



COMMUNITY CENTER
IN GER DISTRICT, ULAANBAATAR, MONGOLIA

POLITECNICO DI MILANO

School of Architecture and Society

Master of Science in Architecture

Thesis Project

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INTRODUCTION

For more than 3'000 years, Mongolians are staying in central asia with nomadic lifestyle moving from one pasture to another. With the help of ger housing (international term: yurt) and the horses with long-lasting stamina, Mongolian empire was created in 13th century. Since that period, for over 800 years, "Mongolian ger" has not been changed much. Nowadays, Mongolians still use ger because of its lightness, simplicity, cost-effectiveness, comfort and durability. Gers have been used by nomads in countryside and inhabitants of slum areas in the city.

This thesis focuses on Ger districts in the capital city Ulaanbaatar in Mongolia. Ger districts, the result of urbanization process in the city are creating negative impacts such as air pollution and soil contamination. Those inhabitants are not that comfortable with the environment they are living in because of the lack of very basic human needs like sanitation and heating. Weak economy and ignorant governmental act allowed ger districts to expand day by day and it is now covering already 60% of the total land of city.

Nomadics, who were in freedom in the wide empty Mongolian steppe, had to face a new way of life of living together with the neighbors in the city. In harsh winter periods of -30 degrees, people in Ger districts have no chance but to burn what they could find with cheap cost and easy reach. As the result of that, heavy air pollution lead the city look like a kind of distopian city.

The project was began by making general analysis and specified several problems. The main goal of the project is to find out possible architectural solutions to those problems related to Ger-districts. As a project area, 8 and 9th Khoroo of Chingeltei district (north side of the historical and religious buddhist complex area Gandan) has been selected because of its location and potential to develop.



view of from a part of ger district

Mongolia has diplomatic relations with 188 United Nations member states. It is neighboring with China in the south and Russia in the north. Since 1991, after the collapse of Soviet Union, Mongolia has developed economic and cultural relations with other international countries.

Relation between Mongolia and the Russian Federation have been traditionally strong since the Communist era, when Soviet Russia was the closest ally of the Mongolian People's Republic.

Almost half of the Mongolian exports are done to China, which is the most influential economic neighbor. China expanded its investments in Mongolia's mining industries, seeking to exploit the country's natural resources.

- LEGEND**
- direct flights
 - - - trans-siberian railway
 - country borders
 - land
 - water



Soviet Russian prefabricated buildings in Ulaanbaatar



Chinese Residential Development in Ulaanbaatar

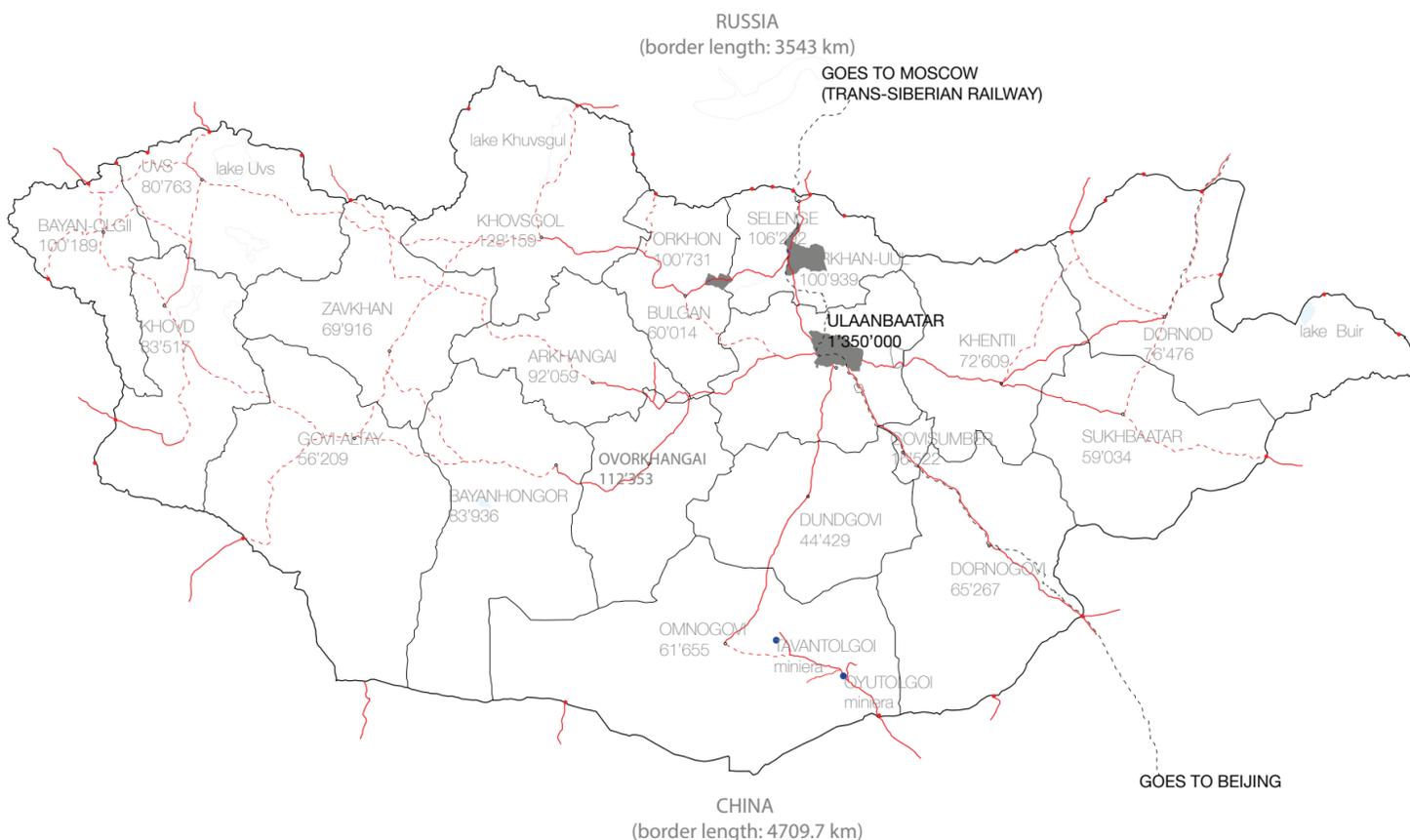


Administrative Borders

Mongolia consists of 21 provinces which are then divided into 329 districts. Ulaanbaatar is the capital, the most populated, and the largest city in Mongolia. There are two other big cities; Darkhan and Erdenet with more than 100 thousand inhabitants. Around half of the provinces are connected with asphalt road while the railway connects only the north to the south. Distant provinces can be reached by local airplanes.

- LEGEND**
- border exit
 - asphalt road
 - - - gravel road
 - region border
 - state border
 - - - railway

scale 1:10'000'000



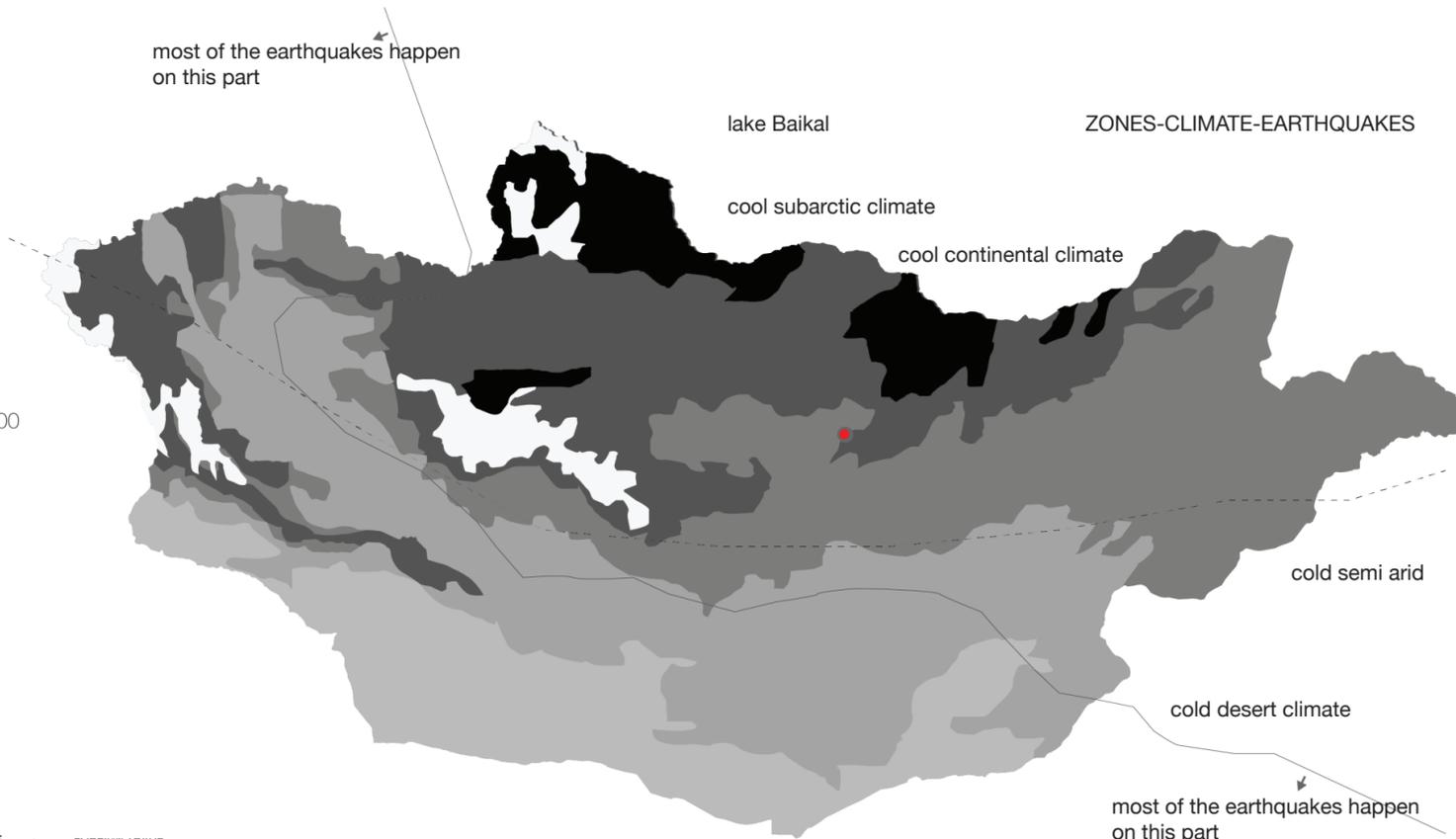
Geography and Climate

The climate is harshly cold in winter (it could reach -30 degrees) but it is mostly warm in summer time. Mongolia is known as the Country of Blue Sky because it has over 250 sunny days a year.

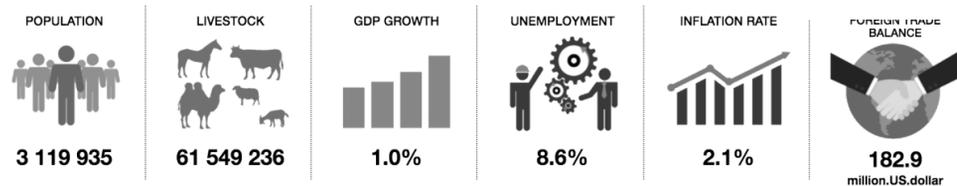
The geography consists of mountainous area with forest in the north, wide flat steppe in the middle, and Gobi desert in the south.

- LEGEND**
- Ulaanbaatar city
 - Mountain
 - Taiga zone
 - Forest steppe
 - Steppe zone
 - Desert steppe
 - Desert zone

scale 1:10'000'000



GENERAL STATISTICS OF MONGOLIA

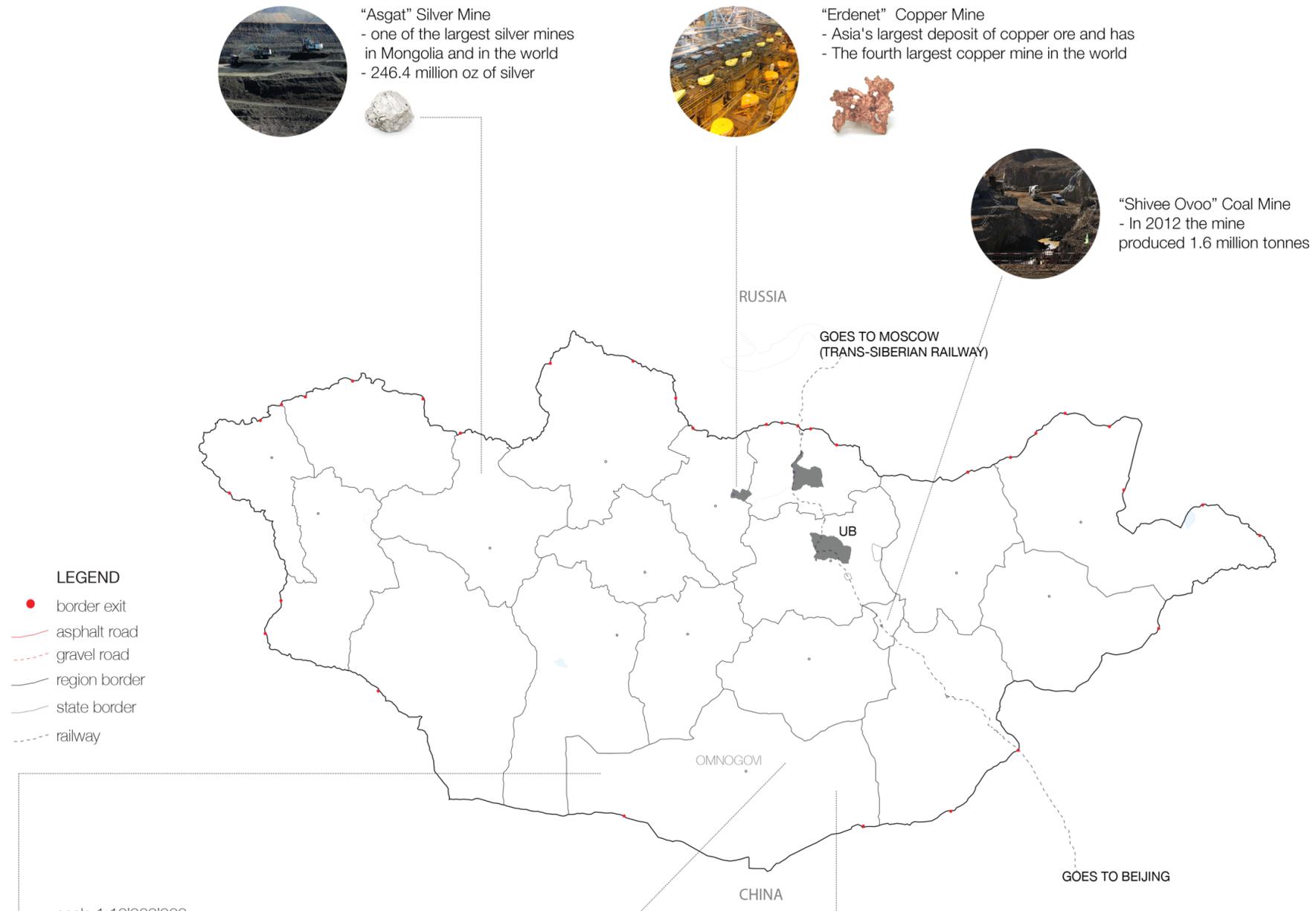


1957 earthquake
magnitude: **8.1**
depth: 30km
generally **4-4.9**



ANALYSIS: ADMINISTRATIVE BORDERS

Mongolia consists of 21 provinces which are then divided into 329 districts. Ulaanbaatar is the capital, the most populated, and the largest city in Mongolia. There are two other big cities; Darkhan and Erdenet with more than 100 thousand inhabitants. Around half of the provinces are connected with asphalt road while the railway connects only the north to the south. Distant provinces can be reached by local airplanes.



