

Haa Dzongkhag



Bhutan

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LOCAL AREA PLAN HAA TOWN, BHUTAN

Draft Final Report
December'16

1 Prelude	12
Contents	
1.1 The Regional Context.....	13
1.2 Review of Structure Plan	21
1.3 Local Area Plan.....	21
1.3.1 Objectives:	22
1.4 Need for LAP.....	23
2 THE PEOPLE.....	24
2.1 The History.....	25
2.1.1 The Culture	25
2.2 Demography.....	27
2.2.1 Population.....	27
2.2.2 Town.....	28
3 THE LAND	31
3.1 Land Form and Physiography	32
3.2 Slope Analysis.....	33
3.3 Hydrology and climate	35
3.3.1 Climate.....	37
3.4 Environmentally Valuable Assets	37

4 THE TOWN.....	39	6.3.1 Health	86
4.1 Planning Boundary	40	6.3.2 Education.....	87
4.2 Existing Land use	42	6.3.3 Civic Utilities and Facilities	88
4.4 Building Intensity.....	48	7 Physical infrastructure	90
4.5 Residential Density	50	7.1 Water Supply	91
4.6 Plot Detail	52	7.2 Sewerage and Sanitation	95
4.7 Plot Utilization.....	54	7.3 Drainage	97
4.8 Housing Typology	56	7.4 Solid Waste Management	99
5 URBAN FORM ANALYSIS	62	7.5 Power.....	100
5.1 Spatial Analysis	63	8 SWOT	102
5.2 Volumetric Analysis	66	9 FUTURE PROJECTION.....	106
5.2 Urban Design Networks	68	9.1 Population Projection	107
6 EXISTING NETWORKS.....	74	9.2 Housing	112
6.1 Existing Road Network.....	75	9.2 Infrastructure Projection	114
6.1.1 Existing Pedestrian Network	77	9.2.1 Water Supply	114
6.1.2 Mobility Network	79	9.2.2 Sewerage and Drainage.....	114
6.1.3 Existing Parking Space.....	80	9.2.3 SWM.....	115
6.2 Existing Green and Open Space Network.....	82	9.2.4 Street Lights.....	115
6.3 Social Amenities	84	Parking	117

10 ISSUES.....	119	12.2.2 Drainage	142
10.1 Infrastructure	120	12.2.3 Solid waste management	144
10.2 Social Issues	126	12.3 Utilities and Facilities Proposal	148
10.3 Environment Issues	126	12.3.1 Parking Facilities	148
10.4 Employment Issues	128	12.3.2 Bus stop	149
11 Vision And Concept	129	12.4 Social Proposal	151
Vision.....	130	12.4.1 Sports field:	151
Principles.....	130	12.4.2 Park:	151
Developmental Strategies.....	131	12.5 Environmental Projects.....	153
Infrastructure:	131	River front protection.....	153
Social Strategy:	131	Conservation of streams	153
Environment:	131	12.6 Economy Enhancement	156
Employment:	131	13 LAND POOLING	157
Concept:.....	132	13.1 LAND POOLING	158
12 Proposals.....	135	14 Estimates	165
12.1 Proposed Landuse.....	136	15 Plan Implementation.....	185
Landuse Allocation	136	15.1 Shelter Strategy	186
12.2 Infrastructure Proposal.....	140	15.2 Development Control Regulations	187
12.2.1 Sewerage and Sanitation.....	140	15.2.1 Applicability	187

Interpretation	187
Delegation of Power	188
Discretionary Powers.....	188
Power to Change the Appendices and Proformas	189
15.2.2 Definitions	189
15.2.3 Land Use Development Control	189
Environmental assets:	191
15.2.4.1 Development of Land.....	192
15.2.4.2 Requirements of Site	192
Means of access	192
Approach To Buildings	192
15.2.4.3 No Objection Certificate from Referral Authorities	193
15.2.4.4 Distances from Rivers and Streams.....	193
Rivers And Major Streams.....	193
Rivulets / Minor Streams	193
15.2.4.5 Development permissible on environmental clearance from the Relevant Authority.....	194
Addendum:	194
General Requirement.....	195
15.2.5 Sub-Division / Layout of Land / Group Housing / Row Housing	195
15.2.5.1 Land Utilization.....	195
15.2.5.3 Plot Consolidation	196
15.2.5.4 Approach Road	196
15.2.6 Parking Requirements.....	196
15.2.7 Footpaths.....	198
15.2.8 Other Requirements	198
15.2.8.1 Minimum Plot Size for Different Uses	198
15.2.9 Special Regulations for Low Income Group Housing Schemes and Temporary Settlement Rehabilitation Schemes	199
15.3 Urban Design Guidelines	202
Walkways, street, street furniture	202
16 Annexure	206
Annexure 1: Town Map	207
Annexure 2: Existing Landuse Map	208
Annexure 3: Building Use	209

Annexure 4: Building Intensity	210
Annexure 5: Existing Residential Density (Comparative)	211
Annexure 6: Road Network.....	212
Annexure 7: Road Sections	213
Annexure 8: Water Supply Network	215
Annexure 9: Sewerage system	216
Annexure 10: Drainage network	217
Annexure 11: Electricity network.....	218
Annexure 12: Plot Details	219
Annexure 13: Sample Socio economic Survey Format	219

List of Figures

Figure 1 Physical Features of Bhutan	13
Figure 2 Dzongkhahs of Bhutan (20)	14
Figure 3 Regions of Bhutan	17
Figure 4 Location of Haa Dzongkhag in Bhutan	18
Figure 5 Timeline Images.....	23
Figure 6 The Three Brothers	25
Figure 7 Water Temple on Katsho Stream	26
Figure 8 Population Growth in Haa	28
Figure 9 In Migration during the years.....	29
Figure 10 In-migration pattern in Haa.....	29
Figure 11 Age sex ratio	30
Figure 12 Showing ridge lines	32
Figure 13 Slope Profile	33
Figure 14 Dimensional representation of slope percentage	34
Figure 15 Slope Analysis	35
Figure 16 Haa Chhu.....	36
Figure 17 Katsho Stream	36
Figure 19 Haa Chhu.....	38
Figure 18 white poppy.....	38
Figure 20 Cropping Pattern.....	43
Figure 21 Showing Building Intensity Classification.....	48

Figure 22 Land Use Breakup	52
Figure 23 Volumetric Analysis of Haa bazar area	66
Figure 24 Pedestrian way beside Haa Chhu.....	77
Figure 25 Vehicle Ownership.....	79
Figure 26 On Street Parking along Main Road	80
Figure 27 Archery Ground	82
Figure 28 Open Gym	83
Figure 29 Gross National Happiness	84
Figure 30 The District Hospital Under Construction	87
Figure 31 Ugyen Dorji High School.....	87
Figure 32 Post office.....	88
Figure 33 Public Toilet near Weekly Market	88
Figure 34 On- street Parking (Market Area)	89
Figure 35 Source for Haa water supply	91
Figure 37 Laying of new pipelines	92
Figure 36 Alternate Source	92
Figure 38 Septic Tank	95
Figure 39 Road side Drains	99
Figure 40 Water Logging	99
Figure 41 Open Dumping of solid waste	99
Figure 42 Region- wise Growth rate of Bhutan	110
Figure 43 Population Projection through different methods ...	112
Figure 44 Housing Ownership Ratio	113

Figure 45 Age Sex Structure	118
Figure 46 Schematic Constructed Wetland	142
Figure 46 Schematic Constructed Wetland	142
Figure 47 Pontederia cordata.....	143
<i>Figure 48 Pit Composting</i>	145
Figure 50 recycling beer bottles in construction of walkways ..	146
Figure 49 plastic bottle collection bins	146
Figure 51: Process flow diagram.....	147
Figure 52 Typical Fabric Based Silt Fence	153

List of Tables

Table 1 Haa Details	27
Table 2 Population of Haa Dzongkhag	28
Table 3 Landuse Distribution	42
Table 4 Detail Land Use Area Chart.....	43
Table 5 Building Use	46
Table 6 Land Use breakup.....	52
Table 7 Categories of Plots.....	53
Table 8: Coverage and FAR	54
Table 9 Figure Ground Analysis.....	65
Table 10 Road Details	75
Table 11 Existing Parking Lots in Haa	80
Table 12 Social Infrastructure Elements.....	86
Table 13: Proposed landuse classification	138
Table 14: Land details of reconfigured plots.....	159

List of Maps

Map 1 Planning Boundary.....	41
Map 2 Existing Land Use.....	45
Map 3 Building Use within LAP area	47
Map 4 Building Intensity within LAP area.....	49
Map 5 Residential Density	51
Map 6 Figure Ground Map	64
Map 7 Green Space Network	69
Map 8 Sense of Place	70
Map 9 River Permeability Map.....	72
Map 10 Urban Concentration.....	73
Map 11 Existing Road Network	76
Map 12 Existing Pedestrian Network	78
Map 13 Existing Parking Spaces within LAP area	80
Map 14 Water Supply Network	93
Map 15 Existing Sewerage and Sanitation Network	96
Map 16 Existing Drainage Network.....	98
Map 17 Existing Power Supply Network	101
Map 18 Location of Problem Areas	122
Map 19: Proposed land use.....	139
Map 21: Schematic sewerage network	141
Map 25: Proposed mobility network.....	150
Map 26: Green network	155

Map 28: Plots with new IDs 164

List of Abbreviations

IMTRAT	:	Indian Military Training Team
IEC	:	Information Education Communication
LAP	:	Local Area Plan
NSB	:	National Statistics Bureau
PHCB	:	Population and Housing Census of Bhutan
RBA	:	Royal Bhutan Army
UNFPA	:	United Nations Population Fund
C.W.	:	Constructed Wetlands

1 PRELUDE

1.1 The Regional Context

The Kingdom of Bhutan, covering an area of 38394 km² lies between 27° 30' N latitude and 90° 30' E longitude. It is located in the South Asian Continent. It is landlocked with China to the north and India form east, south and west. It is surrounded by the Indian states of Sikkim, West Bengal and Arunachal Pradesh to the west and south. Bhutan forms the southern slopes of the Eastern Himalayas with dramatic topography.

The land consists mostly of steep and high mountains crisscrossed by a network of swift rivers, which form deep valleys before draining into the Indian plains. Elevation rises from 200 m (660 ft) in the southern foothills to more than 7,000 m (23,000 ft). This great geographical diversity combined with equally diverse climate conditions contributes to Bhutan's outstanding range of biodiversity and ecosystems

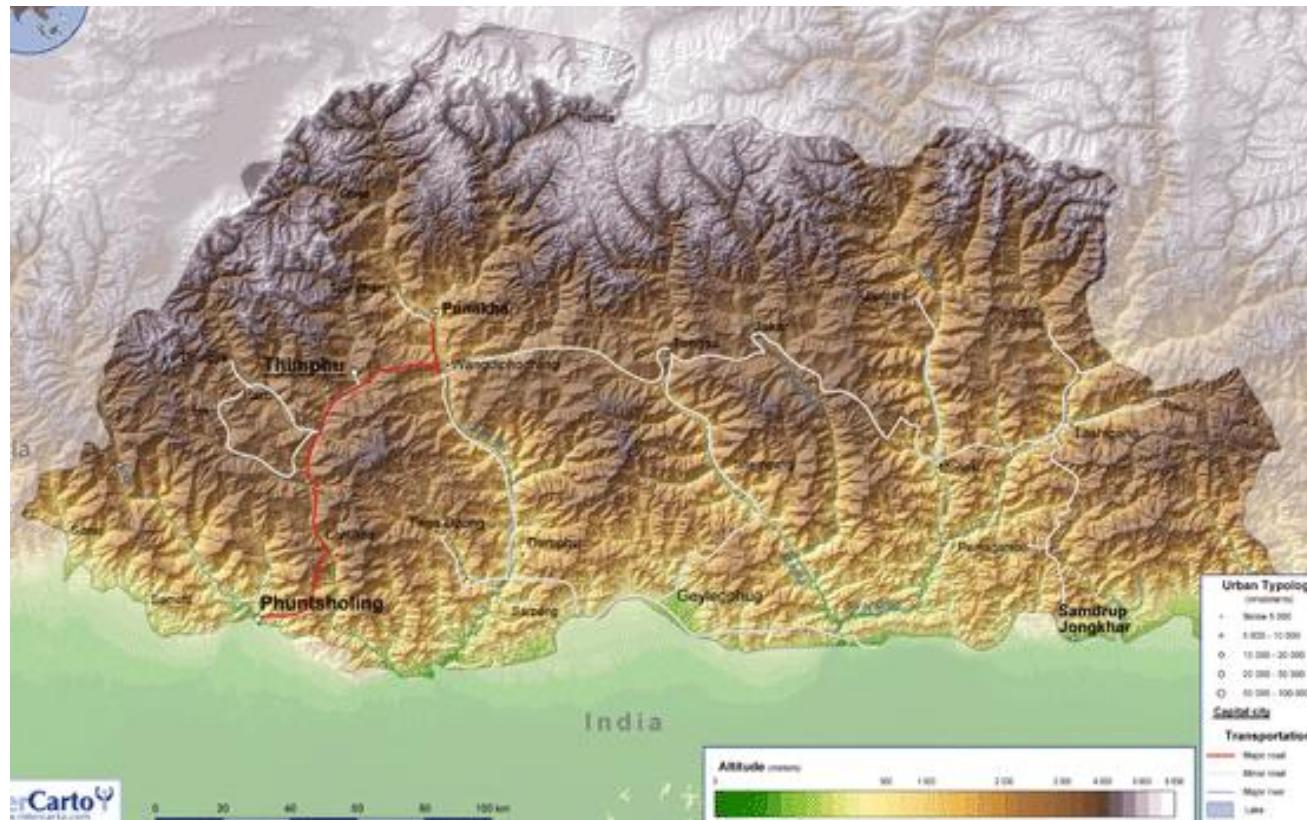


Figure 1 Physical Features of Bhutan

The entire country of Bhutan lies in the Himalayan region, mostly on the greater Himalayas

The land consists mostly of steep and high mountains crisscrossed by a network of swift rivers, which form deep valleys before draining into the Indian plains. Elevation rises from 200 m (660 ft) in the southern foothills to more than 7,000 m (23,000 ft). This great geographical diversity combined with equally diverse climate conditions contributes to Bhutan's outstanding range of biodiversity and ecosystems.

Small population and topographical extremes along with centuries of isolation have made Bhutan maintain one of the most intact ecosystems in the world. Thus, owing to its rich flora and the mandate in its constitution, Bhutan preserves at least 60% of forest cover at all times, which makes Bhutan - the only carbon neutral country in the world. Thus Carbon trading is major source of earning and most of rural electrification projects are funded by it. The diverse and magnificent flora also helps sustain wide range of animals in Bhutan. This includes the Golden Langur, Bengal Tiger, Snow Leopard, Sloth Bear, Himalayan Black Bear, Red Panda, Blue Sheep, Tibetan Wolf,

Antelope, Himalayan

Musk Deer and Takin to name a few. Similarly Bhutan owns about 770 species of birds which includes the world endangered White winged duck and 5400 species of plants.

Bhutan has a strategic location, being located between India and China on the potential Sino - Indian battleground. It shares about 447 km of border with the China's Tibet Autonomous Region and about 659 km with India. Currently, India has more political influence in the nation.

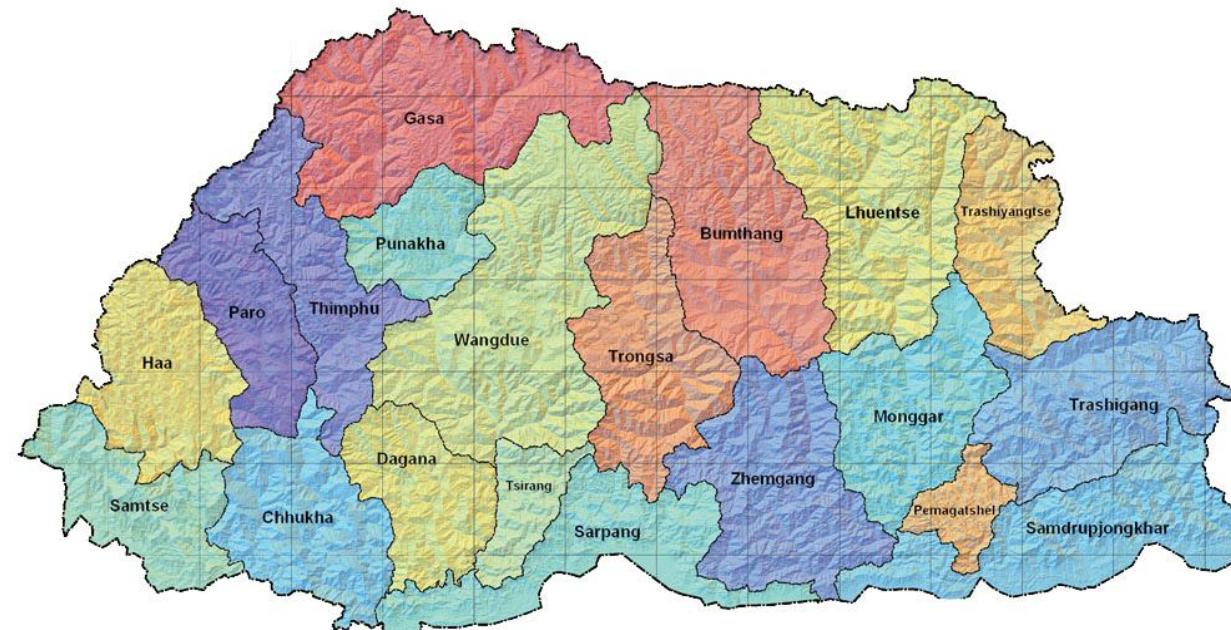


Figure 2
Districts of Bhutan (20)
Bhutan's border with Chin

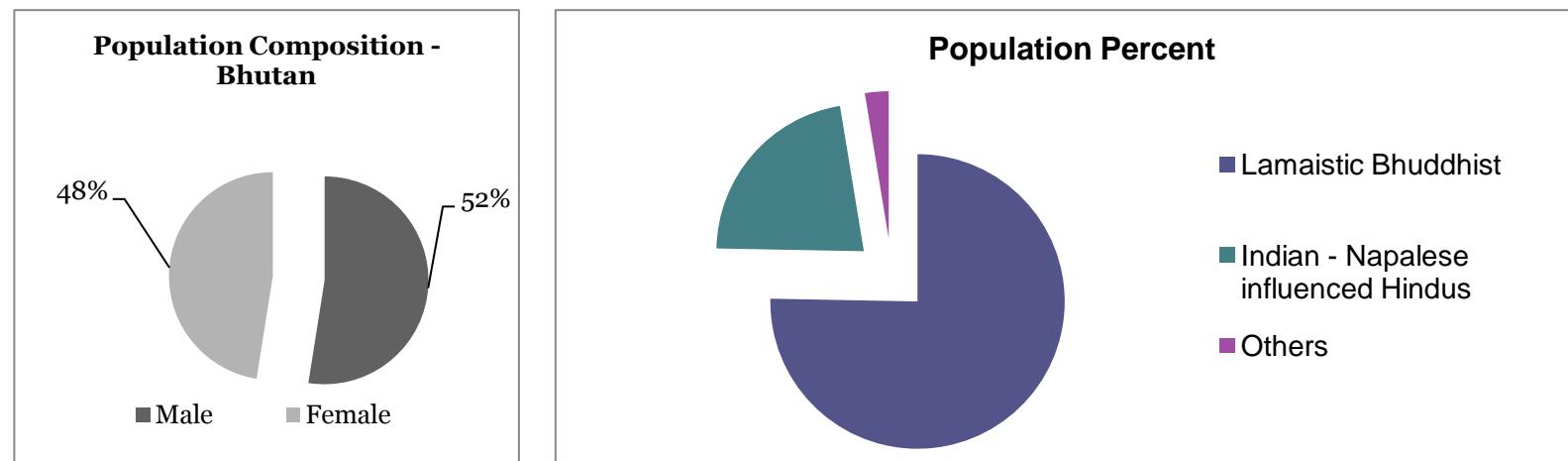
a is largely not demarcated. It is further aggravated by the Chinese takeover of Tibet. The Indian Army wing, 'IMTRAT' supports in the training of Royal Bhutan Army and the development of the country's road infrastructure.

Bhutan is predominantly a Buddhist country followed by Hinduism being second largest religion.

Dzongkha is the official language of Bhutan with other non Bhutanese minority dialects spoken along the borders.



The first census which took place in Bhutan in the year 2005, recorded the population of 634,982 with a composition of 333,595 males and 301,387 females. According to the census, large portion of its population of about 75.3% are Lamaistic Buddhists, 22.1% are Indian- and Nepalese-influenced Hindus 22.1% and 2.6% other



On the basis of natural population increase, Bhutan is divided into four regions viz. Eastern, Central Eastern, Central Western and Western.

The Western Region comprises of six western districts of Bhutan namely Thimphu, Paro, Haa, Wangdue Phodrang, Punakha and Gasa. It houses the two important cities of Bhutan, Thimphu (the National Capital Region) and Paro (the International Airport City of Bhutan). The Haa town lies in the Western Zone. The northern and western part of the Western Region lies at an altitude of about 5000 metres and the central and southern areas of Western Region is at an elevation of about 3000 meters. The region is rich in blue pine which is one of the major sources of economy of the state.

The region contains the two most populated towns of the country; Thimphu with a population of 43,479 and Phuentsholing with a population of 12,625 in the year 2000, as quoted by the Thimphu Structure Plan, although the northern and western part of the Western Region is sparsely populated. The region houses all the three centres of IMTRAT in Bhutan and has one of the major road networks of Bhutan.

It connects Thimphu and Paro to Phuentsholing, which is an important gateway to the imports from India to Bhutan

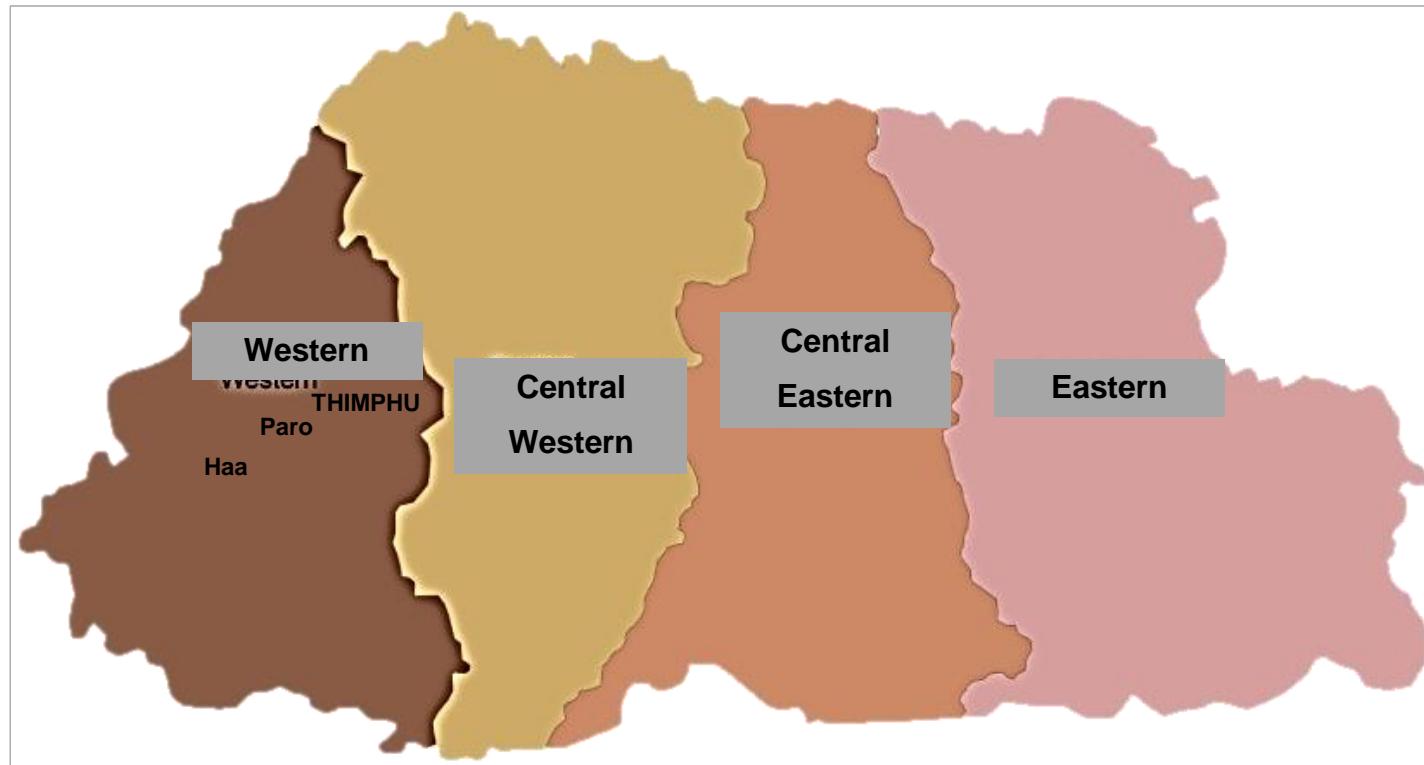


Figure 3 Regions of Bhutan

Haa Dzongkhag

The Haa Dzongkhag (district) is the west most district of Bhutan bordering China. It is bounded by Samtse district in the southwest, Chukha district in the southeast and Paro district in the northeast. It covers an area of 1864.76 sq.km, out of which almost 4.72% of the area is snow covered. According to the 2005 census, the Dzongkhag had a population of 11833 with 5454 males and 6378 females, making it the second least populated district in Bhutan after Gasa.



Figure 4 Location of Haa Dzongkhag in Bhutan

The National Statistics Bureau (NSB) with the support of United Nations Population Fund (UNFPA) projected the population of Bhutan in 2007 up till the year 2030. With the same projections, the population of Haa in 2015 would have been 13500 comprising of 6270 females and 7230 males. The sex ratio of Haa Dzongkhag in 2005 was 855 females for every 1000 males which increased to 867 in 2015. The sex ratio indicates the selective expatriates working in Bhutan.



The Dzongkhag lies at an elevation ranging between 100 to 5600 metres above mean sea level. Haa valley which is a steep north south valley with a narrow floor is the most inspiring feature of the district. Haa Chhu traverses the district along the Haa town.

The district has six village blocks or Gewogs; Bji Gewog, Gakiling Gewog, Katsho Gewog, Sama Gewog, Sangbay Gewog and Uesu Gewog

Almost 65.35% of the district is covered with forests which play an important role in the local economy of the district. The forests are rich in blue pine, spruce, etc. Livestock rearing is among one of the major activities of the people in the district. Potatoes, apples and few other cash crops are grown by the farmers along with some rice and barley in the lower reaches of the valley.

The valley opened for tourists lately in 2002, for security reasons. The tourism sector of the district has not flourished well as for Thimphu or Paro.

Haa contains Torsa Strict Nature Reserve, one of the environmentally protected areas of Bhutan. Torsa contains no human inhabitants, occupying substantial portions of the gewogs of Bji and Sangbay. Torsa is connected to Jigme

Dorji National Park via biological corridor, cutting across the north eastern half of Haa District.

Haa Town

Haa town is the district headquarters of the Haa Dzonkhag/ District. It is located at 27°19'60" N latitude and 89°11'0" E longitude in the Haa valley. It covers an area of about 273.95 acres or 1.11 sq km with a population of 3224. The town is located at a distance of about 110km from Thimphu, the Capital of Bhutan and 220km from Phuentsholing, which is the second largest town of Bhutan. Haa is an important town in the western part of Bhutan bordering China in the north. Town has a large establishment of Indian Military Training Team (IMTRAT) and Royal Bhutan Army (RBA).

The town developed along the Haa Chu (River) in a linear fashion from South East to North West. The town is bounded by the highway in the east and Haa Chhu in the west, with lush green forests on either side. The Haa Thromde is bounded by Katsho Bridge in the North and the southern part of the town is occupied by the Indian Military Training Team (IMTRAT) camp and Royal Bhutan Army (RBA)

The town can be divided into two distinct sectors; the Northern part and the Southern part. The northern part consists of the Dzong and the upper market consists of the main bazaar shops and restaurants while the Southern half of the town is occupied by the IMTRAT.

Owing to its altitude and summer monsoons, Haa experiences cool summers and cold winters with temperature dipping up to - 7° (minimum) during the winters.

Haa being located at a very high altitude, the cultivable agricultural land forms are only around 2 percent of the total area of the Dzongkhag. Most of the area comprises of dry agricultural land. The people of Haa majorly depend on the livestock rearing. Haa valley opened to foreign tourism in 2002. Since then tourism has been an important source of livelihood through community based tourism. The wooded hills for hiking and mountain biking, religious and cultural sites, yak and cattle shows and the annual Summer Festival organized by the Dzongkhag provide the opportunities for further development of tourism in Dzongkhag. Also, the traditional lifestyle could also help in enhancing the community based tourism through development of home- stays and tourist packages.

Haa was predominantly dependant on livestock rearing. It has shifted to commerce with time. Similarly, agriculture is also restricted to rural areas only. Nonetheless, some agriculture fields can be seen in the urban area too. The discussions with the agriculture department revealed the fact that production of potato is highest in Haa. Similarly, crops like wheat, buckwheat etc is also grown.

There are apple orchards and forest nursery in the LAP area. Fruits like peach, plum, walnut and grapes are also grown. There is no irrigation system and crops are rain fed. The soil is sandy loamy and fertile. Manure from cow sheds is used for farming. There is a scope for a cold storage or an agro based small scale unit. This will lead to employment generation and would strengthen the economic base of the town.

1.2 Review of Structure Plan

A structure plan is a planning tool used to prescribe strategies for development in general but is used specifically for towns and cities. It sets out strategic planning policies through integration of social, physical and infrastructural parameters. It broadly defines future development & land-use patterns; the layout of trunk infrastructure and main transportation routes; protected areas and other key features to direct the course of development.

It was informed in the TOR, that a Structure Plan was earlier prepared during 1987- 89 for Haa. It has been attempted for the last one month but a copy of the Structure Plan Report could not be obtained due to unavailability with the Dzongkhag Administration. Due to this particular gap, a Report on Development Of Haa Town in Bhutan By M.L. Chotani, Town & Country Planner, Town And Country Planning Organisation, Ministry Of Urban Development, under the Government of India assisted project prepared for Royal Government of Bhutan, has been relied upon as the basis for this Local Area Plan.

Major proposals in the Structure Plan included improvement of sanitary conditions, augmentation of water supply scheme, provision of storm water drains, training of river, consolidation of existing built up areas, development of new residential areas to

accommodate the future growth, provision of basic amenities and recreational facilities. The structure plan gave a broad outline about the urban planning aspects and a need of a detailed intervention was sought.

1.3 Local Area Plan

LAP is a public, participation-based approach to developing comprehensive neighbourhood plan that enable residents, business owners, property owners, community groups and other stakeholders to provide direct input into determining the future of their community. LAP set out objectives and policies that guide the growth and development of settlement.

Local Area Plan (LAP) sets out a strategy for the proper planning and sustainable development of a specific area within a local authority and for a timescale as specified by the authority. The plan consists of a written statement and maps, which set out the local authorities' objectives for the plan area.

Accordingly, Local Area Plan should be an integrated affair, which shall include the following:

- Land Use Zoning & Density
- Public and Private Open Space
- Parking Facilities

- Up gradation of existing Infrastructure and Provision of new Infrastructure
- Conservation of Built Heritage
- Conservation of Natural Environment
- Community Facilities
- Design & Development Standards.

1.3.1 Objectives:

The broad objectives of the Local Area Plan (LAP) would be to develop an integrated approach to locally focused planning, capitalize on opportunities and sensibly manage future development outcomes for the timescale. It will be an integration of a technically, economically, socially and sustainably viable plan for a phased implementation to meet the requirements of the future. Following are the specific objectives:

- To understand the city in its regional context and the characteristics of the people to ensure holistic development
- To understand the land use pattern and analyse the issues related to land use regulations
- To find gaps in the existing infrastructure and urban services, and upgrade and propose for the future

- To propose the land use / precinct plan along with density pattern and land detail of each plot
- Propose Urban Design Guidelines and Development Control Regulations for a sustainable development.
- To promote public and private partnership and involvement of local stakeholders to successfully implement the management plan.

Local Area Plan falls in the purview of a Structure Plan. The policies or objectives contained in a Local Area Plan must be consistent with the objectives of the Development Plan (Structure Plan) and must include information on the likely significant effects on the environment of implementing the Plan.

1.4 Need for LAP

After the formulation of Structure Plan, Local area Plan was to be prepared to implement and achieve the objectives of the Structure Plan. But the LAP is not prepared even

The Structure Plan approved by the Royal Government of Bhutan in 1992, was to be followed by the formulation of the LAP

for Haa, to achieve the objectives of development. But, the LAP has not come in to existence until now. In such a situation, any developmental works have become difficult to be undertaken. Thus, in the absence of LAP the growth of the town has stagnated over the period of time. This has obstructed the overall growth of the town including economic growth.

This has obstructed the overall growth of the town including economic growth



2 THE PEOPLE



2.1 The History

No history of Bhutan can be written without edge of the history of the two most important elements, the Dzongs and the monasteries, around which the Bhutanese style of living revolves. Each one of them has its own story, its own character. They depict happy blending of the secular with the temporal and the emergence of a system akin to that of the Tibetan culture in a way. The architecture is of sublime beauty and depicts the inner feeling of a nation which is so deeply imbued with a sense of their cultural heritage based on their religion.

In the absence of a documented history of the Haa valley, it becomes difficult to quote the early civilisation of the valley. Although, discussions with local people revealed the flavour beliefs, tradition and culture etc. of the valley.

Most people of Haa follow Buddhist religion. The early inhabitants of the valley worshipped a local deity known as '**Ap Chundu**'. Every year, yak sacrifices were performed which was stopped in the later years. There are two temples on the periphery area of the district and are still visited and worshipped by many.

Lhakhang Karpo

Lhakhang Karpo (*temple of the white dove*), located at Dumchhoe, 3 kilometres (1.9 mi) south of Ha village, is a monastery believed to have been built in the 8th century by the Tibetan King, Songtsen Goenpo, after he sent two doves (one black and one white) to find a sacred place to build a monastery. Lhakhang Karpo is the main seat of Ha's guardian deity – Ap Chundu.

2.1.1 The Culture

According to Bhutanese culture, the country worships the nature. Following this, the inhabitants of the valley worship the 3 hills adjoining the Haa Chhu. The 3 hills are known as 3



Figure 6 The Three Brothers

brothers and have names such as ***Chana Dorji*** (means God of Land), ***Chenrazi*** and ***Jampalyang*** (God of wisdom). These mountains are collectively known as ***Meri Pensum*** because they look identical in shape and size.

Also, a popular fair is organized in the IMTRAT ground every year in October. People from the nearby valleys and villages participate in this Mela in heavy numbers.

Following this, a festival called “***Lomba***” festival is observed on the 29th day of the 10th month of the Bhutanese calendar every year. On this occasion every family cooks the local delicacy called “***Hentey***”. This festival is celebrated with a 3 day succession where people take part in different social events.

A number of water temples and prayer wheels can be seen in the town and the adjoining area which marks the typical style of Bhutanese tradition. A **Prayer Wheel** is a wheel or a series of wheels, with the inscription of the prayer “*Om Mani Padme Hum*” which has a distinct sacred character associated with it. Prayer Wheels vary in size and depending on whether they are part of a religious complex or not, vary in number as well. The wheel is always rotated clockwise as part of a prayer. Running water, often diverted from streams, rotates larger Prayer Wheels or springs which are often called water temples.



Figure 7 Water Temple on Katsho Stream

2.1.2 Uniqueness

It is believed that the flat terrain of the valley, a conducive environment and presence of the river makes the valley suitable for inhabitation. The first ever high school was started in Bhutan in Haa Thromde. The presence of

IMTRAT, RBA gives the settlement a unique identity. Haa is also the wholesale market place for many nearby settlements.

The 2010 GNH index reports Haa to be in **high happiness** category with a value of **0.775**

Table 1 Haa Details

	Total Population	Total Male	Total Female	Sex ratio
2005	11833	6378	5454	855
2015	13500	7230	6270	867

2.2 Demography

Study and Analysis of the demographic data for any settlement is extremely important as it gives an insight into the characteristics of a population residing in a settlement. The latest Population Census, and the only one, is The Population and Housing Census of Bhutan (PHCB) 2005 and it offers a wealth of information. The Haa Dzongkhag had a population of 11,833 in the year 2005, out of which 5454 were female and 6378 were male. The National Statistics Bureau (NSB) with the support of United Nations Population Fund (UNFPA) projected the population of Bhutan in 2007 up till the year 2030. With the same projections, the population of Haa in 2015 was 13500 comprising of 6270 females and 7230 males. The sex ratio of Haa Dzongkhag in 2005 was 855 females for every 1000 males which increased to 867 in 2015. The sex ratio indicates the selective expatriates working in Bhutan.

2.2.1 Population

Population is the basic ingredient of any human settlement. Though, population/ demographic analysis has to have a wide range of statistical data ranging over years or decades to understand the dynamics of the resident population. Bhutan has

very little statistical database to comprehend and make accurate projections.

Statistical data is available either at the Dzongkhag level and a little bit at the town level. Census data of 2005 gives the total number existing in the Dzongkhag to be 11833 with 6378 males and 5454 females with a sex ratio of 855. The census itself projects the population in 2015 to be 13500 with 7230 males and 6270 females with an increased sex ratio of 867 females per 1000 males. Thus, indicating a slight stabilization of population.

2.2.2 Town

Though exact population figures are not known but figures available from the structure plan as indicated by Mr. Chotani's Report, indicate 2005 Census population for Haa town to be 2489.

Table 2 Population of Haa Dzongkhag

	Total Population	Growth Rate (p.a)
1987	1314	
2000	1731	2.38
2005	2489	8.75
2015	3224*	5.90

*As per data given in the TOR

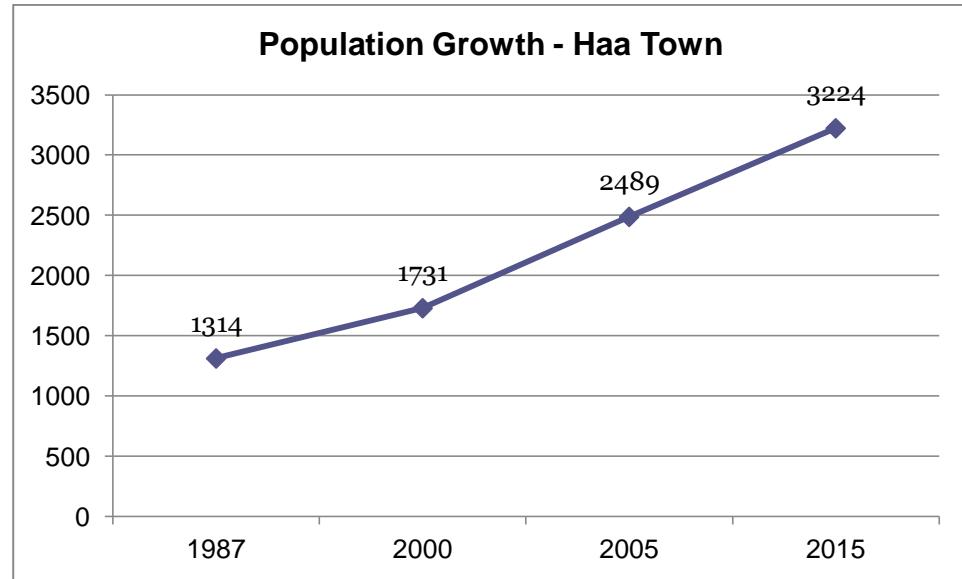


Figure 8 Population Growth in Haa

Furthermore, in the absence of an elaborate demographic survey, a household socio economic survey was conducted within the LAP area. This Sample House Hold Socio Economic Survey was conducted over 100 families, which divulged a population of 373 persons, i.e. almost 12% of the total population of the town.

The Results of the House Hold Socio Economic Survey, analysis and inferences are as following.

Salient Demographic Indicators

1. In- Migration

Haa has been showing in-migratory trends for quite some time now. Though it was a trickle a decade back, it has swollen into waves since 2008. The pi- diagram below displays this factual scenario very aptly.

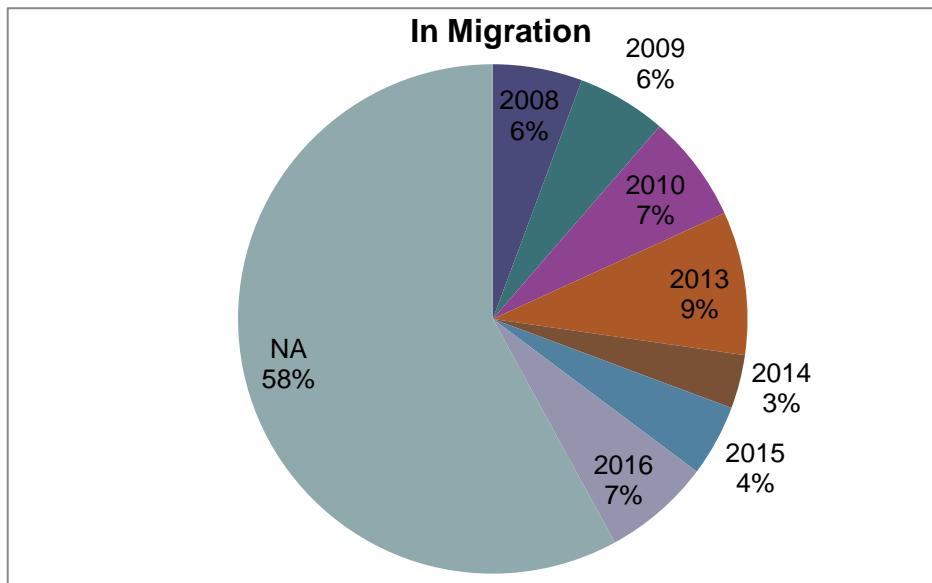


Figure 9 In Migration during the years

Since, Haa is the head quarter of Dzongkhag, it has attracted some population. This can be one of the reasons of in - migration. Another reason can be the establishment of the government offices which has also created some employment.

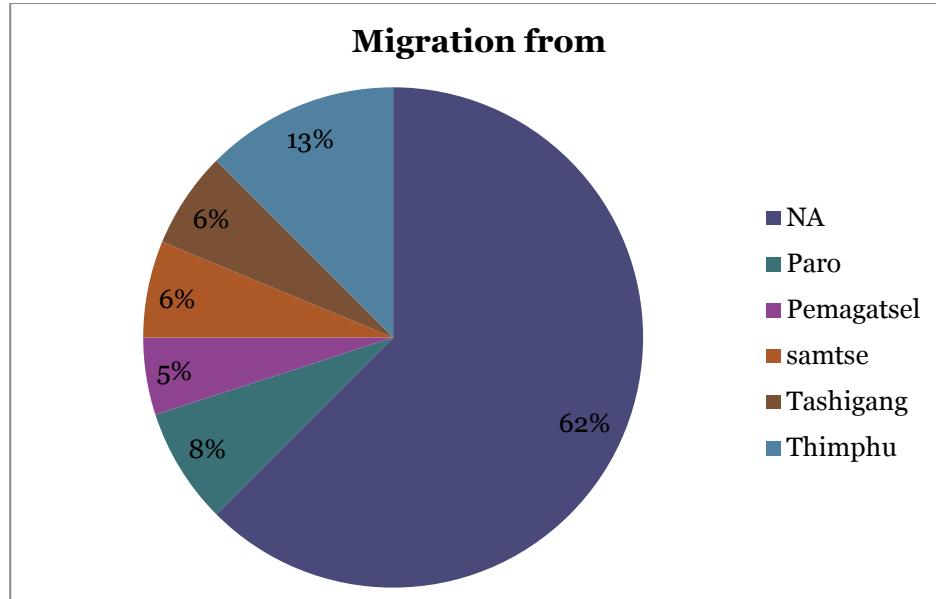


Figure 10 In-migration pattern in Haa

As described above, the establishment of government offices suffices the fact that the major in migration in Haa is from Thimphu, the state capital.

2. Family Size

The average family size according to the socio economic survey is 3.7, which, for the ease of further calculations is rounded up to 4. The size varies from as small as 2 to as large as 7. From the data, it is inferred that more than 58% families are core families,

3. Age Sex Structure

The Age Sex Structure of a city is an indicator of the functioning of the city. Whereas in the emerging scenario of a city with lot of in-migration, the structure becomes middle heavy with the number of working population age, more than the dependent population.

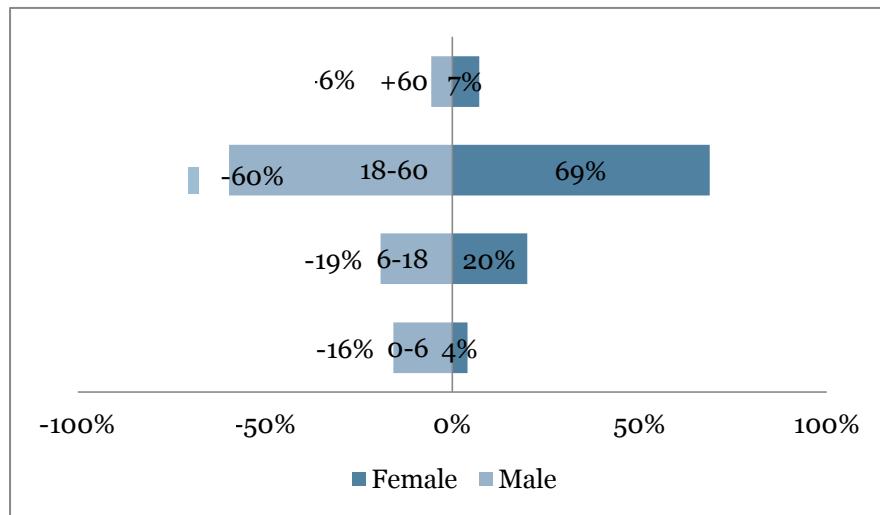
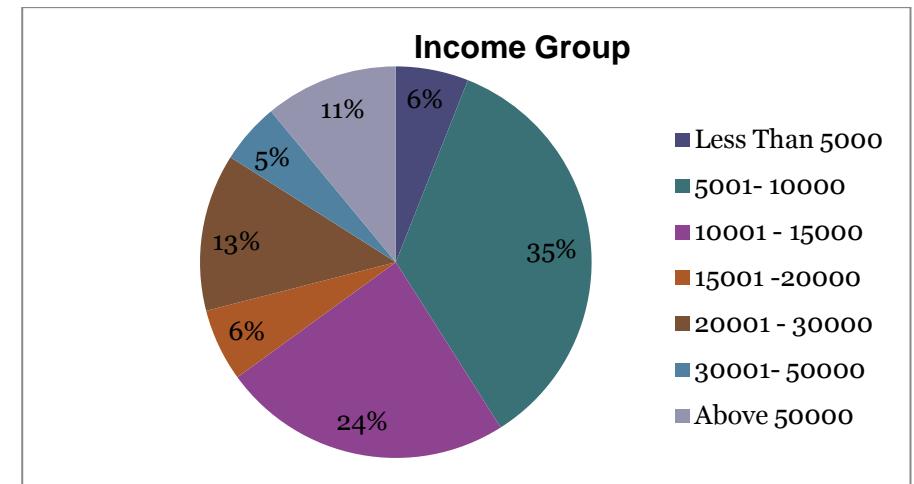


Figure 11 Age sex ratio

Income Group:

The income status of town is average. 95% of the population earn more than 5000 Nu while 35% of the population earns within 5000- 10000 Nu.



3 THE LAND



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3.1 Land Form and Physiography

The Haa Valley situated to the West of Paro Valley is fully similar to the Paro Valley in geology, soil characteristics, forest and vegetation except for the spatial configuration. Haa Valley is ringed by higher altitudes on the sides, east and west, with Haa

Chhu River flowing in between. The eastern hills however provide a respite with a valley in between. Eastern valley holds the highest motorable road passing through Chele -la Pass and further connecting to the Paro valley.



Figure 12 Showing ridge lines

The areas having slope more than 30% are unfit for construction activity as they are prone to soil erosion and landslides. To develop these areas activities like cutting of slopes, clearing of vegetation etc need to be carried out. This damages the slope characteristics and affects the stability of the soil increasing erosion and surface run-off

Haa Chhu starts from snow hills and small streams flowing downhill add up to The Chhu and thus makes it Perennial River. Katsho Chhu is major feeder stream from Haa town. The valley floor is formed by sedimentation of soil glided from hills and almost all in the eastern side has a gentle slope before the sudden advent of higher elevations. This gentle slope territory enables it to become a habitable area.

