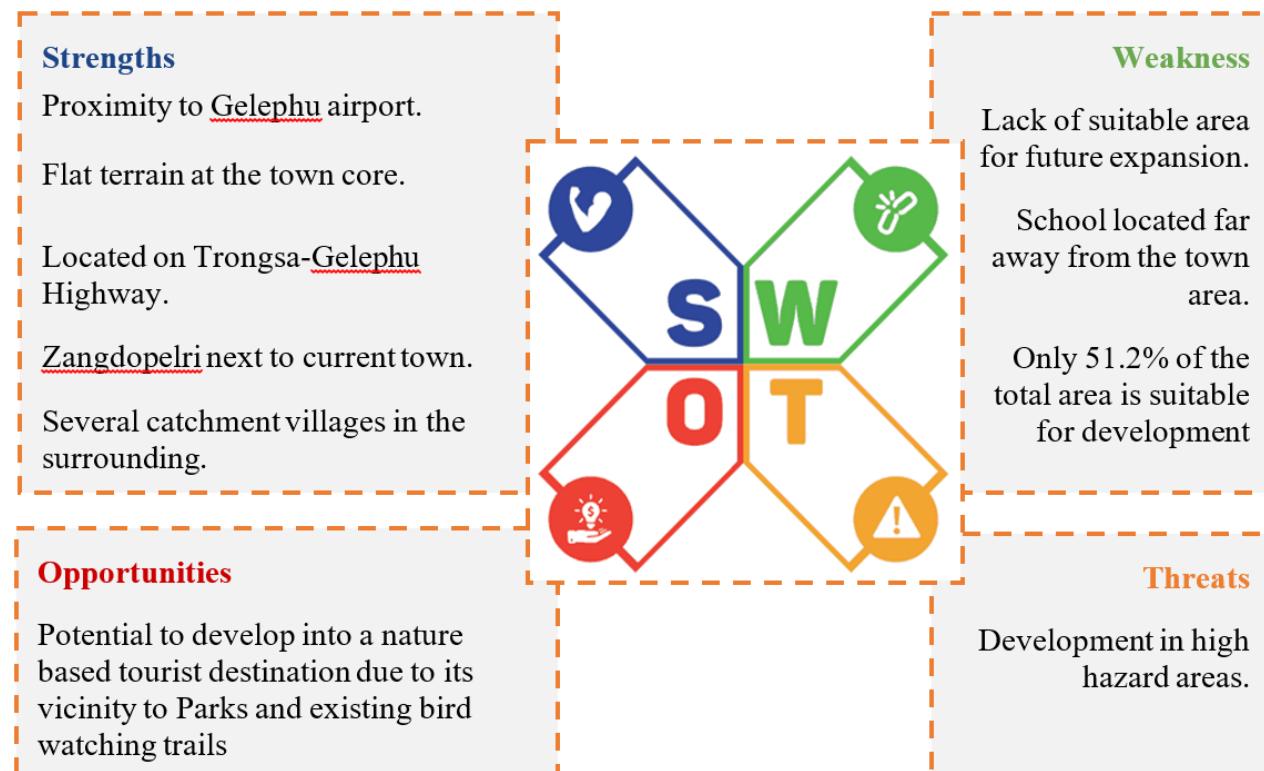


Figure 4. 5 SWOT Analysis for Tingtibi Town

#### 4.4 Socio-economic survey analysis

A socio-economic survey was carried out for number of households sampled randomly from both Tingtibi and Zhemgang, by distributing a survey questionnaire. Through this survey, it helps to understand various aspect of the town such as pressing issues if any, satisfaction level of the residents with the existing infrastructures and facilities, aspiration of the residents, and so on.

Findings from the survey result reveal that major problems within Zhemgang town are; lack of sports facilities, poor or lack of tourist infrastructures, limited public transport, and poor utility services like sewer and waste disposals. However, the residents of Zhemgang are quite optimistic about its future economic situation wherein 75% of the respondents reflected as ‘for better’ whiles the remaining 25% as ‘remain unchanged’. When asked to rank importance of different fields in which the Dzongkhag should invest to boost the economic development, industry came to be their first priority followed by utility. The industry must be referring to the need for Cottage and Small Industries (CSI) like furniture house within the planning area because this was also raised during the public occultation meeting. The analysis on the happiness level of residents from 1 to 5 (1- very happy and 5- not happy at all) shows that they are generally happy with the mean score of 2.23.



Similarly, major problems in Tingtibi town are; lack of sports facilities, poor or lack of tourist infrastructures like standard hotels, and shortage of housing. When the respondents were asked to rank the importance of different fields in which the Dzongkhag should invest to boost the economic development of Tingtibi, housing and agriculture topped the list followed by education and industry. The happiness level of the residents of Tingtibi is relatively lower than that of the residents of Zhemgang town, with a mean score of 2.64 (1-very happy, 5 –not happy at all).



## 5 PROPOSAL FOR ACTION

### 5.1 Concept of the Plan

Zhemgang Thromde boundary extends to both Tingtibi and existing Zhemgang town although 35kms apart. The two towns have their own unique character, be it in social, economic or physical context. This sets the foundation for deriving the concept of Zhemgang structure plan wherein the two towns are envisaged to be developed in such a way that they complement each other based on their comparative advantages. Considering their existing condition and future potential, Zhemgang will serve as an administrative hub while Tingtibi as a district economic development zone.

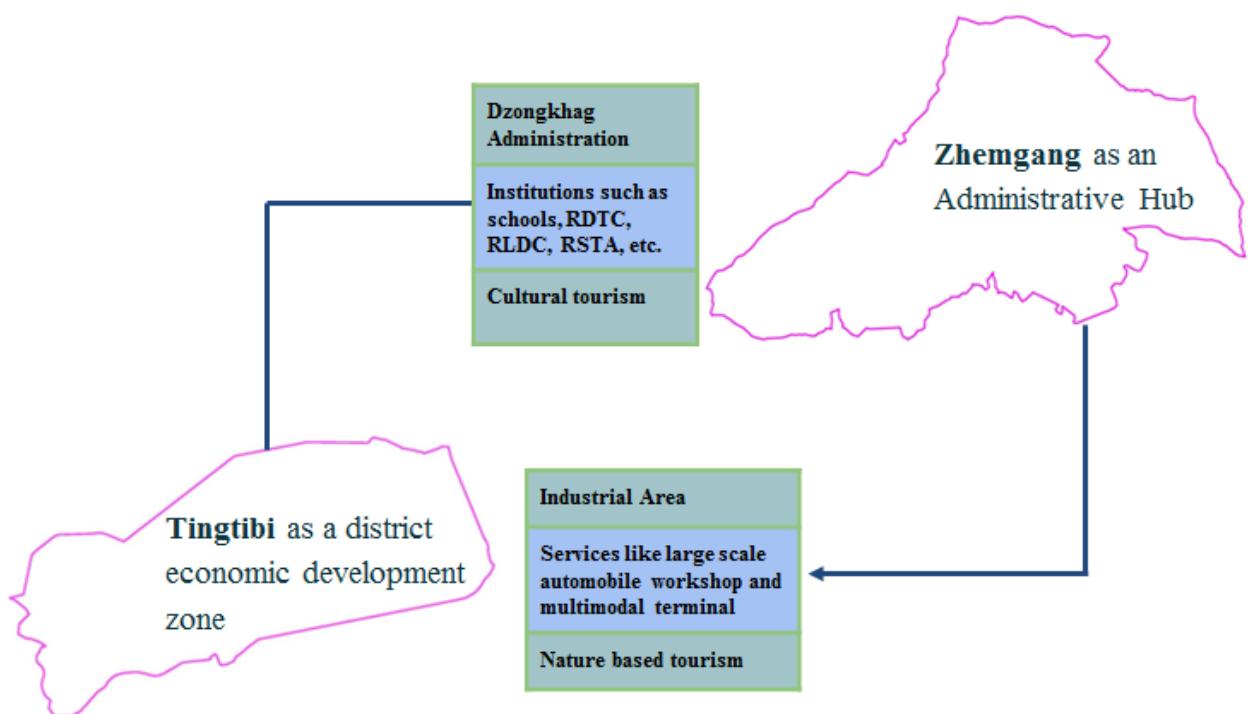


Figure 5.1 Figure illustrating concept of the plan

As illustrated in figure 5.1. above, Zhemgang will depend on Tingtibi for services like large scale automobile workshops and industrial activities while Tingtibi will depend on Zhemgang for administrative services (Dzongkhag) and for institutions like higher secondary school, RDTc, RLDC, RSTA and etc. However, both Zhemgang and Tingtibi will have their own day to day services including small scale automobile workshops and cottage and small industries (CSI).



## 5.2 Vision

*“To develop Zhemgang Thromde into one of the most liveable towns in Bhutan offering unique cultural and nature-based recreational experience”*

## 5.3 Planning principles

The Principles of Intelligent Urbanism (PIU) is a planning approach comprising of ten principles that guide the formulation of urban development plans. The Principles of Intelligent Urbanism are discussed here in brief:

### 5.3.1 Principle One: A Balance with Nature

The development of town should be in harmony with the nature. The principle states that there is a level of human habitation intensity wherein the resources that are consumed will be replaced through replenishing cycle of seasons, creating environmental equilibrium. The principle states that blatant "acts against nature" include cutting of hillside trees, quarrying on slopes, dumping sewage and industrial waste into the natural drainage system, paving and excavating excessively, and construction on steep slopes. This urban theory proposes that the urban ecological balance can be maintained when fragile areas are reserved, conservation of eco-systems is pursued, and low intensity habitation precincts are thoughtfully identified. Thus, the principles operate within the balance of nature, with a goal of protecting and conserving those elements of the ecology that nurture the environment. Therefore, the first Principle of Intelligent Urbanism is that urbanization be in balance with nature.

### 5.3.2 Principle Two: A Balance with Tradition

The towns and settlements in their process of development should not lose their identity. This principle of 'A Balance with Tradition' seeks out traditional wisdom in the layout of human settlements, in the order of building plans, in the precedents of style, in the symbols and signs that transfer meanings through decoration and motifs. This principle respects the order engendered into building systems through years of adaptation to climate, to social circumstances, to available materials and to technology. It promotes architectural styles and motifs designed to communicate cultural values.

Embedded in the principle is the concern for unique cultural and societal iconography of regions, their signs and symbols. Their incorporation into the spatial order of urban settings is promoted. Adherents promote the orientation and structuring of urban plans using local knowledge and meaning systems, expressed through art, urban space and architecture. Planning decisions must operate within the balance of tradition, aggressively protecting, promoting and conserving generic components and elements of the urban pattern.



### **5.3.3 Principle Three: Appropriate Technology**

Appropriate technology emphasizes the employment of building materials, construction techniques, infrastructural systems and project management which are consistent with local contexts. People's capacities, geo-climatic conditions, locally available resources, and suitable capital investments all temper technology. Where there are abundant craftspeople, labour intensive methods are appropriate. Where there is surplus savings, capital intensive methods are appropriate. For every problem there is a range of potential technologies, which can be applied, and an appropriate fit between technology and other resources must be established.