"Asgat" Silver Mine
- one of the largest silver mines in Mongolia and in the world
- 246.4 million oz of silver



"Erdenet" Copper Mine
- Asia's largest deposit of copper ore and has
- The fourth largest copper mine in the world



"Shivee Ovoo" Coal Mine
- In 2012 the mine produced 1.6 million tonnes



"Nariin Sukhait" Coal Mine
- 380 million mt of resources



"Tavan Tolgoi" Coal Mine
- 6.4 billion tonnes of coking coal



"Oyu Tolgoi" Gold, Copper Mine
- biggest mining exploration project in the world, 2003
- 1'900 tonnes of silver
- employment of 3,000-4,000 people

- 2,700,000 tonnes of copper



- 48,195 kg of gold



Number of Animals:	sheep	goat	cow	horse	camel
					
Total: 56 million (by 2015)	25 million	24 million	3.8 million	3.3 million	370 thousands



Ulaanbaatar is the capital and the biggest city in Mongolia with the inhabitants of 1.3 million. It is divided into 9 districts. Ger district covers vast area of the city, is created because of the nomads moving into the city. Ger districts are created by individual parcel fences neighboring one another and each one covers around 400-500 metric square land. It is hard to say it is urbanization process because Ger districts look like rural, we can say in other words that it is a ruralization process in urban area.



image: lonelyplanet.com

Ulaanbaatar city districts

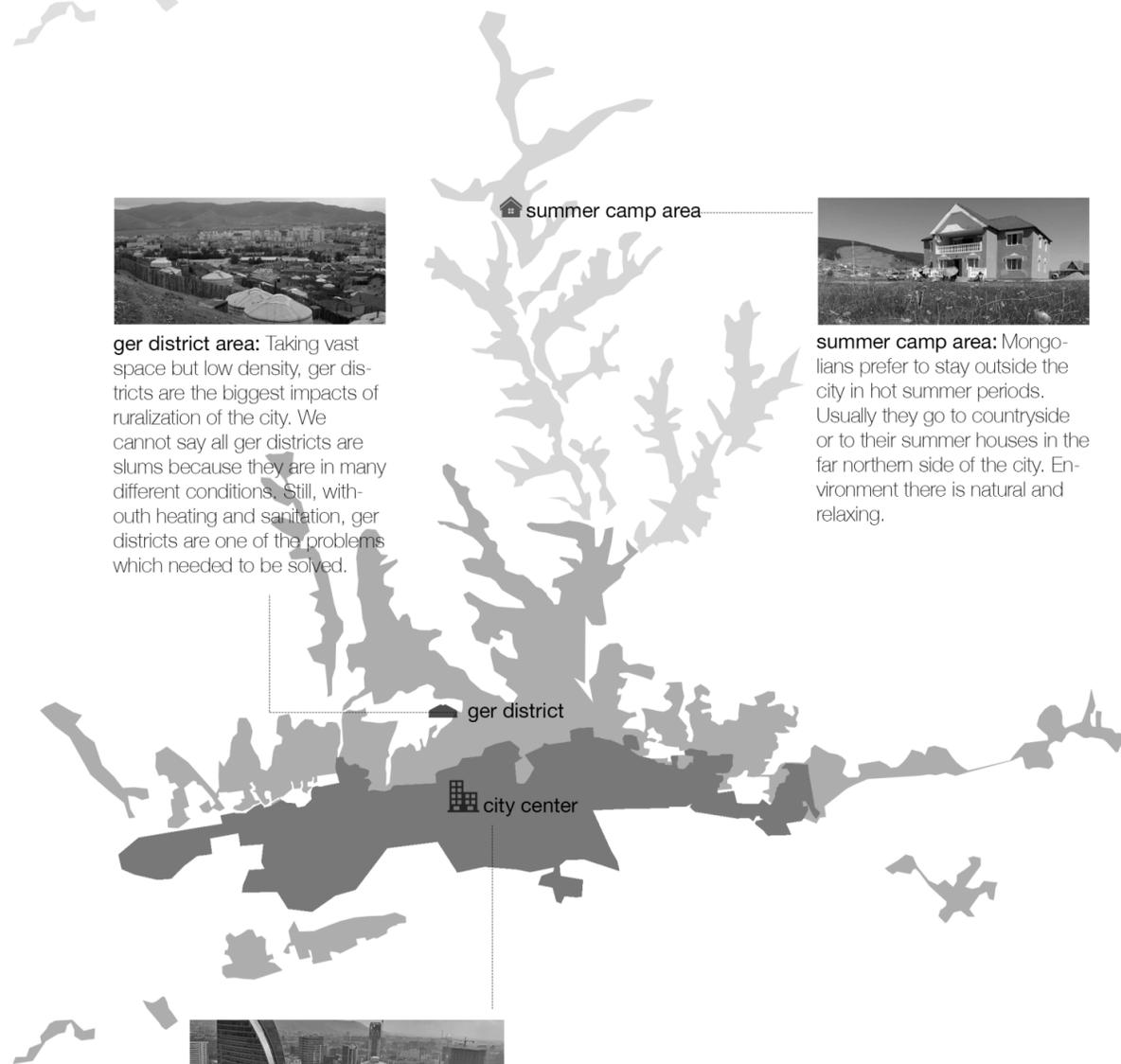
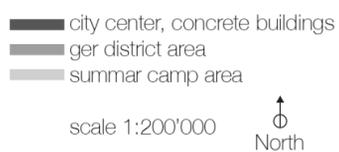
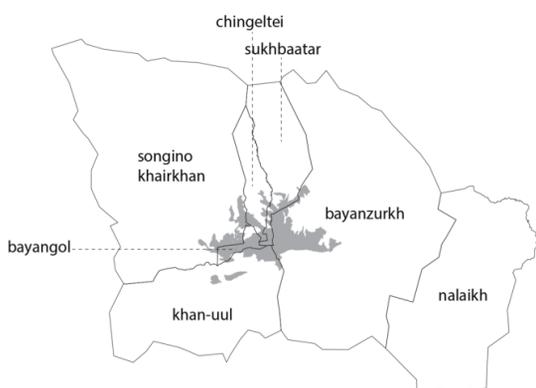


ger district area: Taking vast space but low density, ger districts are the biggest impacts of ruralization of the city. We cannot say all ger districts are slums because they are in many different conditions. Still, without heating and sanitation, ger districts are one of the problems which needed to be solved.

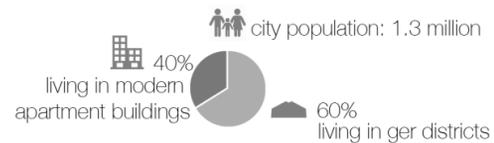


summer camp area: Mongolians prefer to stay outside the city in hot summer periods. Usually they go to countryside or to their summer houses in the far northern side of the city. Environment there is natural and relaxing.

Ulaanbaatar City Districts



city center area: Ulaanbaatar is a dynamic city which is getting changed day by day with a lot of construction going on in different areas. Air pollution in winter caused by ger district burning coal for heating in the north is a critical problem in the city.





1 | Power Plant #3: (founded in 1966) one of two the most powerful power plants in Ulaanbaatar. It produces electricity and heating, distributes and regulates them to the city.



2 | Khoroolol: is an area consists of commercial district along the road and 9 floors high Soviet architecture residential apartment block behind them. It is one of the busiest and most crowded districts in UB.



3 | Gandan monastery: was first founded in 1806 and is one of the most ancient and historical buildings in Ulaanbaatar. Nowadays, it still is a spiritual area of the city containing several monasteries around it.



4 | The Peace Avenue: the main traffic circulation corridor of the city. Many shops, restaurants, cafes, and offices are located in this area.



5 | Zaisan hill: (founded in 1971) a monument devoted to Soviet union soldiers who lost their lives in the WWII.



6 | National Sports Stadium: (founded in 1958) the stadium was built for multi-use such as football, festivals, etc., the only mandatory event is the Naadam festival held on July 11 of each year which commemorates the independence day of 1921.

Nowadays, it is one of the main recreational areas, on which people can see panoramic view of the city from the top of the hill.



7 | Ulaanbaatar Railway Station: (established in 1955) is one of the Trans-Siberian railway stations connecting Moscow to Beijing.



8 | Industrial area: located in south east part of the city center, contains cashmere industries, furniture expo center, auto-reseller office, drink industry etc...



9 | National Park: (is being established since 2012) is one of the most visited recreational areas near the city center, covering 9.6 km square area.



10 | Misheel Expo Center: the biggest and the most influential covered space expo area.

In order to make readers understand the project, basic introduction of the city has been made by emphasizing its notable zones. We can see the city is scattered in diverse zones and each of them has their own role in the city.



LEGEND
 ■ important areas
 □ other areas
 ger district border

scale 1:50'000



11 | Narantuul: is a black market located in east of center where people can find almost anything. It is the biggest market in Mongolia.



12 | National University: (is being established since 2012) The National University of Mongolia is the oldest university in Mongolia. It hosts twelve schools and faculties in Ulaanbaatar



13 | Zuun Ail: is a district in the north of Ulaanbaatar, consists of mostly retail shops and stores of all kinds of construction materials



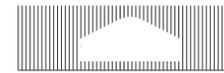
14 | Military and Defence University



15 | Da Khuree: the biggest car market in the city. Different brand cars and their parts are sold here.



16 | Botanic: a terminal station of the trolley-buses and the influential stop in the east of the city for buses.

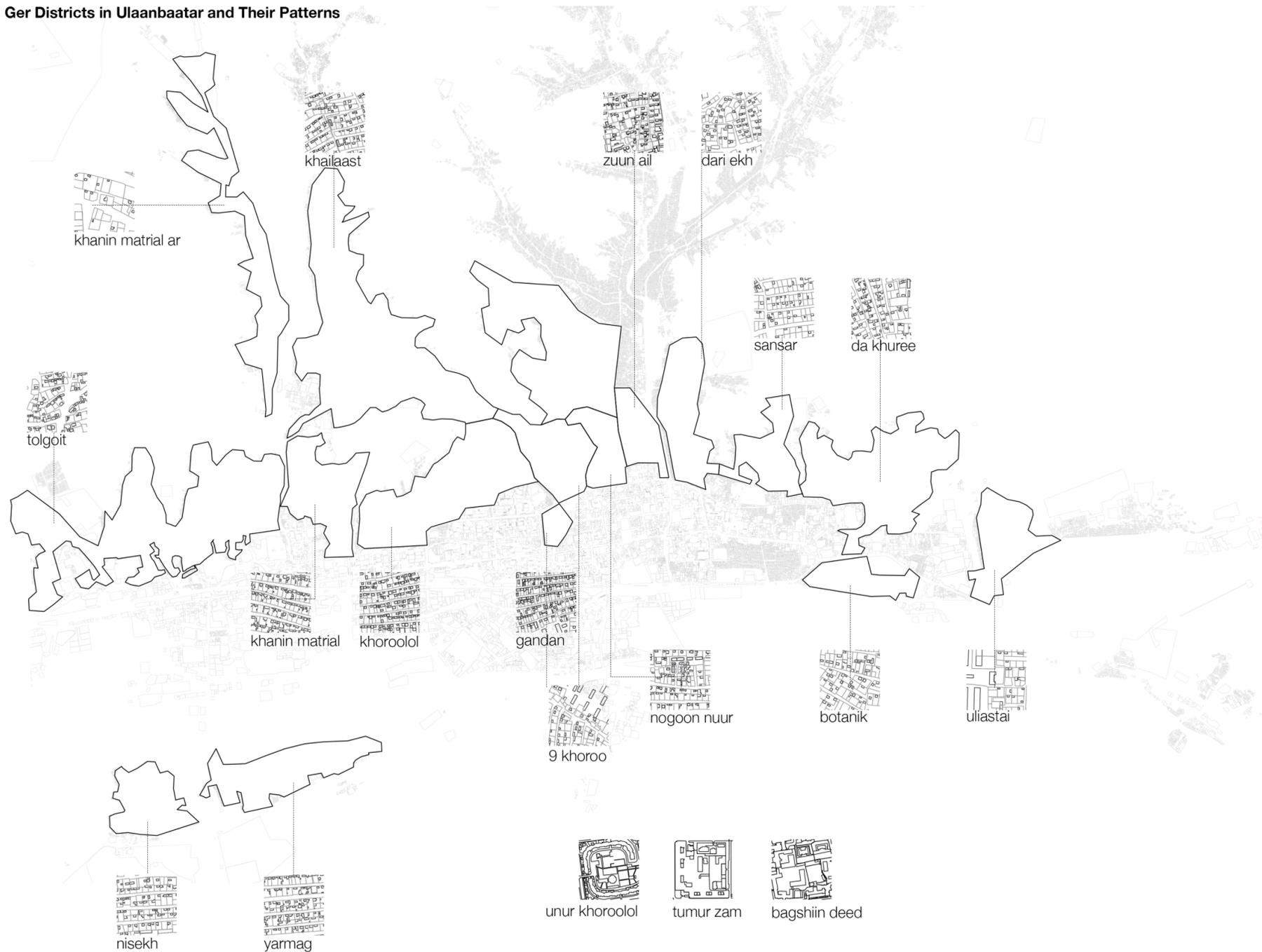


What is Ger-District?

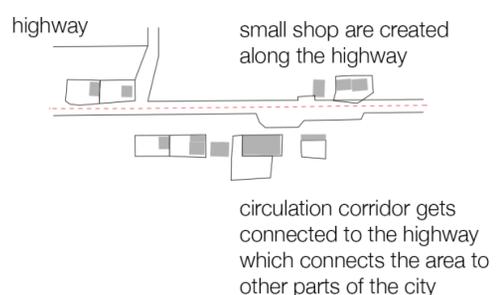
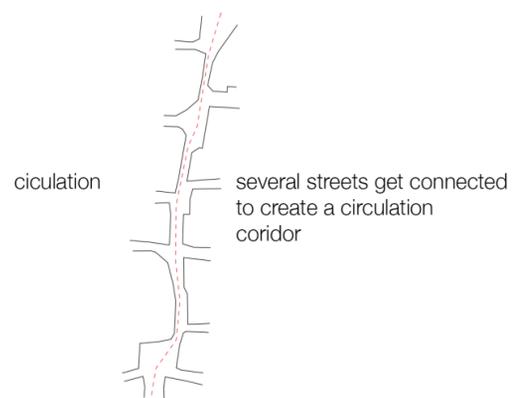
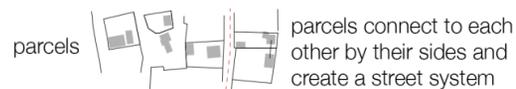
Ger district is a residential settlement most of which were contrary to the construction regulations at the beginning and then most of them got legalized by authorities. It is a sort of urbanization process which is caused by nomads moving to the urban areas. Most of them does not have access to the central water line, there is no application of the city planning but fortunately all of them have got access to the electricity.

Ger district in Ulaanbaatar city is expanding in the city scale. It consists of individual parcels with one or more housing units or gers inside. The biggest disadvantage of living there is that it is not connected to city sanitation system. Therefore ger district inhabitants take their water from water kiosks. It is now taking around 60% of the population of the city. The oldest settlement is 100 years old Gandan district in the center of the city. It is a main source of Ulaanbaatar air pollution by each family burning coal to get the house heated in the night hours. Fortunately 99% of them are connected to the electricity.