3.2 Slope Analysis

Slope analysis helps in understanding the topography of the region. It provides the slope ranges available in the region using the contour data thus determining the compatible and incompatible slopes for urban development. Slope analysis, along with surface geology and soil data, will determine the most appropriate sites for various land uses.

The slope of an area is the ratio of the difference between the highest and lowest altitude points of the place (rise) to the horizontal distance measured between the points (run). The larger rise and the shorter run, the steeper is the slope. Normally slope is represented in terms of slope angle (α), or in terms of the slope percentage (%).

The slope angle, or degree of slope α , is determined by $\tan \alpha = \text{rise} / \text{run}$.

The slope percentage is determined by the formula $\text{slope \%} = (\text{rise/run}) \times 100$.

The slopes are classified into five categories based on the steepness of the slope. They are:

1. Flat terrains (0 –5%)
2. Gradual slopes (5 –10%)
3. Moderate slopes (10 –20%)
4. Steep slopes (20 –30%)
5. Very steep slopes (greater than 30%)

This is a software generated valley section; section plane is looking towards north perpendicular to river. Section clearly suggests gradual and moderate slope on western side of river and steep slope on eastern side of river Haa Chhu.

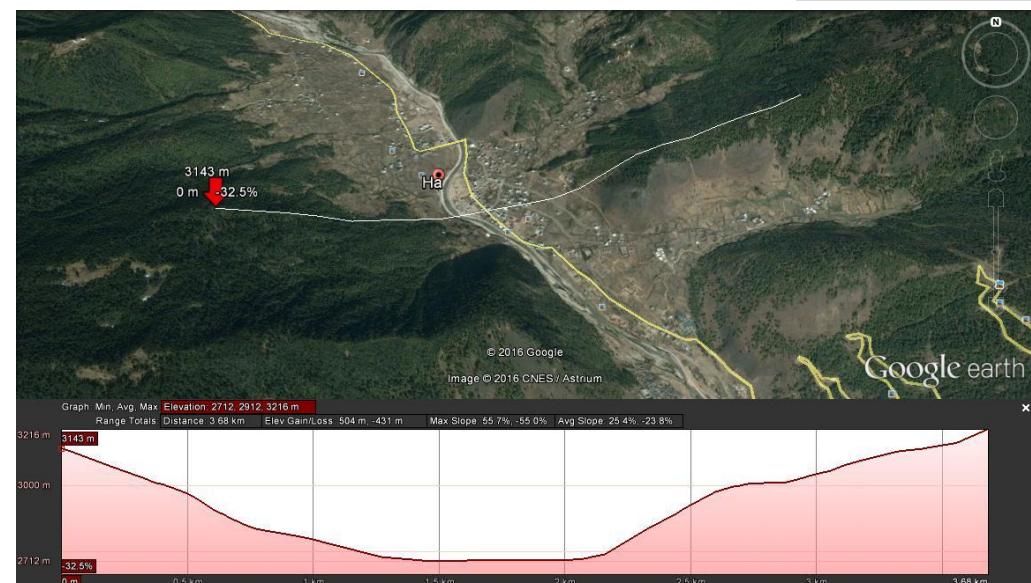
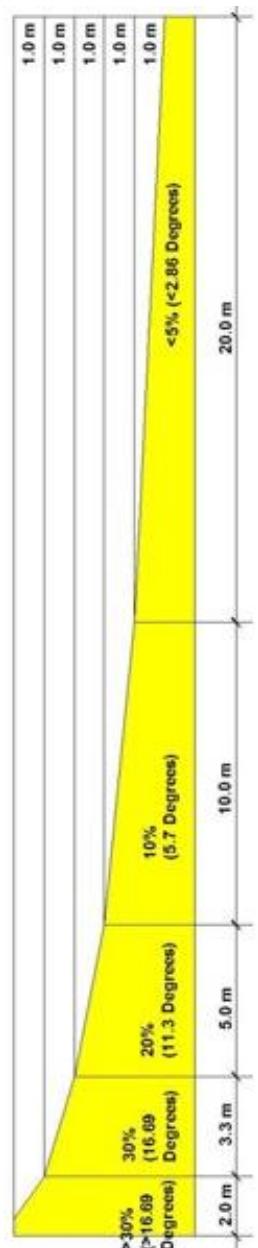


Figure 13 Slope Profile



The graphic on left demonstrates the various slope categories represented as colour codes in the slope analysis map. The slope analysis map provides the range of slope percentage for the valley. The colours ranging from light green to dark green represent the flat, gradual and moderate elevations. The first three categories are considered as suitable for urban development.

The above graphics demonstrate the various slope categories represented as colour codes in the slope analysis map. The slope analysis map provides the range of slope percentage for the valley. The colours ranging from light green to dark green represent the flat, gradual and moderate elevations. The first three categories are considered as suitable for urban development.

The analysis shows that major percentage of the floor valley area is subsumed under the first three categories of slope. The overlay analysis of slope map over the geological data reveals that maximum area goes under 0-5% slope which is potent in ground water and soil resources. The remaining area is deemed fit for the urban development. None of the area in the city has slope more

than 30% thus 100% area except water body

buffer zone in local area plan can be considered as habitable.

The areas having slope more than 30% are unfit for construction activity as they are prone to soil erosion and landslides. To develop these areas activities like cutting of slopes, clearing of vegetation etc need to be carried out. This damages the slope characteristics and affects the stability of the soil increasing erosion and surface run-off.

Figure 14 Dimensional representation of slope percentage

3.3 Hydrology and climate

Hydrological networks and units are the spinal cord of the entire natural system. Rivers, streams, springs, aquifers, lakes, ponds and ground water are interlinked to each other and though the link is not prominently seen they function in close association. If we discern the different determinants of natural systems, especially geology, climate and vegetation, these links will be

revealed to us.

Understanding these links and the functioning of these hydrological units is an important factor in planning and resource management. As was discussed earlier, water is the prime resource for any habitable place. The entire world has only 3% of its hydrological wealth as potable water, out of which major volumes are in the form of frozen ice, or as ground water.

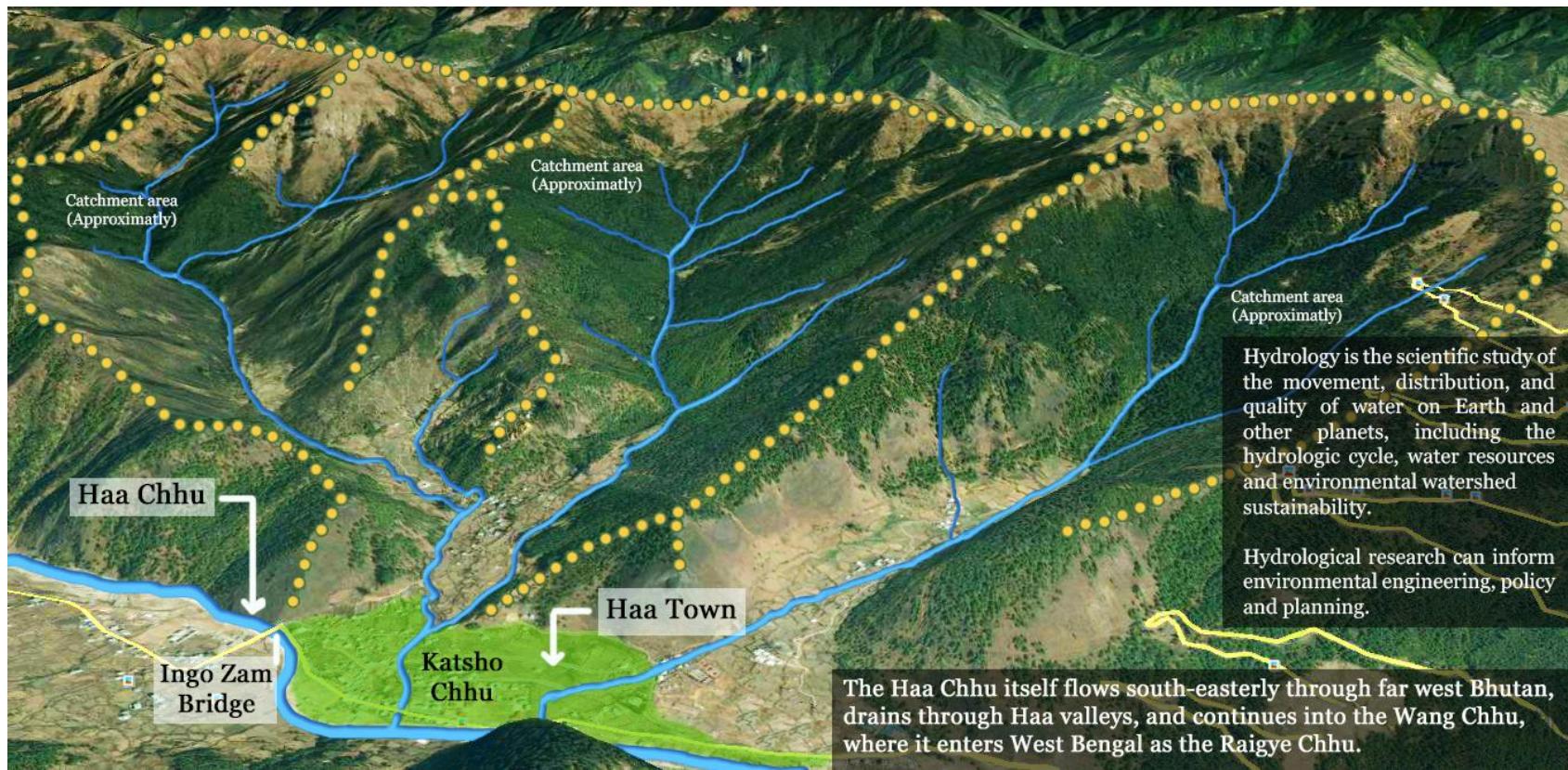


Figure 15 Slope Analysis

So it is very important for us to manage and protect the available water resources efficiently.

The predominant feature in the Haa valley is the River HaaChhu and no. of streams joining the river bed. The major stream in the Haa town is the Katsho stream which comes from the hills adjoining the highway and flows from the middle of the town to meet HaaChhu. The catchment for the HaaChhu is the Ha Chhu originates in a valley glacier on the south facing slope of the main Himalayas. The source area is located to the south of Chomo Lhari (*Mountain of the Goddess*). A number of smaller streams flowing from glaciers in hanging valleys join the main stream. The Ha Chhu then flows in a general direction, south south-east to join the Wang Chhu at Chukha

The upper valley of Ha Chhu is glaciated but in its lower and middle course it flows along a deep V-shaped valley. There are many rocky outcrops along this river. Bulk of the Ha Chhu catchment is under alpine, sub-alpine and temperate mixed coniferous forests.



Figure 16 Haa Chhu

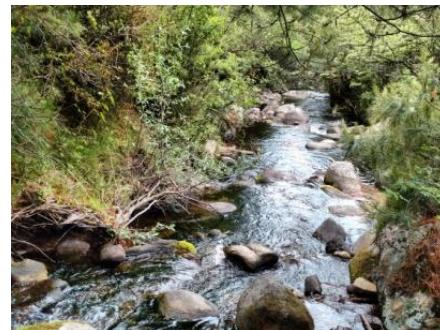


Figure 17 Katsho Stream

3.3.1 Climate

The climate here is tropical. Altitudes also affect the temperature and range approx from 16 deg to 23 deg Celsius during the summer months and drop to -7 to 14 deg Celsius during the winter months. The precipitation is brought by the monsoons and is fed by the westerly winds giving the Dzongkhag an approx precipitation of 14.5 mm during the winter months and 122 mm during the summer months. The annual precipitation is approximately about 815 mm (SYB, 2014)

3.4 Environmentally Valuable Assets

Bhutan is committed to follow a more dignified path. Bhutan is committed to create one of the first environment friendly habitats in the world, where humankind and nature find a modicum of eternal harmony. Rich in history and heritage, the country has various precincts which are environmentally valuable assets. Bestowed by natural resources like river, forests, agricultural fields need to be conserved and protected for future generations. The area has a complex and vulnerable eco-system comprising of a rich variety of flora, fauna and avifauna. The rapid urbanization and the limitation of the habitable land in the country put a pressure on the environs. Blatant activities against nature like cutting of hillside trees, quarrying on hill slopes, dumping sewerage and industrial waste in the natural drainage system and construction on steep slopes is damaging the already fragile environment.

The environmentally valuable assets in the valley are-

1. Forest

There are trees like Blue Pine, mixed coniferous like spruce, hamlock, oak species etc. Cane shoots, Mushrooms, Fern etc are also found which are used for



eating purposes. At some places Doma plantation is also done.

"White Poppy" which is a rare flower is endemic to Haa only. An herb called Putishing Dzongkha is found here which is used as a medicine against cough and cold.

"Aconotium" which is used as poisons in arrows for hunting is also found in these forests.

Wood is mainly used for firewood, furniture and construction purposes. There are 19 wood saw mills in the district. A concept of community forest was recently introduced to conserve the forest. In this concept, villages near the forest adopt the forest and nurture and maintain it. In this way, the deforestation is controlled to a large extent.

2. River and Streams

The HaaChhu is the only river flowing through the Haa valley which is joined by 2 streams which flow from the adjoin hills. Out of the 2 streams one is perennial and the other is seasonal. The streams are a valuable asset as they serve as a source for water supply and irrigation purposes. The catchment for the HaaChhu is the hills surrounding the valley. HaaChhu forms the tributary to the WangChhu. The upper valley of Ha Chhu is glaciated but in its lower and middle

course it flows along a deep V-shaped valley. There are many rocky outcrops along this river. Bulk of the Ha Chhu catchment is under alpine, sub-alpine and temperate mixed coniferous forests. The river and streams support a variety of plant species within their Riparian Zone (The ecosystem in the immediate surroundings of the watercourse, which is influenced by it). In turn this eco-system protects the environment of streams and rivers.

The rivers and streams prove to be a valuable asset. But, uncontrolled road construction and other developments in the recent past have severely damaged the river course. Also, the lack of disposal techniques for solid waste and sewerage account to the degradation of the health of the river.



Figure 19

Haa Chhu

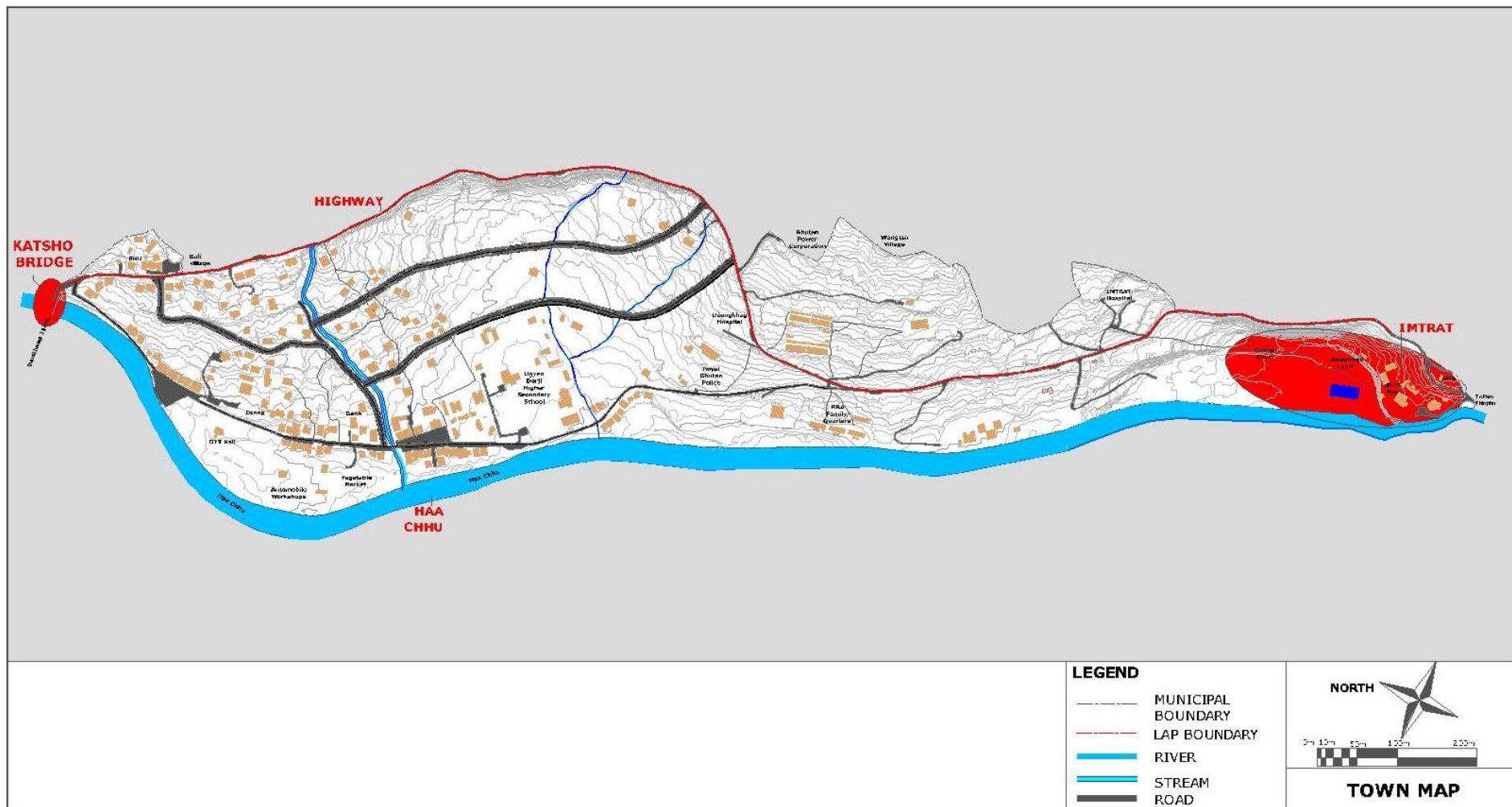
4 THE TOWN



4.1 Planning Boundary

For initiating any Planning task, the delineation of the Planning area is a prerequisite. The Structure Plan for Haa split up the entire town in five areas to conceive the formulation of the Local Area Plans in phases. Thus, the TOR demarcated the planning area for LAP extending over 150 acres which was interpreted with actual boundaries and edges during the site visit. The proposed area for LAP turns out to be 154.08 acres. The demarcated area comprises of the Katsho Bridge along with the BHU area on the north, the highway being the boundary on the east and the RBA officer's mess constituting the southern boundary of the LAP and Haa Chhu being the western boundary of the LAP. A map with the boundary follows

Map 1 Planning Boundary



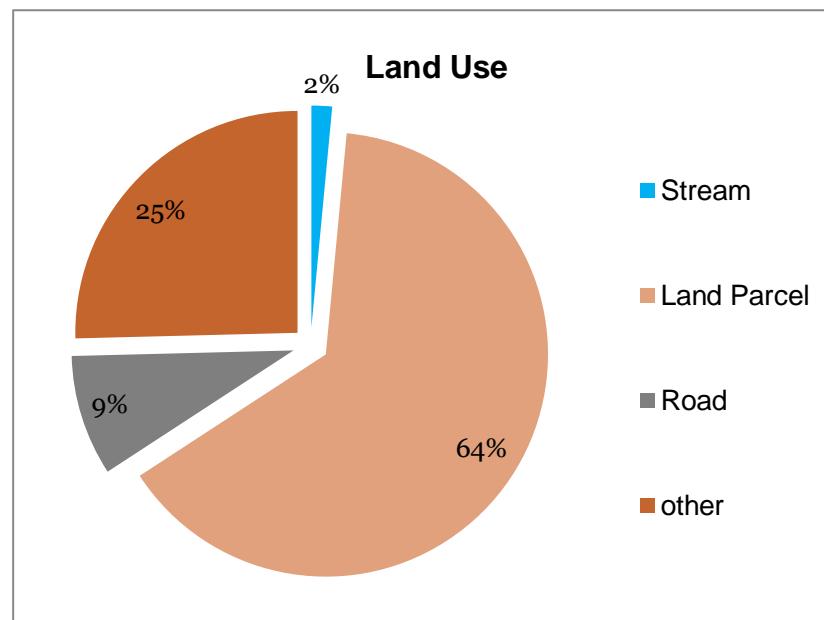
4.2 Existing Land use

As mentioned earlier, the Haa Local Planning Area extends over an area of 154.08 acres. The use wise break up of this extent of land is as under;

Natural Features, which is a stream, covers the least area of only about 2%, more than two thirds of the LAP is covered by land parcels, predominantly used for residential use and some land parcels with a combination of residential and some other use.

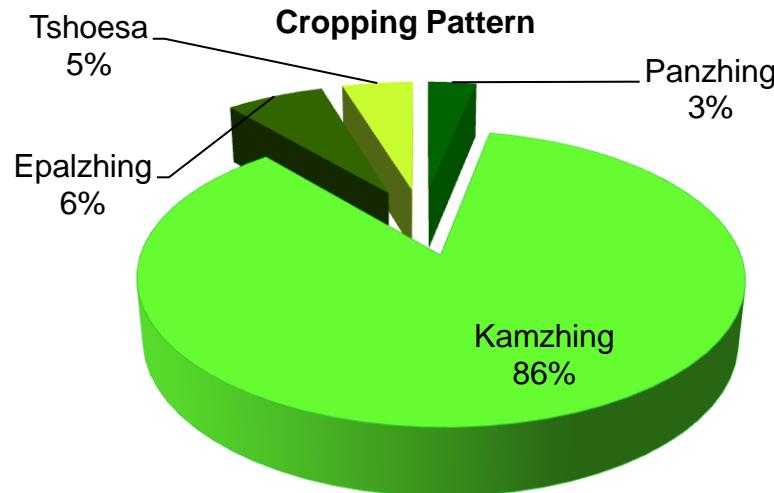
Table 3 Landuse Distribution

Broad Use	Area (sq mt)	Area (in Acres)
Natural Feature		
Stream	9487.41	2.34
Human Intervention		
Land Parcel	400764.62	99.03
Road	54629.53	13.50
Other	158646.00	39.20
Grand Total	623527.56	154.08



The existing land use study illustrate that the 43.5% of the land in the Haa LAP is under agriculture activity of some kind viz. Kamzhing, Pangzhing, Epalzhing, etc. which shall be considered sacrosanct and maintained owing to the lack of agriculture activities in such a terrain.

Figure 20 Cropping Pattern



Out of all the agriculture activities undertaken in Haa, Kamzhing is the predominant. Almost 64.1% of the land cover is occupied by non agriculture activities which includes residential, commercial, institutional and roads. This marks the presence of urban character of the town .The detailed study divulges that most of the non-agriculture uses are located adjunct to an existing main road link. The detailed breakup is as under.

Table 4 Detail Land Use Area Chart

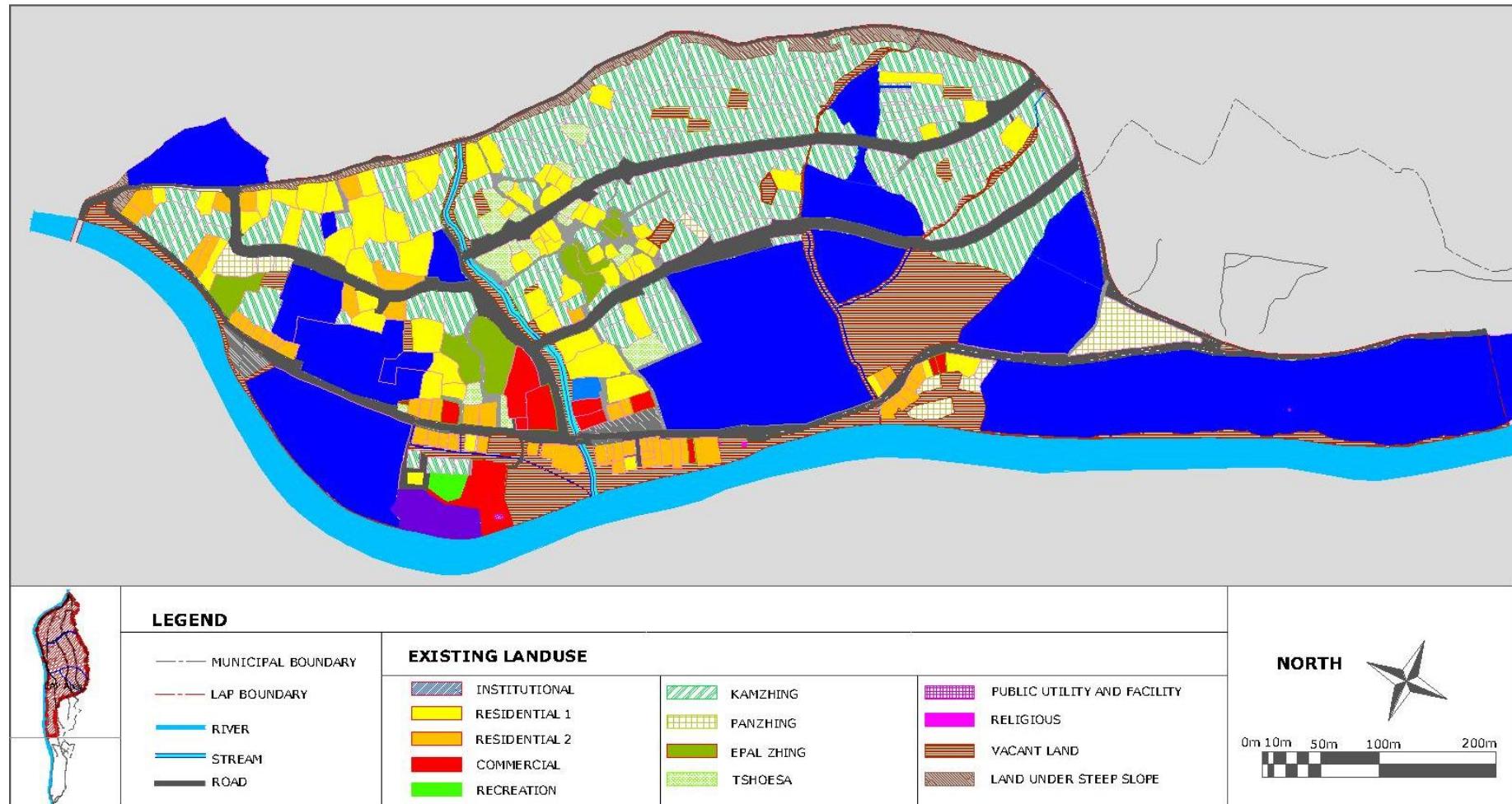
Use	Area (Acre)	Total (Acres)	% of Total Area
<i>Natural Feature</i>			
Stream	2.3	2.34	1.91
<i>Human Intervention</i>			
Agriculture		120.24	
Panzhing	1.3		1.09
Kamzhing	35.7		29.12
Epalzhing	2.7		2.20
Tshoesa	2.0		1.60
Residential	11.7		9.51
Institutional	46.2		37.70
Mixed	5.3		4.33
Commercial	1.9		1.54
Road	13.5		11.01
<i>Total</i>	122.58		100.0

In the non agriculture category, Institutional areas have the major land use covering about 37.7% of the entire area of LAP. This is because of the large RBA establishment falling within the LAP, which is the main contributor.

Haa has a good network of major roads. The highway (both new and old) and other new roads laid over the time, thus contributing 13.5% of the land use of the LAP.

Residential area covers only about 11% with roads covering 2.38% and the institutional area almost about 2%. Though the presence of Commercial and Mixed use is in minuscule quantities, their very presence in making a mark indicates strong advent of urbanity in the area

Map 2 Existing Land Use

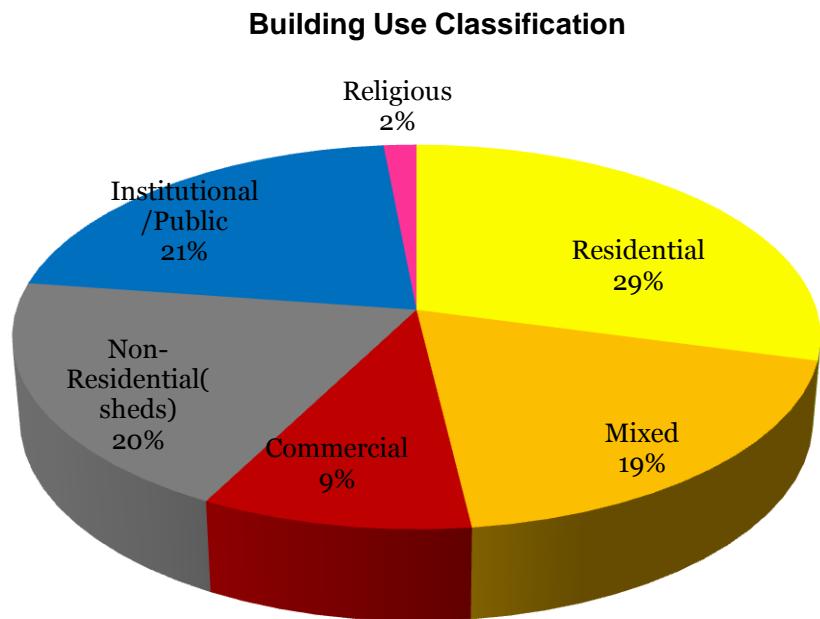


*for better image quality,
maps are attached in
annexure

4.3 The Built Regime

Building Use:

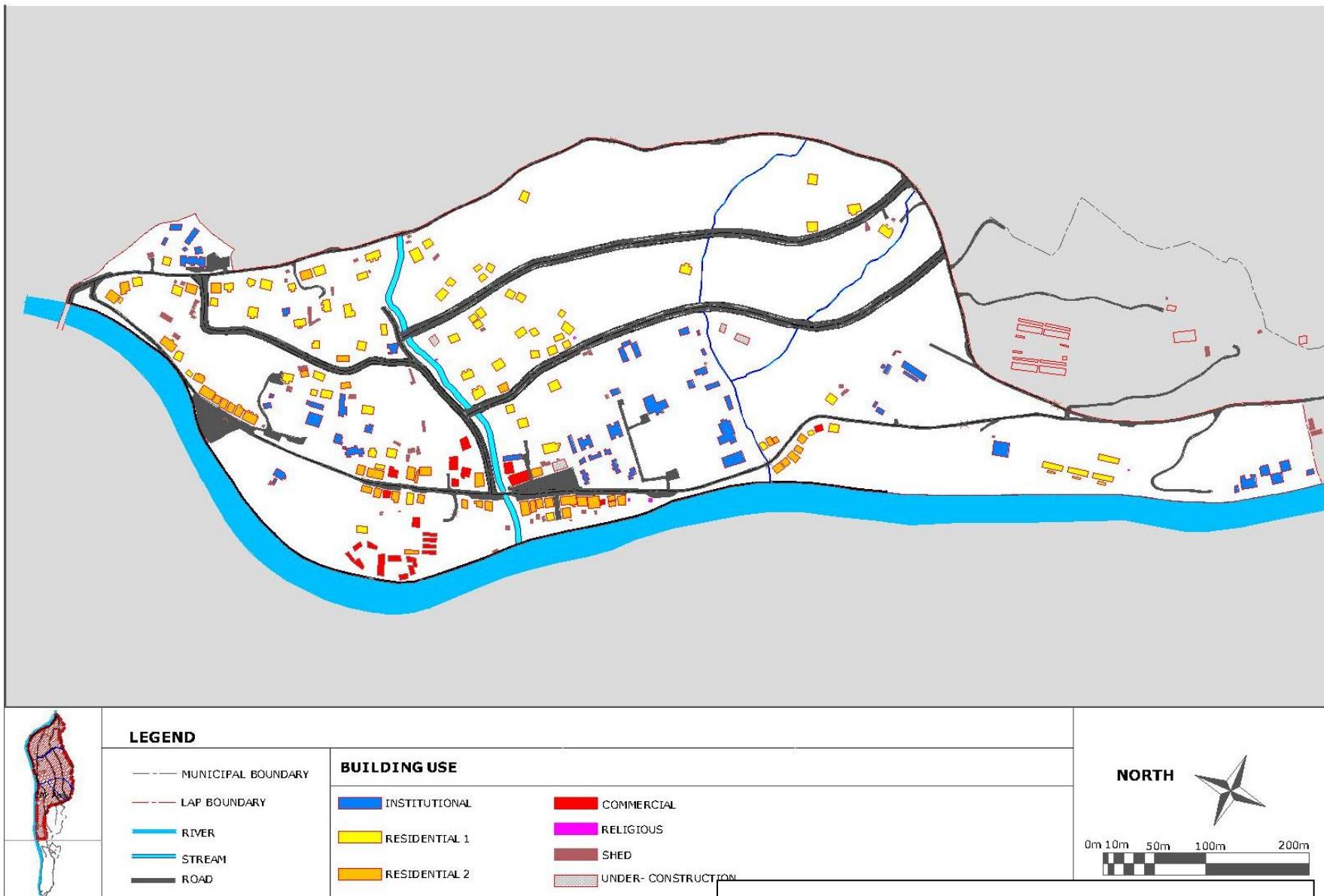
Having delineated the existing land use an exhaustive detailed survey was undertaken to identify the Building Use. This would immensely help out in the local area planning, urban design solutions and implementation. There are a total of 264 built structures in the Haa LAP. A building use- wise break up of these structures is as under.



Most of the buildings (29.2%) are residential while Commercial buildings account for about 9.5% of buildings. A major share of 18.9% of the buildings is put to mixed use, which constitutes of commercial and residential. Institutional Use has the second highest building use in Haa LAP, Haa being the Dzongkhag Headquarter. Dzongkhag office, District Court, DYT Hall, Higher Secondary School, Royal Bhutan Police compound is the major Institutional areas. 4.09% buildings are under institutional use. Non-Residential buildings (19.7%) include temporary structures like cow-sheds. 1.5% of the buildings are under Religious use which is the Chorten.

Table 5 Building Use

Building Use	No. of Buildings	%
Residential	77	29.2
Institutional/Public	56	21.2
Mixed	50	18.9
Commercial	25	9.5
Non-Residential (sheds)	52	19.7
Religious	4	1.5
Total	264	100.00



Map 3 Building Use within LAP area

*for better image quality, maps are attached in annexure

4.4 Building Intensity

Built form intensity of any town indicates the intensity of use of the ground and is understood in terms of number of built floors in the buildings. This survey was conducted simultaneously with the building use survey of built space in the settlement. Haa has a more of an urban character with 57% of the buildings being ground and first floor structures. This urban character of the town is also a result of the presence of IMTRAT and RBA.

In the absence of LAP for Haa, the stagnation of development activities can be demarcated by the absence of any high rise or even four storeyed structures with just 2 buildings (1%) being three storeyed.

Building Intensity Classification

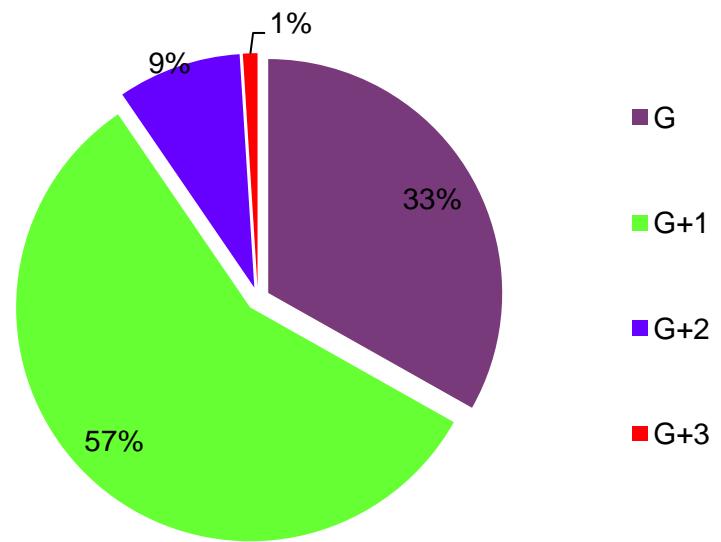
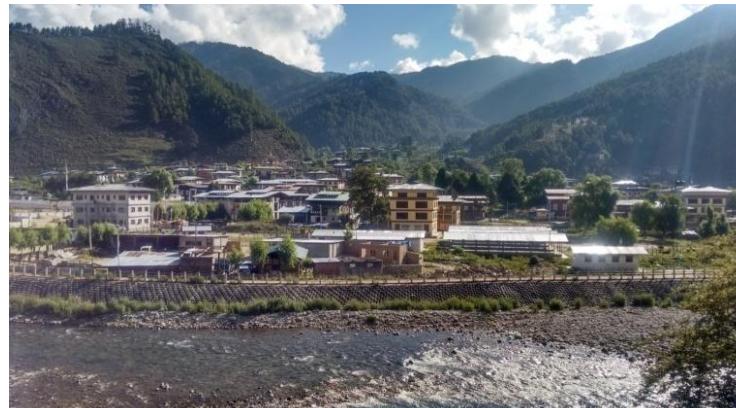
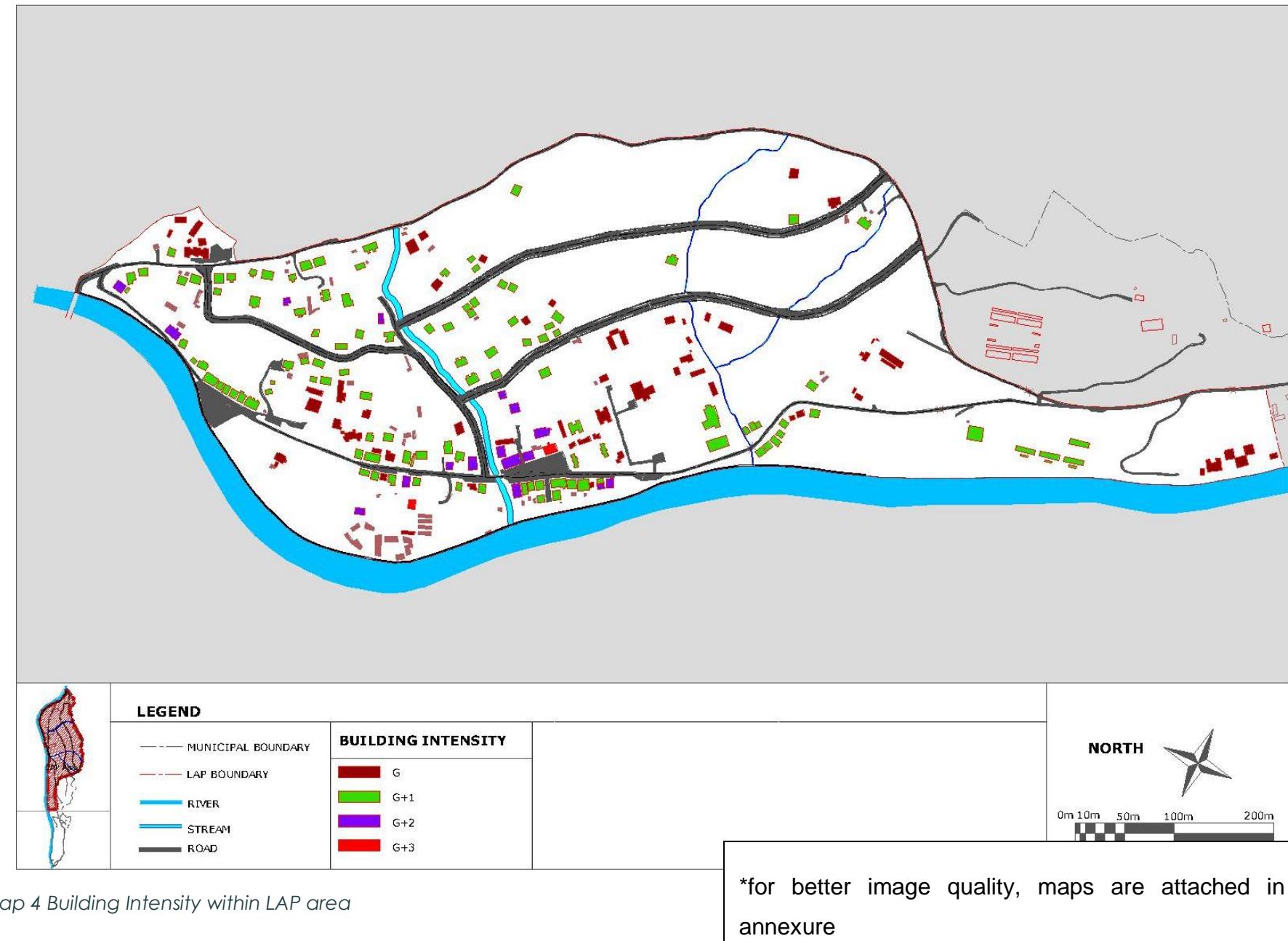


Figure 21 Showing Building Intensity Classification





Map 4 Building Intensity within LAP area

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IRG

4.5 Residential Density

Establishing a Man-Built space–Land Relationship

In order to explore the existing loading on various areas in Haa, the existing residential density, which would form the basis of formulating the proposals, an exercise had to be undertaken with a detailed population data for these areas, which was not available.

The population of LAP is not known which otherwise would have easily given the residential density, although it would not reflect the pressure areas. The existing settlement is not uniformly loaded with some areas heavily loaded while others are sparsely loaded.

Thus a methodology was devised using the data available. The LAP area of 154.08 acres contains 45.56 acres (184402.25 sq m) of residential land use but the total built up area varies from plot size. Based on the scaled and updated base map, building use and building intensity survey, a data was generated by forming clusters of plots and multiplying individual block (ground coverage area) with number of stories to get the total built area of each block and computing for all the residential clusters in the LAP area. Based on the socio economic and visual survey it is known that on an average each floor of each residential building

has two family units and average family size is 4. Furthermore, a data is generated by multiplying the number of floors by 2 which gives the no. of families within the LAP.

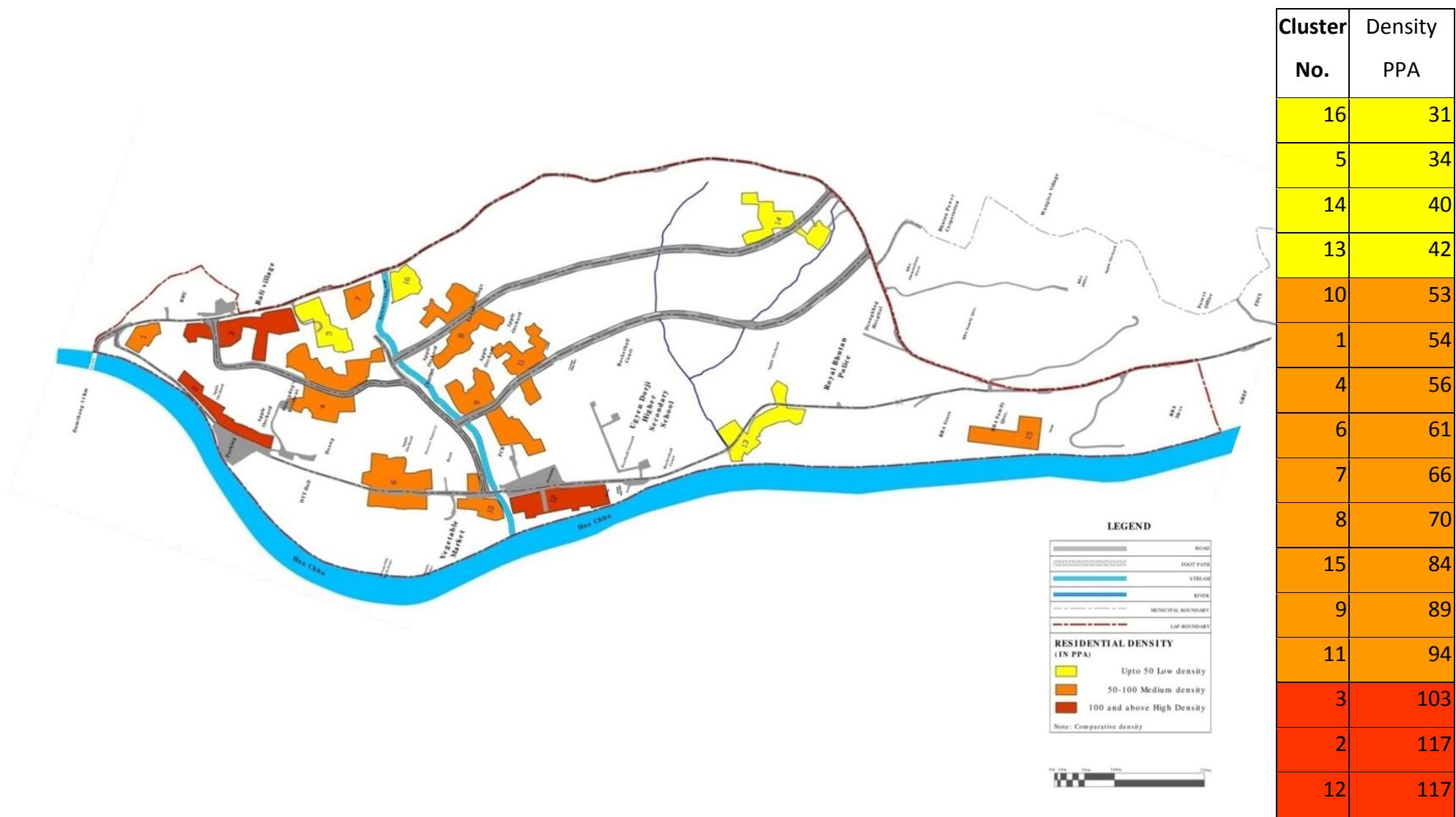
Built Type	No.	Ground Coverage(sq m)	Total Built Up Area (sq m)
G	12	1610.28	1610.28
G+1	103	15846.20	31692.42
G+2	13	2439.21	7317.62
Total	128	19895.69	40620.32

The total built up area of LAP is 40620.33 sq m

Total Population within the LAP = 1656

Thus, comparative density of the clusters within LAP area were calculated and mapped as following:

Map 5 Residential Density



4.6 Plot Detail

There are in all 379 plots within the Thromde, out of which 285 are residential making it the largest land use category. Most of these residential plots fall under Type 2 Residential Category which is a combination of Residential along with some other use like Commercial, etc.

