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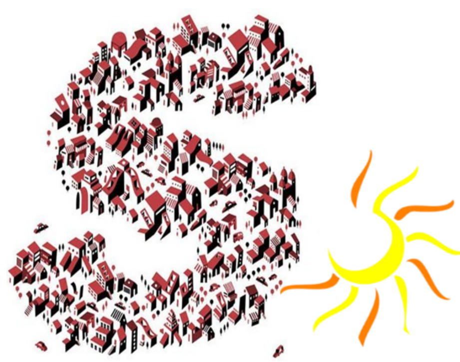
Urban Planning Engineering

كلية الهندسة و تكنولوجيا المعلومات
قسم التخطيط العمراني

An-Najah National University
Urban Planning Engineering
Graduation Project

DESIGNING & PLANNING A



LAR
NEIGHBORHOOD

This project aims to planning and designing a new residential neighborhood at the west of Nablus City take into account the sun aspects at the first degree. So that it works to take advantage of renewable energy of the sun to reduce the consumption of fuel and energy production.

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1. Chapter 1:Introduction :

Recently, the world is moving towards the Promotion of Renewable energy use and mainly on solar energy. And solar energy is the most important because it is easier to use, is available to everyone and can be obtained simply. In addition to the possibility of utilization in other ways for power generation and other uses. But for the exploitation this energy at the city level, it requires many changes in the morphology of the city and the design. So, this project will take in consideration the factors that affect the designing and planning the urban scale to make it depending on the solar energy.

This project will depend on the analyzing of the main factors that affect the planning and designing a solar neighborhood, so it depends mainly at topography and solar analysis, then starting the planning process deepening on the analysis, so to start this stage it will depend on shadow analysis to maximize the concept of solar access at winter and minimize the sun shadows at summer.

So the project starts with attempts and Experiences on built-up environment to reach to the best orientation from the buildings and streets, all planning and designing stage will depend on this phase of shadow analysis.at the design stage also solar aspects will be taken into account, at designing of buildings, parking's, street lightings, solar park and the green areas. Also, the project suggest to use the solar cells at the neighborhood, these cells use to produce energy used at the neighborhood , also use vegetation and shading to control the shadow at summer . Also, the project will have regulation result from the shadow analysis, these regulation will be used as guidelines for designing and planning urban areas that have the same analysis results. Finally, the project will introduce Final master plan for the solar neighborhood that explain all the results from the planning and designing depending on the solar access.

Applying this project to Palestinian cities in general will solve a lot of problems related to energy and the lack of its sources, and provides the amounts of energy that make these cities rely on the production of the necessary energy autonomously and without need for importing it from abroad by Israel ways, and get rid of the pressure of Isra'il on the Palestinians in the field of energy and electricity. And the importance of implementation of such projects was increased in the Gaza Strip where the show continued uninterrupted power supply and the problems related to it, and the hard life of the people of the strip due to the prevention of supplying the power by Israel. And therefore it must adopt such projects by the Ministry of Planning and Authority Energy and the environment for a better future.

So, at this project it will be planned and designed to apply at a neighborhood scale, to make it clearer and to understand the process. The project can be applied at most of locations at Palestine , but we chose a location for the project for many criteria will explained after studying the selected site .

Chapter 2: About Solar City:

1.1. Introduction to Solar city :

In recent decades, urban population growth, the acceleration of energy consumption and energy price, the increase of public concerns about environmental pollution and the demolition of non-renewable energies, have adverted the attention of different groups to the use of sustainable, available and clean solar energy as a sustainable energy.

Most of the specialists like architects and planners takes in consideration the subject of solar power in the design, but this has been applied at the household level individually and not on the level of city or neighborhood. Also, they didn't take its effect on the surroundings. But the need for solar energy and its usage push us to use it on a wider level to achieve higher efficiency in the use for all beneficiaries and residents. So the use of solar energy on an urban level focus on the city design in the way that can maximize the use of solar energy in cities. In other words, before the enforcement of solar projects in cities, it is necessary to note all the dimensions related to their execution in order to reach their optimum efficiency. The goal that could be attained by long-time and multi-dimensional planning.

This research guides the focus of urban planning and design on the application of solar energy. That urban planners should consider three aspects of environment, economy and society in three related elements of cities consisting buildings and urban spaces, urban infrastructures and urban land uses to achieve sustainable goals is discussed in this project. So this project includes designing and planning a city powered by sun based on group of standards to follow in design. Also, makings assessment for the project visually, economically, socially and environmentally.

1.2. Solar Urban Planning:

The aim of solar building, which is similar to solar building design and ecological design, is the reduction of using fossil fuel, efficient use of energy, providing environmentally friendly, healthy and economical style of life and use the solar energy actively and inactively through the complete and accurate understanding of ecological condition. Solar urban planning means integration of energy efficiency and solar energy in town planning via urban renewal, urban removal and new developments (Lindner,2007). The choose of technical and planning measures that are useful in solar urban planning and solar building projects economically and technically depends on the specific characteristics of each project such as topography, climate, consumers' demands and the financial resources of the project.

In this regard, solar master plans can be mentioned. Solar master plan is a tool to distinguish the solar potential of each part of a city, the determination of regions with high priority, the definition of measures for the conversion of the potential to trial projects. The solar factor ranking in the plan is a tool in order to determine the solar potential of different regions in depend on the absolute area of developed lands of the regions and existed buildings. The main subjects outlined in the preparation of solar master plans and solar planning are the presentation and proposition of instructions to find the solar potentials of each part of cities, the study of orientation and the shading position (through simulation methods), the feasibility study technically and legally, the study of demand and consumption potentials of energy (thermal and power energy) and the identification of regions with high priorities.

Determining a correct vision and practical goals are important steps of solar planning like every planning programs. Considering the importance of using solar energy and determining appropriate goals in this direct are essential. For example, the visions of the strategic program of solar city Goteborg until 2050 are the development of sustainable energy systems for a sustainable community, smart and efficient use of energy, renewable energy supply, changing life-styles and shifts in values, energy efficient urban planning, energy storage in a Hydrogen society.

Solar urban planning use three approaches concluding urban renovation, urban clearance and new developments for the expansion of solar technologies application. In addition to the idealist renovation plans like solar floating city in Monaco as a new solar city which provide their necessary energy from clean energies, there are multiple studies done in existed urban textures or urban blocks which are destroying and renovating for the usage of solar technologies.

Without any doubt, in solar urban planning that consider the goal of sustainable city, three aspects of environment, economical benefit and society must be always considered.

1.3. The necessity of using solar energy in urban scale:

The demand for more ecological development of cities and towns is urgent. Most of the actual cities have environmental and resource related problems. Best practice examples can help to distribute urban ecological knowledge and set standards.

- **The increase and the acceleration of urban population growth around the world.**
- **The global prediction results showing the exhausting of none-renewable energy resources.**
- **High consumption of fossil fuels and non-renewable energy, and high price of these energy.**
- **The increase of public concerns about environmental pollution** and destroy of non-renewable energy resources, are causing different experts including specialists related to building and construction to look for alternative ways of energy provision.

Chapter 2: Project Location:

2.1. Selected location :

The location was selected depending on group of justifications that will be explained later .This site was located at the Nablus and Qalqilyah Governorate administrative boundaries as shows at Map.1 below, and located at the west of Nablus City, and 46% of site land was located at Nablus Boundaries and 54% at Qalqilya Governorate, as shows at Map.2 and Figure.2 below .

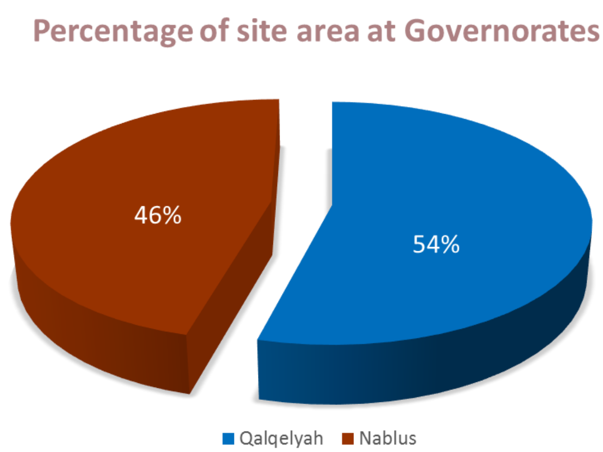


Figure 1 :Percentage of site area at Governorate.

Also, it located at the administrative boundaries of three local communities and this make the project location more strategic and have more importance, these communities are Jitt at Qalqilya and Biet wazan and Biet Iba at Nablus as shown at Map.3 .

As shown at the Figure.3 below , the highest percent of land located at Jitt , then by 27% at Bit wazan , the least with 19% at Bit Iba ..

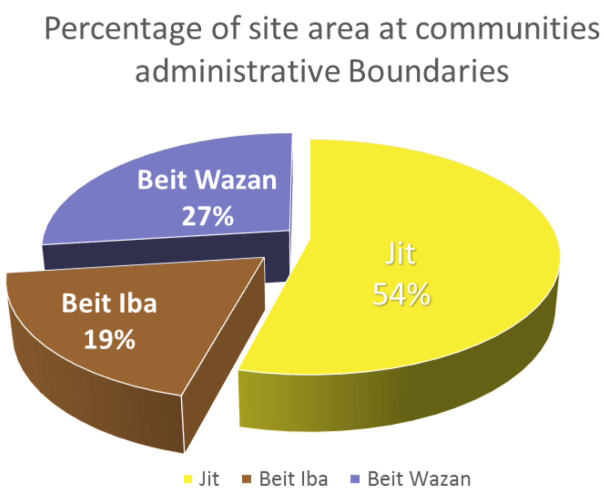
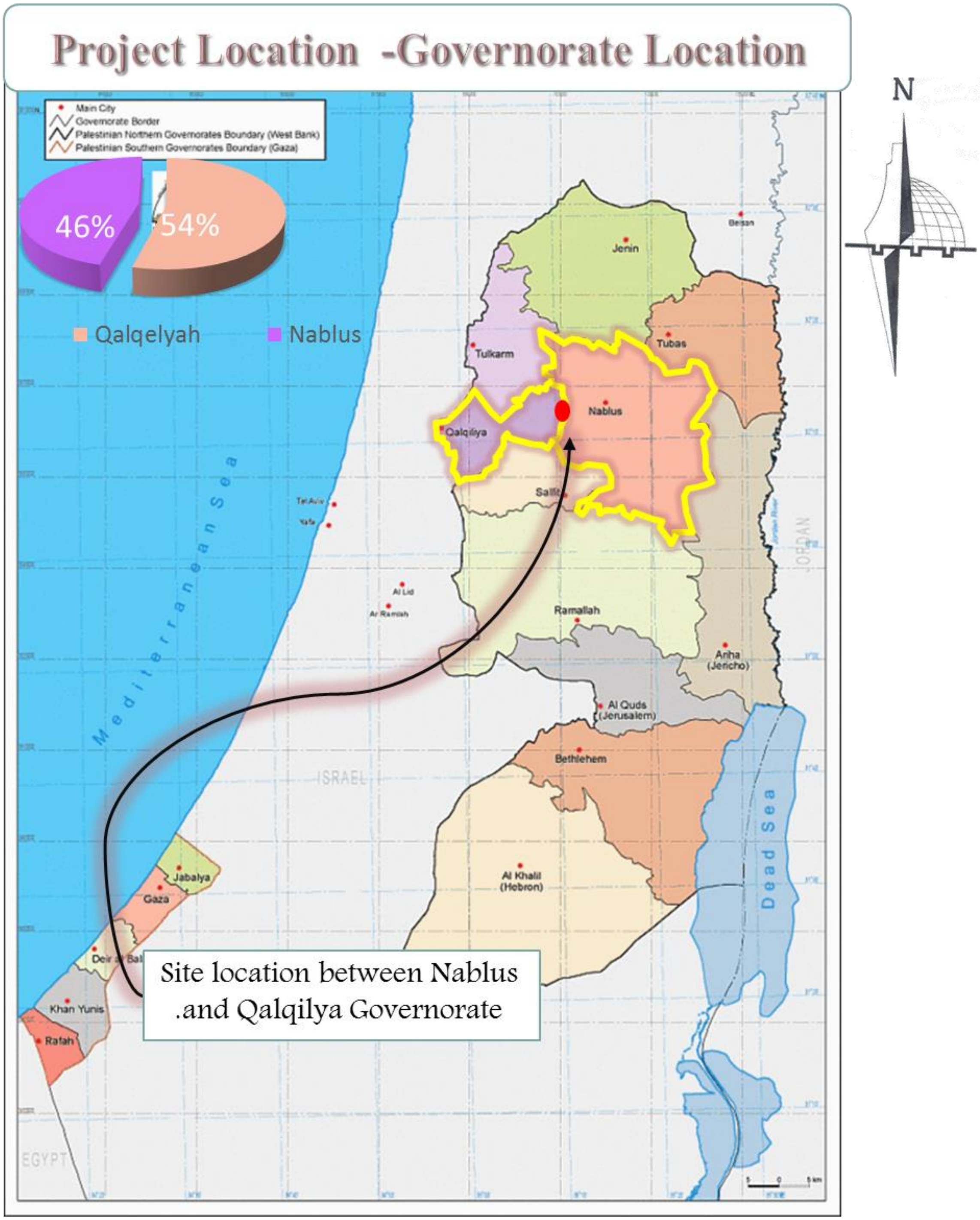
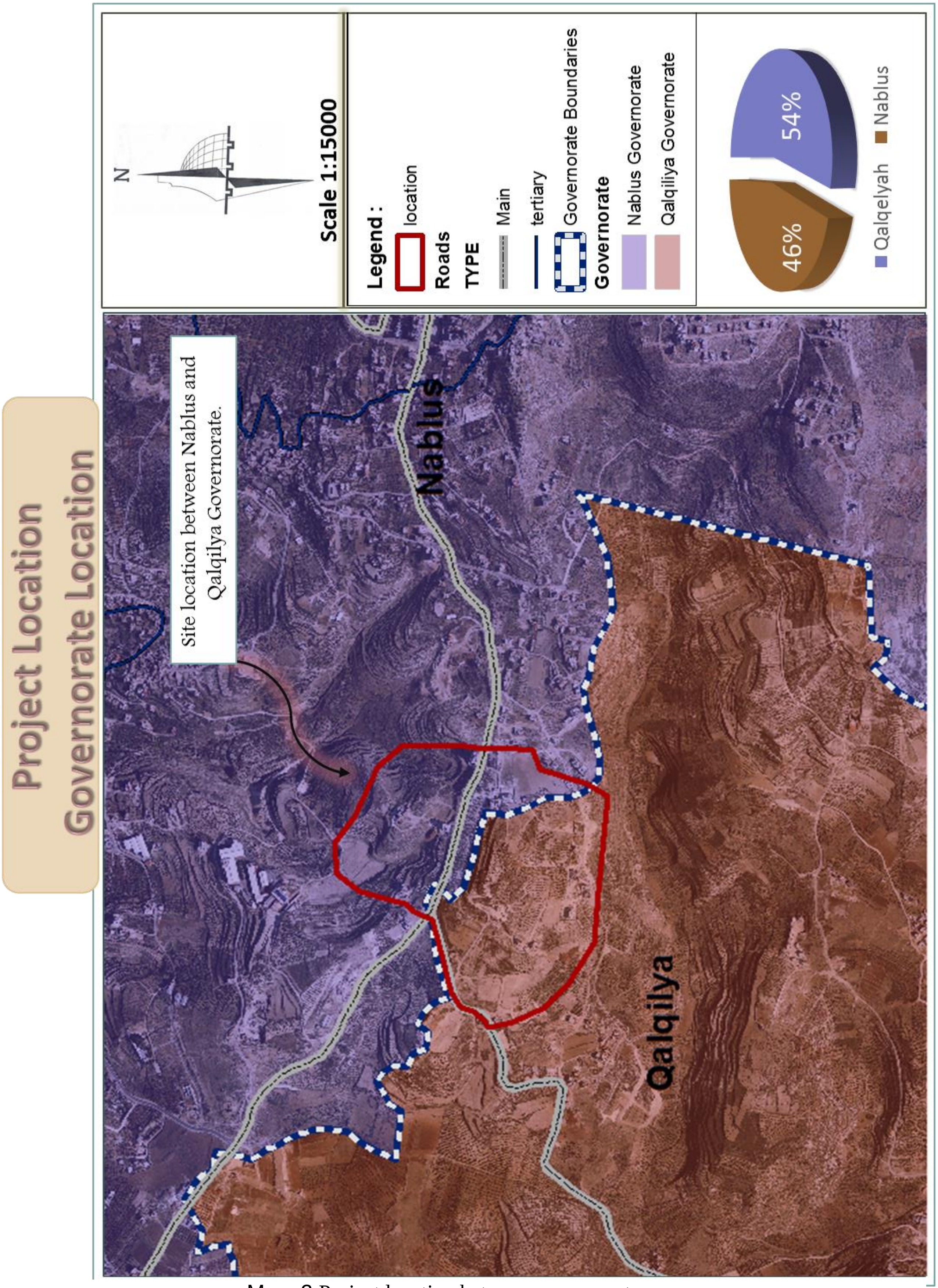


Figure 2: Percentage of site area at Governorates

Also. Figure.4 below shows the Arial photo of the selected site , that shows the boundaries of the site and it's relation to administrative boundaries of nearby communities , also explains the the surrounding roads and cross roads , and shows the the most important roads, the main rod that devided the site into tow parts,and connect Nablus to Qalqilya , Salfit and Jenin City.

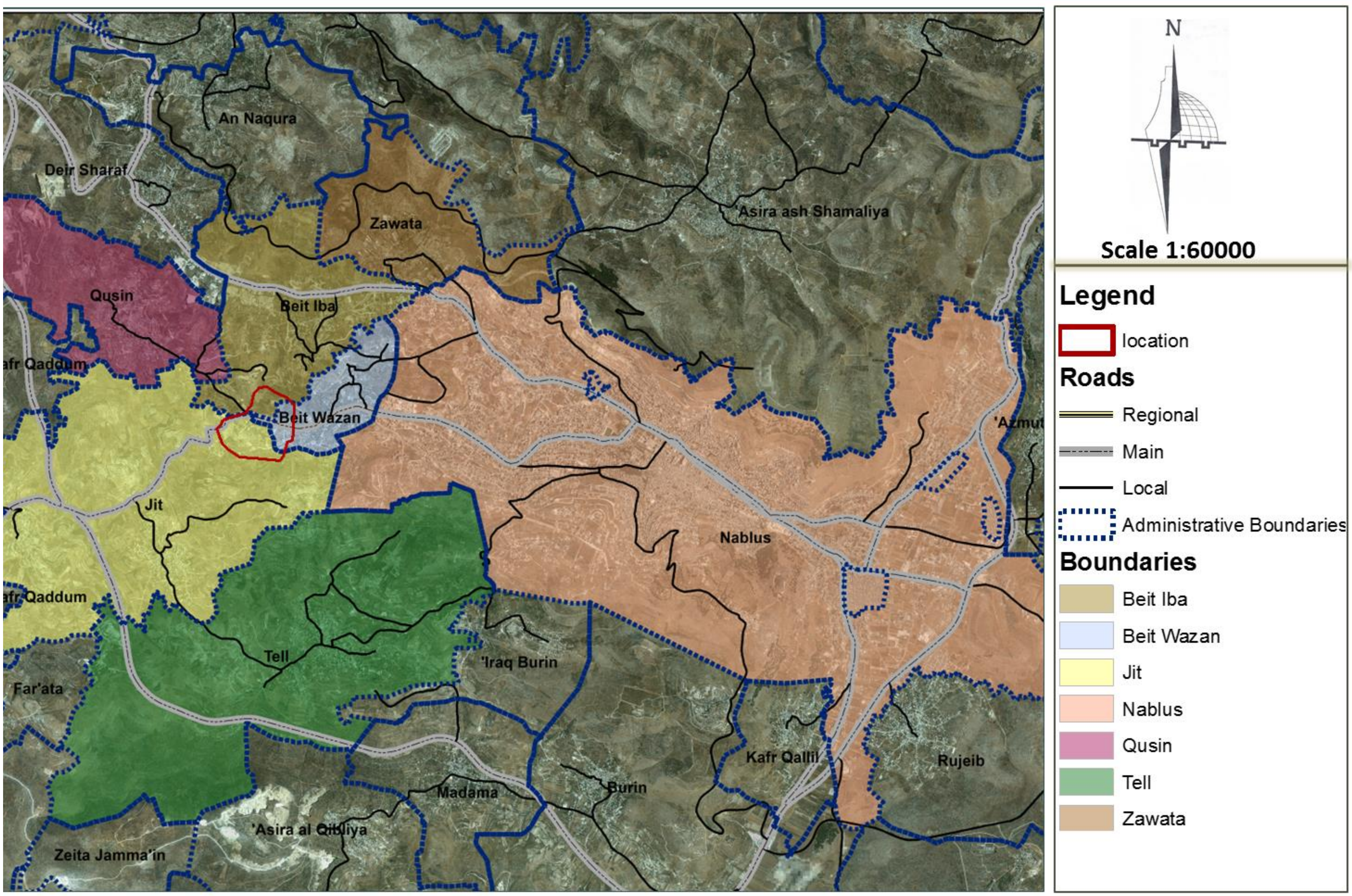


Map. 1 : Project location map

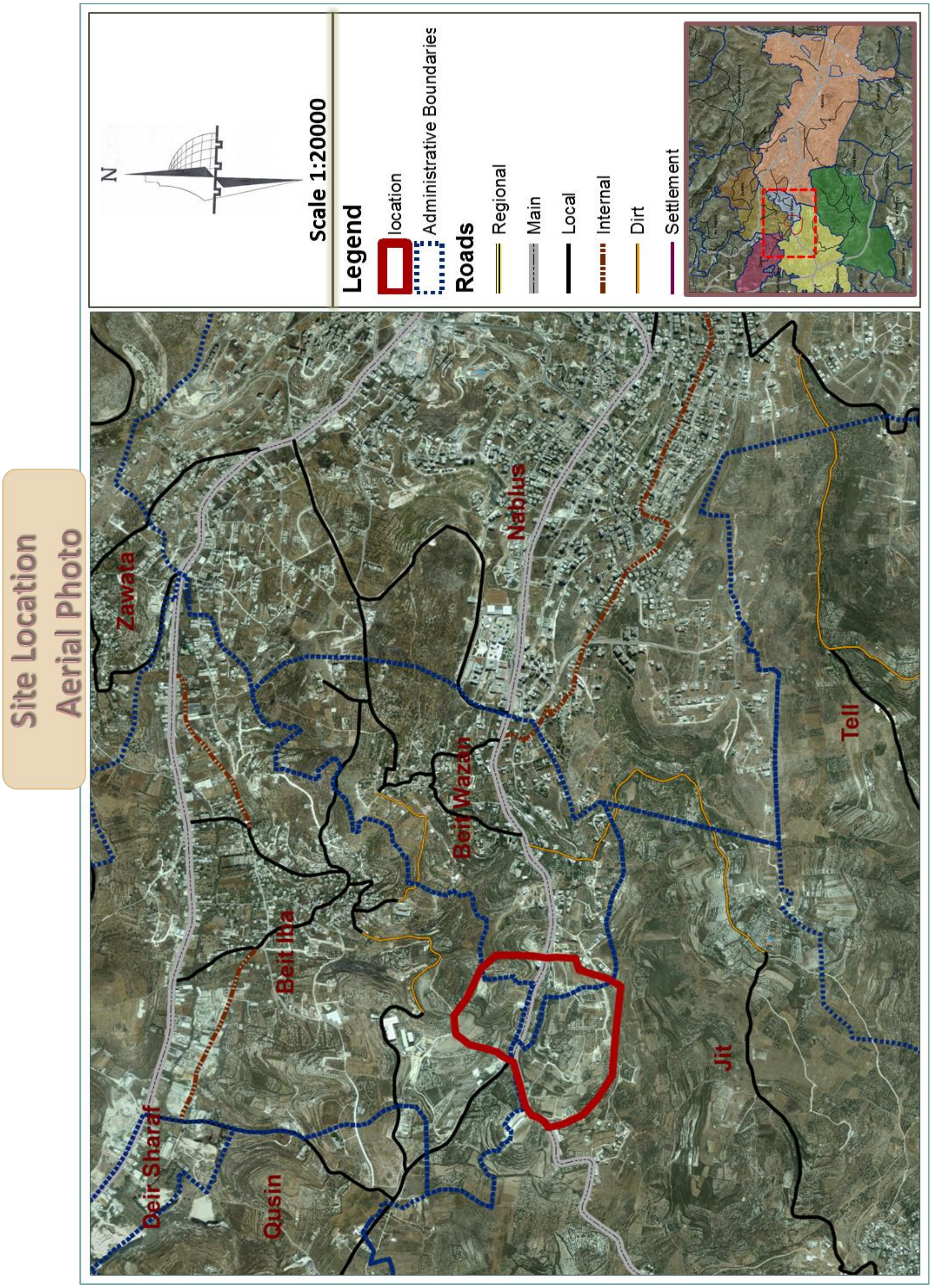


Map. 2:Project location between governorates

Project Location Administrative Boundaries



Map. 3 : Project location between communities administrative boundaries



Map. 4: Project site Arial photo

2.2. Relationship with Surroundings :

The project area reaches about 45 donom distributed at the surrounding local communities , and the Map below explains the relationship of the site to surroundings and the accessibility to reach from the site itself to the to the locations that have a direct relationship mainly to Nablus and Qalqilya cities, related to their importance of the site creation .

Also the local communities that are around the project location have a strong relationship mainly that the project located at their land (Jitt. Bit Iba, Bit wazan) , in addition to another communities near the site like Qusin the located at the North-West of the site , also Sarra that located at the South of the site .

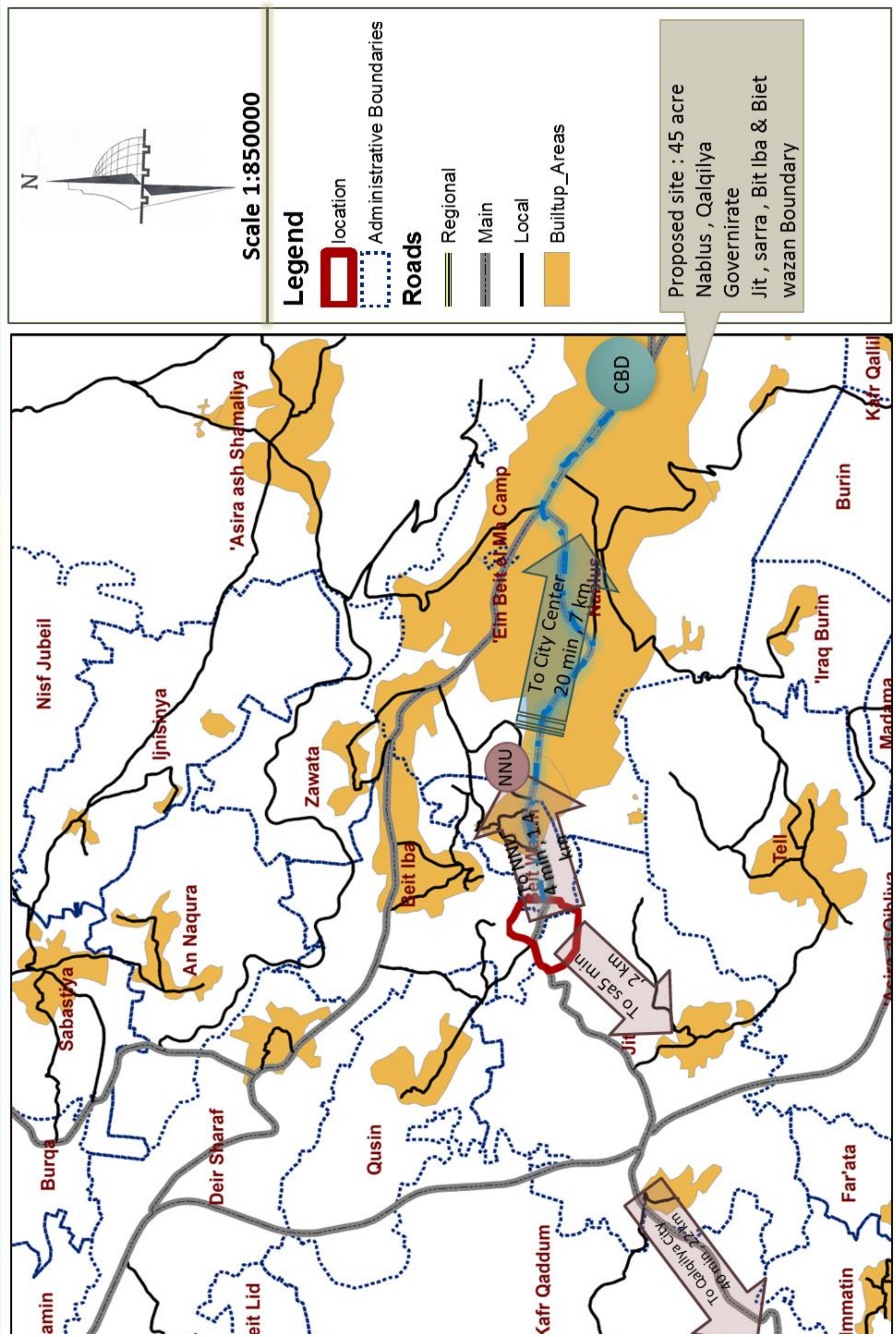
Also the importance of the site can be determined from its relationship to many land marks like Al-Najah National University , that far from it by only 1.5 km , also it's relation to the CBD of Nablus City, because it was the nearset city center to the site distance of 6 km .And the site and surrounding buildings depednd on the center services .

Table No . 1 and Figure.5 below shows the most Surrounding areas, which have a relationship with the project, and the distance and the time required to reach them from the site.

Table١ : Project location table

Surrounding areas	The distance	Time to reach
Qalqilyah	**22 km**	**40 min**
Nablus city center	**6 km**	**20 min**
Jet	**4.1 km**	**15 min**
Beit Iba	**3.2 km**	**12 min**
Beit Wazan	**1.3 km**	**4 min**
Al-Najah National University	**1.5 km**	**5 min**
Sarra	**2.1**	**8 min**
Qusin	**1.7**	**5 min**

Project Location
Locational Plan



Map. 5 : Project locational plan and relationship

2.3. Justifications for the site selection :

1. **The general trend of population expansion in the city is towards the west of the Nablus**: So that the general direction of expansion and population growth is moving to the west of the city, that was because of the lack of concentration of population in those areas and to enjoy the quiet of the region, also it was far from the noise and overcrowding, which suffers from the center of the city and other areas.

2. **New development at this area:** This is become a clear evolution in recent years, so residents go to the development and construction in those areas surrounding the city and on the sides .