Ger Districts in Ulaanbaatar and Their Patterns



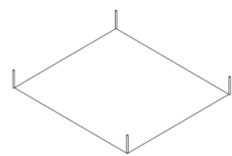
Transition from Parcel to the Highway



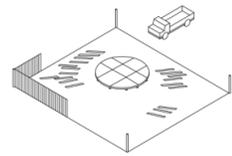
LEGEND
 ger districts border
 scale 1:100'000
 North



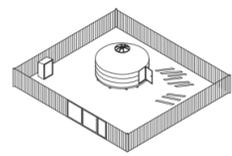
Process of Building one Parcel



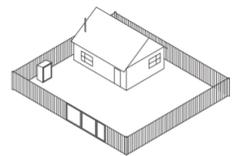
determining the area



building fence around

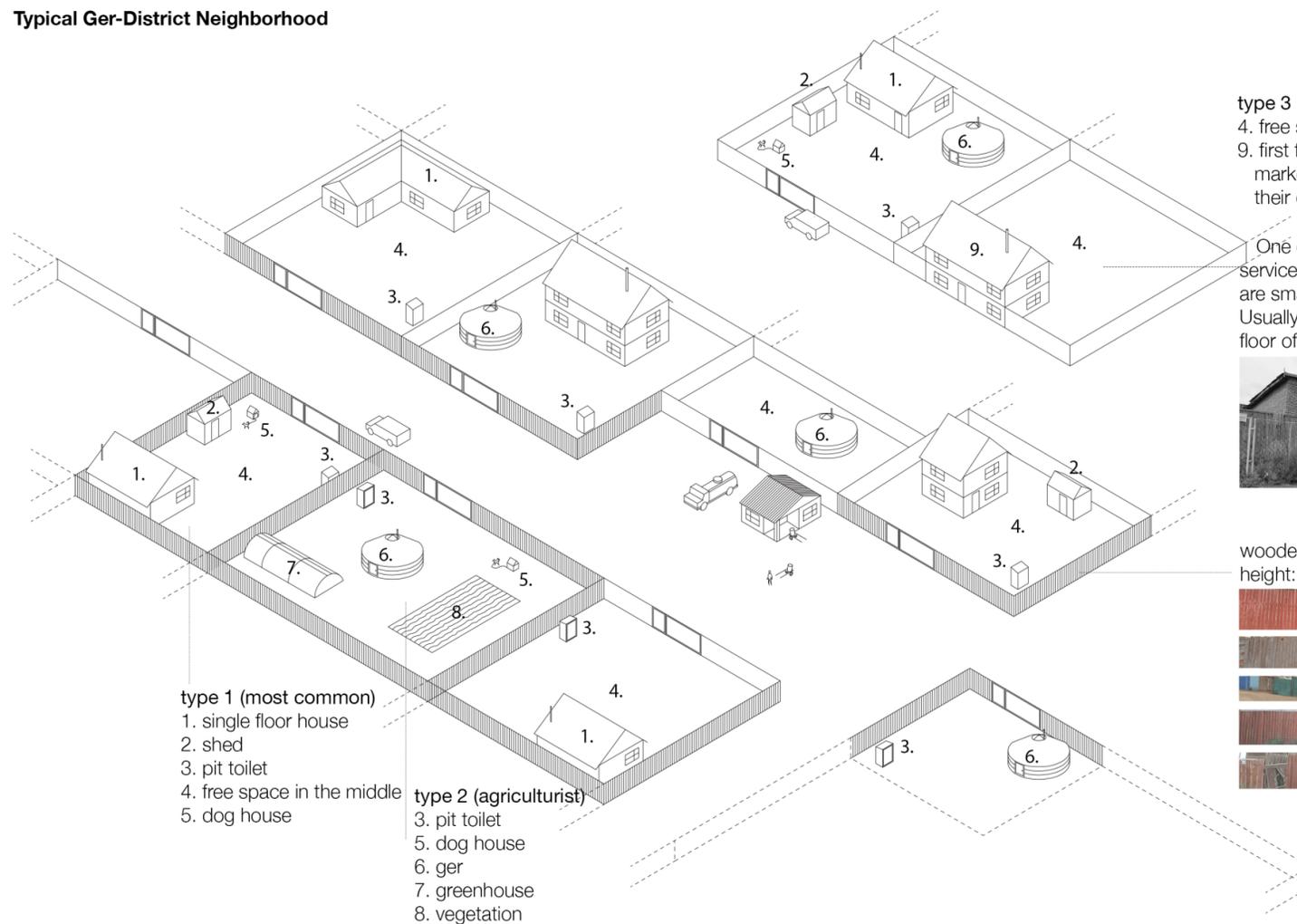


building ger and a pit toilet



building a housing unit

Typical Ger-District Neighborhood



type 1 (most common)

- 1. single floor house
- 2. shed
- 3. pit toilet
- 4. free space in the middle
- 5. dog house

type 2 (agriculturist)

- 3. pit toilet
- 5. dog house
- 6. ger
- 7. greenhouse
- 8. vegetation

type 3 (shopkeepers)

- 4. free space in the middle
- 9. first floor used as a small food market second floor used as their own house

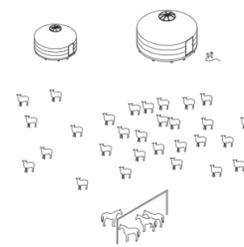
One of the most common service places in ger districts are small sized private shops. Usually the vendors use first floor of their own house as a



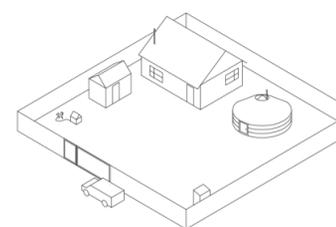
wooden fence height: 2 metres



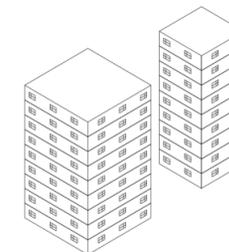
Comparison of Life Styles of Mongolia



nomadic in countryside

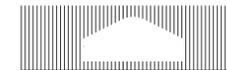


settled in ger district



settled in urban district

	nomadic in countryside	settled in ger district	settled in urban district
(SOCIAL)			
DENSITY	low	low	high
ACCESS TO WATER	from nature	water kiosks	centralized
SEWAGE SYSTEM	no	no	centralized
PUBLIC TRANSPORT	no	yes (problematic)	yes
ACCESS TO MUNICIPALITY SERVICES	distant	yes	yes
INCOME LEVEL	differs	low	medium/ high
EDUCATION POSSIBILITY	yes (far)	yes	yes
TRANSPORTATION TYPE	car, motorbike horse, camel, cow	car	car
(POLLUTION LEVEL)			
AIR POLLUTION	no	yes (very high)	yes (varies on location)
GROUND POLLUTION	no	high	low
(ARCHITECTURAL)			
BUILDING HEIGHT	low	low/ medium	medium/ high
LAND DIMENSION	wide	medium	little
BUILDING TYPE	mostly ger	ger+ 1.2 floors houses	apartment
(LIFESTYLE)			
WORK	rural style (herding animals)	urban style	urban style
CONTACT WITH NATURE	completely	medium	little
FOOD	self sufficient with animal and farming	commercial (supermarkets)	commercial (supermarkets)

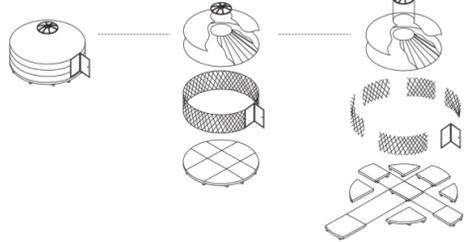


front view of ger

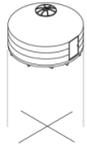
Ger is a traditional housing unit of the nomads in Mongolia. Throughout hundreds of years of nomad lifestyle, ger has been optimum choice for Mongolians.

It is a tent-like housing unit made with wooden structure covered with wool felt. It can be built and dismantled in less than an hour and can be transported on back of no more than three animals (horses, camels, yaks). Nowadays, it can be transported easily by a medium size transportation vehicle. Its architecture has not been modified much for the last several hundred years.

dismantling (~30 mins)



Damage Level to the Ground



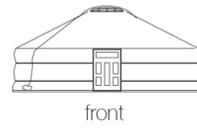
almost no damage to the ground



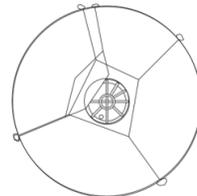
certain amount of damage to the ground

Since this nomadic house does not leave any trace of its existence and does not make damage to the ground by building a found, we can say that it is a nature-friendly housing unit.

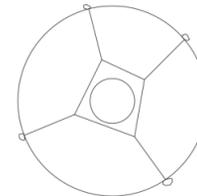
Ger Views



front

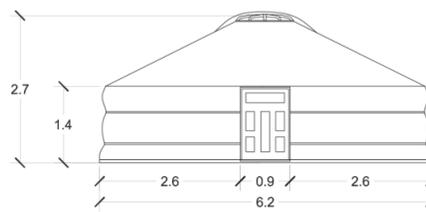


top



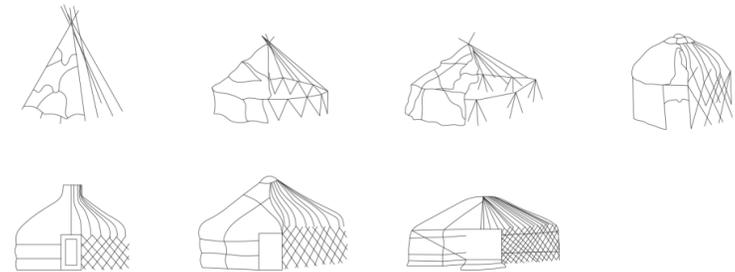
top (window covered)

Ger Dimensions



Dimensions of Ger varies according to the needs but the most common type ger has 6.2 metres of diameter and 2.7-3 metres of height.

Ger Evolution



It has been around 3'000 years since people began to use Ger as a housing unit in central asia.

Animal Role for Ger



sheep or goat's fur is used as an insulation layer for ger. It helps to keep warmth inside ger for long hours even in the worst climate conditions of



three camels can easily carry on ger on their back

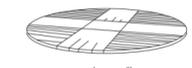
Ger Components



wooden structure



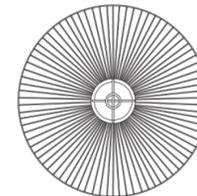
structure of the wall unit



wooden floor (can be dismantled into 9 pieces)



cover layers (outer layer: cotton plastic water insulation felt insulation inner cotton finish)



structure (top view)



1x1.35 door



window at top



window (top view)



window cover



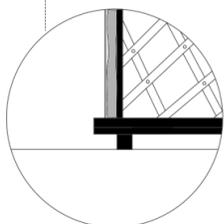
column with traditional oriental pattern



roof cover

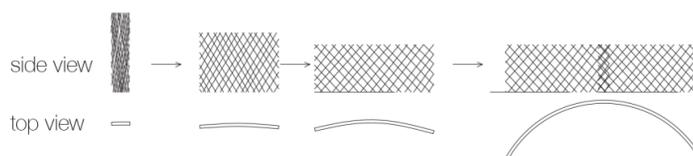


section scheme



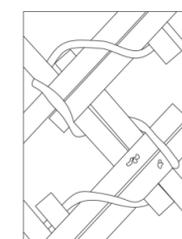
corner detail 1:20

Compressing- Decompressing of th Wall Unit

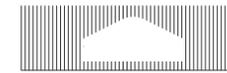


side view

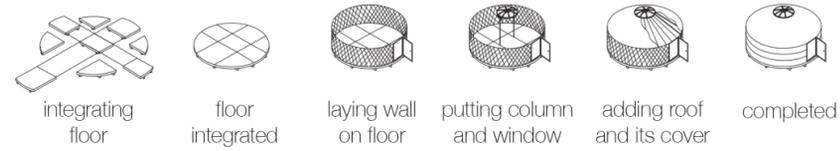
top view



wall connection 1:10



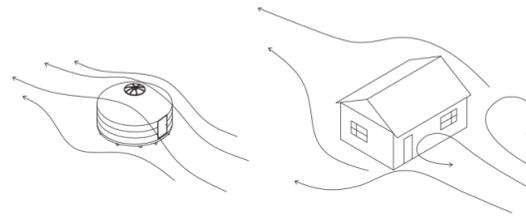
Construction Process



One of the most notable properties of ger is that it is easily built and dismantled. Two adults can build it in less than an hour. Beginning from assembling the floors, walls and a window are placed and finally insulation covers are placed.

Performance

in wind flow



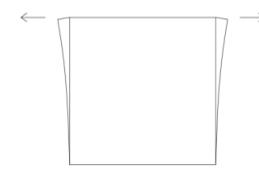
inside heat circulation



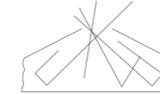
releasing the heat in hot weather



stability in earthquake



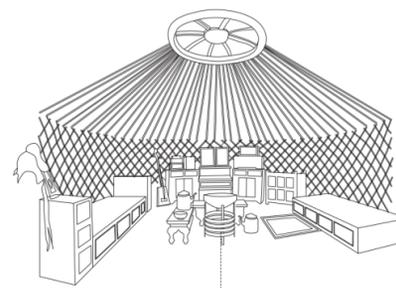
distribution of sunlight



Performance of Ger is type units are strong in wind, earthquake, and harsh winter climates. Though, if the floor is not lifted from the ground well, it is not much durable against flood and also it does not have any fire resistance.

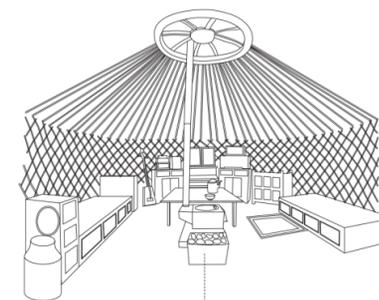
Comparison between ger as a nomadic house and ger in urban settlement

interior of nomadic ger



traditional fireplace

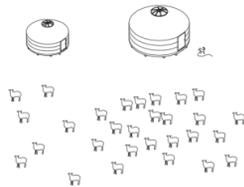
interior of ger-district ger



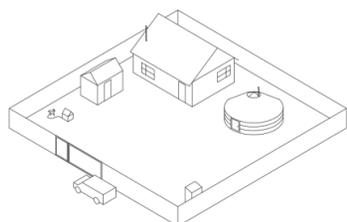
coal burning stove

Usage Types

as a nomadic housing unit



as a ger district housing unit



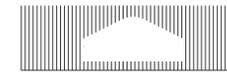
Ger is a nature friendly housing unit. It has been shaped considering the issues of respecting nature and not to create damage to the environment. Mongolian nomads in countryside move following their animals. When they move, there is not much evidence left to prove that they were previously settled there.

They use wood and animal droppings to burn to heat the house which is a way to heat without polluting the air.

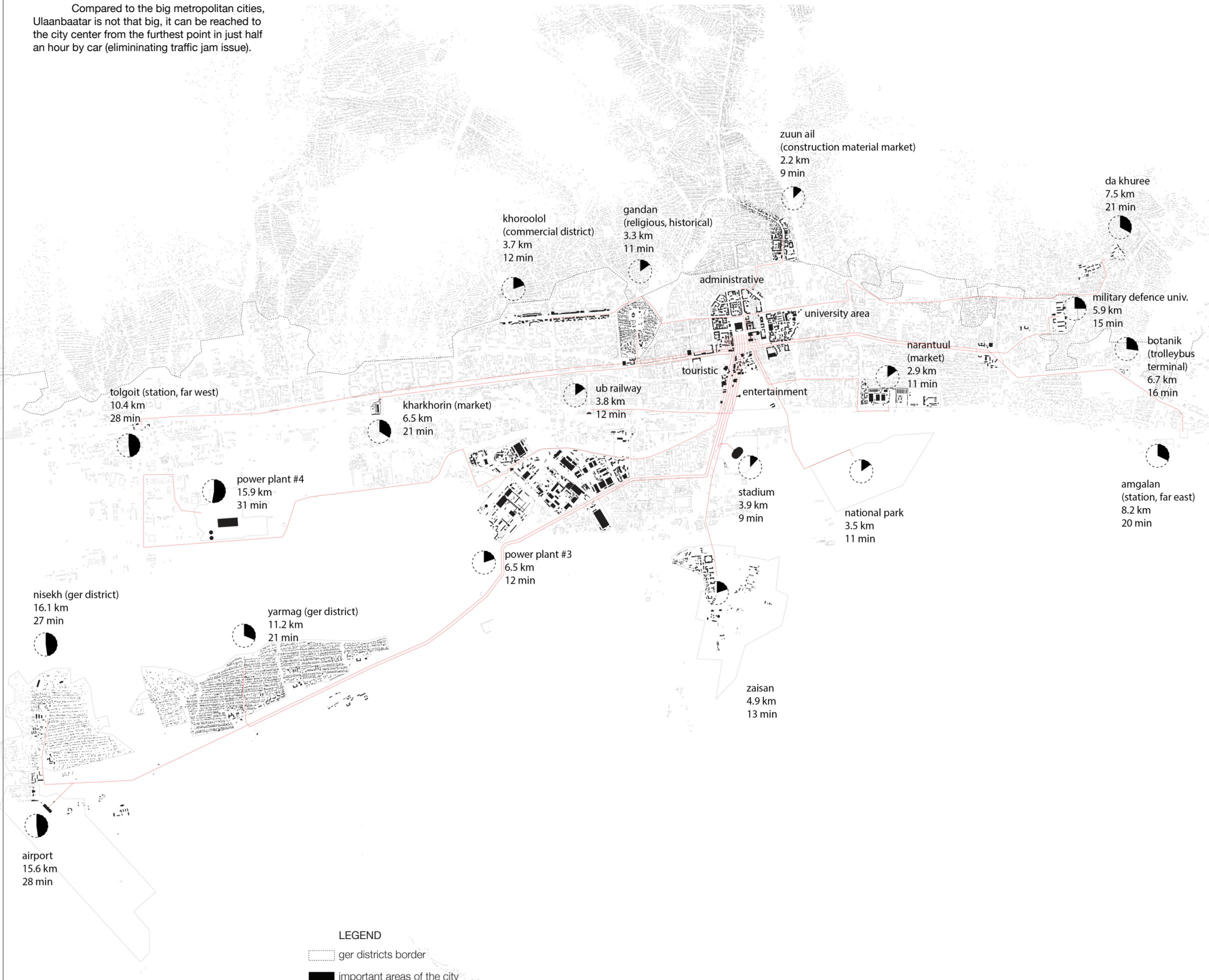
The way people use Ger in the city is very different than they use in the countryside. The biggest difference is that they do not move it often like nomads.