### **5.3.4 Principle Four: Conviviality**

The fourth principle sponsors social interaction through public domains, in a hierarchy of places, devised for personal solace, companionship, romance, domesticity, "neighborliness," community and civic life. The principle maintains that this can be achieved through design and that society operates within hierarchies of social relations which are space specific. The hierarchies can be conceptualized as a system of social tiers, with each tier having a corresponding physical place in the settlement structure. The community spaces for Zhemgang will be required at different levels that is, for young, common citizens and elderly.

#### **A Place for Individual**

A goal of Intelligent Urbanism is to create places of solitude. These may be in urban forests, along urban hills, beside quiet streams, in public gardens and in parks where one can escape. These spaces may also be the interior courtyards of public buildings, or even the thoughtful reading rooms of libraries.

#### **A place for friendship**

The axiom insists that in city plans there must be spaces for "beautiful, intimate friendship" where unfettered dialogue can happen. This principle insists that such places will not exist naturally in a modern urban fabric. They must be a part of the conscientious design of the urban core, of the urban hubs, of urban villages and of neighbourhoods, where people can meet with friends and talk out life's issues, sorrows, joys and dilemmas. This second tier is important for the emotional life of the populace.

#### **A Place for Householders**

There must be a unique domain for social groups, familiar or biological, which have organized themselves into households. These domestic precincts are where families live and carry out their day-to-day functions of life. This third tier of conviviality is where the individual socializes into a personality.



### **A Place for Neighbourhood**

Smaller household domains must cluster into a higher social domain, the neighborhood social group. These are social groups where everyone recognises one another. Festivals are celebrated in neighborhoods, and one may be passively drawn into local functions without any proactive effort. Neighborhoods built according to Intelligent Urbanism should accommodate play areas for children, small hang-out places for pre-teens and common facilities where people can meet casually.

### **Places for Community**

The next social tier, or hierarchy, is the community. Historically, communities were tribes who shared social and cultural behavioural patterns. In contemporary urban settings communities are formed of diverse people. But these are people who share the common need to negotiate and manage their spatial settings. In plans created through the Principles of Intelligent Urbanism these are called Urban Villages. Like a rural village, social bonds are found in the community management of security, common resources and social space. Urban Villages will have defined social spaces, services and amenities that need to be managed by the community. Intelligent Urbanism calls for the creation of dense, walkable zones in which the inhabitants recognize each other's faces, share common facilities and resources, and often see each other at the village centre. It is intended to promote initiative and constructive community participation.

### **A Place for City Domain**

The Principles of Intelligent Urbanism call for city level domains. These can be plazas, parks, stadia, transport hubs, promenades, "passages" or gallerias. These are social spaces where everyone can go. One may find people from all continents, from nearby districts and provinces and from all parts of the city in such places. By nature, these are accessible and open spaces, with no physical, social or economic barriers. These domains would include all freely accessible large spaces. These are places where outdoor exhibits are held, sports matches take place, vegetables are sold and goods are on display. These are places where visitors to the city meander amongst the locals. It is this higher tier of social space which defines truly urbane environments.

### **5.3.5 Principle Five: Efficiency**

The principle of efficiency promotes a balance between the consumption of resources such as energy, time and fiscal resources, with planned achievements in comfort, safety, security, access, tenure, productivity and hygiene. It encourages optimum sharing of public land, roads, facilities, services and infrastructural networks, reducing per household costs, while increasing affordability, productivity, access and civic viability.



Intelligent Urbanism promotes efficiency in carrying out functions in a cost-effective manner. It assesses the performance of various systems required by the public and the consumption of energy, funds, administrative time and the maintenance efforts required to perform these functions. The functions include various public infrastructures like the transport, water supply, sewerage etc. Good city planning practices promote compact settlements along dense urban corridors, and within populated networks, such that the numbers of users who share costs are adequate to support effective and efficient infrastructure systems. Intelligent Urbanism is intended to foster movement on foot, linking pedestrian movement with public transport systems at strategic nodes and hubs.

### **5.3.6 Principle Six: Human Scale**

Intelligent Urbanism encourages ground level, pedestrian oriented urban patterns, based on anthropometric dimensions. Walkable, mixed use urban villages are encouraged over single-function blocks, linked by motor ways, and surrounded by parking lots. An abiding axiom of urban planning, urban design and city planning has been the promotion of people friendly places, pedestrian walkways and public domains where people can meet freely. These can be parks, gardens, glass-covered gallerias, arcades, courtyards, street side cafes, river- and hill-side stroll ways, and a variety of semi-covered spaces.

Intelligent urbanism promotes the scale of the pedestrian moving on the pathway, as opposed to the scale of the automobile on the expressway. It promotes the ground plan of imaginable precincts, as opposed to the imagery of facades and the monumentality of the section. It promotes the personal visibility of places moving on foot at eye level.

Human scale can be achieved through building masses that “step down” to human scale open spaces; by using arcades and pavilions as buffers to large masses; by intermixing open spaces and built masses sensitively; by using anthropometric proportions and natural materials. Traditional building precedents often carry within them a human scale language, from which a contemporary fabric of build may evolve.

The principle conceives of urbanity as a process of facilitating human behaviour toward more tolerant, more peaceful, more accommodating and more sensitive modalities of interaction and conflict resolution. Intelligent urbanism recognizes that ‘urbanity’ emerges where people mix and interact on a face-to-face basis, on the ground, at high densities and amongst diverse social and economic groups. Intelligent Urbanism nurtures ‘urbanity’ through designs and plans that foster human scale interaction.

### **5.3.7 Principle Seven: Opportunity Matrix**

The principle envisions the city as a vehicle for personal, social, and economic development, through access to a range of organizations, services, facilities and information providing a



variety of opportunities for enhanced employment, economic engagement, education, and recreation. This principle aims to increase access to shelter, health care and human resources development. It aims to increase safety and hygienic conditions. The city is an engine of economic growth. This is generally said with regard to urban annual net product, enriched urban economic base, sustained employment generation and urban balance of trade. More significantly this is true for the individuals who settle in cities. Moreover, cities are places where individuals can increase their knowledge, skills and sensitivities. Cities provide access to health care and preventive medicine. They provide a great umbrella of services under which the individual can leave aside the struggle for survival, and get on with the finer things of life.

### **5.3.8 Principle Eight: Regional Integration**

Intelligent Urbanism envisions the city as an organic part of a larger environmental, socio-economic and cultural-geographic system, essential for its sustainability. This zone of influence is the region. Likewise, it sees the region as integrally connected to the city. Intelligent Urbanism sees the planning of the city and its hinterland is a single holistic process.

The region may be defined as the catchment area from which employees and students commute into the city on a daily basis. It is the catchment area from which people choose to visit one city, as opposed to another, for retail shopping and entertainment. Economically the city region may include the hinterland that depends on its wholesale markets, banking facilities, transport hubs and information exchanges. The region needing integration may be seen as the zone from which perishable foods and building materials supply the city. Intelligent urbanism sees the integrated planning of these services and facilities as part of the city planning process.

### **5.3.9 Principle Nine: Balanced Movement**

Intelligent Urbanism advocates a balance between appropriate modes of movement. More capital-intensive transport systems should move between high density nodes and hubs, which interchange with lower technology movement options. These modal split nodes become the public domains around which to cluster high density, pedestrian, mixed-use urban villages. The automobile is here to stay, but that it should not be made essential by design.

### **5.3.10 Principle Ten: Institutional Integrity**

Good practices inherent in considered principles can only be realized through accountable, transparent, competent and participatory local governance, founded on appropriate data bases, due entitlements, civic responsibilities and duties.



Intelligent Urbanism recognizes that there are developers and promoters who have no long-term commitment to their own constructions, and their only concern is to hand over a dwelling, gain their profit and move on. For these players it is essential to have Development Control Regulations, which assure the public that the products they invest in are safe, hygienic, orderly, durable and efficient. For the discerning citizen, such rules also lay out the civil understanding by which a complex society agrees to live together.

The institutional framework can only operate where there is a Structure Plan, or other document that defines how the land will be used, serviced, and accessed. The Structure Plan tells landowners and promoters what the parameters of development are, which assures that their immediate investments are secure, and that the returns and use of such efforts are predictable. A Structure Plan is intended to provide owners and investors with predictable future scenarios.



## 5.4 Proposed Precinct Plan

Precincts in structure planning are a fundamental blueprint for use of land or developments that take place over the years. Such precinct planning is very crucial in making growth areas highly liveable, both for the present and generations. It not only focuses on the designation of Greenfield sites but also focuses on urban consolidation to address population growth, housing and employment demands that flows from it.

This plan embodies precincts instead of zones thereby delineating areas based on their land uses. Meanwhile, precincts are identified through urban design surveys that classify the region into different precincts based on typical characteristics of each area.

### 5.4.1 Proposed Urban Core

The Proposed Urban Core comprises the existing and proposed redevelopment of Town Centre. It is a precinct of trade and commerce, amenities which promotes high density mixed-use development

#### UC: Urban Core

The Urban Core identified in the Zhemgang Structure Plan is mainly the pre-existing commercial land uses. For Zhemgang, the urban core includes those plots falling in between the Dzong road and National highway and a line of plots below the national highway towards Tingtibi. For Tingtibi, the urban core includes those first line of plots on right and left side of the primary road at existing Tingtibi town. The urban core will cater to the entire town residents and the hinterland communities surrounding the town. The Core will have retail outlets and convenience stores. Additionally, it will also have entertainment facilities such as cinema halls, restaurants, bars, discos, etc. The existing commercial core is to be redeveloped and upgraded into an Urban Core with higher level of commercial activities. It is envisioned to be more vibrant and interactive so as to attract residents as well as commuters along the highway.

### 5.4.2 Proposed Urban Villages

The Urban Villages will be predominantly residential precincts with residential uses dominating over other permissible uses.

#### UV-1: Urban Village 1

Urban Village 1 is proposed to be medium density precinct with mixed use development, generally with convenience shopping and basic services in the floor with direct road access. Their locations are mostly next to the urban core and if located further away, forms the core of the Urban Village and essentially would have amenities and facilities to make it self-sustainable.



### **UV-2: Urban Village 2**

Urban Village 2 is proposed to be medium density precinct with predominantly residential use. It will accommodate majority of the Zhemgang Thromde residents. Since Zhemgang and Tingtibi town area are relatively small in size, almost all of the proposed UV-2 are within the walkable distance of the work places and commercial outlets and hence it can be called walkable community.

### **UV-3: Urban Village 3**

Urban Village 3 is proposed to be a low-density residential precinct. This precinct comprises of relatively smaller sized plots such as the plots/areas belonging to Trong kidu recipients below the Wamptakpa road and below the RBP office. The areas around Trong Village are also proposed under UV-3 owing to the smaller plot sizes as well as being in proximity to the cultural precinct so as to not undermine the heritage significance of the Trong Village.

### **5.4.3 Proposed Cultural Precinct**

#### **CP-1: Cultural Precinct 1**

The Cultural Precinct 1 entails traditional village clusters that need to be preserved for its heritage significance to the community and the country at large. Since Trong Village has been designated as a Heritage Village, it is proposed under this precinct.