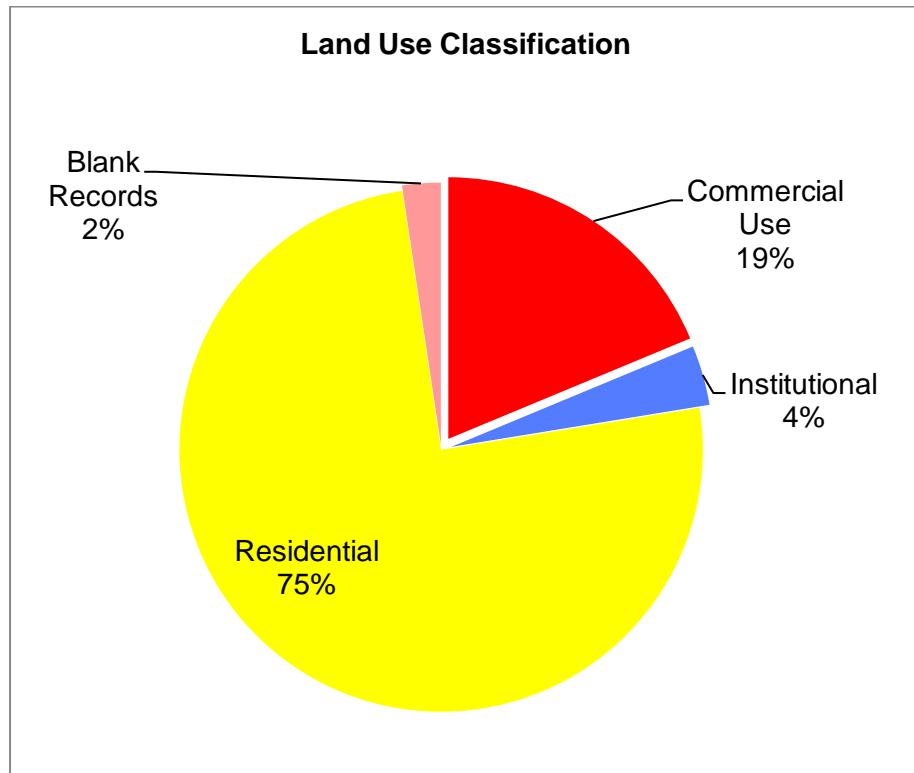


Figure 22 Land Use Breakup

Area dedicated for varied Landuse is as follows:

Table 6 Land Use breakup

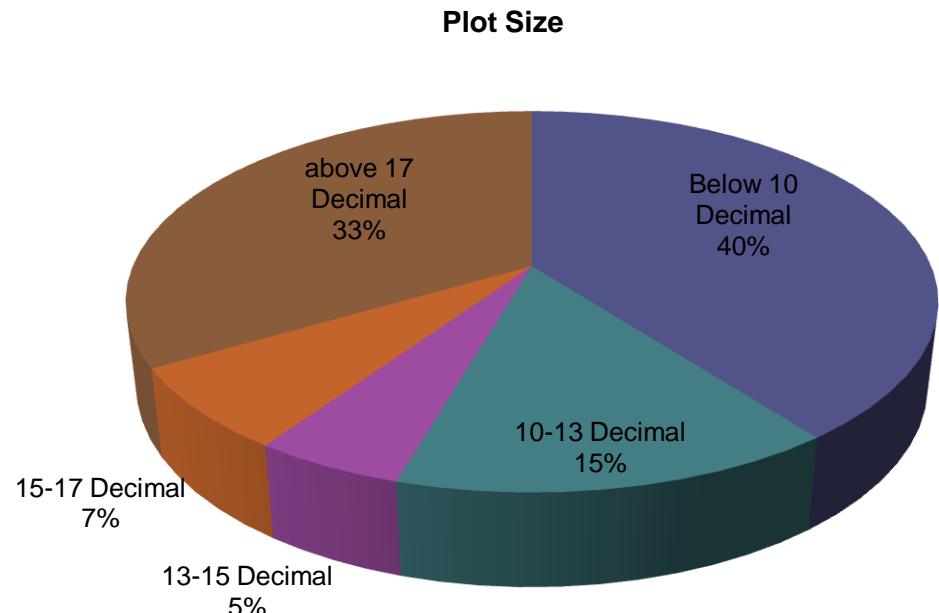
Land Use	Area (Sq Mt)	Area (Acres)	No. of Plots
Commercial Use	43716.571	10.82	71
Institutional	77037.498	19.03	14
Residential	184402.250	45.56	285
Blank Records	85635.484	21.16	9
Total Area	390791.8	96.57	379

Based on the cadastral map, the plot sizes within the LAP area are studied and further analysed. The details of the cadastral are given in the annexure.

All the non government plots were studied with respect to their area in decimals. Out of 356 land holdings, major portion of about 141 plots are below 10 decimals and about 119 plots are above 17 decimals.

Table 7 Categories of Plots

Area in Decimal	No. of Properties
Below 10	141
10-13	53
13-15	18
15-17	25
above 17	119
Total	356



4.7 Plot Utilization

A study of the existing residential plot utilization reveals that maximum ground coverage goes upto 72.5% while a majority of plot coverage is around the 35-40% mark. This may be due to the reason that some of the plots are smaller to the extent of being just about 110sq.m.

The highest recorded existing FAR is 2.2 with the market area recording higher ground coverage and higher FAR. Most of the purely residential areas consume an FAR of less than 1. The study implies that the plot size is in the reconstituted scheme should be such so that it could accommodate atleast 2 units in the ground coverage and provide spaces for car parking etc.

Table 8: Coverage and FAR

Plot ID	Plot area	Coverage	FAR	Front	Back	Side 1	Side 2
		%age		m	m	m	m
1U-206	465.145	53.4	1.5	3.1	1.6	3.5	7.1
1U-22	749.732	25.7	0.5	8.6	8.5	2.1	2.1
1U-362	354.632	44.7	0.9	3.2	3.9	1.2	2.8
1U-115	583.259	28.7	0.6	9.2	5.5	2.1	4.6
1U-134	469.570	40.5	0.8	6.7	4.1	1.8	2.2
1U-277	503.406	27.4	0.8	1.3	35.4	2.3	
1U-361	667.803	22.6	0.7	2.5	36.4		1.4
1U-248	834.279	16.0	0.3	0.7	5.3	3	2.9
1U-59	2184.318	9.7	0.2	4.9	32.1		2.2
1U-309	247.556	62.7	1.3	1.8	3.5	2.4	

1U-80	207.920	63.9	1.3	2.7	2.8		1.3
1U-84	163.338	65.1	1.3	3.2	1.5	0.3	0.5
1U-68	205.549	60.5	1.2	2.2	2.6	1.1	0.9
1U-91	254.177	52.7	1.1	2.5	2.4	1.9	1.2
1U-53	111.647	70.1	1.4	2.4		1.5	
1U-244	121.680	57.1	1.1	2.4	1.6	1	
1U-380	451.709	59.7	1.2	2.2	0.4	1.8	1.3
1U-422	5359.455	3.3	0.1	27.2	14.7	5.9	57
1U-4	708.013	14.6	0.3	13.5	16.6	2.1	4.1
1U-132	568.552	27.2	0.5	6.1	1.7	7.3	2.5
1U-35	882.289	27.9	0.6	7.2	4.3	2.6	23.5
1U-190	610.642	19.6	0.4	10.7	3.1	3.9	12.9
1U-105	1597.097	11.7	0.2	16.4	3.9	7.6	23.6
1U-344	1516.165	18.9	0.2	2.1	29.3	6.2	3.3
1U-295	874.661	14.6	0.3	12.8	2.8	5.5	17.2
1U-100	545.194	30.6	0.6	2.7	2	2.3	13.1
1U-125	325.415	43.2	0.9	0.6	5.4	3.2	1.1
1U-26	347.347	38.7	0.8	2	11	2.4	
1U-311	408.263	58.3	0.9	2	13.8		1.7
1U-420	636.058	25.1	0.3	7.8	6.8	5.7	3.2
1U-168	541.456	46.4	0.9	5.5	1.5	4.5	5.3
1U-152	660.749	30.5	0.6	13.8	3.8	2.1	2.6
1U-293	221.142	45.6	1.4	1.6	2.8	2.7	2.2
1U-183	1875.368	22.3	0.6	13.2	20.5	2.7	19.9
1U-368	2502.981	16.4	0.2	1.2	25	3.7	
1U-235	335.026	43.6	1.3	4.2	2.3	3.4	2.1
1U-83	286.258	48.3	1.9	1.8	5.5	1.8	1.7
1U-290	386.332	32.5	0.6	1.1	10.6	1.9	1.5
1U-291	282.599	44.8	0.9	0.4	6.6	1.5	2.1
1U-55	233.637	42.2	0.4	1	8.2	0.9	1.4
1U-310	293.646	52.2	1.0	1.1	4.2	1.3	1.3

1U-250	284.708	58.0	1.7	1	3	1.6	2.3
1U-166	283.633	40.4	0.8	1.8	7	1.8	2
1U-296	242.165	41.0	0.8	1	3.5	2.6	3.2
1U-120	283.069	33.7	0.3	1.5	7.5	0.3	1.5
1U-121	1243.028	11.1	0.2	1.7	16.7	20.1	2.6
1U-109	534.680	20.2	0.4	2.8	9.6	3.4	5.1
1U-113	523.096	37.0	0.7	4.6	2	7	4.2
1U-148	587.011	23.0	0.5	9	14.1	2.3	3.1
1U-3	968.064	22.0	0.4	10.8	20.2	1.9	3.2
1U-58	619.986	17.1	0.3	2.1	5.6	3.2	18.1
1U-255	1256.961	16.7	0.3	12.6	8.1	14.7	4.6
1U-57	1267.672	13.6	0.3	21.2	9.3	17.4	2.3
1U-302	577.115	18.2	0.5	4	4.4	2.1	16.4
1U-381	737.672	14.4	0.3	21.3	5.8	2.2	8
1U-88	1163.679	9.7	0.2	9.7	18.7	16.4	5.3
1U-280	2563.224	7.3	0.1	5.3	21.8	17.9	26.7
1U-208	1123.544	21.5	0.4	2.2	12.7	9.1	10.1
1U-131	1290.838	11.5	0.2	6	7.4	10.1	
1U-246	1935.668	7.8	0.2	2.5	36.2	14	10.4
1U-238	2077.253	15.3	0.4	10.5	5.4		16
1U-133	671.972	31.2	0.6	7.8	9.4	1.7	4.1
1U-276	671.853	30.2	0.6	7.8	9.6	3	2.6
1U-19	643.017	19.1	0.4	6.8	18.1	3.5	1.1
1U-216	1327.715	17.3	0.3	6.4		3.6	7.4
1U-175	1077.580	24.6	0.2	20.2	7.5	3.4	4.9
1U-14	924.978	13.9	0.1	15.2	22.2	4.2	3.3
1U-448	317.828	53.5	0.5	2.4	1.6	1.1	4.4
1U-331	613.573	17.7	0.4	26.2	4.3	0.8	3.5
1U-449	356.923	23.1	0.5	6.9	1.9		14.1
1U-450	376.607	26.5	0.3	8.7		7.3	2.6
1U-451	494.018	16.7	0.3	8.5	3.2	16.4	0.5

1U-416	704.629		23.6	0.5	7.6	8.1	2.2	6.3
1U-398	404.332		50.1	1.0	1.4	1.4	1.1	2
1U-281	1128.617		21.3	0.2	1		57.5	10.3
1U-439	732.209		24.4	0.2	1.7	7	6.7	3.6
1U-365	1123.504		20.1	0.4	4.6	7.9	16	8.1
1U-147	918.223		21.6	0.4	4.4	3.2	4.4	12.6
1U-453	321.928		39.8	0.8	1.6		2.5	10.8
1U-454	577.463		22.2	0.4	6.5	3.2	1.2	13.2
1U-461	292.318		40.1	0.8	3	0.7	10	
1U-462	140.942		54.0	1.1	1.8	1		3
1U-463	360.661		21.1	0.2	6	2.7	3.4	6.9
1U-458	303.358		24.9	0.5	3.4	11.8	2.4	
1U-459	238.228		29.3	0.6	2.9	11.8		1.7
1U-460	496.351		37.0	0.7	2.1	15.3	6.8	2.1
1U-455	348.517		40.8	0.8	1	4.5	5	2.6
1U-456	253.768		42.3	0.4	4.5	1.7	5.8	1.3
1U-397	504.472		24.7	0.5	5.9	8.1	3.6	2
1U-95	307.670		49.0	1.0	1.9	3	2.3	2.4
1U-229	612.373		30.9	0.6	3.1	2.7	2.8	15.1
1U-253	792.262		23.9	0.5	4.9	3	13.1	5.9
1U-5	675.881		34.6	0.7	5.9	3.4	7.2	3.3
1U-338	1301.208		10.5	0.2	8.7	20.5	8.3	4.7
1U-464	510.570		29.0	0.6	5.8	2.7	3.4	4.9
1U-452	407.406		33.5	0.7	4.6	9.2	2.5	1.1
1U-165	298.082		3.9	0.1	8.2			2.4
1U-487	126.270		46.9	0.9	6.6	3	1	
1U-488	153.535		23.9	0.5	5.9			8.4
1U-141	1111.212		17.0	0.3	13.3	25.5	1.8	4.5
1U-400	1278.516		9.7	0.3	4.1	5.7	10	28.2
1U-320	2562.014		7.3	0.2	5.8	18.6	16.7	37.8
1U-423	961.031		19.7	0.2	3.1	4.2	1.1	19.5

1U-10	699.834	27.7	0.8	18.2	8.2	1.5	1.5
1U-106	640.907	63.0	1.9	1.5		7.1	0.4
1U-92	364.089	52.4	1.6	2.7	5.1	0.9	1.2
1U-82	334.051	72.5	2.2	0.7	1.4	1.1	1.9
1U-85	283.389	46.9	0.9	1	2.4	0.4	0.6
1U-81	285.352	41.8	0.8	1	10	1.5	0.8
1U-122	285.036	54.4	1.1	1.4	4	2.2	1.1
1U-9	248.415	50.7	1.0	2.3	1.8	3.1	1.8
1U-61	182.033	50.7	1.0	2.4	1.7		3.4
1U-27	158.337	60.5	1.2	2.4	1.7	1.7	
1U-64	158.852	51.1	1.0	2.7	2.5		2.4
1U-272	118.084	69.3	1.4	2.6	2.7		
1U-67	326.614	37.1	0.7	2.5	19	0.4	
1U-339	482.833	38.6	0.8	2.2	19		
1U-402	404.054	36.6	0.7	2	18.7		1.9
1U-312	297.794	45.4	0.9	1.9	13.7	1.2	
1U-234	291.753	17.2	0.2	6.6	17.8	2.9	
1U-249	1064.682	28.4	0.8	1.9	16.8	2.1	15.9
1U-273	298.835	31.4	0.6	13.5	2.6	0.9	1.4
1U-143	235.924	40.7	0.8	10.2	2.2	1.4	
1U-444	274.039	23.3	0.5	5.8	5.2		6.5
1U-40	444.579	32.6	0.7	3.3	7.7	0.9	4.9
1U-443	282.450	37.8	0.8	2.9	8.3	1.3	0.8
1U-136	342.045	45.1	0.9	2.7	5.2	1.1	1.7
1U-247	224.447	44.3	0.9	5.4	1.2	1.9	1.4
1U-274	363.464	34.6	0.7	2.3	6.2	1.6	3.3
1U-232	212.092	27.1	0.3	5.8	9.6		1.4
1U-108	204.020	21.5	0.2	3.8	11.6		3.6
1U-86	292.439	17.2	0.2	3.9	11.6	6.1	
1U-260	935.374	16.2	0.3	4.4	5.4		1.2

4.8 Housing Typology

Traditional houses serve as a home or residential dwelling for the family, a shelter for domestic livestock, a place for weaving and other household activities and also a religious space. The architecture of vernacular houses has an open or semi-covered courtyard in front of the building, which is used to grow vegetables and other agricultural produce, drying things, as a shelter for the animals and other functions that are performed in the open. Most of the indigenous rural houses are two or three stories high and each level has a unique function. The ground floor is simply a space to keep animals, the living quarters; the family room, the kitchen and the store find their place on the first floor while the religious rituals are performed in the upper storey, which is considered sacred.

With respect to vernacular building typologies, it can be observed that certain similarities exist with some typologies that can be found in Northeast India. Due to its geographical vicinity, Bhutanese typologies may have been influenced by Tibetan architecture as well. Besides, Bhutanese artisans had developed their own traditional construction techniques and these skills are reflected from every Dzong (fortress), temple and traditional Bhutanese house.

Common features of a large percentage of vernacular building typologies are sloping roofs (probably because of heavy snowfall), open attics (for storage and air circulation purposes), and large openings in exterior walls (in order to get sunlight into the house). Construction materials for vernacular typologies are mainly mud, rubble and semi-dressed stones, timber¹ and in some cases bamboo for partitions (Ikra).

A common feature of all types of construction in Bhutan is the arrangement of an attic that is mostly left open. This construction feature, which stems from traditional Bhutanese houses and which mainly served the purpose for storage of grain and equipment, has also been adopted for contemporary engineered constructions. However, here attics are mainly used for residential purposes. The light roof construction (mainly made of timber, in few cases made of steel tubes) rests upon posts made of timber, masonry or RCC. The crucial point to note here is that these posts are not integral to the structural system and are simply resting on the topmost floor.

The houses in Haa are divided into three parts that is BO-GO-KHO. BO is the upper part of the house which is the attic. Attic is the very common feature of construction around Bhutan. The

middle part is GO which is the living area and KHO which consist of basement, cattle barn or foundation.

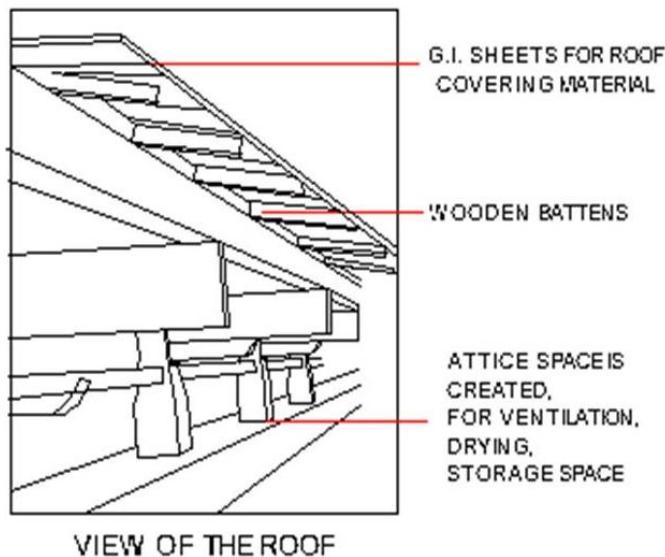
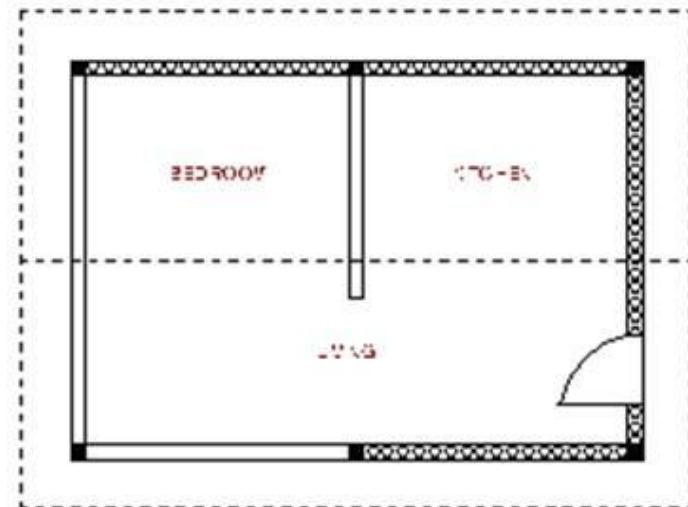
There are 3 types of housing typologies in Haa.

- Temporary single storey house

- Traditional Double storey House
- Contemporary R.C.C houses

TEMPORARY SINGLE STOREY HOUSE

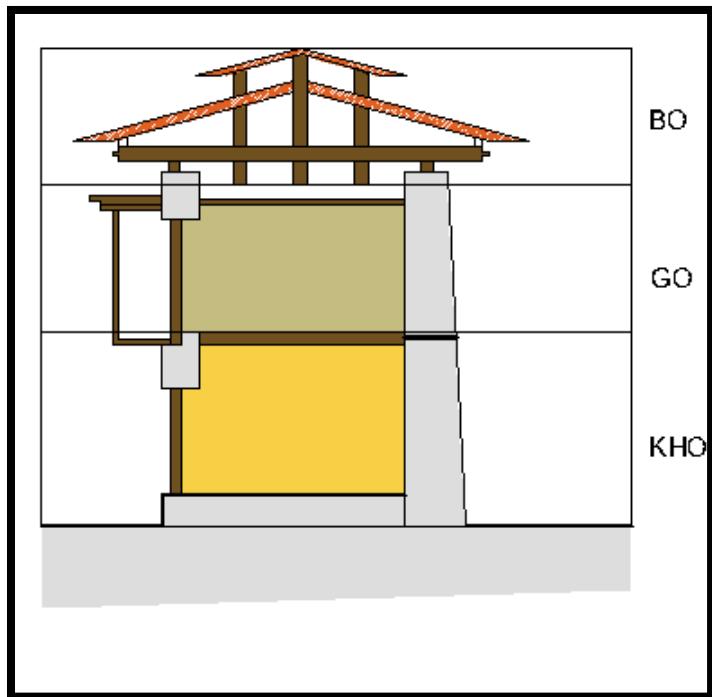
- Nature- Temporary
- Number of floor- usually ground floor structure.
- Construction area- 5-8 decimal.
- Material used- bamboo
- Technology - Non engineered designs with bamboo framing and enclosure.



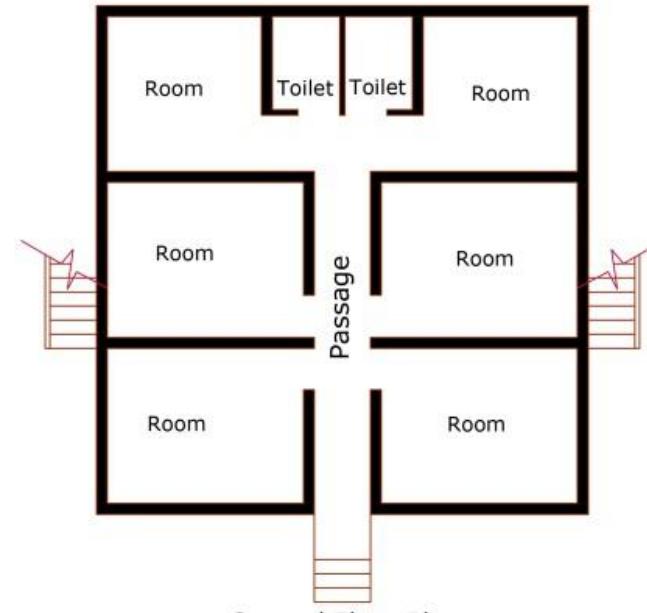
Traditional Double storey House

- Nature of house- Permanent
- Number of floor- usually G+1 or G+2.
- Construction area- 6-10 decimal.
- Material used- bamboo, Pine wood, Stone, Mud, tin for roof

Technology - Non engineered designs with bamboo framing and enclosure fix with mud plaster, roof made up of tin and decorative wood façade give attractive look.



First Floor Plan

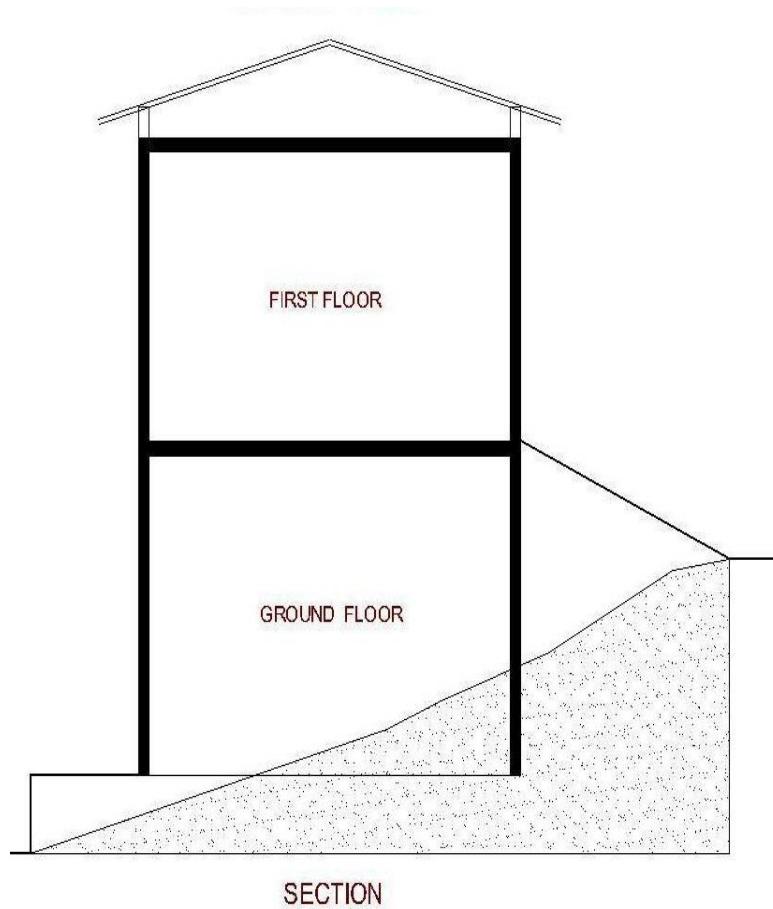


Second Floor Plan

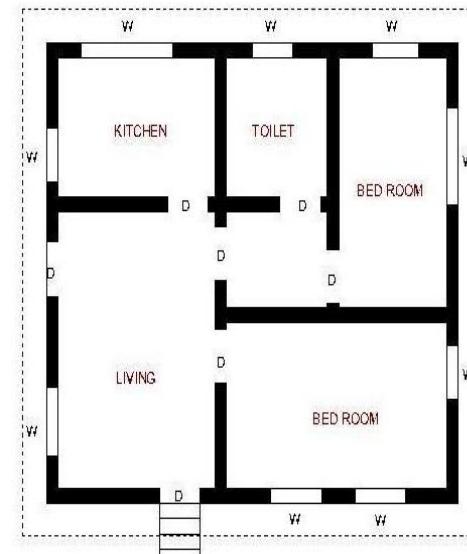
CONTEMPORARY

R.C.C. HOUSES

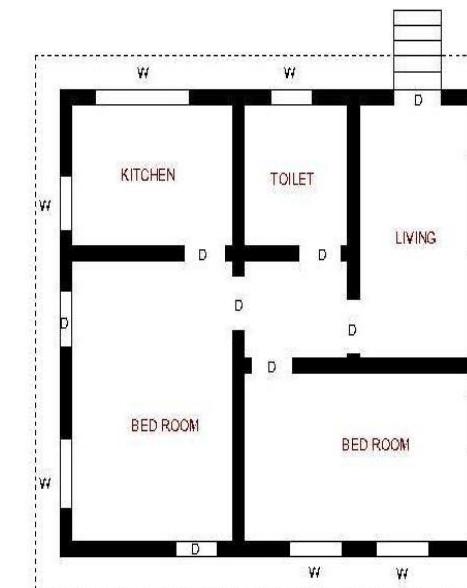
- Type of House- Permanent
- No. of floors- G+1
- Construction Area- 7-10 decimals
- Material Used- RCC
- Technology- Modern technique



BHUCORE – IRGSSA



GROUND FLOOR

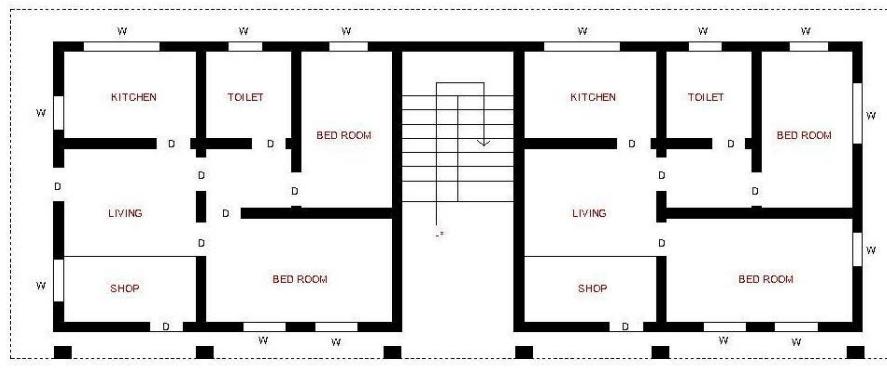
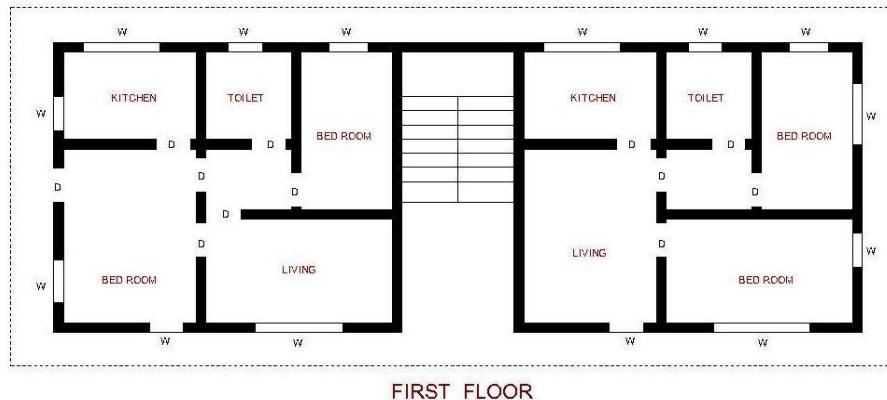


FIRST FLOOR



CONTEMPORARY MIXED USE
APARTMENTS

- Type of House- Permanent
- No.of floors- G+2
- Construction Area- 7-12 decimals
- Materials Used- RCC
- Technology- Modern

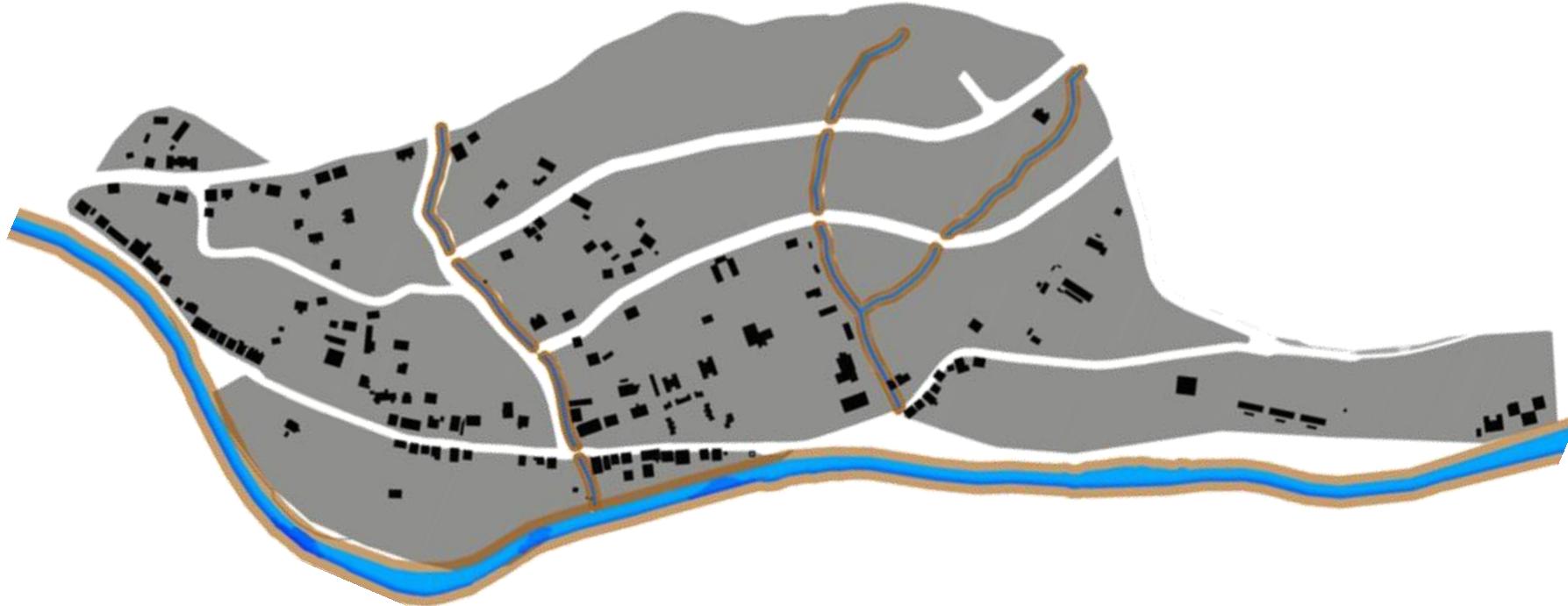


5 URBAN FORM ANALYSIS

5.1 Spatial Analysis

Haa is an urban countryside, a highly varied but humanised landscape. It is neither urban nor rural in the old sense, since houses, workplaces and places of assembly are set among trees, farms and streams. Spatial analysis is study of settlement in 2 dimensional map regarding building location, orientation and arrangement, thus resulting spaces created or formed between built environment are analysed to understand the spatial characteristics of city. Complex issues arise in spatial analysis, many of which are neither clearly defined nor completely resolved. The most fundamental of these is the problem of defining the spatial location of the entities being studied.

A figure-ground diagram is a two-dimensional map of an urban space that shows the relationship between built and un-built space. The figure-ground theory of urban design relates the amount of "figure" to the amount of "ground" in a figure-ground diagram, and approaches urban design as a manipulation of that relationship, as well as being a manipulation of the geometric shapes within the diagram. A figure-ground illustrates a mass-to-void relationship, and analysis of it identifies a "fabric" of urban structures



Map 6 Figure Ground Map

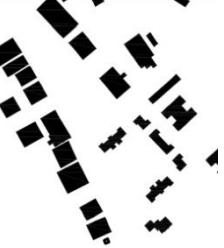
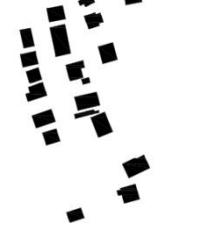
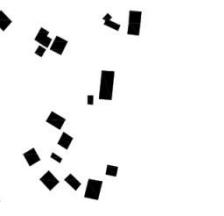
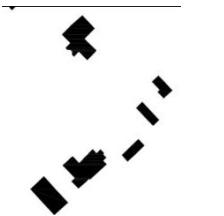
Type	Map	Locality	Characteristics	Remarks
Coarse Grain Even texture		Linear development along main road in Haa bazar	<ul style="list-style-type: none"> Bigger footprints Arrange in line Similar size of footprint 	They create a corridor thus results in strongly defined linear open space.
Fine Grain Even Texture		Upper Haa bazar area and area on north side of Katsho chhu	<ul style="list-style-type: none"> Comparatively smaller footprints All of similar size Evenly distributed space 	They do not form large open spaces but smaller spaces on regular interval are created.
Fine Grain Uneven texture		Far western settlement away from Haa Chhu	<ul style="list-style-type: none"> smaller footprints Scattered development Dissimilar orientation 	They do not form any defined open space.
Coarse grain Uneven texture		School building, hospital and office buildings are only large footprint figures.	<ul style="list-style-type: none"> Larger footprints Surrounding large open space No geometric formation. 	stand-alone buildings with large footprint results in landmark structures

Table 9 Figure Ground Analysis

5.2 Volumetric Analysis

Elements of space making

Volume is created by horizontal and vertical elements. Horizontal elements can be defined by any distinct surface with soft

landscape or hard landscape associated with vertical element natural or man-made like wall, building, and tree defines volume.

Type of volumetric spaces in Haa Town:

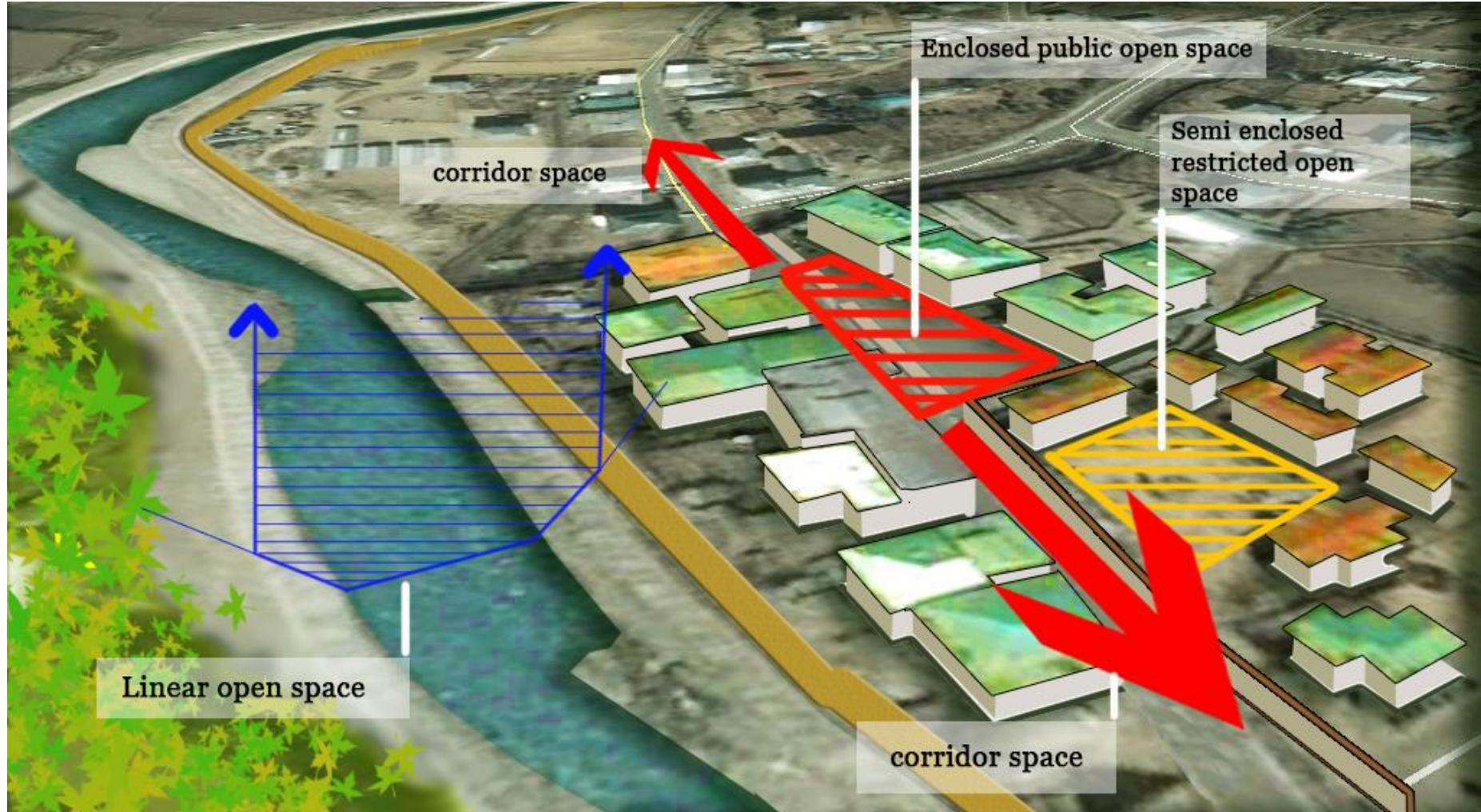


Figure 23 Volumetric Analysis of Haa bazar area

1. Urban Open Space

Urban open space is open space areas for "parks", "green spaces", and other open areas. The landscape of urban open spaces in Haa includes playing fields, Buffer greens. They are open to public access, however, urban open spaces may be privately owned like school grounds. Areas outside of city boundaries, such as forest and water bodies as well as open space in the countryside, are not considered urban open space.

2. Enclosed open spaces

Enclosed open space is Open space which is strongly defined by vertical elements on all sides. In above diagram parking space is enclosed by G+2 and G+3 buildings in all side which gives a sense of bounding or holding from all sides.

3. Semi enclosed open space

Semi enclosed open space is open space firmly defined on 2 or 3 sides and virtually completing its dimension on remaining side directly or indirectly. Space inside the school is surrounded by buildings on 3 side and one side is open ground, fourth dimension of open space is virtually completed by buildings thus space created is semi enclosed and since it is inside the campus ownership and usage is restricted to particular group of people.

4. Linear open spaces / corridors

Linear open spaces / corridors are spaces created because of linear elements of developments like roads, rivers. In above graphics we can clearly find such corridor spaces.

5.2 Urban Design Networks

Green Spaces

Haa town has an Archery ground, a children's park, community ground, weekly market and school ground are designed and dedicated open spaces in the city. Other than that 30m offset to river edge and 15 m offset to stream is protected green buffer which can only be used for development purpose and not for construction of permanent structure.

Main Streets

Main streets are linear corridor of district-wide importance characterized by dense commercial and mixed use development and transit-supportive residential uses, frequent transit service, and high pedestrian use. Haa Bazar road, Bypass Highway, phase 1 link road, phase 2 link road are the major main streets.

Off Street Paths

Off street paths are formed by contributing private land on mutual understanding or good will of people for easy commute. Off street paths may be appropriate in corridor not well served by the street system, to create shortcuts that link urban designations and origins along continuous greenbelts such as river, park and

shorten, and other farm corridors. They can be good scenic points.



Map 7 Green Space Network

Vintage point

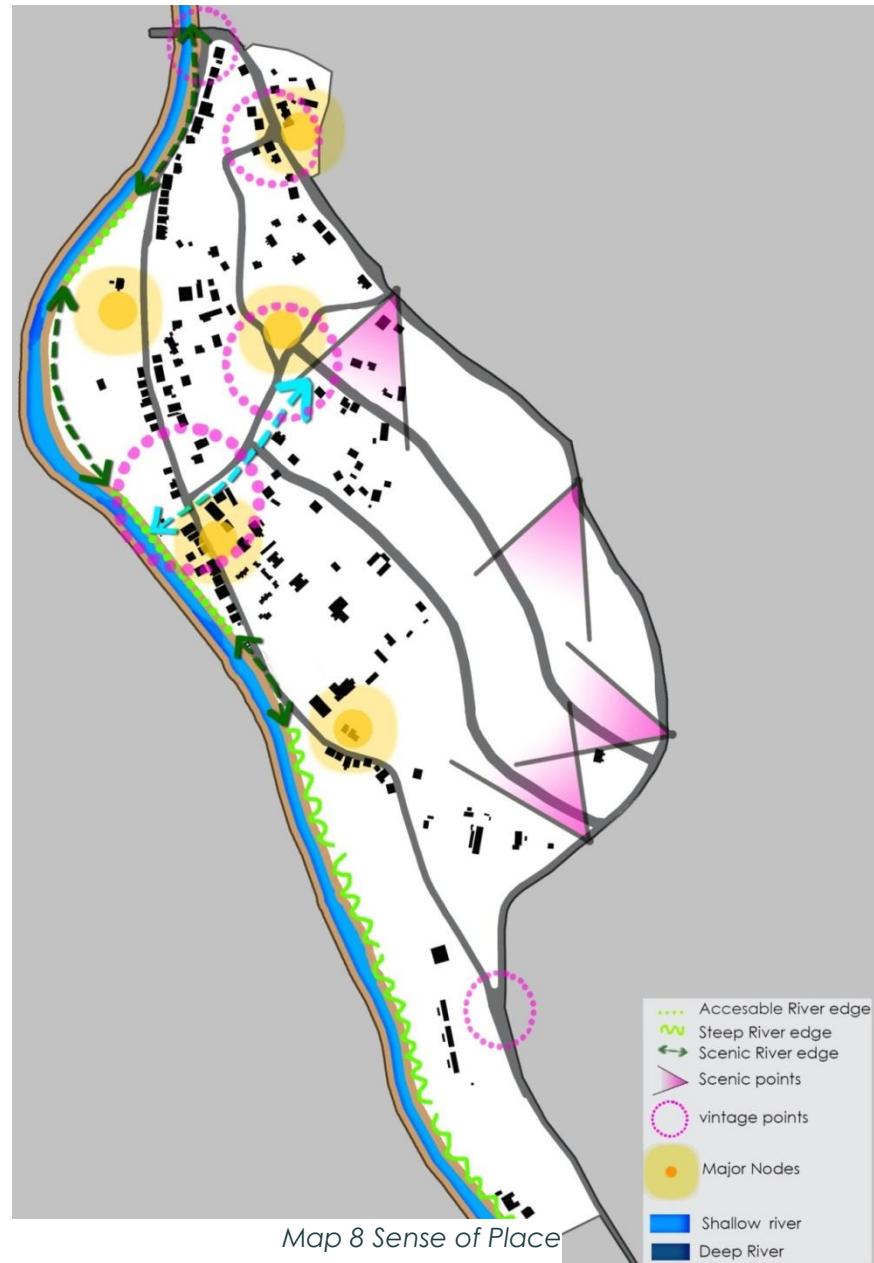
Vintage point is a position or standpoint from which something is viewed or considered. While entering into the Haa town initial 'Y' Junction, Bazar Chouk, Power house Chouk and Hospital 'T' points provides a position to find out major function centers in the town. They have locational as well as visual advantage thus they will play important role for habitats of town.

Major Nodes

Major nodes are important points for traffic generation and termination. Lower Bazar, Haa Bazar, Upper Market and hospital are major nodes in the town. They are landmark locations for outsiders to understand city in first view thus major nodes will play important role in creating image of the city. Lower Bazar, Haa Bazar, Upper Market and hospital are major nodes in the town.

Scenic Points

Haa valley has beautiful landscape with Perennial River flowing on one side followed by partially dense traditional built form, enclosed by rich agriculture lands and topped by hills with lush green forest of pine wood. Highway running on higher level of town provides lovely scenic points to view the town all entry points from highway to town gives good vista of the city. These

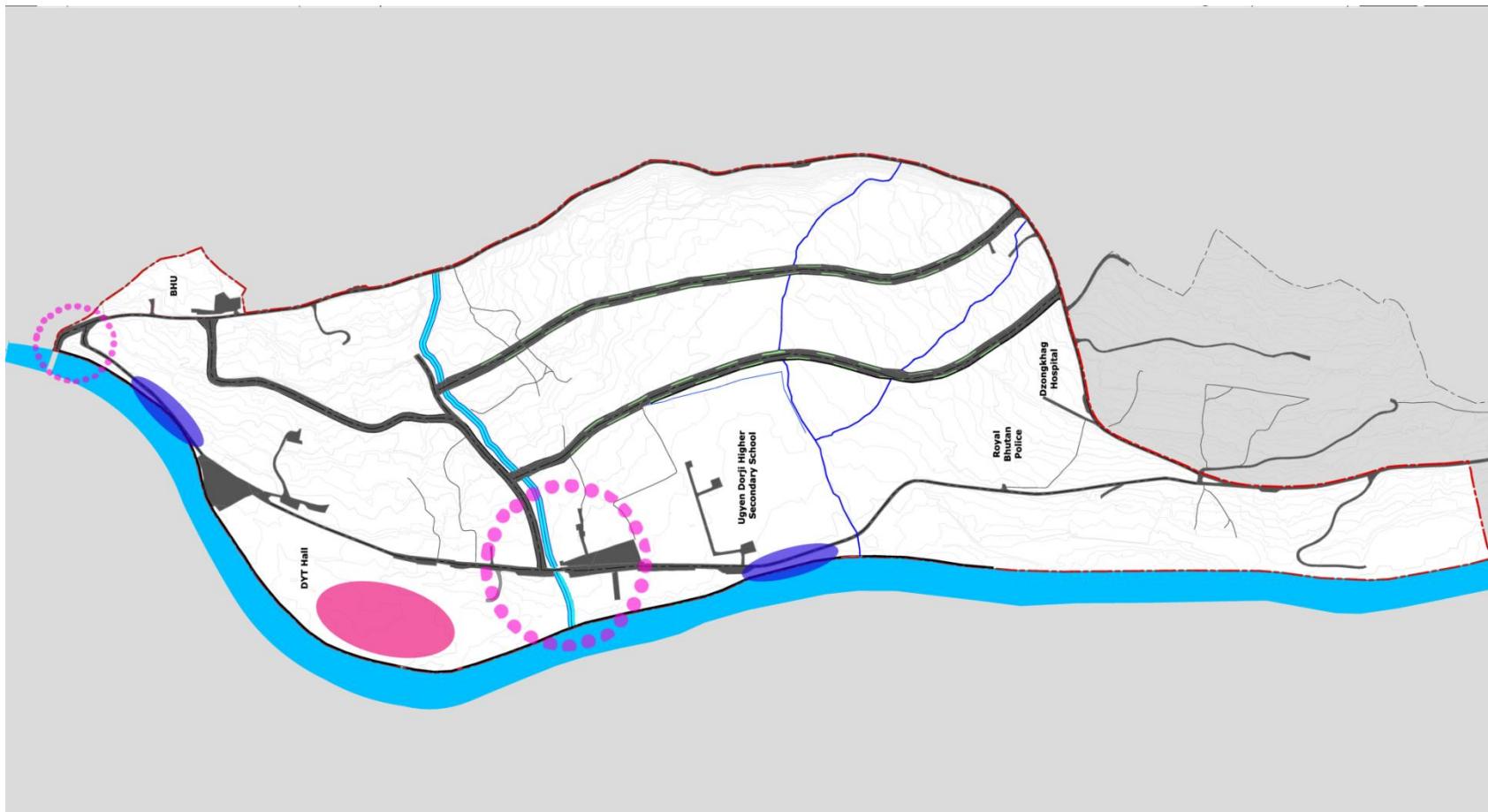


Map 8 Sense of Place

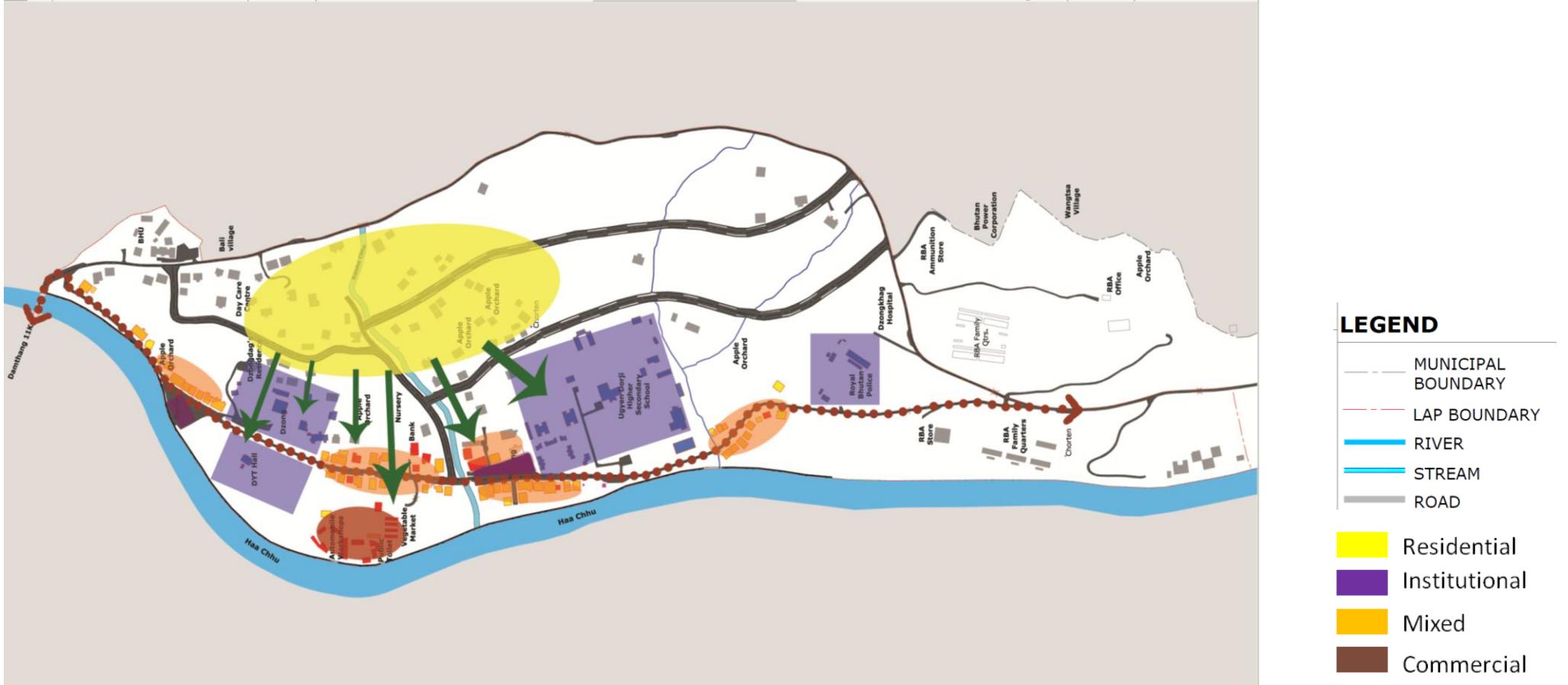
points can be further developed as pausal destinations for highway travellers.