3. **The existence of residential projects and investment in the Western Region :** this region has many new housing projects was contrasted at the recent years like Engineers Housing project , Al-Amreyh , and Sarra Housing Project .Also many adjacent Housing projects are contrasting now like Tall Al-Qamr for sustainable housing and Orjowan Housing .

4. **Slopes in the region is suitable for use in receiving the sun's rays :**after studying the topography and orientation at the site, it was found to be a suitable location and can be controlled in the planning of its elements, It is also has a suitable topography for the design and receiving the sun as will be explained later.

5. **The climate can be exploited well**: the climate of the region in general was good and has the large number of sunny days compared to the rate of other areas, and due to the importance of climate dramatically in this project, the areas with the sunny days are more important to capitalize the use of sunlight.

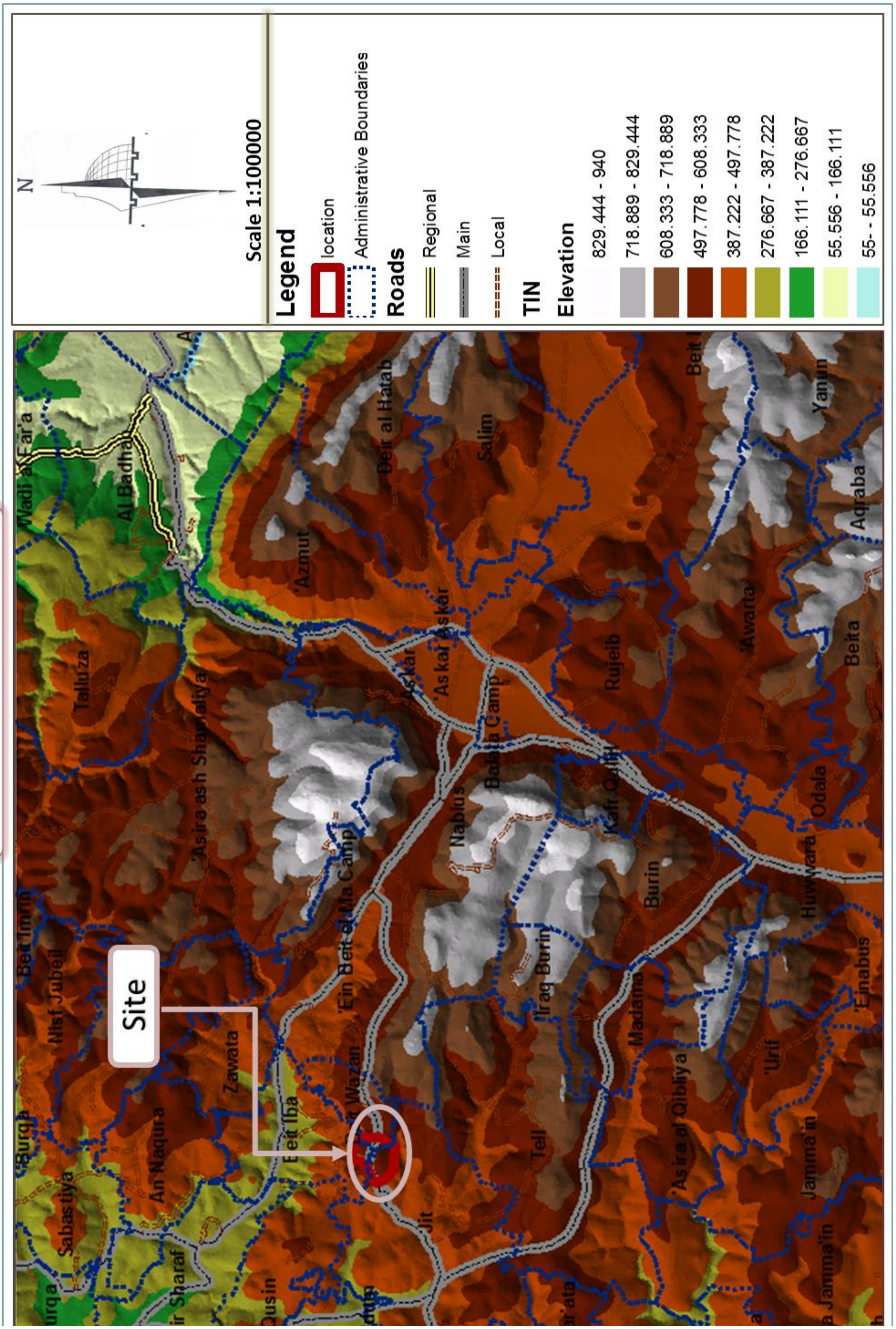
Chapter 3 : Site Analysis:

3.1. Topography:

For the topography of the site is followed by mountains stretching to the city of Nablus, where it follows the extension of the southern mountain of the city, but gradually rise but declines at the site, and as can be seen from the map at the bottom number (6), which describes the topography of the site for the city in general, it comes in third class in the general elevations of the city, and go down from the highest point in the southern mountain by 300 m parallel to that direction and at the same axis to reach the site, which is also too high relative to the axis of the city, which ends with the site.

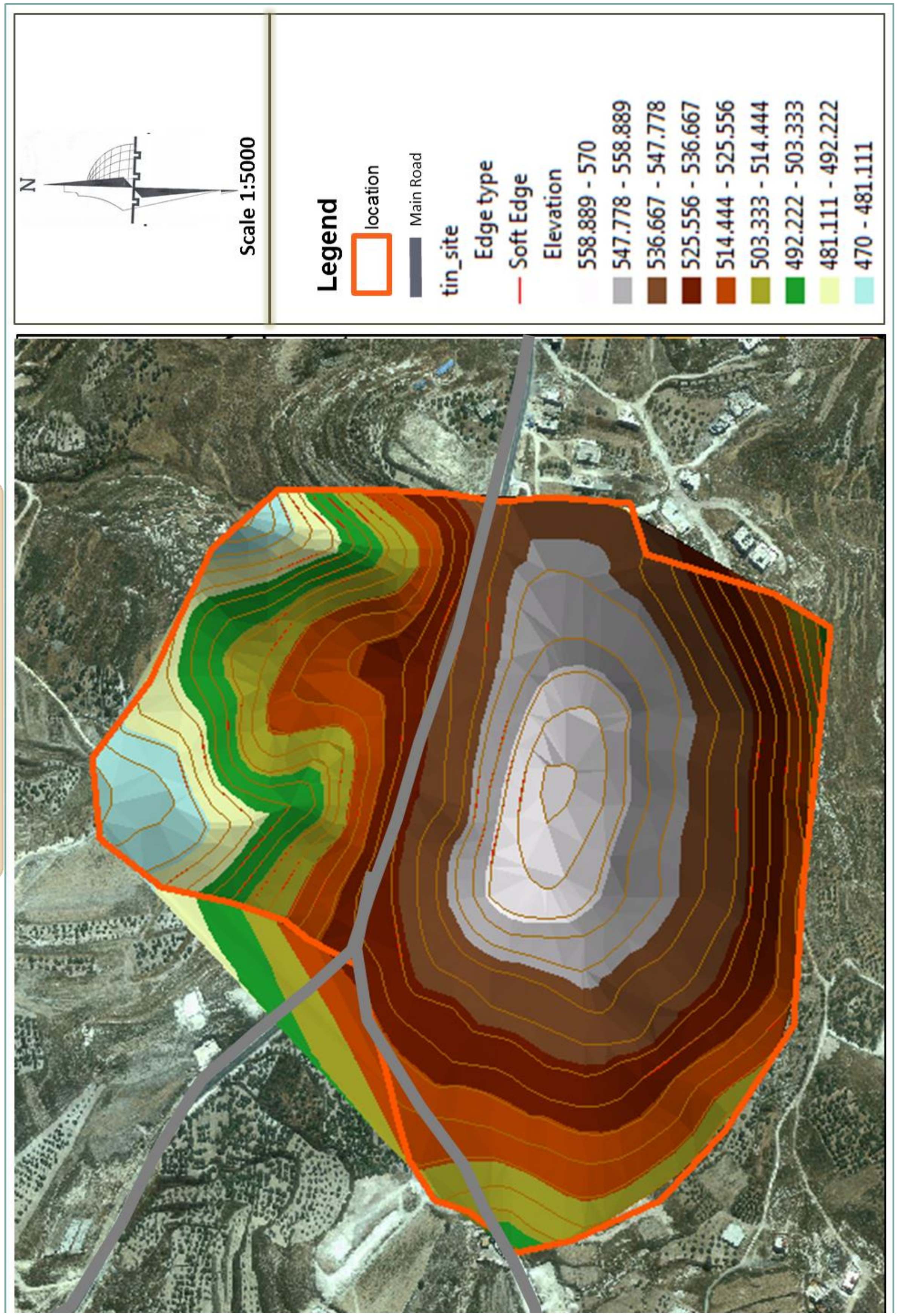
Map No. (7) Below describes the Contour of the site, it's ranging and the height differences include it and the extent of the site altitude. In addition, it clarifying the site the elevation variation and the occurrence of most of the land site at medium elevation hill and as illustrated the presence of gradients in elevation on the north side of the site.

Topography



Map. 6 : Topographical map of the city of Nablus

Topographic Map



Map. 7 : Topographical map of the selected site

1. Profile Sections :

After studying the topography of the site, the land sections are made for three longitudinal and cross sections that pass gradations elevations of the land to study the land slopes and differing heights to learn how to deal with them later in the planning and design process with respect to streets and buildings, and the quantity of cut and fill. As illustrated in Figure 4 below ground profiles that will be studied:

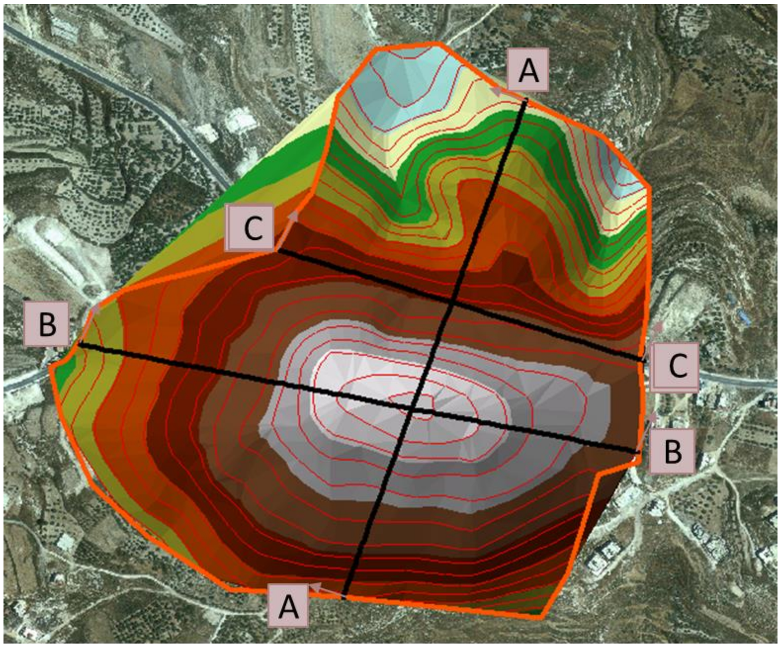


Figure 3 : land profile sections

After making profile sections, the fist was taken from south to the north and divided the hill at the center and shows that it has the highest height at the site then the heights decrease to the south as shown in figure.5 below .

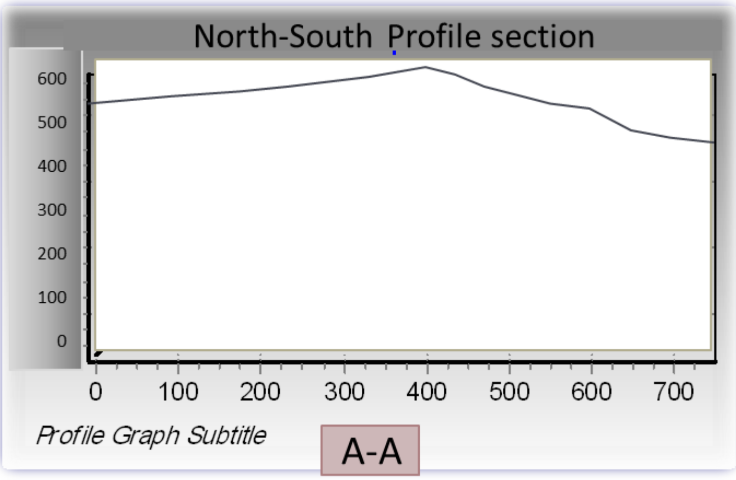


Figure 4 :North-South Profile section

The second profile section was made at the hill itself but longitude and shows the general slop for the whole area that ranges from (500-570) m.

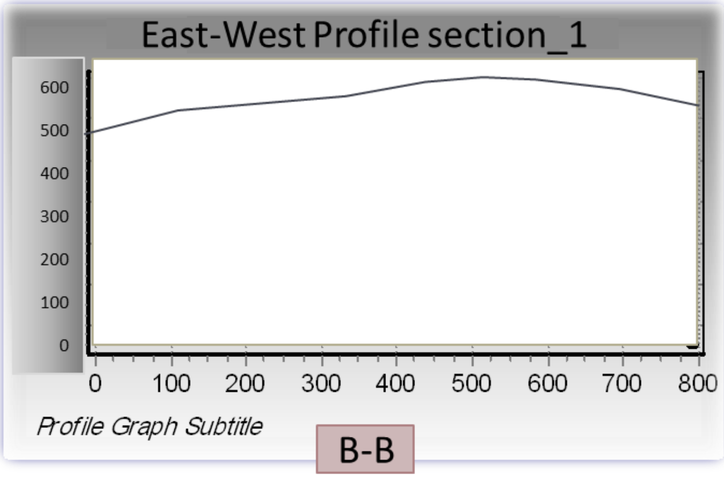


Figure 5: second profile section (East-West)

The third was made at the street that divided the site into two main areas, and shows how it sloped from east to west from (541-532) m .

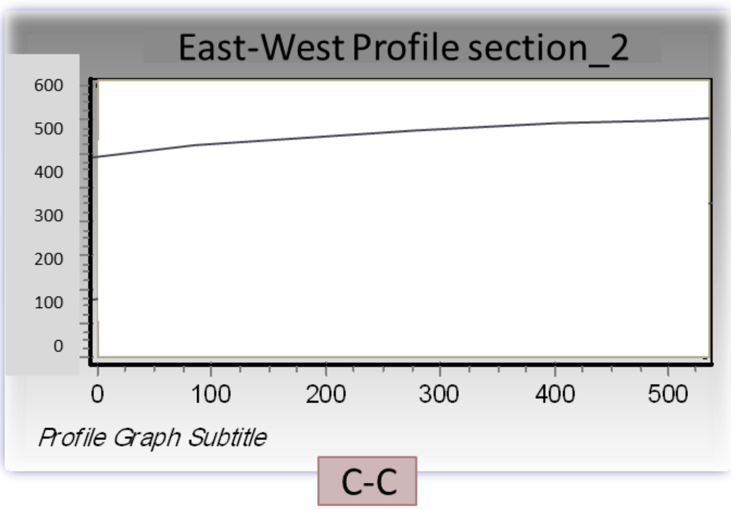


Figure 6: Third profile section (Main Street)

1. <u>Site Steep Depth Lines:</u>

It shows how the lines of the steep pass region and the direction of these lines at the site. So as shown at the figure (8) below the steep depth lines declined from the highest points at the hill down to the sides.

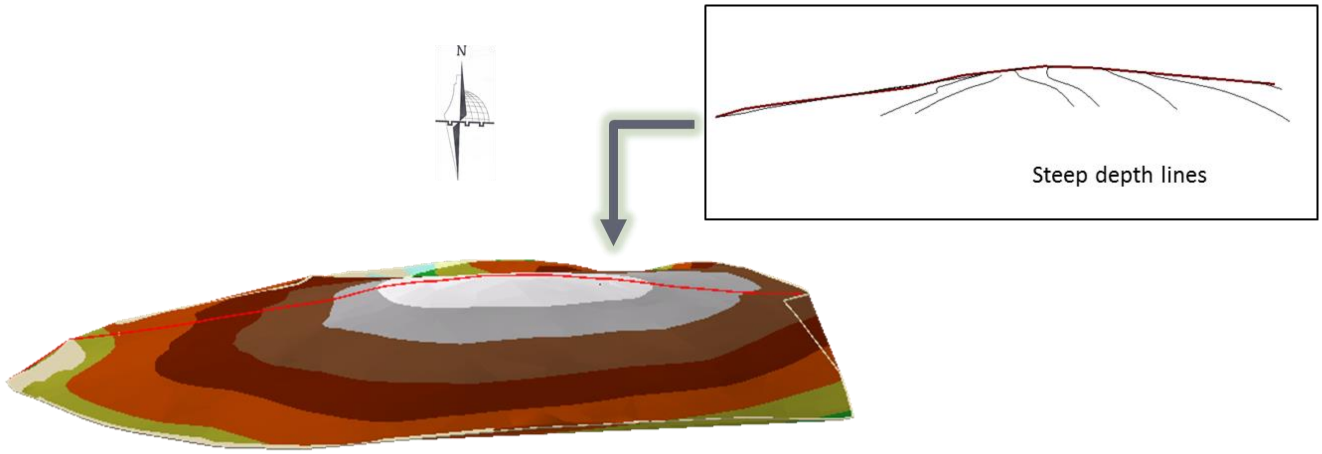


Figure 7 : Steep depth lines at the site .

2. Slope Model and Heights:

The model in the figure below shows the maximum height of the site is 570 m and declined down to reaches 470 m by difference of 100 m vertically. The site also extends longitudinally by 954 m and therefore the longitudinal slope of the site reaches 9.5%, as shown in Figure below.

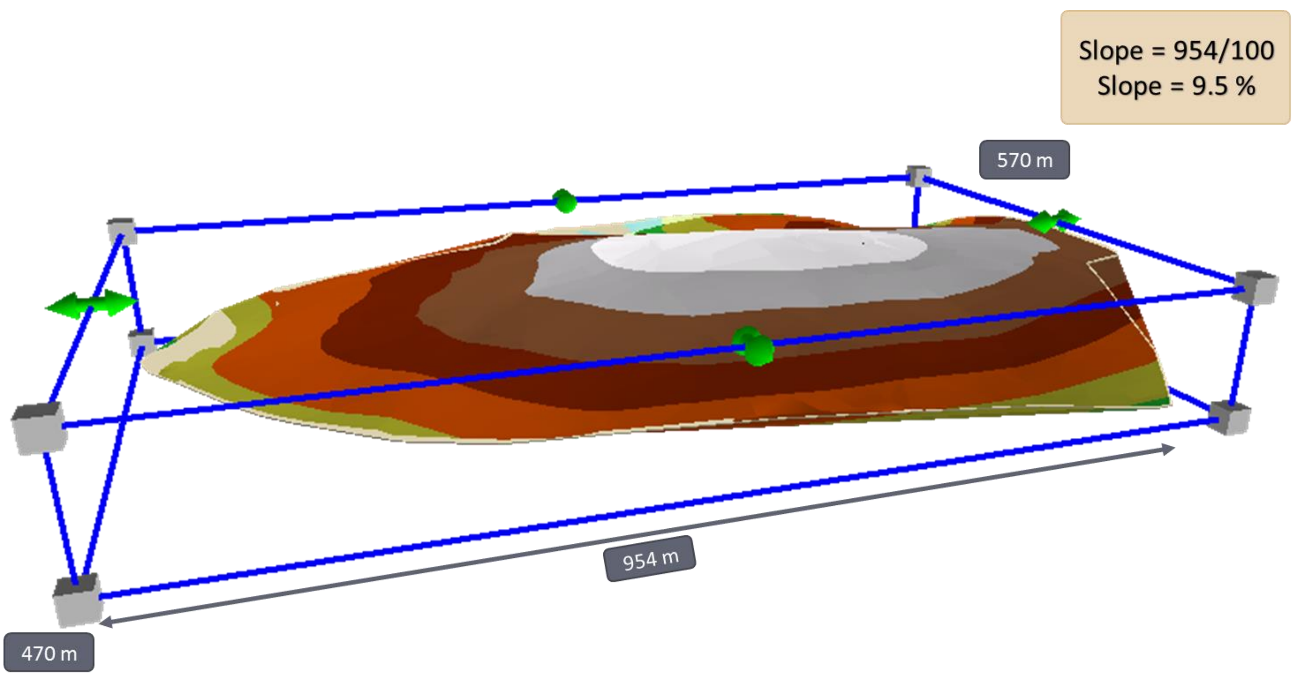


Figure 8 : A model of the terrain and slope for the site .

2. **Site Rates of Elevation** :

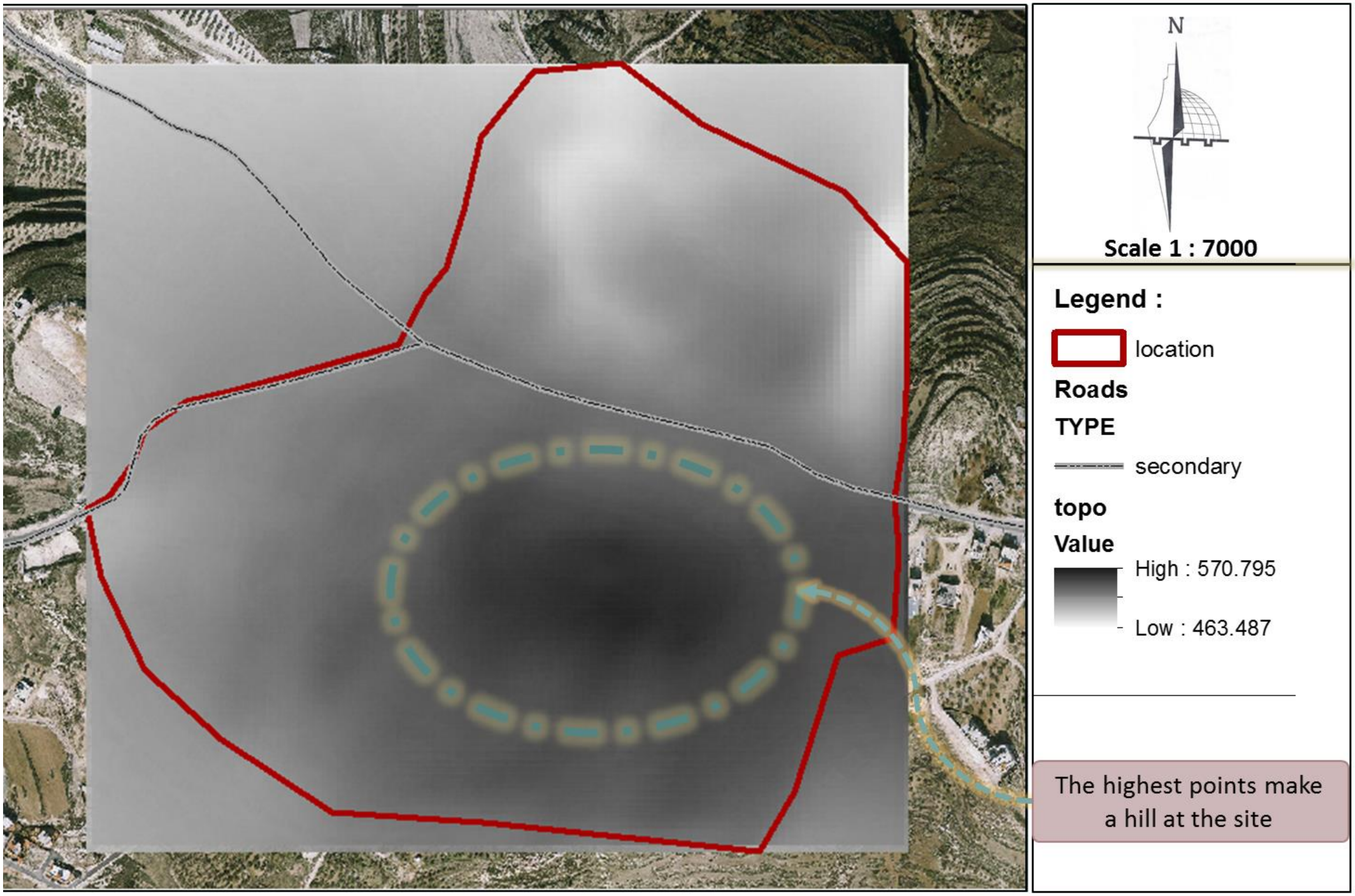
As for the heights at region they are concentrated in specific areas and the highest elevations concentrated in the south-eastern region of the site and which form elevated hill, while in other areas it is less rise as shown in the map below No. (8) .

3. Slopes of the Site:

The slopes of the site was distributed at all region by percent's, and as shown at the map of slopes number (9) below , the highest percent of slopes concentrated at the north part of the site, that located at the north of the ,main street , so this affect the design and planning of the area , and affect the solar insolation of the area .

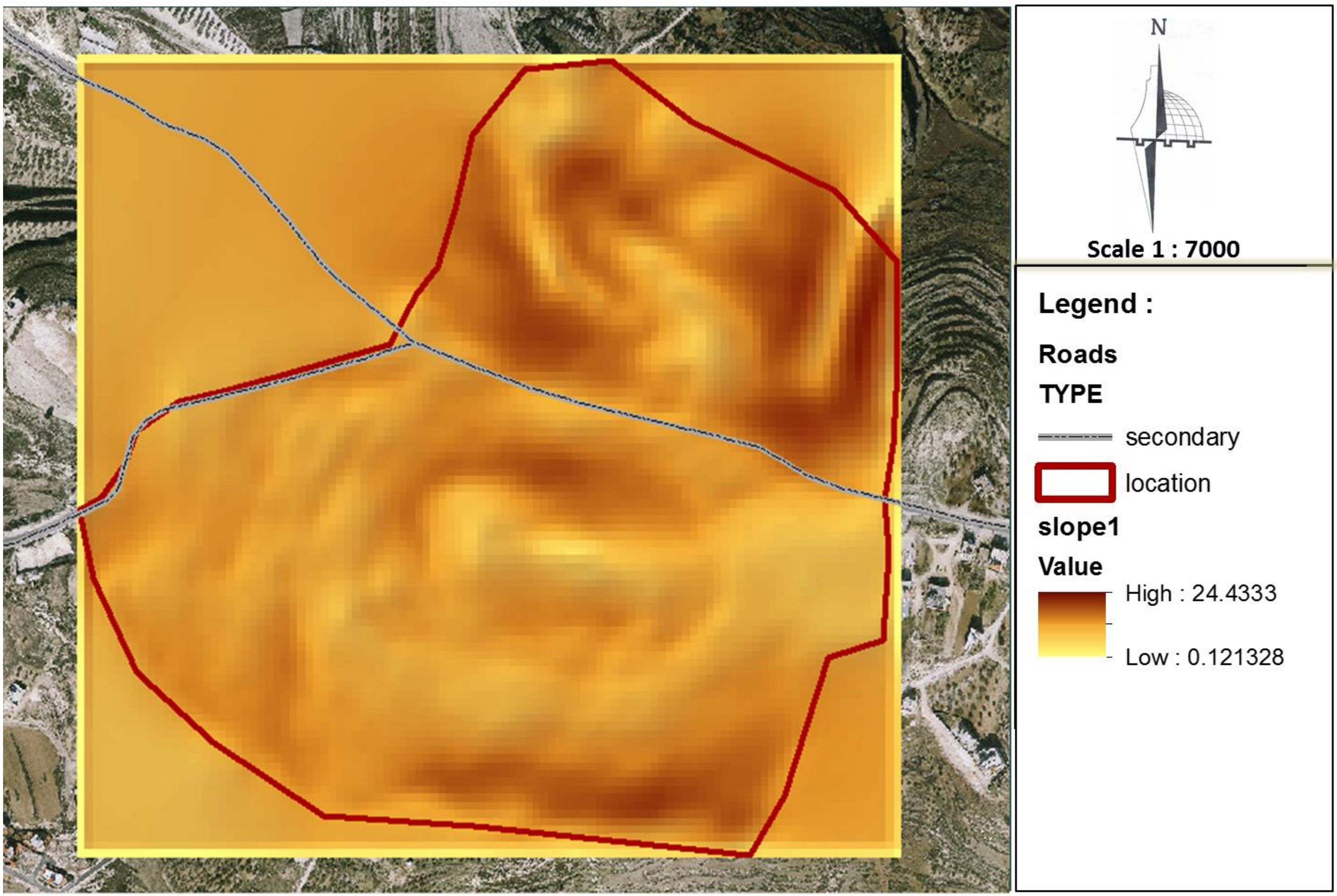
The highest point of slope reaches about 24 % at the north part , and this was higher than the allowed limit of slope for street planning , so this make an obstacle at planning process that will explained at the next step .

Site Rates of Elevation



Map. 8 : Site elevation rates.

Slopes & Topography



Map. 9 :Slopes of the site and topography

3.2. Site Land Analysis:

1. **Agricultural Classification**:

There are two types of Agricultural land as shown by the map No. (10) Below, :

- Medium Agricultural value that has 63% of land, as illustrated by Figure.
- Low Agricultural value, of 37% of land.

And therefore a large proportion of land available for construction, development and suitable for building in this project because it is mainly concerned with the environment in the development and construction.