#### **CP-2: Cultural Precinct 2**

The Cultural Precinct 2 comprises of Cultural features such as the Dzongs, Lhakhangs, sacred sites and historic sites. This precinct comprises of the Zhemgang Dzong, Zhemgang Dratshang, Trong Lhakhang, etc. in Zhemgang and the Zangdopelri in Tingtibi.

### **5.4.4 Proposed Institutional Precinct**

#### **I-1: Institutional Precinct 1**

The Institutional Precinct 1 (I-1) comprises of institutional land uses such as the Educational and training institutes and health service centres. In Zhemgang, I-1 comprises of the Rural Development Training Centre (RDTC) complex in the northern end of the Thromde above the national highway, Zhemgang Higher Secondary School and the Zhemgang Lower Secondary School areas. As for Tingtibi, only Tingtibi Lower Secondary School falls under I-1.

#### **I-2: Institutional Precinct 2**

The Institutional Precinct 2 (I-2) comprises of all public, corporate and other offices such as the Municipal Office, Telecom, BPC, FCB, NGOs, Banks, etc.



### I-3: Institutional Precinct 3

The Institutional Precinct 3 (I-3) will comprise of land uses related to defence and military uses such as the Royal Bhutan Army and Royal Bhutan Police. This land use will comprise of only the Royal Bhutan Police in both Zhemgang and Tingtibi.

### 5.4.5 Proposed Service Precinct

#### S-1: Service Precinct 1

This service precinct (S-1) will comprise of lighter non-polluting town level services and amenities such as the Water Treatment plant, Sewerage Treatment plant, Communal Septic Tanks, Electrical Substations, Distribution points, Vegetable Markets, Craft markets, etc.

#### S-2: Service Precinct 2

The Service Precinct 2 (S-2) will comprise of town level services with some form of pollution such as the automobile workshop and servicing, fuel station, small scale industries, etc. There is no S-2 precinct as such within Zhemgang besides the current fuel station, and therefore permissible uses under S-2 such as automobile workshop and small-scale cottage industries are proposed outside the Thromde boundary about 1.5 km away from the town (current Automobile workshop area) due to acute shortage of land within the Thromde. S-2 precinct in Tingtibi comprises of existing BoD area and handmade paper factory area. However, majority of the polluting services including automobile workshop are to be placed outside the Thromde boundary at about 1km from Tingtibi town towards Zhemgang (within the proposed industrial area: refer section 5.7.5 of this report). The existing automobile workshop at Tingtibi below BoD falls under environment precinct and therefore recommended to be relocated as per the provision of this plan.

### 5.4.6 Proposed Transport Precinct

#### T-1: Transport Precinct 1

This Transport Precinct (T-1) will comprise of bus terminal, bus stop, taxi stand and all public parking spaces within the town. The bus stop for Zhemgang is proposed to continue in the same location below the Trong village while the bus terminal is proposed on the way to RDTC near present archery ground (proposed helipad area of the old Zhemgang urban Development Plan). In case of Tingtibi, bus stop is proposed in the town core parking near the proposed town plaza while the bus terminal is proposed at the back side of the Tingtibi town near the proposed vegetable market.



## T-2: Transport Precinct 2

The Transport Precinct 2 (T-2) will comprise of heavy vehicle parking and dry ports. The heavy vehicle parking for both Zhemgang and Tingtibi are proposed outside the Thromde boundary. The T-2 for Zhemgang is proposed somewhere around the current automobile workshop site which is about 1.5km towards Trongsa (refer section 5.7.6 of this report) and for Tingtibi, it is proposed above the highway near Industrial area which is about 1km outside the thromde boundary along old highway towards Zhemgang (via Dakphel).

### 5.4.7 Proposed Industrial Precinct

The industrial area is proposed at Tingtibi due to its locational advantage by virtue of being on Trongsa-Gelephu highway, easier market access for importing raw materials and exporting products, relatively flat terrain and existing industrial establishment such as hollow block manufacturing unit. However, due to anticipated pollution and limited land within the Thromde area, industrial area is proposed about 1km away from the Thromde boundary along the old highway towards Zhemgang (via Dakphel). Any industrial proposals in the future will be allocated in this area through appropriate land mobilization modalities and with prior clearance and feasibility study by relevant agencies. Zhemgang town will also depend on this industrial area if any industrial proposals arise, except small and cottage industries which may be permitted within the service precinct as specified in the Development Control regulation (DCR).

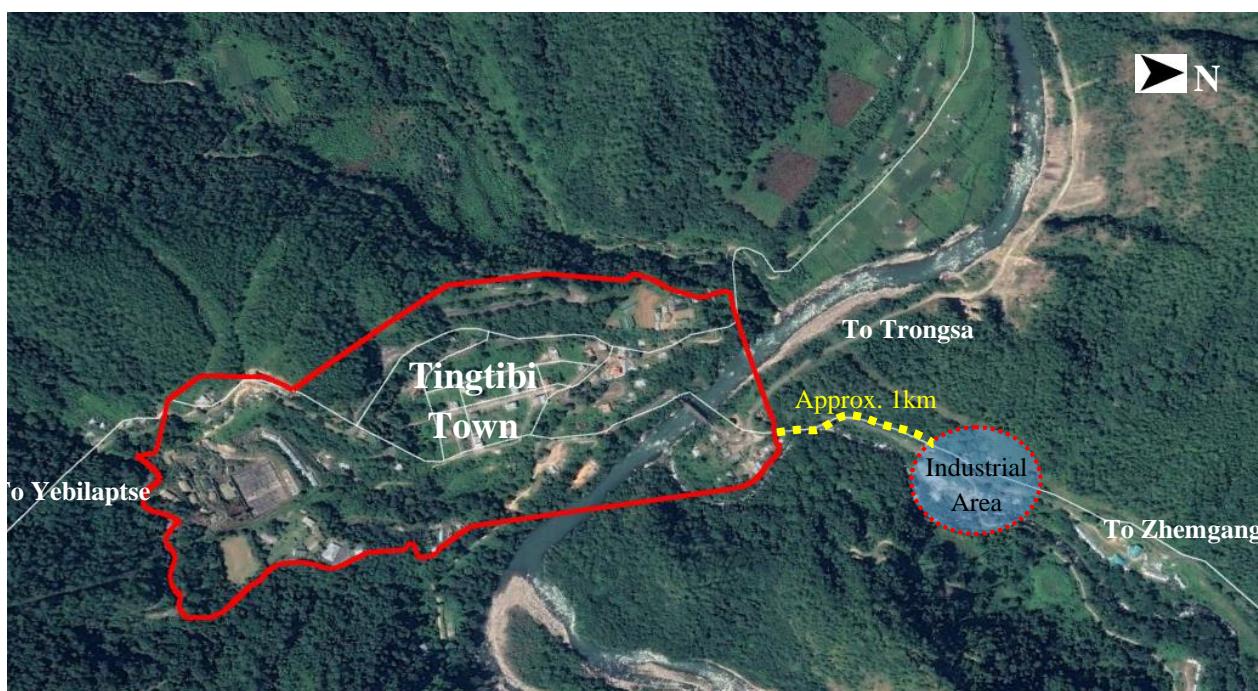


Figure 5. 2 Location of industrial Park, Tingtibi



### **5.4.8 Proposed Recreational Precinct**

Recreational systems have become an integral part of town planning as a result of the intense demand for outdoor recreation and a growing concern for conservation. Recreational spaces have a crucial role in the urban life, since they act as breathing spaces in the dense urban fabric, or a place for recreation and retreat for the urban population. They also vitalize the social and cultural activities of the town and play a major role in controlling and managing the urban environment, health and climate. Providing the spaces for the much-needed recreational activities in close proximity to urban communities has become an urgent necessity in all urban centres.

A town has to provide a variety of open spaces, which satisfy the great differences in recreational demands between different groups of the society. The open space system in an urban area should therefore contain a great variety of facilities, suitable for all kinds of special interest groups: challenging and autonomous place for the teens: serene rural and quiet for older people; or crowded and active areas for those who want stimulus and companionship. Another important factor is the even distribution of these open spaces in the urban landscape distributed and located in close proximity to urban communities. The proposed recreational precinct consists of:

#### **R-1: Recreational Precinct 1**

The Recreational precinct 1 (R-1) comprises of open spaces wherein construction of games and sports facilities such as indoor stadiums are permitted.

##### **Sports Complex**

As Zhemgang is envisioned to be developed into an Institutional Center, with majority of land use within the Thromde under institutional ownership, a need to have a variety of sports facilities for the younger generation in the town is felt necessary. However, the availability of land and the steep topographical condition of land within the Thromde serves as a major constraint in the development of such complexes. The need for bigger facilities such as the football ground for the whole Thromde populace can be supplied by the two schools in their existing grounds while a futsal court is proposed in the open space below the municipal office. This recreation space can also accommodate other smaller games and sports facilities like the basketball court, lawn tennis court, a badminton court, table tennis and volley ball court.

#### **R-2: Recreational Precinct 2**

Proposed Recreational spaces 2 (R-2) are open and green spaces where development of indoor games and sports infrastructures are not permitted and rather it will encourage more of public open spaces, gardens and outdoor games and sports facilities. Following recreational spaces are categorized under R-2:



### **Community Parks**

The community Parks will form a part of each urban village neighbourhood and will have a variety of children's play equipment and amusement facilities. These are located at a convenient walking distance and it will be local level recreational space that will cater to various age groups. Aside from the local recreational spaces proposed in the plan, additional such open spaces can be created during the preparation of a detailed LAP through the Land Pooling exercise.

### **Archery Field**

Archery being the National Game of Bhutan is set to be on a high priority. Presently there are two archery fields in the northern part of the town in the land registered under Rabday and RDTC. Since the two areas are not fully developed at the moment, the archery field may continue in the existing location. However, permanent location of Archery field needs to be decided by the Dzongkhag Administration in coordination with the Competent Authority upon consultation with the registered landowners (Rabday and RDTC).

### **Urban Greenery**

It is proposed that planting and maintaining, indigenous tree species of the region within the compound of any urban development in the Thromde limit should be made compulsory. As a thumb rule, one tree space per every hundred square meter of plot area could be considered. This will not only maintain urban greenery in the town's landscape but also help in creating a micro-climatic region within the town.

#### **5.4.9 Proposed Environment Precinct**

Development is inevitable and must be accommodated. However, uncontrolled growth is destructive. Any development, which does not address the environmental factors of the place for which it is designed, will lead to degradation and destruction. The aim of the proposed Environment precinct (E) is to conserve the valuable environmental assets of the town and the entire region for future generations.

The proposed Environment Precinct comprises of ecologically fragile environments such as Forests, Rivers, streams, and disaster-prone areas. Protecting these ecologically fragile environments would protect the mountain slopes, wildlife habitats and would also enhance greenery in the surrounding landscape. It will also help in controlling the climatic conditions of the place by creating micro-climatic regions. The protection zone will also create a passive recreational zone for the town residents.