River Edge

- Scenic edge: In town edge of river near School, Weekly market, Parking of Upper market and Katsho Bridge on north provides beautiful sceneries and they shall be taken under consideration while designing adjacent open spaces.
- Accessible edge: Since river has undergone protection work particularly in this area they have easy access to river thus this river edge can further be developed for local tourist as leisure and pleasure destination in town.
- Inaccessible river edge: river protection work is been done till south end of the primary school. In this area a bowel has been formed because of high river edge and low farm lands which create water logging problem this edge can be properly developed for pedestrians and cyclists.



Map 9 River Permeability Map



Map 10 Urban Concentration

6 EXISTING NETWORKS

6.1 Existing Road Network

The new roads and the main road run parallel to the highway with other intersecting roads.

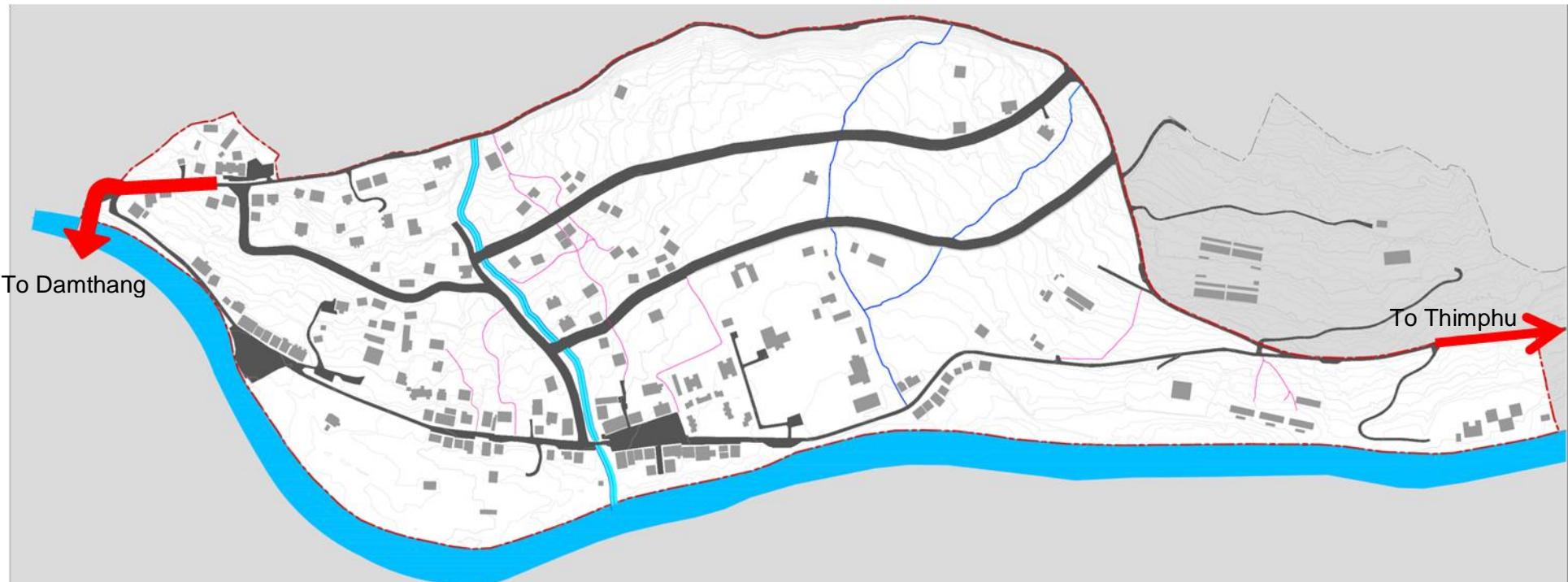
The town has a good road network with a number of four transit routes forming a loop and encompassing the entire town. The highway running from the south east towards northwest of the town is an asphalt road with a ROW of 10 metres. It contains trench for services on either side. The road from the Bhutan Power Corporation Office up to the Highway is a newly laid road with a ROW of about 15 metres and green belt, parking bay and pedways at regular intervals. Another new road beside the Hospital up to the Forest Nursery travelling behind the School is alike the other new road.

The old highway which is the main road or spine of the town is also asphalt road with the ROW varying between 7.5 metres to 20 metres across the entire stretch.

A no. of sections is taken to verify the road geometrics. The road sections are attached in the annexure.

Table 10 Road Details

Road Type	Road Length (in mt)					Total
	Highway	New Road 1(from Bhutan Power Corporation up to the Highway)	New Road 2 (Govt. Hospital under construction to Forest nursery)	Old Highway	Highway to Main Road (beside Katsho Stream)	
Asphalt	1723	770	755	1552	620	5420



Map 11 Existing Road Network

*for better image quality, maps
are attached in annexure.

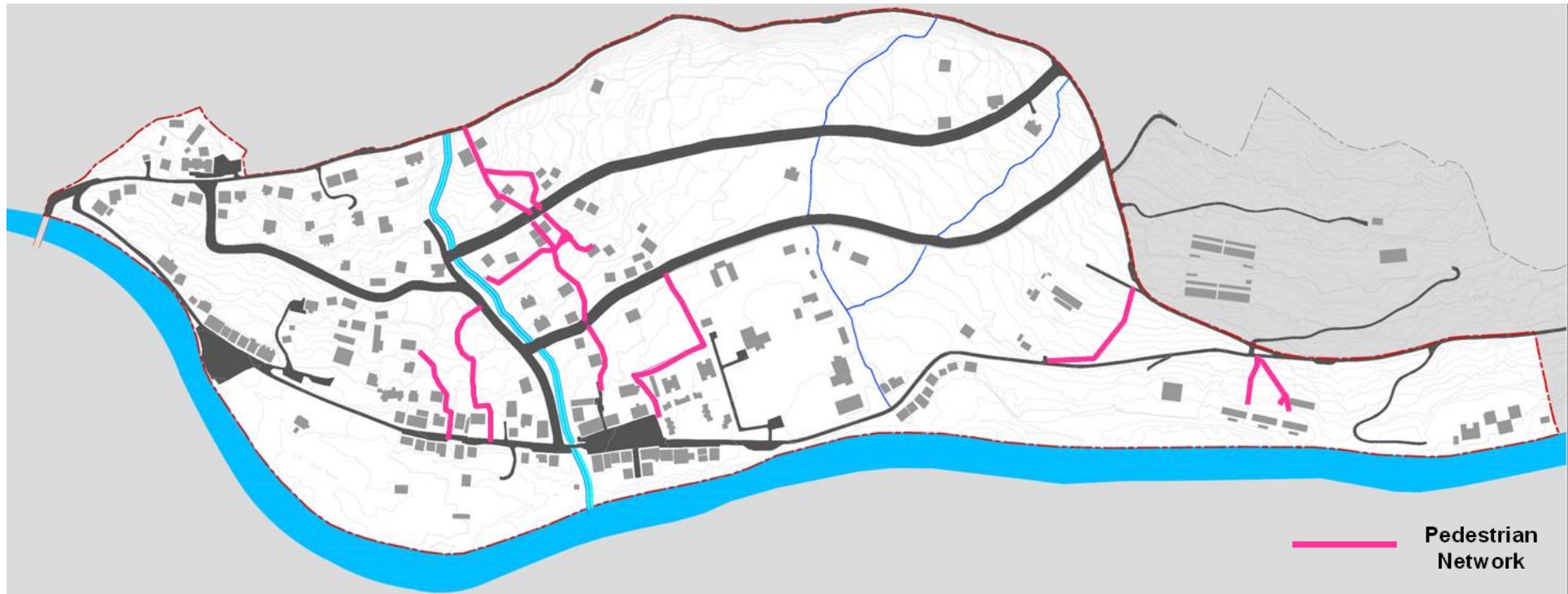
6.1.1 Existing Pedestrian Network

Pedestrian way plays a significant role in providing accessibility to the people in areas where terrain is a major determinant. They connect the houses, farmlands, etc. wherein construction of roads is difficult owing to the terrain. But the pedestrian tracks are very few in the LAP area. One of the few which exists is along the Haa Chhu starting from the Katsho Bridge up to the workshop behind the vegetable market.

The total length of the pedestrian track in the Haa LAP area is 1.8km.

Figure 24 Pedestrian way beside Haa Chhu





Map 12 Existing Pedestrian Network

*for better image quality, maps are attached in annexure.

6.1.2 Mobility Network

In terms of communication facilities, owing to its inter dependency on Phuentsholing, Thimphu, Paro and Damthang, there are not enough bus services to these towns from Haa. One bus each to these places ply in a day which makes people to depend on their own cars or taxis to travel. There is no bus stand rather the buses drop the passengers on the bus stop and park in the dedicated parking area between the DYT Hall and the Workshop overnight.

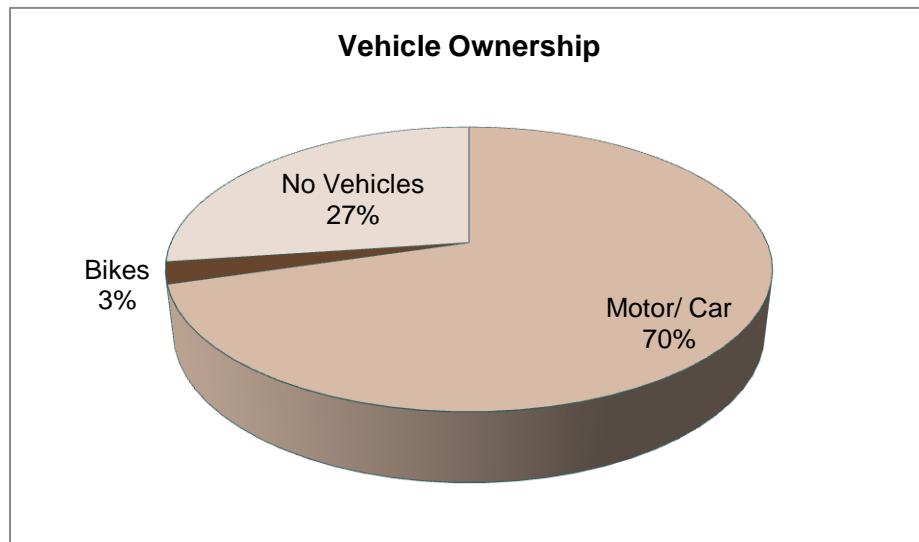


Figure 25 Vehicle Ownership

All respondents used mobile phones to communicate. Table below shows that 70% owned cars and 3% owned bikes out of

which 33% population within LAP area use car, bike or cycle to commute to place of their employment while 64% of the people walk to their place of employment. The people take from 1 minute to 30 minutes to get to work.

6.1.3 Existing Parking Space

Haa has 3 dedicated parking lots within the LAP area. One is on street parking abutting the main market along the main road with a capacity of about 30 cars.

Another parking lot for about 2564 sq mt area is provided for light vehicles towards the north of DYT Hall of about.

While a parking space for heavy vehicles is provided just abutting the compound wall of the DYT Hall to its south. The buses commuting between Haa and Thimphu, Paro,



Figure 26 On Street Parking along Main Road

Phuentsholing or Damthang are parked in this space after arriving Haa.

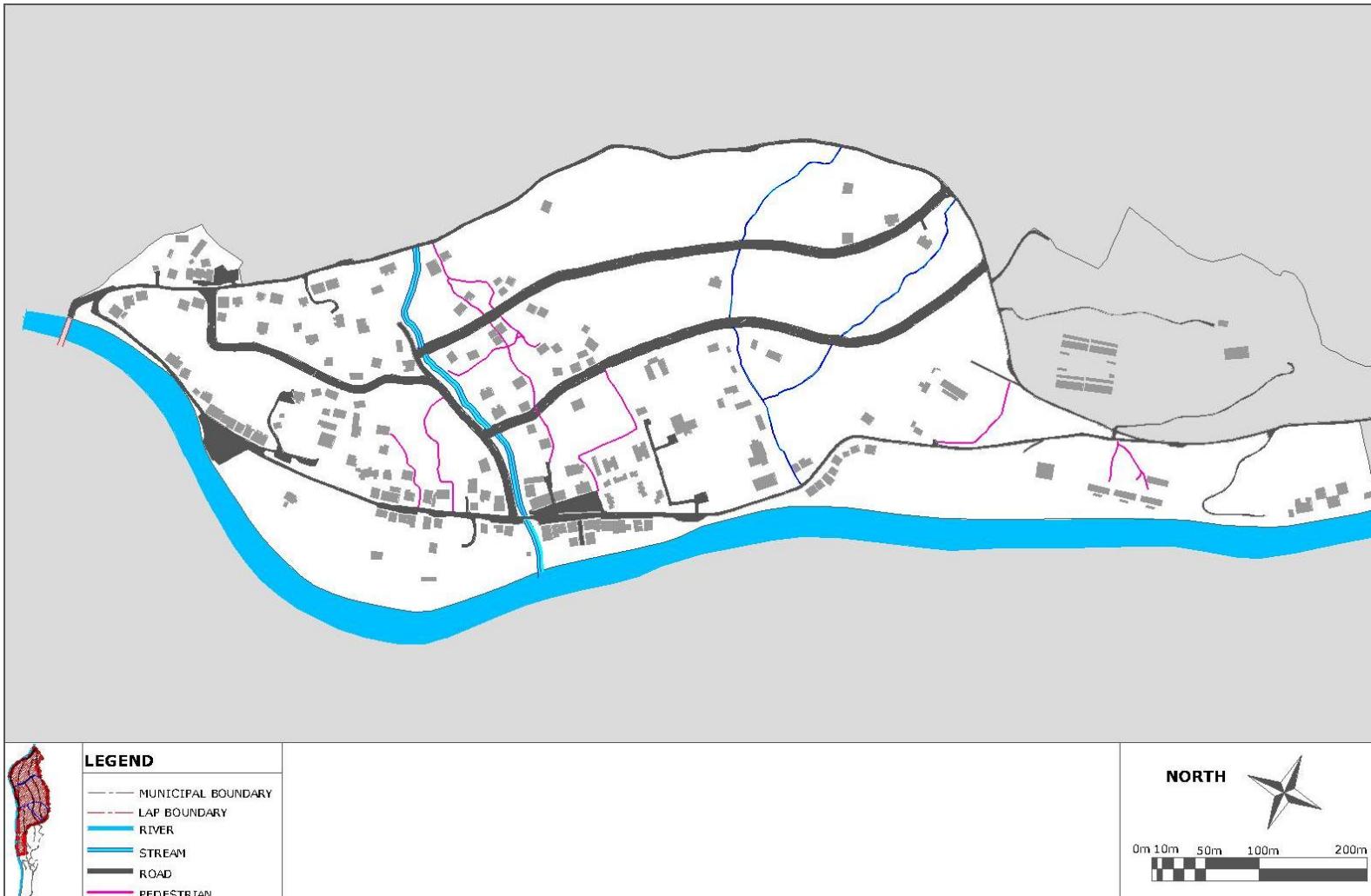
At household level, the citizens residing along the main road park their vehicles in the On Street Parking lot. The others living along the new roads towards the north and north east of the town, park their vehicles in their own compounds.

Table 11 Existing Parking Lots in Haa

No	Location	Parking Area (Sq Mts)	Type of Vehicle
1	BHU Parking	640	Motorcycles, Cars, Ambulance
2	Parking beside DYT	2150	Cars, Motorcycles
3	Parking near Vegetable Market	1380	LCVs, Cars, Motorcycles
4	Parking Lot in Commercial Area	1656	Cars, Motorcycles
5	Off street Parking in Commercial Area	300	Cars, Motorcycles

Map

13 Existing Parking Spaces within LAP area



*for better image quality, maps
are attached in annexure.

6.2 Existing Green and Open Space Network

Open spaces offer opportunity to the people to relax foster good health and pursue their hobbies as well. It encourages creativity, social gathering, and personal development, social, physical and intellectual growth.

The people are fond of Archery and pursue it as their hobby during leisure time. Archery can be done at different altitudes and need not necessarily require plain surface. There is an archery field within Haa LAP area between the Haa Chhu and the DYT Hall, i.e. the west of DYT Hall along with the hill forming the backdrop.

Community spaces provide congregational place for the people with a common interest. It promotes widespread participation, flexibility and adaptation, trust and a sense of community. It also helps in developing the ability to discuss, reach consensus, co-operate and connecting social, cultural, environmental and economic spheres in the community.

The people are fond of Archery and pursue it as their hobby during leisure time. Archery can be done at different altitudes and need not necessarily require plain surface. There is an archery field near the DYT hall which is about 150 meters long.

People also prefer private singing rooms and karaoke clubs for the recreation in their free time.



Figure 27 Archery Ground

Volleyball and football is also played here near the BHU, near the Ugyen Dorji School etc.

There is a cinema hall near the weekly market which is opened when the new movie is released. In collaboration with ministry of health, Haa Dzongkhag administration has developed an open gym for the people. This is developed near the weekly market and is free of cost and is open for all age groups.



Figure 28 Open Gym

There is a DYT hall in front of the Dzong. There is 1 meeting hall which is proposed.

6.3 Social Amenities

Social Infrastructure is a subset of the infrastructure sector and typically includes assets that accommodate social services. It includes education facilities, health facilities, civic utilities, law

and order to the people. It is exclusively provided by the central government and is under the supervision of the Dzongkhag. It is a long term objective of the government to suffice and deliver the services to the people.

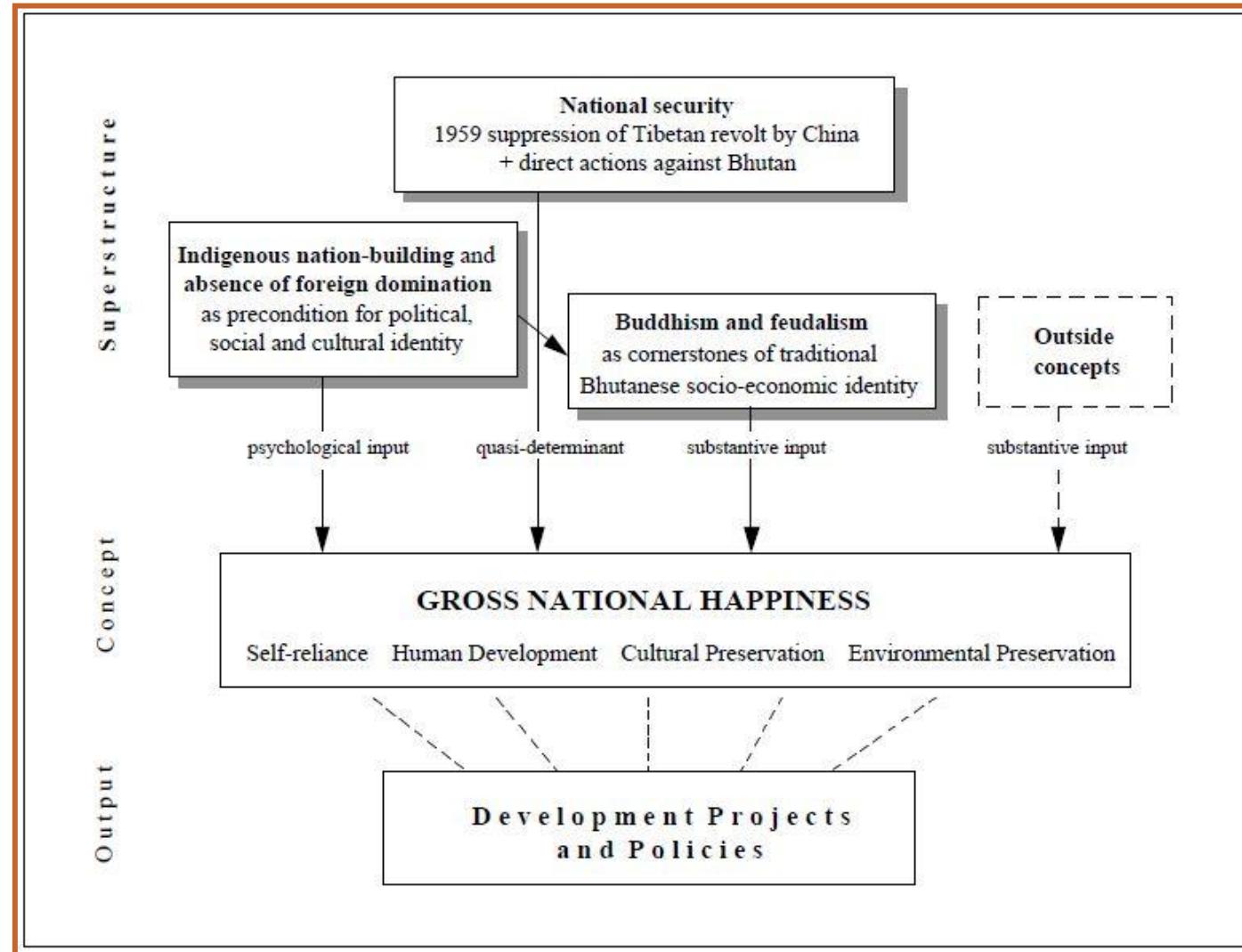


Figure 29 Gross National Happiness

Source: Gross National Happiness – Bhutan's Vision of Development and its challenges, Stefan Priesner, Programme Officer, United Nations Development Programme, (UNDP) Thimphu, Bhutan.

Bhutanese development has always emphasized on emotional development rather than economic development. This influenced and determined the concept of Gross National Happiness Index. The configuration and the interrelations of the dimensions of Bhutanese development are schematically demonstrated in the figure below.

In Bhutan, Gross National Happiness (GNH) is more important than Gross National Product and thus, it is the only dimension to calculate the growth. The Bhutan Legal code of 1629 states:

'If the government cannot create happiness for its people, then there is no purpose for government to exist'.

GNH Index measures the quality of a country in more holistic way and believes that the beneficial development of human society takes place when material and spiritual development occurs side by side to complement and reinforce each other. It mentions nine domains which set the parameters to measure the GNH. The nine domains of GNH Index are as follows:

- i. Living Standard
- ii. **Education**
- iii. Psychological well being

- iv. **Health**
 - v. Time – Use
 - vi. **Cultural Diversity and Resilience**
 - vii. Good Governance
 - viii. **Community Vitality**
 - ix. Ecological Diversity and Resilience
- A person is happy when he enjoys sufficiency in 6 or more of the 9 domains.

Out of the above mentioned domains Education, Health, Cultural Diversity and Community Vitality form a part of the social infrastructure. The social infrastructure can be categorized as follows:

Table 12 Social Infrastructure Elements

Sector	Examples
Health	Medical facilities Ancillary infrastructure (e.g. offices, car parks, training facilities)
Education	Schools (primary and secondary) Tertiary facilities Residential student accommodation
Civic and Utilities	Community & sports facilities Local government facilities Water and wastewater treatment
Transport	Bus stations Parking lots
Law and Order	Prisons Courts

available for the residents of the Haa valley. It is a 10 bedded unit with facilities like OPD, inpatient facility etc. There is also an indigenous unit, facility for lab tests and ultrasound. It has a separate mother and child unit which looks after maternity care, child health care, family planning etc. There is also a dental unit and a pharmacy unit. The BHU has 2 ambulances and an emergency response vehicle. There are 3 doctors, 1 medical officer, 2 dentists and 4 health assistants. The staff includes 4 support staff, 3 administrative staff. The BHU campus also has staff quarters for accommodating the staff. The waste from the hospital is taken to the landfill site except the biomedical waste. The bio medical waste is disposed in a pit in the BHU campus. There is no scientific method of disposal of the waste.

A district hospital is proposed near the highway in place of the old guest house which is under construction at present and will start functioning in 2018. This will be a 20 bedded hospital with upto 5 doctors and 4 ambulances, 2 drivers etc. The staffing shall be according to the Bhutanese norms for a district level hospital.

6.3.1 Health

The incident of epidemic in Bhutan led the government to intervene and make provisions for medical facilities in the country. Therefore, Bhutan government holds the responsibility of providing free medical services and medicines to the people. A Basic Health Unit (BHU) Grade- I is the basic health facility made



Figure 30 The District Hospital Under Construction

Other health facility available in Haa is the IMTRAT hospital but is beyond the LAP boundary.

6.3.2 Education

There is only one school within the LAP boundary. This is the first ever school started in the entire country. Many bureaucrats of the country are the alumni of this school. The Ugyen Dorji Higher Secondary School is a residential school from 9th grade to

12th grade. It is supported by many feeder schools from in and around Haa valley. The school has all the three courses including science, arts and commerce. There are 16 sections in total and each section has upto 32 students on an average. It has facilities like hostels, sports, laboratories, library, multi-purpose hall dining hall, bus facility for students etc. The staff includes 41 teachers, technicians, lab assistants, cooks, matrons, peons etc.

At present, reconstruction of some of the school buildings is going on, and there are no plans of expansion of the school.



Figure 31 Ugyen Dorji High School

6.3.3 Civic Utilities and Facilities

1. Fire Fighting- There are two vehicles for fire fighting. The vehicles have facilities like a tanker and a pump. These are parked inside the Royal Bhutan Police campus and have an emergency response system.
2. Post office- There is an RSTA and Post and telegraph office in the middle of the market. There is a letter box in front of the office.



Figure 32 Post office

3. Crematorium- There is only one crematorium near Bhutan Oil distribution, Pharikha which is in the south of the Haa Thromde which is beyond the demarcated LAP area.
4. Public toilets- There are 3 public toilets in the LAP area. One is located near the weekly market which is functional and is open on Sunday only. The other is inside the open gym area. The third is behind the repair shop but is closed and defunct.



Figure 33 Public Toilet near Weekly Market

5. Parking spaces- There are three dedicated parking zones for vehicle parking in the market and near the Dzong. Out of the

three, one zone is specifically dedicated for heavy vehicles like buses etc.

In the market area, there are many streets which have on- street parking facility. The on- street parking consumes heavy portion of the designated ROW of the roads.



Figure 34 On- street Parking (Market Area)

7 PHYSICAL INFRASTRUCTURE



7.1 Water Supply

The water supply for entire Haa Thromde is taken care by Haa Dzongkhag administration.

Source



Figure 35 Source for Haa water supply

The source for water supply is mainly the Katsho stream which flows from the hills adjoining the highway. This stream flows through the middle of the settlement and further joins Haa Chhu. This source has proven the dependability as of yet and there hasn't been an incidence of water scarcity. There is another stream which is only used for the water supply for rural areas only. This can serve as a potential source for future needs.

Distribution

The distribution network of Haa is done in a loop system. The water from the treatment plant is stored in a storage reservoir with the help of a main line of 150 mm dia. All the main distribution lines are drawn from this reservoir. The diameters of these lines range from 100 mm to 32 mm. The distribution network for Haa is shown in the map below. Different distribution lines are present for BHU and RBP and Dzongkhag Hospital. Similarly, there are different lines for the upper and lower parts of Haa.

The water supply pipe line in the settlement is dug one foot below the soil surface to keep it safe from harsh climatic conditions which are connected to houses on an individual basis. There are no public or community taps. In Haa town a continuous water supply is ensured. The coverage of water supply is reported to be 100%.

The present water supply system is very old and needs to be replaced. Hence, new lines are being laid all over the town and soon the distribution will be done through these pipelines.



Figure 37 Laying of new pipelines



Figure 36 Alternate Source

Use of alum is proposed during sedimentation. After this step, water is put in a mixing chamber where mixing of chlorine is proposed

Treatment Plant

From the source, water is tapped through 150 mm dia pipe and is stored in a chamber which is further stored in a pressure down chamber else with a heavy pressure the pipelines will burst. The water is then transferred to the sedimentation tank to settle the waste in the water below. This tank is cleaned once in six months but checked once in every 3 months for cleaning and maintenance. It is then transferred to slow sand filters (2 in no. ; used alternately in every 2 weeks). As of now, mixing chamber is not used and water from the slow sand filter is directly

transferred to the reservoir. This reservoir has a volume of 75 cubic meter from which different supply mains are drawn.



Sieved at the Source

Pressure Down Chamber

Sedimentation Tank



Elevated Reservoir

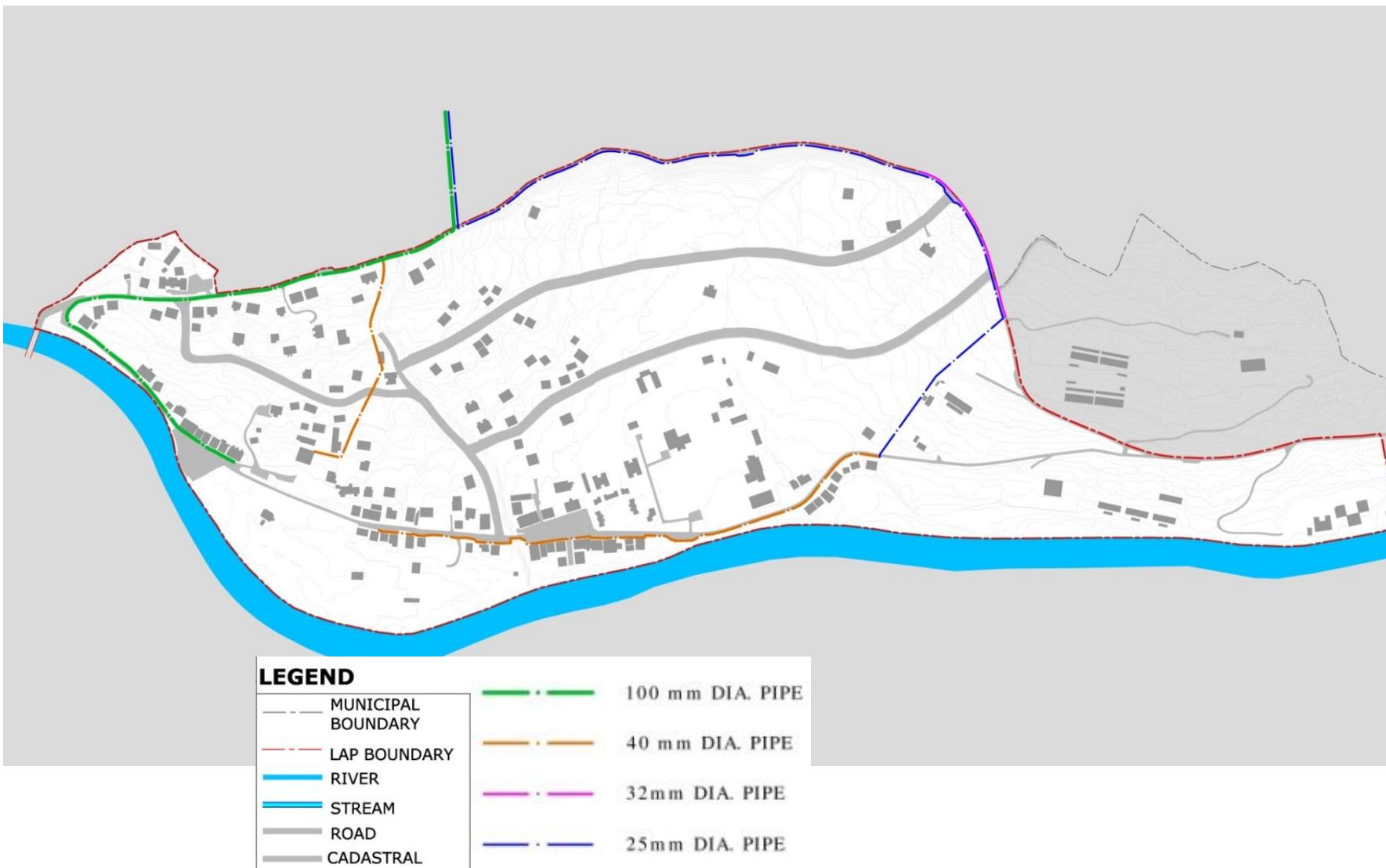


Slow Sand Filter

*for better image quality, maps are attached in annexure.

TO DISTRIBUTION LINES

Map 14 Water Supply Network



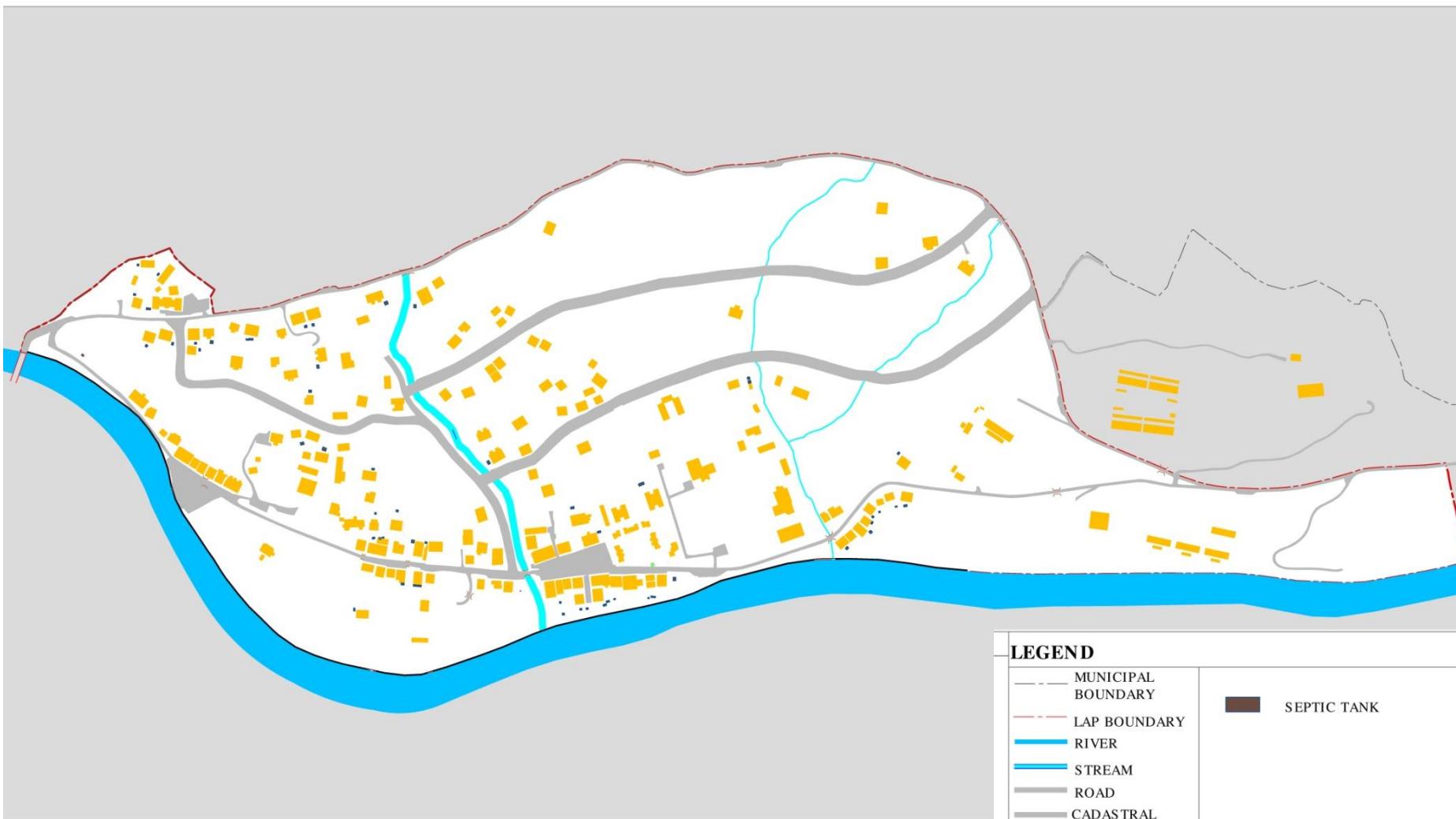
7.2 Sewerage and Sanitation

In Haa, waste water mainly consists of the grey water. The black water is disposed to the septic tank. Septic tanks are used for the on-site primary treatment. The grey water in the form of kitchen waste and the bathroom waste is connected to the composite drain which runs along the main roads.

Every household has an individual toilet. There are no community toilets in Haa. There are 3 public toilets, one near the weekly market; other is near the open gym. The third toilet behind the repair shop is defunct. There is no sewage treatment plant in Haa at present.



Figure 38 Septic Tank



Map 15 Existing Sewerage and Sanitation Network

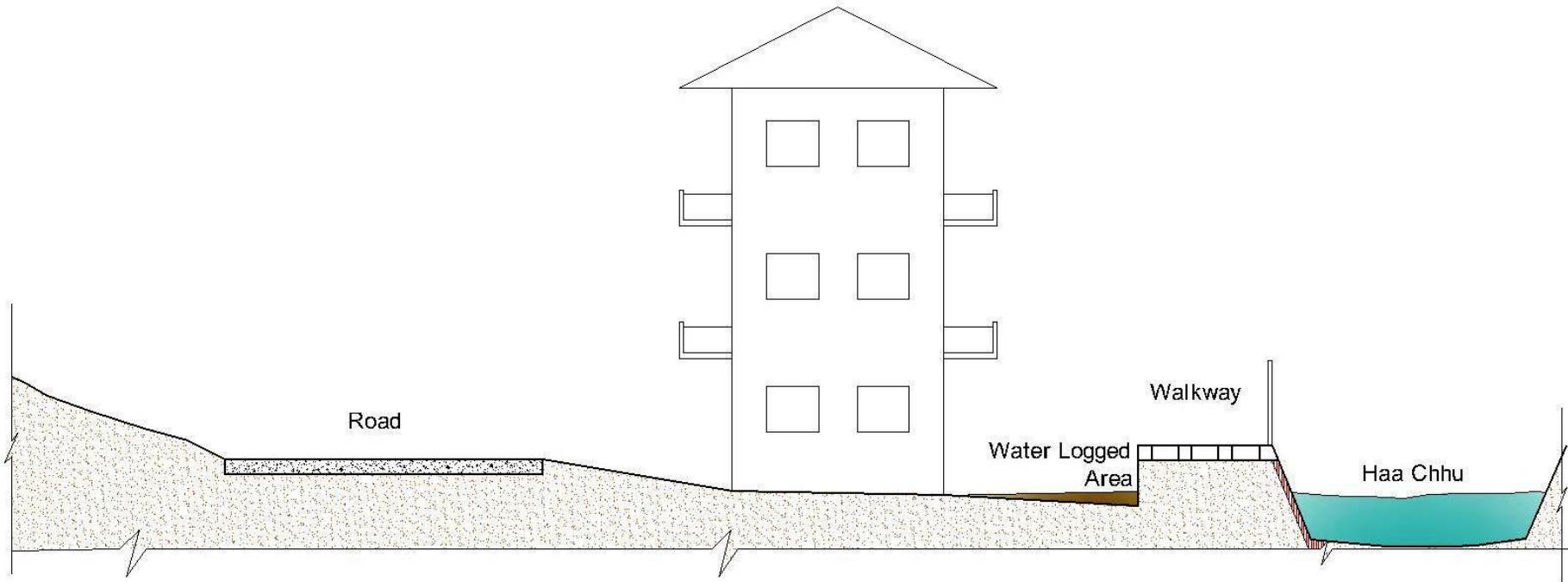
*for better image quality, maps are attached in annexure.

7.3 Drainage

The composite type of drains is found along all the major roads. Composite drains are the drains in which both the storm water and the grey water is conveyed. The smaller drains carrying the grey water from the households is connected to the storm water drain which is ultimately drained into the river.

These drains are open at many places, which lead to the dumping of solid waste and leads to choking. Near the parking and the market area, the drain is well lined and closed. Primarily in residential areas the drains are open. On the newly

constructed roads there are open drains on both sides. Main roads have curb and channel drains. In some areas the household drains are not connected to the main drains and hence the problem of water logging is seen. The topography of Haa is such that the entire slope is towards the river.





Map 16 Existing Drainage Network

*for better image quality, maps
are attached in annexure.



Figure 39 Road side Drains



Figure 40 Water Logging

7.4 Solid Waste Management

In Haa, solid waste is collected by a truck on a daily basis. No segregation is done at the household level. The solid waste is dumped at the dumping site located at Anakha which is 10 km from the Haa town.

No scientific method of disposal is practiced at present. There are no dustbins in the area apart from a few near the RBP campus.

At many places, open dumping of waste is seen. This clogs the regular flow of drains and streams and leads to choking and odour nuisance.



Figure 41 Open Dumping of solid waste

7.5Power

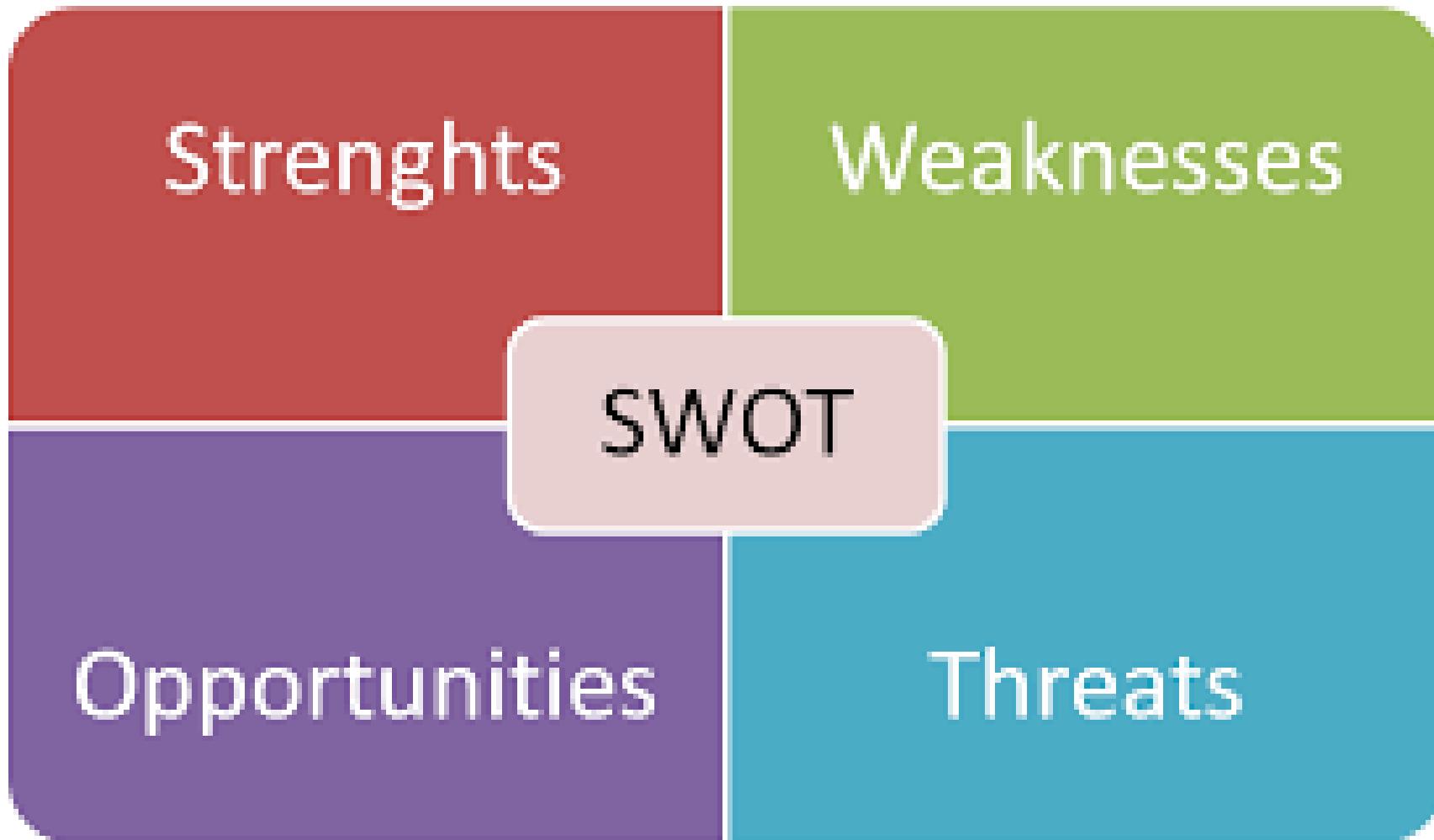
There are three substations in the LAP area one is along the highway which is of 500KVA. The other is near the market culvert which is of 315 KVA. The 3rd is near the RBP campus which is of 500 KVA. All the households have electric connections. The main line is of 11KV. The street lights are present on all the roads and are electrical lights.



Map 17 Existing Power Supply Network

*for better image quality,
maps are attached in
annexure.