In the city, they have access to coal to burn for heating. Burning coal in long Mongolian winter, it creates extreme air pollution in the city.

ACCESSIBILITY TO THE CITY CENTER BY CAR 🚗



Compared to the big metropolitan cities, Ulaanbaatar is not that big, it can be reached to the city center from the furthest point in just half an hour by car (eliminating traffic jam issue).

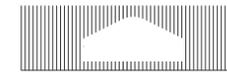


LEGEND

- ger districts border
- important areas of the city

scale 1:50'000





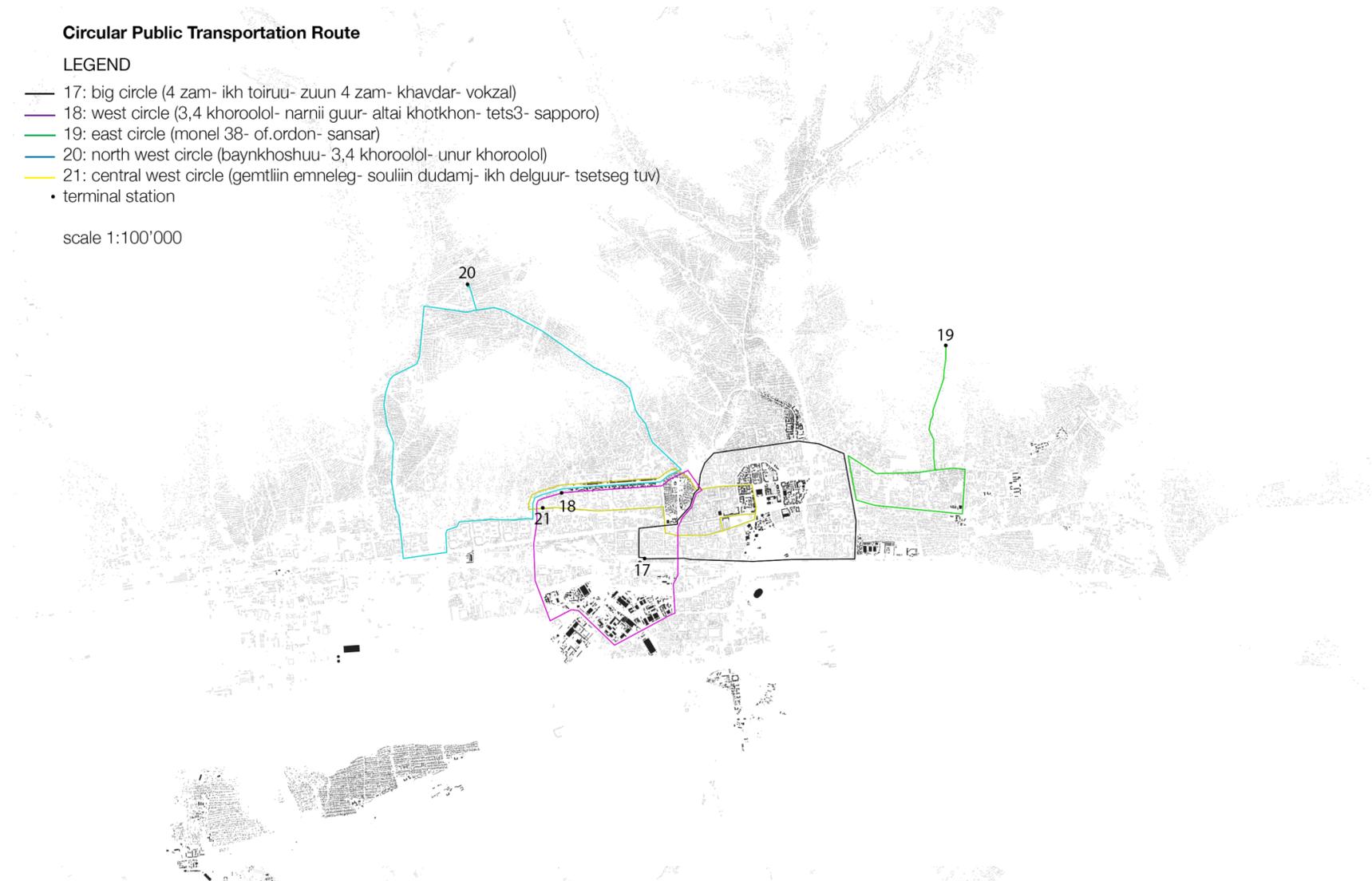
The only public transportation in Ulaanbaatar city is the bus. Only a few years ago, it was not necessary to have another means of transportation except the bus, now the buses are getting crowded during peak hours and the city needs additional public transportation system like metro. Some of the inhabitants of distant ger districts might have difficulty in terms of transportation services

Circular Public Transportation Route

LEGEND

- 17: big circle (4 zam- ikh toiruu- zuun 4 zam- khavdar- vokzal)
- 18: west circle (3,4 khoroolol- narnii guur- altai khotkhon- tets3- sapporo)
- 19: east circle (monel 38- of.ordon- sansar)
- 20: north west circle (baynkhoshuu- 3,4 khoroolol- unur khoroolol)
- 21: central west circle (gemtliin emneleg- souliin dudamj- ikh delguur- tsetseg tuv)
- terminal station

scale 1:100'000



long bus with special route



medium sized bus



mini bus

Horizontal Public Transportation Axis

LEGEND

- 1 (of.ordon-5 shar)
- 2 (sharkhad- mubis- 3,4 khoroolol)
- 3 (zuun salaa- mubis- khaldvart)
- 4 (5shar- 3,4 khoroolol- ktms)
- 5 (shar khad- zuun ail- 3 surguuli- baynburd)
- 6 (tolgoit- vokzal- botanik)

scale 1:100'000





Compared to the big metropolitan cities, Ulaanbaatar is not that big, it can be reached to the city center from the furthest point in just half an hour by car (eliminating traffic jam issue).

Vertical Public Transportation Axis

LEGEND

- purple (misheel expo- baynzurkh 21)
- red (zaisan- 7 buudal)
- green (niseh- 7 buudal)
- blue (khunsnii 4- niseh)
- terminal station

scale 1:100'000



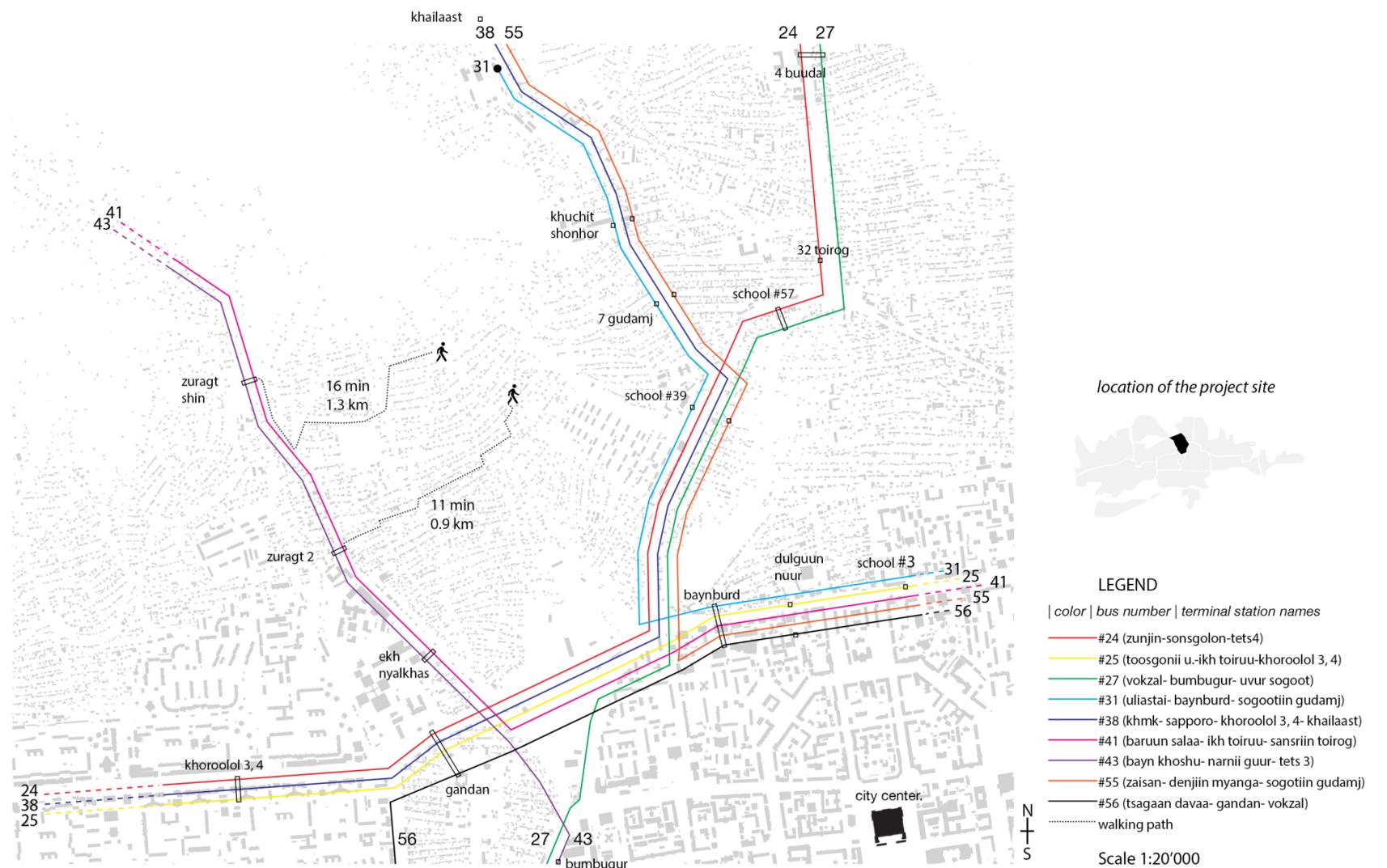
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ANALYSIS: PUBLIC TRANSPORTATION AROUND PROJECT SITE



There are 9 different public bus lines passing through the area. 27 and 56 brings passengers to the train station, where they can go to other cities and countries.

In the area, it takes more than 1km of walking in order to reach the nearest bus stop. It shows that some additional public transportation vehicles are needed for the people living in the project area.



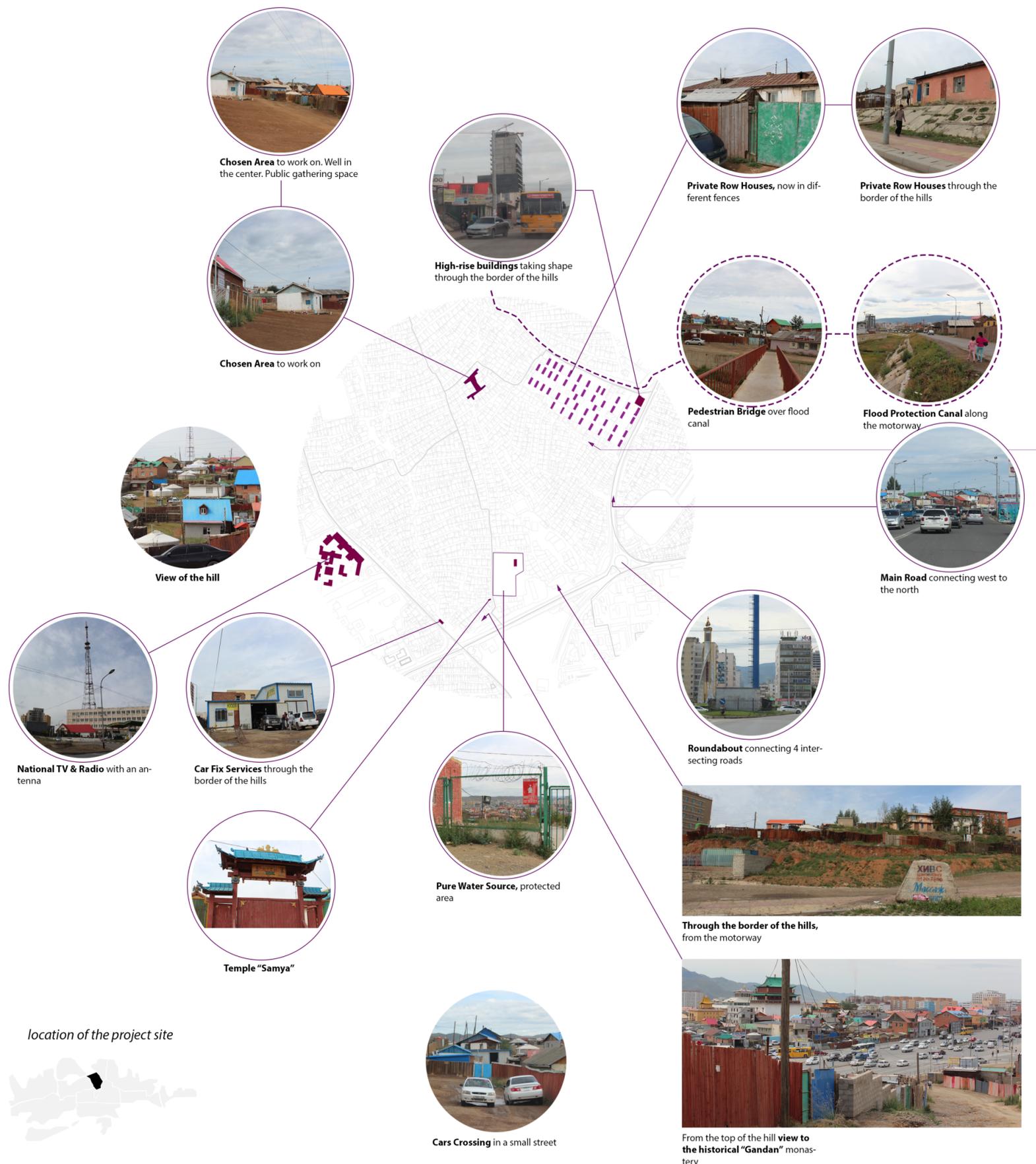
PROPOSAL: ECOLOGIC MINI-BUS SYSTEM

At some parts of the site, it takes 15 minutes to get to the nearest bus station. So the additional mini-bus service line can contribute to the area's life comfort.



FENCE & ITS TYPE

(generally wooden material with random colours)



It is true that once all of the Mongolians lived in yurts but now people of Ulaanbaatar city is divided into two categories; those who are living in ger district and those who are in apartment buildings.

Children in ger-districts have to deal with more difficult labours compared to the children living in apartments. They spend many of their daytime waiting in the line in water kiosks. The most challenging is the winter period that they have to carry water in -25 degrees cold.