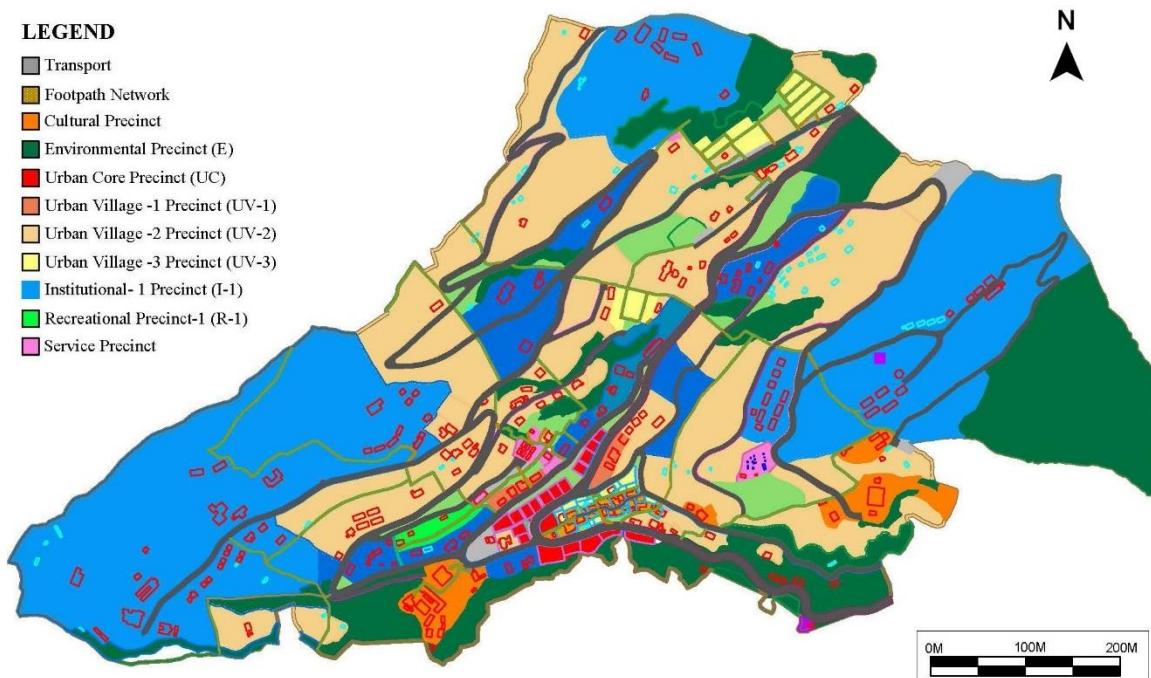
It is necessary for the decision makers to understand that protection of the ecologically fragile environment within the town is essential for the very existence of the town in the future as disturbance to ecological balance could lead to the destruction of the entire town. In Zhemgang, the environment precinct comprises of the natural forests and forest plantations sites, high hazard zones while in Tingtibi, it comprises of the forest on steep slopes, Mangdechhu River and Streams. In order to protect the environment from undesirable consequences related to development pressure in ecologically fragile environment; development is strictly prohibited in the Environment Precinct.

#### **5.4.10 Proposed Buffer Zones (BZ)**

The proposed Buffer Zones comprises of buffers along the rivers and streams, around heritage structures and sites; along international boundaries and under High Tension (HT) lines. In Zhemgang, Buffers Zones are proposed around the Dzong and heritage sites while in Tingtibi, buffer zones comprise of buffers along the river and streams and along the HT lines.

#### **5.4.11 Proposed Special Zones (SZ)**

The proposed Special Zones (SZ) comprises of land uses such as the Royal uses, land for future endowment and special economic zones.



*Figure 5. 3 Proposed Precinct Plan (Zhemgang)*



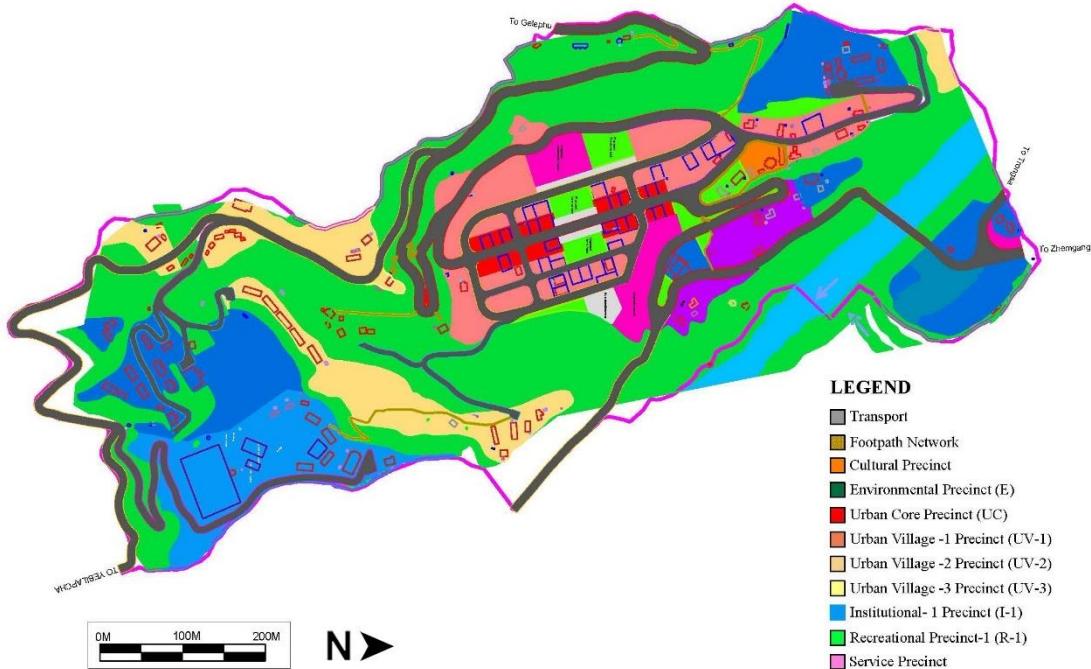


Figure 5. 4 Proposed Precinct Plan (Tingtibi)

## 5.5 Population Carrying Capacity

Generally, Urban Core and the Urban Village 1 holds higher density development while the Urban Villages 2 and 3 holds medium and low densities respectively. This is totally dependent on the population projected and the accommodation capacity of the Thromde area. As the projected population for Zhemgang Town is much lower than the estimated carrying capacity, Zhemgang town would undergo a medium and low-density development over the next 20-year period. Hence, three levels would be allowed for commercial activities leaving one level for residential use. Therefore, the Structure Plan promotes a lower density residential development in the urban core and relatively higher density residential development in the Urban Villages.

Considering the future development needs, the population growth and the available facilities in the town, the Structure Plan advocates for a medium-rise development with built structures not more than three floors in height in the Urban Core, three floors in UV-1 and UV-2 and two floors in UV-3 with varying ground coverage based on the Transect model of development.



*Table 5. 1 Population Carrying Capacity: Zhemgang Town*

Proposed Precinct	Total Area (Sq.m)	Coverage	Max . Floor	Resi-Floor	Resi-Area	No. of Units	HH size	CC (persons)
					(Sq.m)			
Urban Core	10816	0.6	3	1	6489	65	3.6	234
Urban Village 1 (UV-1)	4745	0.5	3	2	4745	47	3.6	171
Urban Village 2 (UV-2)	266060	0.45	3	3	319272	3193	3.6	11494
Urban Village 3 (UV-3)	13119	0.35	2	2	9183	92	3.6	331
Services 2 (S-2)	5330	0.3	3	1	1599	16	3.5	56
Institution	427104	0.4	3	0.2	34168	342	3.6	1230
<b>Total Carrying Capacity</b>								<b>13515</b>

*Table 5. 2 Population Carrying Capacity: Tingtibi Town*

Proposed Precinct	Total Area (Sq.m)	Coverage	Max . Floor	Resi-Floor	Resi- Area	No. of Units	HH size	CC (persons )
					(Sq.m)			
Urban Core	9213	0.6	3	1	5528	55	3.5	193
Urban Village 1 (UV-1)	30111	0.5	3	2	30111	301	3.5	1054
Urban Village 2 (UV-2)	50126	0.45	3	3	67670	677	3.5	2370
Services 2 (S-2)	7012	0.3	3	1	2104	21	3.5	74
Institution	102822	0.4	3	0.2	8226	82	3.5	288
<b>Total Carrying Capacity</b>								<b>3979</b>



## 5.6 Proposed Infrastructures and utilities

### 5.6.1 Road Classification

A transportation plan for a town consists of roads of various hierarchies based on its location, population it serves on the density pattern, its linkages within the town and outside and the surrounding land uses. The hierarchy of roads essentially defines the right of way (ROW), that consists of carriageways, parking, spaces for utilities, planters and the road side pathways and drainages. The right of way is decided based on the land uses sanctioned along it and the volume of traffic it would be carrying in the future. The Transportation Plan for Zhemgang Thromde identifies a town level Road Network composed of Primary, Secondary, Tertiary and Access roads.

#### Primary Road (Highway)

The National highway that runs through the town core in both Zhemgang and Tingtibi is identified as the Primary Road. In case of Zhemgang town, the primary road is the stretch of national highway starting from the Thromde boundary towards Trongsa till the other end of thromde boundary towards Tingtibi, and has 11.5m ROW. While, the primary road for Tingtibi is the road that runs through the town and the national highway itself within the thromde boundary and has 12m ROW.

As shown in the figure below, Primary Road for Zhemgang comprises of 6m carriageway, 2.5m parallel parking on the lower side adjacent to the commercial buildings, 1m tree plantation space and 1.5m footpaths on the same side of the street.

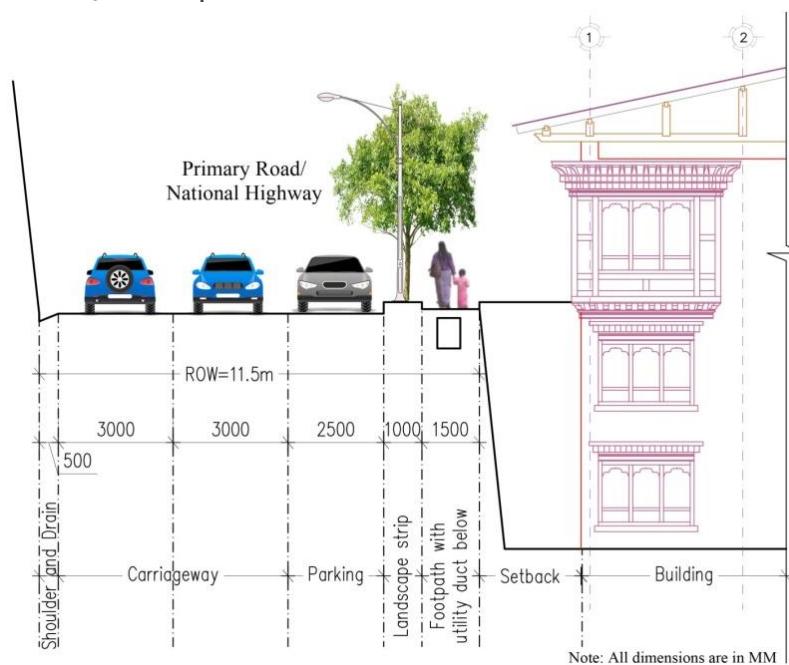


Figure 5. 5 Primary Road Section (Zhemgang)



## Secondary Road

The width of the secondary road is mainly governed by the land use pattern, the future population growth and the density distribution across the town area. As it is envisioned that Zhemgang would have a very slow growth, the secondary road is proposed to be 10m ROW with 6m carriageway, footpath on both sides and 1m planter on one side. All road side footpaths and parking areas are proposed to have services running underneath. The water line, sewage lines, electrical distribution, telecommunication networks, etc. will form a part of the service that run underneath the parking and footpaths in future.