8 SWOT

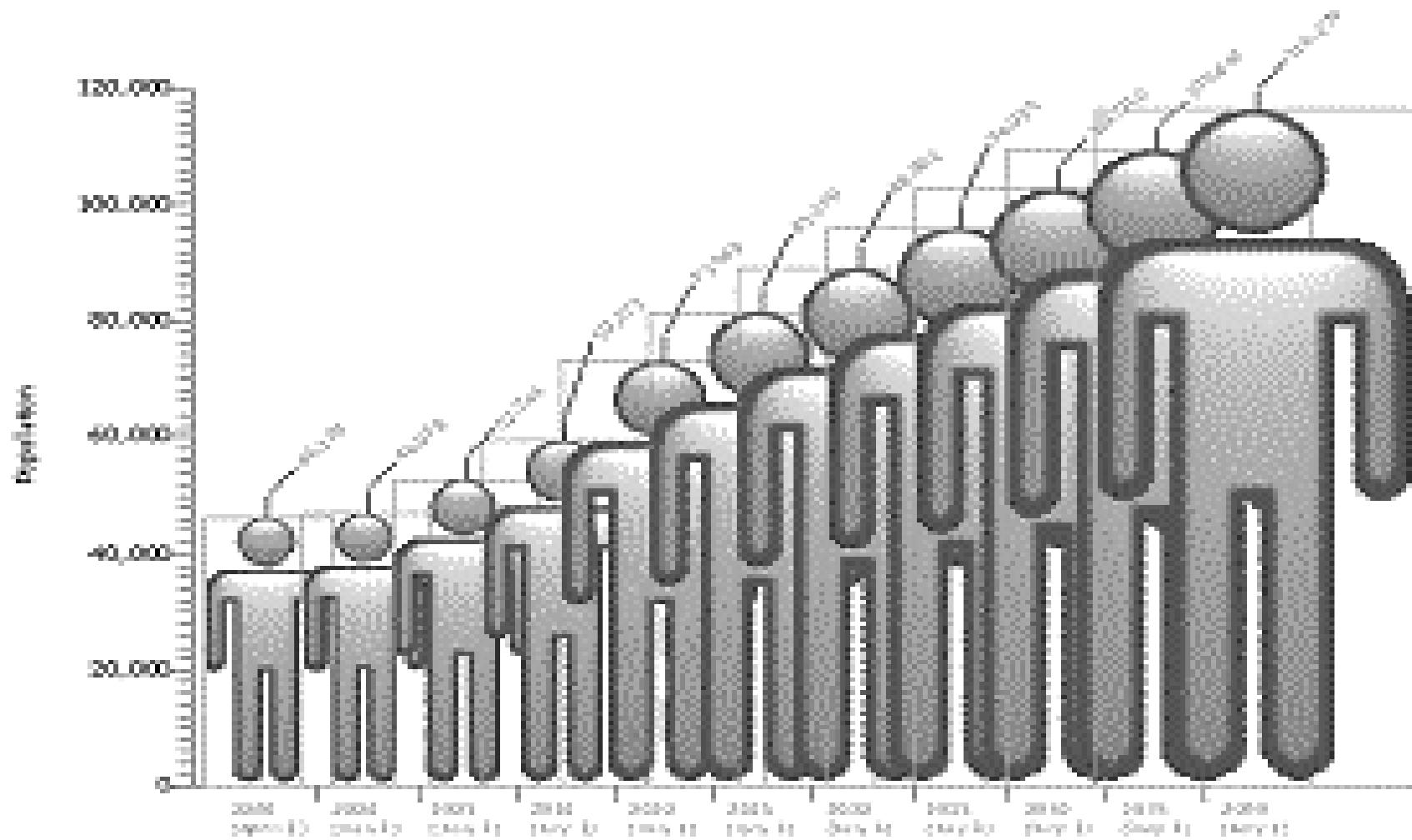


<u>Strength</u>	<u>Weakness</u>
1. Water bodies (both the stream and the Haa Chhu) Presence of water bodies is strength in the sense that there is no water scarcity for potable water and irrigation.	1. Connectivity The absence of interlinking roads in the settlement makes one cover longer distances.
2. Agriculture production Variety of food crops are produced, the soil is suitable for agriculture and climatic conditions also favour agro practices.	2. Drainage The drainage system is not developed adequately. This leads to water logging at many places which creates unhygienic surroundings.
3. Urbanization Urbanization brings along the development of facilities and amenities which acts as a strength for any settlement.	3. Solid waste management There is no scientific method of disposal of the waste. The collection of waste is not regular. Absence of dustbins in the town leads to open dumping of waste which leads to clogging of natural and manmade drains.
4. Walkability The residents walk mostly to go to one place from another. The climate, presence of footpaths etc. foster walkability.	4. Employment opportunities Lack of employment opportunities leads to out migration of people and stagnates the growth of any settlement.

<u>Opportunities</u>	<u>Threats</u>
<p>1. Tourism The Haa Valley is known for its scenic beauty and hills for trekking and hiking. This can be used to promote tourism.</p> <p>2. Terrain The terrain is such that it supports many activities such as agriculture, good drainage, walkability etc.</p> <p>3. Forests The presence of forests will promote balanced environment and ecology. Also forest products can be used to promote household or small scale industry.</p> <p>4. Market A strong market in Haa is present. In the absence of any other settlement of similar scale, people from nearby settlements are dependent on this market for various needs.</p> <p>5. Potato production Production of potato is highest in the valley. Rest of the fruits and vegetables are brought in from Phuentsholing. But raw potato is sent to other parts of the country</p>	<p>1. Health of water bodies The open dumping of waste causes clogging of natural drains and affects their flow. This degrades the health of the water bodies. This poses a threat to the environment.</p> <p>2. Urbanization Rapid urbanization leads to quicker development. The original character and the uniqueness are lost in this process.</p>

9 FUTURE PROJECTION

9.1 Population Projection



Population projections are estimates of the population for future dates. They are typically based on estimated population consistent with the most recent decennial census.

Projections illustrate possible courses of population change based on assumptions about future births, deaths, net migration etc. Estimates generally use existing data collected from various sources, while projections make assumptions about what demographic trends will be in the future.

Normally, statistical demographic population data is taken from three or more decades to create a past trend and then project the population for desired number of years/decades to get the possible future trends.

In case of Haa, series of past trends is not available except for
The following:

Year	Total Population
1987	1314
2000	1731
2005	2489
2015	3224*

*As per TOR

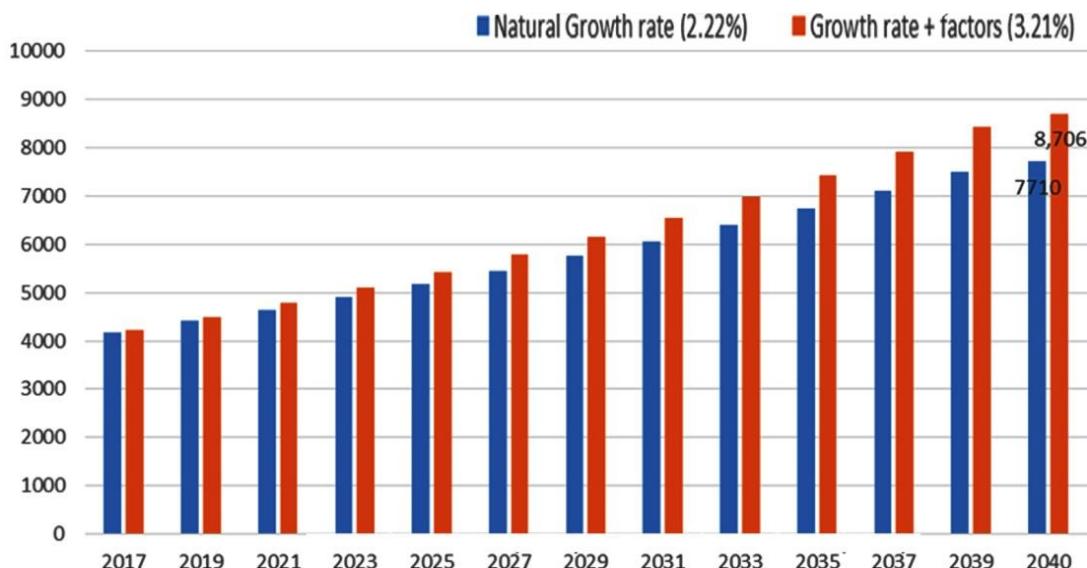
The data is derived from the Census 2005, headcount of 1987
from Structure Report, 2000 headcount from Mr. M.L Chotani's

Report and 2015 population from the TOR. Thus, some indigenously derived projections have been made. The methods adopted are illustrated below-

- A) The Natural Growth Rate of the Country
- B) Growth Rate based on the In-migration rate in Haa
- C) Growth Rate of Western Bhutan as per the Census
- D) Arithmetic Growth with 2005 population as the base
- E) District Growth Rate (Haa Dzongkhag)

A) Natural Growth Rate (GR 1)

Natural population increase (in contrast to total population increase) happens as people are born (in contrast to immigrate) into a country, and decrease as people die (in contrast to emigrate). Rates of population growth, usually expressed as a percentage, vary greatly.



This projection is calculated based on the no. of births and no. of deaths and the increase in population due to this phenomenon.
The natural growth rate is estimated to be **2.22% per annum**.
The blue bars represent the trend due to the natural growth.

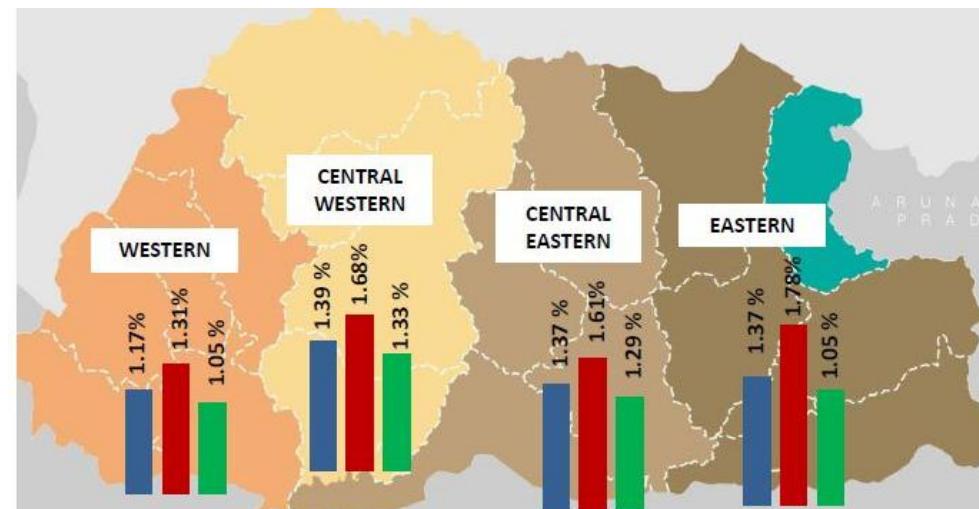
(Source: Population Housing Census 2005)

B) Growth Rate on the basis of In-migration (GR 2)

During the Household survey undertaken in the exercise, an in-migratory trend emerged which was **16.66 % per annum**, which was used as a trend to project possible configurations.

C) Growth Rate of Western Bhutan as per the Census (GR3)

According to the Bhutan National Urbanization Strategy, 2008 the rate of natural increase in the population is computed for each region from the data on survivals given in the census. The results are seen in the table below. It is observed that the Western Region has the lowest growth rate 1.31 % per annum considering both urban and rural population.



Population		Bhutan	Regions			
			Western region	Central-western region	Central-eastern region	Eastern region
Total Population	Popln., 2005	634,982	281,244	88,855	89,720	175,163
	Natural increase per annum	1.28%	1.17%	1.39%	1.37%	1.37%
Urban Population	Urban Popln., 2005	196,111	127,677	13,840	22,880	360,508
	Natural increase per annum	1.45%	1.31%	1.68%	1.61%	1.78%
Rural Population	Rural Popln., 2005	438,871	153,567	75,015	66,840	143,449
	Natural increase per annum	1.14%	1.05%	1.33%	1.29%	1.05%

Figure 42 Region- wise Growth rate of Bhutan

D) Arithmetic Growth Rate (GR4)

In this method, the growth rate is calculated as per the increase in population with respect to the base year. Here population of the year 2000 was 1731 and population of 2015 was 3224. So the **average growth rate per annum is 2.95 %**

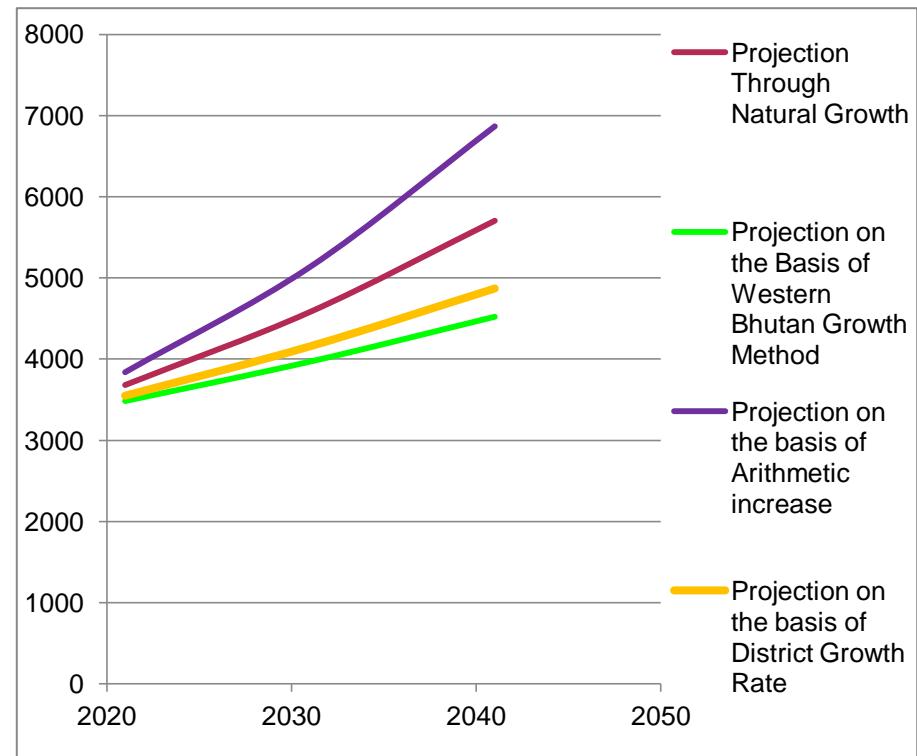
F) District Growth Rate (GR5)

In this method, the growth rate is calculated as per the increase in population with respect to the base year of Haa district. The growth rate of the district is 1.6% as per Census 2005.

Optimum Population and Design Population

Since the In – Migration trends (GR2) will not be applicable in the long term as there is no attraction such as employment opportunities that will induce the population at such a huge rate, thus the population projection trends from this method are not being considered. It is also evident that, values like the in – migration trend or the arithmetic increase method averages out the many possibilities of the future and gives a higher value. GR4, the Arithmetic growth method and the method with two actual figures of 2005 census and 2015 headcount, gives the maximum projection of 3829 persons. Though it appears appropriate to adopt this as the projected population, yet, it is felt that continuous 2.95 % growth annually is hard to achieve. In light of this, the district growth rate is the one which gives us a real and practical picture of the future population. It seems to be more accurate for Adopted Population than the projection through Natural Growth (GR1) or Western Bhutan Growth Rate (GR3), since it will be more accurate than the growth rate of the entire country or the region which it belongs to. The district growth rate will be the closest and true depiction of the trend, so it is used for the final adopted population projection. Thus, the Adopted Population for 2041 shall be 4872 or 4900 approximately.

The next higher figure which is 5704 obtained from the Natural Growth Rate shall be designated as the Design population. This will be used for design of physical infrastructure.



*Refer Annexure _____

Figure 43 Population Projection through different methods

9.2 Housing

Population projection for Haa, project the maximum population of 4900 in 2041 for housing requirement. The demographic analysis

emerges that the average family size in Haa town is 4 persons. Thus the number of household projected in 2041 is 1225.

Contemplating the housing ownership trend in Haa from the primary survey, it is observed that at present 61% of the houses are rented and 31% owned. Thus, anticipating the housing ownership trend in 2041 the existing ownership will be 65% rented and 35% owned whereas the new ratio of housing stalk will be 80% rented and 20% owned. Also, there is a common

followed, the number of dwelling units required for the projected population by 2041 to meet the housing demand will be 306.

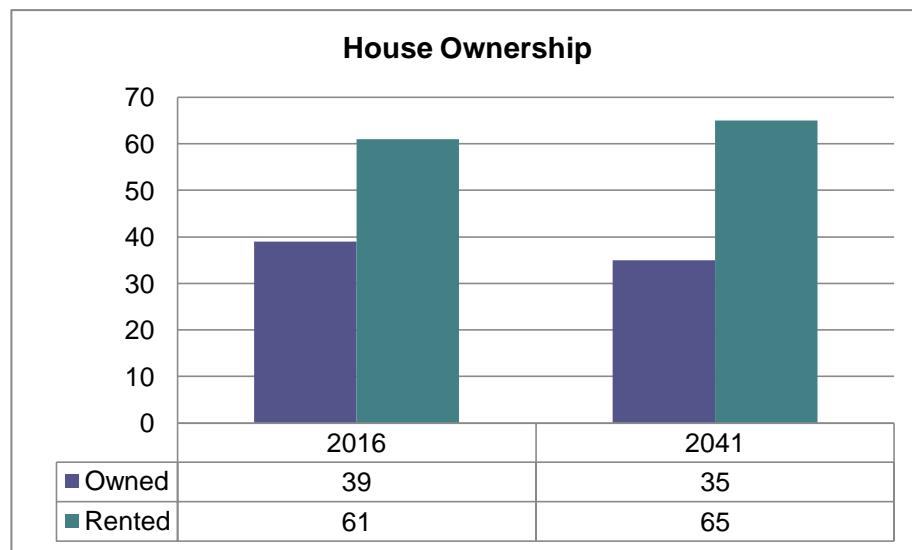


Figure 44 Housing Ownership Ratio

feature associated with the housing typology in the town, i.e. a typical dwelling unit is divided into four parts accommodating four households. Therefore, if this trend of housing typology is

9.2 Infrastructure Projection

The infrastructure shall be projected with reference to the projected population for the year 2041. It shall serve the future population with ease and without lagging. Thus, considering the present and future demand requirements of the infrastructure, the following shall be considered:

9.2.1 Water Supply

The water supply in Haa is tapped from a stream into a water intake tank some kilometre north of Haa. The water is taken to the treatment plant from where it is distributed by pipelines to the households through gravity. Firstly, the water treatment tank has the capacity of 1.5MLD. Thus, the per capita water supply capacity in Haa sums to 465.7 LPD, which is more than 3 times the standard water supply requirement for domestic use. Therefore, considering the same quantum of water from the stream, the water availability for a population of 5700 by 2041 shall be easily achieved. Hence, the existing water supply system is sufficient to serve the population up to 2041.

Secondly, assuming the water supply in the town to be 135LPD, the water requirements for 2041 are extrapolated. Thus, it is estimated given the above facts that the town requires 0.77MLD of water for domestic use by 2041.

9.2.2 Sewerage and Drainage

Like many other towns of Bhutan, Haa also has a huge advantage of the topography for functioning of sewerage system. Each household has a septic tank for primary treatment of sewerage which is connected to the storm water pipes running along the roads. However, all roads do not have storm water drain and are open and temporary at many places.

A well laid network of covered permanent drain along all the roads have to be developed. All the uncovered and temporary drains shall be made permanent and covered. The grey water shall undergo secondary treatment before disposal into the river. Thus, a Sewage Treatment Plant has to be developed in the town.

The secondary treatment by STP shall be done at town level. All household septic tank shall be connected to main sewer line which will connect to the STP. The design of STP shall be determined on the basis of waste water generated and since, the town has flush toilets, the quantity of waste water generated shall be 80% of the water supplied.

$$80\% \text{ of } 0.77 \text{ MLD} = 0.62 \text{ MLD}$$

Thus waste water generated is 0.62MLD.

All households in Haa have septic tank for primary treatment of sewage. The sewage undergoes a primary treatment in the septic tanks and the grey water is drained into the STP through sewer line.

The storm water drains shall be constructed along all new roads. Since the IMTRAT taps the water from Haa Chhu downstream, the storm water also needs to be treated to avoid any impurity. Therefore, the storm water drains shall be connected to the constructed wetlands for secondary treatment before disposing the effluents to the river.

9.2.3 SWM

A rising quality of life and increasing rate of resource consumption patterns have an unintended and negative impact on the urban environment. The waste should be reduced and scientifically disposed. Thus, a comprehensive management plan for solid waste shall be adopted.

Presently approx 1TPD of waste is disposed on the landfill site daily. According to the standards 250gms of waste is generated per person/day. Thus, until the end of the plan 2041, as per the design population, Haa is assumed to generate about 3 MT/day of solid waste.

While projecting the break up is virtually impossible, based on the present habits and lifestyle, an indicative break up shall be as under

1. Bio-degradable material - 66%
2. Plastic - 23%
3. Glass - 2%
4. Cloths and Paper - 4%
5. Metals -5%

However, reduction at source and recycling the non biodegradable waste shall be emphasized and practiced. The quantity of inert waste for sanitary landfill should be reduced as much as possible. The bio degradable waste will constitute about 1.98 TPD of the waste and non recyclable, inert waste will be 1.02 TPD of waste.

To contain 3MT/day of waste, a sanitary landfill of 0.02 sq. km. size will be required. The scientific method of disposal shall be used.

9.2.4 Street Lights

At present there is 5.42 km of road length in Haa LAP with the advent of new proposals/development, the road length shall increase about 3800 m.

The existing roads have street lights all along the length. Thus, it will be the new roads on which street lights need to be installed.

The c/c distance of the street light shall be 40m. Thus, 126 no. of street lights will be required by 2041.

9.3 Facilities and Amenities

Parking

From the primary survey analysis it was observed that 72% of the households have private vehicle, which means that, based on the sample survey the town has approximately 580 vehicles in the town area.

A majority of houses in the town are on large plots of land and they keep their own vehicles on their plots. The only exception is the market area where the plot coverage is heavy due to commercial activities and thus the cars are parked on streets.

The Development Control Rules should ensure that residential plots should have sufficient space for parking within the plot boundary for resident's cars/ vehicles to be parked.

The survey also mentioned that majority of people use walking as the mode for movement within the town. This means that the vehicle is predominantly used for travel outside the city.

This leaves us with public parking. Almost all the Institutional places, the Dzong, the BHU, the School, and the RBP have their own long term parking. The commercial area has a dedicated parking while a large parking is available near DYT hall on one side and a Heavy vehicles parking is available just before DYT hall. This heavy vehicle parking is bit far from the commercial area. It should be brought closer to the commercial area.

Similarly, Haat Bazaar area should be provided with a organized car parking for approximately 25 cars along with heavy vehicle parking for about 10 heavy vehicles.

The improvement of pedestrian facilities would definitely reduce the vehicular travel within the town and the town would not face any parking deficiency.

[MAP](#)

9.4 Economy and Employment

As evident from the existing age sex structure of the population of Haa town, the number of people in the working age group which comprises a major portion shall be almost similar in 2041 if there is no out migration from the town. The structure at present is due to the major recruitment in the Government sector over the last two decades.

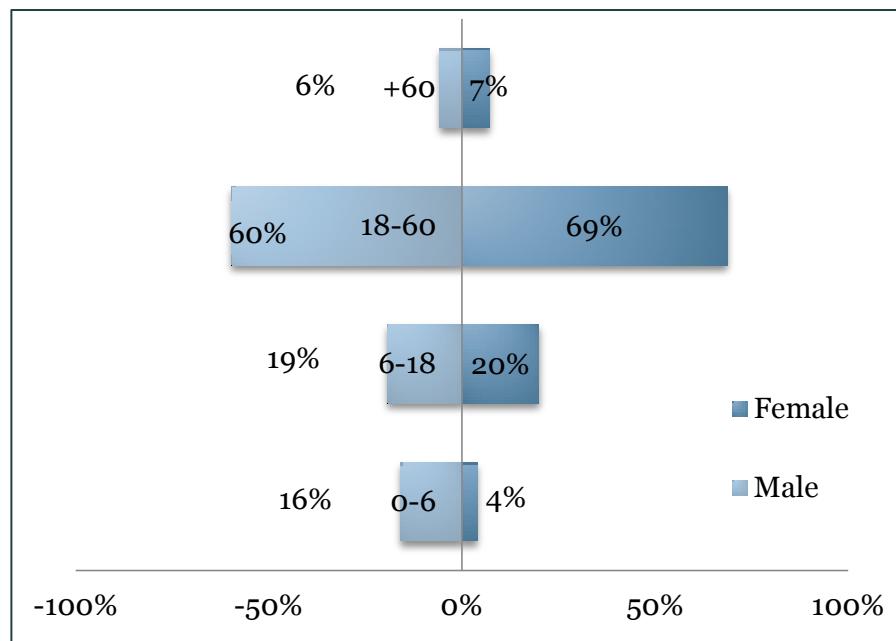


Figure 45 Age Sex Structure

Next two decades shall be extremely important with respect to employability of the people in the working age group. The

Government employability shall not continue to be at the same rate and apart from government employability, service sector in private commercial enterprises and eateries are the only option at present. If a good worker participation ratio has to be maintained for a sustainable survival of the population, alternative sources of employment in the secondary sector and the tertiary sector has to be found out and developed.

In earlier chapters, studies of the town show that as a resource, timber and Potato is available in the district. These could emerge as a major resource sector.

Though timber sawing could be available at many places, skill development of making building units such as doors, windows, shutters, trusses and various furniture items such as tables, chairs, settees, and cupboard/cabinets could be developed as a major employment avenue.

Similarly making of traditional artifacts as mementos could be developed as a house hold cottage industry. A curio shop could also be established.

A unit of production of potato chips, and their packing, which at present is brought over from outside also could be developed to generate employment for the people in Haa town.

10 ISSUES

10.1 Infrastructure

Accessibility

There are certain patches of the major roads within the LAP area which need surface dressing. These include the highway, main road and various other internal roads of the town.







Also, many road junctions also have improper geometry and irregular turning radius which needs to be improved for smooth traffic movement.



Solid Waste Management

In the absence of secondary bins and irregular waste collection in the town, the waste is dumped in open spaces. This blocks the drains and also contaminates the river.

The waste is also disposed beside the Haa Chhu at some points and if it persists may deteriorate the health of the river.



Improper Drainage

The absence of connection of household drains to the main lines has lead to the spilling of grey water and water logging at various locations. This leads to unhygienic conditions in the town.



10.2 Social Issues

Public interaction spaces in a settlement make the settlement cohesive and interactive. Haa lacks in congregation spaces and the one which is DYT Hall is a restricted public space. Recreational spaces for elderly are also unavailable. The roads lack signage and bus stops at intermediate levels. The footpaths are unsurfaced and the slopes are uneven leading to difficulty in walking. Absence of street furniture further deteriorates the situation due to unavailability of in – between seating spaces and dustbins, leading to littering of garbage on the roadsides.



The public toilets are either defunct or are not maintained and remain locked, however the number is adequate. There are no directions or sign boards to the public toilets around the town. With the up – gradation of all the aspects mentioned above, the social structure shall be enhanced.



10.3 Environment Issues

The town is blessed with abundant natural water resources. Haa Chhu and Katsho Chhu are the major water sources which meet the water needs of the population. The health of these water bodies need to be monitored and maintained, since at present the drainage is disposed into the river without any treatment.

This degrades the water quality and deteriorates the health of the river.



The water health is also compromised with the disposal of solid waste beside the river which needs immediate attention.

10.4 Employment Issues

Understanding the economic scenario of Haa and through household survey data, it is evident that the employment opportunities in the town are minimal. The town underwent in – migration, which was mainly for the government sector. Since the government sector is not an ever increasing employment generator, to retain the youth of the town from out migrating in search of employment, certain employment activities must be induced at the earliest. Furthermore, it is essential to sustain the economy of the town.

11 VISION AND CONCEPT

Vision

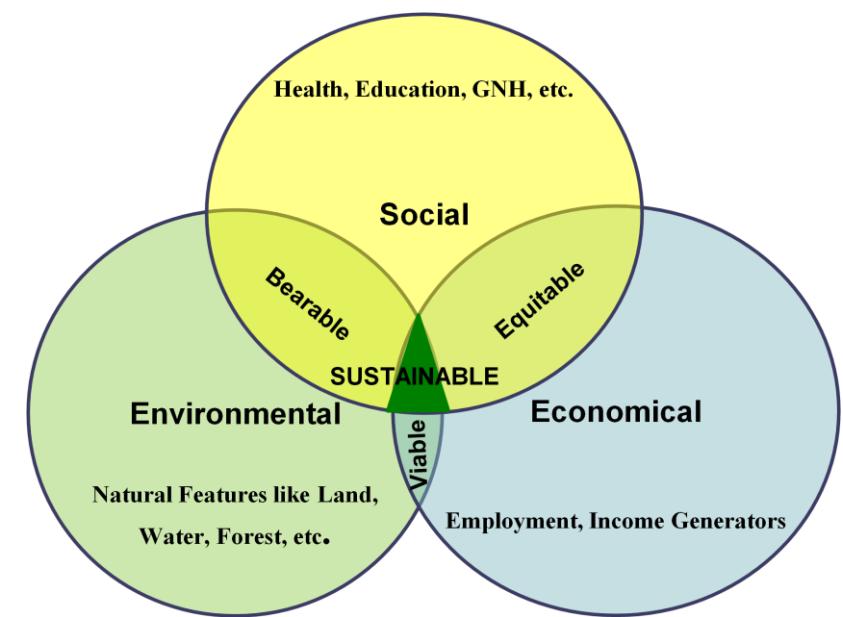
To preserve and protect the integrity and identity of the place whilst promoting the “**cultural landscape**” of Haa.

Principles

Haa epitomizes a human settlement in tranquil surroundings with a strong community bonding and aspirations for growth. Thus, Haa is envisioned as a town-

- Where residents and visitors experience a scenic town with a characteristic charm that offers a safe, friendly and peaceful atmosphere where individuals can live, work, and play and raise a family.
- Where the actions of the community ensures that the natural resources like rivers, forests are conserved and protected, that views from Town to the surrounding mountains are maintained, that both air and water quality are clean and improved, and that accessible open spaces, are preserved.
- Where a diversity of housing is integrated throughout the community and provides a variety of housing options.
- Where art, architecture and cultural events and facilities improve the community experience for residents and visitors, offer diverse and affordable programming,

- The activities are served by community facilities that enrich and ensure affordable and accessible recreation opportunities for residents.
- Where the built environment is of high quality design and construction that respects the historic context and natural setting. The built environment will also convey innovation and creativity that supports community character and enhances the quality of life through sustainable building and development principles.



Developmental Strategies

Infrastructure:

Infrastructure is the spine in any development process and serves to be the basic requirement to keep the city functioning, be it road, drains or sewage network. Any malfunctioning or breakdown in any of these infrastructure results into mayhem. Thus, robustness is a prerequisite for a strong and enduring infrastructure development. This includes hard wearing, resilient and durable network. Providing a robust infrastructure layout to the town will enhance the physical appearance of the town.

Social Strategy:

A society depicts the true picture of a town. A cohesive social structure of the town helps to absorb the development process and it is appropriately quoted, 'A socially cohesive society is one which works towards the wellbeing of all its members, fights exclusion and marginalisation, creates a sense of belonging, promotes trust and offers its members the opportunity of upward mobility'. The built environment is a significant parameter to bring about social cohesion. Integration of different public spaces, recreational and open spaces, and residential areas in a closely knit spatial setting is a way forward in achieving social sustainability. It offers safe interactive environment and open to

development for its people whilst preserving culture, heritage and traditions.

Environment:

While development is an extremely desirable scenario, the present pristine environment in terms of air , land, and water, is the most valuable and vulnerable issue in the town. The aim is to make the developmental process, sustainable, so that, while the development takes place, the environment should not only survive, but should also thrive. The stress on environment should be viable and bearable while the social structure and economy should be equitable. That is the scenario of sustainable development.

Employment:

In the purview of the present employment scenario in Haa, employment generation is the major concern, since in its absence it is difficult to retain the youth in the town. Progressivism as a concept shall be used to overcome this drawback. Progressivism is a philosophy based on the idea of progress which asserts that advancement in science, technology, economic and social development are vital to improve the human condition. It implies that certain skill sets need to be developed

and inculcated in the generation to come to create a huge economic base for the population.

Concept:

In light of the **vision**, the concept of the local plan area plan has been envisaged. The concept maintains the sanctity of the environmentally valuable assets, forest, built regime and community character of the town.

The fundamentals of the concept are as below-

1. Integration of Streams

The conservation of stream is proposed by making a green buffer along the banks of the streams. The green buffer will include walkways. Deweeding and de silting of stream is also proposed.

2. Cohesiveness in the built form

The in-coherent form at present, in bits and pieces, is envisaged to be conjoined and made into a cohesive and contiguous form.

3. Improvement in Accessibility

Construction of loop roads is proposed to improve the interconnectivity. Green spaces along these roads are also proposed to enhance the aesthetics of the road.

4. Creation of public interaction spaces.

Since the built form distribution is in a linear form, public interaction spaces shall have to be developed in southern portion of Royal Bhutan Police Campus. Green spaces, where ever possible could be developed

5. Up-gradation of Infrastructure

Physical Infrastructure like, drainage, sewerage and solid waste management, surface dressing of roads is proposed to be developed in a system.

6. Parking Near Vegetable Market

For the ease and convenience of the sellers and suppliers of the vegetable market, a parking space is proposed near the vegetable market.

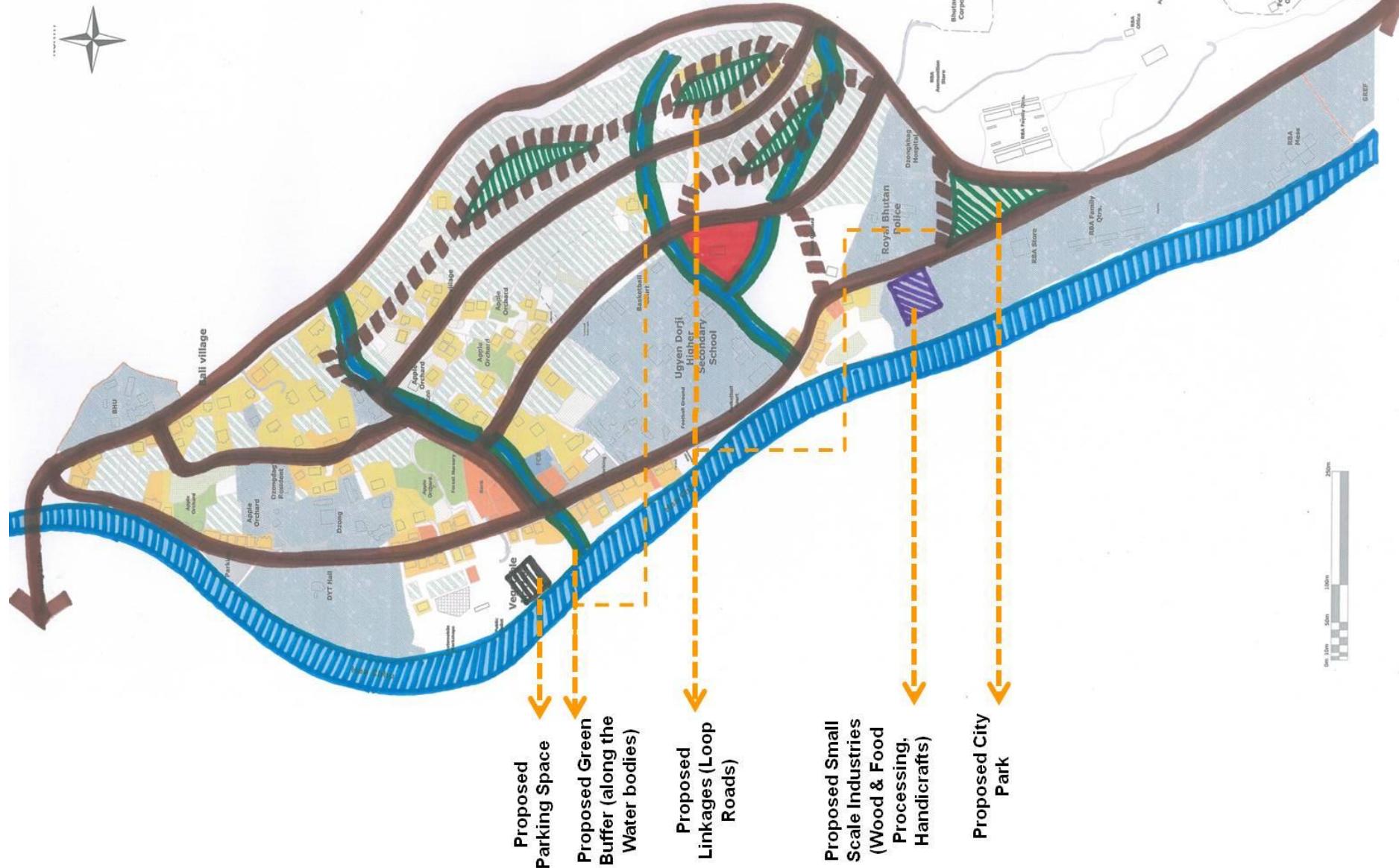
7. Creation of Work Centres

Owing to the scale of production of potato and the likes a small scale processing unit is proposed. This would generate employment opportunities for the residents of the Haa town.

Furniture manufacturing units- The timber from the forest can be used for furniture manufacturing units. There are already 19 saw mills in the Haa Dzongkhag.

Handicrafts- To promote tourism, a small unit for locally manufactured handicrafts could also be developed. This will not only give Haa a USP but also will strengthen the economy.

*Concept Sketch is attached in the annexure



12 PROPOSALS

12.1 Proposed Landuse

Landuse Allocation

Residential

The Design Population as per projections for the year 2041 is 4900 persons. Thus for future land use allocation the land utilization rate is calculated. At present, the area of land used for residential purposes which include Residential 2 (mixed) as well is 17 acres and the population curtailed is 3224. Therefore, land utilization rate i.e. land used per 1000 persons is 5.27 acres reaching to an existing density of 190 persons per acre. Observation from visual survey and building footprints as evident from different digital sources, the land parcels used for residential uses cover a small portion of the parcel which makes it denser than it ought to be. Thus, the residential density needs to be reduced for future. Consequently, to attain a gross density of 125 persons per acre, 39 acres of land is required. The land can be acquired from existing agriculture available in the town. However, land under Epalzhing shall have to be retained. As gathered from existing landuse distribution, the land which can be acquired from agriculture except for Epalzhing (bigger

than 500 sqm in area) works out to be 40 acres which appears to be adequate for future requirement. Thus, the land proposed for future residential use is marked in the map.

The land allocated for residential use is 32.57%, which includes, reconstituted (5.03%), Proposed (19.09%) and existing (8.43%).

Proposed Commercial

Owing to the existing commercial zone in the town, the parcel abutting north of the road to vegetable market is earmarked for commercial use. Also, a commercial parcel is proposed in the new proposed residential areas, overall accounting to 1.37% of the town.

Proposed Buffer

Owing to environment conservation laws of Bhutan, the water bodies and streams shall have a green buffer around it. Although, the existing structures within the buffer can be retained but no further private development within 30 m from the edge of Haa Chhu, 15 m on both the edges of Katsho Chhu and 5 m from non perennial streams shall be permitted. The land under green buffer accounts to 5.69%.

Industrial

The existing workshop near Haa Chhu which is a polluting industry is proposed to relocate away from the river. Thus,

the workshop shall be located near highway. Also, non-polluting industry which includes timber processing and potato chip producing units shall be proposed near vegetable market. It constitutes 0.3% of land.

Road & Pathways

The town lacks inter linkages and so, loop roads are proposed to improve the connectivity. This includes the new residential areas as well. The existing pathways are improved and some are upgraded to road.

The area under proposed roads and pathways is 12.7 %.

Parking

The land allocated for parking is 1%. The heavy vehicle parking is shifted near vegetable market and certain parking lots are proposed near Football court and new residential areas.

Green

Though Haa has inherent beauty and proximity to nature, it lacks organized green spaces. It is hence proposed that an organized park fully equipped with seating lounge shall be developed near plaza which shall facilitate the northern Haa. Another park at Y- Junction at the entrance of the town shall be a town level facility with other green spaces proposed

among the new residential areas. The park at Y- Junction will enhance the image of the town.

Thus, at the town level, about 2.18% of area is dedicated to green.

Recreation

Apart from the archery ground, Haa lacks recreational spaces. The existing children's park and open gym is invariably susceptible to accidents due to archery field. Thus, a conscious effort is made to propose recreational and gathering spaces in the town.

- Children's park, which at present is situated near vegetable market, shall be relocated near Bhutan Power Corporation.
- The existing DYT hall has been proposed as a football court and the adjacent land is proposed as public gathering space or congregational space.

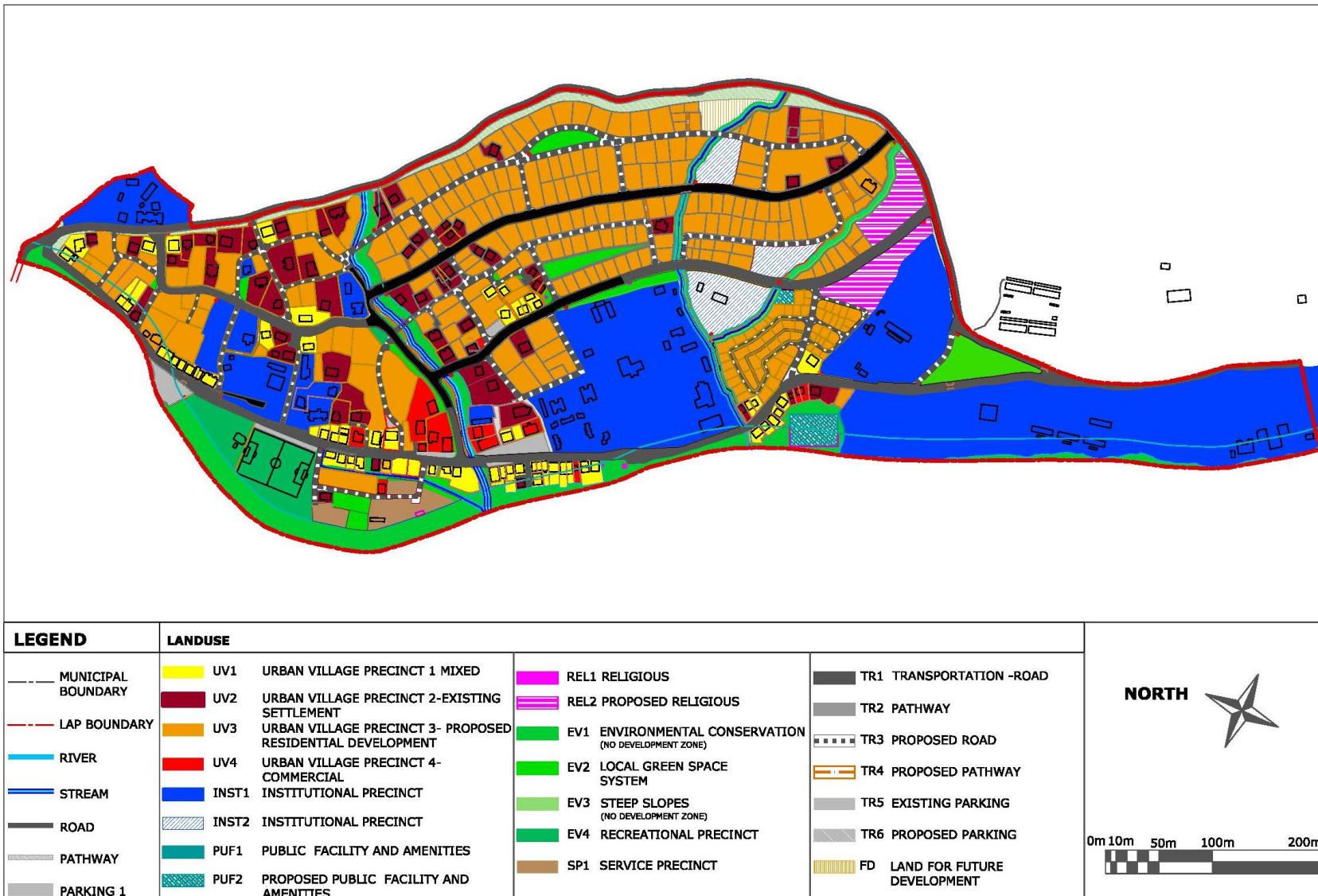
The town hence, has 2.22% of area dedicated to recreational spaces.

Public Utility and Facility

To facilitate the residents certain utilities are proposed which include Sewerage treatment plant, Public toilet and constructed wetlands. Therefore dedicating about 0.48% of land to this category.

Table 13: Proposed landuse classification

CODE	AREA
UV 1	22050.562
UV 2	42309.388
UV 3	153861.193
UV 4	8259.585
INST 1	167296.058
INST 2	13011.995
PUF 1	62.599
PUF 2	3486.911
REL 1	44.712
REL 2	11891.94
EV1	43329.342
EV2	14445.577
EV3	8584.002
EV4	14324.77
TR1	57572.894
TR2	1204.956
TR 3	61934.3824
TR4	3520.834
TR5	3688.686
TR6	2364.068
FD	2458.934



Map 19: Proposed land use

The proposals for Haa are categorised under three pillars of sustainability viz. Environmental, Economical and Social.

12.2 Infrastructure Proposal

1. Up gradation of physical infrastructure

12.2.1 Sewerage and Sanitation

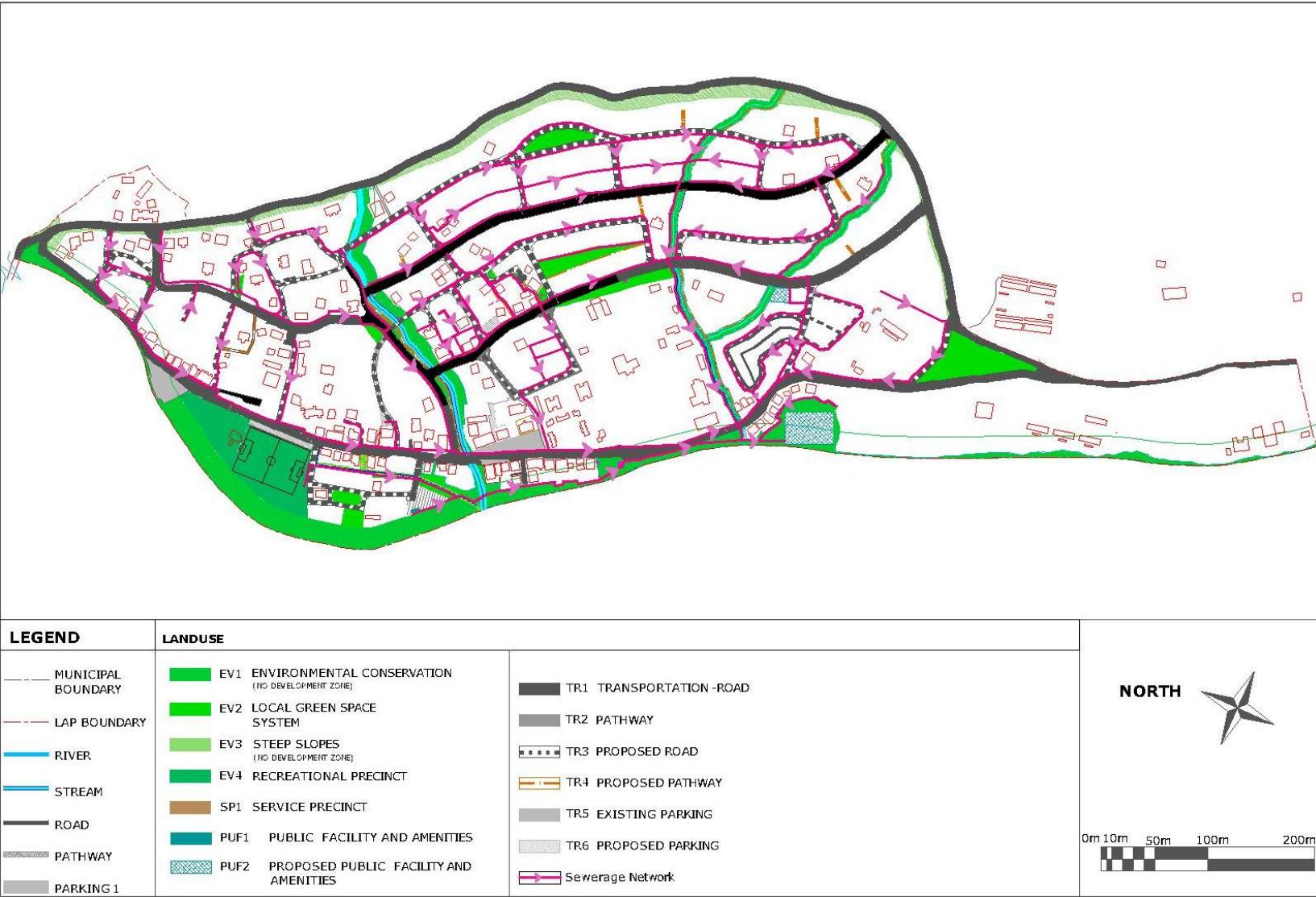
Owing to the lack of the infrastructural facilities like absence of connections from household drains to the main sewer lines causes water logging in some areas. This leads to the odour and fly nuisance. This also pollutes the land and renders it unfit to use.