- Problems in Street scale**
- No pavement (causing sliding in winter)
 - No light
 - Lack of public spaces
 - No regulation for building fence
 - No security protection against fire
 - No rainwater protection system
 - Soil contamination
 - Lack of greenery
 - Lack recreational spaces
 - Lack of standardization systems (ex: building material)
 - Lack of official trash collection points

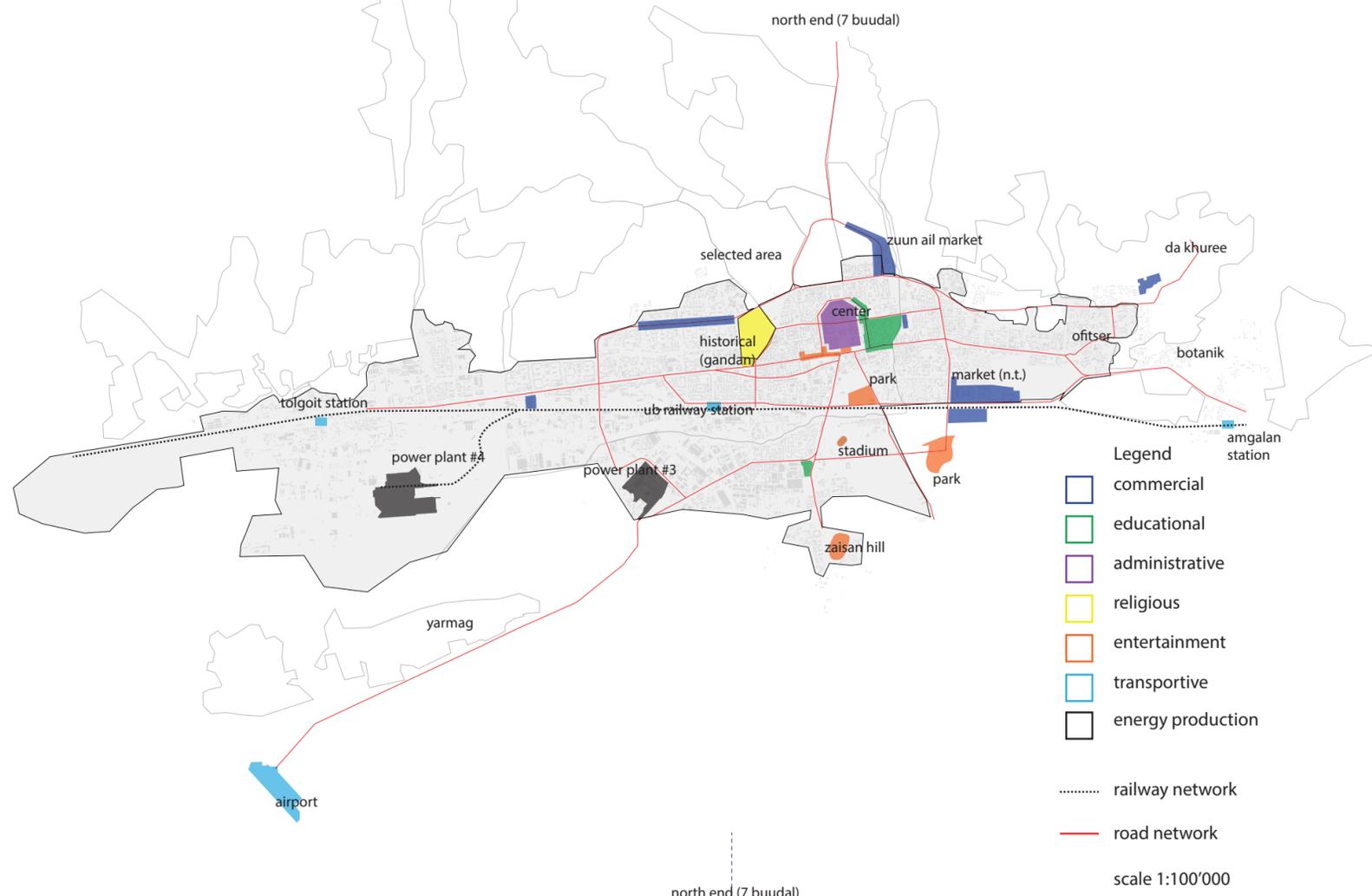


ANALYSIS: FUNCTIONS OF THE CITY

Since socialist period under Russian influence fell off, city planning of Ulaanbaatar city did not extend much to outward but it got more dense and crowded. From the plan view, we can say that only ger-districts were the major extension of the city for the last few decades.

City is extending more to the north rather than any other directions, it is because southern part of the city is protected land area with high mountains.

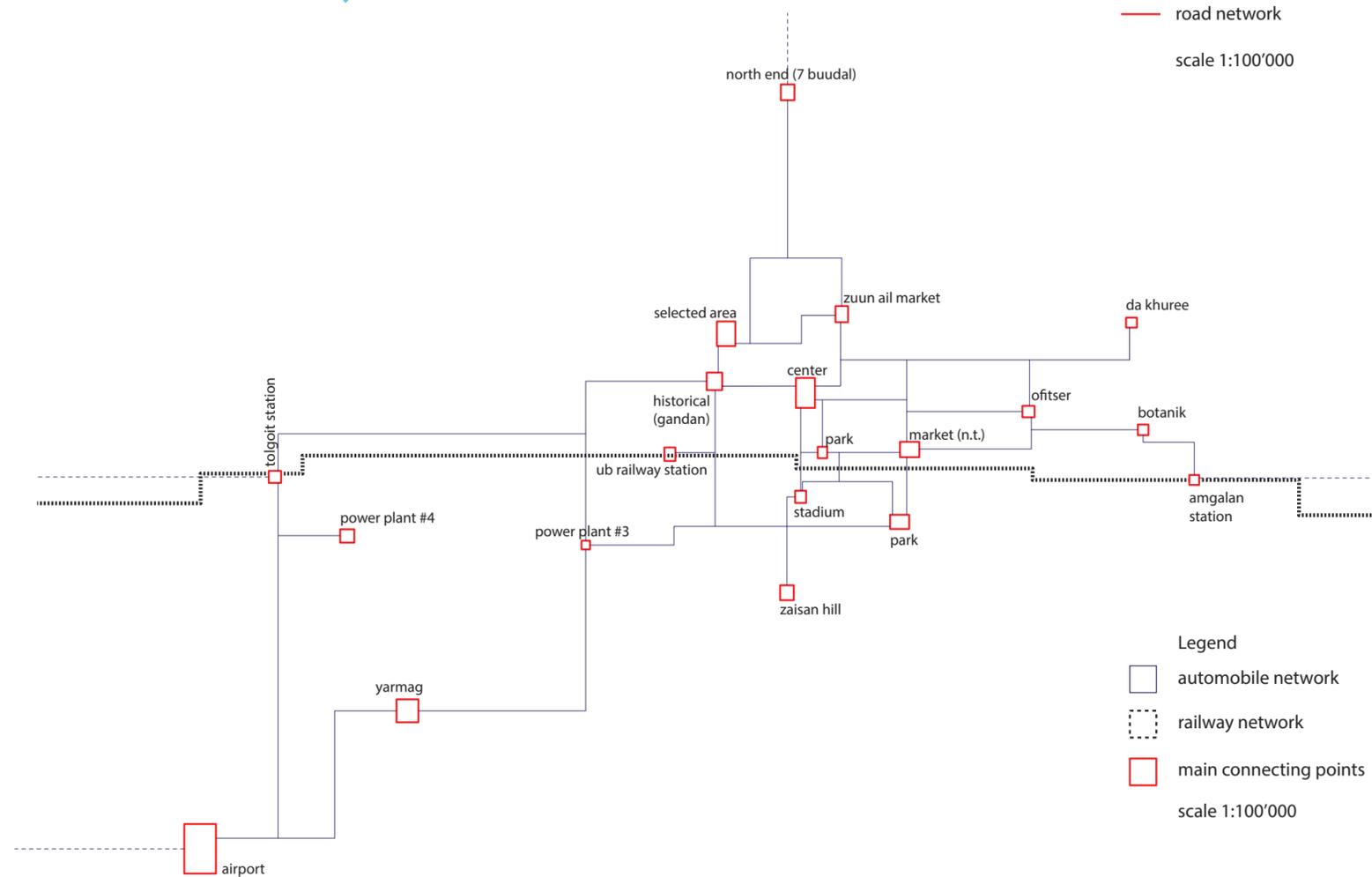
We can also say that almost all of the functional activities except residential are located more to the city center part and outside ger districts.



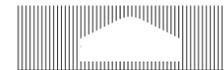
- Legend
- commercial
 - educational
 - administrative
 - religious
 - entertainment
 - transportive
 - energy production
 - railway network
 - road network
- scale 1:100'000

SCHEME: CONNECTION NETWORK OF THE MAIN AREAS

From the scheme, we can see how the notable parts of the city are connected and how many main routes to get there. The main city planning is shaped by the influence of covering mountains. Trans-Siberian railway line is crossing the city in linear direction with three major stations.



- Legend
- automobile network
 - railway network
 - main connecting points
- scale 1:100'000



ANALYSIS: FUNCTIONS OF THE PROJECT SITE

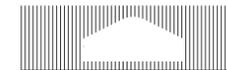
Chingeltei district 8 and 9 th quarters are selected. The area consists mostly of ger parcels and there are not many functional activities to do, which is one of the serious problems. Lack of playground, public areas, entertainment, job opportunities, shopping areas make people move outside the area or quit to do those activities.

There is lack of green areas such as parks, grassland, and forest. The infrastructure is at quite poor level except the electricity.

There are high risks of fire, flooding, and crime. Since the settlement structure is quite confusing, there is possibility of firefighters lose time searching for the location. Also there are no rainwater removal lines which might cause rainwater to flow in any direction when it pours in summertimes. Even if the streets have lights, there are not many people in the street at dark hours because of lack of public activities and people prefer to stay at their private parcels.

Surrounding the area, there are enough high schools and market places but we almost cannot find any other functional places except some small shop in the ger-area. Therefore, the area looks dull and inactive even in the daytimes.

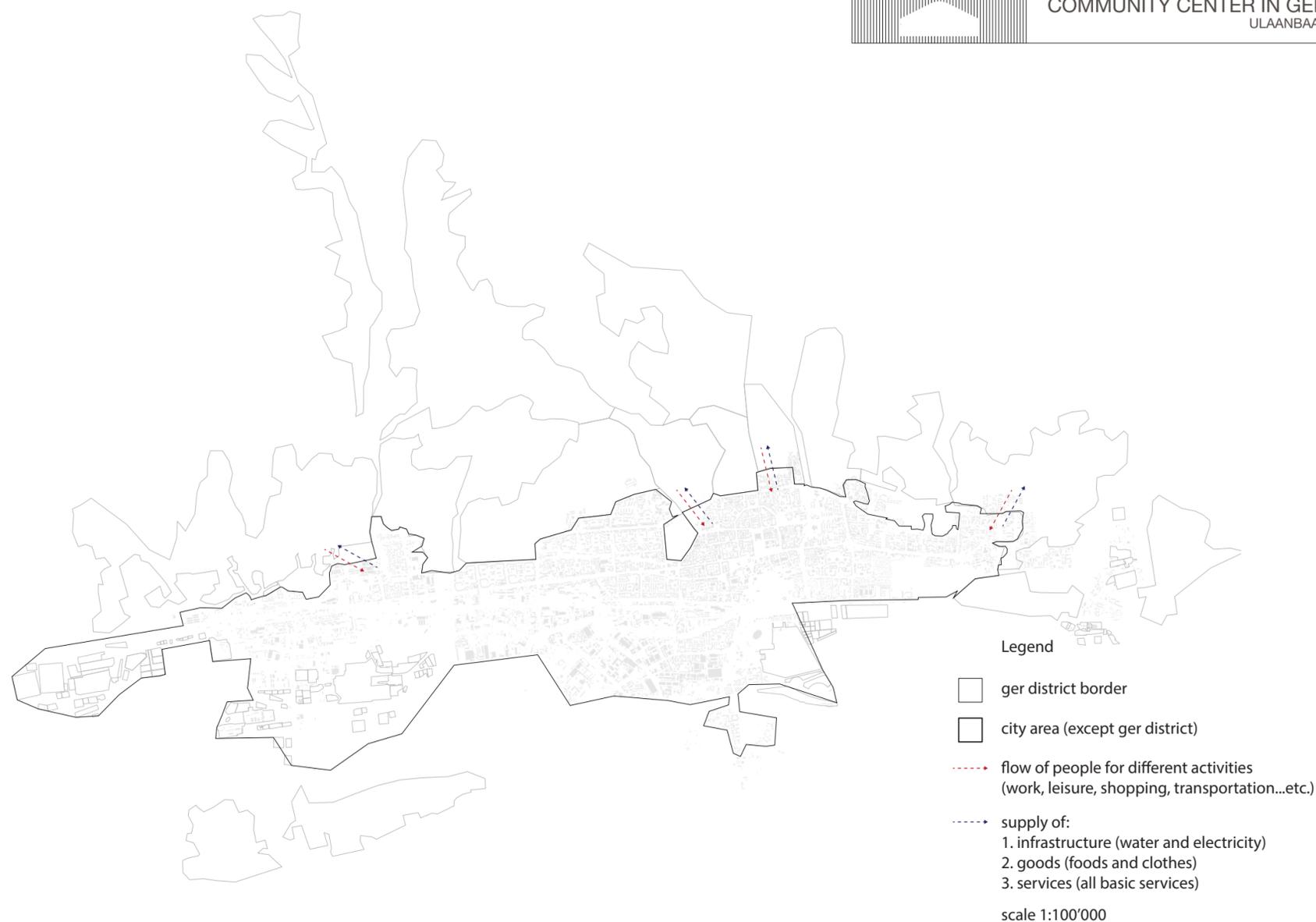




ANALYSIS: RELATION BETWEEN GER-DISTRICT AND THE CITY

Even if it may seem that Ger-districts are connected physically to the city, they are quite isolated in terms of activities. In Ger districts, there are not enough entertainment activities and this condition leads to the movement of people everyday from Ger districts to the cities by using public transportation. It is really necessary that each Ger district areas to have their own independency in terms of both infrastructure and function.

Ger-districts affect the city negatively by polluting the air, creating soil contamination, and overcrowd in traffic flow. Also, those Ger-districts supply all their goods and services from different parts of the city.



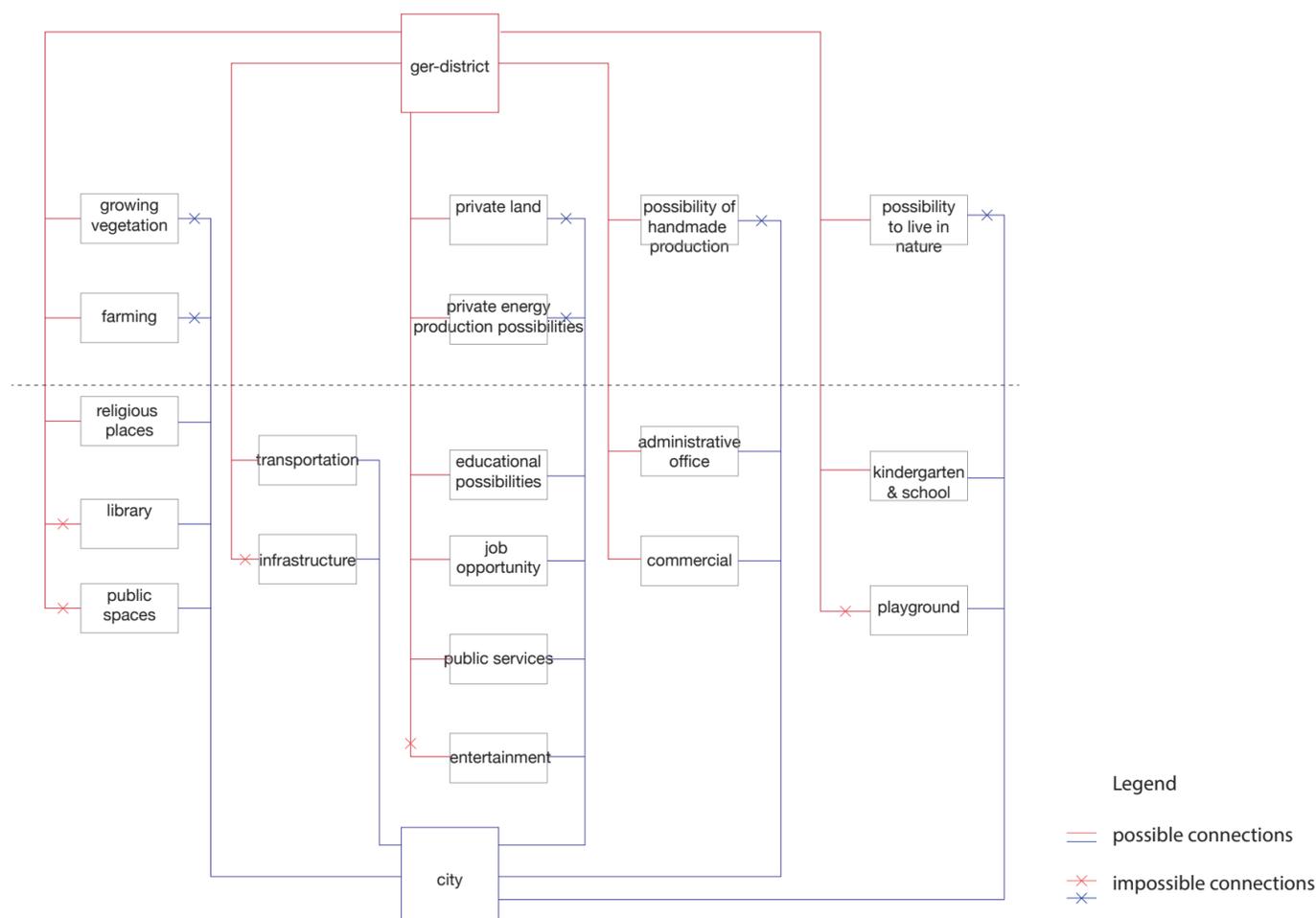
ANALYSIS: COMPARISON OF GER-DISTRICT AND CITY (IN TERMS OF ACTIVITIES & OPPORTUNITIES)

Living in the city center provides much more opportunities to the people than living in ger-districts. Locals of ger-districts usually have to go to the city to get some of their basic needs. Therefore, the living condition in ger-districts are quite stricted and poor but there are much more opportunities in ger-districts to have a better living condition than living in the urban part of the city.