Figure 5. 6 Secondary Road Section (Zhemgang)

## Tertiary Road

The Tertiary Roads are designed to serve low volumes of traffic through a pedestrian friendly environment. Carriageways should only be wide enough to allow two vehicles to slowly pass each other. Bicycles are encouraged on the street itself, rather than on separate bicycle ways. The Tertiary Road is proposed to be 8m ROW with 6m carriageway, 1.5m on the lower side of the road for footpath and tree planter and 0.5m on the upper side for Drainage.



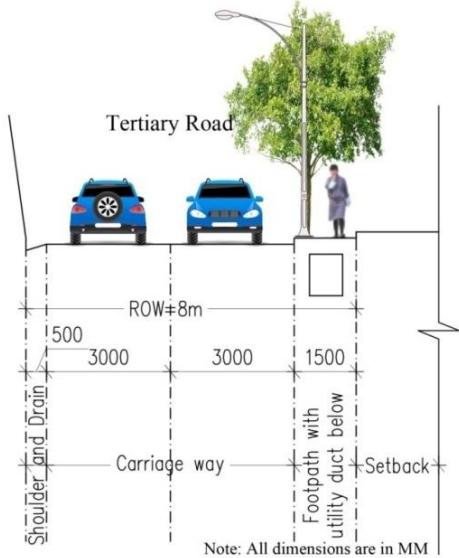


Figure 5. 7 Tertiary Road Section (Zhemgang)

### Access Road

The proposed Access Roads are mostly dead-end roads provided to access plots in difficult site conditions. These roads are often leading to the public open spaces such as children play area and there is interaction amongst neighbours. Vehicular movement should be controlled and provided for within this context. These roads are of 6m ROW with 5m carriageway and 1m on upper side for drainage and tree planter. The carriageway can also be used as pedestrian access pathways.

### 5.6.2 Pedestrian Pathways

The Transportation Plan puts special emphasis on promoting pedestrian movement by making it safer and more convenient through several measures. Given the scale of the town, walking makes it easier to commute between destinations. A town-wide system of pathways, providing shorter and safer routes to residential areas, open space systems, important nodes and heritage sites is identified in the Structure plan in addition to the existing footpaths.

### On-street Footpaths

Comfortable sidewalks along the roads reinforce pedestrian environments. The comfort and convenience of the pedestrian walkways, which encourage pedestrian movement, will reduce internal auto trips and reinforce the efficiency of the Public Transit System by creating destinations, which are attainable without a car, and origins, which do not depend solely on park-and-ride modes transfer.



A minimum of 1.5m on-street footpath is comfortable for two people to walk abreast and hence it is to be provided along all roads within the Thromde as long as the site condition permits.

### **Off-Street Footpath**

The Off-street footpath network should be complementary to the road network and it often provides the shortest and easier connections between roads, residential sectors, commercial nodes and other destinations. Off-street footpaths will provide flexibility for pedestrian movement inside the town attracting various leisure activities along them. Most of the existing off-street footpaths runs across the slope terrain and serves as a shortcut towards key destinations such as the town core, the Dzong and the schools. Additional off-street footpaths running across the slope gradient as well as along the slope gradient are proposed to further enhance the connectivity and convenience and to make walking a joyful experience for the pedestrians.

### **5.6.3 Parking Facilities**

In the modern context, where vehicles have become an important component of an individual's life, accommodating them within the urban area, has become essential and crucial. It is crucial in the sense that, though it helps to overcome the separations created by distance, it has created contradictions for human needs at various occasions. At these situations parking spaces form a vital negotiating entity. The Zhemgang Structure Plan through clear understanding of the urban life's need, provides various parking options for the vehicles in the town.

#### **On-street parking**

On-street parking helps to create street activity, as well as provide functional spaces. It supports in the orientation of building entries to the streets by providing convenient access. On-street parking helps "civilize" the street for pedestrians by creating a buffer between moving cars and the sidewalks. On-street parking also tends to slow down the flow of through traffic and helps to develop a pedestrian environment where walking is desired.

The on-street parking in the commercial core in Zhemgang and the off-street parking in the Tingtibi core should be charged a minimal fee. The objective of this proposal is to make the parking work for the town instead of the other way round. Charging some fees for the motorist using the valuable core parking spaces has direct or indirect benefits such as making the town core more pedestrian friendly, freeing up limited core parking spaces for the visitor's, thereby earning additional income for the local businesses from non-residents,



making additional revenue for the town which can be used for maintenance of urban facilities and services.

### Off-street Parking

Off-street parking in small pockets will allow vehicles to penetrate into the town core and urban villages from peripheral access streets, while maintaining the pedestrian friendly nature of the urban areas. In Zhemgang town, off-street parking is provided for Bus and light vehicle parking, for employees of the Dzong and for plots without direct road access. In Tingtibi, off-street parking is proposed in town core as it doesn't have on-street parallel parking. Additional off-street parking may be allocated during the preparation of detailed Local Area Plan (LAP) wherever necessary for both Zhemgang and Tingtibi.

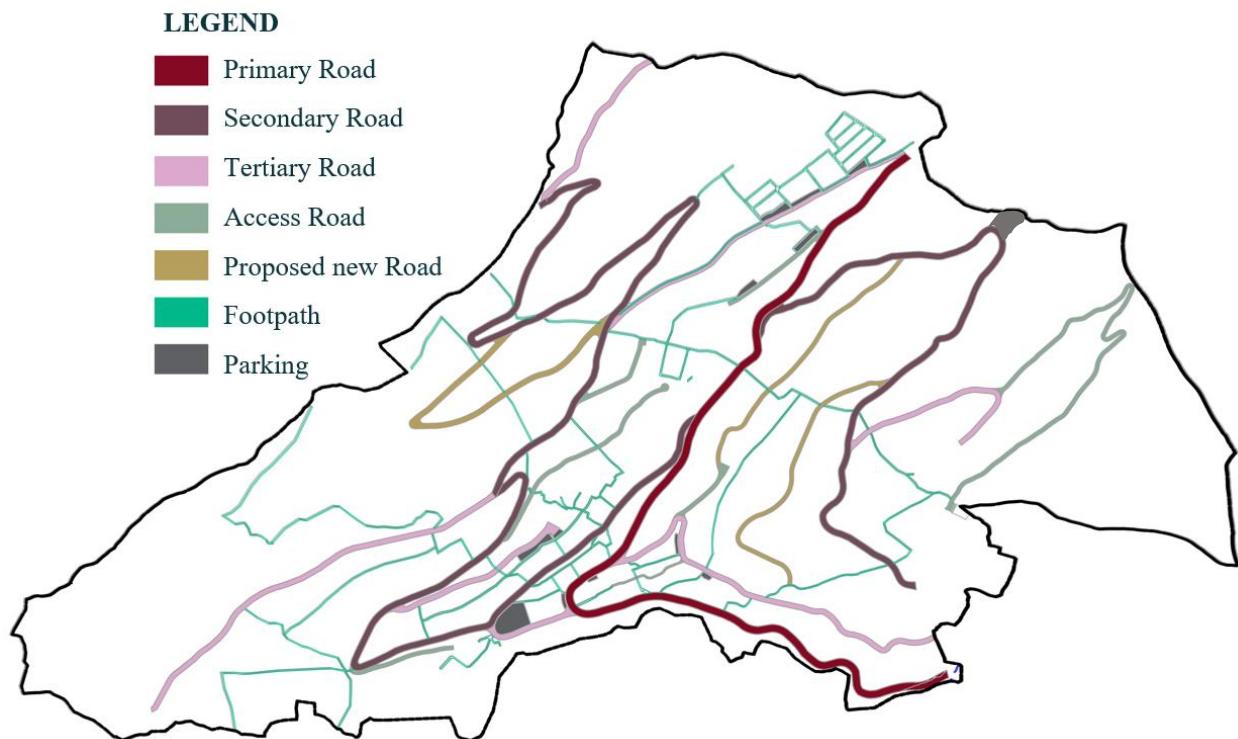


Figure 5. 8 Proposed Circulation Network (Zhemgang)



#### LEGEND

- Primary Road
- Secondary Road
- Tertiary Road
- Access Road
- Footpath
- Cycling lane

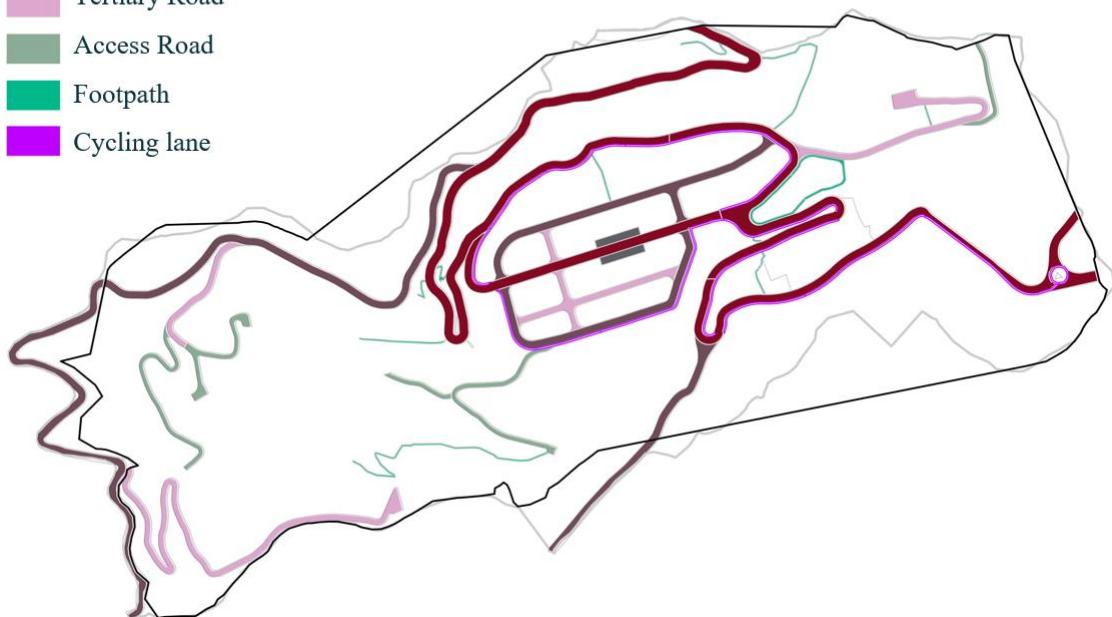


Figure 5. 9 Proposed Circulation Network (Tingtibi)

#### 5.6.4 Proposed Water Supply

Considering the future needs of growing population, the water flag ship network was proposed by the Water and Sanitation Division under MoWHS on the request of the Zhemgang Dzongkhag Administration. The project proposes for the increase in requirement of drinking water from additional source (Brogsar and Bangkaphai). The water reservoirs proposed at various strategic locations will store treated water from the water treatment plant before distributing to the individual households. They are proposed at the higher topography areas from the town.