In light of the topographical scenario, segregated built form and the fact that the future housing development being the initiative of the private sector, with no definite time frame makes designing and implementing a comprehensive system nearly impossible. This is so because, while technology may help out overcoming the topographical problems, the future housing development scenario does not have a time frame; assured flow would not be there and shall lead to silting and clogging. It is thus recommended that smaller cluster systems based on a septic tank should be developed. Therefore, connecting the entire household drains to the main sewer lines is proposed. Presently each household is provided with septic tank, which needs to be

treated and disposed off. For which, sewer line is proposed to collect the waste water from households. This waste water will be treated in Sewage treatment plant which is proposed at a location with the lowest elevation in the town. Thereafter, the treated water shall be disposed off to the river.

In view of the extreme climatic condition, Waste Stabilization Pond as is present in Thimphu or Aerated Lagoon method shall not be effective in Haa. In fact no aerobic process shall succeed and thus the anaerobic process, such as the Upward Anaerobic Sewage Process or similar process shall have to be used.

The sewage treatment plant shall be of capacity about 675,000 litres per day.



Map 20: Schematic sewerage network

12.2.2 Drainage

Drainage is extremely important in hilly terrains. An attempt has been made to synchronize the existing drain network to develop as a comprehensive drainage network. While box drains have been used in the area as primary collectors, Kerb and Channel drains along the roads within the settlement area act as the secondary and tertiary collectors. It was observed during the study that many households discharge their waste water in the open or vacant land thus damaging the surroundings. Protective box drains as a concept have been proposed which collect the domestic waste water and dispose it off through a system of constructed wetland.

The method can be understood as below- Constructed wetlands as the term suggests, are man-made wetlands for many purposes, one of them being a waste water treatment systems and to improve the quality of effluent disposed into the river. For this purpose, pits of 9m X 3m size and 2 m depth are constructed near the disposal points. Waste water is filled in the pit with the help of inlet pipe. In the pit a stone lining is made which traps the solid waste and certain types of plants are also planted to trap the biological micro-organisms. This is also known as root zone treatment. Then this water is passed out through outlet pipe to the river.

The schematic diagram can be as shown below-

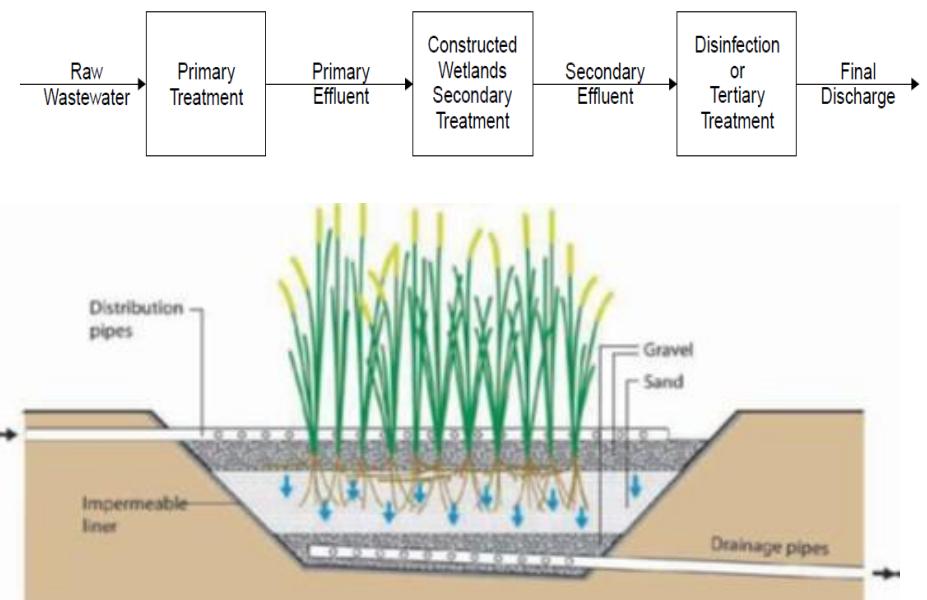


Figure 47 Schematic Constructed Wetland

Advantages of using this system are-

- Cost effective with low O&M costs.
- No limitation on design life period
- High levels of pathogen and other pollutant removal
- The wetlands can be harvested for use as a resource.
- Looks natural and adds to the appearance

There are temporary drains in some places of the LAP area which are proposed to be made as permanent drains. The length of the temporary drain is 1.28 km.

Pontederia or Pontederia cordata is a species of plant which is suitable for Constructed Wetlands and can grow in such an altitude and climate, as in Haa.



Figure 48 Pontederia cordata

12.2.3 Solid waste management

Solid waste management usually refers to the collection, transportation, recycling, resource recovery (composting, waste to energy, etc.,) and disposal of municipal solid waste, "Municipal solid waste is defined to include refuse from households, non-hazardous solid waste from industrial and commercial establishments, refuse from institutions, market waste, yard waste and street sweeping, etc. (World Bank, 1994).

Accordingly, waste management should be an integrated affair, which shall include:

- Minimizing waste,
- Maximizing environmentally sound waste and re - use and recycling
- Promoting environmentally sound waste disposal and treatment and extending the coverage of waste management services.
- The stages involved in SWM are primarily as follows:
 - Primary collection of solid waste from households
 - Primary transportation to municipal waste bins and collection points,

- Secondary transportation of garbage from municipal bins to disposal sites, and actual disposal of the waste.

Improper management of solid waste has become a risk to human health and the environment. Open dumping and improper handling of wastes has led to different type of alarming problems. Owing to the absence of a day to day collection system for solid waste and absence of collection bins or dust bins at public places, open dumping of solid waste is seen at many places. The open dumping also leads to odor and fly nuisance. Thus, there is a need of a Solid Waste Management Plan for the town

The SWM plan for Haa shall be designed with special focus of waste segregation (biodegradable and non-biodegradable) at source itself. The tipping vehicles will collect waste from each household, after collection the waste will be transported to the scientific landfill site. Collection of waste shall be done on a day-to-day basis. The dustbins shall be placed at certain intervals in the market area. Therefore, shopkeepers may dispose off their waste in these dustbins.

The wastes collection will be carried by the tipper truck and disposed off to the landfill site. The process of segregation and decomposition will be carried out at landfill site.

Treatment of Municipal Solid Waste

Bio Degradable wastes shall be treated through pit composting.

Pit composting: With the waste composition of Haa, we know about 66% of the total waste is bio degradable. This is evident that about 1.98TPD of waste will be bio degradable. For pit composting, an area of 134 Sq m with 1.5 m depth shall be dedicated. Approx 2 TPD of biodegradable waste can be decomposed here.



Figure 49 Pit Composting

Recyclables are segregated through the process of pre sorting.

Scientific Landfill Site

Inert Wastes will be dumped in landfill site. Inert waste mainly includes silt generated from drains and from processing plants. It will be used for daily and weekly covering purpose. The rejects from the compost plant, and non-biodegradable waste, and rejects from recyclable waste are to be disposed off in the Sanitary landfill.

It is proposed to use the existing site in Anakha which is about 10 km away from the town for the construction of integrated waste treatment and disposal facility. A green belt shall be proposed around the landfill site.

Few key points of scientific disposal of waste are as follows;

- Bio-degradable material can be composted and used for farming, gardening etc. The plastic can be pelletized and used in road construction. For Glass and Metal can be recovered to recycle. Paper and cloth needs to be incinerated.



Figure 50 plastic bottle collection bins

- Plastic bottle collection points alongside the dustbins to collect the empty plastic bottles which can be directly taken for recycling. Empty beer cans or bottles can be used in construction of walkways or as a landscape element as shown in the picture below.



Figure 51 recycling beer bottles in construction of walkways

The key recommendations addressed for Haa are:

1. Devising a system of Storage of Non - Biodegradable waste as well as bio degradable waste separately at the source of generation of waste.
2. Devising a cost effective system for Primary Collection of waste from the town.
3. Devising systems to include IEC activity as an integral part of the plan to eliminate the practice of throwing garbage on the streets, drains or near Haa Chu

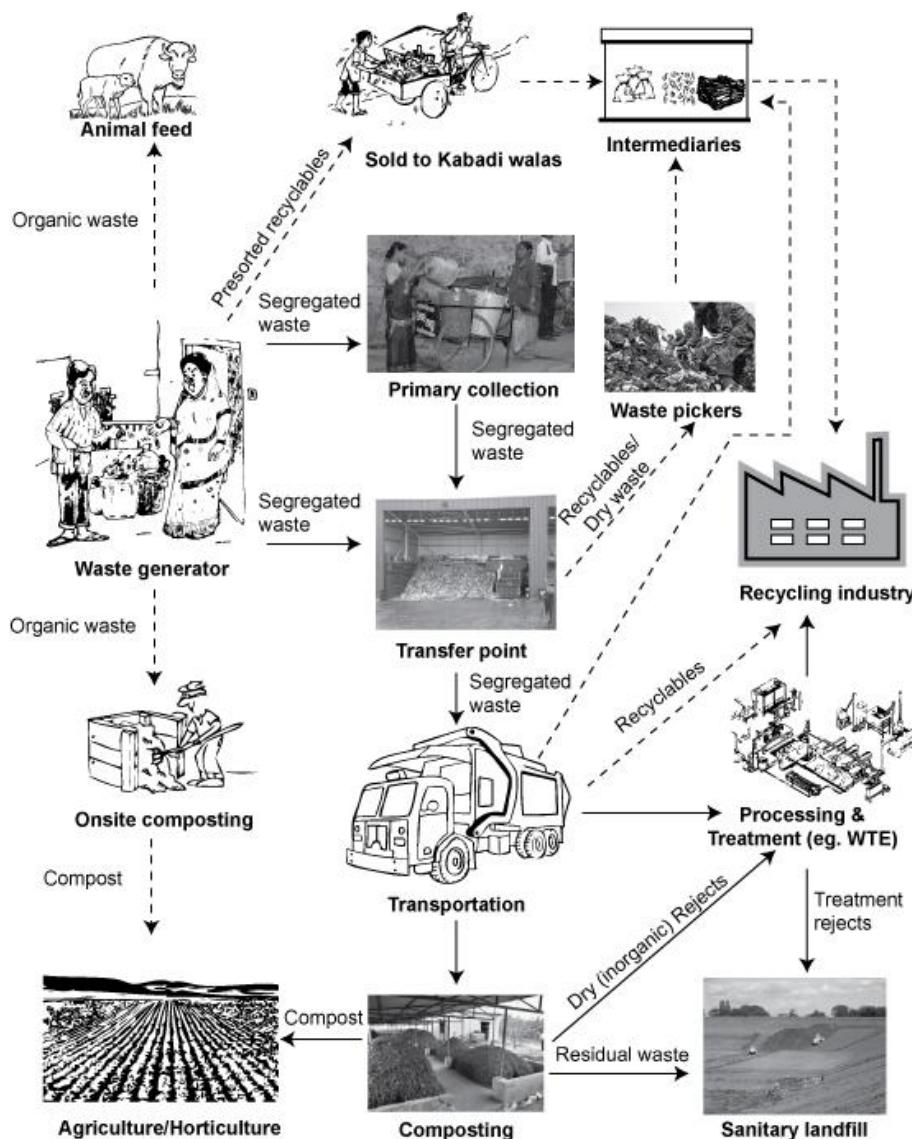


Figure 52: Process flow diagram

causing nuisance to the people and posing a threat to the health of the community at large.

4. Establishing monitoring mechanism for services.
5. Improving the system of transportation of waste using GPS equipped vehicles and equipments.
6. Promoting processing of waste for deriving Bioorganic fertilizer, reduce quantity of waste going to landfill site, deriving income from the processing of waste.
7. Ensuring safe disposal of waste.

12.3 Utilities and Facilities Proposal

12.3.1 Parking Facilities

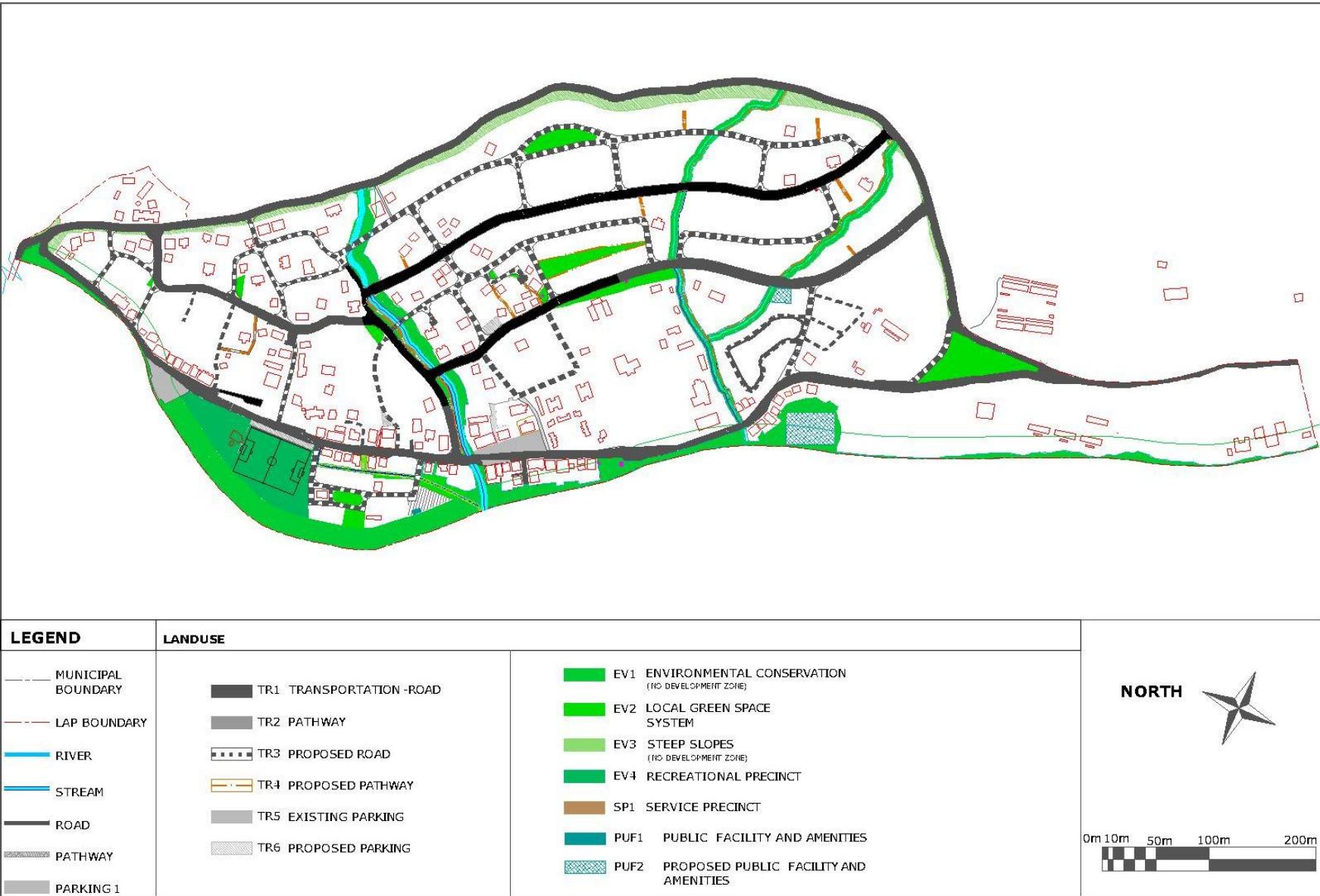
Parking spaces are proposed in the town near vegetable market, commercial and residential areas. Out of the two proposed near vegetable market, one is designated for heavy vehicles meant for loading – unloading for vendors and overnight parking of buses plying in this area. The existing parking lot for heavy vehicles towards the south of the DYT Hall is shifted to this location. The heavy vehicle parking can accommodate around 20 vehicles at a time and the visitors parking with a capacity of 22 two wheelers and 20 four wheelers. Another parking lot is two and four wheeler parking which shall serve the commercial area and nearby residents.

Separate parking space is provided for the football court along the road. Also, parking space of about 400 sqm in the residential area, near the lower access road is proposed. This shall accommodate 16 cars respectively.

12.3.2 Bus stop

The absence of organized bus stop has been observed in Haa town. The buses plying from Haa to other towns access the main road of Haa which is two lanes. There are two ticket counters and bus stops near both the parking areas.

In order to develop a smooth movement for the plying buses, a loop is proposed. The existing route shall now include a segment of the inner roads, i.e. the buses shall now take a loop through the road behind the Ugyen Dorji H S School and then reach the bus termination point near the vegetable market. The new route will make the bus service more efficiently accessible by the people.



Map 21: Proposed mobility network

12.4 Social Proposal

12.4.1 Sports field:

The existing DYT hall campus is proposed with an organized sports complex with football ball ground, archery ground (existing) and other outdoor game spaces along with multipurpose building fully equipped with seating lounge and children's play area with equipment for indoor game and can be used for public gathering. This would facilitate the elderly and the children of the town.

12.4.2 Park:

The absence of organized public interaction spaces like park has been observed in Haa town. Public interaction spaces in a settlement make the settlement cohesive and interactive. Space near Y-junction at the entrance of Haa town has a potential to be developed as an informal recreation space. Thus a park is proposed in this area admeasuring an area of 5135sq m.

A children's park shall be developed in front of Bhutan Power Corporation on the road along Katsho Chuu, since the one existing near Archery field is susceptible to accident. The new children's park is around 360 sq m.

A green space is developed towards the east of Dzongkhag's residence admeasuring about 280 sq m.

Another green is developed in between the vegetable market and non-polluting industry accounting to 898 sq m. This shall serve the residents at macro level.

12.4.3 Plaza

In the dearth of a public interaction space in Haa, a plaza shall be developed near vegetable market. The plaza shall contain seating and congregational spaces accompanied with some eating joints with about 610 sq m of area.

12.4.4 Pathway

Not all the roads in the town are complemented with footpaths, except a few roads in the market area. The existing pathways in the areas which have access roads shall be improved. However, the pathways in the areas which do not have any access road shall be upgraded to a new road. The existing length of the pathway and needs improvement is 270 m. To strengthen the existing mobility network and for the land parcels in the town which does not have any access and road cannot be carved due to existing structures shall be linked by pathways. The pathways

shall also be laid along the streams and thus, the total length of the proposed pathway is 1566.702 m

12.4.5 Street Lights

The entire town shall have 3800 m of new roads and pathways. Thus, almost 126 street lights shall be installed for which locations are marked in the map. The street lighting shall also include lighting pedestrian areas.

12.5 Environmental Projects

River front protection

Protection works of the river have already been done along the Haa Chhu. But it is proposed to enhance the banks of the river by not letting the solid waste or the drainage water directly into the river. For this separate proposals for drainage and solid waste are described in the other part of this section.

Conservation of streams

There are two streams flowing through the settlement. The banks of the streams need to be regularized. Cleaning, de-weeding, de-silting of the streams is proposed. A silt fence 950 m long (475 m on either side of the stream) is proposed to avoid the silting of streams through natural run-off.

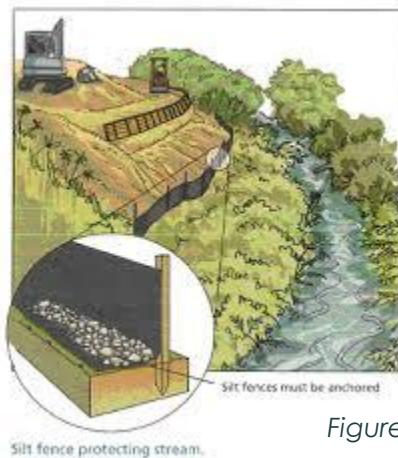


Figure 53 Typical Fabric Based Silt Fence

Beautification of Katsho Stream: The stream traverses through the town to meet Haa Chhu. It is a landmark which shall be enhanced to act as a piece of admiration in the middle of the town. It is thus proposed to be lodge musical fountains in the stream and resurface the pathway abutting it with some flowering shrubs. The following are the shrubs which shall be planted to keep the surrounding area of the stream flowering throughout the year.



Daphne bholua - A sickly sweet smelling shrub of open temperate forests. Found between 1800 and 3100m and flowering from October to April. The bark of the Daphne shrubs is collected to make traditional paper.



3600m and flowers in May and June, which is the peak season for flowering rhododendrons..



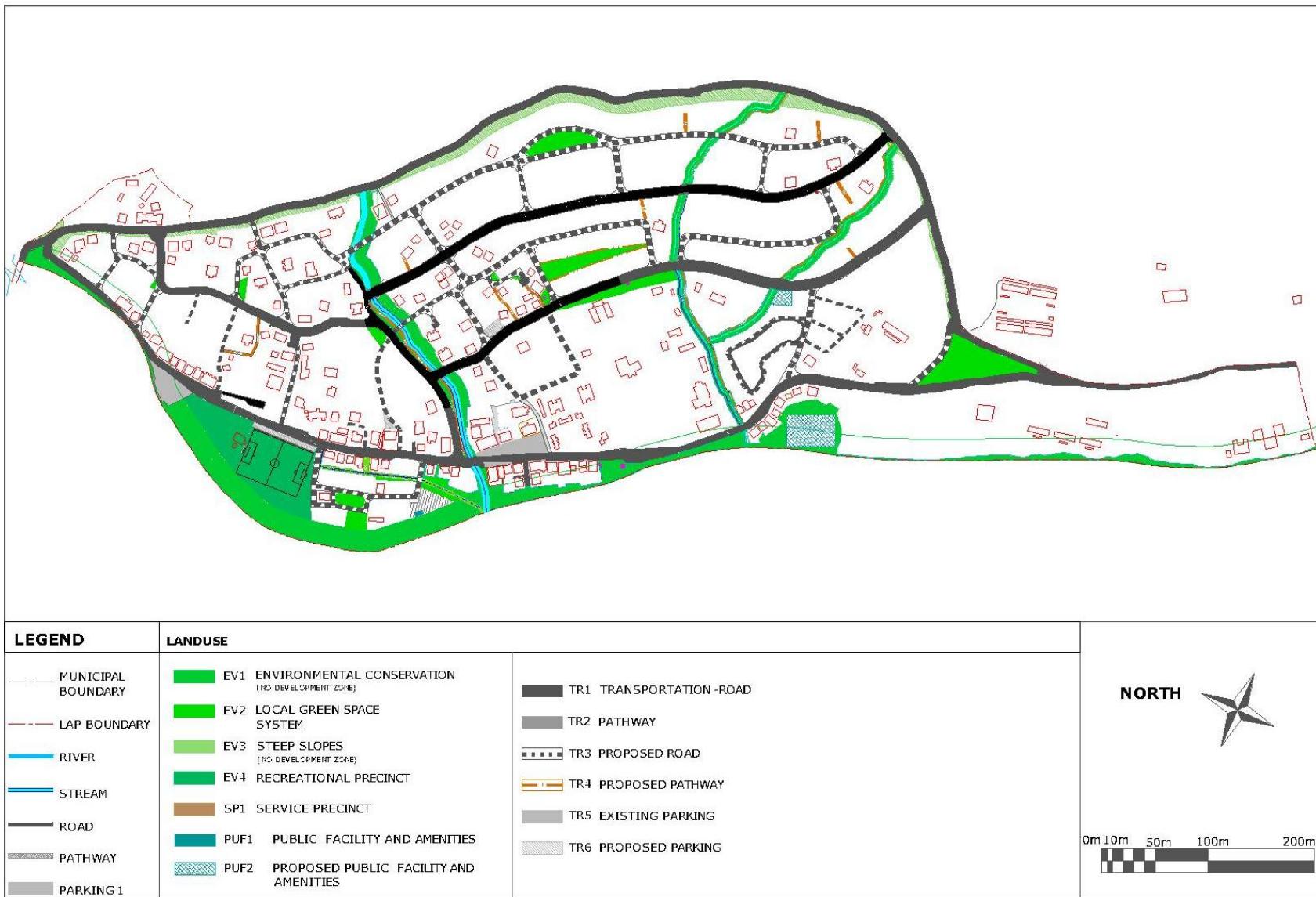
Delphinium stapheliosum.- A fine flower of mid-altitude meadows, from 1200 to 3000m, flowering from July to October.

Jack in the pulpit- *Arisaema nepenthoides*. Found along forest edges and scrub land at elevations from 2000 to 3300m, where it flowers in May and June



Rhododendron cinnabarinum - Found in forests and scrubland between 3000 and





Map 22: Green network

12.6 Economy Enhancement

Skill development centres and industries pertaining to it, shall be promoted to curb the employment issues in the town in the coming years.

A land parcel measuring around 1150sq min size is proposed near the vegetable market wherein skill development shall be done. The skill development shall be pertaining to the potential and emerging sectors in the industry, organised by the Dzongkhag.

The automobile workshop generates oils and other pollution causing waste products and disposes it directly into the river without treating creating a serious health hazard in the years to come. The health of the river at no cost shall be compromised and so the workshop shall be shifted to a location outside the LAP boundary owing to its non compatibility with other urban uses within the town.

13 LAND POOLING

13.1 LAND POOLING

Varied developmental strategies are adopted for different areas in the town. The town level amenities viz. Main road, Highway, Sewerage Treatment Plant, Constructed Wetlands, Town Park and Public facilities and amenities shall be shared by all land owners of the town in cash in lieu of land.

The area beside Katsho Chhu bounded by main road (excluding main road) on the west and Highway on the east and south shall be under land pooling. This shall also include the road abutting Katsho Chhu. The existing and proposed roads within this area, the green spaces, parking space shall be shared by the land owners from this demarcated area. The land pooling share for the area comes out to be 19.19%.

The land parcels below 13 decimal of area shall pay in cash in lieu of land and those with more than 13 decimals shall contribute in land. The list of all the land parcels within this demarcated area is given in the table below.

The northern area of the town i.e. the area bounded by Katsho Bridge and the road beside Katsho Chhu which is majorly an existing settlement shall be under Guided Development. The area under roads and green spaces shall be shared by the landowners, wherever the roads traverse.

The northern part of the town i.e., north of Katsho Chhu, where the existing settlement is observed as irregular shaped and non geometric shaped plots at present, which makes these plots non buildable and creates a stagnancy. In the planning exercise all plots have been reconstituted and brought on to be geometrical or regular shapes as the case may be, so that all the plots become buildable with access to promote a comprehensive compact development of the town.

Table 14: Land details of reconfigured plots

IDs	AREA	Area after deduction	New IDs
1U-73	58.015		73
1U-471	77.259		471
1U-335	80.91855		335A
1U-466	81.150		466
1U-468	87.802		468
1U-396	99.689		396
1U-382	99.899		382
1U-327	104.088		327
1U-352	105.975		352
1U-196	121.4243		196A
1U-198	121.4243		198A
1U-354	121.4243		354A
1U-465	123.417		465
1U-487	126.270		487
1U-433	128.295		433
1U-317	132.145		317
1U-462	140.942		462
1U-486	148.483		486
1U-110	149.671		110
1U-394	150.410		394
1U-488	153.535		488
1U-431	153.908		431
1U-201	157.606		201
1U-316	160.396		316
1U-382	161.8371		382A
1U-406	165.899		406
1U-457	166.827		457
1U-469	167.705		469
1U-313	173.424		313
1U-429	178.821		429
1U-69	180.344		69

IDs	AREA	Area after deduction	New IDs
1U-430	187.855		430
1U-412	193.487		412
1U-408	198.345		408
1U-74	198.801		74
1U-404	199.667		404
1U-472	200.195		472
1U-164	201.861		64
1U-415	202.3428		415A
1U-350	225.747		350
1U-489	228.728		489
1U-459	238.228		459
1U-142	238.724		142
1U-71	239.381		71
1U-333	239.527		333
1U-287	242.8485		287A
1U-283	242.8485		283A
1U-345	242.8485		345A
1U-74	242.8485		74A
1U-476	245.323		76
1U-388	245.951		388
1U-285	248.390		285
1U-456	253.768		456
1U-357	256.920		357
1U-480	258.411		480
1U-477	263.642		477
1U-334	263.936		334
1U-387	266.046		387
1U-29	270.565		29
1U-269	271.593		269
1U-144	271.980		144
1U-428	273.123		428
1U-30	283.2614		30A
1U-110	283.2614		110A

IDs	AREA	Area after deduction	New IDs
1U-29	283.2614		29A
1U-405	285.032		405
1U-385	291.235		385
1U-461	292.318		461
1U-138	292.602		138
1U-442	293.416		442
1U-165	298.082		165
1U-393	298.153		393
1U-358	298.467		358
1U-458	303.358		458
1U-95	307.670		95
1U-474	307.676		474
1U-139	315.555		139
1U-318	316.339		318
1U-448	317.828		448
1U-453	321.928		453
1U-330	321.955		330
1U-325	325.491		325
1U-251	327.473		251
1U-111	328.406		111
1U-191	335.805		191
1U-203	338.553		203
1U-434	341.317		434
1U-268	343.189		268
1U-264	346.209		264
1U-455	348.517		455
1U-449	356.923		449
1U-473	359.113		473
1U-463	360.661		463
1U-347	360.842		347
1U-204	364.1799		204A
1U-201	364.1799		201A
1U-450	376.607		450

IDs	AREA	Area after deduction	New IDs
1U-413	377.293		413
1U-392	383.655		392
1U-323	391.625		323
1U-386	393.925		386
1U-156	395.548		156
1U-228	403.782		228
1U-479	404.005		479
1U-398	404.332		398
1U-410	404.6856		410A
1U-135	404.6856		135A
1U-408	404.6856		408A
1U-70	404.903		70
1U-353	405.448		353
1U-72	406.089		72
1U-63	406.283		63
1U-452	407.406		452
1U-154	407.546		154
1U-197	428.079		197
1U-262	430.011		262
1U-319	430.557		319
1U-300	430.835		300
1U-467	431.342		467
1U-326	432.541		326
1U-97	440.114		97
1U-89	442.802		89
1U-264	445.1914		264A
1U-251	445.1914		251A
1U-391	445.387		391
1U-28	450.316		28
1U-470	450.366		470
1U-263	461.567		263
1U-96	480.221		96
1U-39	483.866		39

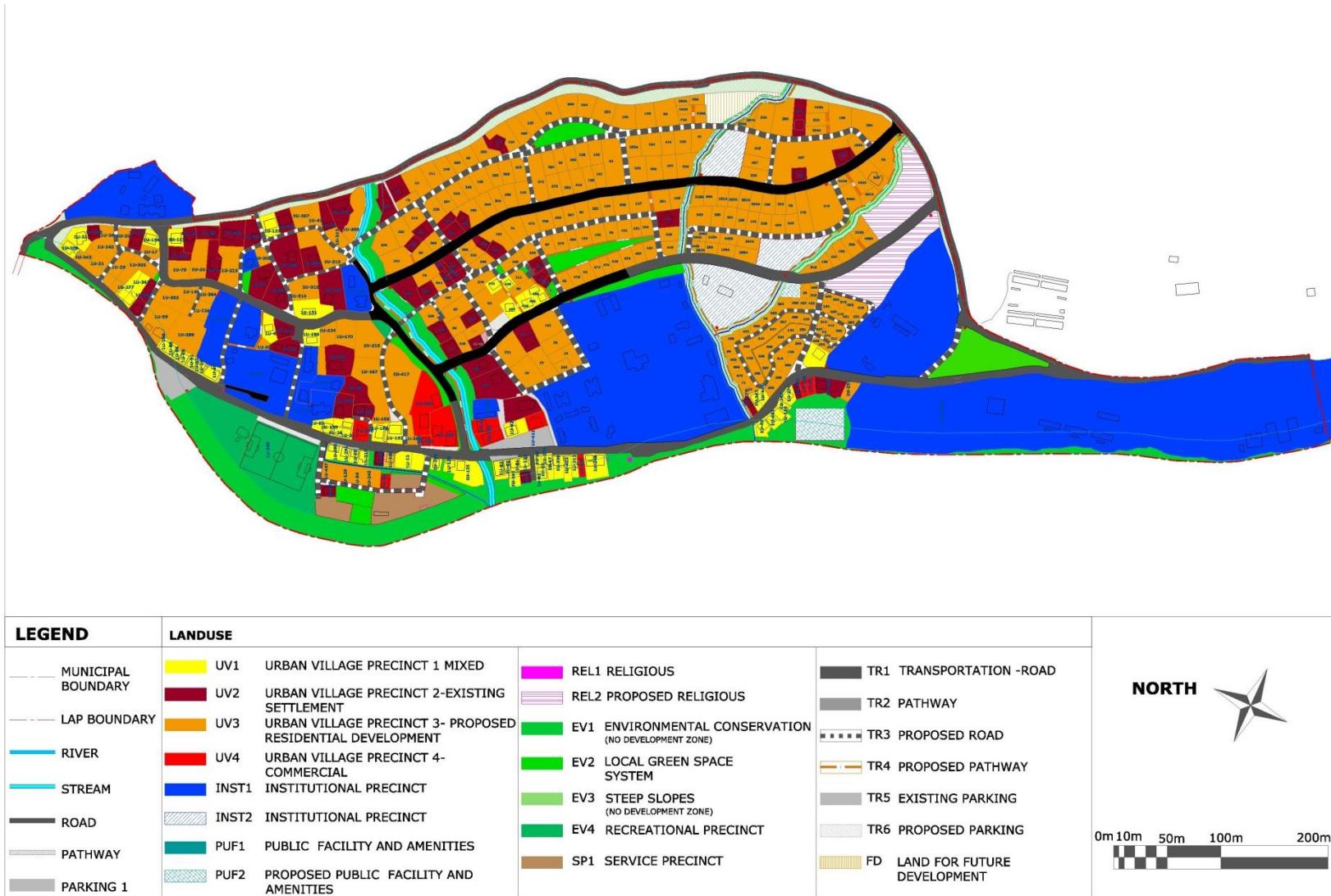
IDs	AREA	Area after deduction	New IDs
1U-357	485.6042		357A
1U-316	485.6042		316A
1U-124	491.213		124
1U-451	494.018		451
1U-460	496.351		460
1U-155	496.592		155
1U-270	496.761		270
1U-351	502.763		351
1U-397	504.472		397
1U-63	505.8571		63A
1U-159	508.892		159
1U-389	509.477		389
1U-464	510.570		464
1U-390	512.702		390
1U-101	512.788		101
1U-16	514.152		16
1U-102	515.596		102
1U-123	524.444		123
1U-359	524.459		359
1U-186	525.088	424.324	186A
1U-186	525.122		186
1U-297	525.575		297
1U-307	526.1099	425.149	307A
1U-90	526.1099		90A
1U-191	526.1099	425.149	191A
1U-419	527.151	425.991	419
1U-199	534.077	431.588	199
1U-258	537.508	434.360	258
1U-171	538.590	435.235	171
1U-103	548.905	443.570	103
1U-266	550.606	444.945	266
1U-44	551.326	445.527	44
1U-326	566.5227	457.807	326A

IDs	AREA	Area after deduction	New IDs
1U-99	571.250		461.627
1U-454	577.463		466.648
1U-267	606.752		490.316
1U-229	612.373		494.859
1U-331	613.573		495.828
1U-328	613.931		496.118
1U-355	614.593		496.653
1U-214	619.656		500.744
1U-151	619.789		500.851
1U-282	620.935		501.778
1U-32	624.256		504.461
1U-409	631.878		510.621
1U-193	649.561		524.910
1U-185	659.233		532.726
1U-226	665.232		537.574
1U-158	671.805		542.886
1U-259	675.187		545.619
1U-5	675.881		546.179
1U-298	697.281		563.473
1U-284	697.998		564.052
1U-223	700.208		565.838
1U-416	704.629		569.411
1U-475	722.525		583.872
1U-395	725.667		586.412
1U-142	728.4527		588.663
1U-203	728.4527		588.663
1U-308	730.510		590.325
1U-439	732.209		591.698
1U-116	749.427		605.612
1U-414	750.951		606.844
1U-130	754.303		609.552
1U-187	758.227		612.723
1U-173	760.994		614.959

IDs	AREA	Area after deduction	New IDs
1U-149	765.967	618.978	149
1U-118	768.732	621.212	118
1U-355	768.8656	621.320	355A
1U-75	769.218	621.605	75
1U-174	769.241	621.624	174
1U-349	778.976	629.491	349
1U-253	792.262	640.227	253
1U-407	797.669	644.596	407
1U-256	808.089	653.017	256
1U-336	810.781	655.192	336
1U-332	817.641	660.736	332
1U-227	828.308	669.356	227
1U-349	849.877	686.786	349A
1U-265	854.639	690.634	265
1U-279	863.363	697.684	279
1U-301	885.486	715.561	301
1U-383	899.964	727.261	383
1U-211	914.084	738.671	211
1U-147	918.223	742.016	147
1U-41	918.763	742.452	41
1U-14	924.978	747.475	14
1U-366	925.005	747.497	366
1U-239	934.296	755.005	239
1U-324	942.357	761.519	324
1U-160	966.725	781.210	160
1U-329	967.607	781.923	329
1U-117	971.625	785.170	117
1U-222	1002.344	809.994	222
1U-76	1003.124	810.625	76
1U-54	1009.213	815.545	54
1U-107	1044.223	843.837	107
1U-348	1057.331	854.429	348
1U-230	1057.344	854.440	230

IDs	AREA	Area after deduction	New IDs
1U-153	1066.329	861.700	153
1U-192	1072.182	866.430	192
1U-87	1073.734	867.684	87
1U-175	1077.580	870.792	175
1U-31	1082.291	874.599	31
1U-194	1087.832	879.077	194
1U-343	1094.529	884.489	343
1U-162	1103.761	891.949	162
1U-172	1105.309	893.200	172
1U-233	1106.506	894.167	233
1U-141	1111.212	897.970	141
1U-365	1123.504	907.904	365
1U-281	1128.617	912.035	281
1U-77	1134.989	917.185	77
1U-145	1163.895	940.544	145
1U-225	1211.807	979.261	225
1U-104	1255.235	1014.355	104
1U-119	1273.953	1029.481	119
1U-400	1278.516	1033.169	400
1U-15	1280.095	1034.445	15
1U-338	1301.208	1051.506	338
1U-254	1301.260	1051.548	254
1U-36	1362.101	1100.714	36
1U-150	1363.561	1101.894	150
1U-66	1398.184	1129.872	66
1U-241	1407.845	1137.680	241
1U-321	1543.411	1247.230	321
1U-18	1552.520	1254.591	18
1U-271	1568.118	1267.196	271
1U-161	1606.561	1298.262	161
1U-62	1615.299	1305.323	62
1U-28	1618.743	1308.106	28A
1U-384	2021.139	1633.282	384

IDs	AREA	Area after deduction	New IDs
1U-43	2120.175	1713.313	43
1U-320	2562.014	2070.364	320
1U-210	3037.786	2454.835	210
1U-367	5406.631	4369.099	367
1U-425	7129.190	5761.098	425
1U-377	7585.969	6130.222	377



Map 23: Plots with new IDs

14 ESTIMATES

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
ROADWORK										
9m ROW										
1		Block cost of 9m Wide ROW road is Nu 1,500,000 for 100m span length.	1	m	17024.64			17024.64	15000	255369600
7.5m ROW										
2		Block cost of 7.5m Wide ROW road is Nu 1,300,000 for 100m span length.	1	m	743.92			743.92	13000	9670960
6m ROW										
3		Block cost of 6m Wide ROW road is Nu 1,100,000 for 100m span length.	1	m	738.01			738.01	11000	8118110
4.5m ROW										
4		Block cost of 4.5m Wide ROW road is Nu 1,000,000 for 100m span length.	1	m	125.55			125.55	10000	1255500
PARKING										
5	EW0031	Earth work in excavation over areas, depth >300mm, width >1.5m, area >10 Sq.m on plan, including disposal of excavated earth within 50m lead and 1.5m lift & disposed soil to be neatly dressed Hard Soil	1	cu.m	2502.29	0.65	1626.4885	116.01	188688.9309	

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
6	RW0121	Preparation of sub grade with proper camber by excavating earth to depth equal to pavement thickness, consolidation with roller, disposal of surplus earth up to 50m <i>All kinds of soil</i>	1	cu.m	2502.29	0.25		625.5725	31.72	19843.1597
7	RW0123	Consolidation of sub-grade with roller, and making good the undulation with earth and re-rolling the subgrade.	1	sq.m	2502.29			432	7.28	3144.96
8	RW0130	Providing and laying Granular sub-base course (GSB) to required degree of compaction with proper formation of cross fall using motor grader for laying and compacted to required density as per material gradation and aggregate quality specified.	1	cu.m	2502.29	0.25		625.5725	1367.76	855633.0426

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
9	RW0131	Providing and laying wet mix macadam graded aggregate base course to required degree of compaction with proper formation of cross fall by using well graded crushed aggregates premixed with OMC using suitable mixer, motor grader as per material gradation and a aggregates quality specified.	1	cu.m	2502.29	0.15		375.3435	1759.65	660473.1898
10	RW0135	Providing and Laying Dense Bituminous Macadam (DBM) to required degree of compaction based on mixture design (job mix formula) approved by the supervising engineer including preparation of surface with road broom, application of prime coat @ 0.75 kg/sq.m by mechanized method using asphalt plant, paver, steel roller, tyre roller etc. complete. 80 mm	1	sq.m	2502.29			2502.29	861.67	2156148.224

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
11	RW0138	Providing and Laying Asphalt/Bituminous Concrete to required degree of compaction based on the job mixture design approved by the supervising engineer using asphalt plant, paver, steel roller, tyre roller etc. as per material gradation and aggregate quality specified 35 mm	1	sq.m	2502.29			2502.29	449.75	1125404.928
DRAINAGE										
12	DR0001	Providing and laying 50mm thick Plinth Protection and grouted with fine sand mix including well rammed, finishing the top smooth With cement concrete 1:3:6, 20mm aggregates, laidover 75mm thick layer of compacted gravel (40mm)	1	m	400	0.35		140	293.11	41035.4

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
13	DR0013	Constructing second class brick masonry open surface drain in cement mortar 1:4 including earth work in excavation 100 mm thick concrete bed 1:5:10, 40mm aggregate and 25mm thick cement concrete 1:2:4,12 mm aggregate for filling haunches including 12mm cement plastering 1:4 with a floating coat of neat cement and disposal of surplus earth etc. complete. 300mm x 450mm depth	1	m		400		400	1083.72	433488
PATHWAY										
14	EW0021	Earth work in surface excavation, depth <300mm, width >1.5m, area >10 Sq.m in plan, including disposal of excavated earth within 50m lead & 1.5m lift and disposed soil to be neatly dressed Hard Soil	1	sq.m	4844.725			4844.725	18.25	88416.23125

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
15	CW0010	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level. 1:4:8 (1 cement : 4 sand : 8 graded gravel/shingles 40mm nominal size)	1	cu.m	4844.725	0.3		1453.4175	2490.43	3619634.545
PATHWAY										
16	SM0081	Providing and laying hammer dressed 150mm thick flat stone pavement with hammer dressed stone edging 150mm wide & 250mm deep on both sides, including grouting joints With cement mortar 1:3	1	sq.m	4434.63			4434.63	272.23	1207239.325
PATHWAY NEAR KATSO CHHU										
17	FL0001	Providing & laying 2nd class Brick-on-edge flooring <i>In cement mortar 1:4</i>	1	sq.m	410.095			410.095	785.2	322006.594

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
18	WW0495	Providing & fixing railing with 90x60mm top & bottom rails, trellis 60x45mm including 2 coats of paint etc. all complete 900 mm high, Champ wood	1	m	54			54	464.3	25072.2
MANHOLE										
3 FT (0.92m) DEEP MANHOLE										
19	EW0031	Earth work in excavation over areas, depth >300mm, width >1.5m, area >10 Sq.m on plan, including disposal of excavated earth within 50m lead and 1.5m lift & disposed soil to be neatly dressed Hard Soil	1	cu.m	0.9	0.6	0.92	0.4968	116.01	57.633768

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
20	DR0106	Constructing Brick masonry manhole in cement mortar 1:5, R.C.C top slab with 1:2:4 20mm aggregates, foundation concrete 1:4:8 40mm aggregates, 12mm plaster in CM 1:3 finished with floating coat of neat cement and making channels in cement concrete 1:2:4 20mm aggregates, neatly finished complete. Inside dimension 900 x 800mm & 600mm deep including C.I. cover & frame (weight >38 kg)	1	each			1		8852.2	8852.2
21	DR0115	Extra for additional depth of manholes 900 x 800mm	1	m		0.315	0.32	5553.11	1776.9952	

4 FT (1.22m) DEEP MANHOLE

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
22	EW0031	Earth work in excavation over areas, depth >300mm, width >1.5m, area >10 Sq.m on plan, including disposal of excavated earth within 50m lead and 1.5m lift & disposed soil to be neatly dressed Hard Soil	1	cu.m	0.9	0.6	1.22	0.6588	116.01	76.427388
23	DR0106	Constructing Brick masonry manhole in cement mortar 1:5, R.C.C top slab with 1:2:4 20mm aggregates, foundation concrete 1:4:8 40mm aggregates, 12mm plaster in CM 1:3 finished with floating coat of neat cement and making channels in cement concrete 1:2:4 20mm aggregates, neatly finished complete. Inside dimension 900 x 800mm & 600mm deep including C.I. cover & frame (weight >38 kg)	1	each			1		8852.2	8852.2
24	DR0115	Extra for additional depth of manholes 900 x 800mm	1	m			0.62	0.62	5553.11	3442.9282

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
5 FT (1.52m) DEEP MANHOLE										
25	EW0031	Earth work in excavation over areas, depth >300mm, width >1.5m, area >10 Sq.m on plan, including disposal of excavated earth within 50m lead and 1.5m lift & disposed soil to be neatly dressed Hard Soil	1	cu.m	0.9	0.6	1.52	0.8208	116.01	95.221008
26	DR0106	Constructing Brick masonry manhole in cement mortar 1:5, R.C.C top slab with 1:2:4 20mm aggregates, foundation concrete 1:4:8 40mm aggregates, 12mm plaster in CM 1:3 finished with floating coat of neat cement and making channels in cement concrete 1:2:4 20mm aggregates, neatly finished complete. Inside dimension 900 x 800mm & 600mm deep including C.I. cover & frame (weight >38 kg)	1	each			1		8852.2	8852.2

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
27	DR0115	Extra for additional depth of manholes 900 x 800mm	1	m			0.92	0.92	5553.11	5108.8612
UTILITY DUCT										
28	EW0031	Earth work in excavation over areas, depth >300mm, width >1.5m, area >10 Sq.m on plan, including disposal of excavated earth within 50m lead and 1.5m lift & disposed soil to be neatly dressed Hard Soil	1	cu.m	18390.2	0.475		8735.34975	116.01	1013387.924
29	CW0008	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level. 1:4:8 (1 cement : 4 sand : 8 graded crushed stone 40mm nominal size)	1	cu.m	18390.2	0.45	0.1	827.55945	3064.58	2536122.139

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
30	RC0001	Providing & laying in position reinforced cement concrete excluding the cost of centering, shuttering and reinforcement - all work upto plinth level M25, 1:1:2 (1 cement : 1 sand : 2 graded crushed rock 20 mm nominal size)	1	cu.m	18390.2	0.207		3806.77347	6206.7	23627500.9
31	RC0083	Providing & fixing Thermo-Mechanically Treated reinforcement bar (Yield Strength 500 MPa) for R.C.C work including cutting, bending, binding and placing in position complete.	1	kg	Total steel required is 117.75kg (1.5%) per cu.m of concrete			448247.5761	67.63	30314983.57
32	RC0090	Providing & fixing centering and shuttering (formwork) , including strutting, propping etc. and removal of formwork Foundation and plinth etc.	1	sq.m	18390.2	3.75		68963.2875	252.04	17381506.98

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
33	RC0001	<p>Slabs to be put over the ducts</p> <p>Providing & laying in position reinforced cement concrete excluding the cost of centering, shuttering and reinforcement - all work upto plinth level M25, 1:1:2 (1 cement : 1 sand : 2 graded crushed rock 20 mm nominal size)</p>	36780	cu.m	1	0.32	0.05	11769.6	6206.7	73050376.32
34	RC0083	<p>Providing & fixing Thermo-Mechanically Treated reinforcement bar (Yield Strength 500 MPa) for R.C.C work including cutting, bending, binding and placing in position complete.</p>	1	kg	Total steel required is 117.75kg (1.5%) per cu.m of concrete			1385870.4	67.63	93726415.15

CULVERT

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
35	EW0031	Earth work in excavation over areas, depth >300mm, width >1.5m, area >10 Sq.m on plan, including disposal of excavated earth within 50m lead and 1.5m lift & disposed soil to be neatly dressed Hard Soil	1	cu.m	9	0.976		8.784	116.01	1019.03184
36	EW0197	Providing & laying dry earth bedding, including consolidating each deposited layer by watering, ramming and dressing.	1	cu.m	9	0.06		0.54	163.97	88.5438
37	CW0006	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level. 1:3:6 (1 cement : 3 sand : 6 graded crushed rock 40mm nominal size)	1	cu.m	9	0.072		0.648	3453.39	2237.79672

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
38	RC0001	Providing & laying in position reinforced cement concrete excluding the cost of centering, shuttering and reinforcement - all work upto plinth level M25, 1:1:2 (1 cement : 1 sand : 2 graded crushed rock 20mm nominal size)	1	cu.m	9	1.67		15.03	6206.7	93286.701
39	RC0083	Providing & fixing Thermo-Mechanically Treated reinforcement bar (Yield Strength 500 MPa) for R.C.C work including cutting, bending, binding and placing in position complete.	1	kg	Total steel required is 117.75kg (1.5%) per cu.m of concrete			1769.7825	67.63	119690.3905
40	RC0090	Providing & fixing centering and shuttering (formwork) , including strutting, propping etc. and removal of formwork Foundation and plinth etc.	1	sq.m	9	12.2		109.8	252.04	27673.992

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
41	RW0135	Providing and Laying Dense Bituminous Macadam (DBM) to required degree of compaction based on mixture design (job mix formula) approved by the supervising engineer including preparation of surface with road broom, application of prime coat @ 0.75 kg/sq.m by mechanized method using asphalt plant, paver, steel roller, tyre roller etc. complete. 80 mm	1	sq.m	9	4		36	861.67	31020.12
42	RW0138	Providing and Laying Asphalt/Bituminous Concrete to required degree of compaction based on the job mixture design approved by the supervising engineer using asphalt plant, paver, steel roller, tyre roller etc. as per material gradation and aggregate quality specified 35 mm	1	sq.m	9	4		36	449.75	16191

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
GREEN SPACE										
43		The cost of Landscape is taken lumpsum	1	sq.m		14333.26		14333.26	350	5016641
GREEN BUFFER										
44		The cost of Green Buffer is taken lumpsum	1	sq.m		41492.22		41492.22	150	6223833
DRAINAGE										

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
45	DR0013	Constructing second class brick masonry open surface drain in cement mortar 1:4 including earth work in excavation 100 mm thick concrete bed 1:5:10, 40mm aggregate and 25mm thick cement concrete 1:2:4,12 mm aggregate for filling haunches including 12mm cement plastering 1:4 with a floating coat of neat cement and disposal of surplus earth etc. complete. 300mm x 450mm depth	1	m		1246.81		1246.81	1083.72	1351192.933
CONSTRUCTED WETLAND NEAR STP										
46		Lumpsum cost taken is Nu50,000								50000
CONSTRUCTED WETLAND NEAR KATSO CHHU										
47		Lumpsum cost taken is Nu100,000								100000
FOOT BRIDGE OVER DRAIN										
48		Lumpsum cost of footbridge over non-perennial stream as a footpath Nu100,000								100000
Total										539980681

Item no.	Code	Description of Work	No.	Unit	L (m)	B (m)	H (m)	Total Quantity	Unit Rate	Total Cost
10% Contingencies to be added										53998068
TOTAL COST										593978749

15 PLAN IMPLEMENTATION

15.1 Shelter Strategy

The sample survey conducted over Haa town displays that more than half the population is immigrant and stays to in rented accommodation.