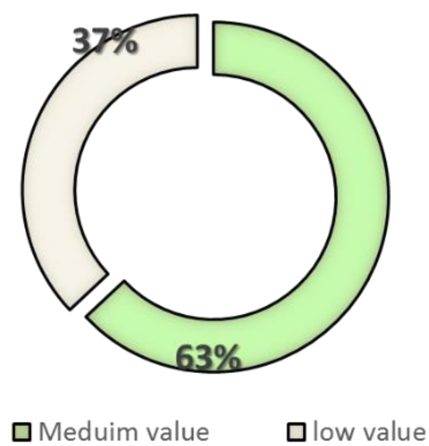


Figure 9 : The percentage of Agricultural Classification

2. **Water sensitivity:**

It means the vulnerability of ground water and its impact on the construction and development which, in view of the map No. (11) Below, shows the extent of the sensitivity of the ground water, the site does not have any sensitivity to water, and therefore it does not make an obstacle to the site and development

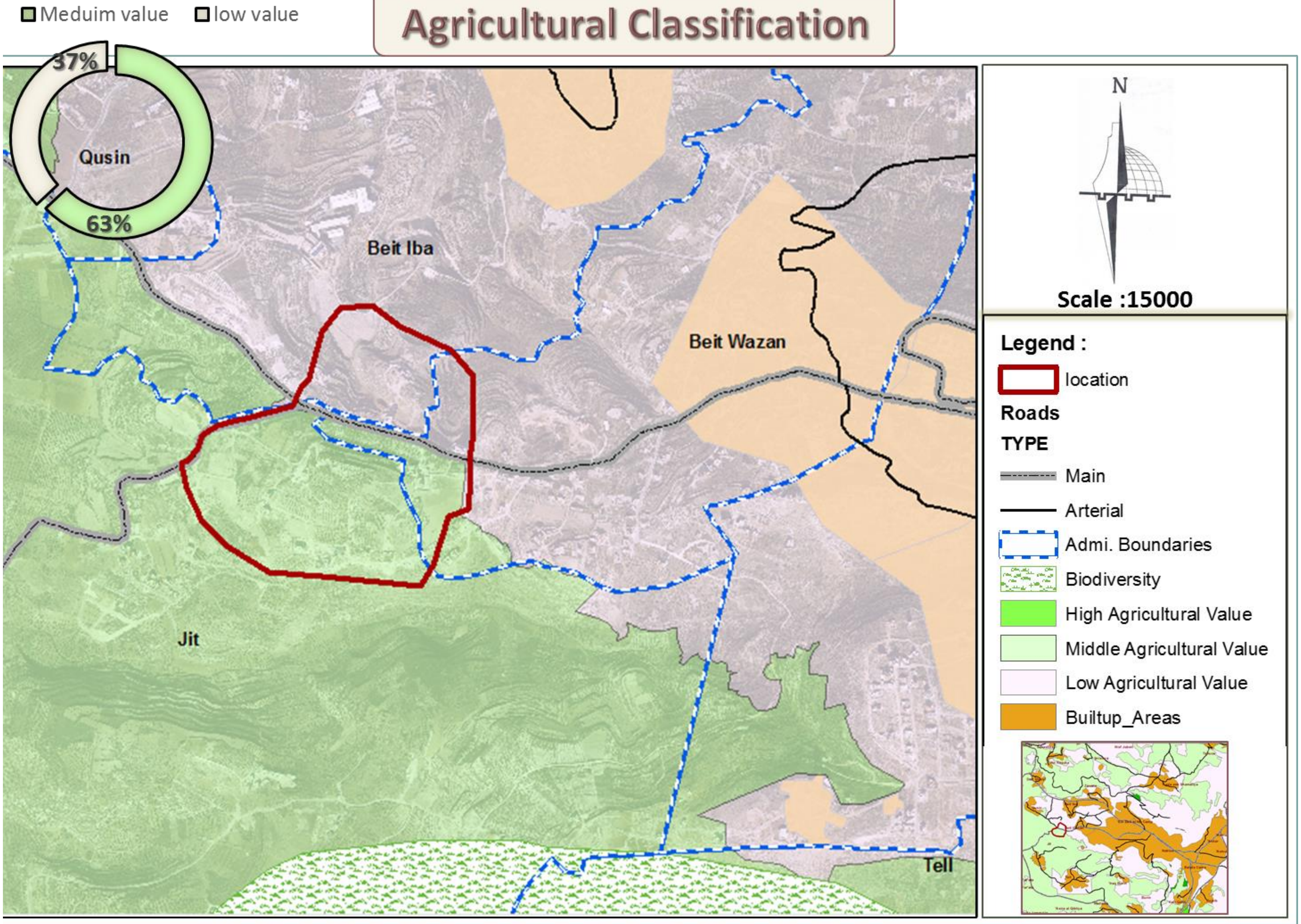
3. **Soil Classification**:

There are two types of soil at the site as shown at the map no. (12) Below:

- **Clay:** this type was the best for building because the soil war rock and has a percentage of 7% as shown in the figure below.
- **Clay loam:** this type has rocks but also gravel, also it was good for building and has no problem for development and has the highest percent of 93%.

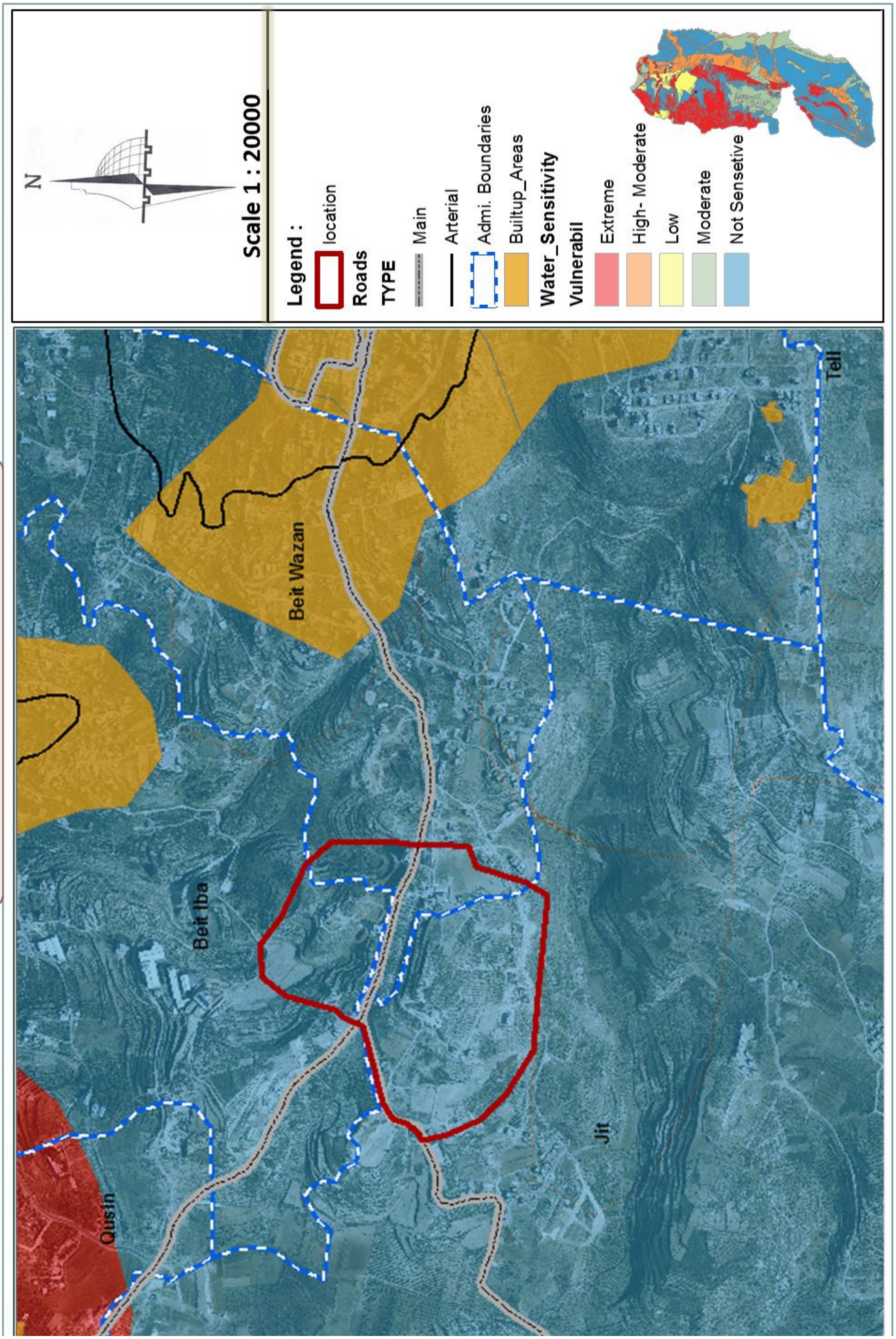
Figure 10 :The Soil Classification at site land.

Agricultural Classification

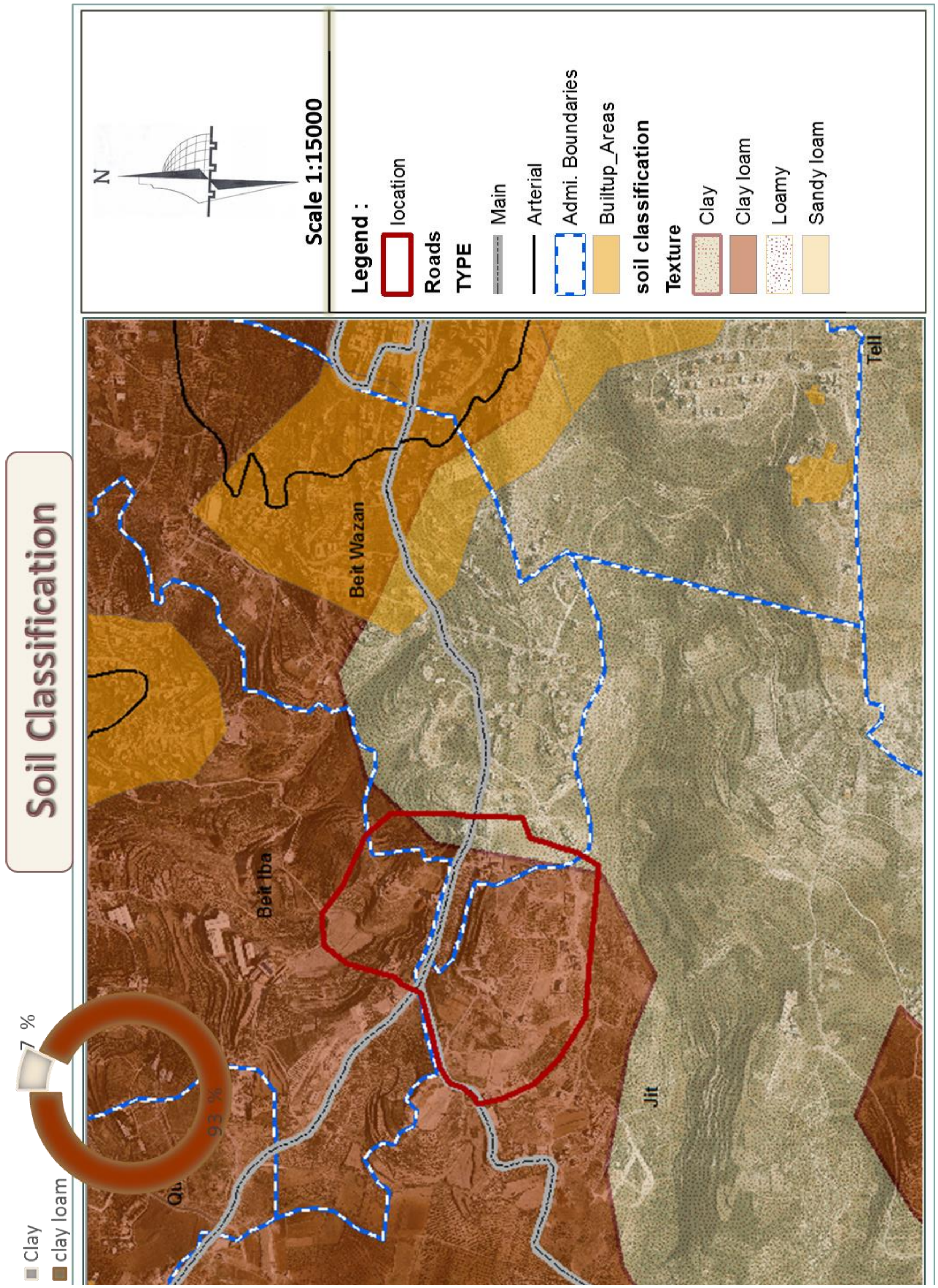


Map. 10 : Agricultural Classification of the site land

Water Sensitivity



Map. 11 :Water sensitivity of the site land



Map. 12 :Soil Classification of the site land

4. **Seismic Zones**:

Seismic factor is an important factor in the construction and development in any area, and given the location of the project is located mostly within the Zone 2B , as shown in the Map .No (13) below

This region is seismically dangerous area and the construction and development within it needs to take into account a lot of aspects in design and construction. Also 2% of the project area was located at Zone 2, which pose no seismic risk.

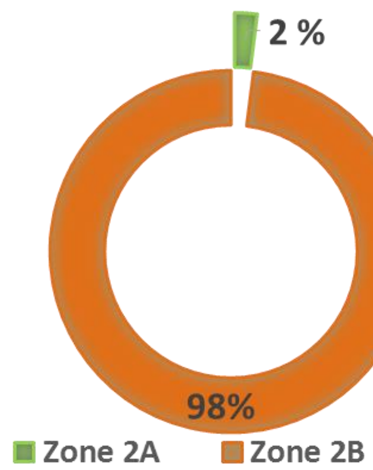
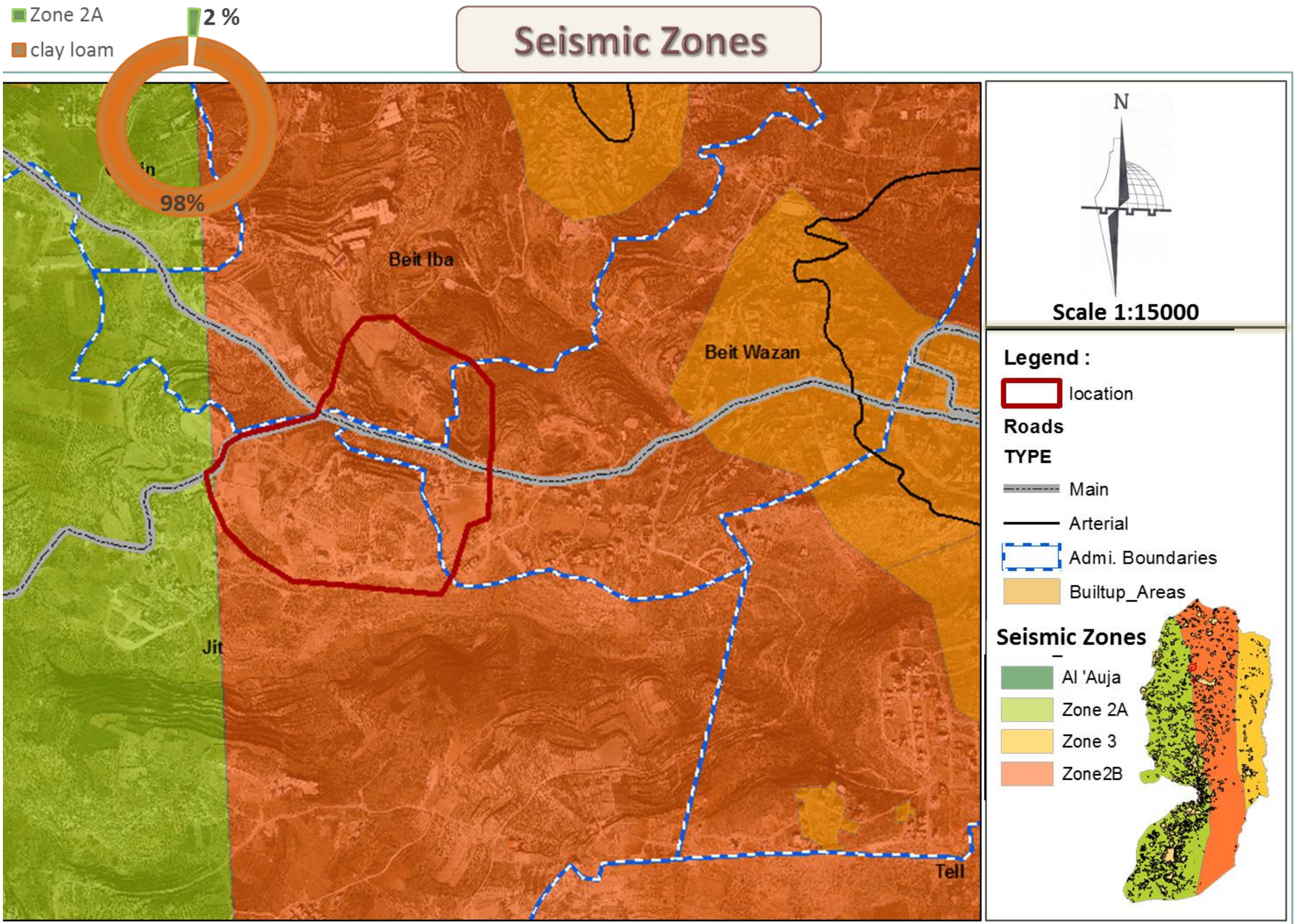


Figure 11 : The Seismic Zones at the site

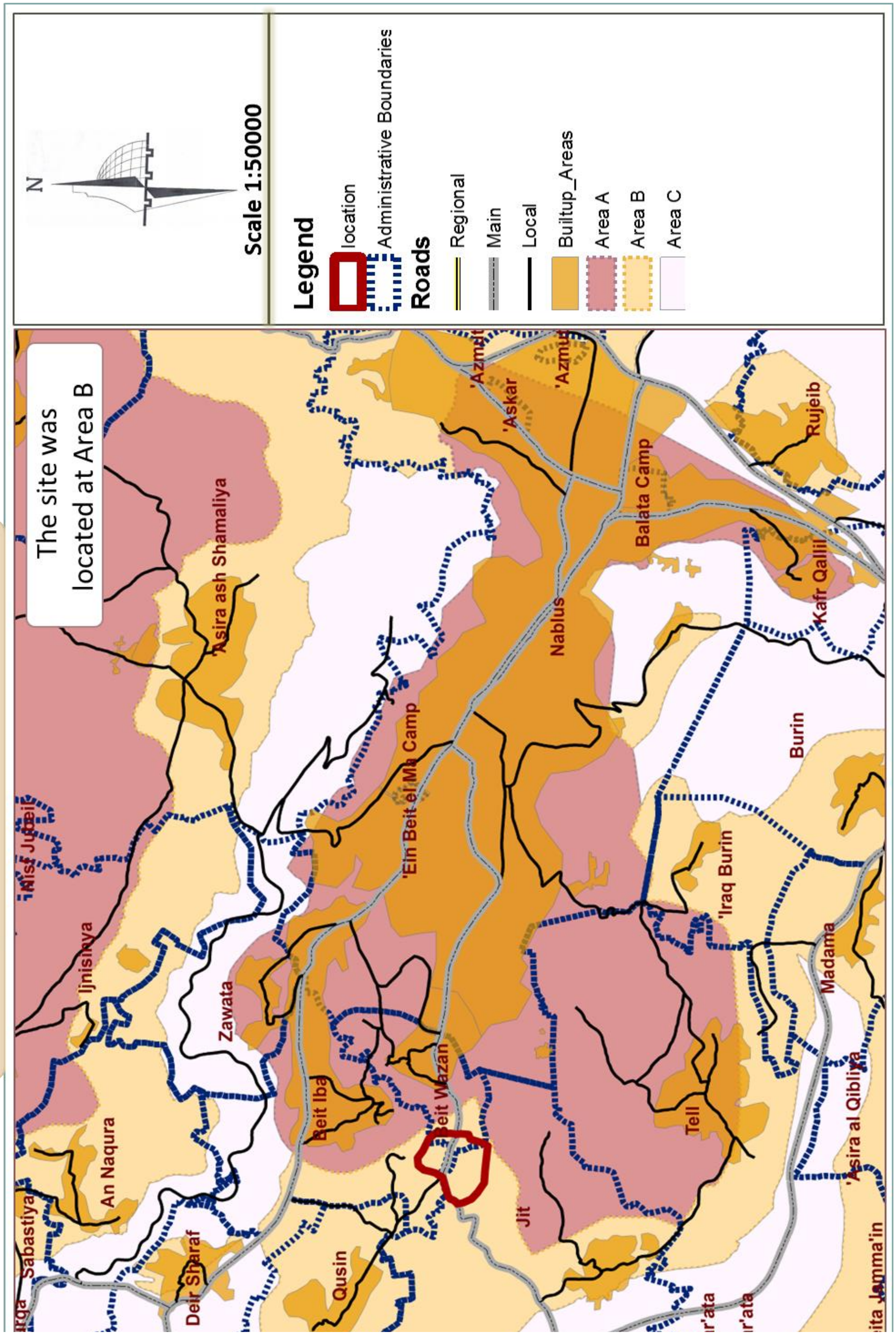
5. Geopolitical Classification :

As shown in the Map No. (14) below the site selected was located at Area B Which follows the administrative classification of the Palestinian Authority and security for Israel , so the construction and building at this area do not need a security clearance from Israel .



Map. 13: The Seismic Zones map of the site

Geopolitical Classification



Map. 14 : Geopolitical classification of the site

3.3. Accessibility and Transportation:

1. **Road Around the site**:

The proposed project is located along the main street leading from Nablus to Jenin , Tulkarm ,Qalqilya and Salfit .

This street has a great importance because it is the main link among other governorates, which lies to the west of the city of Nablus as it is reflected in the map no. (14)At the bottom. It is also an extension of the main street of Rafidia Street that passes Nablus city center.

As seen from the next map No. (15) the site is also linked to a local street and the street is the Connector that branches from the intersection of the main road passing through the site to connect with Qusin village in the northwest of the site itself.

And so this increases the importance of the site as an important junction also the main street in addition increase pressure and the traffic jam on the street in the land within the project.

2. **Site Road Classification**:

There are many categories that have been classified streets within the site are based upon and include three categories, namely:

a. Hierarchy:

Roads at the site was classified to three types at the site based on the hierarchy of these roads as shown at the map nu.(16) below and they are:

- **The Main Roads:** is the main road that cross the site and it has 22% as shown in the figure below
- **The Residential Roads:** Streets that are used for the purposes of housing, which has set up to serve it, and has a percent of 44%.
- **The Agricultural Roads:** Dirt streets used to access to agricultural areas and has a percent of 34%.

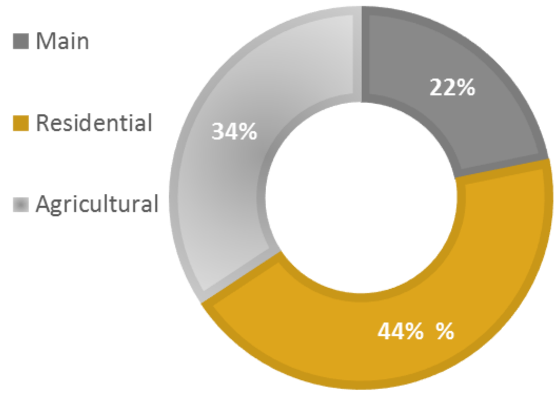


Figure 12 : Site Road Classification-Hierarchy

b. Pavement : Streets were classified based on the presence of the girl to:

- **Paved streets,** which includes the main street and in addition to my brother enters the street to the ground , it have a percent of 41% as shown in the figure below .
- **Unpaved Roads:** that include the rest of the streets, including residential and agricultural ones, and have a percent of 59% .

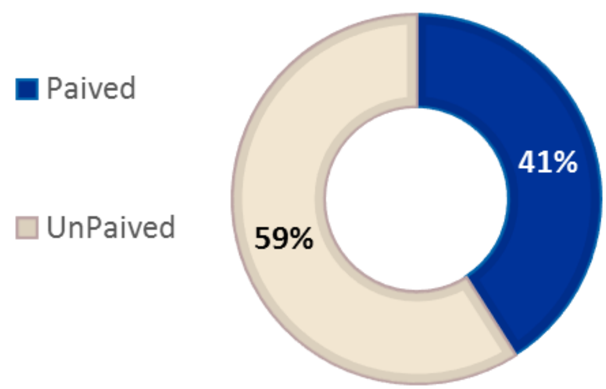


Figure 13: Site Road Classification-Pavement

a. Width : It can be classified as street widths at the region into two categories:

- **Width of 10 m** , and is in the main street passing the site
- **Width 3-5 m ,** and include other streets ,so that the only street that passes the site was paved and reaches 5m width , but the rest of the dirt in the streets reaches at the most 3m.

FIG. 2: PAVED ROAD ATH SITE

FIG. 1 :MAIN ROAD AT THAT INTESRCT THE SITE

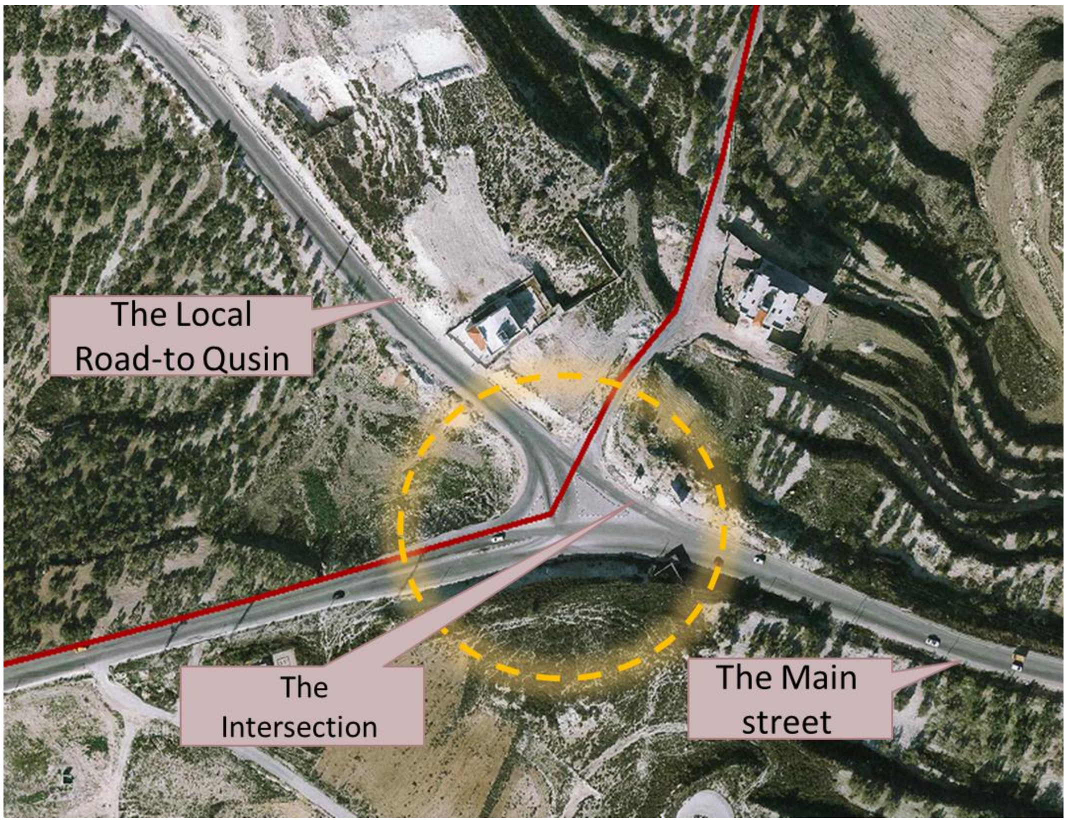
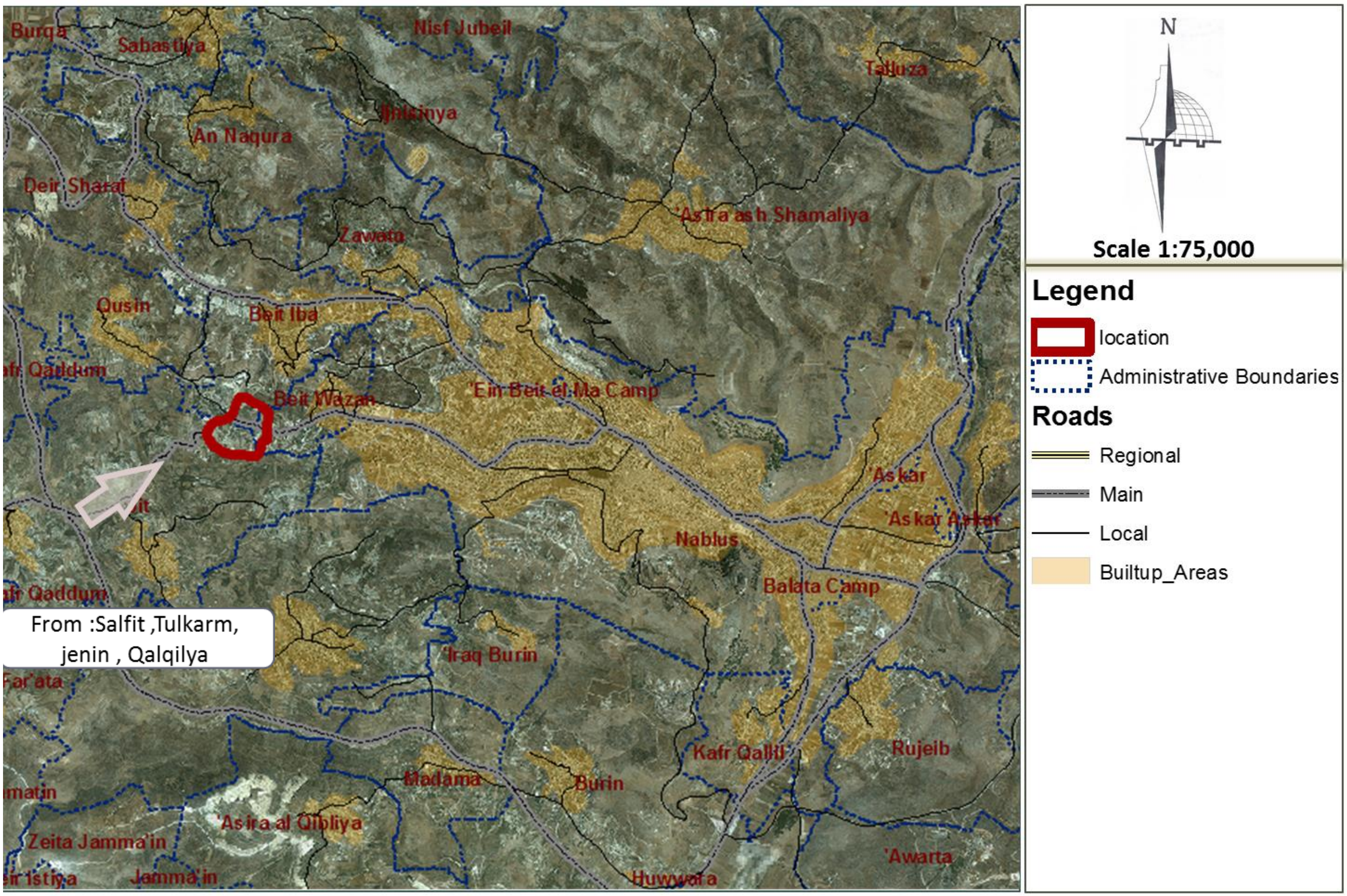


Fig. 3 :The Intersection of the Main and Local street at the site.