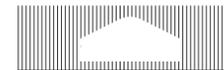
We can make conclusion from the scheme that ger-districts provide more natural way of living than living in apartments. They can have their own farmland and vegetation spaces or they can even build their own habitat, which is impossible to do for somebody living in apartments.

Living in apartments provide easy accessibility to most of the public services such as education, job, and public spaces.

Thus, this project will be focused on searching for opportunities on finding the ways to make ger-districts to provide better living conditions to local people.



Legend
— possible connections
—x— impossible connections

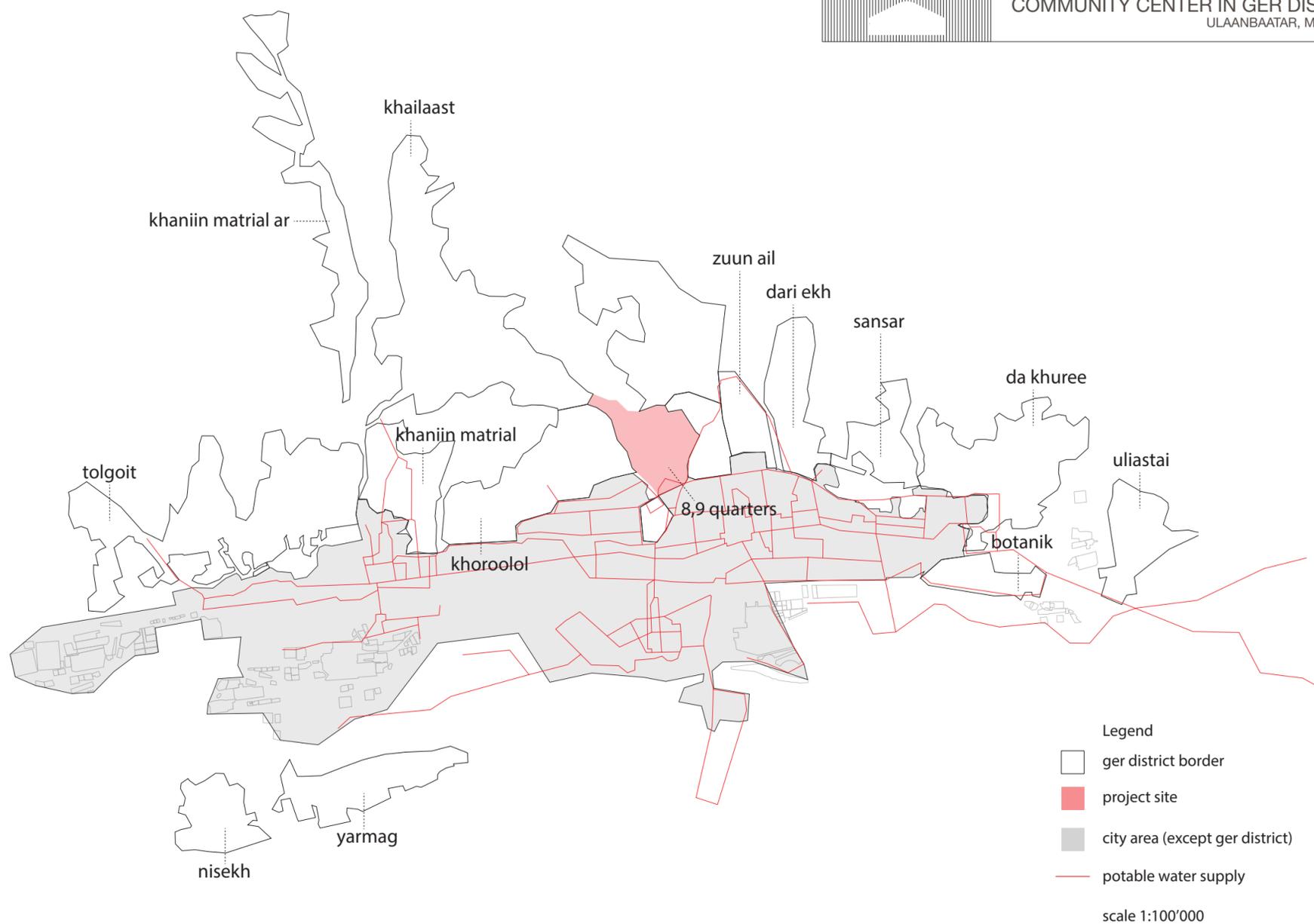


ANALYSIS: WATER SUPPLY NETWORK OF THE CITY



Ulaanbaatar city water supply is provided by the river and deep ground water. Most of the areas in Mongolia have water flow in the deep ground but it is not unlimited. So water usage should be treated carefully.

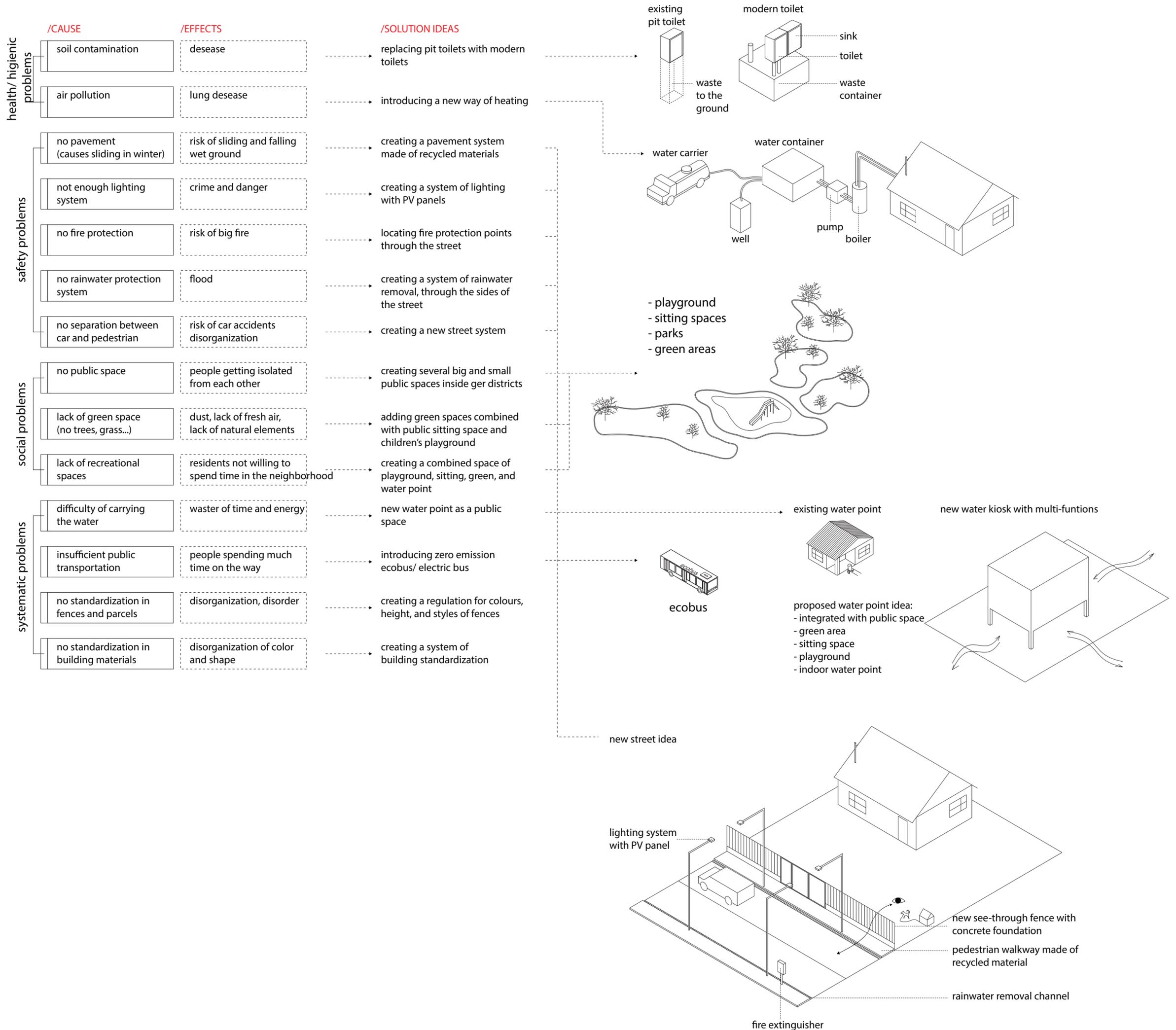
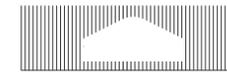
The positive side of the Ger district is that local people use much less water in a day than those who are staying in apartment. For instance, if we imagine 5 liters of water is used by one ger district resident, one person in apartment is using around 100 liters of water in a day. Therefore, even if we provide pipelines through all the ger-districts, city water treatment plant will have a problem of water shortage.



PROPOSAL: WATER SUPPLY

It can be an advantage that one of several water reservoirs of the city is located in the area. It gives possibility to build water pipelines through proposed public spaces around the area.

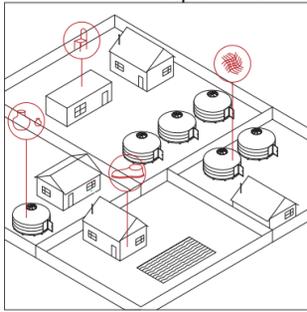






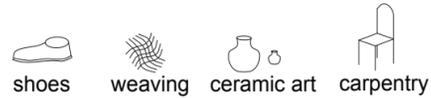
INDUSTRY

producing handmade local products



Each parcel of Ger district has its own land of around 600 metres square and it has potential to make kinds of small or medium size productions.

Through the borders of ger districts, usually there are market areas. So, productions made in that specific area can be sold with the help of those market areas through the border of the district.



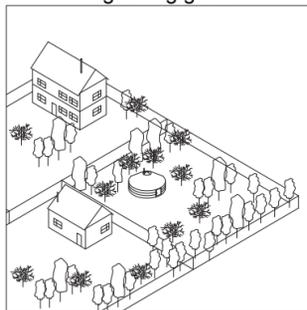
recycling stations

Recycling waste: Everyday, tons of rubbish is thrown away from ger districts without being sorted or re-used. If there is a possibility to re-cycle plastic, metal, or even biological wastes, it will have a huge positive impact on the district as well as the city.

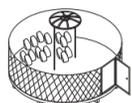
The simplest is maybe to re-cycle biological rubbish, since households can do it in easily in their own private land of Ger district.

GREENERY

planting trees & growing grass



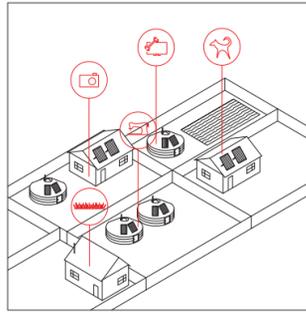
Trees are one of the methods to reduce air pollution. The wide landscape of Ger districts are totally capable of growing an Urban forest.



use of Ger as a storage

SERVICE

locals providing service to themselves

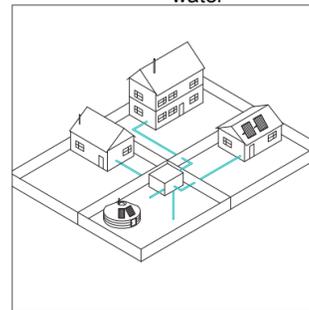


There are absolutely not enough service areas in Ger districts. People have to go to the city center to get basic services. Sometimes those service areas are kilometers away.

Self-sustainable Ger district will be independent from the city, so they have to have their own basic service centers. The idea is that those new services will be operated by that district citizens, as a result, each district will have their own characteristics and speciality.

RESOURCE

diggin deep ground water

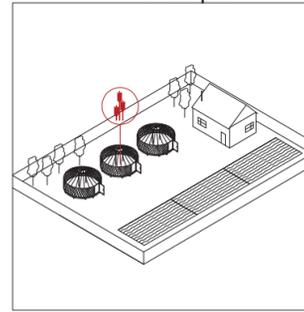


Even though Ger districts are totally isolated from pipelines of city water access, it can harvest its own water from the deep underground. The number of water kiosks can be increased since there are times when hundreds of households take water from only one point.

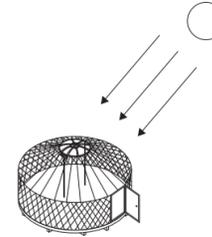
Pipeline: Another method to get access to pure water is to build network of pipelines through ger district.

FOOD

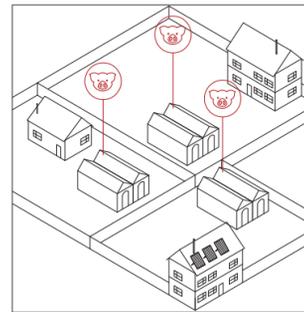
growing vegetation in the parcel



Even though Mongolia has a harsh sub-arctic cold climate, it has 3 months of warm summer season. There are still opportunities to grow vegetations in "Khashaas" (parcels) of ger district because of its wide open and private space.



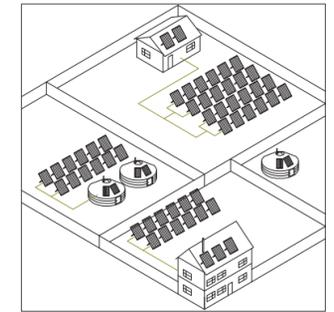
use of Ger as a greenhouse



Farming: It is possible that one parcel to hold a farmhouse with pigs, cows, and chicken. It will help them to supply food materials to the district.

ENERGY

building PV panels

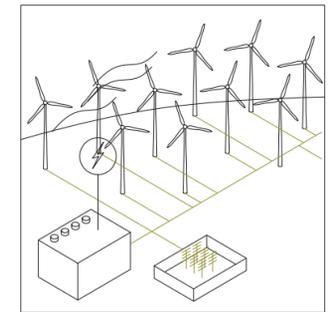


Solar energy production: Because of 250 of 365 days of Mongolia are sunny, it is suitable to produce energy by using sunlight.

Specially Mongolian Ger districts have many types of infrastructures that can hold PV panels and there is space for installing those structures. The only difficulty in applying this method to Ger districts is that it costs more than what is used there at the moment.

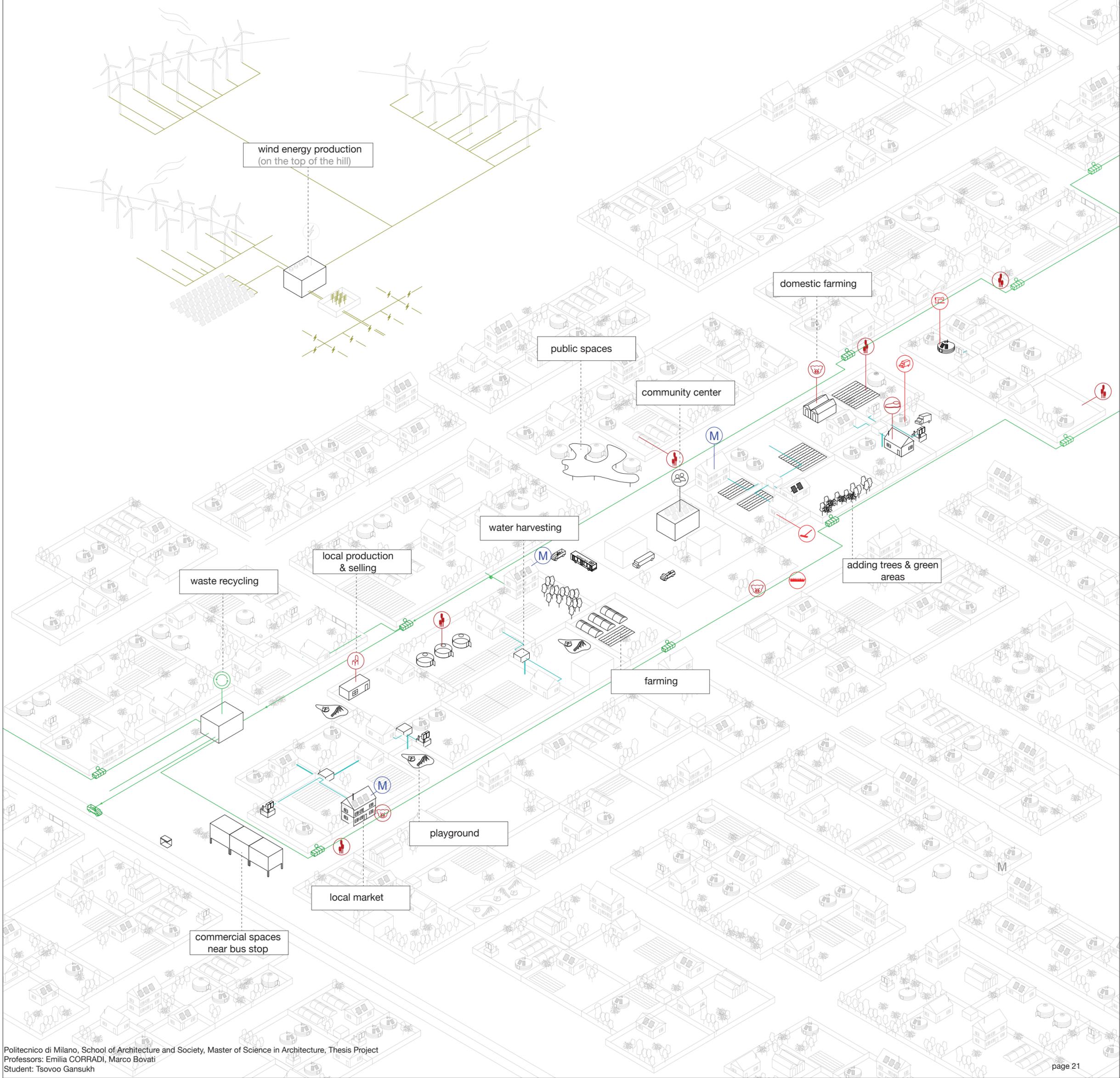
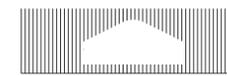


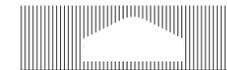
installing solar panels on Ger



Wind energy production: Mongolia is located in a high altitude with cold windy climate and has vast natural landscape which is suitable for wind farming.