The land is under local ownership, thus the basic strategy for shelter has to have rental housing in prime focus. At present, most of the land which has not been built up or in under Kamzhing which may be giving some return to the owner. If rental housing is developed, that can also start giving returns to the owner. To achieve success in this strategy housing finance availability shall be the key.

Housing finance will be essential for the plot owner for construction and development, a formalized system of financial by the bank or its subsidiary can be effectively considered.

Subsequently the housing finance system could also start financing the purchase of unit/flat in a building.

15.2 Development Control Regulations

These Regulations shall come into force with effect from the date of their notification by the Royal Government of Bhutan. These Regulations shall apply to the Haa LAP planning area, that is, the area defined under the Local Area Plan - 2016 – 2014¹. The successful implementation of structure plan shall be taken under **Haa Dzongkhag Administration.**

15.2.1 Applicability

- These Regulations shall be applicable from the date of their notification by the Royal Government of Bhutan.
- Except, as herein after otherwise provided, these Regulations shall apply to all development, redevelopment, erection or re-erection of a building, change of use, etc., as well as to the design, construction, reconstruction of, and making material additions and alterations to a building. However, where a part of a building layout or group-housing scheme is demolished, or altered, or reconstructed, these Regulations shall apply only to the extent of the new work involved.
- Any action taken, or developments permitted, under the Regulations or Building Rules, existing prior to these

Regulations coming into force, shall be deemed to be valid and continue to be so valid, unless otherwise specified.

- In the case of development, for which the Commencement Certificate has been obtained prior to these Regulations coming into force, and where amendments to the sanctioned plan is proposed, these Regulations shall apply.
- ‘Commencement Certificate’ granted in the past shall be revalidated in conformity to these Regulations.
- If there is a conflict between the requirements of these Regulations and those of any other rules or byelaws, these Regulations shall prevail.

Interpretation

Unless the context otherwise requires, the terms and expressions not defined herein shall have the same meaning as indicated in the following legislations:

1. The local Government Act of Bhutan 2009
2. The Land Act 2007
3. Urban Area and Property Regulations 2003
4. National Housing Policy 2002
5. Building Code of Bhutan 2003

6. Bhutan Building Rules 2002

Delegation of Power

The Implementing Authority may delegate any of the powers, duties or functions conferred or imposed upon or vested in the Implementing Authority to its officers, or designated committee of officers, generally or specially in writing and may impose certain conditions and limitations on the exercise of such powers as it may deem fit.

Discretionary Powers

The Implementing Authority may exercise its discretion in conformity with the intent and spirit of these Regulations, in order to mitigate any demonstrable hardship or to sub serve public interest in the following ways:

- a) Decide on matters where it is alleged that there is an error in any order, requirement, decision and determination, interpretation made by it under delegation of powers, while applying these Regulations.
- b) Interpret these regulations in various contexts or in situations where more clarity is required under such circumstances the Implementing Authority's decision shall be final and binding.

- c) Decide upon the nature and the extent of concessions in respect of marginal distances, room heights, etc. that can be granted in cases of proven hardship for reasons which are to be recorded in writing. However, such relaxation shall not affect the health, safety and hygiene of the inhabitants of the building and the neighbourhood and the structural stability of the building. Provided further that while granting such relaxation, as above, the authority may impose conditions as may be necessary. These may include a payment of deposit and its forfeiture for non-compliance, payment of a premium amount and other obligations, etc.
- d) No concessions in respect of the F.A.R., or additional floors, shall be given.
- e) Decide on the fine or compounding charges to be made applicable in cases of developments where non-adherence to these Regulations is detected.
- f) Modify the limit of a precinct where the boundary of a precinct divides a parcel of land or where a layout street or a survey number actually on the ground varies from its location shown on the Structure Plan.

- g) Authorize the erection of a building or the use of premises for a public services undertaking or a public utility purpose where such an authorization is reasonably necessary for the convenience and the welfare of the public, even if such erection or use is not permitted as per these Regulations.
- h) Determine and establish the location of precinct boundaries in cases of doubts or controversies.

As regards the delegation of powers to exercise the discretion, all matters stated above shall be decided by a committee designated and authorized by the Implementing Authority. When issues arise that are not covered within these Regulations, the Implementing Authority shall refer the matter to the Competent Authority.

Power to Change the Appendices and Proformas

The Implementing Authority shall have the powers to make amendments to the contents of appendices 2 and 4, the proforma and the procedures for grant of development permission from time to time.

15.2.2 Definitions

These Regulations, unless the context otherwise requires, the terms and expressions defined as follows shall have the meaning

indicated against each of them. The terms and expressions not defined in these Regulations shall have the same meanings as in the Bhutan Municipal Acts, 1979 and the rules framed there under or as mentioned in the Bhutan Building Rules, 2002 and the Building Code of Bhutan, 2003 as the case may be unless the context otherwise requires.

"Temporary structure" means a structure that does not have a permanent foundation, which involves no grading or site improvements, and that, when removed, results in no physical alteration of the site like wooden structures for shop, tin shed for wood work, animal shelter etc.

"Permanent Structure" means a building fabrication or construction, attached or affixed to land, consisting of foundations, walls, columns, girders, beams, floors, and a roof, or some combination of these elemental parts, which is intended as a habitation or shelter for people or animals or a shelter for tangible personal.

15.2.3 Land Use Development Control

For regularised and systematic development of planning area land use map has been given. Following table describes landuse classification and activities permissible in planning area for construction of permanent structures.

Land use	Uses Permitted
Residential1	Individual house, Apartment, row houses, semi attached houses, hostel, quarters, retiring homes, service apartment, old age homes.
Residential 2	<p>Residential, local level retail shops and services, household economic activity, Biogas Improvement Schemes, Commercial uses like local level retail shops with floor area less than 40m.sqm or internet browsing centre, fast food outlets, canteens, snack bars not exceeding floor area of 30m.sq; area will be permitted only on the ground floor per plot. Educational institutional buildings, day-care centres, dispensaries, clinics, public facilities and utilities, local community halls are allowed.</p> <p>Institutional uses in a minimum of 1000 sq. m. plot may be permitted.</p> <p>Resorts, Hotels with boarding and lodging facilities in a minimum of 2500sq.m plot may be permitted</p>
Public utilities and facilities	Water treatment plant, Electric Substation, trenching grounds, trunk line corridor, Sewer, HT line, LT line, Gas or oil pipe line and related structures; telephone exchange, solid waste disposal plant, constructed wetlands, police station.
Recreational/ Open Spaces	Parks, plazas, gardens, Temporary structures for public events, rain shelter, Community Level/Local Recreational and Sports Facilities etc.
Road	Roads, streets, pathways, Bus stand, bus stop, helipads, taxi stand, cycle stand, Parking, Traffic node, rain shelter
Commercial	<p>Residential, local level retail shops and services, household economic activity and cottage industries not involving use of, or installation of, a machinery driven by more than 1 KW power and which do not create noise, vibrations, fumes, dust, etc. only in independent dwelling units (not in tenement dwellings or flats).</p> <p>Convenient Shopping / Basic Amenities Retail commercial use such as Retail shops, Restaurants, Hostels, Hotels, Convenience Shopping, professional offices and establishments (of less than 15 employees), ATMs, Crèche / Children's day care centre, pre-primary educational facilities, dispensaries, clinics, Public facilities, Public Utilities, Public Transportation Stops, Gardens, etc, bakeries, local libraries, club houses, community halls, service stations with or without petrol pumps, Kiosks, taxi stands, vegetable vendors, display areas, Neighbourhood Pub, bars, Discotheques, Pool rooms, Outdoor cafes and Indoor games parlour.</p>

	LPG delivery centres and Fuel station can be permitted under the fulfilment of all relevant safety norms.
Institutional/ public	School, Government offices, Health Care center, Hospital, Community center, Training center, Educational institution, government offices, public institutions, Government operated Services.
Public Plaza	hard and soft surface development, Seating, Service shop, retail commercial, Tourist kiosk, tourist shop, entertainment activities, temporary structures for public event.
Religious	Surface development, Temporary shelter, Chorten, lakhang, any Religious structure.

Note:

“Uses Permitted”: This shall include all the uses which do not require any permission* from the Development Authority and are predefined in the land use.

“Uses Permissible”: This shall include all the uses which would require permissions and NOC from Development Authority.

(*For all kinds of development and construction it is mandatory to follow DCR- Haa Local Area Plan 2016-2041)

Environmental assets:

- Activities related to environmental enhancement / protection and permitted / undertaken by or on behalf of the National Environment Commission Existing structures with an approval may be retained, but new development and

extension to the old structure (except the above mentioned) is not permissible.

- Footpaths and cycle tracks, footbridges, landscape elements like lamp posts, benches, gazebos, children's play equipment and litter bins, shall be permitted only beyond fifteen meters of the edge of the Haa Chhu and major streams.
- Footpaths shall be permitted along the fifteen meters boundary of the rivulets and other streams protection zone. NOC to be obtained from the NEC. No access road or any service installations to private plots to be permitted through this zone.

- Vegetable and flower gardens, nurseries or other green areas shall be permitted within the buffer area along the Haa Chhu.
- Forest should be protected. Activities related to and permitted / undertaken by or on behalf of the Department of forest. As per Forest Conservation Act 1995. Chhuzhing2 Should be protected under land act 2007
- No private development or construction shall be permitted within thirty meters of the edge of the watercourse or the edge of the gullies of Haa Chhu and major stream or such distance as may be prescribed under any other general or specific orders of Royal government or any other authority.

No development or building construction shall be permitted within fifteen meters of the edge of all natural rivulets and natural drainage channels or such distance as may be prescribed under any other general or Edge/Bank protection works for river and major streams shall be permitted under the clearance from the National Environment Commission and the Nature Conservation Division.

15.2.4 Land Development and Subdivision Regulations (General Planning Requirements)

15.2.4.1 Development of Land

For undertaking land development that includes layout /subdivision / consolidation of land/plots, and/or building activity, the application shall comply with the following planning requirements of these Regulations. A preliminary approval will be given if the application complies with these requirements, on the basis of which the applicant may start the site development. Final Approval shall be given only on the fulfilment of the requirements under these Regulations on the site.

15.2.4.2 Requirements of Site

Means of access

Subdivision of a land into smaller parcels for developing a layout or for construction of building/s shall not be permitted unless it derives access from an authorized and developed street/means of access prescribed in these Regulations. This implies that land locked / trapped sites shall not be sub-divided. (All roads should be designed according to Road Standards 2002)

Approach To Buildings

For residential development with buildings up to two floors: The width of the approach from the public street or means of access to a building shall not be less than:

- a) 1.8 m. wide provided its length is not more than 3 m. and /or the floor area of the building served does not exceed 100 sq.m. and /or the building consists of only one housing unit.
- b) 2.5 m. wide if its length is more than 3.0 m. and /or the floor area of the building served does not exceed 100 sq.m. and /or the building consists of only one housing unit.
- c) 3.5 m. wide in all other cases.

Such approach way shall be paved and shall always be kept open to sky and no projection or overhang shall be permitted over such pathways Subdivision of property where buildings with more than two floors exist, or are proposed, (residential or non-residential buildings), shall be permissible only if the following additional provisions of means of access are ensured:

1. The width of the main street on which the building abuts shall not be less than 4.5 m. and one end of this street shall join another street not less than 6 m in width
2. Provision shall be made for one entrance to the plot, of adequate width to allow easy access to the fire engine.

- 3. The entrance gate shall fold back in the plot against the compound wall of the premises, thus leaving the exterior access to the plot free for movement of fire service vehicle.

15.2.4.3 No Objection Certificate from Referral Authorities

- In the Case of any Use or Activity other than proposed land use the application has to be accompanied by a No Objection Certificate from the Haa Dzongkhag Administration or concern Authorities.
- In the Case of construction of permanent structure in Environmental Conservation zone, Forest and Agri-based Environments The application has to be accompanied by a No Objection Certificate from the National Environment Commission

15.2.4.4 Distances from Rivers and Streams

Rivers And Major Streams

No development or building construction shall be permitted within 30 m. of the edge of the water course/edge of the gullies/ banks of the Haa Chhu

Rivulets / Minor Streams

No development or building construction shall be permitted within 15 m. of the edge of all natural rivulets and natural drainage

channels or such distance as may be prescribed under other general or specific orders of royal government or other Authority.

1. Katsho Chhu,
2. And other natural streams as may be prescribed under other general or specific orders of the Royal Government or other authority.

15.2.4.5 Development permissible on environmental clearance from the Relevant Authority

1. Beyond 15 m. from the edge of the above rivers and beyond 10 m. from the edge of the rivulets / minor streams any development like Foot paths and cycle tracks, foot bridges, edge/bank protection works for river, can be made under Haa Dzongkhag Administration,
2. Vegetable and flower gardens, nurseries or any other green area abutting the Haa Chhu can be developed under Haa Dzongkhag Administration.
3. Actions related to conservation of the precinct and enhancement of the environment under the guidance of Nature Conservation Division and the Haa Dzongkhag Administration.

Addendum:

- a) Natural landscape features of the rivers, major streams and rivulets, which includes the natural course of the water, banks/ edges, soil, vegetation (trees, shrubs and ground covers), rocky outcrops, boulders and other features or elements which are considered as part of the ecosystem or which are considered to be of scenic value shall not be damaged or disturbed from their natural state of being.
- b) Construction of roads, laying of underground cables and other service networks, structures like high-tension cable pylons, transmission towers and installations of electric substations shall not be permitted within the 30 m. zone of the rivers and major streams, and within the 15m. Zone of the rivulets.
- c) In case of change in proposed Local Area Plan 2016 - 2041 Dumping of solid wastes, cleaning and servicing of vehicles/automobiles or other action considered as polluting shall not be permitted.

General Requirement

The proposed development shall not have a detrimental impact on the ecology or be against the aesthetic sensibility within the environmental setting or be against public interest.

15.2.5 Sub-Division / Layout of Land / Group Housing / Row Housing

15.2.5.1 Land Utilization

In case of land development for the purpose of plotted development, or for group housing in the form of flatted development, the following land utilization indices shall be achieved.

Table: Land Utilization as Percentage of the Residential Layout Area

Land utilization	For layout of above 1 ha area (% of land)	For layouts of less than 1 Ha area (% of land)
Residential*	60 to 65	65 to 70
Roads and Footpaths	Up to 25	20 to 25
Parking	As per parking norms	As per parking norms
Open Space/ Garden / Children's Play area (minimum 50% area with	10	10

slope less than 10 %)		
Public utilities (OHT, septic tank, Garbage collection arrangements, Electric sub-station, water supply reservoir / pumping station, etc)	1	-
Total	100	100

*Within this, plots for commercial use (permissible on ground floor only) shall be limited to 5 % of the total layout area. Such plots where commercial use is limited to the ground floor shall be allowed only along main roads within the layout and the building shall have a minimum setback of three metres.

the area under open spaces should be planned in such a way that at least half of such an area is provided in single combined plot so that it can be utilized for public use.

15.2.5.2 Internal Road Layout

The width of internal road right of ways in a layout for different purposes and the width of the internal approaches for tenements and ownership tenement flats shall be regulated as outlined in the LAP or as per Urban Roads Standards -2002.

1. The arrangement of tenements, service center, retail shops, ownership tenements / flats in a plot, shall be approved by the Implementing Authority with due regard to internal approach roads, marginal open spaces/setbacks, common plot, water supply, drainage, and internal road lighting.
2. In the case of service center, retail shops and commercial development the minimum width of road/access to shops, stall/ complex entrance, or shed shall be 7.5 m.
3. In the case of tenement type buildings such as ownership flats, row type, cluster type, group housing, semidetached buildings, 1.5 m. margin/setback will be necessary from internal approach roads, wherein no steps shall be permitted in the margin/setback

15.2.5.3 Plot Consolidation

In the case of a site/plot with existing buildings, its sub-division or consolidation shall not be approved unless it fulfils all the requirements under these regulations.

15.2.5.4 Approach Road

Consolidation of plots shall be allowed only if:

- a) The minimum ROW of the roads within the layout shall be a minimum of 6 metres for Development of Plots, Development of Flats / other non-residential developments.
- b) The minimum specified road widths shall be developed completely up to the plot boundaries by providing all the required infrastructure networks: sidewalks, street lighting, trees, etc.

15.2.6 Parking Requirements

Parking facilities should be provided by a developer within the boundaries of a Site, or at an agreed nearby location, for all public commercial, industrial and Residential developments in accordance with the following schedule.

Table: Minimum Dimensions of parking spaces (Sizes according to draft planning standards for urban settlements in Royal Bhutan -1979)

	Description	Number Of Vehicle Parking Space Required
1	Residential (one family houses and apartments)	<ul style="list-style-type: none"> • Residential unit with total area less than 60sqm: 25% cars and 75% 2-wheelers. • Residential unit with total area between

		60-100sqm: 50% cars and 50% 2-wheelers. • Residential unit with total area equal to or more than 100sqm: 1 car every 100sqm.
2	Public halls, community centres, non-residential clubs	1 car for every 30sqm. Of public floor space or part thereof
3	Restaurants, bars, and cafes	1 car for every 15sqm. Of public space or part thereof
4	Shops (up to 40 m ² clear retail floor space)	1car for every 100 m ² of commercial area
5	Departmental Store or Shopping centre (over 450 m ² clear retail floor space)	1 car for each 25 m ² clear retail floor space
6	Offices	1 car for each 30 m ² net usable office floor area or at least 5 per office
7	Theatres and cinema	1 car for every 10 fixed seats of public accommodation or part thereof. 25% 2-wheelers and 75% car space
8	Hotels and Guest Houses	1 for every 30 m ² clear retail floor space

9	Hospitals	1 for each 10 beds
10	Industry and/or Workshops	1 for each 80 m ² usable floor space
11	Warehouses	1 for each 100m ² of usable floor space
12	Vehicles service and Repair Workshop	5 for each service and/or repair bay * % of total units.

Note:

- No on-street parking will be allowed for all streets, except for the designated ones.
- Conversion of garages for other uses will not be allowed unless otherwise approved by the Implementing Authority.

Car parking should be strictly inside plot boundary and space requirement per car for open parking @ 20 m²; for stilt parking @ 25 m²; for basement parking @ 35M²**(area inclusive of circulation space, effective pa)**

Passenger Car	2.3 x 4.5
Mini bus	2.6 x 6.0.m
Lorry	3.6 x 7.5 m

15.2.7 Footpaths

Where there is no motorable road access to individual plots, but only footpaths, the following shall apply as in Traditional Villages or in the Temporary Settlements.

The widths of paved pathways should be as follows:

Width of footpath (m)	Maximum Length (m)	Maximum number of plots to be served
1.5	20	5
2.0	32	8
3.0	52	12

15.2.8 Other Requirements

15.2.8.1 Minimum Plot Size for Different Uses

Unless otherwise stated specifically in these Regulations, the minimum building plot/ unit shall be as follows:

Category of Use/ Occupancy	Minimum Plot size (Sq M)
Educational Building	1000
Community / multi-purpose hall	2000
Petrol pump	500

15.2.8.2 Special Requirements for Open Spaces

Community open space in plotted development for Enclave / temporary settlements shall have at least one approach road.

In the case of layouts above one hectare area and having more than 50 plots, an open space of at least 700 square metres shall be provided at one place, adjoining community facilities such as a nursery school, community welfare centre etc.

15.2.8.3 Tree Plantation

Tree plantation at the rate of one tree for every 100 sq.m.of land, shall have to be undertaken and maintained in all layouts. These trees shall preferably be planted at a spacing of between four to eight metres along the roads and streets, and along the edge of the common open spaces.

15.2.8.4 On-Site Physical Infrastructure

In all layouts larger than two hectares, or containing forty or more plots, an area of at least one percent of the site shall be provided for garbage collection arrangement, electric substation, water supply storage reservoir / pumping station, etc. This space shall be provided such that it is located on a major internal road of the layout and as per the directions of the H.L.B. and the Department of Power.

15.2.8.5 Collection and Discharge of Water

Every site development shall provide channels at the lower elevation/ level of the site which collects rainwater runoff over the site and discharges this runoff into public storm water drains. The lower plot shall provide an easement or allow / provide a right of

way or channel for the discharge of storm water runoff from natural sources or adjacent plots of higher elevation into the public storm water drains.

15.2.9 Special Regulations for Low Income Group Housing Schemes and Temporary Settlement Rehabilitation Schemes

These regulations shall be applicable to the development of residential schemes for the low income groups or in temporary settlements rehabilitation schemes undertaken by public agencies, co – operative societies and government or semi government bodies and it should be provided according to shelter strategy

15.2.10 Building Regulations

The Development Guidelines for the designated plots are as follows:

Parameters	400 m ² & below	400 – 600 m ²	600 – 1000m ²	1000 m ² and above
1. Min. Green / Open Space (Soft surface)	20%	30%	30%	35%
2. Maximum Plot Coverage*	40%	40%	35%	30%
3. Floor Area Ratio (FAR) (R1)	1.0	1.0	1.0	1.0
4. Floor Area Ratio (FAR)(R2/ Commercial)	1.2	1.2	1.2	1.2
5. Permitted Building Height in terms of floors.	Total permitted number of floors is three (Ground floor, plus two upper floors.	Total permitted number of floors is three (Ground floor, plus three upper floors.	Total permitted number of floors is three (Ground floor, plus four upper floors.	Total permitted number of floors is three (Ground floor, plus five upper floors.)
6. Number of Floors Permissible	3	3	4	4

7. Parking	As per parking requirement Table	As per parking requirement Table	As per parking requirement Table	As per parking requirement Table
8. Set Back (In meters)				
Front set back	3			
Side Set Backs	3			
Rear	3			
9. Attic	Not Permissible		Permissible	Permissible
10. Elevation	All building elevations shall be designed according to Traditional Architecture guidelines by Department of Urban Development and Housing			
11. Massing	The building should not be bulky and it has to have proper massing or “Plural building typology” has to be adopted for plots larger than 1000m ²			

*Note: In Any case Cut-fill ratio for Plot coverage area and Total plot area shall not be more than 50:50. In such cases it is advised to build separate building blocks.

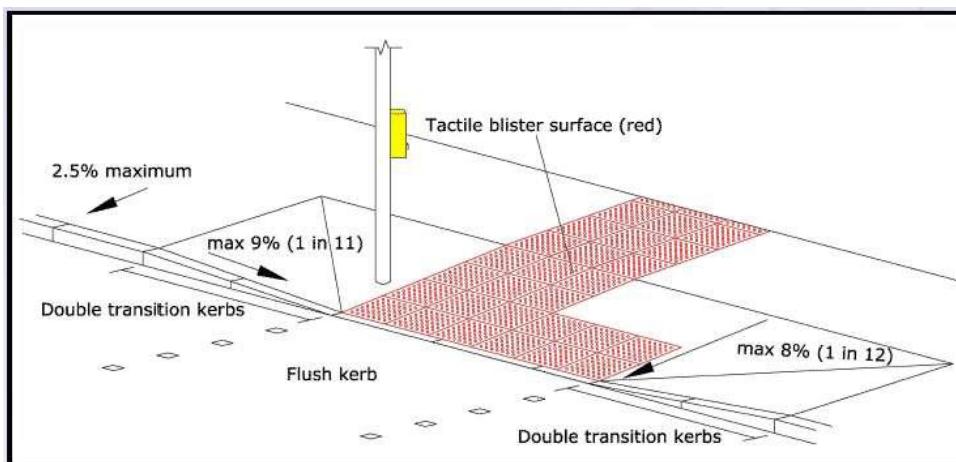
15.3 Urban Design Guidelines

Walkways, street, street furniture

1) Pathway

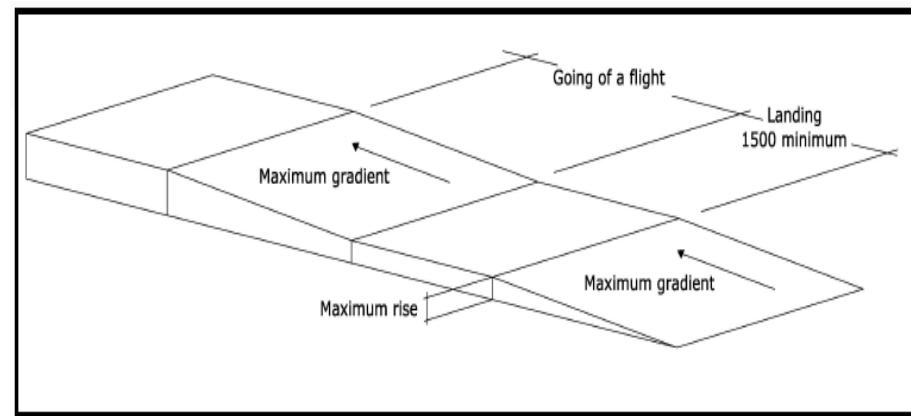
Not all the roads in the town are complemented with footpaths, except a few roads in the market area. The existing pathways in the areas which have access roads shall be improved. However, the pathways in the areas which do not have any access road shall be upgraded to a new road. The length of the pathway which shall be improved is

The height of footpath shall be 0.15 m. Standard paving materials should be used for footpaths. Pavements must be articulated by means of simple patterns created by using different materials, colors and textures to avoid monotony.



The steeper the gradient the shorter the length of slope that people with mobility impairments can negotiate with ease. Level landings on a route with gradients allow people to rest comfortably and safely.

A gradient of 5 per cent (1 in 20) or greater must be considered as a ramp, which requires level landings at regular intervals (the steeper the ramp the shorter the distance between landings). Handrails must be provided on both sides. Level rest points should be provided on footways with gradients between 2 and 5 per cent.

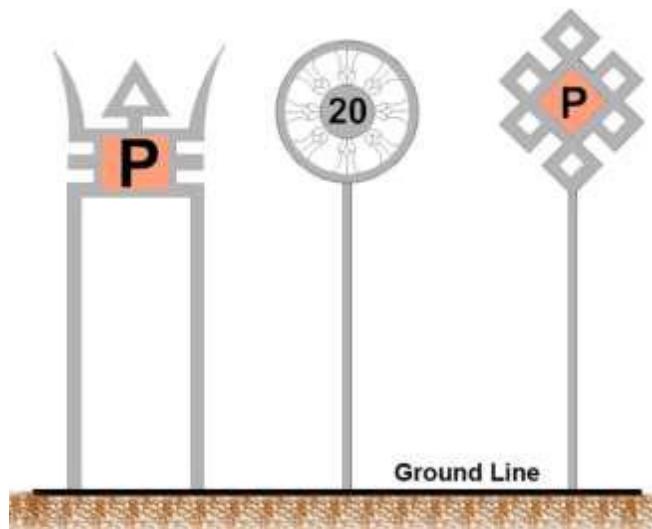


2) Signage

The design of traffic signs and signals must, wherever possible, be physically combined and integrated with other streetscape elements. Good directional and informational signage is

recommended. The signage must have Bhutanese character. The signage should glow during the night time.

The lack of the minimum distance between poles on double pole signs, and the lack of colour contrast to highlight sign poles is an important issue for partially sighted people. Sign poles and cantilevered signs can present a barrier and a hazard to disabled people and the points concerning the position of street furniture and minimum footway widths must be applied.

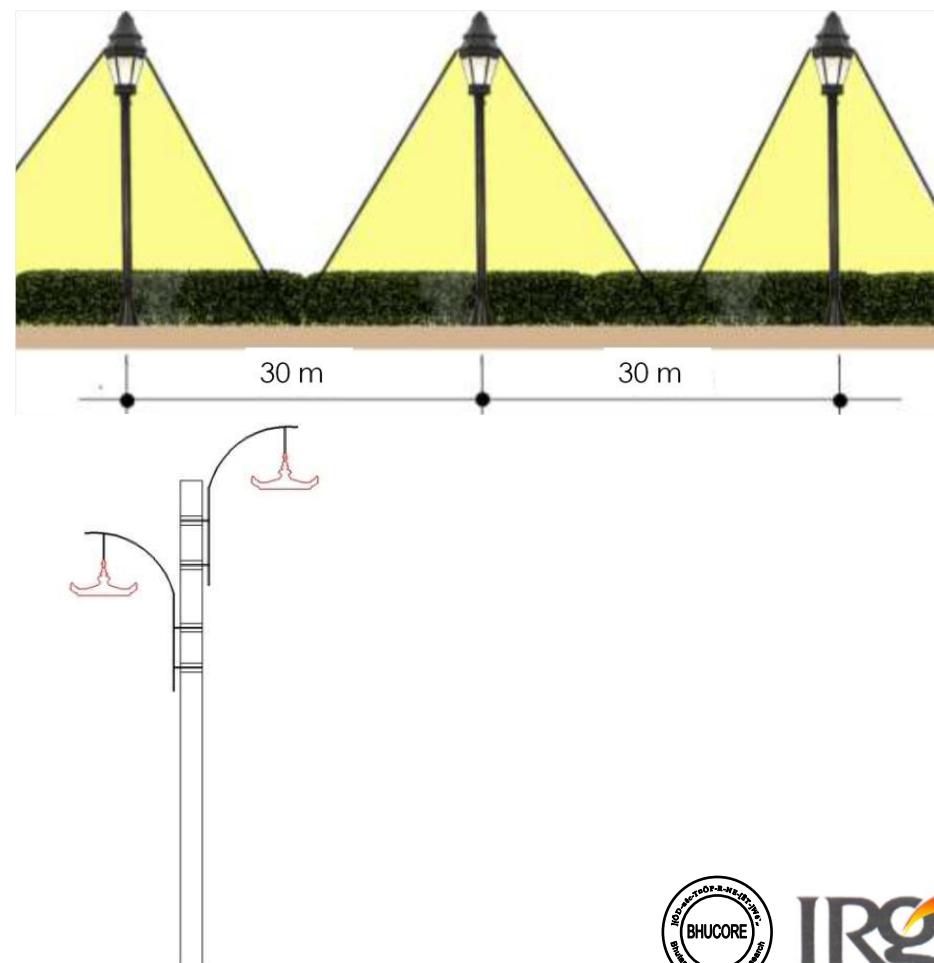


3) Street Lights

The lighting of roads and traffic circles must primarily be lighting that is appropriate for vehicular traffic, but pedestrian areas must also be well lit.

Lighting columns can obstruct the footway and present a hazard to visually impaired people. Therefore, columns must be located at the back of the footway.

In existing locations, columns should be sited consistently either at the back or front of the footway. To reduce clutter at street level in urban areas, new light fittings should, where practical, be fixed to buildings. The locations of the installation of street lights are marked in the map.

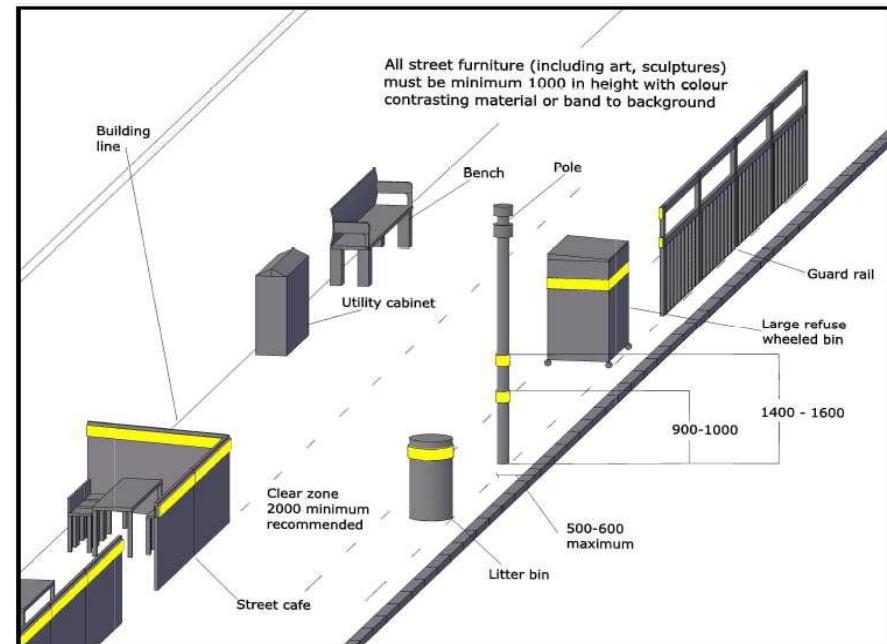


4) Street Furniture

There is a wide range of different types of street furniture, from lighting columns and litterbins to wheeled bins, bollards and sign poles. Most street furniture is necessary but often items of furniture such as lighting columns and sign poles are left behind long after they become redundant. Badly sited furniture is an obstruction to people with mobility impairments and people with visual impairments. Free-standing items, such as bollards, are a particular problem for visually impaired people.

Badly designed street furniture can also pose a hazard to visually impaired people. Furniture lower than 1000 millimeters such as benches without backrests and low bollards are not in most adults normal line of sight. In addition, all street furniture should be detectable at ground level with a long cane. Projecting litterbins fixed to lighting columns and the glazed side walls of cantilevered bus shelters are obvious examples of street furniture which break this rule.

The ends of the railings must be highlighted with two 150 millimeter deep bands which contrast tonally with the color of the railing. By grouping other furniture with a larger profile, such as fixed litterbins, at the ends of guard railing, the collision hazard of the ends of railings can be minimized.

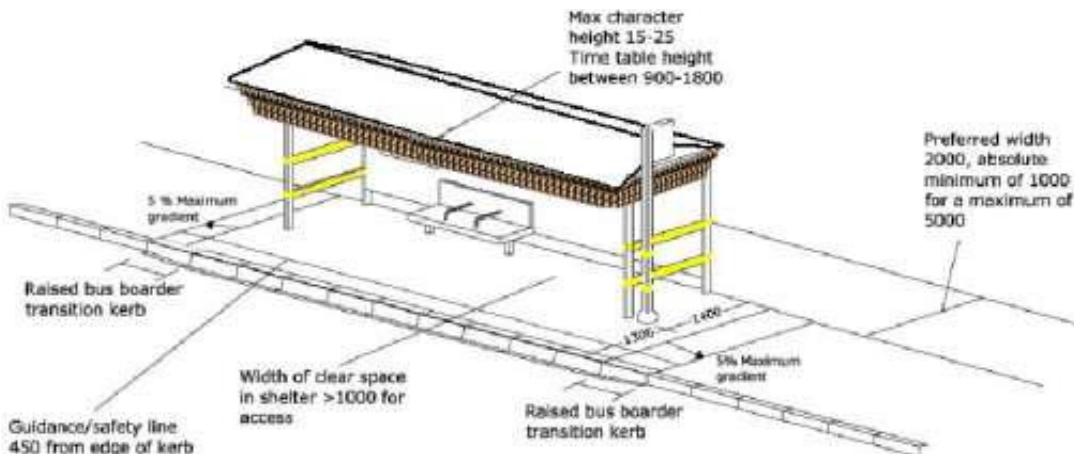


5) Bus and Taxi Stand

The bus/taxi shelter must be designed in order to – offer some seating facility; provide essential public transport information (e.g. the particulars of the route and time table); and provide space for outdoor advertising.

Lighting: The bus/taxi shelter must be well lit at night for the safety and convenience of passengers and to prevent criminals from hiding within them.

Seating: Seating facilities (i.e. benches or leaning rails) must be provided within the shelter.



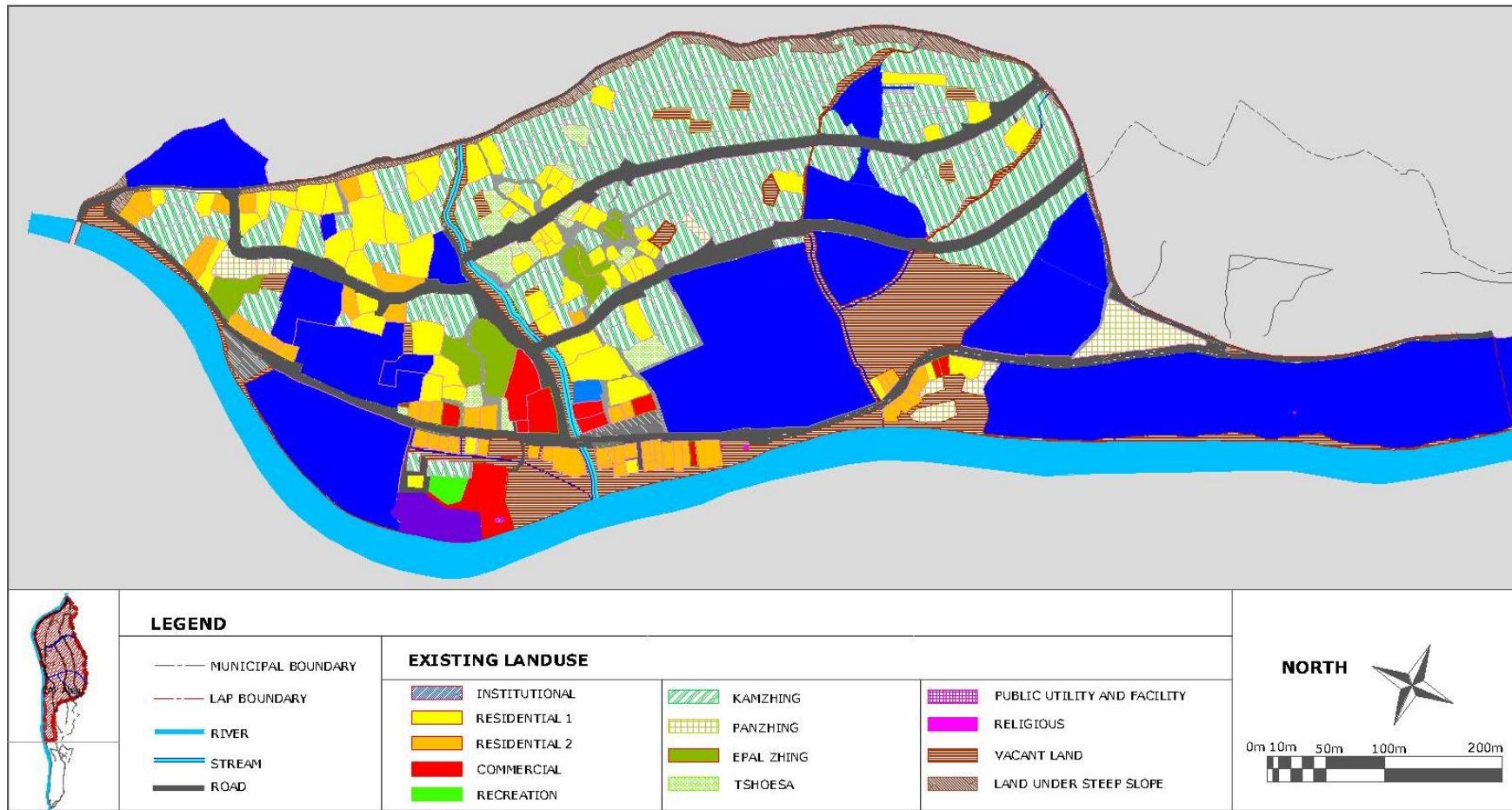
They should be ergonomically designed to allow for comfortable seating, as well as to discourage sleeping and other forms of abuse by vagrants and vandals.