3. Road Accessories:

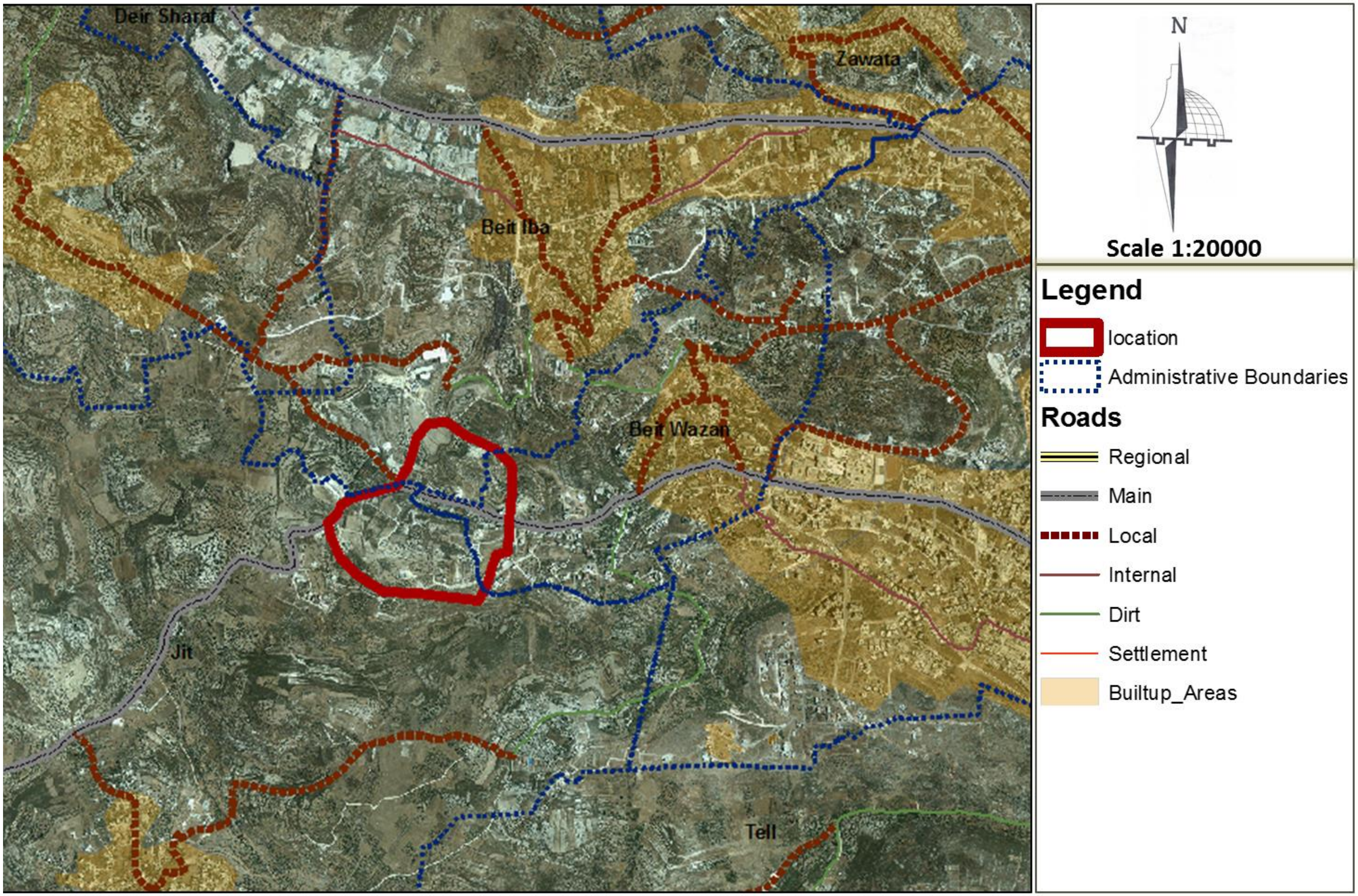
The accessories of the roads explained by the presence of electricity poles and lighting poles. This is inadequate as well as describes the map No. (19). In addition, the presence of a limited traffic signals at the intersection of roads is a Stop signal and a Yield to circumvent stand. And clearly it shows a lack of roads signals, especially the main road and the lack of Signboards and direction signs.

Road specification



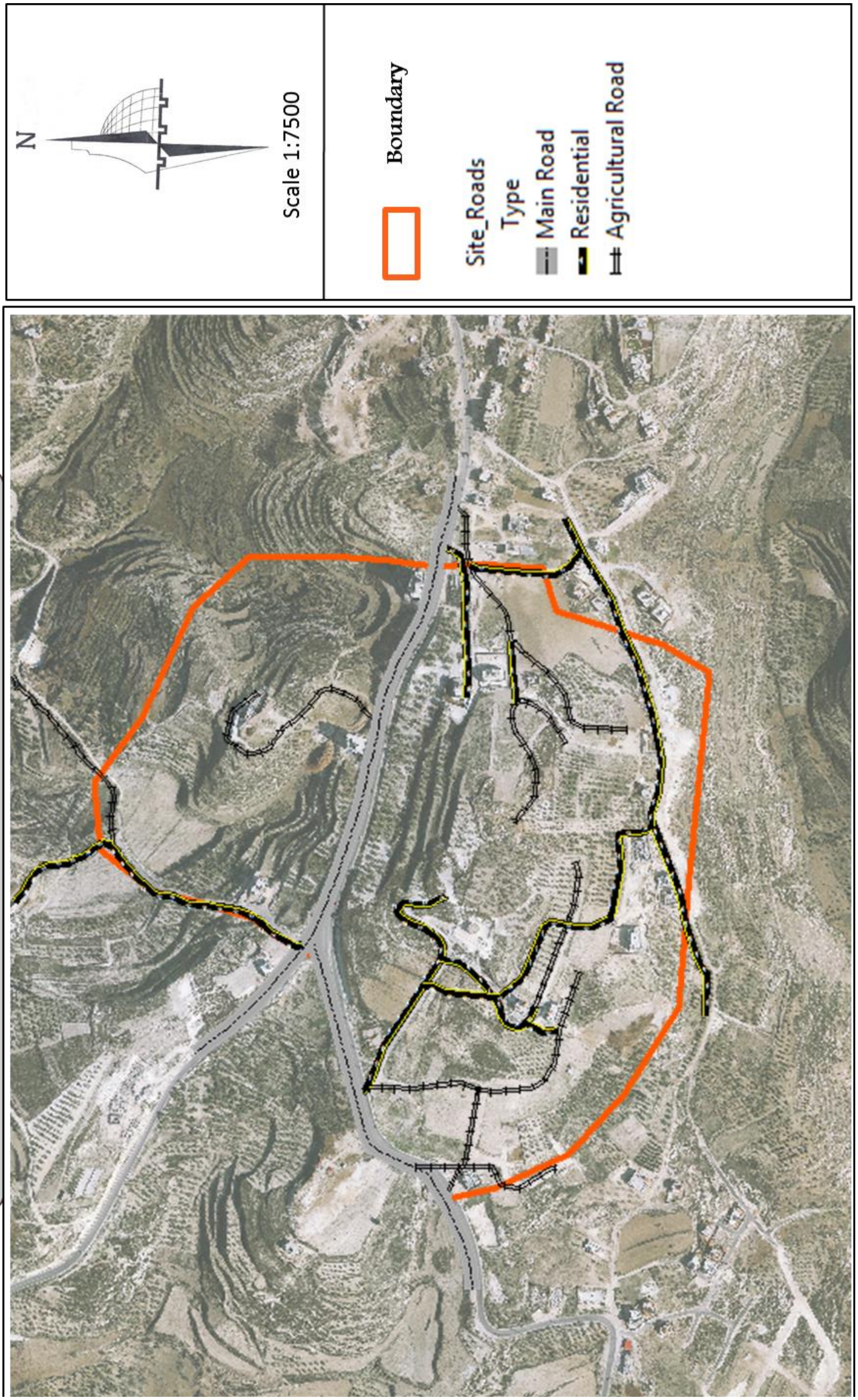
Map. 15 :: Regional road classification

Road specification - local scale

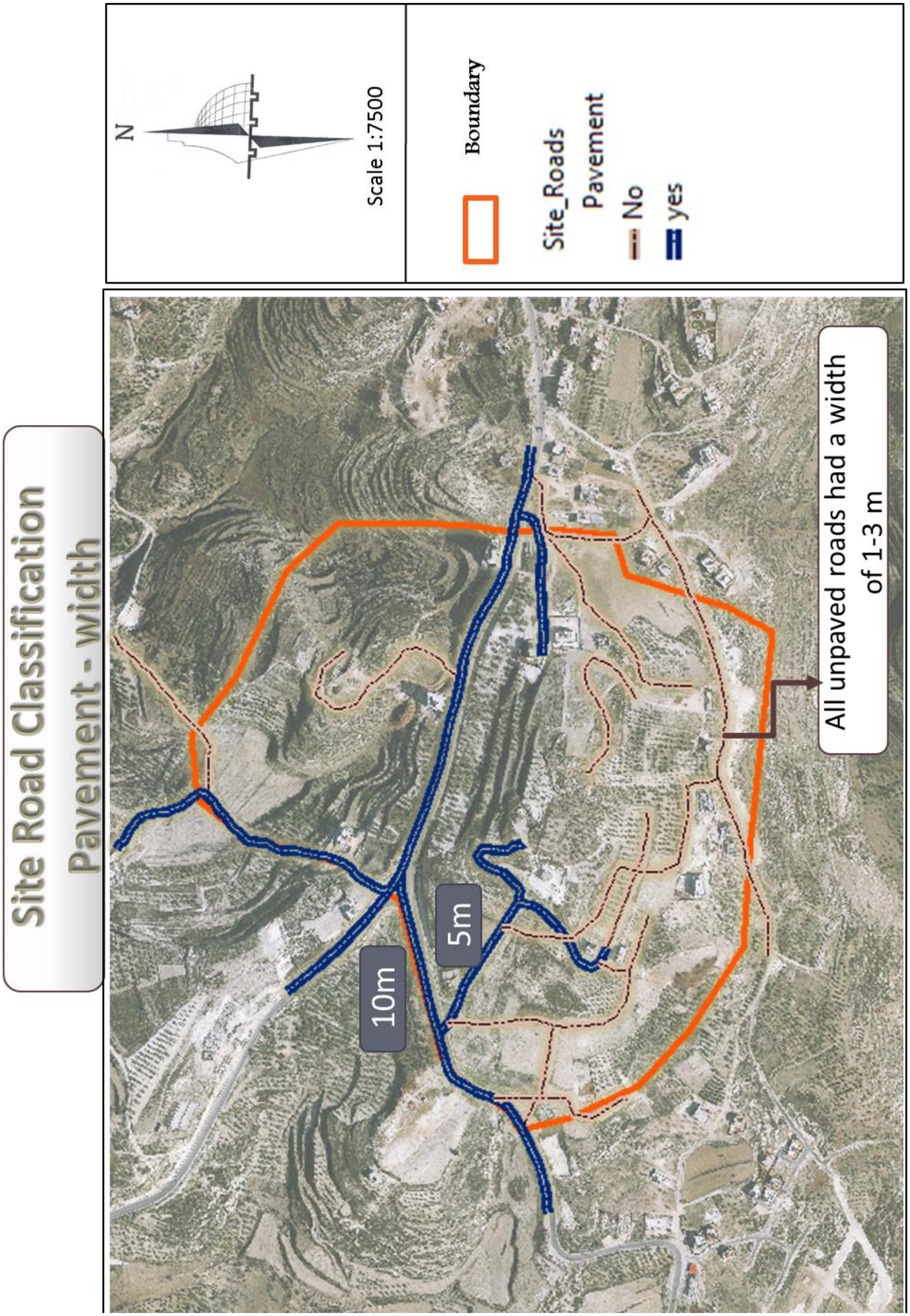


Map. 16 :Road classification local scale

Site Road Classification - Hierarchy

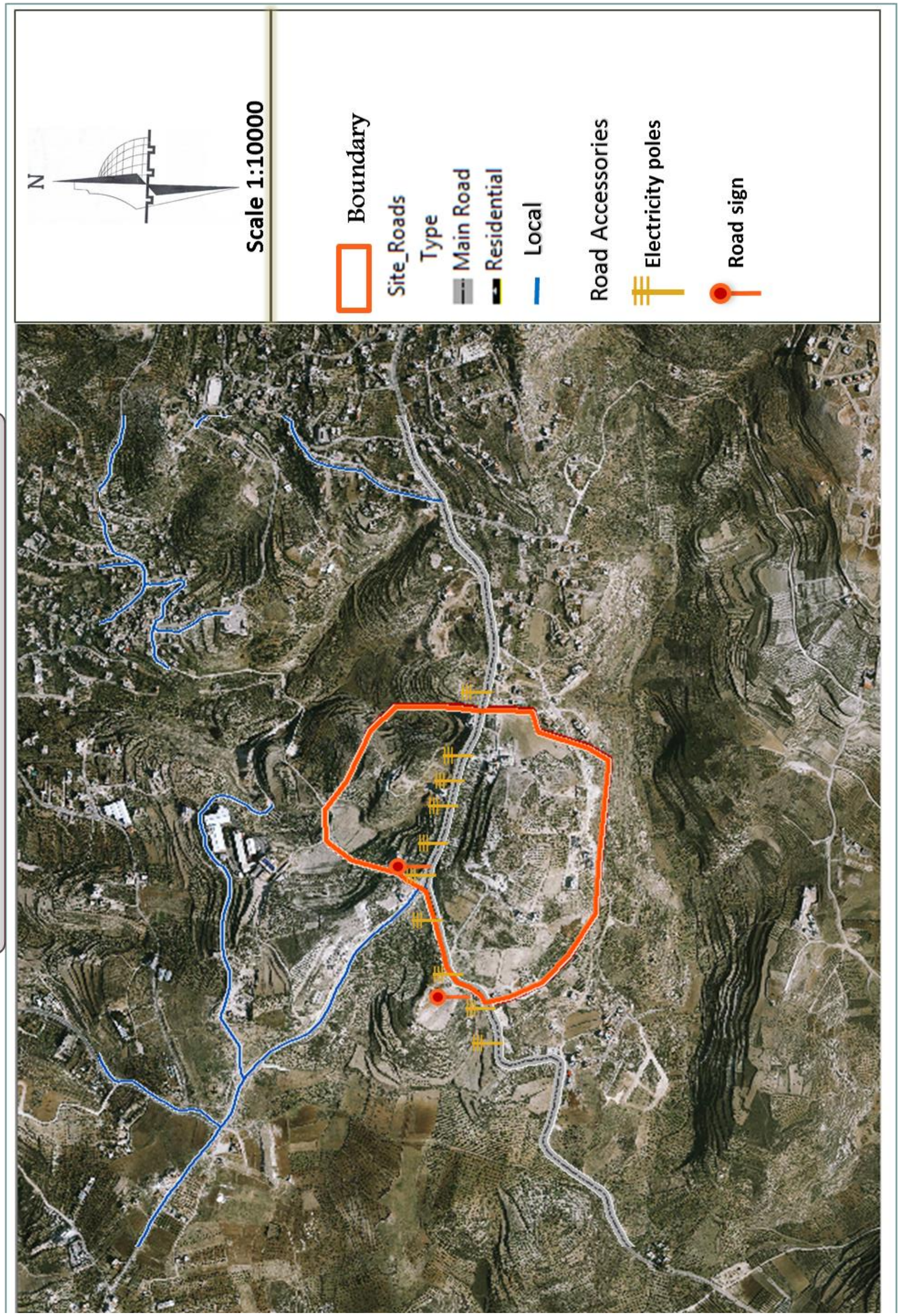


Map. 17 ::Site road classification based on hierarch



Map. 18 :Site road classification based on width and pavement

Road Accessories



Map. 19 : Site road accessories

3.4. Site Morphology:

The morphology of the site, which is illustrated in the following map No. include (20), can be explained as follows:

- **Buildings:**

We have several buildings on the site and as many as 15 buildings, all of it has a residential use, and has a built up area of 3,470 m2 . And most of the residential buildings on the site are serviced by unpaved and Dirt roads, most of these buildings is villas, and their heights ranging from two to three Floors.

- **Roads:**

At shown before the site roads was in bad situation and their width was at most narrow , in general the site need a new road network .

- **Entrances:**

The site have main three entrances, and all of them are at the main road that cross the site, the first was the east side and the second at the intersection with the local road of Qusin, the final is at the main road at the west side .

Fig. 4:The Eastern Entrance

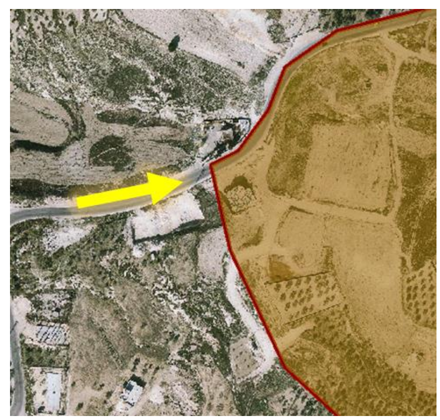
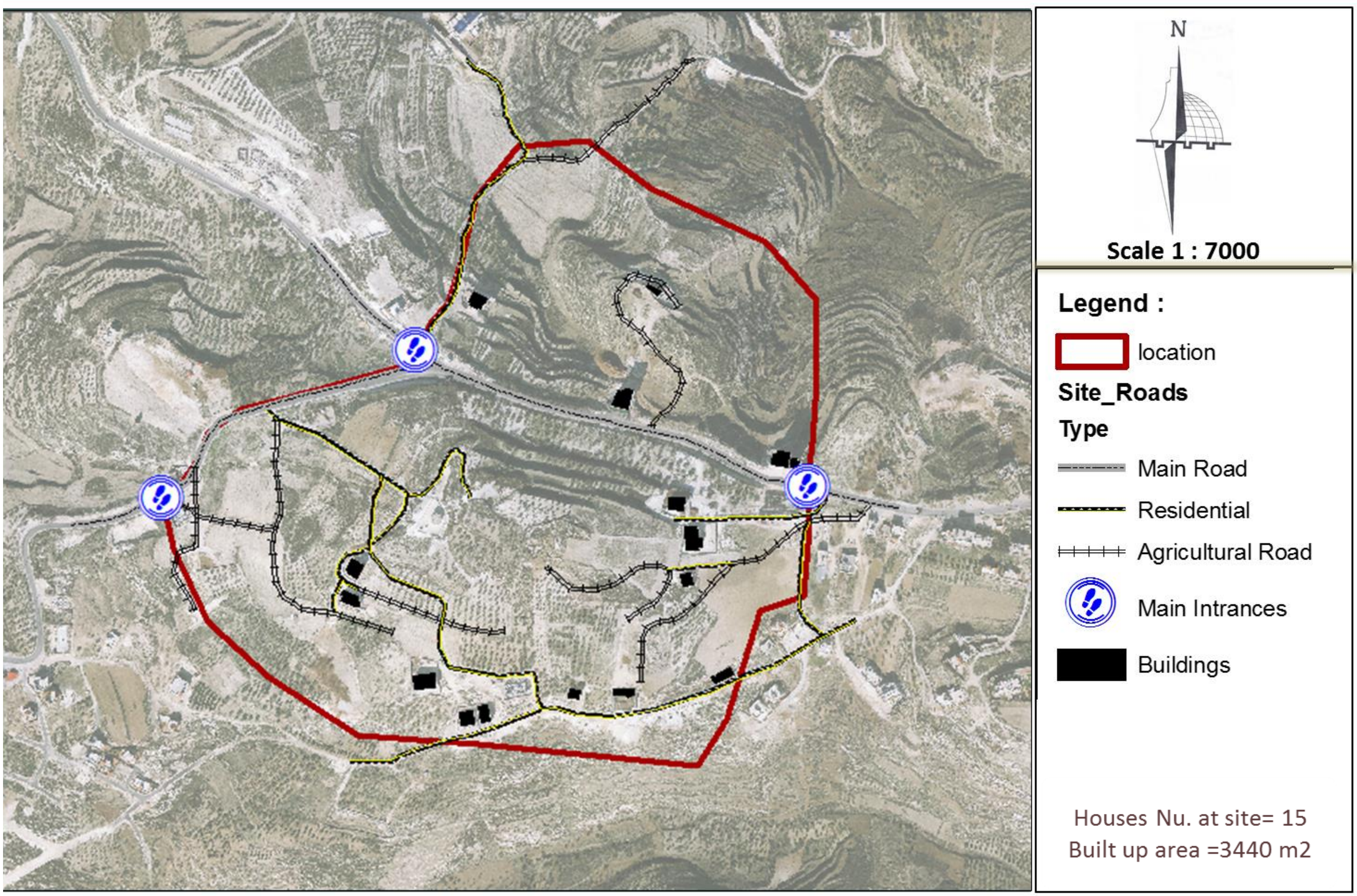


Fig. 5: The Western Entrance

Fig. 6: The Intersection Entrance

Site Morphology



Map. 20 :Site Morphology

3.5. Features in and near the project

There are many land marks that are in and out side the site , that affect the site planning process directly on indirect .

- **Inside the site :**

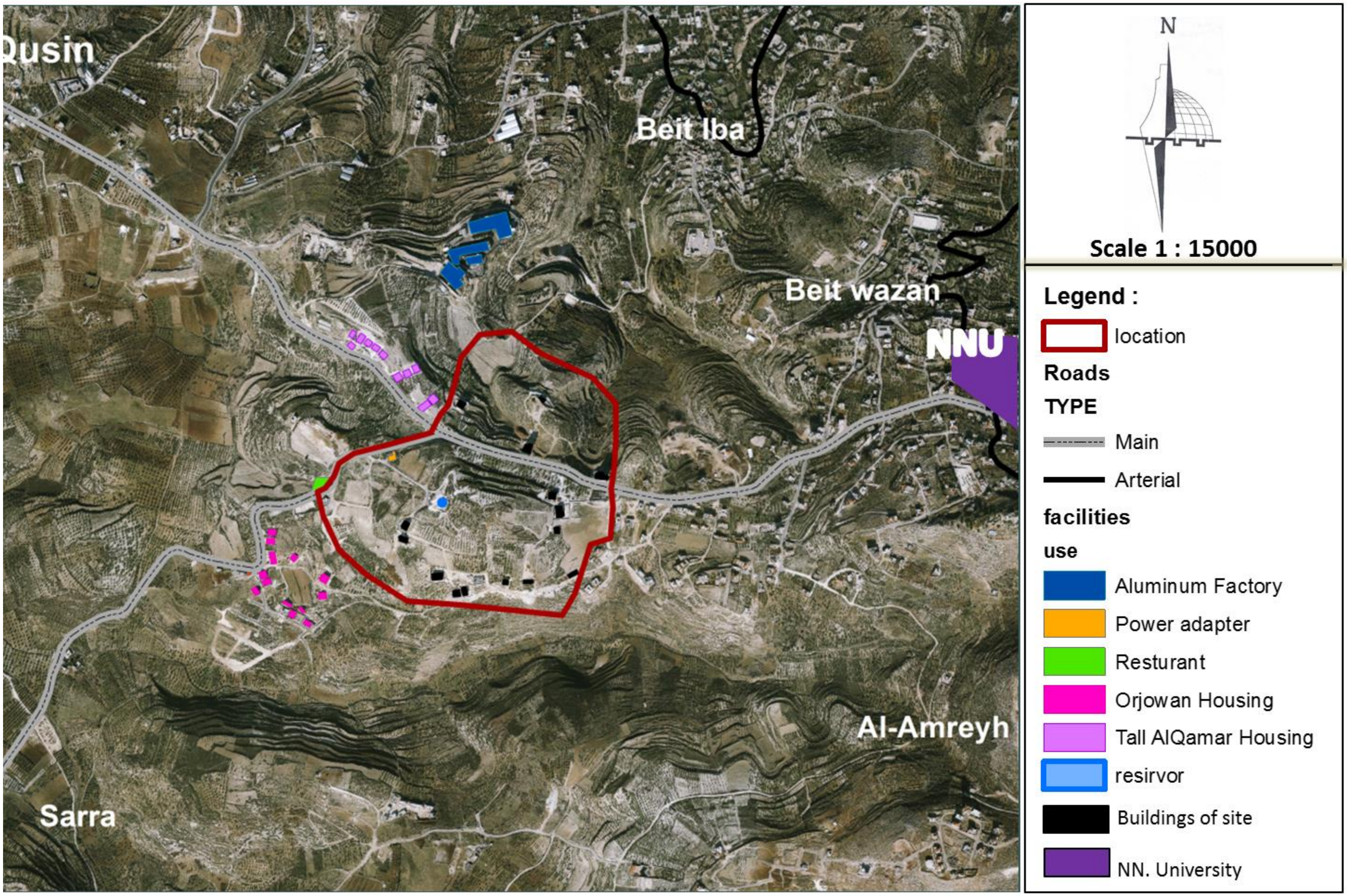
1. **Power adapter :** located at the west of the project site , near the road intersection , have tow effects on the site :
   - Negative : because of the rays result from it that affect humans live there .
   - Positive : it can be used from electricity collection point the site for the project .
2. **Water reservoir:** located at the middle of the site area, used to save water, and conceded as positive point to serve the area.
3. **Building at the site:** it was conceded as an obstacle for the planning process of the site, as will explained later .

- **Outside the site :**

1. **Nearby Housing Projects :**
   - Orjowan Housing: a new housing project, at the south west of the project site, this housing are been contrasted and it started from few period, this housing affect the project positively but also affect the privacy of the site .
   - Tall Al-qamar housing: also a new housing project, nearly finished, located at the north west of the project site ,at the roads intersection ,and considered as sustainable housing .
   - Al-amreya : also new housing project at the area but it was used by people ,it located at the south east of the project .
2. **Aluminum Factory :**

A factory located at the north west of the project , and far from the site by about 270 m, also have a negative effect at the project ,result from the rays that affect humans and the environment .

Features In & Around the site



Map. 21: Features in and around the site

Features Around

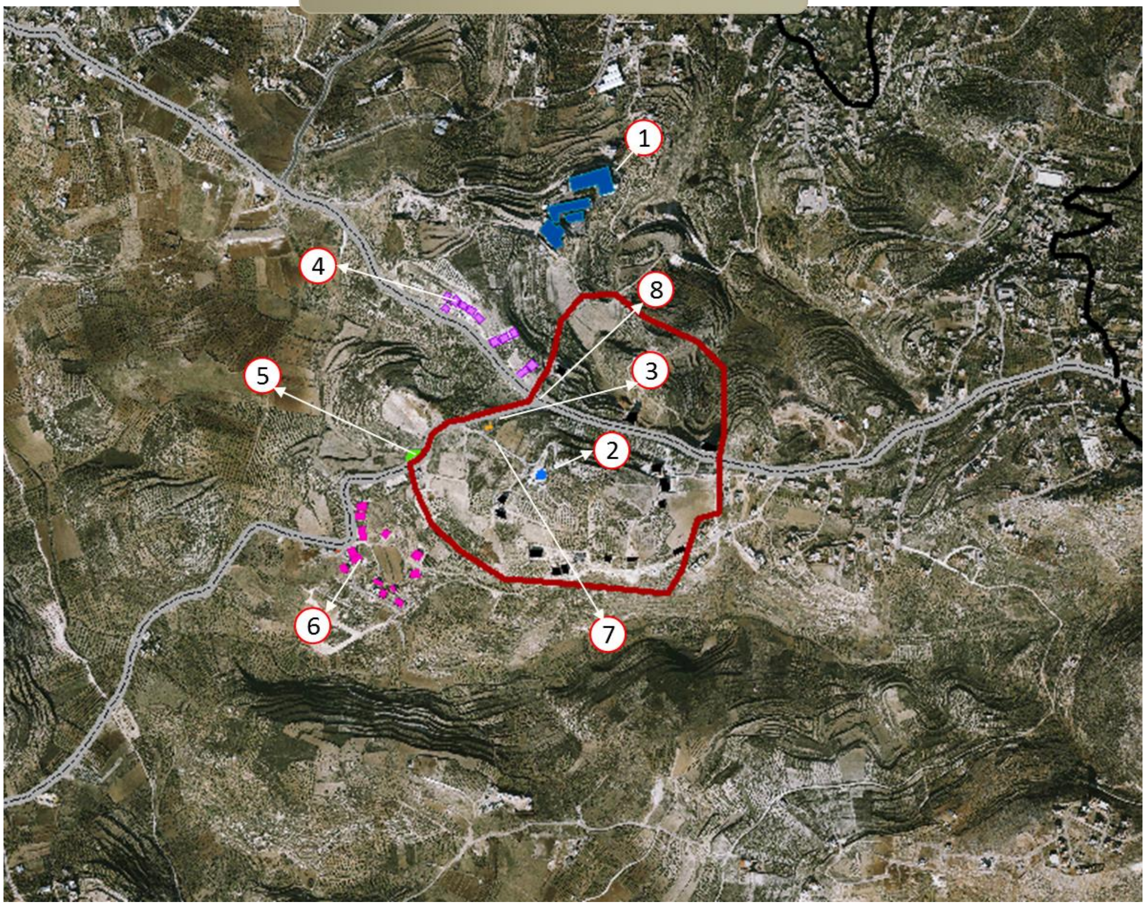


Fig. 7 :Features in and around the site

Fig. 9: Aluminum Factory

Fig. 8: Water reservoir at the site

Fig. 11:: Electricity adapter

Fig. 10: Tall Al-qamar Housing

Fig. 13:Horse Farm

Fig. 12:: Orjowan Housing

Fig. 15 : Bad Paved road at the site

Fig. 14::Electricity poles at site

3.6. Services at the site:

Infrastructure services

1. **Electricity**: it reaches the building at the site, and concentrated at the main road only, it served by Jerusalem Electricity Company.
2. **Water network:** the existing building served by the network of Nablus municipality.
3. **Sewage Network:** there is no sewage network at the area of the site.