According to the design rules, wind turbines need to be located in a place with wind of 16km/h speed. Unfortunately, Ulaanbaatar city is located in the valley with high mountains which obstruct winter wind and the air circulation is obstructed. However, there are a lot of vast landscapes that has high wind circulation in the countrysides of Mongolia.



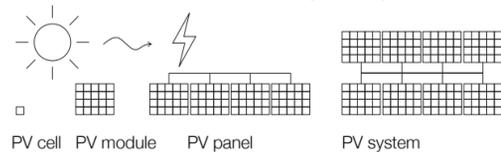


photovoltaic system

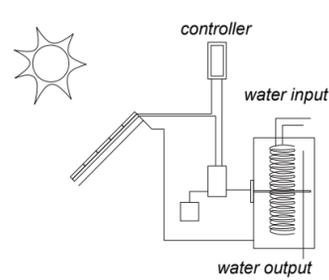
Photovoltaic system is an environmentally friendly power system designed to supply usable solar power by means of photovoltaics. A rooftop system recoups the invested energy for its manufacturing and installation within 0.7 to 2 years and produces about 95% of net clean renewable energy over a 30 years service lifetime. ("Photovoltaics Report" (PDF). Fraunhofer ISE. 28 July 2014)

Sunny days in Ulaanbaatar
108 days cloudy

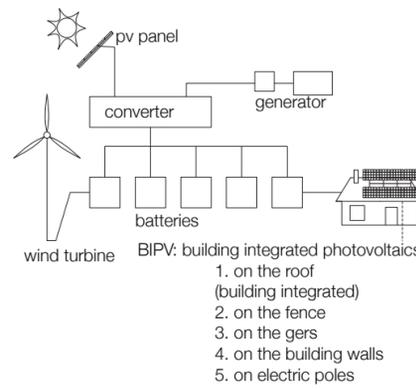
257 days sunny



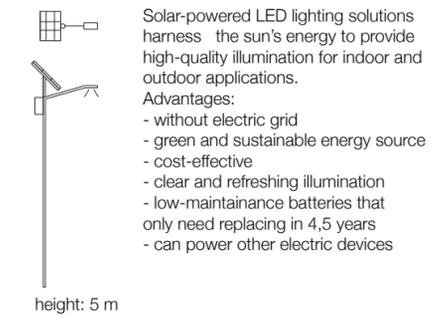
Heating System with PV panels



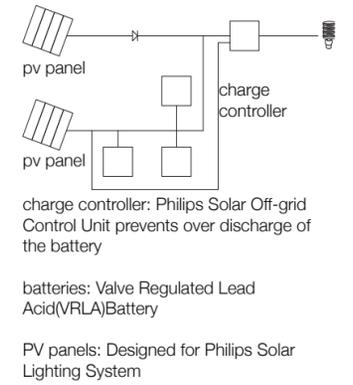
PV and Wind turbine combined system



Standalone Off-grid Street Lighting System

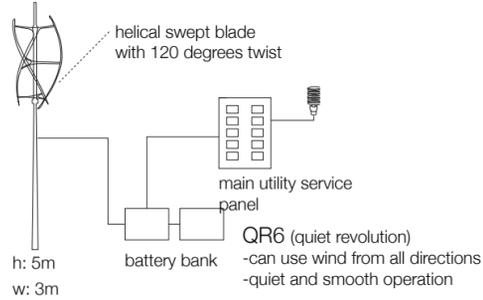


Stand-alone PV panel system with battery & charge controller

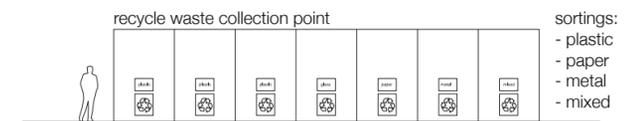
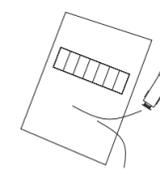
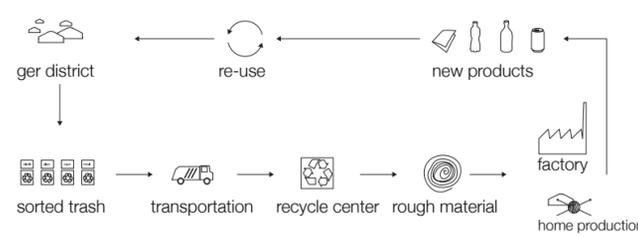


wind turbines

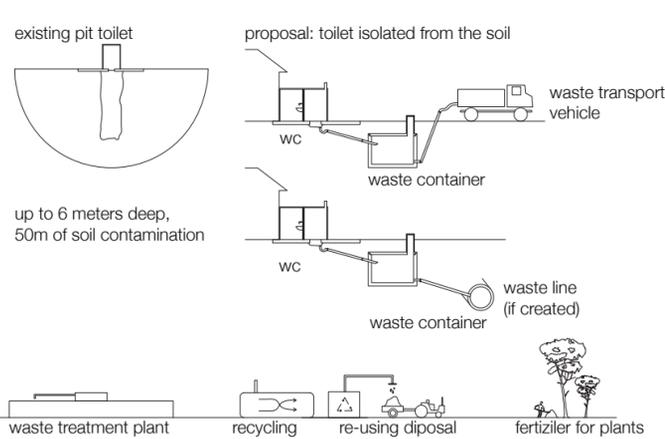
basic grid tie of wind turbine



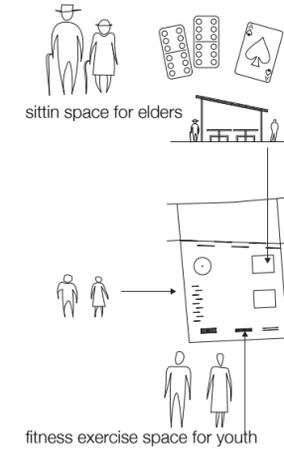
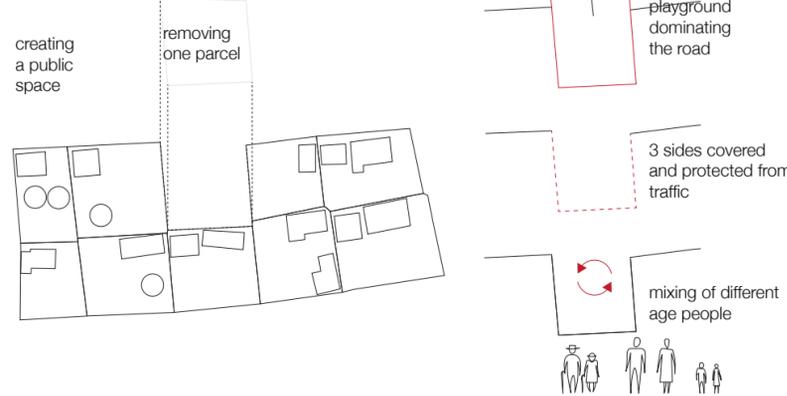
recycling the waste



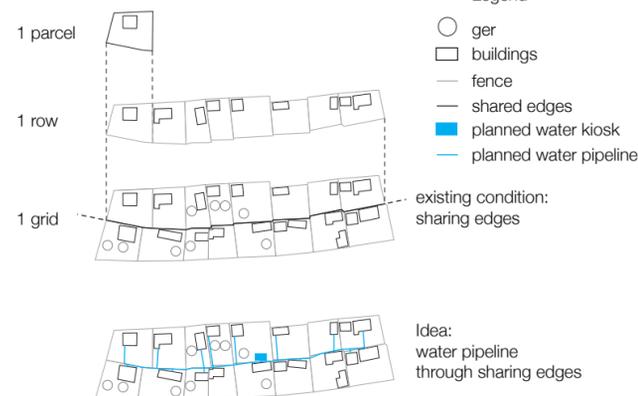
toilet drainage system



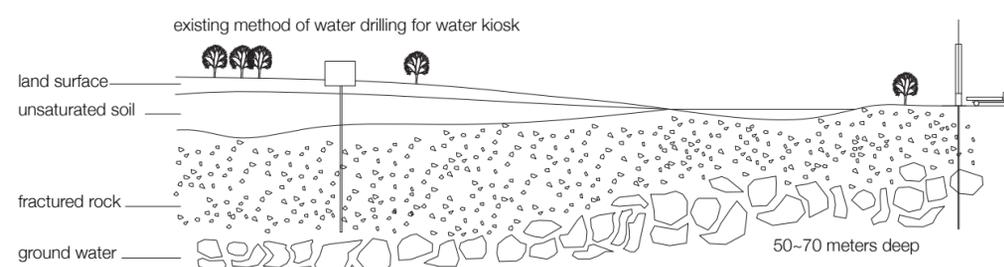
playground



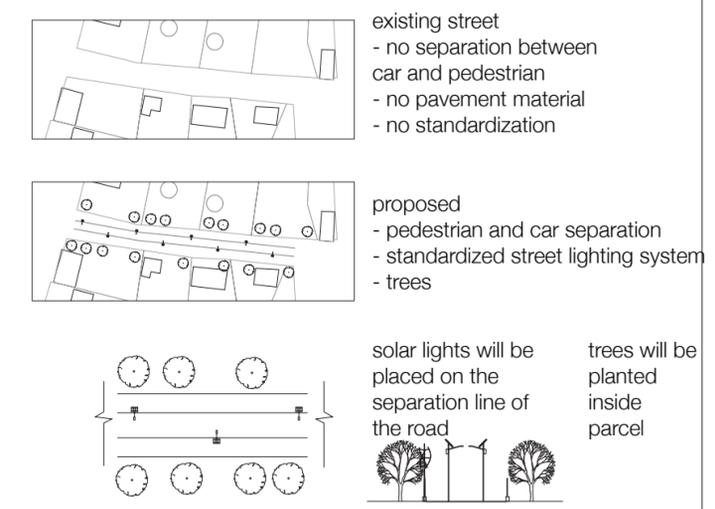
water distribution method

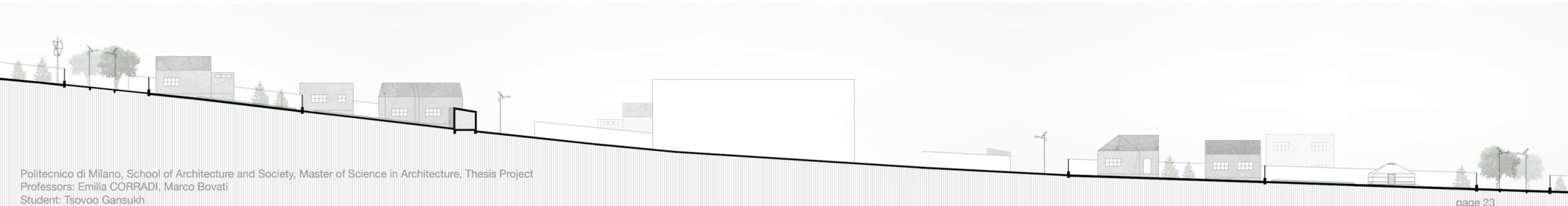


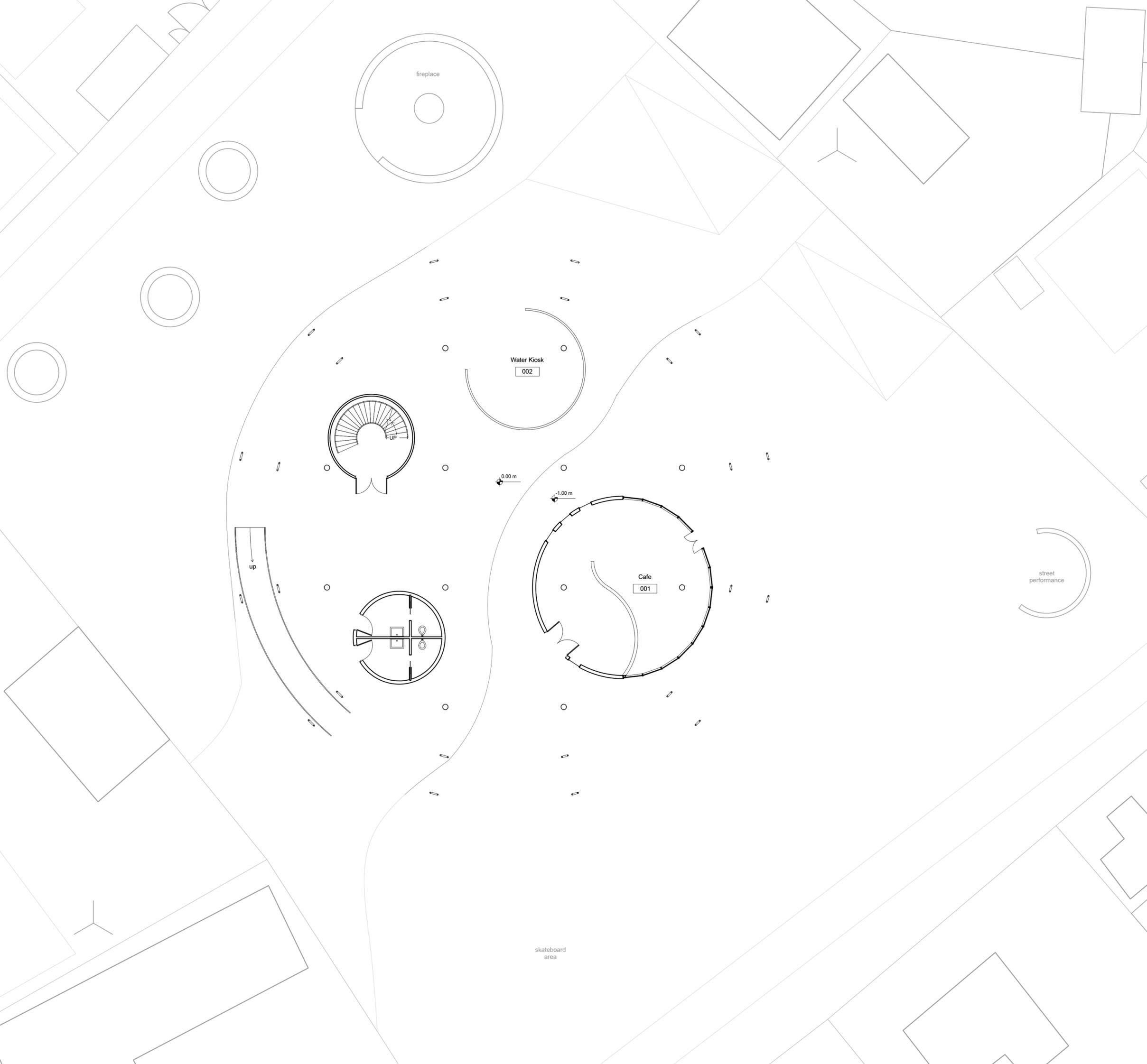
Each row is neighboring with other row with its one side and that side can be where water-distribution pipeline can go through.