For the Flagship programme, the tentative water demand for Zhemgang town was taken as 29 lps or 2.5 MLD (considering growth rate of 5% and PHCB 2017 population data of 2930 persons). However, review of the Structure Plan has projected the population of Zhemgang and Tingtibi as 2641 and 648 persons respectively for the plan period of 2020-2040 based on the assumption that there will be no growth in population until 2030 and then a steady growth of 1.95% per annum. Based on the projected population, the water demand for Zhemgang and Tingtibi are estimated to be 0.61 MLD and 0.15 MLD respectively.



As for Tingtibi town, the existing source Takarbe Source/stream has a yield of 0.50 MLD and is sufficient to cater the demand of the town population based on the estimated demand of 0.15 MLD. The Water Supply scheme for the town was constructed in the year 2003-2004 funded by the World Bank and rehabilitated in the year 2014 -2015.

*Table 5. 3 Water demand for Zhemgang and Tingtibi town*

Town	Residential population	Domestic -D (140 lcpd)	Commercial (C) - 15% of D	Total (D+C)	Wastage (30% of D+C)	Fire station (15% of D)	Total water demand
Zhemgang	2641	369740	55461	425201	127560	55461	608222
Tingtibi	648	90720	13608	104328	31298	13608	149234

### 5.6.5 Proposed Sewerage System

The Zhemgang Urban development plan 2003-2023 recommended for individual on-plot septic tank and soak pits for each plot and a common septic tank for buildings that are not able to accommodate on-plot sanitation facilities for the short term and then for the long term it proposed for centralized conventional sewage treatment facility such as a waste stabilization ponds followed by an extended aerator. The site for the STP was proposed near the Higher Secondary School. The common septic tank as well as the conventional sewerage treatment plant has not been developed as of now. Moreover, the conventional STP would require more area of land (approximately 3.2 acres for a population of 2641) which is of short supply in a hilly area like Zhemgang. Therefore, this plan proposes for a Compact Sewerage Treatment Plant for both Zhemgang and Tingtibi in near future, considering the hilly nature of the Thromde land and the lack of available land for conventional STP. However, detailed feasibility study and design needs to be carried out by the Department of Engineering Services.

### 5.6.6 Proposed Solid Waste Management

The primary objectives of the proposed solid waste collection and disposal system is to minimize volume of waste instead of providing more landfill site or dumping sites.

It includes following methods:

1. Segregation at source of collection into recyclable waste and non-recyclable wastes, degradable and non-degradable.
2. Provision of compost plant at landfill sites.



### **5.6.7 Fire Fighting Facilities**

Fire incidents have been observed in almost all towns and villages in the country. Every year, many houses and huts are burned down by fire incidents. This is due to lack of fire safety provisions in the old buildings. Therefore, a fire safety provisions in the upcoming buildings and firefighting facilities could reduce such incidents.

To safeguard the town, following proposals is recommended for the Zhemgang and Tingtibi towns:

- Provision of a fire hydrant in the core area and higher density residential areas of the town.
- The fire hydrants will be connected to the nearby water reservoirs and 15% of domestic water is accounted for the fire safety.
- At least one fire fighting vehicle (firefighting truck) for the whole town
- Every new building should have provision for firefighting facilities such as fire alarms, fire extinguishers, emergency exists, etc.

### **5.6.8 Storm water drainage system**

Most settlements in Zhemgang town are located on hilly terrain and as for Tingtibi town, the settlement slopes gently towards Mangdechhu River. Moreover, with the fragile land prone to landslide, a proper storm water drainage system is required to safeguard the settlements against such hazards. Therefore, the implementation of proposed drainage system has to be a priority. The drainage system has been proposed along the proposed road and vertical green corridors. Further, the plan proposes drains on a long steep slope to be broken up by introduction of contour drain below the footpath and stilling basin so that the total drop does not become too high. In addition, the drain slope length should not exceed 20-30 meters. The size of the contour drain can be designed by considering flow volume generated from the upstream catchment and considering a negligible channel slope to carry that discharge. A proper drainage system could protect fragile land from landslide as well as soil erosion. Additional recommendations include the following:

- Provision of continuous drainage network.
- Timely maintenance of drainage infrastructure.
- Appropriate selection of drain channel.
- Use of permeable material for both water channel and footpath pavements.
- Creation of retention ponds at various locations.
- Development of stepped drains on steep terrain.
- Provision of sufficient number of weep holes on retaining walls.
- Adequate size and positioning of the culvert.
- Adoption of Sustainable Urban Drainage System (SUDs) and WSUD.



## **5.7 Projects of Special significance**

Several interventions on various planning aspects are proposed during this review envisaging the revised plan to be more comprehensive and implementable so that Zhemgang becomes one of the most liveable towns in Bhutan as envisioned. There are some interventions which are quite significant but not covered by any of the sections under ‘Proposal for Action’; they are categorized under ‘Projects of Special Significance’ as elaborated in the following sections:

### **5.7.1 Redevelopment of Zhemgang Urban Core area**

The urban core of Zhemgang town which predominantly caters to trade and commerce of the area is the stretch of buildings between the National highway and Dzong road and a line of few more buildings below the National highway next to Trong village towards Gelephu. However, it is found that the urban core is not as vibrant as expected and therefore, redevelopment of the urban core is proposed with specific design guidelines as detailed below. The following set of design guidelines need to be read in conjunction with the diagrams and drawings provided and in close consultation with relevant professionals for implementation.

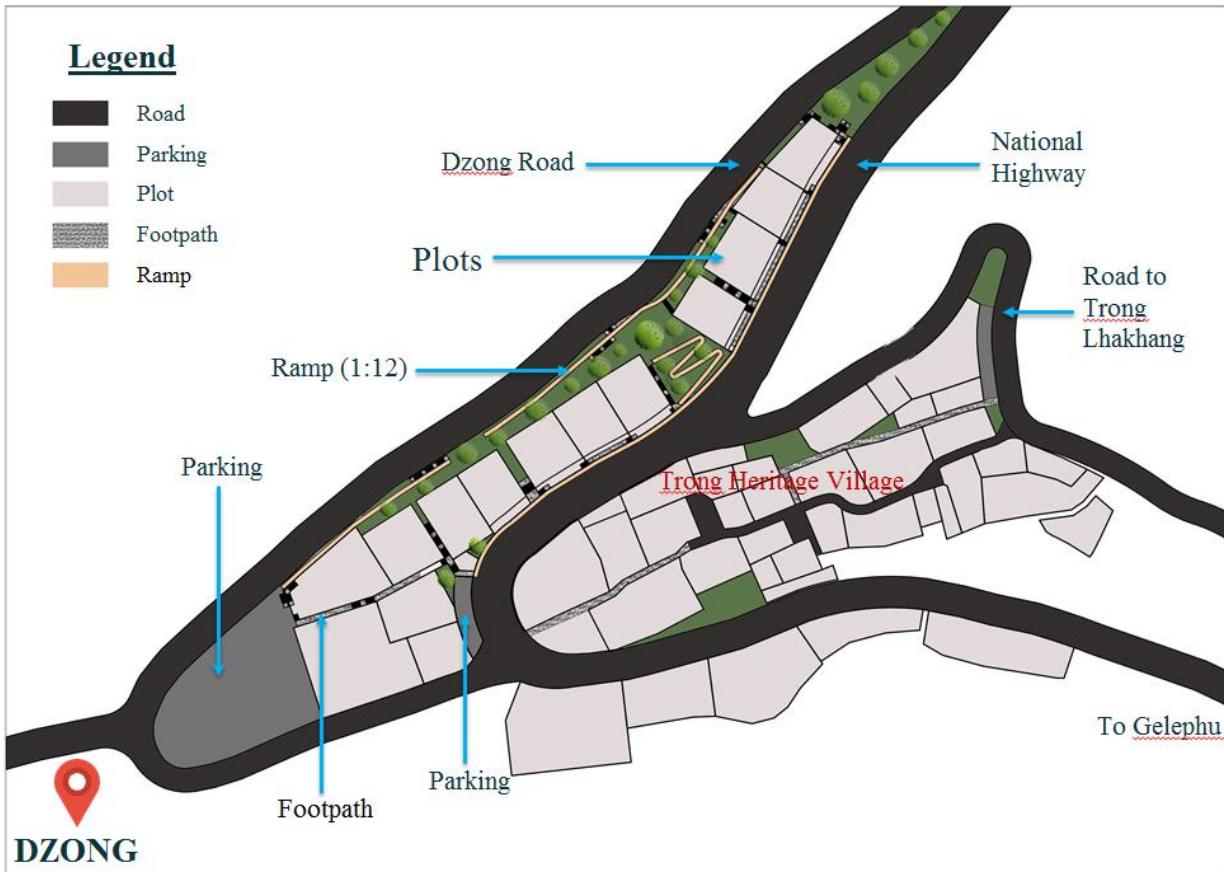
#### **Concept**

The proposed redevelopment of urban core is conceptualized with an objective to create a vibrant traditional town in harmony with the site topography and respecting the pristine sanctity of the Dzong.

#### **Reconfiguration of plots**

To achieve efficient and comfortable access to buildings from the highway, the plots falling within the urban core are reconfigured. Through this intervention, it will enable the provision of sufficient and uniform road right of way (ROW) throughout the urban core and also that all plots will have same building line towards highway on the front as shown in the figure below. The plot reconfiguration exercise also helps to make every plot more regular in shape to ensure optimum developable area.





*Figure 5. 10 Plan of the urban core*

#### **Building form and function**

Most of the existing buildings in the urban core are two-storied traditional structures with commercial use at the ground floor with access from the lower side (Dzong road). As such, there are issues with accessibility where the building height do not reach the upper road level while it is much above the lower road level, thus impeding its vibrancy. At a glance, it is indeed quite difficult to apprehend the existence of shops in that area. Therefore, it is proposed that the buildings in the urban core will be three storied so that one floor will be above the upper road level. The buildings will be of split design where a part of the building on the lower side will be one floor less than the part on the upper side. This is to ensure that the buildings maintain their traditional character and do not contradict or overshadow the sanctity of the Dzong which is located in its close proximity. The buildings in the urban core will appear like a single storied structures from the upper road (highway) and two storied from the lower side (Dzong road). Functionally, the top floors will be commercial with direct access from the highway and lower floors could be residential with open space towards Dzong road but at an elevated level thus providing a safe place for social gatherings including sit-out and children's play area.





Figure 5. 11 Typical Section through Urban Core



## Circulation

The buildings in urban core are directly accessed from the National highway on the upper edge of the plot while it is connected by footpaths and ramps from the Dzong road on the lower side. The road right of way (ROW) of the National highway within the urban core area is 11.5 meters. Both the roads (above and below) are proposed with two-way traffic flow with carriage width of 6 meters and on-street footpath of 2 meters width on the lower edge of the road. The whole stretch of road should be lit with installation of appropriate street light and planted with native growing trees with wider canopy, at appropriate intervals on the 1-meter landscape strip proposed along the footpath. The national highway is proposed with parallel on-street parking. A common parking is also proposed near the roundabout below Trong village entrance from the highway which would cater to the public visiting the town for shopping or any other purpose and also as bus stand to pick and drop passengers.