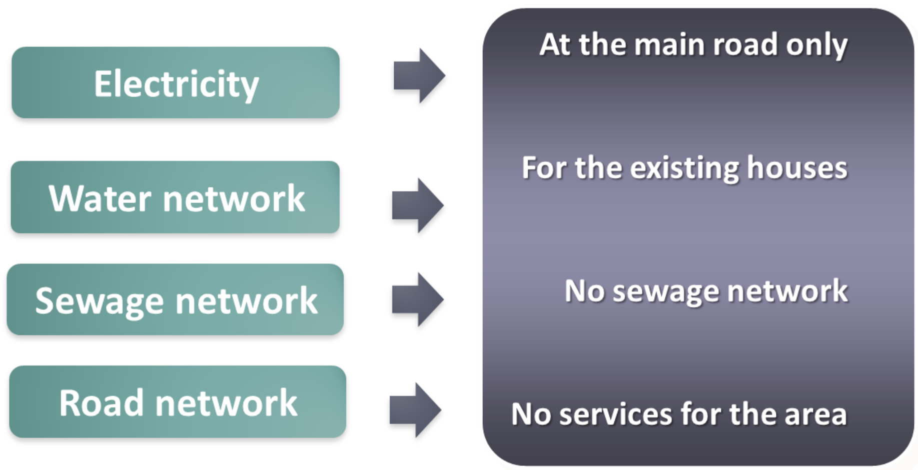


Figure 14: Infrastructure services at the site

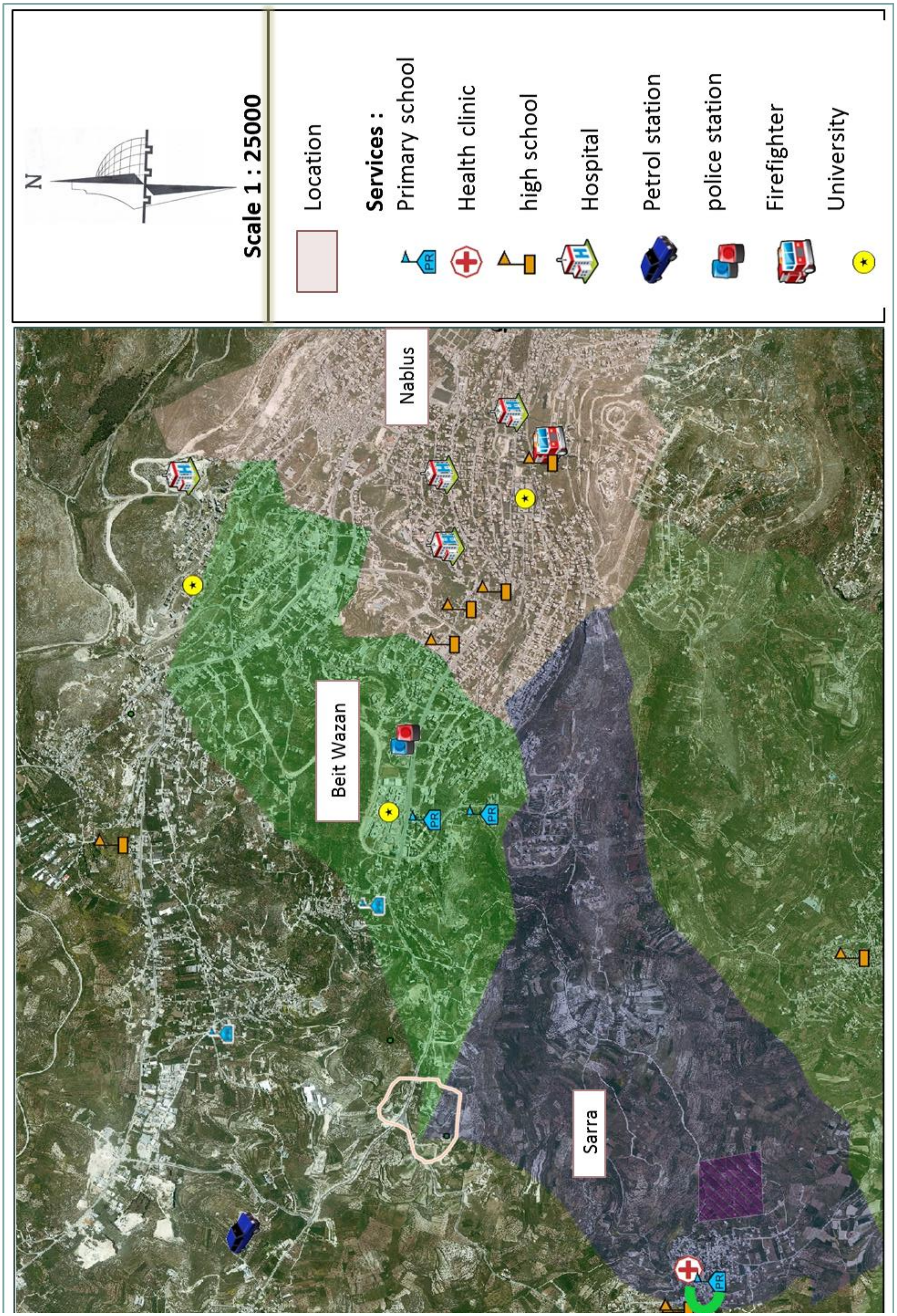
Services needed at the site:

The site depending on the public services of Nablus city, these services include Hospitals, Fire fighter, universities and police station.

Also it depends on the schools of the nearest communities like Bit wazan and Jit schools, also the petrol station of Bit wazan .

These services that can be used from the project modified at the map no (23) below, and explained the distance between services and the project

Regional Services



Map. 22 : Services around the site

6. Solar Analysis:

Solar analysis made for the project site at two stages the first for the winter at 10 o'clock at the first of January and another at summer at 10 o'clock at the first of June .this analysis made for the sun rays , paths and shadows , these are the important three factors that affect the process of solar urban planning .

The factors affected the site explained at the figures below :

At winter:

Table 2 : time zones of the winter solar analysis

Minute	Hour	Day	Month	Year
00	9	1	12	2015
Time Zone : GMT + 2				

1. **Sun Path :** As shown at figure below the path of the sun at the site at winter have a ring direction but in a flat angle, that because of the angle of the sun at winter was lower than summer .

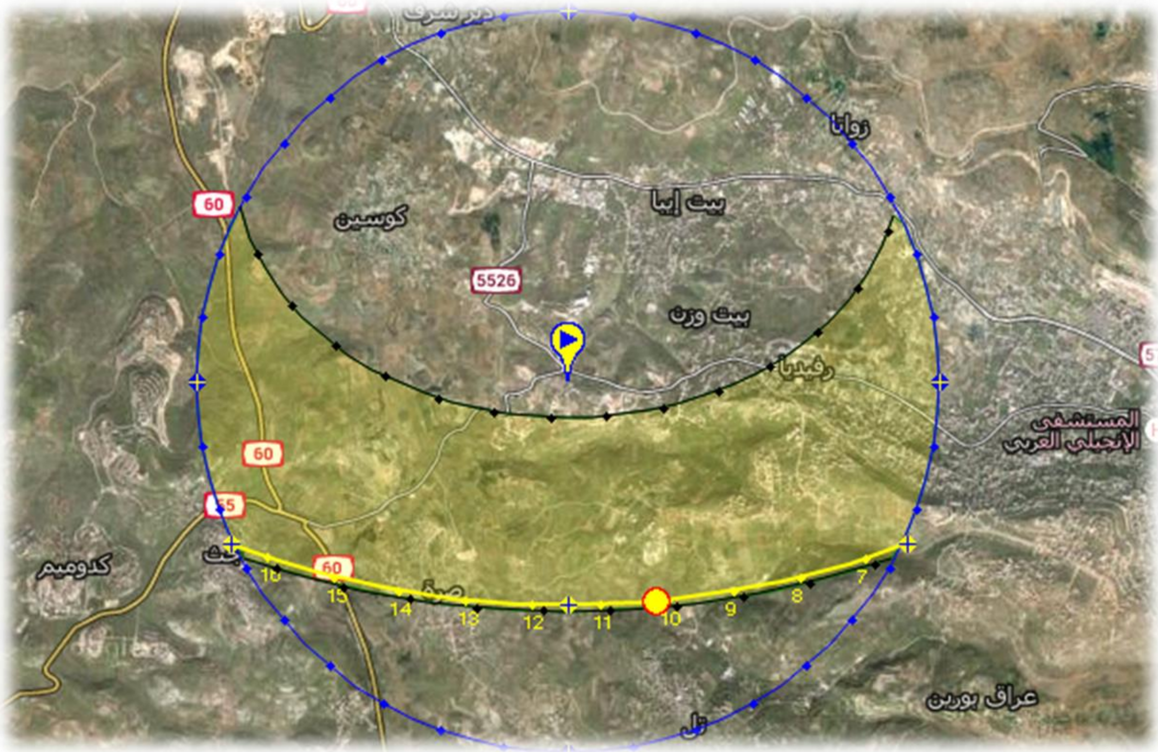


Figure 15 :Sun path at winter

2. **Sun Rays**: As shown in the figure below the sun rays direction goes from the site itself to all sides except the north, so this make the direction of planned area by these directions.

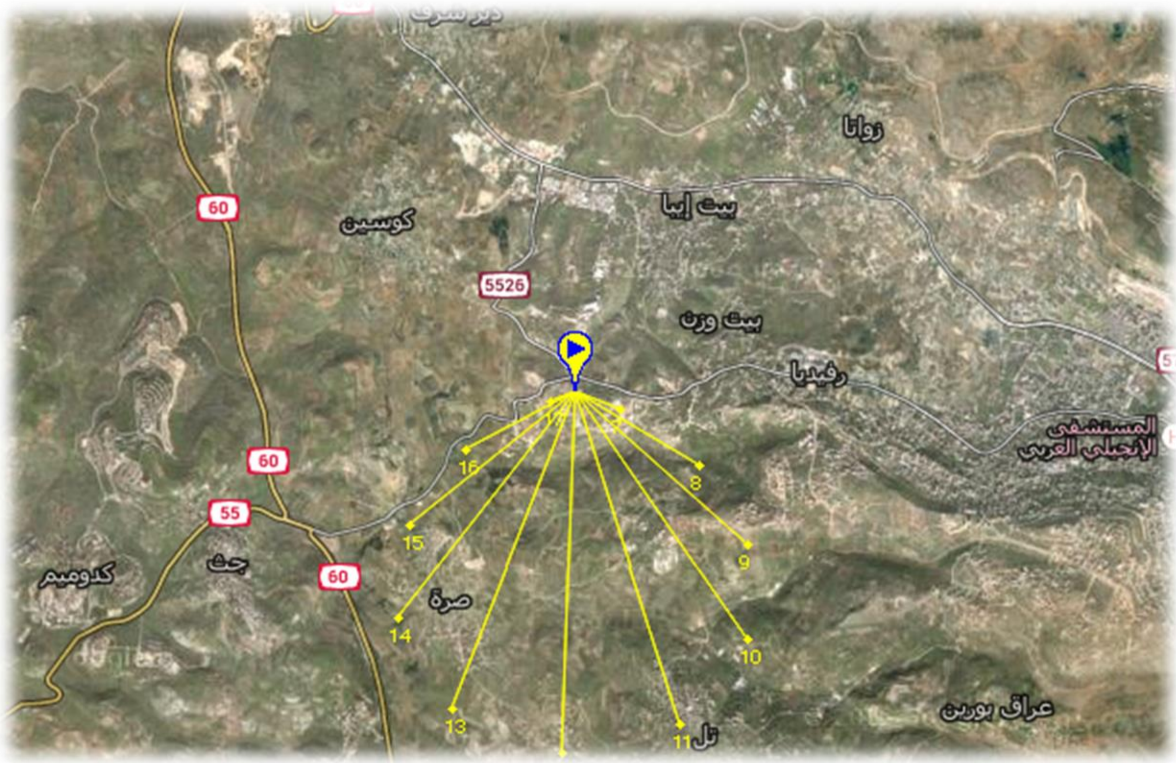


Figure 16: Sun rays at winter

3. **Shadows:** the figure below shows the shadows direction of the site , so it goes to the north, north-east and the north-west direction , so this affect the planning process at high degree.

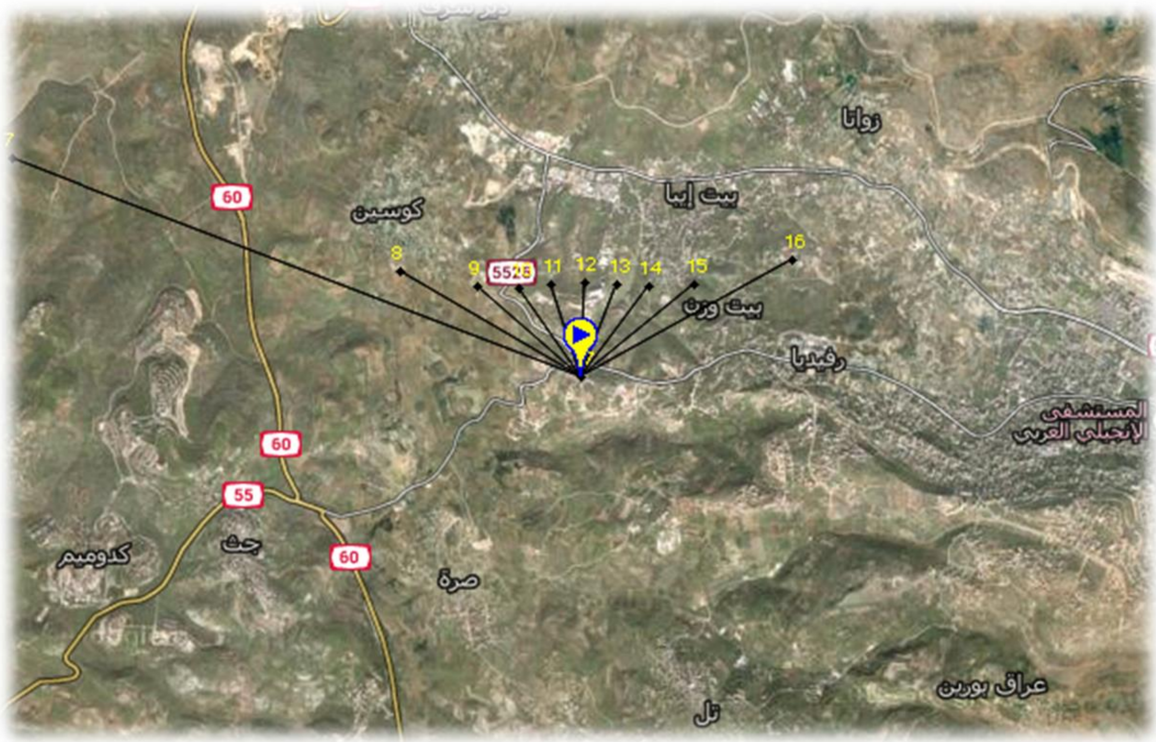


Figure 17: Sun shadows at winter

4. **Sun Path + Rays:** the figure below shows the sun path with its rays at winter on the site.

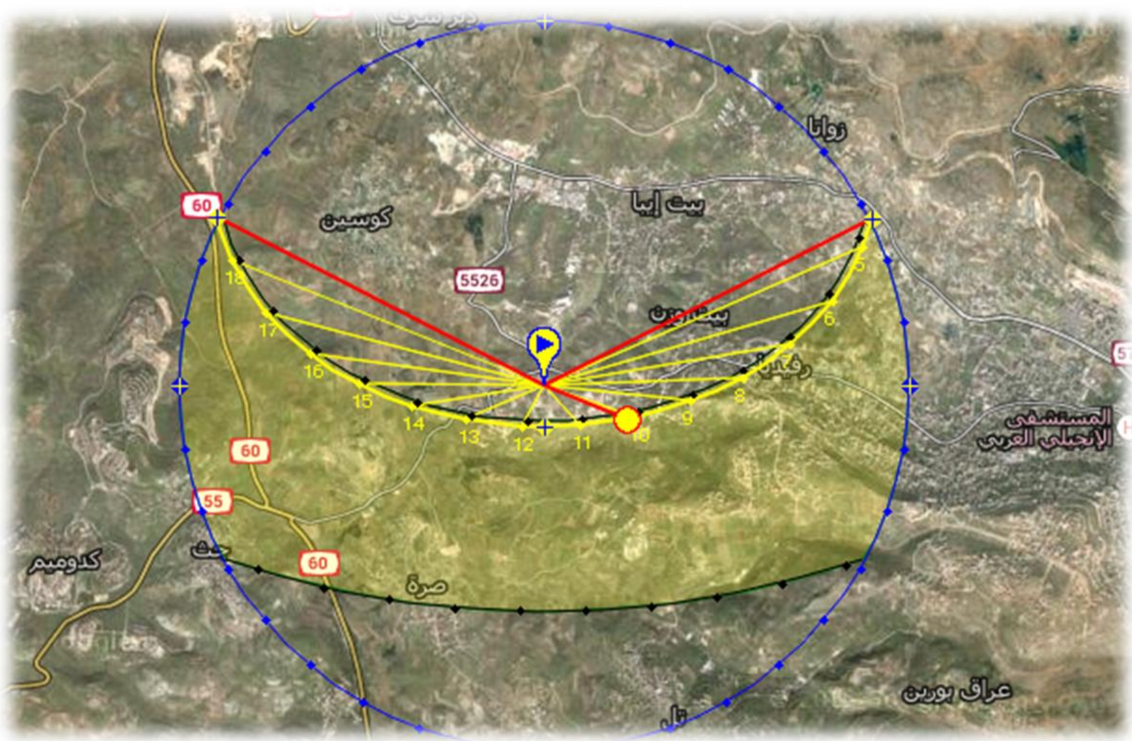


Figure 18:Sun rays and path at winter

At summer:

Table 3 : time zones of the summer solar analysis

Minute	Hour	Day	Month	Year
00	10	1	6	2015
Time Zone : GMT + 2				

1. **Sun Path :** As shown at figure below the path of the sun at the site at summer have a ring direction more than winter, so the sun access at summer will be more than winter.

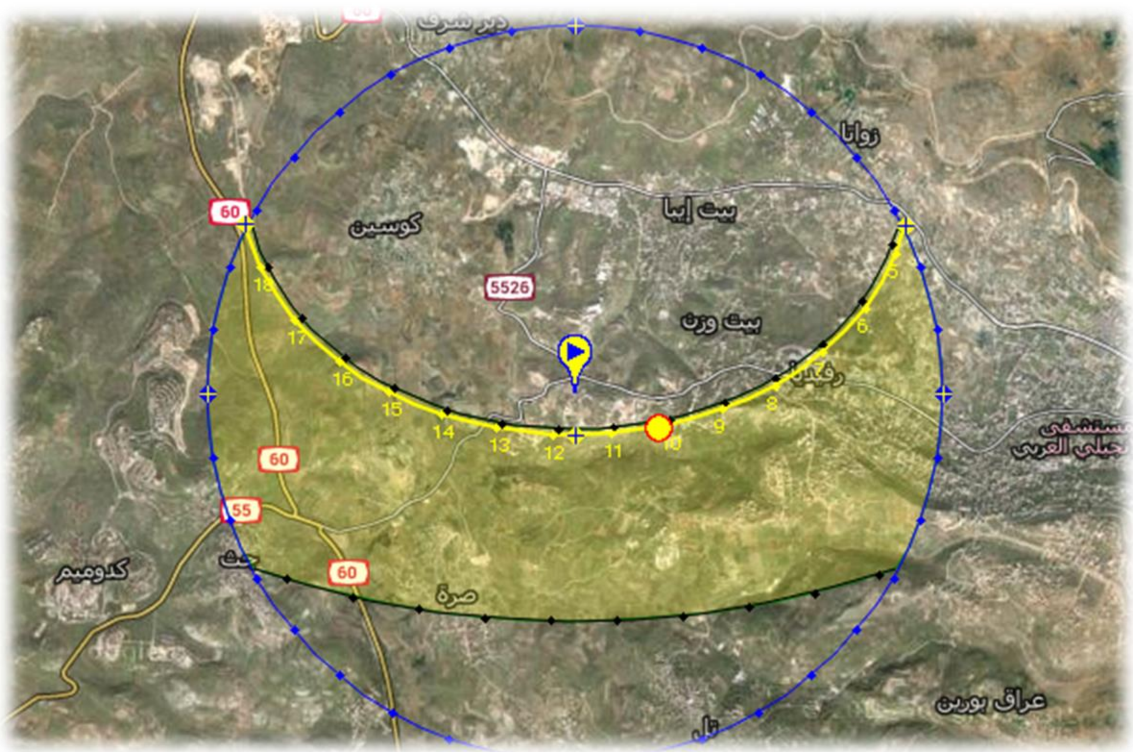


Figure 19: sun path at summer

2. **Sun Rays:** As shown at figure below the rays of the sun at the site at summer reaches all directions at the site and the rays have a longer line.

Figure 20: sun rays at summer

3. **Sun Shadow:** As shown at figure below the shadows direction at the site at summer was at the opposite direction of the shadows at winter, and the rays have shorter length .

Figure 21: sun shadows at summer

4. **Sun Path and Rays:** the figure below shows the sun path with its rays at summer on the site.

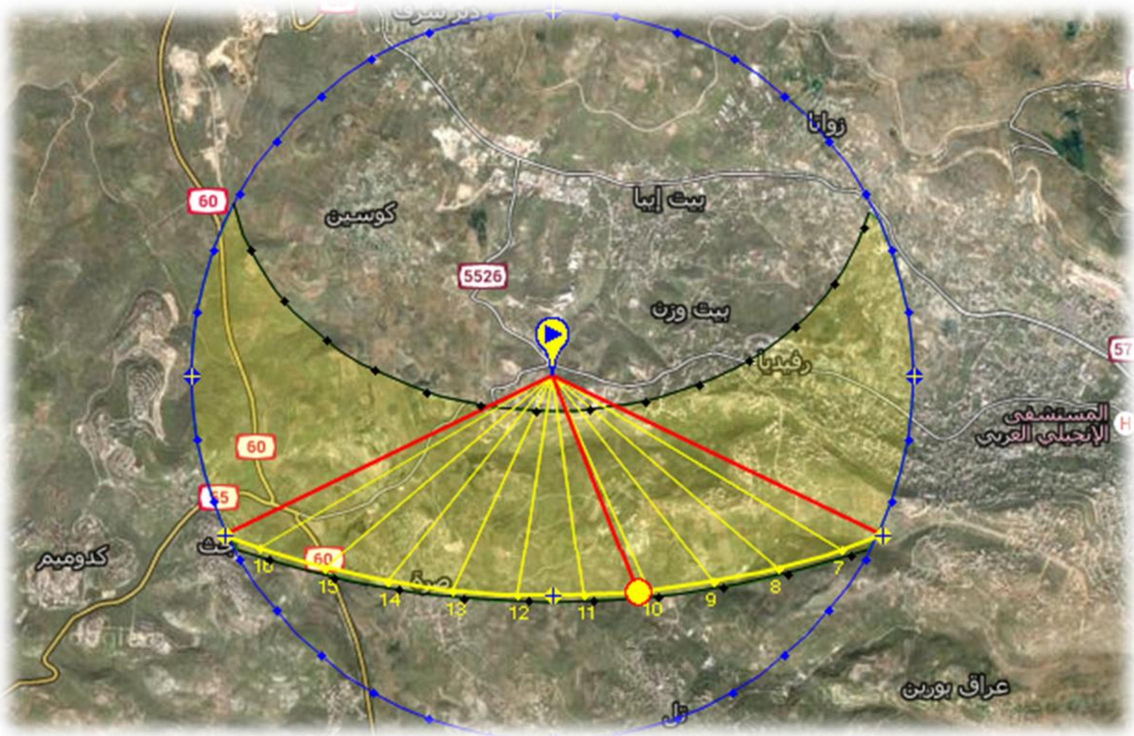


Figure 22 :sun path and rays at summer

Sun path of the site:

The figure below shows the sun path of the site at summer and winter and the difference of the angle of sun at the tow paths.

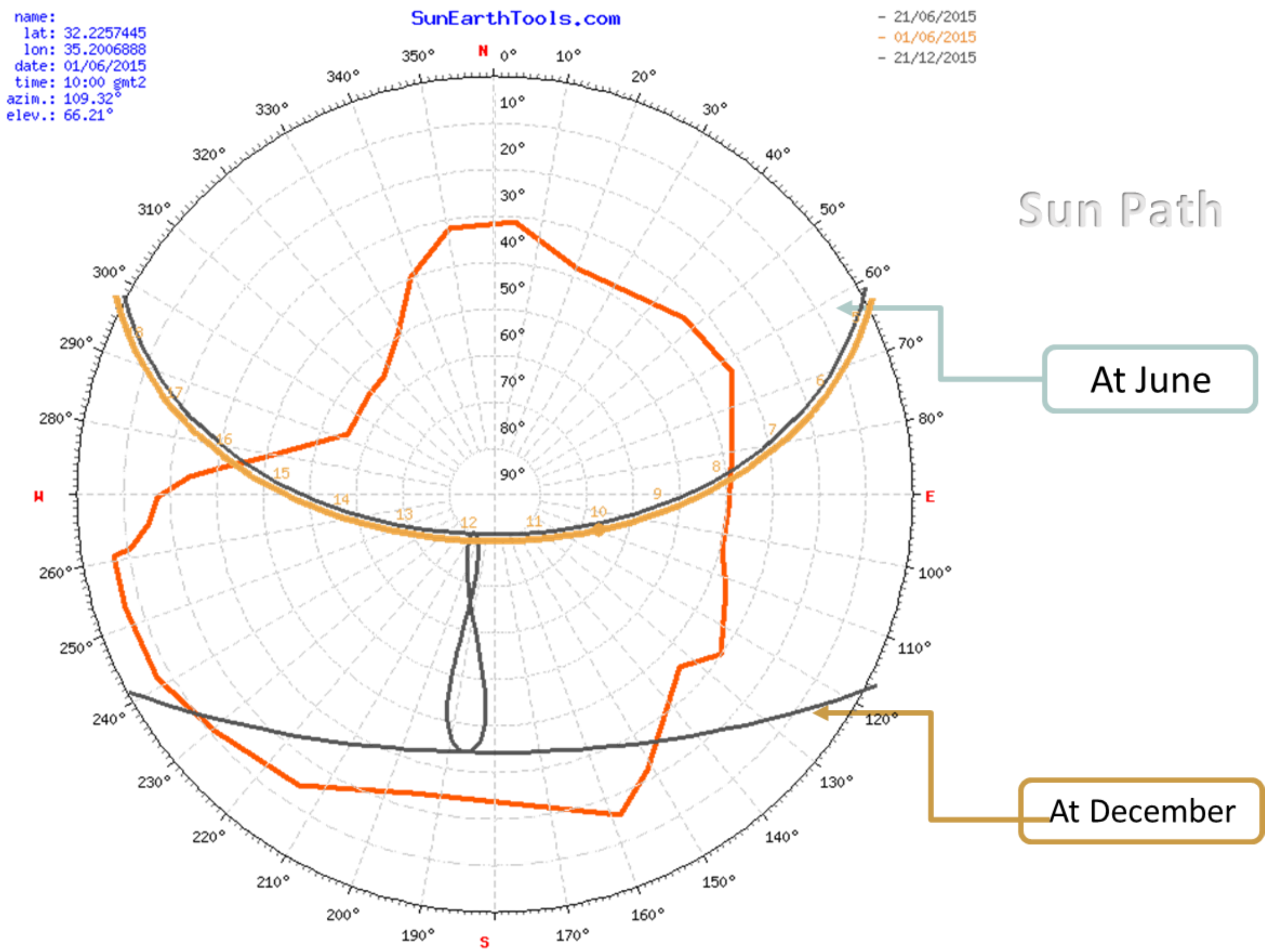


Figure 23: Sun path of the site at summer and winter

Wind direction and shadows:

The wind that affect the site have the direction of north-west direction as shown in figure 25 below , also it shows the direction of shadows at summer and winter of the site.

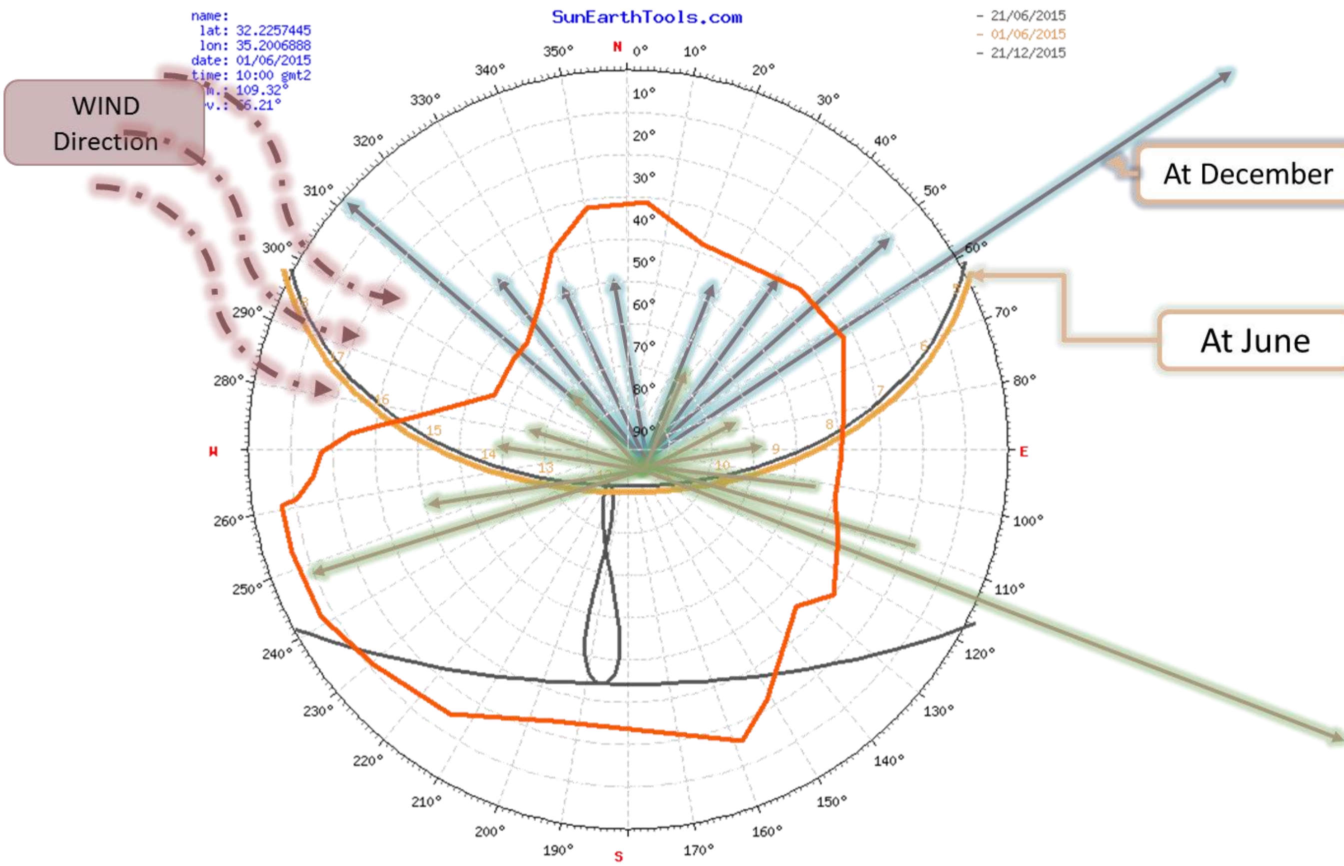


Figure 24 : Wind direction and shadows at the site .

Sun Path – At a year :

The figure below shows the sun path at the all months of the year, as shows , the angles of sun path increase from winter months to the summer , and the sun path access increase at the summer months, and decrease at winter .