16 ANNEXURE

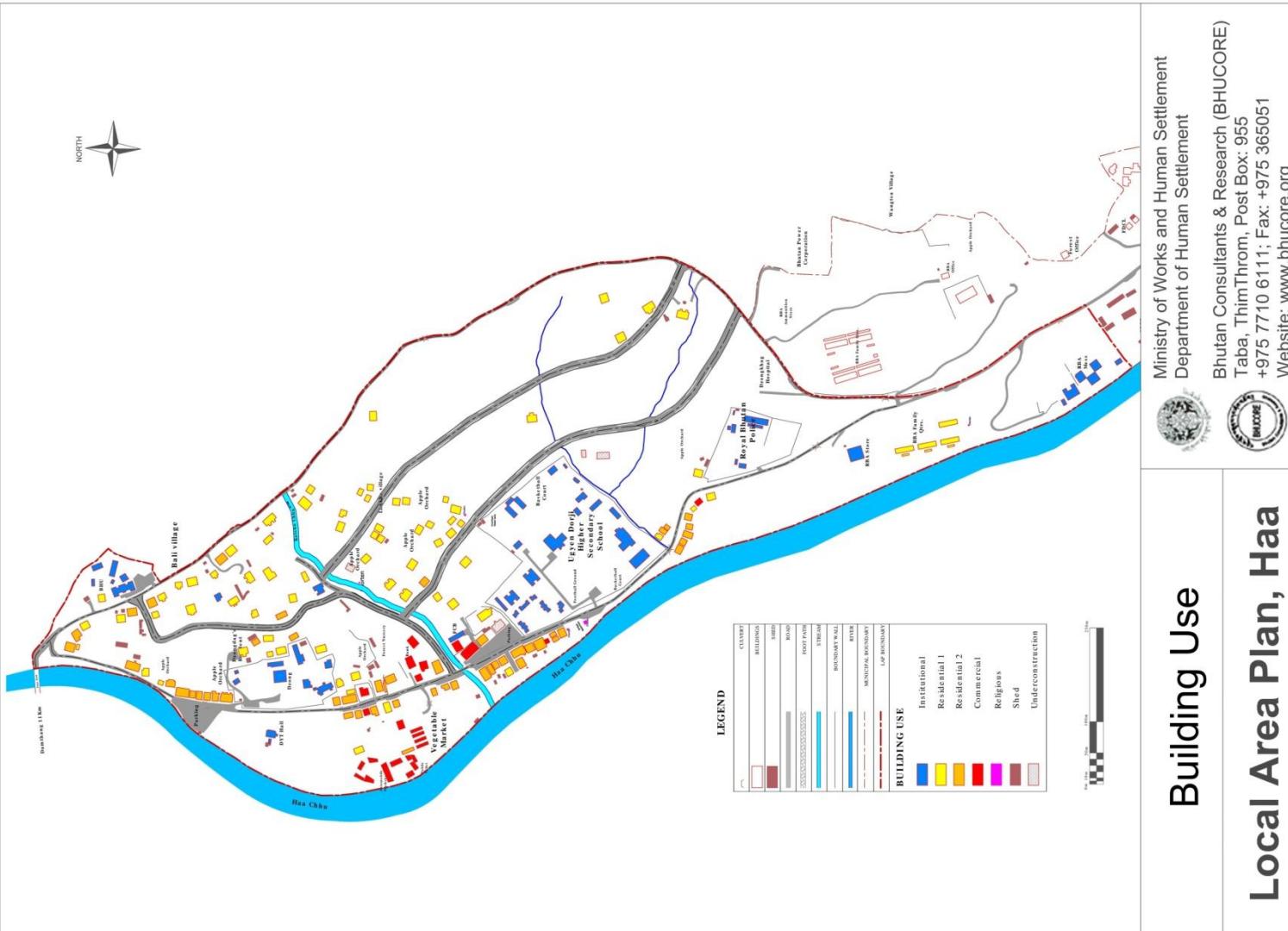
Annexure 1: Town Map



Annexure 2: Existing Landuse Map



Annexure 3: Building Use



Annexure 4: Building Intensity



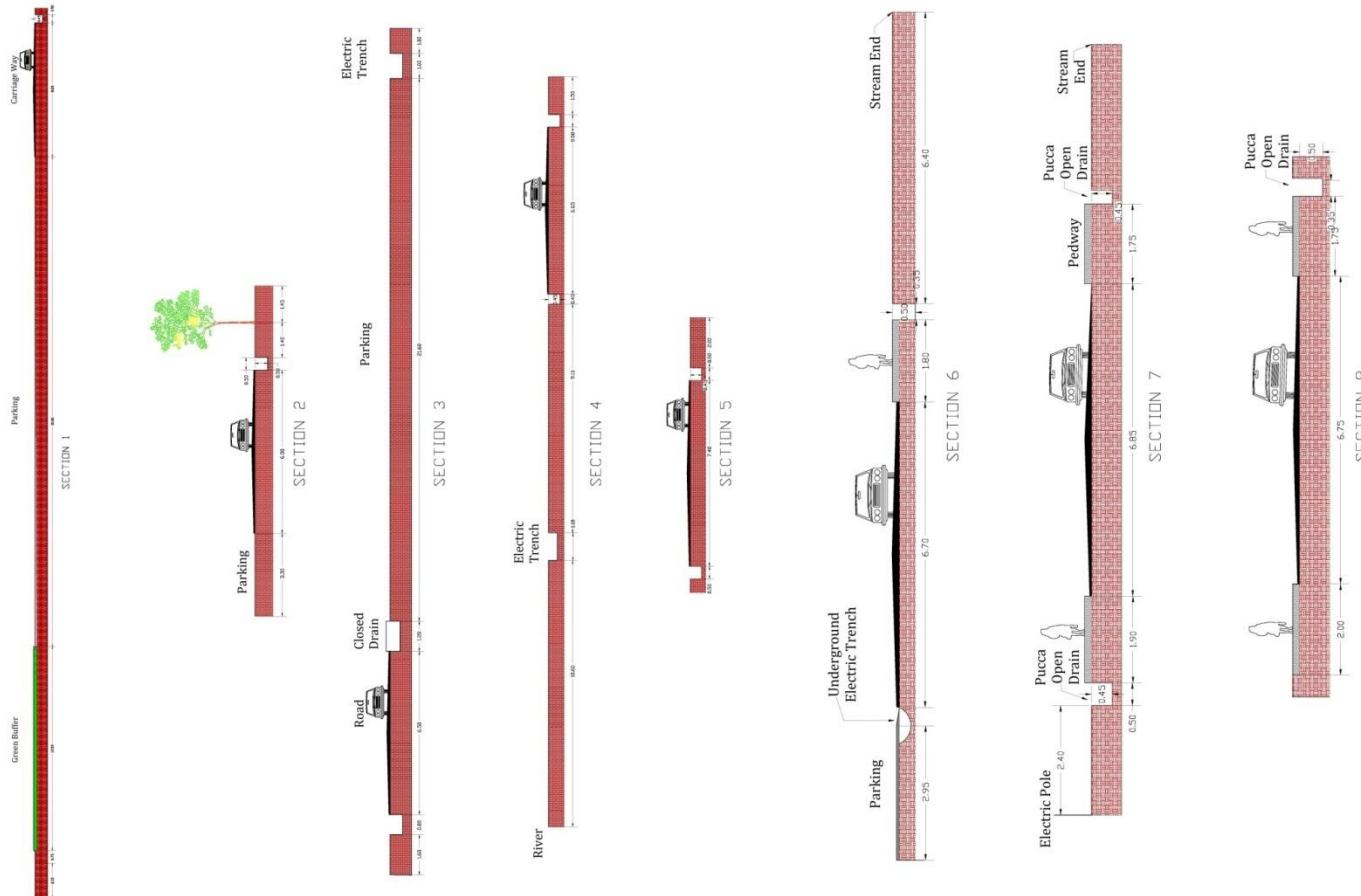
Annexure 5: Existing Residential Density (Comparative)



Annexure 6: Road Network



Annexure 7: Road Sections

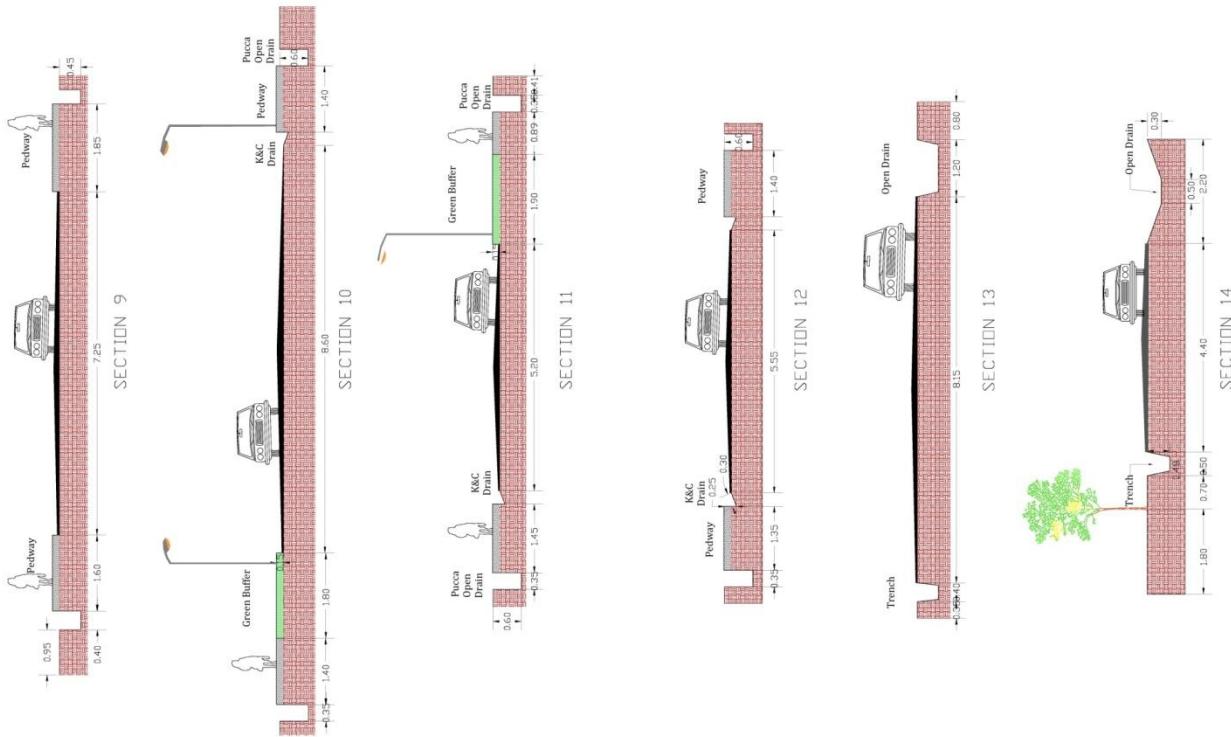


Road Section
Local Area Plan, Haa



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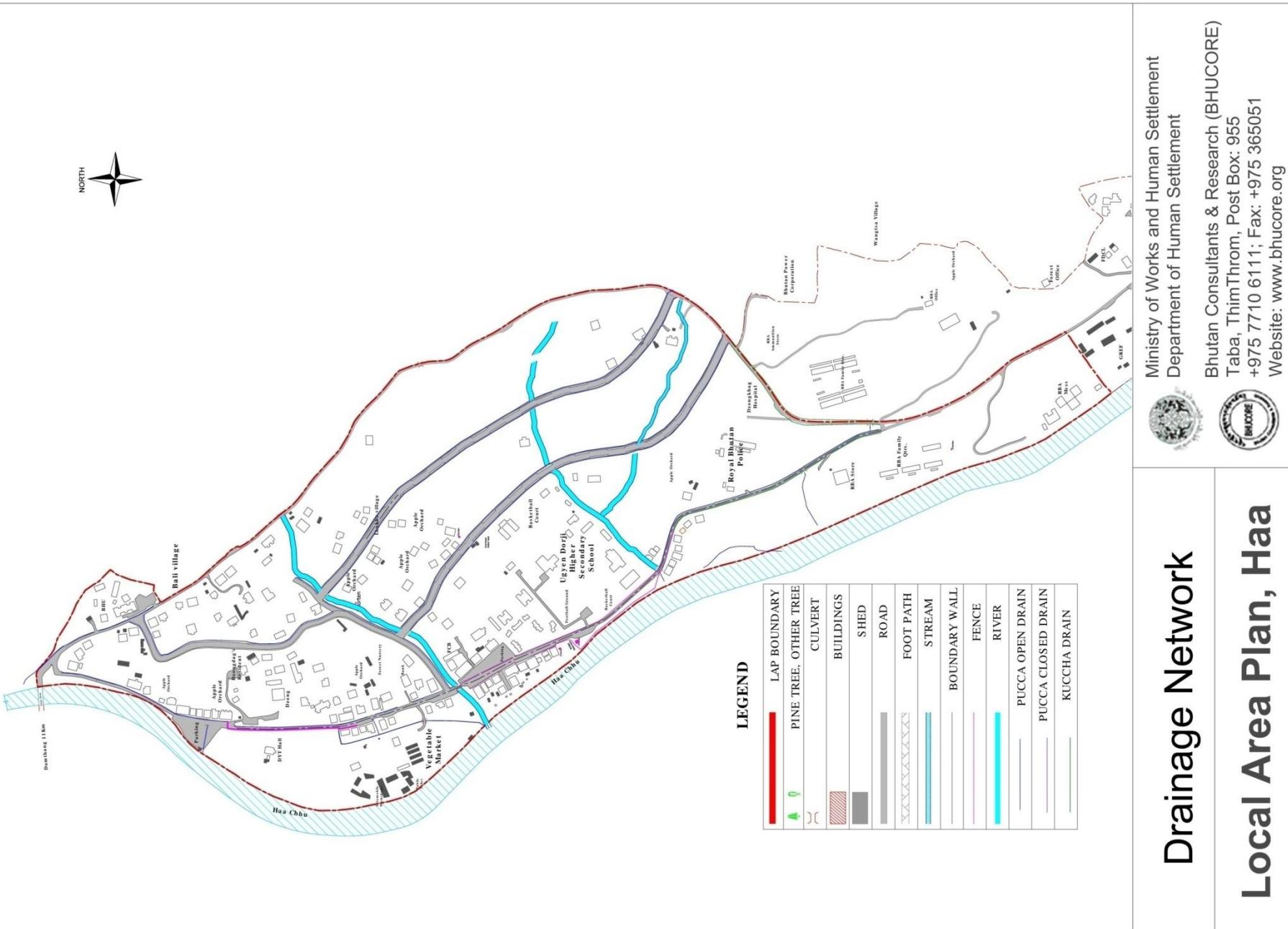
Annexure 8: Water Supply Network



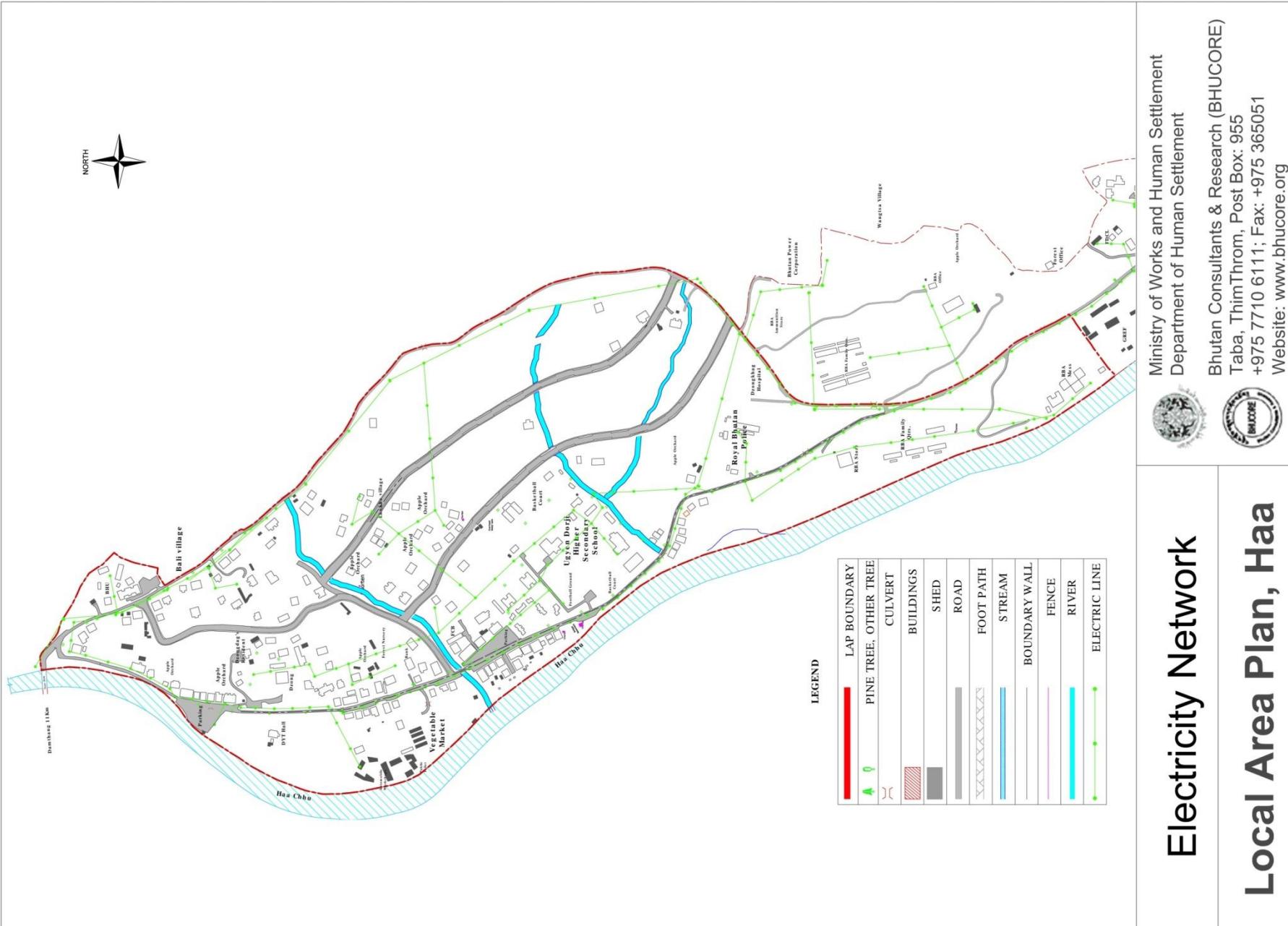
Annexure 9: Sewerage system



Annexure 10: Drainage network



Annexure 11: Electricity network



Annexure 12: Plot Details

CODE	DESCRP	AREA	Own Name	ePlotid	Plot Cat	fDescr	OT Descr
PBDY	1U-238	2077.25	BHUTAN POWER CORPORATION	1U-238	Institutional	Kamzhing	Corporate
PBDY	1U-420	636.06	DZONGKHAG ANIMAL HUSBANDRY	1U-420	Institutional	Zhungdrel Sakhong	Governme Institution
PBDY	1U-417	3569.09	DZONGKHAG NAKTSHEL	1U-417	Institutional	Kamzhing	Governme... Institutions
PBDY	1U-235	335.03	BHUTAN POWER CORPORATION	1U-235	Institutional	Kamzhing	Corporations
PBDY	1U-423	961.03	ZACHAYLAYKHUNG	1U-423	Institutional	Khimsa	Government Institutions
PBDY	1U-344	1516.17	HAA THRIMKHANG	1U-344	Institutional	Khimsa	Government Institutions
PBDY			SONAM LAYKHUNG	1U-422	Institutional	Zhungdrel Sakhong	Governme Institutions
PBDY	1U-422	5359.46		1U-340	Institutional	Zhungdrel Sakhong	Governme Institutions
PBDY	1U-340	20000	DZONGKHAG	1U-340	Institutional	Zhungdrel Sakhong	Governme Institutions
PBDY	1U-294	10000	DZONGKHAG	1U-294	Institutional	Zhungdrel Sakhong	Governme Institutions
PBDY	1U-377	7585.97	KARGOEN LHAKHANG GI YOUESING	1U-377	Institutional	Kamzhing	Religious Institutions
PBDY	1U-114	10000	HAA THRIMSUNGGAPA	1U-377	Institutional	Pang Zhing	Government Institutions
PBDY	1U-425	7129.19	KARGOEN LHAKHANG GI YOUESING	1U-425	Institutional	Kamzhing	Religious Institutions
PBDY	1U-411	1692.95	HAA THROM	1U-411	Institutional	Kamzhing	Government Institutions
PBDY	1U-341	6175.32	MOH, Dzo. Health Sector	1U-341	Institutional	Khimsa	Government Institutions
PBDY	1U-4	708.013	TENZIN WANGDI	1U-4	Commercial	Kamzhing	Family Land
PBDY	1U-170	1019.27	SONAM PELDEN	1U-170	Commercial	Kamzhing	Family Land

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PRDY	1U-293	221 145	SAMRA	293	Commercial	Tshoeca	Familv I and II
CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-368	2502.981	BANK OF BHUTAN	368	Commercial	Zhing	Corporations
PBDY	1U-83	286.258	KINLEY OM	1U-83	Commercial	Khimsa	Family Land
PBDY	1U-166	283.633	TSHERING ZAM	1U-166	Commercial	Khimsa	Family Land
PBDY	1U-290	386.332	LHADEN	1U-290	Commercial	Khimsa	Joint Owners
PBDY	1U-120	283.069	CHIMI DEMA	1U-120	Commercial	Khimsa	Family Land
PBDY	1U-82	334.051	SHARA	1U-82	Commercial	Khimsa	Family Land
PBDY	1U-85	283.389	KIPCHU TSHERING	1U-85	Commercial	Khimsa	Family Land
PBDY	1U-81	285.352	KIBA	1U-81	Commercial	Khimsa	Family Land
PBDY	1U-122	285.036	SONAM CHODEN	1U-122	Commercial	Khimsa	Family Land
PBDY	1U-9	248.415	TSHERING GYEM	1U-9	Commercial	Kamzhing	Family Land
PBDY	1U-106	640.907	LEKEY	1U-106	Commercial	Khimsa	Family Land
PBDY	1U-10	699.834	SANGAY WANGDI	1U-10	Commercial	Pang Zhing	Family Land
PBDY	1U-40	444.579	NIMCHU	1U-40	Commercial	Pang Zhing	Family Land
PBDY	1U-380	451.709	TSHERING DORJI	1U-380	Commercial	Khimsa	Joint Owners
PBDY	1U-53	111.647	PHURPA	1U-53	Commercial	Khimsa	Family Land
PBDY	1U-5	675.881	RINCHEN	1U-5	Commercial	Kamzhing	Family Land
PBDY	1U-229	612.373	DAWA	1U-229	Commercial	Kamzhing	Family Land

CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
'BDY	1U-280	2563.224	RINCHEN DORJI	1U-280	Commercial	Kamzhing	Individual Person
'BDY	1U-165	298.082	DEMA	1U-165	Commercial	Khimsa	Family Land
'BDY	1U-150	1363.561	TSHERING WANGMO	1U-150	Commercial	Kamzhing	Family Land
'BDY	1U-99	571.25	CHODEN	1U-99	Commercial	Kamzhing	Family Land
'BDY	1U-103	548.905	TSHEWANG NAMGAY	1U-103	Commercial	Kamzhing	Family Land
'BDY	1U-107	1044.223	UGYEN	1U-107	Commercial	Kamzhing	Family Land
'BDY	1U-104	1255.235	DENDAY	1U-104	Commercial	Kamzhing	Family Land
'BDY	1U-316	160.396	WANGCHUK	1U-316	Commercial	Kamzhing	Family Land
'BDY	1U-161	1606.561	DORJI TSHERING	1U-161	Commercial	Kamzhing	Joint Owners
PBDY	1U-149	765.967	TSHERING WANGMO	1U-149	Commercial	Kamzhing	Family Land
PBDY	1U-36	1362.101	KUENZANG	1U-36	Commercial	Kamzhing	Family Land
PBDY	1U-171	538.59	KELZANG	1U-171	Commercial	Kamzhing	Family Land
PBDY	1U-52	1156.214	PHUB DORJI	1U-52	Commercial	Kamzhing	Family Land
PBDY	1U-273	298.835	KIPCHU TSHERING	1U-273	Commercial	Pang Zhing	Family Land
PBDY	1U-143	235.924	TSHERING DEMA	1U-143	Commercial	Pang Zhing	Family Land
PBDY	1U-443	282.45	PHUB DORJI	1U-443	Commercial		Family Land
PBDY	1U-444	274.039	PHUB DORJI	1U-444	Commercial		Family Land
PBDY	1U-445	453.61	PHUB DORJI	1U-445	Commercial		Family Land
PBDY	1U-446	507.917	PHUB DORJI	1U-446	Commercial		Family Land
PBDY	1U-274	363.464	LHAB TSHERING	1U-274	Commercial	Kamzhing	Family Land

CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-108	204.02	DEMA	1U-108	Commercial	Kamzhing	Family Land
PBDY	1U-232	212.092	THINLEY DORJI	1U-232	Commercial	Kamzhing	Individual Person
PBDY	1U-86	292.439	TSHERING PEM	1U-86	Commercial	Kamzhing	Family Land
PBDY	1U-260	935.374	TENZIN PEM	1U-260	Commercial	Kamzhing	Family Land
PBDY	1U-447	334.91	LHADEN	1U-447	Commercial		Joint Owners
PBDY	1U-47	404.761	CHIMI DEMA	1U-47	Commercial	Kamzhing	Family Land
PBDY	1U-302	577.115	THINLEY DORJI	302	Commercial	Kamzhing	Individual Person
PBDY	1U-133	671.972	THINLEY BIDHA	1U-133	Commercial	Kamzhing	Family Land
PBDY	1U-29	270.565	SAMBA	1U-29	Commercial	Kamzhing	Family Land
PBDY	1U-28	450.316	SAMBA	1U-28	Commercial	Kamzhing	Family Land
PBDY	1U-430	187.855	SAMBA	1U-430	Commercial		Family Land
PBDY	1U-439	732.209	LHADEN	1U-439	Commercial	Kamzhing	Family Land
PBDY	1U-92	364.089	PENJOR	1U-92	Commercial	Kamzhing	Family Land
PBDY	1U-44	551.326	CHIMI DEMA	1U-44	Commercial	Kamzhing	Family Land
PBDY	1U-22	749.732	SONAM TOBGAY	1U-22	Residential	Kamzhing	Family Land
PBDY	1U-242	370.641	CHUNDU WANGCHUK	1U-242	Residential	Kamzhing	Family Land
PBDY	1U-243	877.888	SONAM DORJI	1U-243	Residential	Kamzhing	Family Land
PBDY	1U-21	1006.095	PASSANG WANGMO	1U-21	Residential	Kamzhing	Family Land
PBDY	1U-20	431.221	JIGME KARMA PHUNTSHO	1U-20	Residential	Kamzhing	Individual Person

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CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-25	999.119	SONAM WANGCHUK	1U-25	Residential	Kamzhing	Family Land
PBDY	1U-305	1321.507	RIKEY	1U-305	Residential	Kamzhing	Family Land
PBDY	1U-17	488.519	WANGCHUK	1U-17	Residential	Kamzhing	Family Land
PBDY	1U-361	667.803	SOANAM DORJI	1U-361	Residential	Kamzhing	Family Land
PBDY	1U-248	834.279	DECHEM WANGMO	1U-248	Residential	Kamzhing	Family Land
PBDY	1U-363	1496.825	WANGMO	1U-363	Residential	Pang Zhing	Family Land
PBDY	1U-59	2184.318	KUENGAP EM	1U-59	Residential	Pang Zhing	Family Land
PBDY	1U-289	2090.094	TSHERING PEM	1U-289	Residential	Kamzhing	Family Land
PBDY	1U-146	422.921	TASHI	1U-146	Residential	Pang Zhing	Family Land
PBDY	1U-364	418.12	TSHERING LOTAY	1U-364	Residential	Pang Zhing	Family Land
PBDY	1U-309	247.556	KHANDU DORJI	1U-309	Residential	Khimsa	Family Land
PBDY	1U-80	207.92	CHHUNDU GYEM	1U-80	Residential	Khimsa	Family Land
PBDY	1U-68	205.549	DORJI	1U-68	Residential	Khimsa	Family Land
PBDY	1U-244	121.68	UGYEN ZANGMO	244	Residential	Khimsa	Family Land
PBDY	1U-79	777.308	RINCHEN GYELTSHEN	1U-79	Residential	Kamzhing	Family Land
PBDY	1U-33	1164.817	NAMGAY CHODEN	1U-33	Residential	Kamzhing	Family Land
PBDY	1U-58	619.986	TSHERING NEDUP	1U-58	Residential	Kamzhing	Family Land
PBDY	1U-3	968.064	RIKEY	1U-3	Residential	Kamzhing	Family Land
PBDY	1U-255	1256.961	LHAB TSHERING	1U-255	Residential	Kamzhing	Joint Owners
PBDY	1U-219	1474.854	RINCHEN KHANDU	1U-219	Residential	Kamzhing	Individual Person



CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-57	1267.672	WANGCHUK	1U-57	Residential	Kamzhing	Family Land
PBDY	1U-208	1123.544	RINCHEN KHANDU	1U-208	Residential	Kamzhing	Individual Person
PBDY	1U-213	1952.712	RINCHEN KHANDU	1U-213	Residential	Kamzhing	Individual Person
PBDY	1U-19	643.017	BALANG DEMA	1U-19	Residential	Kamzhing	Individual Person
PBDY	1U-212	824.465	RINCHEN KHANDU	1U-212	Residential	Kamzhing	Individual Person
PBDY	1U-241	1407.845	PEM ZAM	1U-241	Residential	Kamzhing	Family Land
PBDY	1U-131	1290.838	SONAM TENZIN	1U-131	Residential	Kamzhing	Family Land
PBDY	1U-246	1935.668	CHENCHO LHAM	1U-246	Residential	Kamzhing	Joint Owners
PBDY	1U-60	247.822	KUENGA PEM	1U-60	Residential	Kamzhing	Family Land
PBDY	1U-132	568.552	BOTHI	1U-132	Residential	Kamzhing	Joint Owners
PBDY	1U-35	882.289	ZANGMO	1U-35	Residential	Kamzhing	Family Land
PBDY	1U-190	610.642	KARMA CHODEN	1U-190	Residential	Kamzhing	Family Land
PBDY	1U-224	648.92	CHENKYAB DORJI	1U-224	Residential	Khimsa	Family Land
PBDY	1U-105	1597.097	TSHERING DORJI	1U-105	Residential	Kamzhing	Family Land
PBDY	1U-65	125.051	AU DORJI	1U-65	Residential	Kamzhing	Family Land
PBDY	1U-125	325.415	AU DORJI	1U-125	Residential	Khimsa	Family Land
PBDY	1U-26	347.347	TSHECHU DORJI	1U-26	Residential	Kamzhing	Family Land
PBDY	1U-311	408.263	WANGCHUK	1U-311	Residential	Tshoesa	Joint Owners
PBDY	1U-295	874.661	KBU	1U-295	Residential	Kamzhing	Joint Owners

CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-167	2020.775	TASHI WANGMO	1U-167	Residential	Kamzhing	Family Land
PBDY	1U-98	1025.923	SANGAY WANGDI	1U-98	Residential	Kamzhing	Family Land
PBDY	1U-152	660.749	TOBAGY	1U-152	Residential	Khimsa	Joint Owners
PBDY	1U-292	456.352	SAMBA	1U-292	Residential	Tshoesa	Family Land
PBDY	1U-129	379.185	TSHENTSE	1U-129	Residential	Kamzhing	Family Land
PBDY	1U-94	291.335	PENJOR	1U-94	Residential	Khimsa	Family Land
PBDY	1U-240	373.445	KIBA	1U-240	Residential	Khimsa	Family Land
PBDY	1U-250	284.708	WANGCHUK	1U-250	Residential	Khimsa	Family Land
PBDY	1U-310	293.646	DOLO	1U-310	Residential	Khimsa	Family Land
PBDY	1U-55	233.637	NAMGYAL WANGCHUK	1U-55	Residential	Khimsa	Individual Person
PBDY	1U-291	282.599	LHENDUP WANGDI	1U-291	Residential	Khimsa	Family Land
PBDY	1U-296	242.165	THINLEY WANGMO	1U-296	Residential	Tshoesa	Family Land
PBDY	1U-245	255.086	CHENCHO PEM	1U-245	Residential	Kamzhing	Family Land
PBDY	1U-61	182.033	TSHERING WANGCHUK	1U-61	Residential	Khimsa	Family Land
PBDY	1U-27	158.337	LHABA	1U-27	Residential	Kamzhing	Family Land
PBDY	1U-64	158.852	CHUNDU TSHERING	1U-64	Residential	Khimsa	Family Land
PBDY	1U-272	118.084	NAMGAY	1U-272	Residential	Khimsa	Family Land
PBDY	1U-67	326.614	YUDEN	1U-67	Residential	Khimsa	Family Land
PBDY	1U-402	404.054	YESHI NAMGAY	1U-402	Residential	Khimsa	Family Land
PBDY	1U-234	291.753	NAMGAY TENZIN	1U-234	Residential	Pang Zhing	Individual Person

CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-397	504.472	CHENCHO LHAM	1U-397	Residential	Tshoesa	Family Land
PBDY	1U-338	1301.208	SONAM DEMA	1U-338	Residential	Tshoesa	Family Land
PBDY	1U-164	201.861	GAKI	1U-164	Residential	Tshoesa	Family Land
PBDY	1U-319	430.557	NIM TSHERING	1U-319	Residential	Tshoesa	Family Land
PBDY	1U-351	502.763	SANGAY DEMA	1U-351	Residential	Kamzhing	Family Land
PBDY	1U-329	967.607	SANGAY WANGMO	1U-329	Residential	Kamzhing	Family Land
PBDY	1U-336	810.781	TANDIN TSHERING	1U-336	Residential	Kamzhing	Family Land
PBDY	1U-392	383.655	NAMGAY TSHERING	1U-392	Residential	Kamzhing	Family Land
PBDY	1U-328	613.931	GYELTSHEN MELAM	1U-328	Residential	Kamzhing	Family Land
PBDY	1U-327	104.088	MELAM	1U-327	Residential	Kamzhing	Family Land
PBDY	1U-186	525.122	PASSANG	1U-186	Residential	Kamzhing	Joint Owners
PBDY	1U-352	105.975	KINLEY SITHUB	1U-352	Residential	Kamzhing	Family Land
PBDY	1U-119	1273.953	TSHERING	1U-119	Residential	Kamzhing	Family Land
PBDY	1U-297	525.575	TSHEWANG	1U-297	Residential	Kamzhing	Family Land
PBDY	1U-71	239.381	DAMCHOE DEMA	1U-71	Residential	Kamzhing	Family Land
PBDY	1U-406	165.899	CHANGLO	1U-406	Residential	Kamzhing	Family Land
PBDY	1U-405	285.032	CHANGLO	1U-405	Residential	Kamzhing	Family Land
PBDY	1U-258	537.508	PEMPA	1U-258	Residential	Kamzhing	Family Land
PBDY	1U-390	512.702	KARMA DEMA	1U-390	Residential	Kamzhing	Family Land



CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-16	514.152	PHUB DORJI	1U-16	Residential	Khamzhing	Family Land
PBDY	1U-416	704.629	PEMA GYE LPO	1U-416	Residential	Kamzhing	Family Land
PBDY	1U-14	924.978	KAKA	1U-14	Residential	Kamzhing	Family Land
PBDY	1U-409	631.878	CHANGLO	1U-409	Residential	Kamzhing	Family Land
PBDY	1U-264	346.209	PEMA ZANGMO	1U-264	Residential	Kamzhing	Family Land
PBDY	1U-66	1398.184	JIGME WANGCHUK	1U-66	Residential	Kamzhing	Family Land
PBDY	1U-412	193.487	DAWA ZAM	1U-412	Residential	Kamzhing	Family Land
PBDY	1U-396	99.689	CHENCHO LHAM	1U-396	Residential	Kamzhing	Family Land
PBDY	1U-251	327.473	LHABCHU	1U-251	Residential	Kamzhing	Family Land
PBDY	1U-151	619.789	KINLEY GYE LT SHEN	1U-151	Residential	Kamzhing	Family Land
PBDY	1U-398	404.332	THINLEY	1U-398	Residential	Kamzhing	Joint Owners
PBDY	1U-73	58.015	DAMCHOE DEMA	1U-73	Residential	Kamzhing	Family Land
PBDY	1U-69	180.344	DAMCHOE DEMA	1U-69	Residential	Kamzhing	Family Land
PBDY	1U-74	198.801	DAMCHOE DEMA	1U-74	Residential	Kamzhing	Family Land
PBDY	1U-72	406.089	DAMCHOE DEMA	1U-72	Residential	Kamzhing	Family Land
PBDY	1U-70	404.903	DAMCHOE DEMA	1U-70	Residential	Kamzhing	Family Land
PBDY	1U-214	619.656	RINCHEN KHANDU	1U-214	Residential	Kamzhing	Individual Person
PBDY	1U-211	914.084	RINCHEN KHANDU	1U-211	Residential	Kamzhing	Individual Person
PBDY	1U-222	1002.344	RINCHEN KHANDU	1U-222	Residential	Kamzhing	Individual Person

CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-226	665.232	ZAM	1U-226	Residential	Kamzhing	Family Land
PBDY	1U-210	3037.786	RINCHEN KHANDU	1U-210	Residential	Kamzhing	Individual Person
PBDY	1U-227	828.308	ZAM	1U-227	Residential	Kamzhing	Family Land
PBDY	1U-225	1211.807	ZAM	1U-225	Residential	Kamzhing	Family Land
PBDY	1U-223	700.208	ZAM	1U-223	Residential	Kamzhing	Family Land
PBDY	1U-428	273.123	THINLEY	1U-428	Residential		Joint Owners
PBDY	1U-239	934.296	KARMA TSHERING	1U-239	Residential	Kamzhing	Family Land
PBDY	1U-365	1123.504	RINCHEN DORJI	1U-365	Residential	Kamzhing	Family Land
PBDY	1U-414	750.951	KINLEY DEMA	1U-414	Residential	Kamzhing	Family Land
PBDY	1U-413	377.293	KINLEY DEMA	1U-413	Residential	Kamzhing	Family Land
PBDY	1U-333	239.527	TANDIN TSHERING	1U-333	Residential	Kamzhing	Family Land
PBDY	1U-334	263.936	TSHERING WANGCHUK	1U-334	Residential	Kamzhing	Family Land
PBDY	1U-429	178.821	WANGCHUK	1U-429	Residential		Family Land
PBDY	1U-156	395.548	DOLEY LHAMO	1U-156	Residential	Kamzhing	Family Land
PBDY	1U-389	509.477	CHENCHO LHAM	1U-389	Residential	Kamzhing	Family Land
PBDY	1U-388	245.951	CHENCHO LHAM	1U-388	Residential	Kamzhing	Family Land
PBDY	1U-386	393.925	CHENCHO LHAM	1U-386	Residential	Kamzhing	Family Land
PBDY	1U-387	266.046	CHENCHO LHAM	1U-387	Residential	Kamzhing	Family Land
PBDY	1U-393	298.153	CHENCHO LHAM	1U-393	Residential	Kamzhing	Family Land

CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-203	338.553	PASSANG	1U-203	Residential	Kamzhing	Family Land
PBDY	1U-270	496.761	LHAB GYELMO	1U-270	Residential	Pang Zhing	Family Land
PBDY	1U-317	132.145	LHAB TSHERING	1U-317	Residential	Kamzhing	Family Land
PBDY	1U-201	157.606	ZANGMO	1U-201	Residential	Kamzhing	Family Land
PBDY	1U-382	99.899	LHAM TSHERING	1U-382	Residential	Kamzhing	Family Land
PBDY	1U-158	671.805	KARMA DORJI	1U-158	Residential	Kamzhing	Family Land
PBDY	1U-300	430.835	PHUB TSHERING	1U-300	Residential	Kamzhing	Family Land
PBDY	1U-187	758.227	PASANG BIDHA	1U-187	Residential	Kamzhing	Family Land
PBDY	1U-265	854.639	PEMA ZANGMO	1U-265	Residential	Kamzhing	Family Land
PBDY	1U-15	1280.095	WANGMO	1U-15	Residential	Kamzhing	Family Land
PBDY	1U-197	428.079	NIDUP TSHERING	1U-197	Residential	Kamzhing	Family Land
PBDY	1U-325	325.491	KARMA OM	1U-325	Residential	Kamzhing	Family Land
PBDY	1U-172	1105.309	WANGCHUK	1U-172	Residential	Kamzhing	Family Land
PBDY	1U-271	1568.118	NAMGAY	1U-271	Residential	Kamzhing	Family Land
PBDY	1U-185	659.233	PASANG BIDHA	1U-185	Residential	Kamzhing	Joint Owners
PBDY	1U-313	173.424	WANGMO	1U-313	Residential	Tshoesa	Family Land
PBDY	1U-282	620.935	LHAPCHU	1U-282	Residential	Kamzhing	Family Land
PBDY	1U-159	508.892	CHENCHO	1U-159	Residential	Kamzhing	Family Land
PBDY	1U-32	624.256	TANDIN DORJEE	1U-32	Residential	Kamzhing	Family Land
PBDY	1U-284	697.998	PEMPA LHAMO	1U-284	Residential	Tshoesa	Family Land



BHUCORE - IRGSSA

CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-173	760.994	RINZIN	1U-173	Residential	Kamzhing	Family Land
PBDY	1U-266	550.606	RINZIN	1U-266	Residential	Kamzhing	Family Land
PBDY	1U-269	271.593	LHAB GYELMO	269	Residential	Tshoesa	Family Land
PBDY	1U-330	321.955	CHANGA DAWA	330	Residential	Kamzhing	Family Land
PBDY	1U-268	343.189	RINZIN	268	Residential	Tshoesa	Family Land
PBDY	1U-262	430.011	NAMGAY	262	Residential	Kamzhing	Family Land
PBDY	1U-199	534.077	SONAM WANGCHUK	1U-199	Residential	Kamzhing	Family Land
PBDY	1U-308	730.51	RIKEY	1U-308	Residential	Kamzhing	Family Land
PBDY	1U-419	527.151	TANDIN	1U-419	Residential	Kamzhing	Family Land
PBDY	1U-123	524.444	KINLEY SITHUP	1U-123	Residential	Kamzhing	Family Land
PBDY	1U-359	524.459	KARMA DEMA	1U-359	Residential	Kamzhing	Family Land
PBDY	1U-355	614.593	DECHEN	1U-355	Residential	Kamzhing	Joint Owners
PBDY	1U-301	885.486	TSHERING	1U-301	Residential	Kamzhing	Joint Owners
PBDY	1U-97	440.114	YESHI NAMGAY	1U-97	Residential	Kamzhing	Family Land
PBDY	1U-193	649.561	TSHERING GYEM	1U-193	Residential	Kamzhing	Family Land
PBDY	1U-89	442.802	TSHERING YANGZOM	1U-89	Residential	Kamzhing	Family Land
PBDY	1U-233	1106.506	KARMA	1U-233	Residential	Kamzhing	Family Land
PBDY	1U-130	754.303	PASANG TSHERING	1U-130	Residential	Kamzhing	Family Land
PBDY	1U-324	942.357	TSHERING LHAM	1U-324	Residential	Kamzhing	Family Land



CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-318	316.339	RINCHEN DORJI	1U-318	Residential	Kamzhing	Individual Person
CODE	1U-285	248.39	ZANGMO	1U-285	Residential	Tshoesa	Family Land
PBDY	1U-285	248.39	ZANGMO	1U-285	Residential	Tshoesa	Family Land
PBDY	1U-175	1077.58	WANGMO	1U-175	Residential	Kamzhing	Family Land
PBDY	1U-174	769.241	TANDIN DORJI	1U-174	Residential	Kamzhing	Family Land
PBDY	1U-254	1301.26	GAYGAY	1U-254	Residential	Tshoesa	Joint Owners
PBDY	1U-331	613.573	SANGAY WANGMO	1U-331	Residential	Tshoesa	Family Land
PBDY	1U-136	342.045	LHAB TSHERING	1U-136	Residential	Pang Zhing	Family Land
PBDY	1U-247	224.447	PHUB DORJI	1U-247	Residential	Pang Zhing	Joint Owners
PBDY	1U-207	769.169	TSHERING DEM	1U-207	Residential	Kamzhing	Family Land
PBDY	1U-358	298.467	GANGLA	1U-358	Residential	Tshoesa	Family Land
PBDY	1U-431	153.908	ZANGMO	1U-431	Residential		Family Land
PBDY	1U-433	128.295	PEMA GYELPO	1U-433	Residential		Family Land
PBDY	1U-434	341.317	DAWA ZAM	1U-434	Residential		Family Land
PBDY	1U-200	390.84	UGYEN TSHERING	1U-200	Residential	Kamzhing	Family Land
PBDY	1U-381	737.672	SONAM CHODEN	1U-381	Residential	Kamzhing	Joint Owners
PBDY	1U-276	671.853	TSHERING DEM	1U-276	Residential	Kamzhing	Family Land
PBDY	1U-148	587.011	SONAM CHOKI	1U-148	Residential	Kamzhing	Family Land
PBDY	1U-24	369.921	SONAM TSHEING	1U-24	Residential	Kamzhing	Family Land
PBDY	1U-209	1310.779	TSHERING WANGMO	1U-209	Residential	Kamzhing	Family Land

BHUCORE – IRGSSA



CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-448	317.828	LHAM TSHERING	448	Residential		Family Land
PBDY	1U-451	494.018	WANGMO	451	Residential		Family Land
PBDY	1U-452	407.406	RINCHEN WANGMO	452	Residential		Family Land
PBDY	1U-453	321.928	GANGLA	453	Residential		Family Land
PBDY	1U-454	577.463	DOLEY LHAMO	454	Residential		Family Land
PBDY	1U-192	1072.182	SONAM	1U-192	Residential	Kamzhing	Family Land
PBDY	1U-77	1134.989	SONAM PELDEN	1U-77	Residential	Kamzhing	Family Land
PBDY	1U-298	697.281	BEDHA	298	Residential	Kamzhing	Family Land
PBDY	1U-18	1552.52	ZAM	1U-18	Residential	Kamzhing	Family Land
PBDY	1U-249	1064.682	TSHERING DORJI	249	Residential	Pang Zhing	Family Land
PBDY	1U-455	348.517	PASANG BIDHA	455	Residential		Family Land
PBDY	1U-456	253.768	ZANGMO	456	Residential		Family Land
PBDY	1U-457	166.827	NAMGAY TSHERING	457	Residential		Family Land
PBDY	1U-458	303.358	CHANGLO	458	Residential		Family Land
PBDY	1U-459	238.228	WANGMO	459	Residential		Family Land
PBDY	1U-460	496.351	ZAM	460	Residential		Family Land
PBDY	1U-461	292.318	DAMCHOE DEMA	461	Residential		Family Land
PBDY	1U-462	140.942	KUENZANG	462	Residential		Family Land
PBDY	1U-463	360.661	DAWA ZAM	463	Residential		Family Land
PBDY	1U-464	510.57	TANDIN TSHERING	464	Residential		Family Land
PBDY	1U-465	123.417	WANGMO	465	Residential		Family Land

BHUCORE – IRGSSA



CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-466	81.15	NAMGAY TSHERING	1U-466	Residential		Family Land
PBDY	1U-467	431.342	DOLEY LHAMO	1U-467	Residential		Family Land
PBDY	1U-468	87.802	DOLEY LHAMO	1U-468	Residential		Family Land
PBDY	1U-469	167.705	ZANGMO	1U-469	Residential		Family Land
PBDY	1U-470	450.366	PASANG BIDHA	1U-470	Residential		Family Land
PBDY	1U-471	77.259	ZAM	1U-471	Residential		Family Land
PBDY	1U-472	200.195	DAMCHOE DEMA	1U-472	Residential		Family Land
PBDY	1U-473	359.113	DOLEY LHAMO	1U-473	Residential		Family Land
PBDY	1U-474	307.676	PASANG BIDHA	1U-474	Residential		Family Land
PBDY	1U-475	722.525	PASANG BIDHA	1U-475	Residential		Family Land
PBDY	1U-476	245.323	DAMCHOE DEMA	1U-476	Residential		Family Land
PBDY	1U-477	263.642	PEMA GYELPO	1U-477	Residential		Family Land
PBDY	1U-479	404.005	DECHEN	1U-479	Residential		Joint Owners
PBDY	1U-480	258.411	DODO SAMDRUP	1U-480	Residential		Family Land
PBDY	1U-326	432.541	TANDIN DORJI	1U-326	Residential	Kamzhing	Family Land
PBDY	1U-145	1163.895	TSHERING DEMA	1U-145	Residential	Kamzhing	Family Land
PBDY	1U-41	918.763	KHANDO WANGMO	1U-41	Residential	Kamzhing	Family Land
PBDY	1U-486	148.483	PEMA ZANGMOM	1U-486	Residential		Family Land
PBDY	1U-339	482.833	THINLEY DEMA	1U-339	Residential	Tshoesa	Family Land
PBDY	1U-54	1009.213	SANGAY	1U-54	Residential	Kamzhing	Family Land



CODE	DESCRIP	AREA	Own Name	ePlotId	Plot Cat	fDescr	OT Descr
PBDY	1U-367	5406.631	MEWANG GYELYUM ASHI DORJI WANGMO	1U-367	Residential	Pang Zhing	Individual Person
PBDY	1U-449	356.923	PEMA ZANGMO	1U-449	Residential		Family Land
PBDY	1U-450	376.607	KADEN	1U-450	Residential		Family Land
PBDY	1U-121	1243.028	DORJI TSHEWANG	1U-121	Residential	Tshoesa	Family Land
PBDY	1U-487	126.27	GAKI	1U-487	Residential		Family Land
PBDY	1U-488	153.535	LHAB TSHERING	1U-488	Residential		Family Land
PBDY	1U-489	228.728	PEMPA LHAMO	1U-489	Residential		Family Land

Annexure 13: Population Projection through different Methods

Year	Growth Rate for Projection	Projection Through Natural Growth	Growth Rate for Projection	Projection on the basis of In migration	Growth Rate for Projection	Projection on the Basis of Western Bhutan Growth Method	Growth Rate for Projection	Projection on the basis of Arithmetic increase	Growth Rate for Projection	Projection on the basis of District Growth Rate
2015		3224		3224		3224		3224		3224
2016	2.22	3296	16.66	3761	1.31	3266	2.95	3319	1.6	3276
2017	2.22	3369	16.66	4388	1.31	3309	2.95	3417	1.6	3328
2018	2.22	3444	16.66	5119	1.31	3352	2.95	3518	1.6	3382
2019	2.22	3520	16.66	5972	1.31	3396	2.95	3622	1.6	3436
2020	2.22	3598	16.66	6967	1.31	3440	2.95	3729	1.6	3491
2021	2.22	3678	16.66	8128	1.31	3485	2.95	3839	1.6	3547
2022	2.22	3760	16.66	9482	1.31	3531	2.95	3952	1.6	3603
2023	2.22	3843	16.66	11062	1.31	3577	2.95	4069	1.6	3661
2024	2.22	3928	16.66	12905	1.31	3624	2.95	4189	1.6	3720
2025	2.22	4015	16.66	15055	1.31	3671	2.95	4313	1.6	3779
2026	2.22	4104	16.66	17563	1.31	3719	2.95	4440	1.6	3840
2027	2.22	4195	16.66	20489	1.31	3768	2.95	4571	1.6	3901
2028	2.22	4288	16.66	23902	1.31	3817	2.95	4706	1.6	3963
2029	2.22	4383	16.66	27884	1.31	3867	2.95	4845	1.6	4027
2030	2.22	4480	16.66	32529	1.31	3918	2.95	4988	1.6	4091
2031	2.22	4579	16.66	37948	1.31	3969	2.95	5135	1.6	4157
2032	2.22	4681	16.66	44270	1.31	4021	2.95	5286	1.6	4223
2033	2.22	4785	16.66	51645	1.31	4074	2.95	5442	1.6	4291
2034	2.22	4891	16.66	60249	1.31	4127	2.95	5603	1.6	4359
2035	2.22	5000	16.66	70286	1.31	4181	2.95	5768	1.6	4429
2036	2.22	5111	16.66	81996	1.31	4236	2.95	5938	1.6	4500
2037	2.22	5224	16.66	95657	1.31	4291	2.95	6113	1.6	4572
2038	2.22	5340	16.66	111593	1.31	4347	2.95	6293	1.6	4645
2039	2.22	5459	16.66	130184	1.31	4404	2.95	6479	1.6	4720
2040	2.22	5580	16.66	151873	1.31	4462	2.95	6670	1.6	4795
2041	2.22	5704	16.66	177175	1.31	4520	2.95	6867	1.6	4872

Annexure 13: Sample Socio economic Survey Format

Haa Local Area Plan

Vehicle Ownership	Motor/ Car	Bikes	Tractor	Truck/ 4WD
House Ownership	Individually owned	Family Owned	Jointly Owned	Rented
Communication	Landline	Mobile	Television	Internet
No. Floors			D.U. Area	

E. Income Groups

Income (per month)	Less than 5,000	5,001-10,000	10,001-15,000	15,001-20,000
	20,001-30,000	30,001-50,000	Above 50,000	

F. Elements Defining Sense of Place

Important Buildings / monuments within Haa (according to importance)			
Name the places you like the most (e.g. park, open space, streets, squares and etc.)			

G. Employment Transport

- i) Place of Employment
 - 1. Within Haa
 - 2. Others
- ii) Mode of Transport
 - 1. Private (car, bike, cycle)
 - 2. Public
 - 3. Foot
- iii) Time taken to travel to place of employment (mins)

H. Education

- i) Where do you send your children for schooling
 - 1. Within Haa
 - 2. Others
- ii) Mode and cost of travel from home to school
 - 1. Private
 - 2. Public
 - 3. School Bus
 - 4. Foot
 - 5. N.A.

I.	Recreational	Type of Location	Location	Distance

J. List of major Infrastructure requirements

1. Roads
2. Sewerage
3. Solid Waste disposal
4. Street Lighting
5. Bus Stops
6. Water Supply
7. Footpaths
8. Recreational center
9. Drainages

K. Rank four most required infrastructure

(Use above list)

- 1.
- 2.
- 3.
- 4.