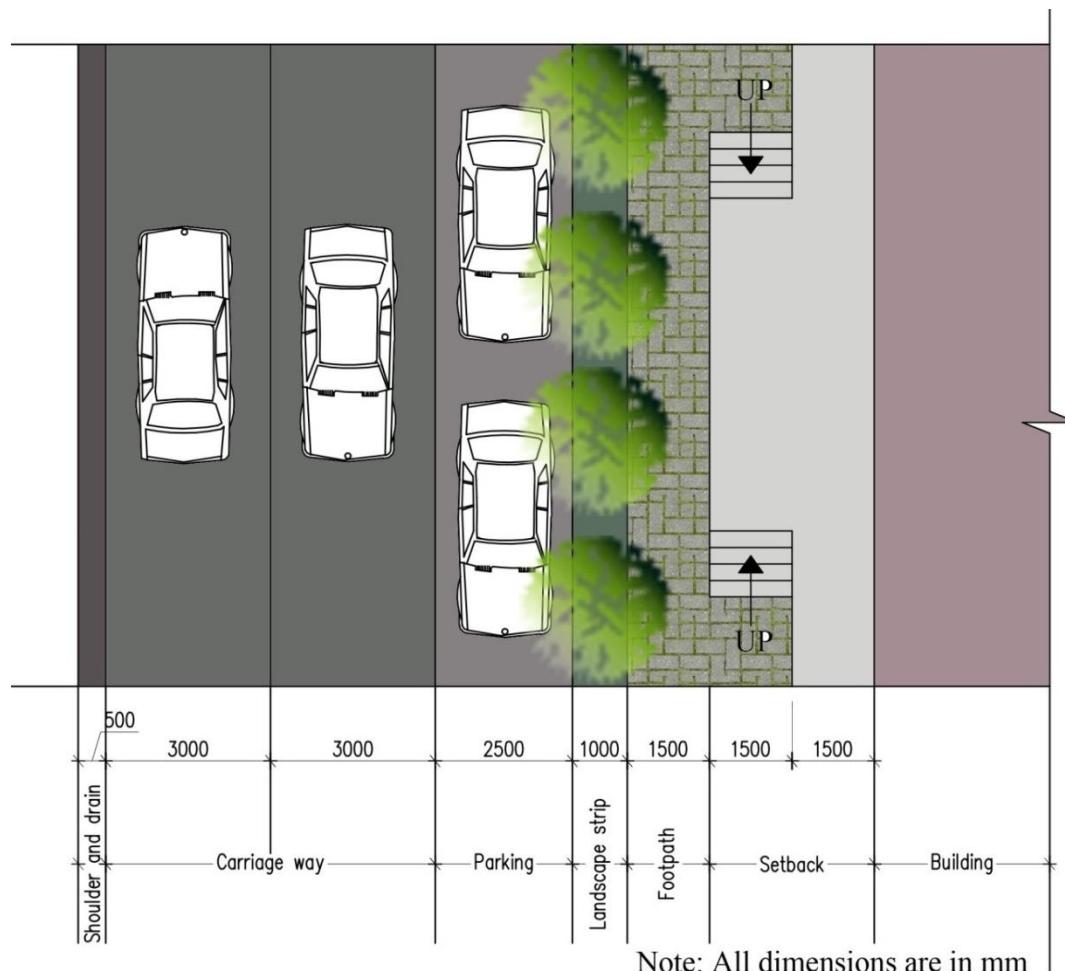


Figure 5. 12 Primary Road Right of Way (ROW) detail



The road above and below the urban core plots (Highway and Dzong road respectively) are well connected at several points with footpaths and ramps. The footpaths are recommended to be built with permeable pavements to minimize environmental degradation and to reduce pressure on the drainage infrastructure during monsoon seasons.

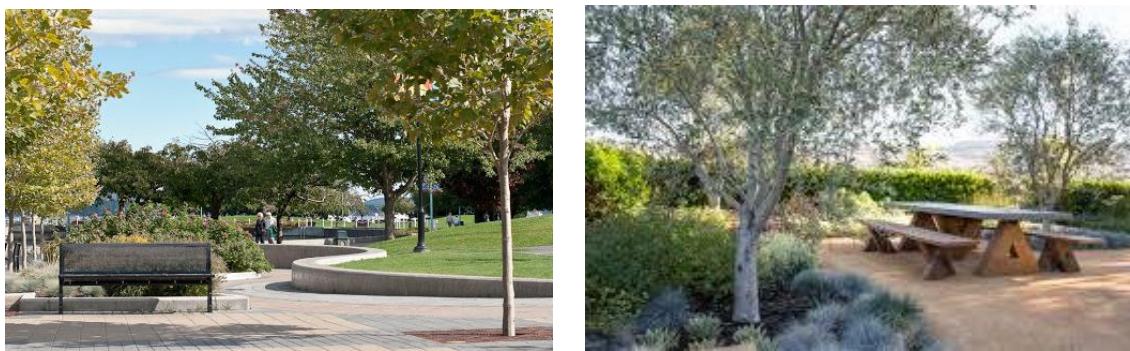


*Figure 5. 13 Images showing example of permeable pavement*

Adequate street lighting should be installed wherever necessary for surveillance and safety during night time. Energy efficient street lighting system should be used as per section 3.1 of ‘Guidelines for Planning and development of Human Settlements in Urban and Rural Areas of Bhutan to Minimize Environmental Impacts’.

### **Open Space**

Open spaces are the breathing space within the dense urban fabric. It is the place for community gatherings and social interactions to enhance the quality of lives of residents or visitors. The stretch of open space in front of the buildings towards Dzong road and the open space right at the centre of urban core shall be maintained green and conducive for spending quality time with their family, friends or community through provision of benches, shades and proper street lighting.



*Figure 5. 14 Images showing the example of Open space design with sheds and benches*



## Implementation

Most of the plots in the urban core area are developed. However, only few are relatively new RCC structures while most are old traditional buildings. This urban core design guideline should be adopted as and when the new structures come up either in the empty plots or through demolition of existing structures.

### 5.7.2 Reconfiguration of Plot within Trong Heritage Village

Trong Village is one of the villages in Bhutan recognized for preservation as Heritage Village and since then there has been concerted efforts from the Dzongkhag Administration to preserve and maintain the village infrastructures. During the analysis of land data for the revision of Structure Plan, it has been observed that the plot boundaries are haphazardly configured during the National Cadastral Resurvey. As a result, the provision of infrastructures such as the emergency vehicular access, footpath connectivity and drainage are adversely affected. Therefore, one of the interventions through this plan revision is the reconfiguration of plot boundaries within Trong Village vicinity so as to enhance the efficiency of the infrastructure and services within the village. The reconfiguration of plot intervention in addition to resolving the plot boundary issues also addressed the circulation and drainage issues.

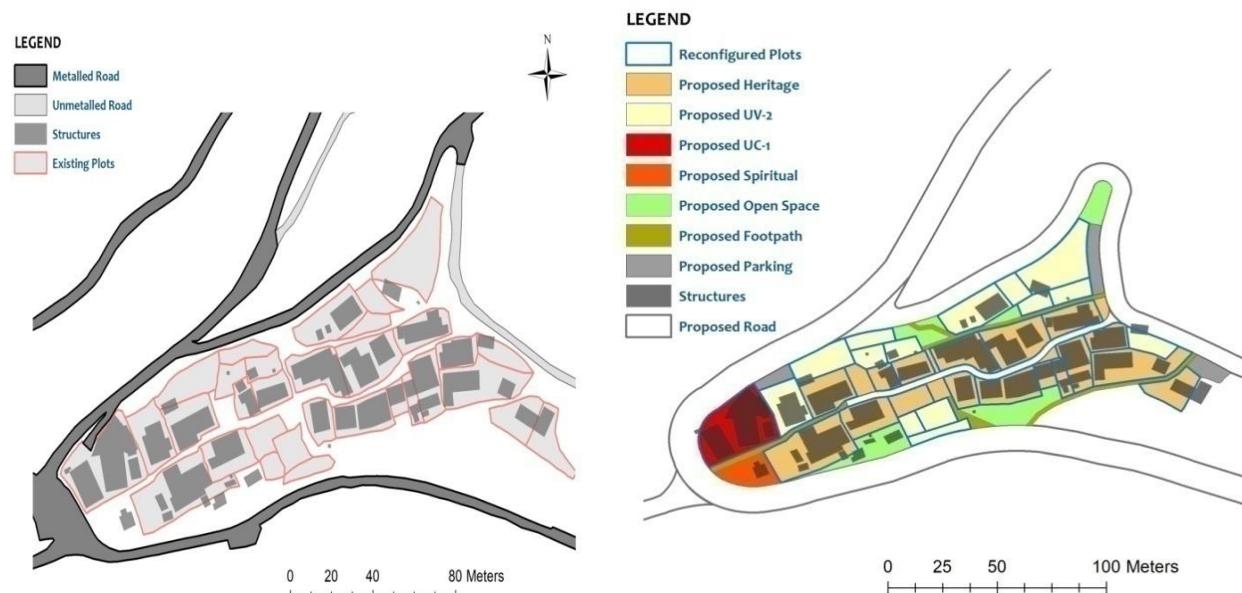


Figure 5. 15 Changes after plot reconfiguration of Trong village



### 5.7.3 Preservation of Zangdopelri view corridor, Tingtibi

Preservation of views and vistas of important landmarks is one of the important considerations in the field of planning. In this line, Zangdopelri at Tingtibi forms an important landmark for Tingtibi town which gives a kind of identity to the place. The current location of Zangdopelri is strategic which is visible from different angles of the town. Coincidentally, it is right at the end of the visual corridor along the thoroughfare of the primary road at Tingtibi core. It is not obstructed by any structure as of today but there is risk of blocking its beautiful view by potential development on the surrounding plots in the future. Therefore, the plots adjacent to Zangdopelri towards Tingtibi town core are relocated so that the area is maintained open and green with unobstructed view.