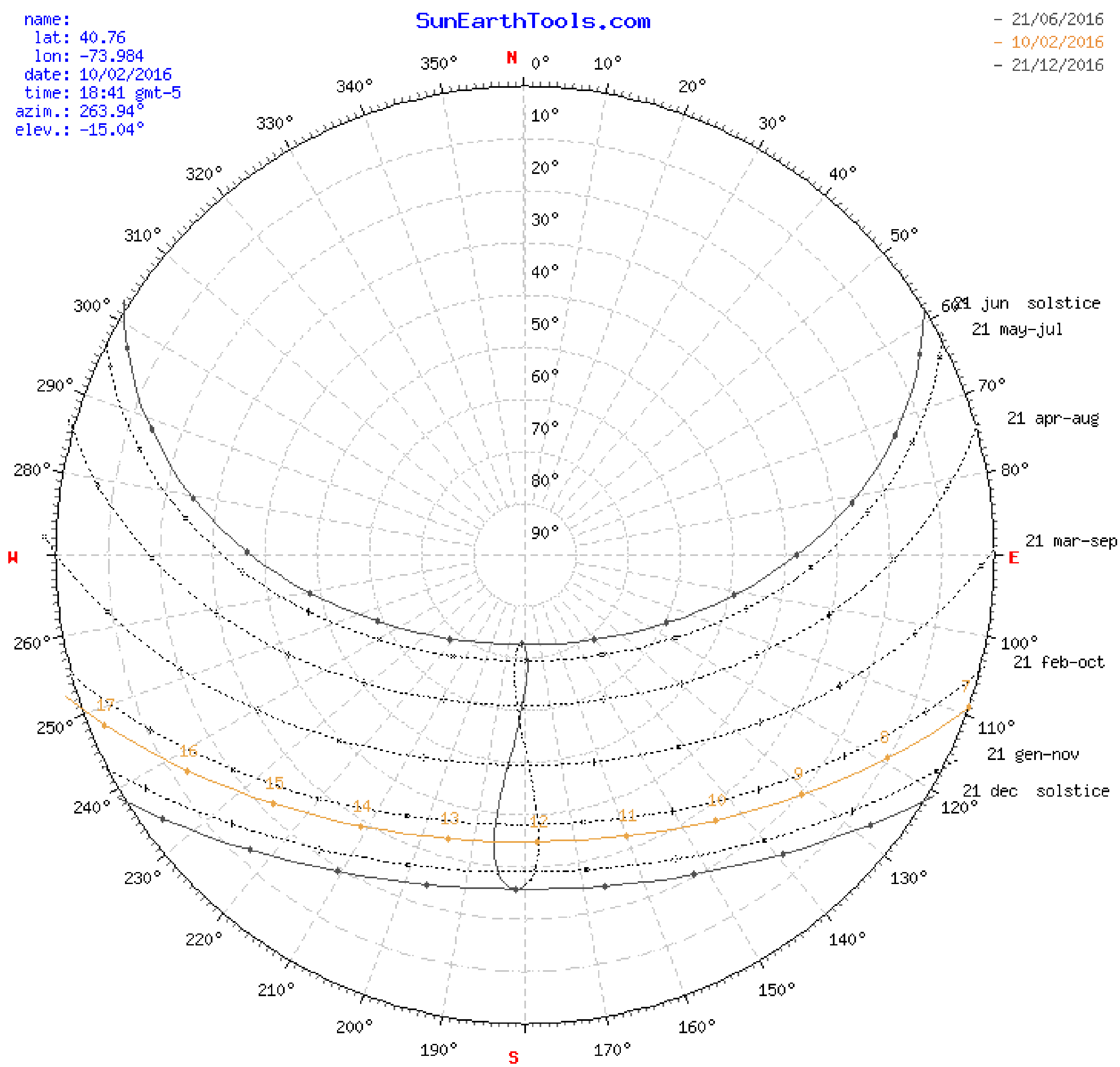


Figure 25 : sun path of the site at all the year

Azimuth – Elevation :

The figure below shows the azimuth angels of the sun at the site at all months of the year ,and it shows the highest azimuth angle reaches 75 degree at summer and the lowest at winter .

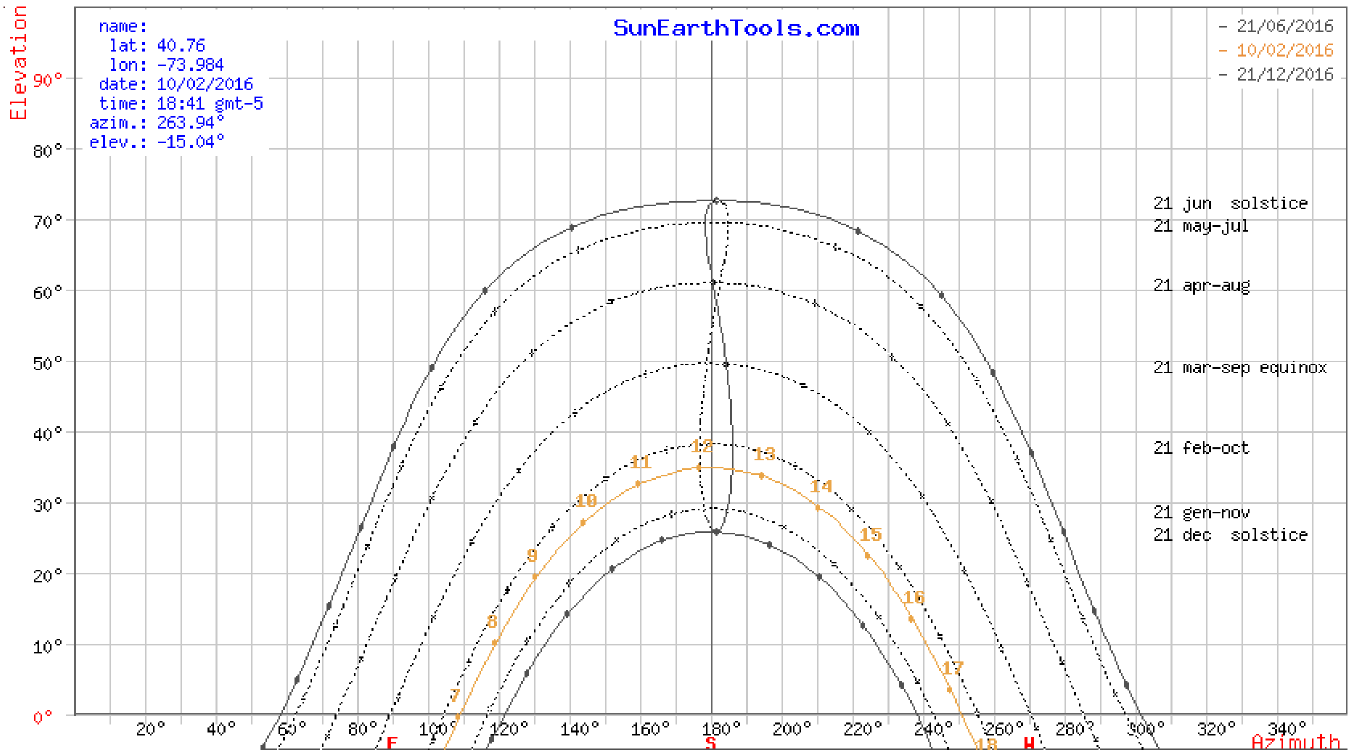


Figure 26 : Azimuth angels at the site at all year months

But the tables below shows the azimuth angels of the sun at 2 times of the year all the days , the first day was at the 2st of Summer as shown in table 4 ,and the azimuth angels have a high values , but in the second table 5, the azimuth angels have lower values ,this related to the lower angle of the sun at winter than summer

Table 4 : Azimuth angels at the site at the 1st of June

Date:		1/6/2016
coordinates:		32.2260168, 35.2015686
location:		
hour	Azimuth	Elevation
04:33:19	63	-0.833
05:00:00	66.49	4.27
06:00:00	73.73	16.2
07:00:00	80.59	28.56
08:00:00	87.71	41.18
09:00:00	96.21	53.85
10:00:00	109.07	66.24
11:00:00	138.5	76.98
12:00:00	208.14	78.71
13:00:00	246.41	69.05
14:00:00	261.37	56.85
15:00:00	270.51	44.2
16:00:00	277.82	31.56
17:00:00	284.68	19.13
18:00:00	291.79	7.08
18:41:08	297.09	-0.833

Table 5 : Azimuth angels at the site at the 1st of December

Date:		1/12/2016
coordinates:		32.2263073, 35.2017403
location:		Nablus
hour	Azimuth	Elevation
06:22:30	115.53	-0.833
07:00:00	120.71	6.15
08:00:00	130.23	16.49
09:00:00	141.76	25.31
10:00:00	155.73	31.91
11:00:00	171.92	35.46
12:00:00	189	35.35
13:00:00	205.08	31.61
14:00:00	218.91	24.86
15:00:00	230.3	15.93
16:00:00	239.71	5.53
16:34:02	244.39	-0.833

Solar Radiation:

The solar radiation is the most important factor that affect the planning of the solar urban area, so at this project it was analyzed at summer and winter to show how this affect the planning of the site area, and the difference between winter and summer. Also solar radiation shows the ability to use solar tools at the area and the places to use.

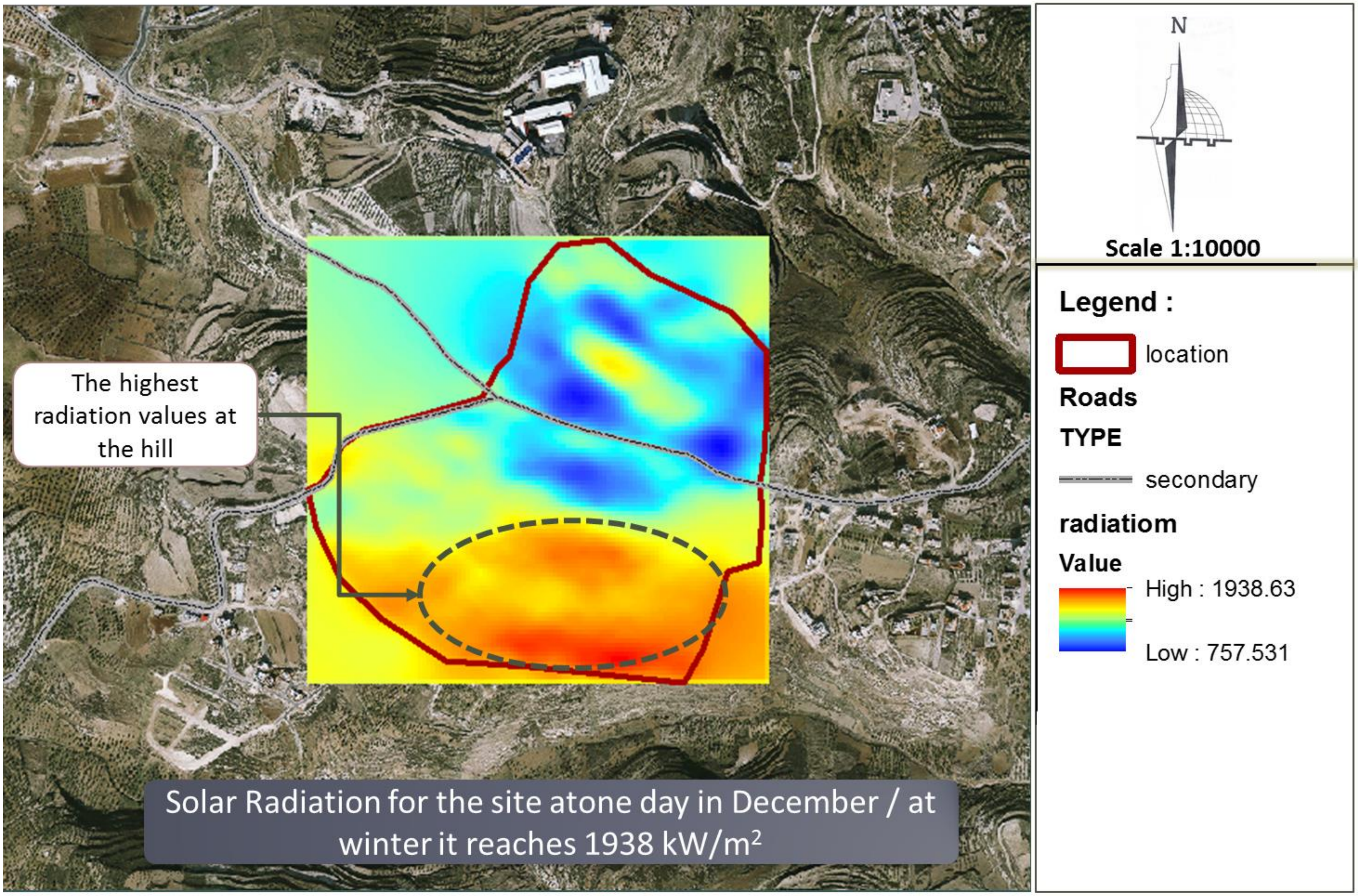
1. At Winter :

The map No. (23) below shows the solar radiation at winter, and from that map the solar radiation concentrated at the south of the site , so the highest radiation values was at the hill and mainly at the south part of it, and the Solar Radiation for the site at one day in December / at winter it reaches 1938 kW/m^2, so this shows the amount of insulation solar energy can be used at this area.

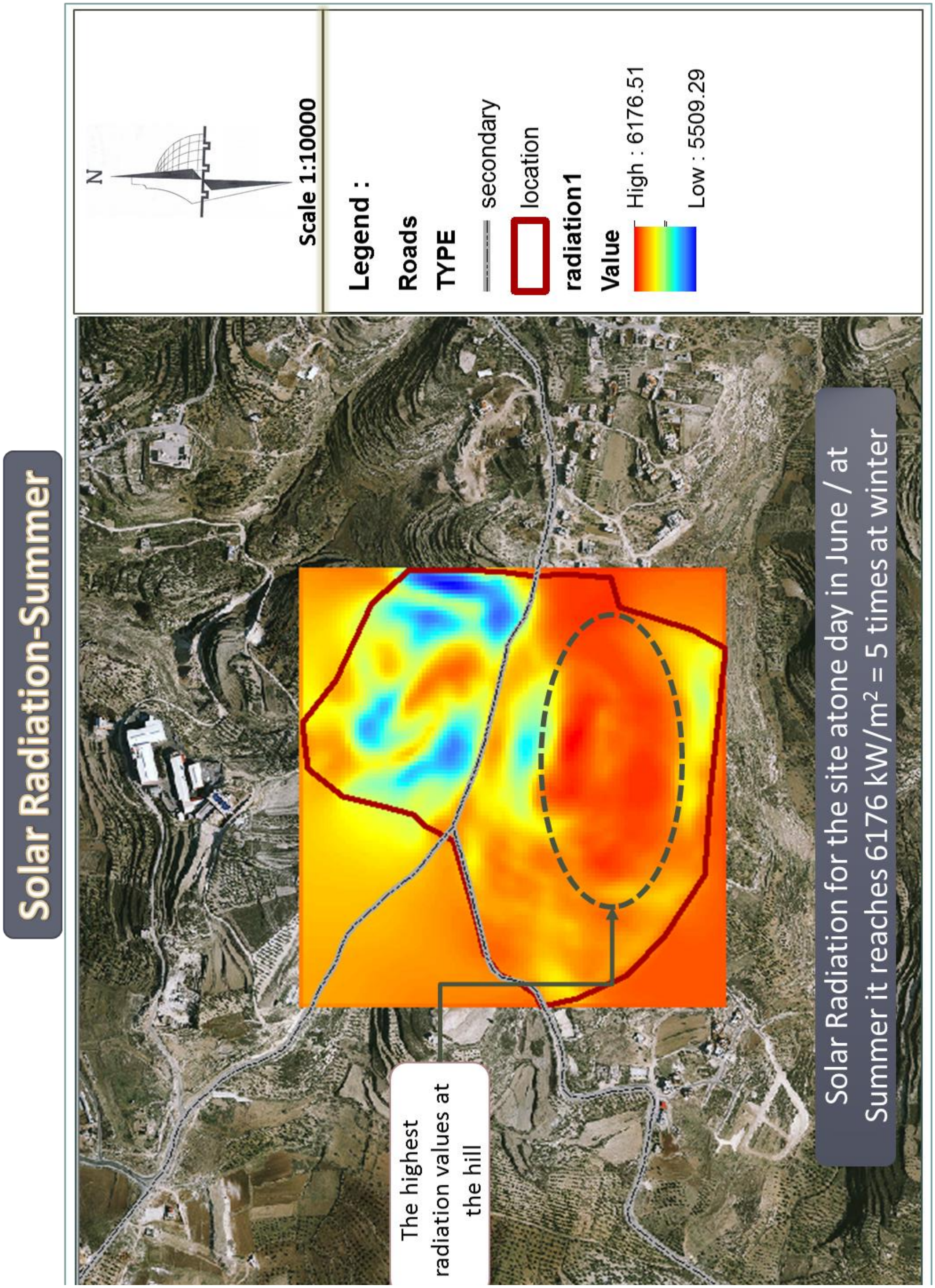
2. At summer :

Solar radiation at summer have a higher values than summer at all areas of the site , and this can be unwanted at many areas , like the highest hill at the site , the Solar Radiation for the site at one day in June / at Summer it reaches 6176 kW/m^2 , so that equals the amount of solar radiation of winter at five times .

Solar Radiation-Winter



Map. 23 :the solar radiation at the site at winter



Map. 24 :the solar radiation at the site at summer

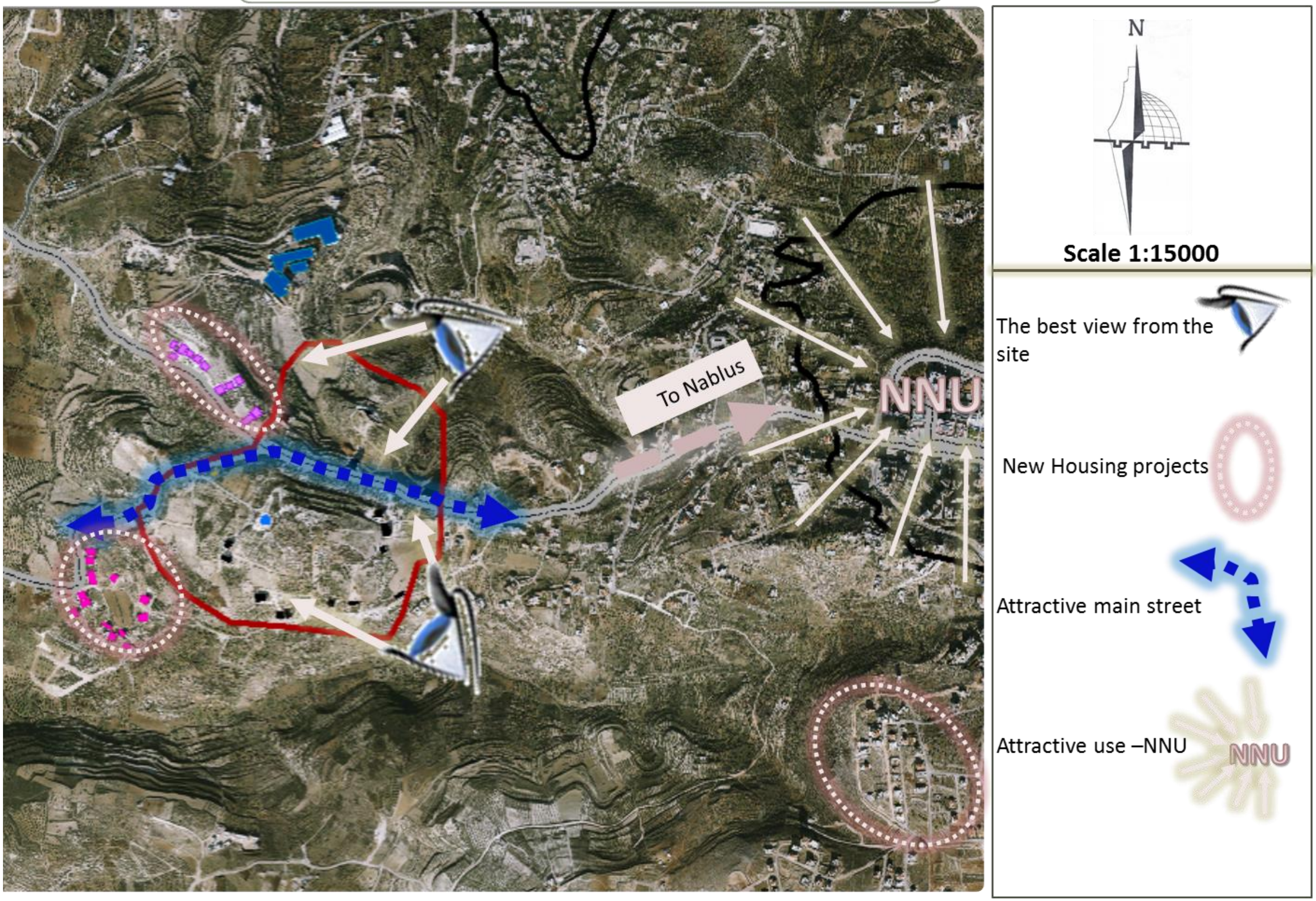
Chapter 4 :SWOT Analysis

The next table summarize all the important points explained at the analysis above, so it shows the strength , weaknesses , opportunities and the threats at the project , and all of these point reflected on the locational map at the opportunities map no(25) below , also at constraints map no(26) .

Table 6 : The SWOT analysis summarize for the site analysis .

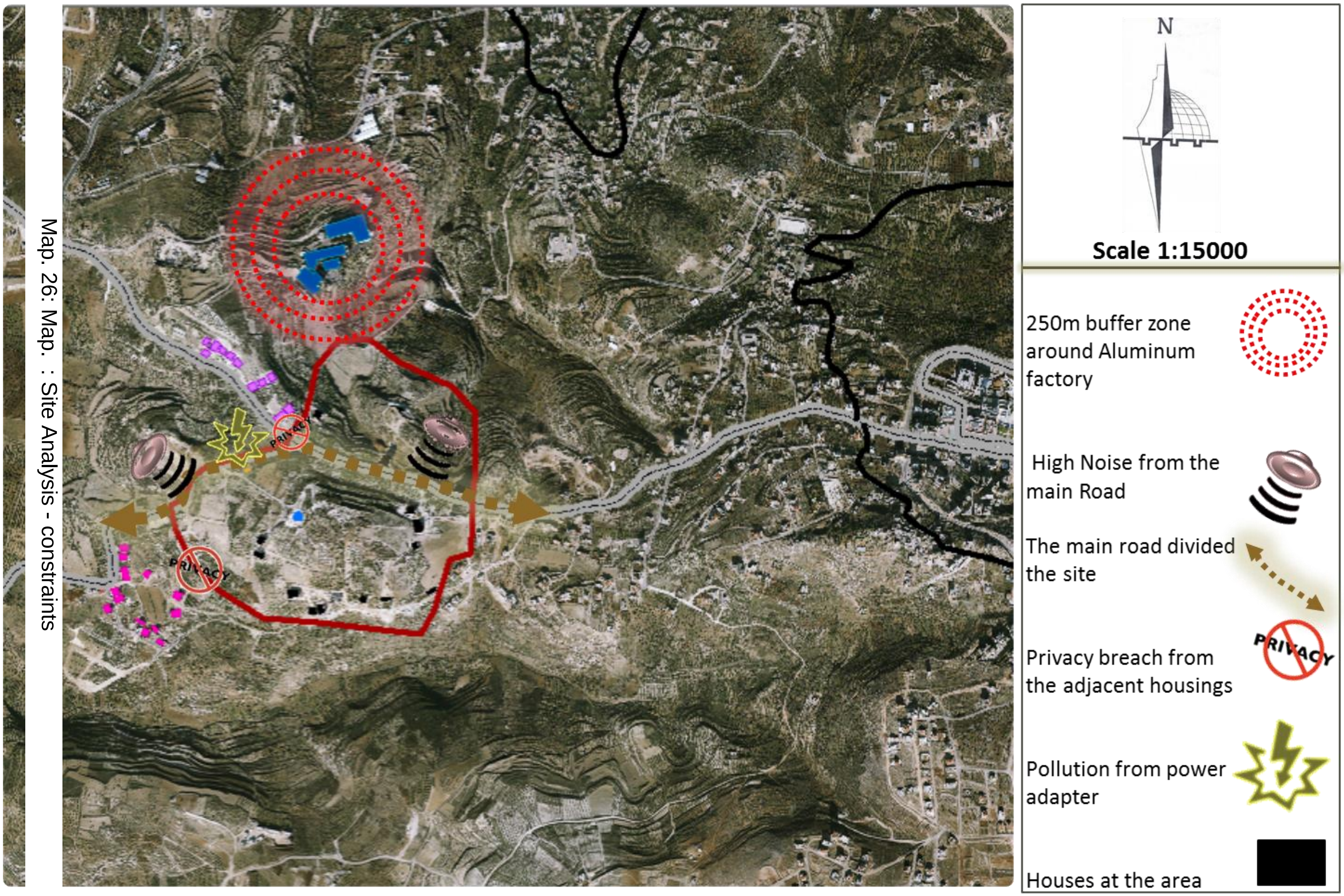
Element	Strength	Weakness	Opportunity	Threat
Accessibility	Existing Main Road (Nablus-Qalqilya-Salfit)		Main road give chance to get services to the site	
Surrounding development	Many new Housing projects developed around the site The new trend of expansion toward the project site	Many residential buildings at site itself	Near the developed Housing projects New services come to the site	The privacy of the site affected by the nearby projects
Side condition	Majority has good slope and can be developed	There are a hill can be developed as low density	Suitable for recreational area and low density	
Location	A very good location At Main road intersection Between 2 governorate		New Polices support the projects at this location	Separation of land between the two governorates
Zoning of Site	Strategic for residential use		Can be developed for any development	
Environmental condition	Good for a quit place to live Far from the noise of the city Overpopulation was low Solar access high at summer and good at winter		Attract people from the city to live their attracts people who care about the environment	Pollution from the main road Pollution from the aluminum factory may affect the people who live there.

Site Analysis- Opportunities



Map. 25 : Site Analysis opportunities

Site Analysis- Constraints



Map. 26: Map. : Site Analysis - constraints

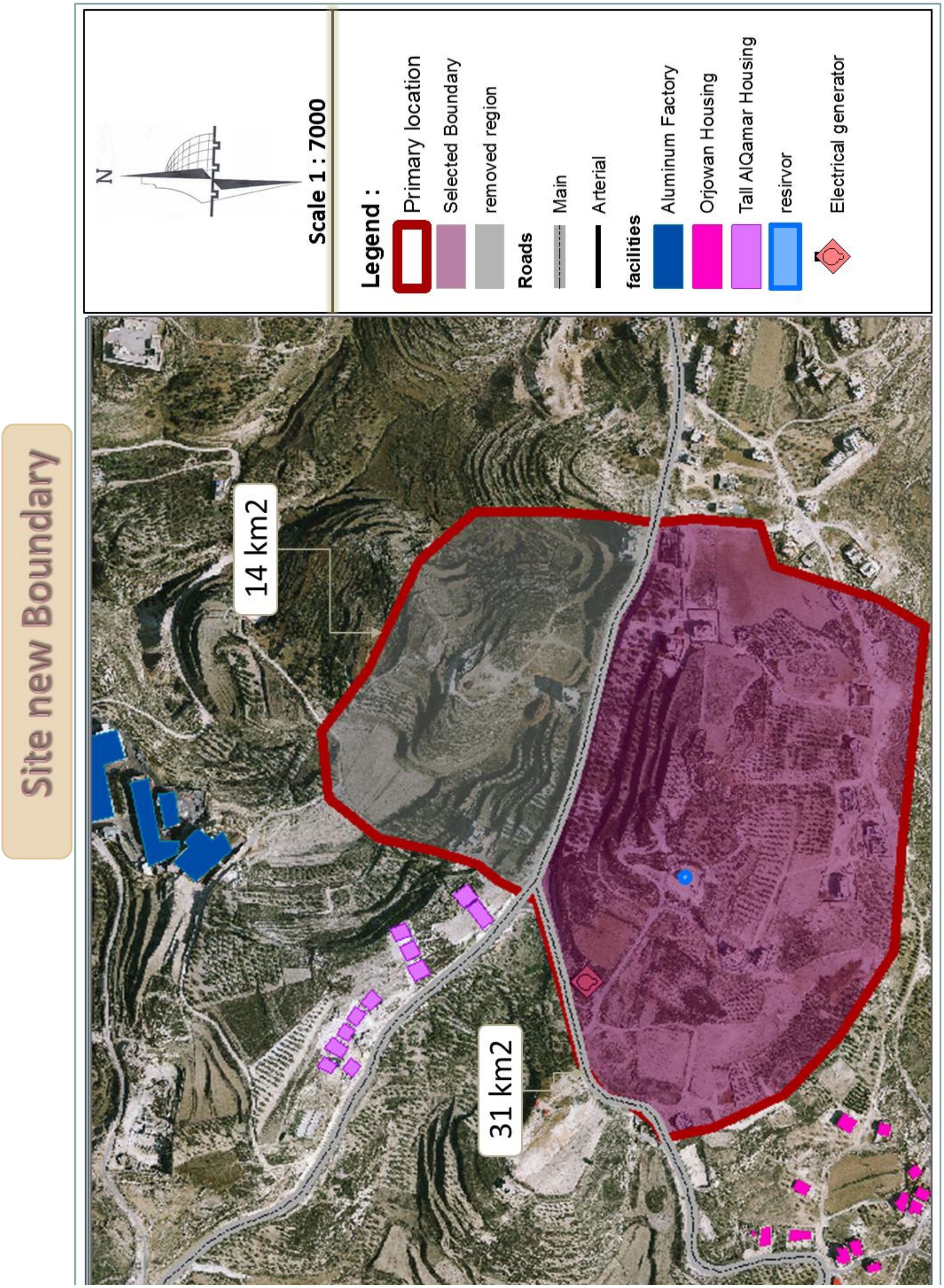
After studying the SWOT analysis for selected site, it seems that the site divided into two parts :

1. The first at the north from the main street, and is the nearest to the Aluminum factory and Tal Al-qamar Housing.
2. The second is at the south from the main street , near Orjowan Housing
3. Also, from the study ,it was explained that it's difficult to divide the project site into two parts, because we cants join these parts through the main road and the problems result from that like accessibility to each part and the noise and high velocity at the main street, also the high slopes at the north part made the planning step very hard, so the south part was selected to be the new site for the project , and the project site was now only at the south part related to the reasons explained before.

The area of the excluded part at the north reach's 14 km2 , but the selected south part area reaches about 31km2 as shows at map (27) below ,and this a suitable area for making neighborhood but depending on solar access factors.