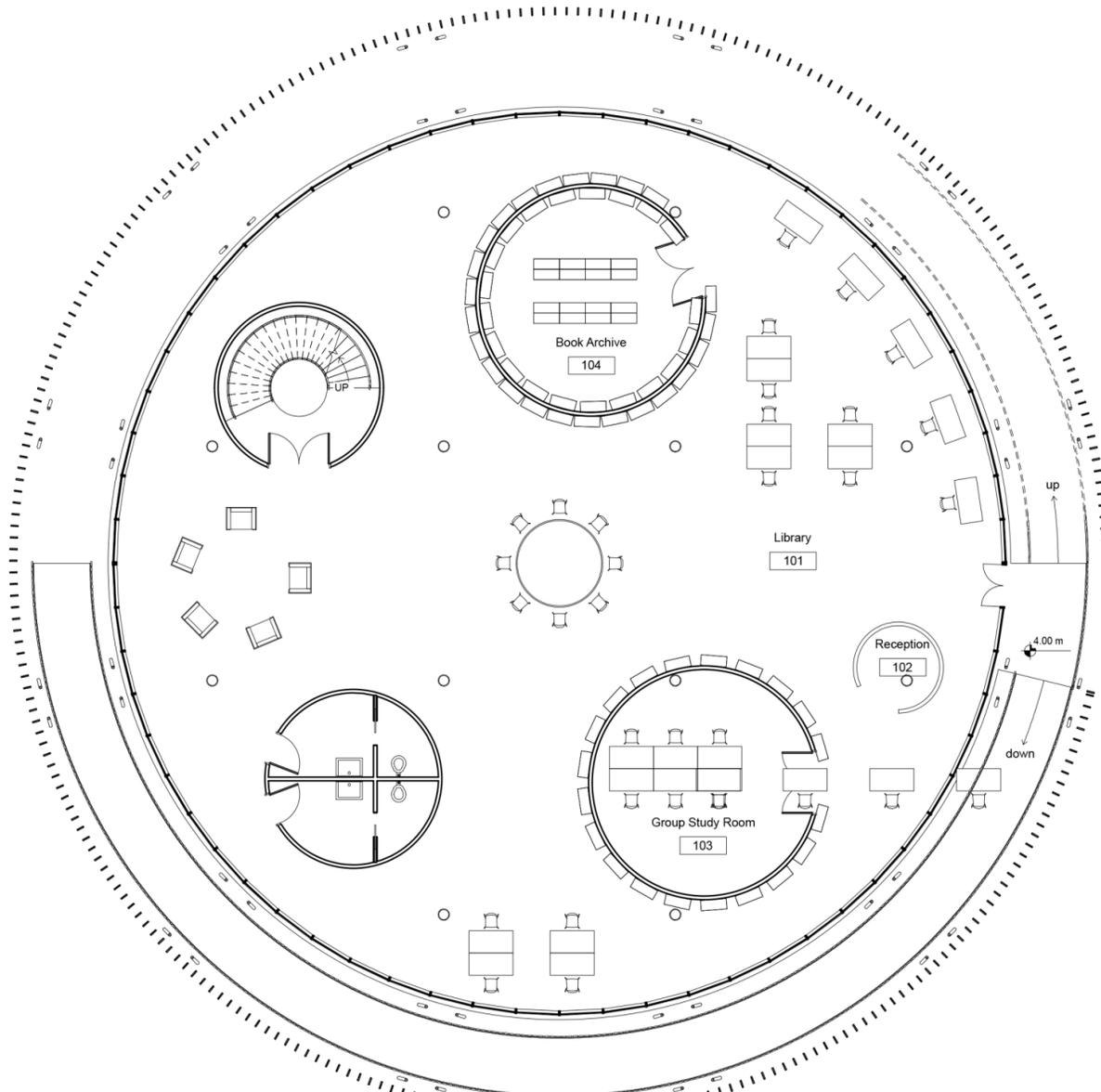
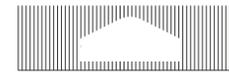


street system

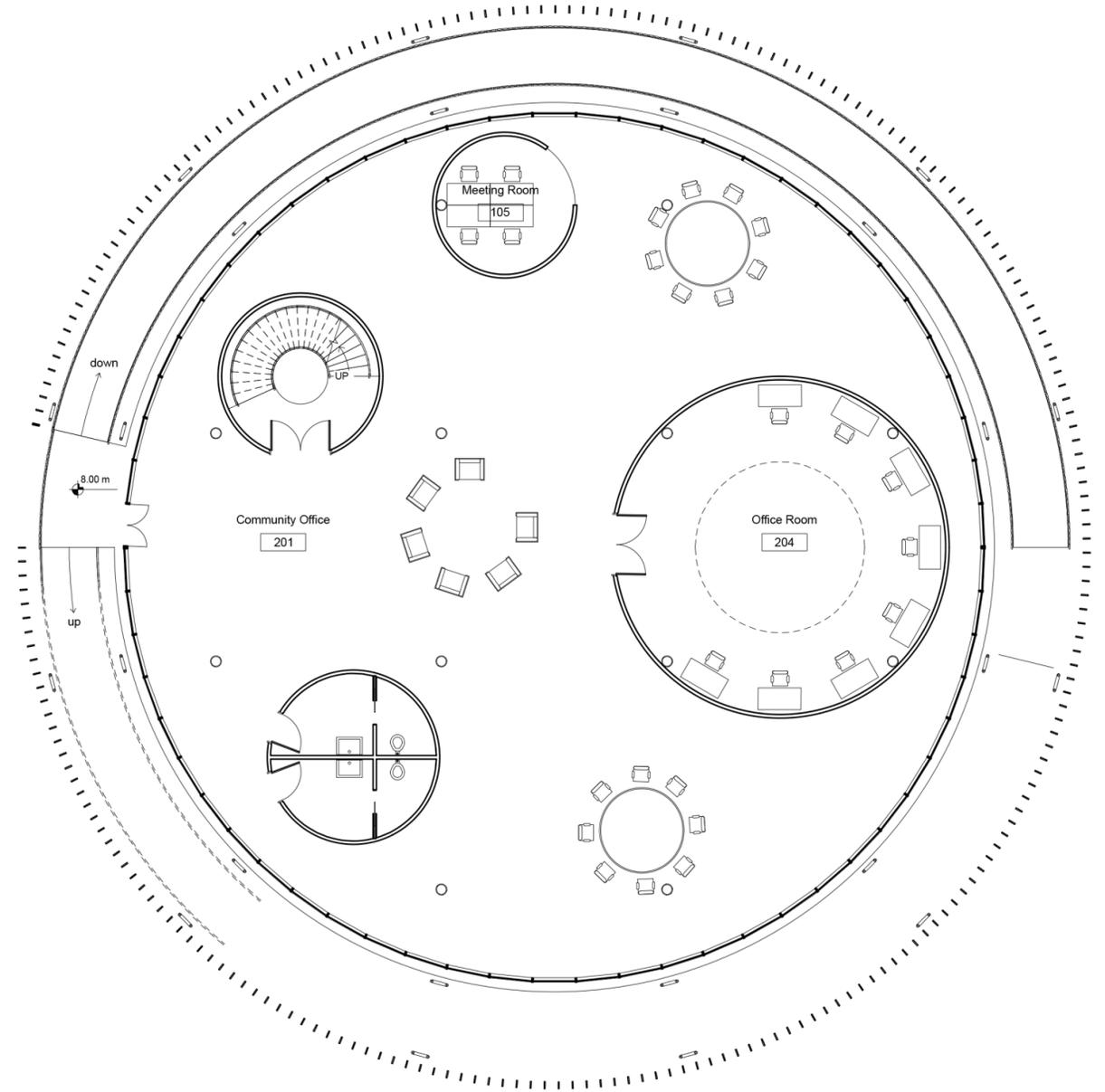




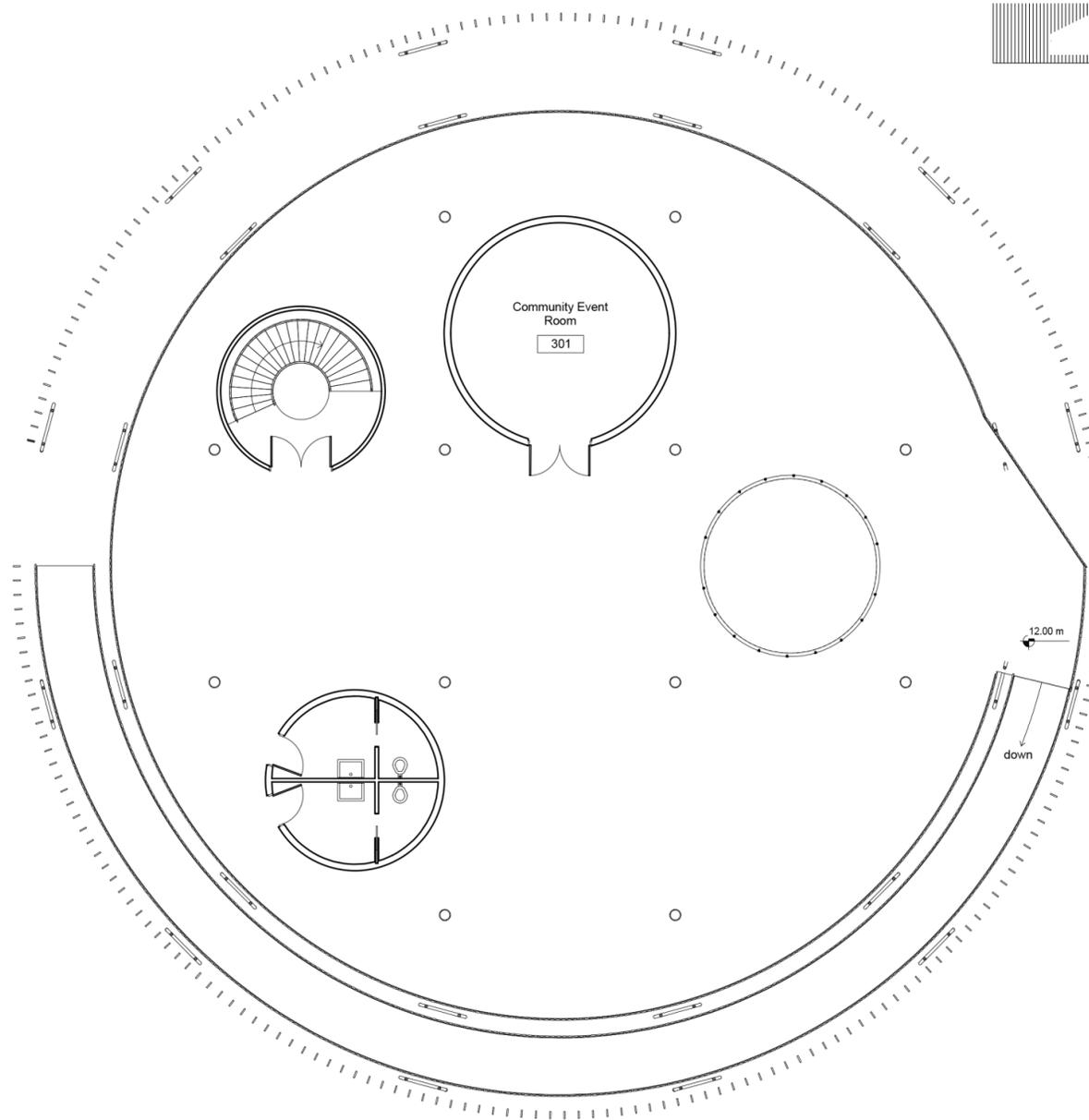




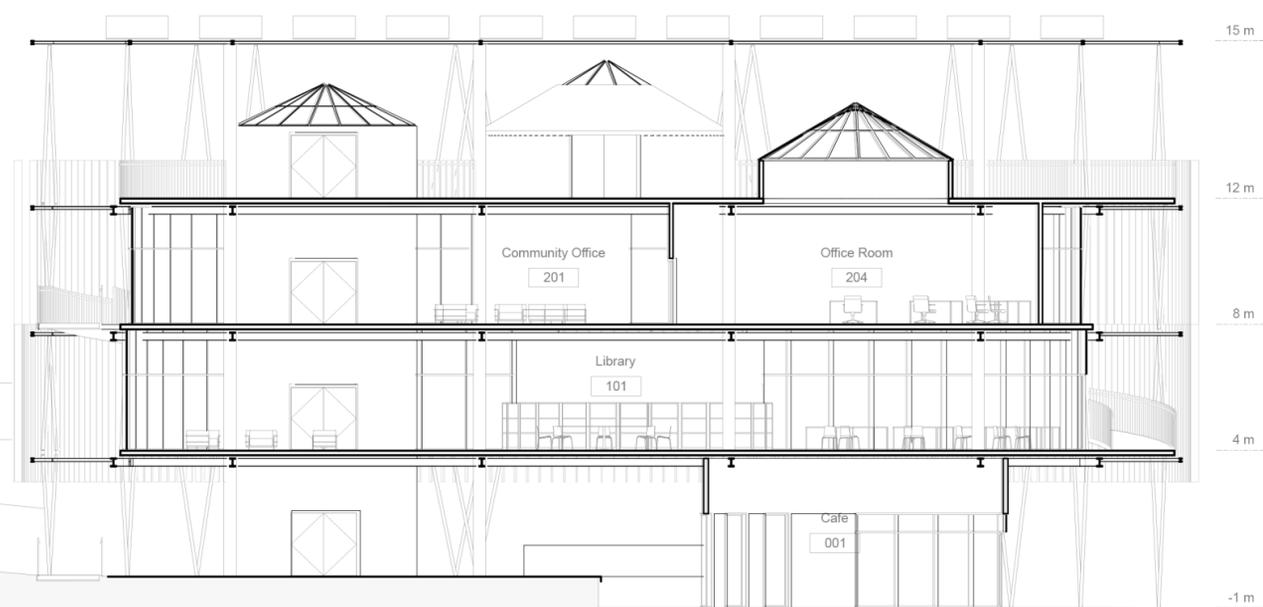
1ST FLOOR PLAN 1:200



2ND FLOOR PLAN 1:200



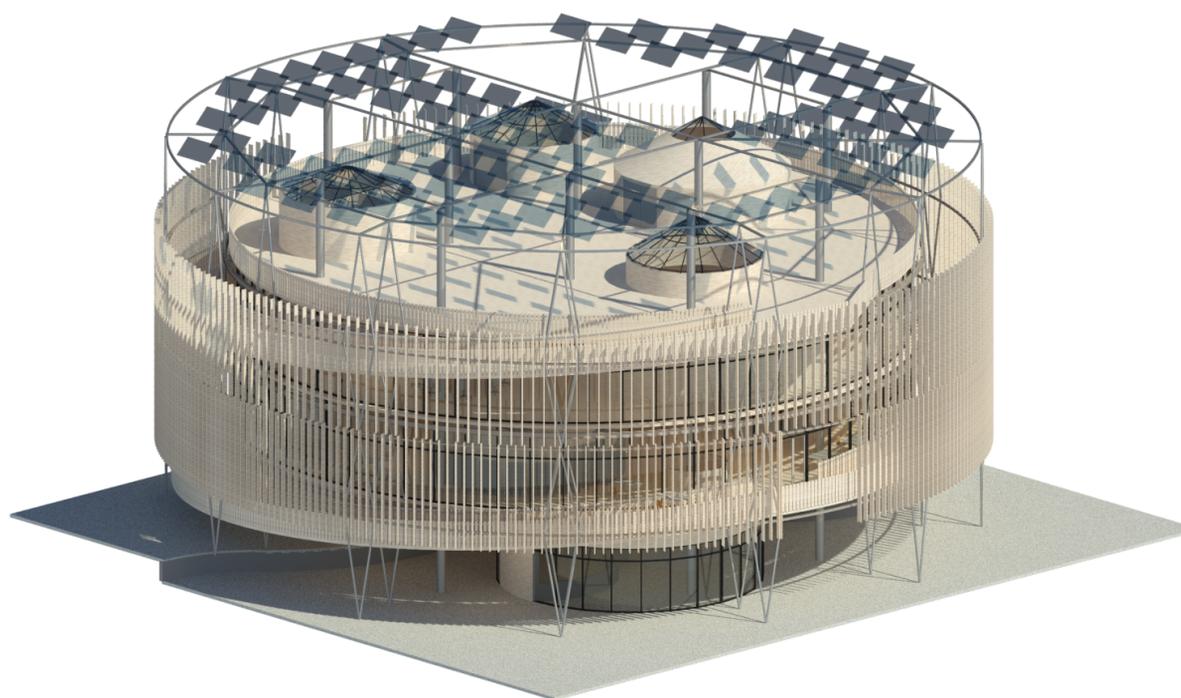
3RD FLOOR PLAN 1:200



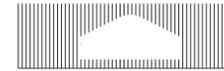
SECTION 1:200



ELEVATION WEST
1:200



3D MODEL



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