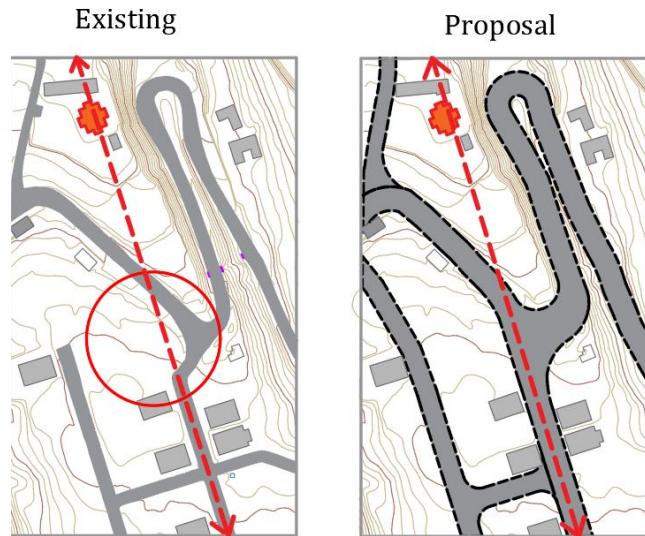


Figure 5. 16 View of Zangdopelri at Tingtibi



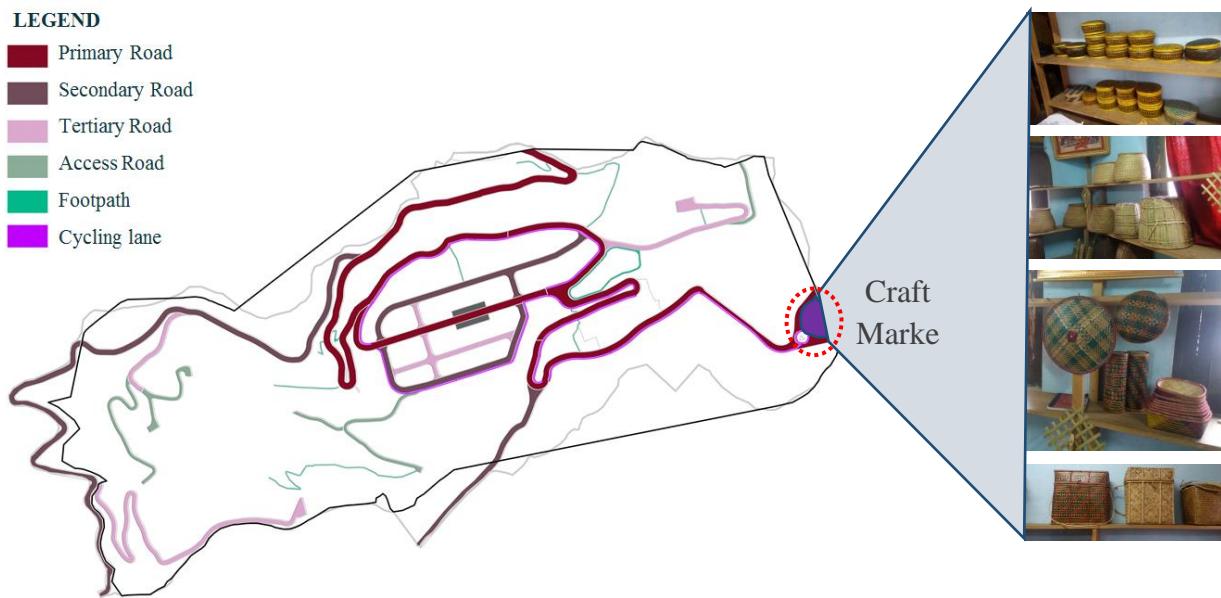
The Primary Road towards the town core is also proposed to be re-aligned at the junction in order to ensure smooth traffic flow and Zangdogpelri visual corridor through the Urban Core main street as shown on the figure beside.

*Figure 5. 17 Realignment of Primary Road at Tingtibi*



#### 5.7.4 Craft market, Tingtibi

Every settlement has their own place of identity, be it in their architectural styles, local festivals, prominent landmarks, or local products. Zhemgang is well known for its pristine natural environment and its products, especially bamboo-made handicrafts such as basket, bangchung, hat, alcohol container, and etc. Through this review, such handicrafts which are also an identity of Zhemgang is promoted by proposing a craft market right at the entrance of Tingtibi from Trongsa and Zhemgang, near Police check point. The site for craft market is chosen at Tingtibi instead of Zhemgang because Tingtibi is centrally located with its road network connected to Tongsa, Gelephu, Panbang, Zhemgang and Upper Kheng via Dakphel and Buli.



*Figure 5. 18 Location of handicraft*



### 5.7.5 Site for heavy vehicle parking, automobile workshop and CSI in Zhemgang

Topographically, Zhemgang is located on a relatively sloping terrain whereby limited area is available for provision of services like parking and automobile workshop within the thromde boundary. Therefore, the revised structure plan proposes a tentative area for services about 1.5 kms beyond the thromde area, at the existing automobile workshop area below the highway towards Trongsa. The proposed area is designated for services which include parking for heavy vehicles, automobile workshop, car wash and other Small and Cottage Industries. The area is relatively flat but the Dzongkhag Administration should implement in close consultation with relevant agencies or professionals particularly with regard to development of parking or any major structures.

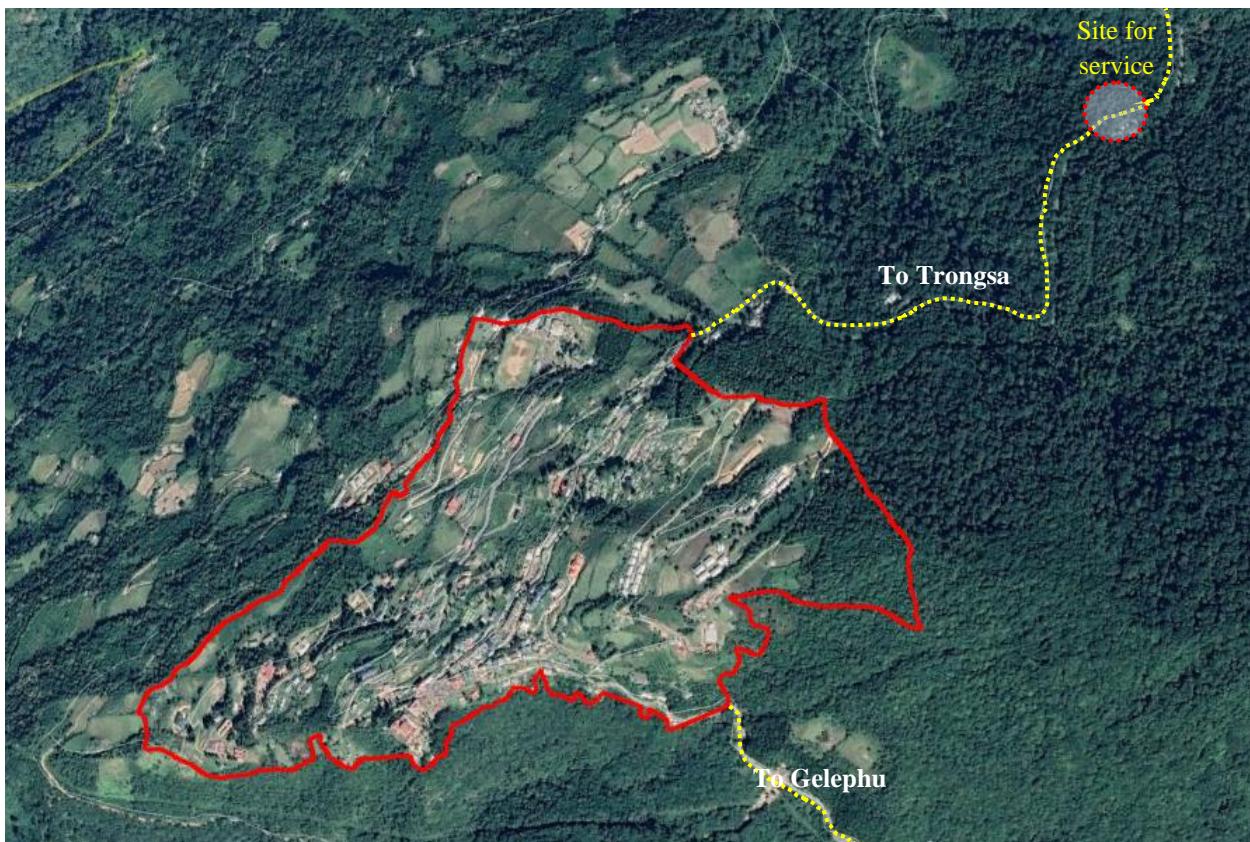


Figure 5. 19 Map showing the location of the proposed service site



## 6 IMPLEMENTATION PLAN

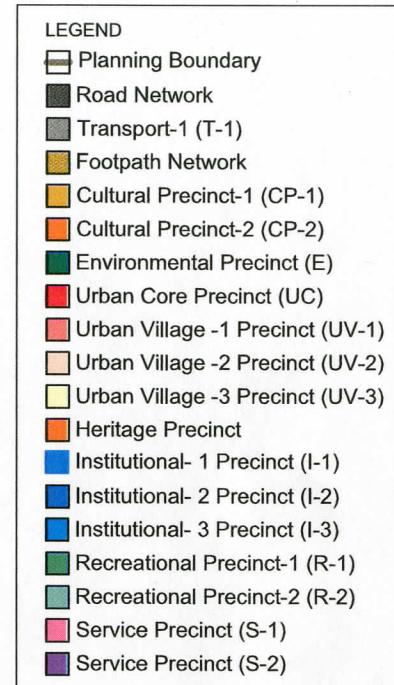
The implementation plan comprises of actions development to carry out the goals and policies identified in the Structure Plan Proposals. It is intended to be used as a working tool which serves to prioritize activities the local government should initiate or maintain to ensure the vision of the Structure Plan is achieved.

The implementation plan has been divided into four phases spanning over a period of 20-year timeframe of the Structure Plan. The asterisk (\*) indicates the period in which the proposals are to be implemented.

*Table 6. 1 Implementation Plan*

Section	Proposal	2020-2025	2025-2030	2030-2035	2035-2040	Remarks
LAPs	Zhemgang LAP	*				LAP to be prepared in consultation with DHS
	Tingtibi LAP	*				LAP to be prepared in consultation with DHS
Recreational Spaces	Development of Recreational Spaces	*	*	*	*	Park design proposal subject to review by DHS
Footpath	Development of on-street footpath (Along Primary and Secondary Road)	*				
	Development of on-street footpath (Along Tertiary Road)		*			
	Development of Off-street footpath		*	*	*	To be developed after the implementation of LAP
Drainage	Development of drainage network		*			To be designed as per the Sustainable Urban Drainage system (SuDs) guidelines





0M 100M 200M



## Zhemgang Structure Plan (2020-2040)

Urban Planning & Development Division,  
Department of Human Settlement,  
Ministry of Works & Human Settlement.

**Sheet Title:**

**PROPOSED  
PRECINCT PLAN**

*[Handwritten signature]*  
Hon'ble Lyonpo  
MoWHS

*[Handwritten signature]*  
Hon'ble Secretary, MoWHS  
*[Handwritten signature]*  
Director, DHS

Approved:

Drawing No: 01

Page No: 01





0M 100M 200M

<b>Zhemgang Structure Plan Tingtibi (2020-2040)</b>	<b>Sheet Title:</b>	<b>Approved:</b>	Drawing No: 01
Urban Planning & Development Division, Department of Human Settlement, Ministry of Works & Human Settlement.	PROPOSED PRECINCT PLAN	Scale: NTS	Page No: 01
Hon'ble Lyompo MoWHS	Hon'ble Secretary, MoWHS	Approved by: 	Approved by: 





**Department of Human Settlement  
Phone: 322182/3227998  
Website: [www.mowhs.gov.bt](http://www.mowhs.gov.bt)**