About the new boundary:

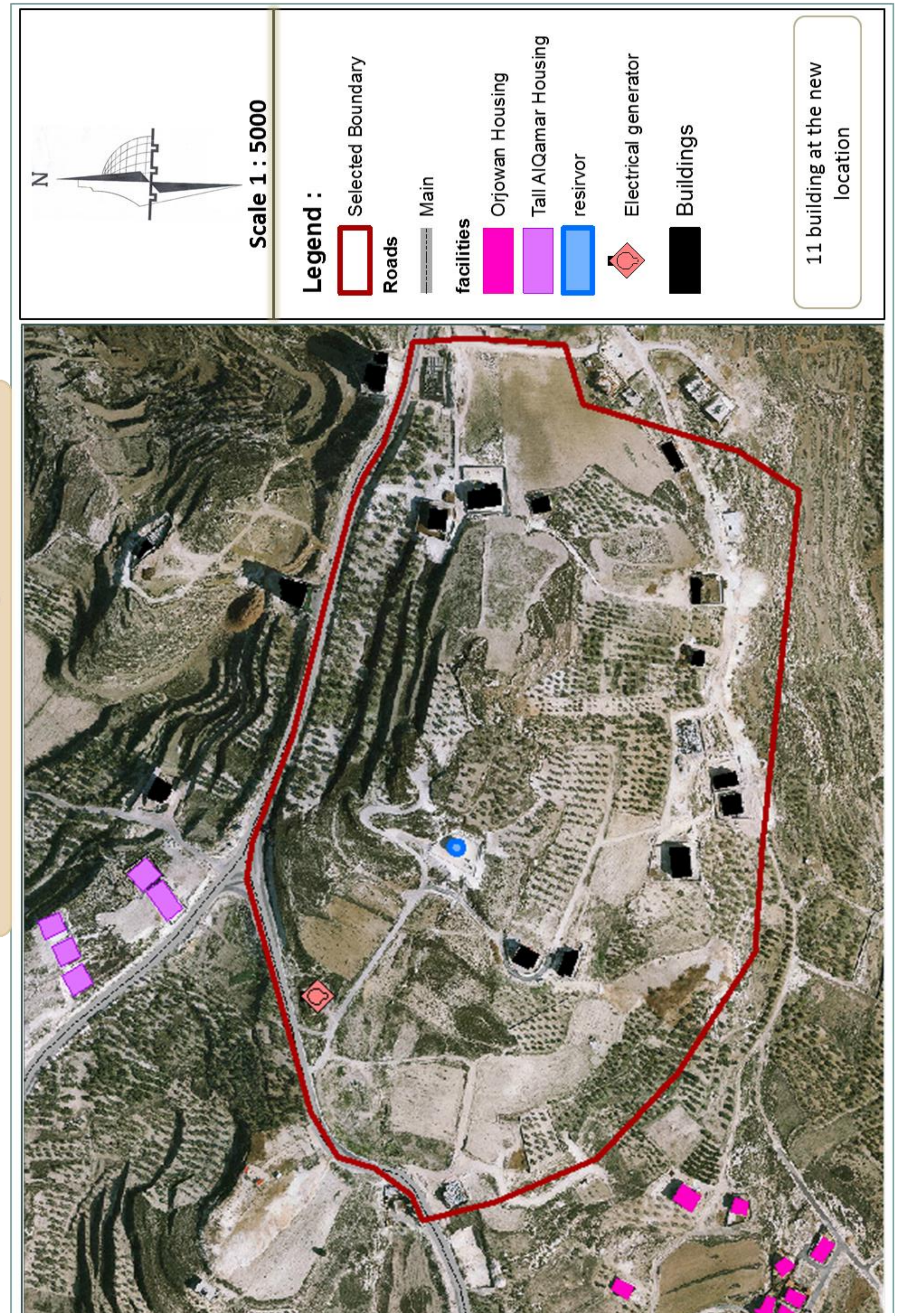
- Located at the south of the main road, it became far from the Aluminum street at about 500 m instead of the 260 at the north part ,so this site is better than before from ecological side , so the new site become for from the pollution of the factory.
- The new area of the site 31 km2 suitable for building and development, and this area will used for planning and designing new neighborhood depending on solar factors, that take into account the orientation of streets, buildings and the green areas to maximize the solar access and to decrease the consumption of energy and to make the urban environment more comfortable for users , so the concept of the project focuses on how to deal with the urban environment by depending on solar access .
- At the selected new site, there are 11 houses as shown at the map number (28) below used for residential uses, most of these houses used as Villas with height of two floors, and in spite of these houses make a challenge for the site planning, it will be dialed with them and used them to decrease the effect on the new planned urban area.
- Region in general , used as new housing projects at the west of Nablus city ,but this project has more advantage with the using of solar design at urban scale , and saving the urban environment comfortable by using the solar energy and decrease the its negative effects .



Map. 27 : Project Parts and the new boundary

P

new Boundary Features



Map. 28 : New boundary features

Chapter 5: Project Definition:

- The master plan of new solar neighborhood is to develop a Future neighborhood of 400 departments and houses for at least 2000 people.
- for the workers in the NNU and people who care about the environment, so it called Solar Neighborhood.
- Solar Neighborhood is situated between Nablus and Qalqilyah Governorate at the administrative boundaries of Jitt , Biet wazan and Biet Iba .
- With direct access into the City of Nablus.

VISION :

The vision of the project can include of all project objectives and what the project mainly focuses on as follows :

"Planning and Designing a new solar neighborhood depending on the Climate , Topography ,solar envelop and solar radiation to maximize the solar utility to everyone live there."

Project Objectives :

This project mainly aimed to use the solar at the urban scale and maximize its benefits, so the main objectives for this project:

- Reduce the amount of fossil fuel and non-renewable energy consumption at the city, and reduce the cost for that.
- Maximize the solar access and gain at the city to replace the fossil fuel.
- Make the City cleaner, by reduce the amount of pollution produced from using fossil fuel.
- Make the city healthier, livable and sustainable.

So the project aimed mainly to Planning & Designing new neighborhood which has the following criteria :

- Minimum fuel consumption
- Maximum energy production
- Maximum Solar Access
- More livable

- Cleaner
- Healthier

- Finally, get a **new approach** in Housing projects planning and **guidelines** in designing residential areas, in order to use that regulation at building for the new projects of housing or neighborhoods or for the public projects such as street or public green areas , as it will explained later.

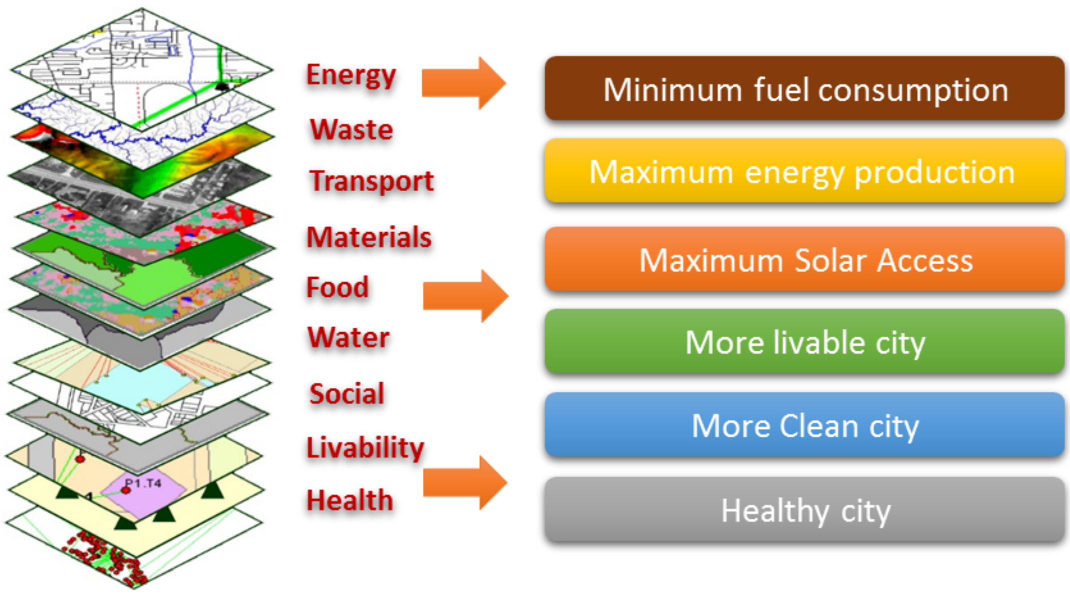


Figure 27: Importance of using solar at urban scale

Solar Neighborhood Attitudes:

- Designing **residential areas** and individual buildings according to the principles of solar architecture.
- Utilization of **active and passive solar** energy and General utilization of **renewable energies**.
- Direct use of the sun to **increase welfare** of people inside as well as outside of buildings and Emphasizing the aspects **nature and leisure.**
- **New approaches** in general for a lasting development of residential areas.

Standers of solar neighborhood design:

- Orientation of streets and building structures to the sun;

- Temperature control and use of daylight in the public realm;
- Topography (land form, overall exposure, general situation);
- Direction and intensity of wind (alignment of streets, sheltered public spaces, systematic ventilation, cold-air corridors);
- vegetation and distribution of planted areas (oxygen supply, dust consolidation, temperature balance, shading, windbreaks);
- Hydro-geology (relationship to water and waterway systems).

Neighborhood Elements:

- Housing Services
- Daily needs :
- Educational (– kindergarten)
- Recreational (playground's – gardens)
- Social services – cultural – religious
- Commercial services
- Health services
- Roads
- Public services

Chapter 6 : Solar Planning Process:

Planning process at this type of projects will be deferent ,this depending on orientation and distribution of buildings and roads to reach after that to the master plan , so the process will start with a conceptual plan depending on the analysis dine before then depending on the solar analysis for the built up area that will explained later .

6.1. Conceptual plan :

The conceptual plan was made depending on the analysis of the site mainly , on solar and topographic analysis. This plan include many of points that the final master plan depend on , these are :

- Area’s that have the highest radiation points at summer and winter , that area's suffered from the highest range of temperature degree’s, and have the highest are temperature , so these area’s can't be livable at general conditions , so to use these area’s as residential is a hard choice , and this affect the urban heat island at the neighborhood ,so the best use for these that as decrease the effect negative effect’s of sun access is the environmental friendly use , that can offer the air condoning and cooling at hot summer days .
- So the best use for these area’s is public green area’s as a public park, as for that we can control the tree’s used by control the dimension and type of that to reach the objective.
- So , at high radiation area’s we should use vegetation that offer shading around also allow the solar access at winter , like tree’s with fallen paper at winter.

But at the site selected the area with the highest radiation points have also the highest elevation points as shown below , The highest solar radiation at the site at summer and winter was explained below, this was good at winter but also harmless at summer because of high radiation and stronger solar access . The same area also has the highest elevation at the site , but also have lower slop , So it has the best view to other area’s from this point .

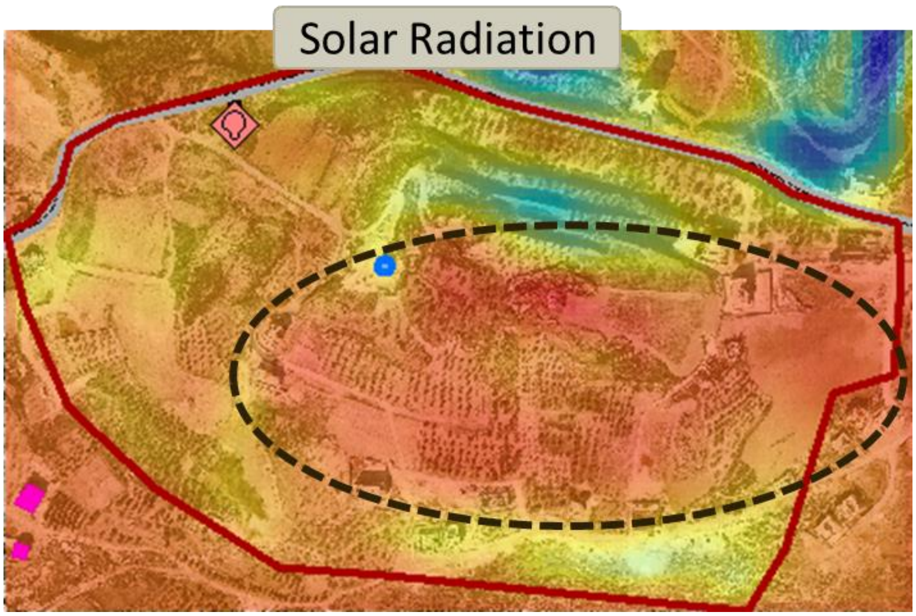


Figure 28: The highest solar radiation at the site at summer and winter

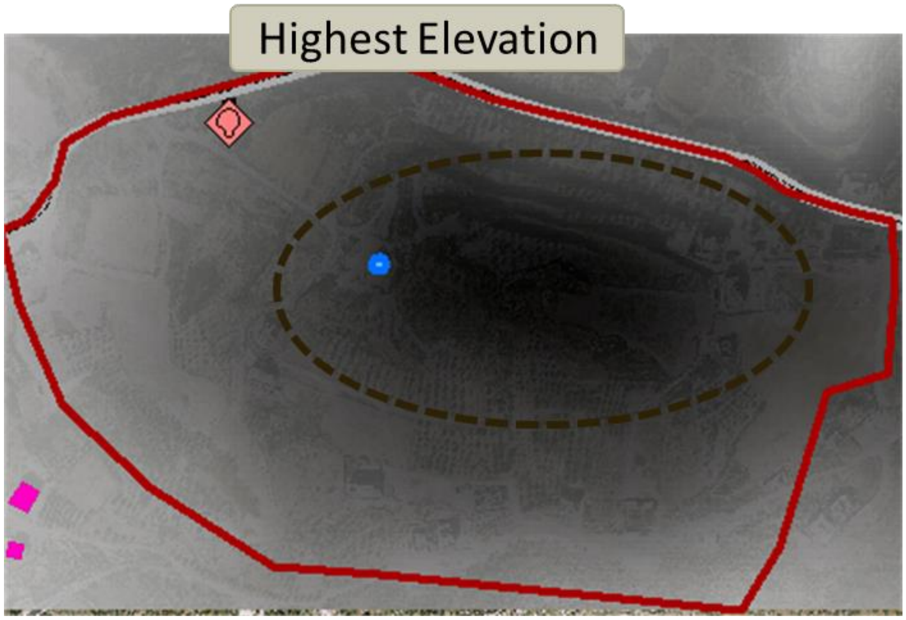
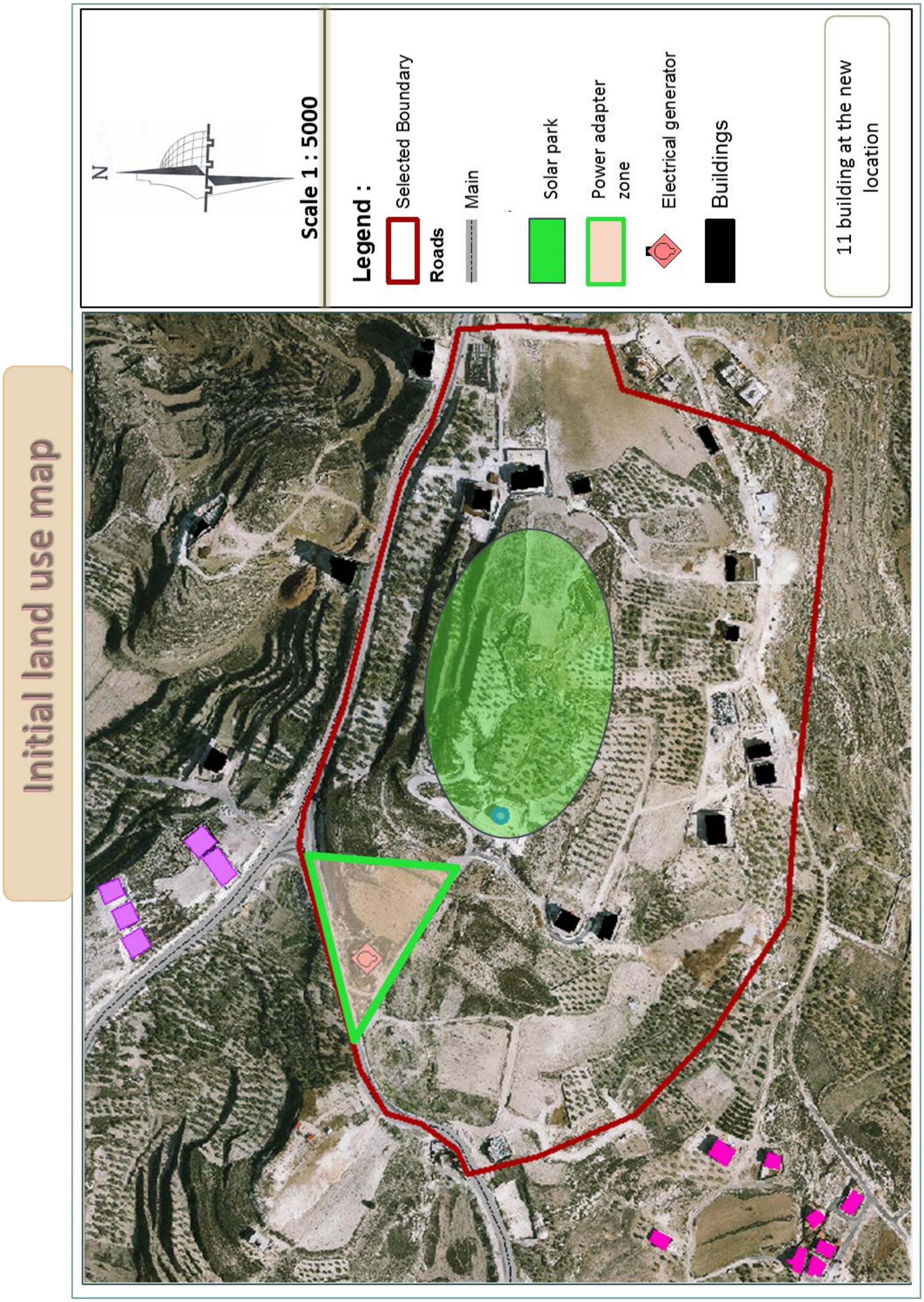


Figure 29: The highest elevation at the site , but also have lower slop

So this area will used as a park , but this park will be more solar effective , so the land use of this area will be a solar park , this park will designed by its furniture , greenery and the use of solar cells at the design, this will improve the concept point of solar .

Also , at the site we have another factor can be used at solar planning , the power adapter , this element can be used as a collector point for the solar energy of the neighborhood , it was located at the intersection of the main road , at the north west of the site , at the edge , and this can be harmful for the people who live there , so it should be isolated by a green shelter of trees that can prevent the rays from go outside, and by making a buffer zone around it as shown at map(29) below .



Map. 29 :initial landuse plan

6.2. Street Patterns & Orientation:

– It was important for making street orientation for the biases for Land-use planning decisions.

– Two types of orientation :

  - as west-east /north south grid
  - With angle related to sun north-east /south-west

The best orientation was with angel to the sun, to maximize solar access at winter and make shadows at summer.

So the figure below show the street shadows comes from buildings at different times at the day , and it made at summer and winter , and it was clear that the best orientation of the streets different at time.

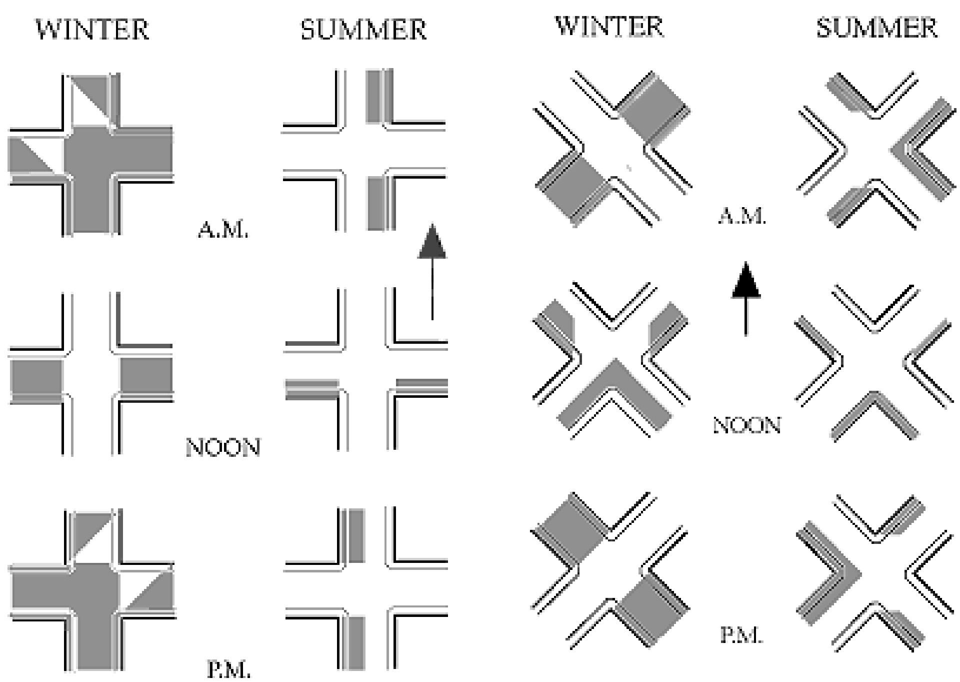


Figure 30: Street orientation with buildings shadows at summer and winter at different times

Street Orientation Concept:

– The most appropriate Orientation in general through the study of the project and the study of factors affecting the gain of energy & solar access is directed the buildings with street orientation.

– So that the sun moving towards an annular, the Orientation is most appropriately streets orientation is with the conduct of the sun line, so that the idea is to embrace the streets of the sun to take advantage of the bulk of the entry of the sun's rays to reach every street parts including residential areas that fall out later.

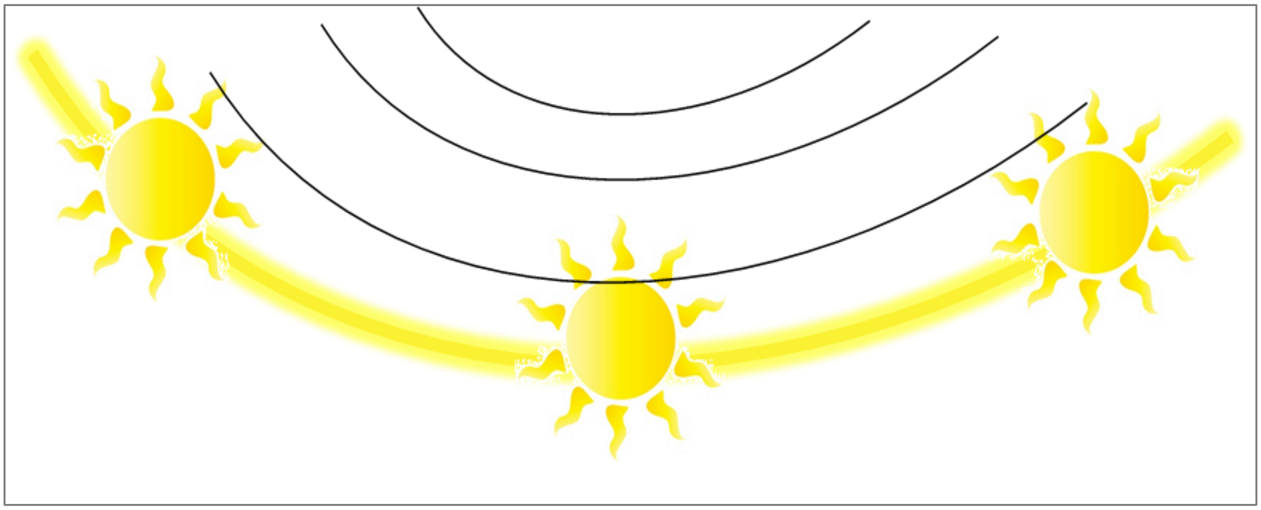


Figure 31: Street orientation concept, with sun line

So the Streets orientation will be :

- East-west with sun angel
- Sun with itinerary of street to embrace the streets by the sun

The topography of the site greatly help in directing the streets, so that the region is elliptical hill and thus to maintain the tendencies, the streets will be east-west with the sun curved line.

Map. 30: Contour direction at the site that helps in street orientation

Street Network :

The street oriented with the sun and related to topography , and served all the site , so the figure below shows the street network used at the site , the design step will explained at the deign stage later.

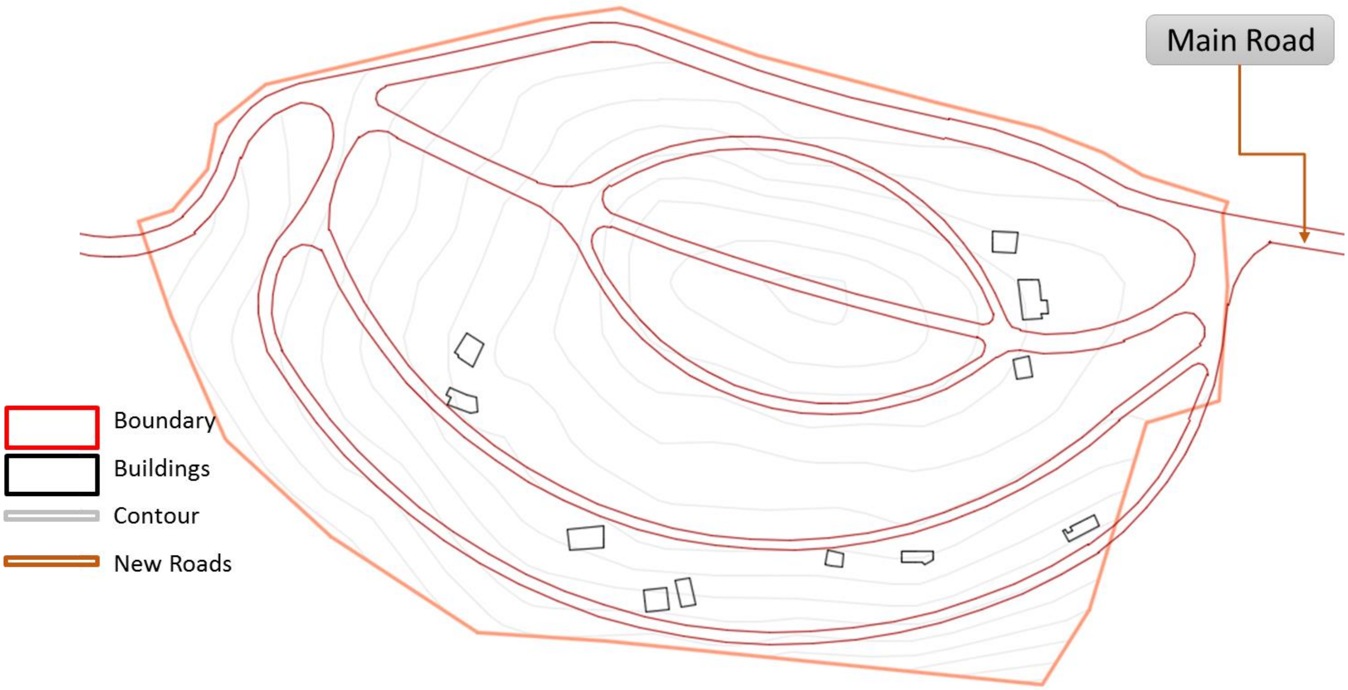


Figure 32: Street orientation for the site

Buildings orientation, locations, heights :

Generally, There are two ways of generating solar envelopes for the urban area:

- The descriptive method which defines the geometry of the buildings based on solar angles and regulates building heights, setbacks etc . .,

- The performance method which defines the number of desired insolation hours or prescribes required radiation levels at the solar envelope .

The solar rights regulation can be applied in three levels based on the two approaches mentioned above:

1. The basic level based on the performance approach, defines the required amount of solar radiation for each orientation, urban location and climatic zone. It allows freedom in design. So this can be

found by sThe second level, also based on the performance approach, indicates the insolation hours which meet the solar radiation requirements.

2. The designer has to present the proof of keeping the surrounding buildings exposed to the sun during that time .hadows analysis , and this method will be used at this project .
3. The third level is a descriptive/prescriptive method, based on the insolation hours indicated. It presents the use of solar section lines as a simple tool for solar rights design a simple tool for solar rights design. Designing according to these section lines ensures the solar rights of the surrounding buildings and open spaces, without the need to demonstrate further requirements

The selected Method , Shadow Analysis :

Building sites was chose depending on trying to orient buildings , by the way the building area's distributed randomly, also the sites of these buildings will distributed around the roads .

Buildings will checked by the shadow analysis at the GiS program to reach to the best orientation , heights and can be classified later Buildings or single houses or Villa's housing.

So these attempts can be sorted depending on the objective to :

- Building density.
- Buildings direction.
- Buildings relationship with streets.
- Buildings heights.
- Spaces between buildings.
- Buildings setback.

6.3. Analysis of the shadows:

- It was distributed to a group of buildings on the streets that have been adopted for the area
- , So that these buildings were directed direction that match street orientation to maximize the entry of the sun's rays at first.
- Buildings and spaces initially will be controlled in the design phase later, but spaces rate between 150-600 m2.
- Building heights were consolidated, but are changed when holding each screening and checking process, so that the region in general classification housing B where housing by which the maximum allowed is 4 floors, so it was a test of the buildings on several rises on 2 floors and then conduct the same test Building up to four floors to compare the results.
- Shadows are analyzed at the level of time and height of the buildings:

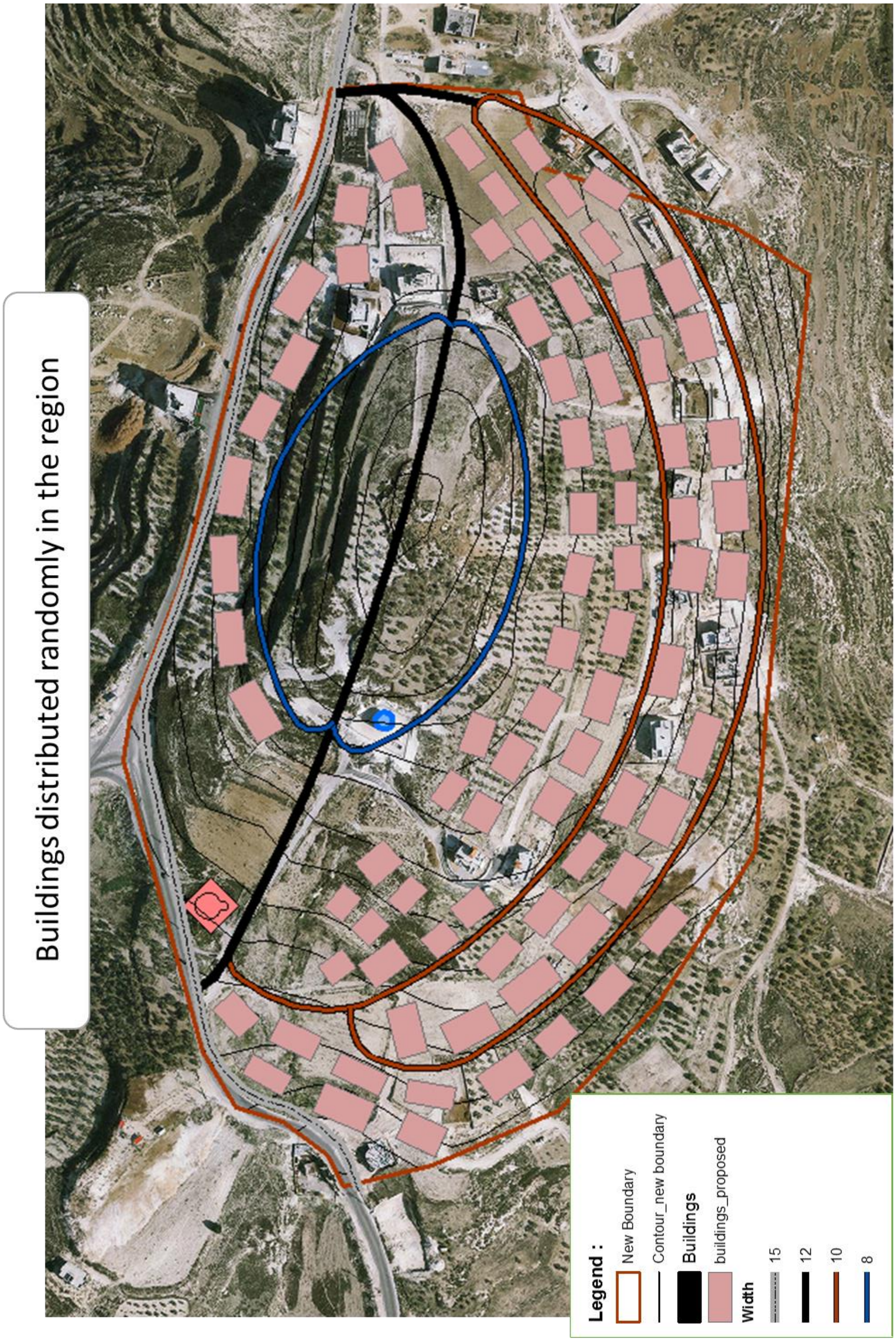
times:

- At Winter (9-12 - 3), related to the sunny day at winter less than summer.
- At Summer (10-2 -5)

Highs, related to the allowed at this area, housing B , the heights allowed up to 4 floors , so the heights will be :

- Two floors (villas)
- Four floors (the condominium)

Building distributed arandomly at the site as shown at the map below ().



Map. 31 :Random buildings at the site

Case 1: Buildings at high of 2 floors:

Buildings at high of 2 floors: the model below shows the buildings with 2 floors at the site, and the shadow analysis will be made for these buildings depending on the height.

Figure 33 :Case1 model : 2 floors buildings.

Case 1 : Shadow analysis:

a. **Summer shadow analysis :**

At summer the shadow analysis was made at 10 a.m and 2 p.m and 5 p.m , so these defferent times at summer will show the shaded area's at the site .

1. **Shadows at 10 a.m :**

Figure 34 :Case 1 :Shadows of 2 floors at summer – at 10 a.m.

2. Shadows at 2 p.m :

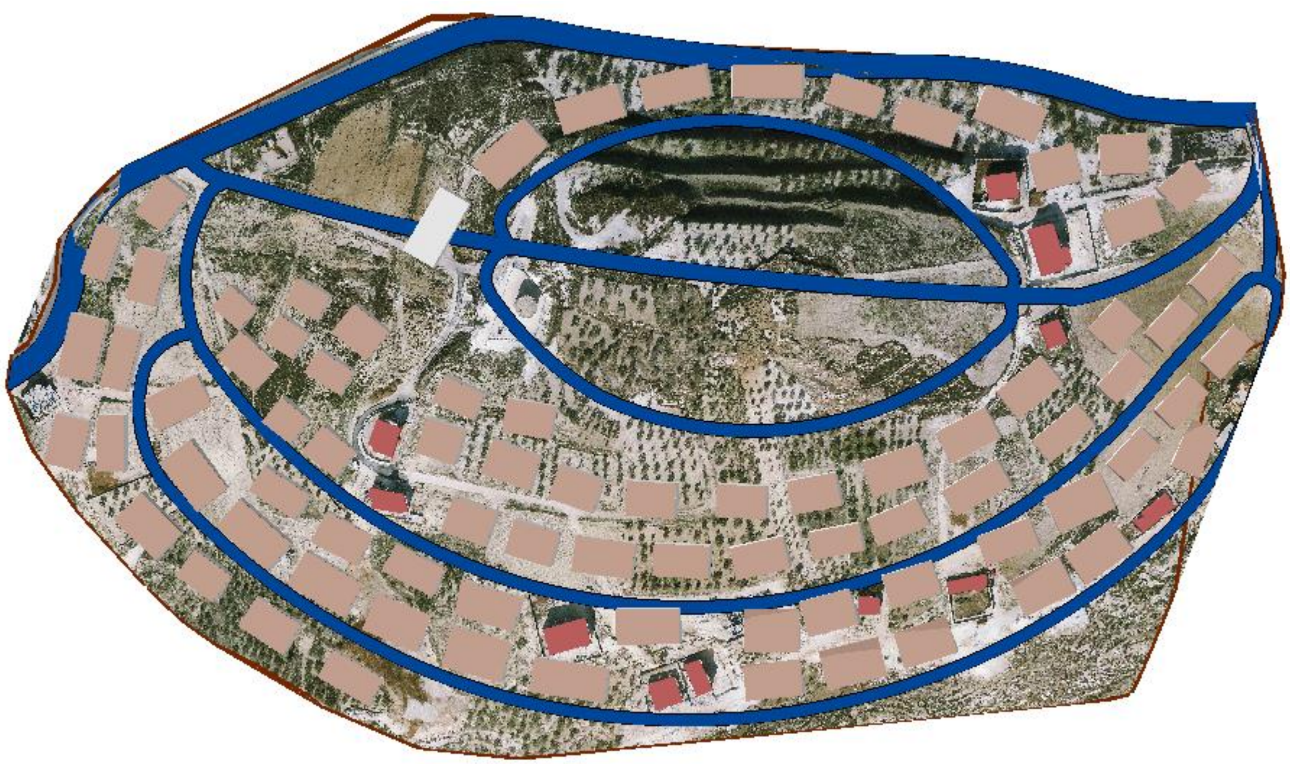


Figure 35 :Case 1 :Shadows of 2 floors at summer – at 2 p.m.

3. Shadows at 5 p.m :

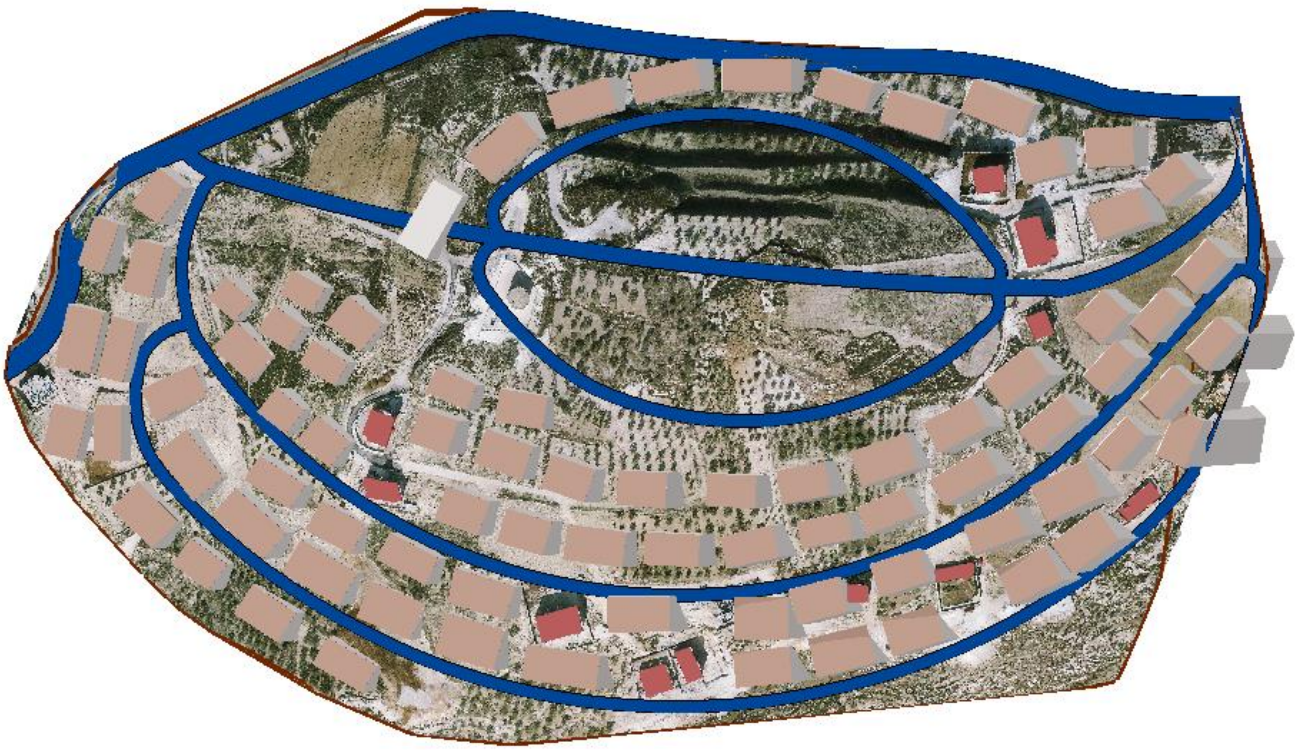


Figure 36 :Case 1 :Shadows of 2 floors at summer – at 5 p.m.

b. **Winter shadow analysis :**

At winter the shadow analysis was made at 9 a.m and 12 p.m and 3 p.m , so these defferent times at summer will show the shaded area's at the site .

1. Shadows at 9 a.m :

Figure 37: Case 1 :Shadows of 2 floors at winter – at 9 a.m.

2. Shadows at 12 p.m :

Figure 38: Case 1 :Shadows of 2 floors at winter – at 12 p.m.

3. Shadows at 3 p.m :

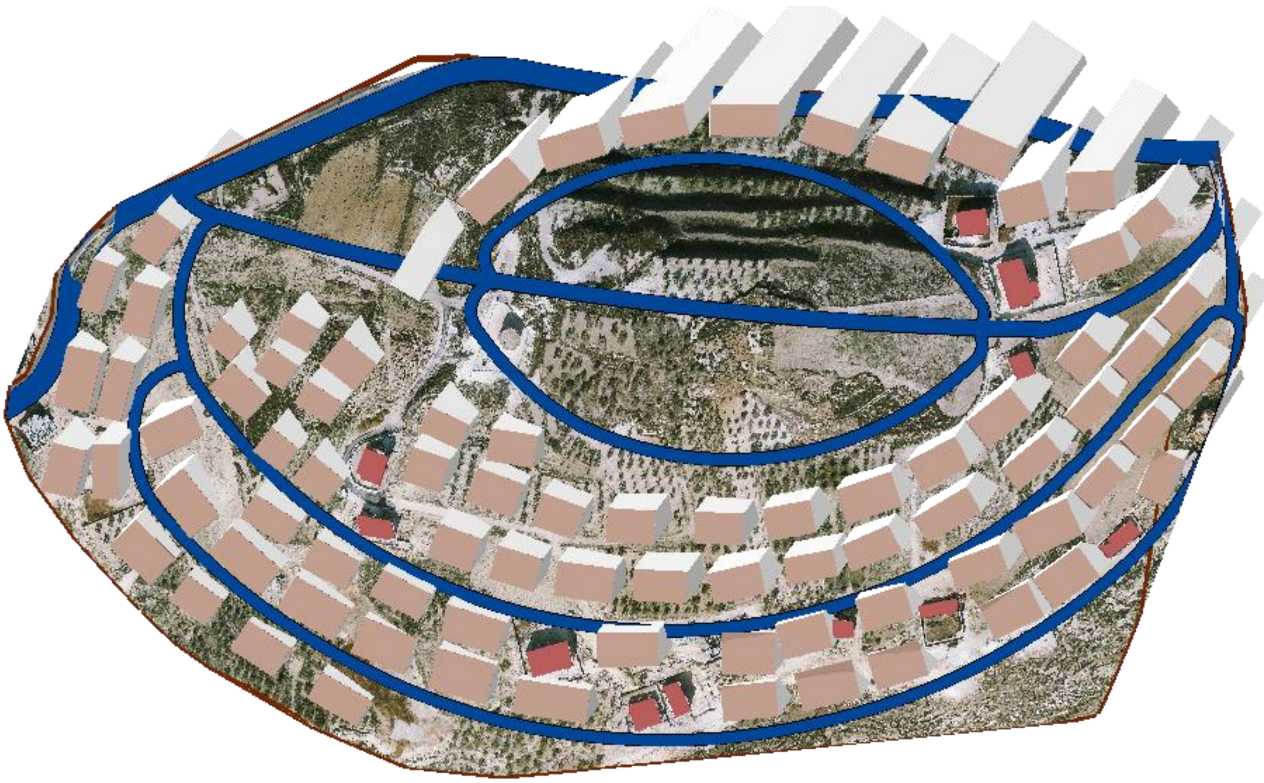


Figure 39: Case 1 :Shadows of 2 floors at winter – at 3 p.m.

From the analysis above it was clear that at summer there is no problem but at winter the eastern and western buildings have the highest shading , that prevent the solar access on streets .

Case 2: Buildings at high of 4 floors

Buildings at high of 4 floors : the model below shows the buildings with 4 floors at the site, and the shadow analysis will be made for these buildings depending on the height.

Figure 40: Case2 model : 4 floors buildings.

Case 2 : Shadow analysis:

c. **Summer shadow analysis :**

At summer the shadow analysis was made at 10 a.m and 2 p.m and 5 p.m , so these defferent times at summer will show the shaded area's at the site .

1. Shadows at 10 a.m :

Figure 41: Case 2 :Shadows of 4 floors at summer – at 10 a.m.

2. Shadows at 2 p.m :

Figure 42: Case 2 :Shadows of 4 floors at summer – at 2 p.m.

3. Shadows at 5 p.m :

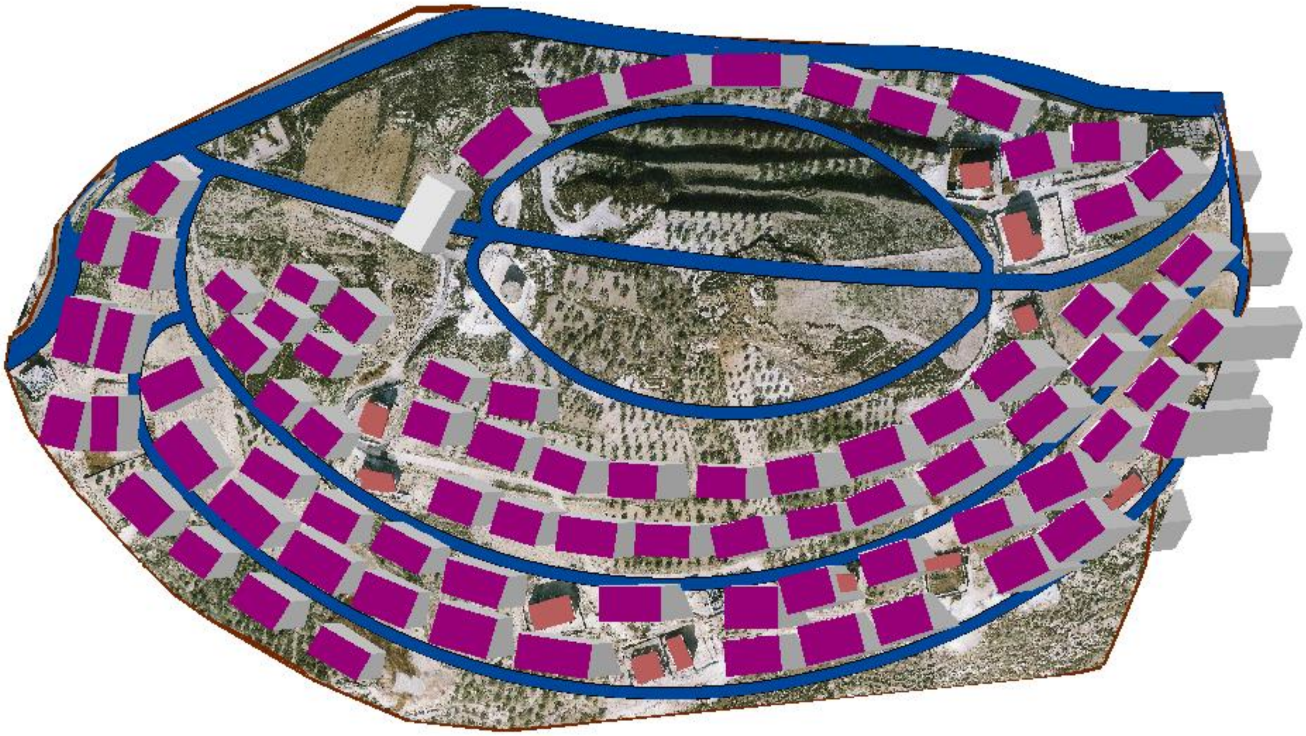


Figure 43: Case 2 :Shadows of 4 floors at summer – at 5 p.m.

d. Winter shadow analysis :

At winter the shadow analysis was made at 9 a.m and 12 p.m and 3 p.m , so these different times at summer will show the shaded area's at the site .

1. Shadows at 9 a.m :

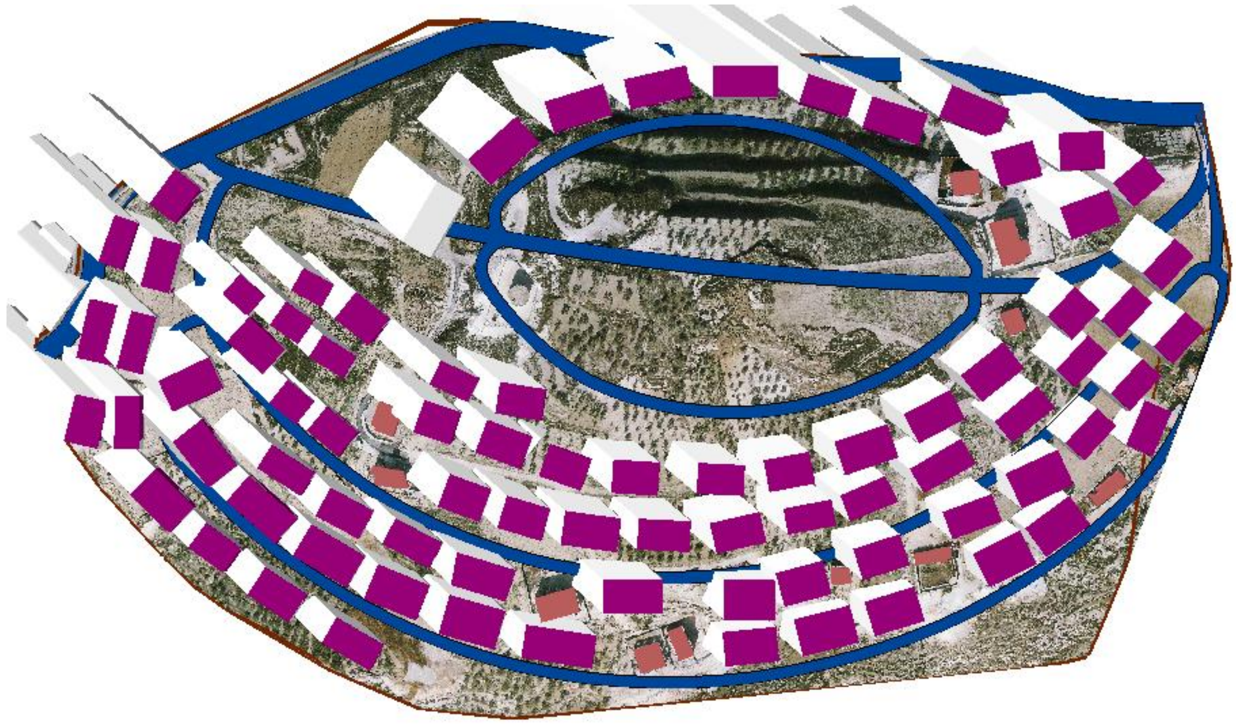


Figure 44: Case 2 :Shadows of 4 floors at winter – at 9 a.m.

2. Shadows at 12 p.m :

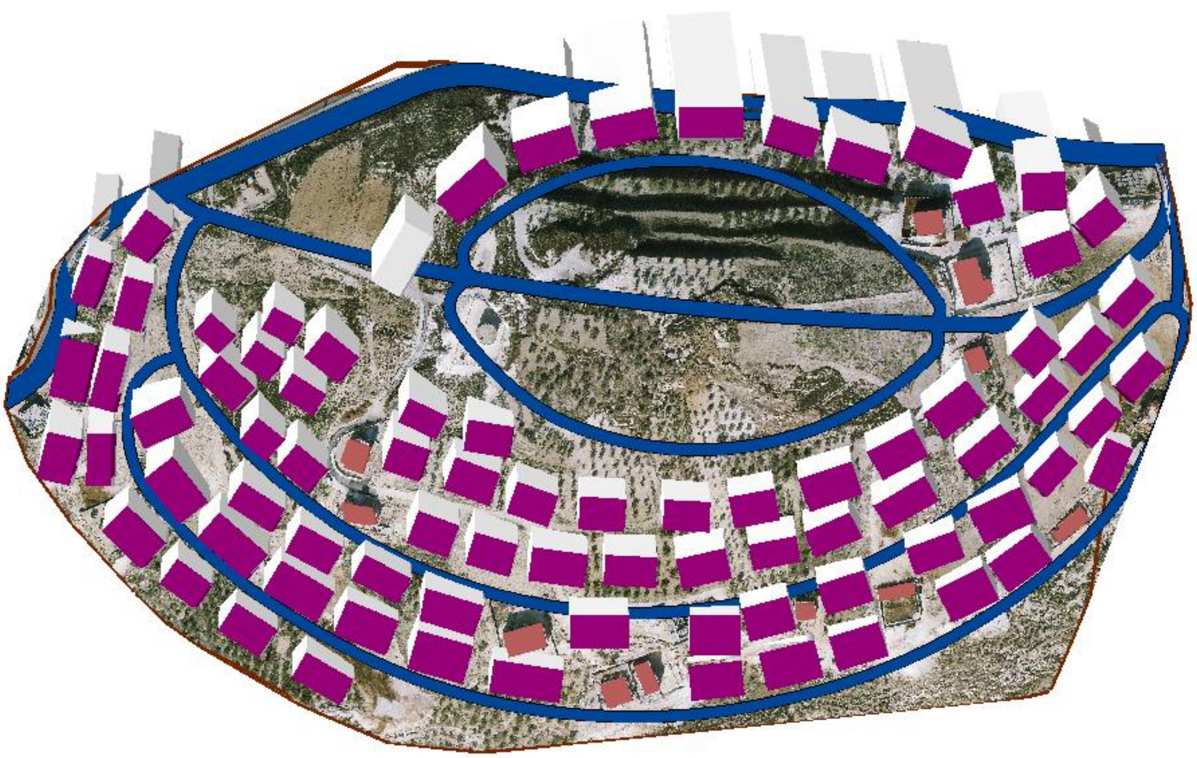


Figure 45: Case 2 :Shadows of 4 floors at winter – at 12 p.m.

3. Shadows at 3 p.m :

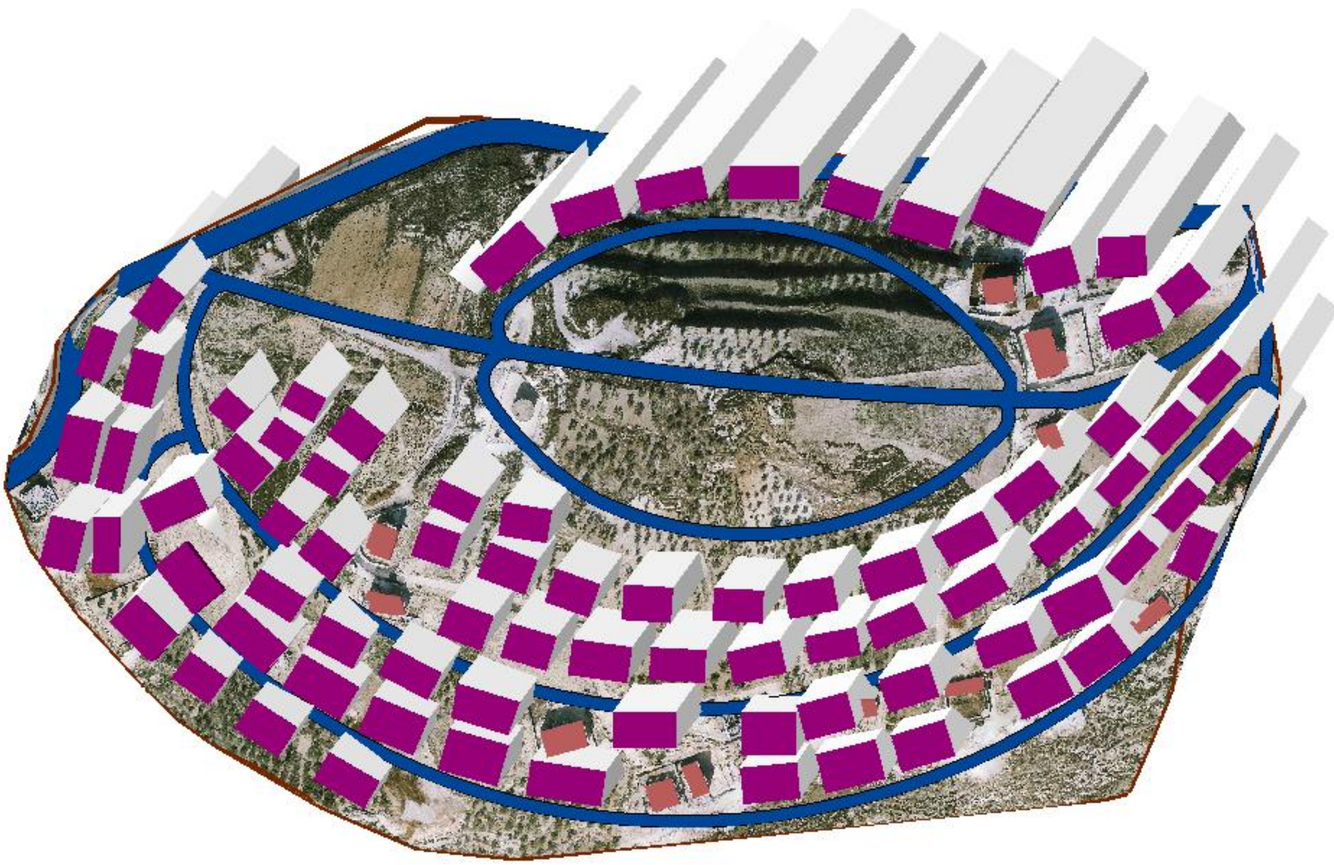


Figure 46: Case 2 :Shadows of 4 floors at winter – at 3 p.m.

From the analysis above it was clear that the problem concentrated at winter , so the hights makes a high shadow at winter at the west and east , also the size of buildings was high so they should be minimized to decrease the amount of shadows mainly on streets .

Case 3: low density building at west and east

In this case, buildings proposed should have less density and size at west and east because the shadows have high degree as shown in the previous case and in the figure below mainly at morning and noon, mainly at 4 floors.

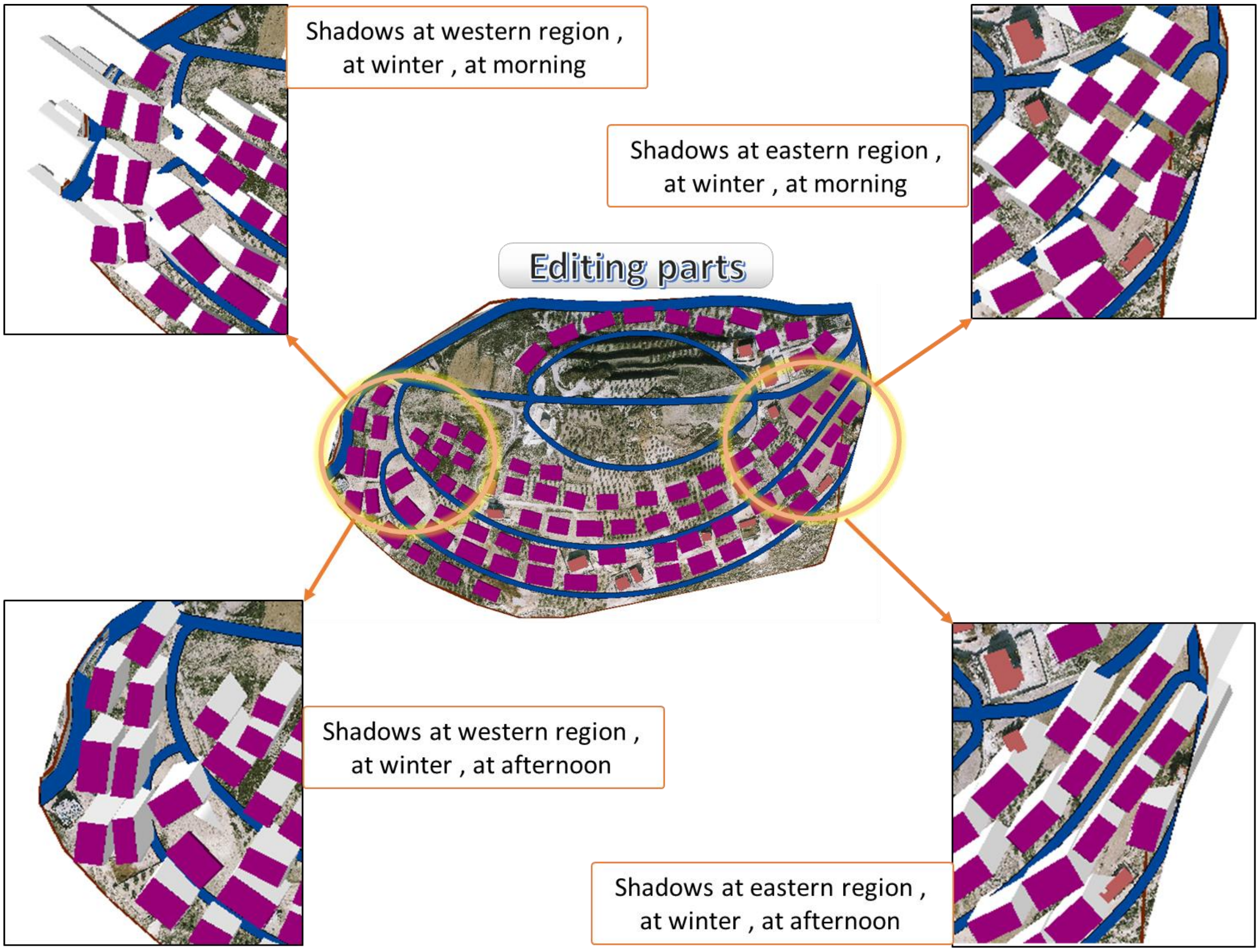


Figure 47: Editing Parts that should be changed

That should be solved by increase the spaces between buildings at west and east , also the buildings at west and east should have at most 2 floors high, because the problem increased at 4 floors high.

As the height decreased also the buildings area's decreased to maximum 250 m2 initially as shows at the map below.

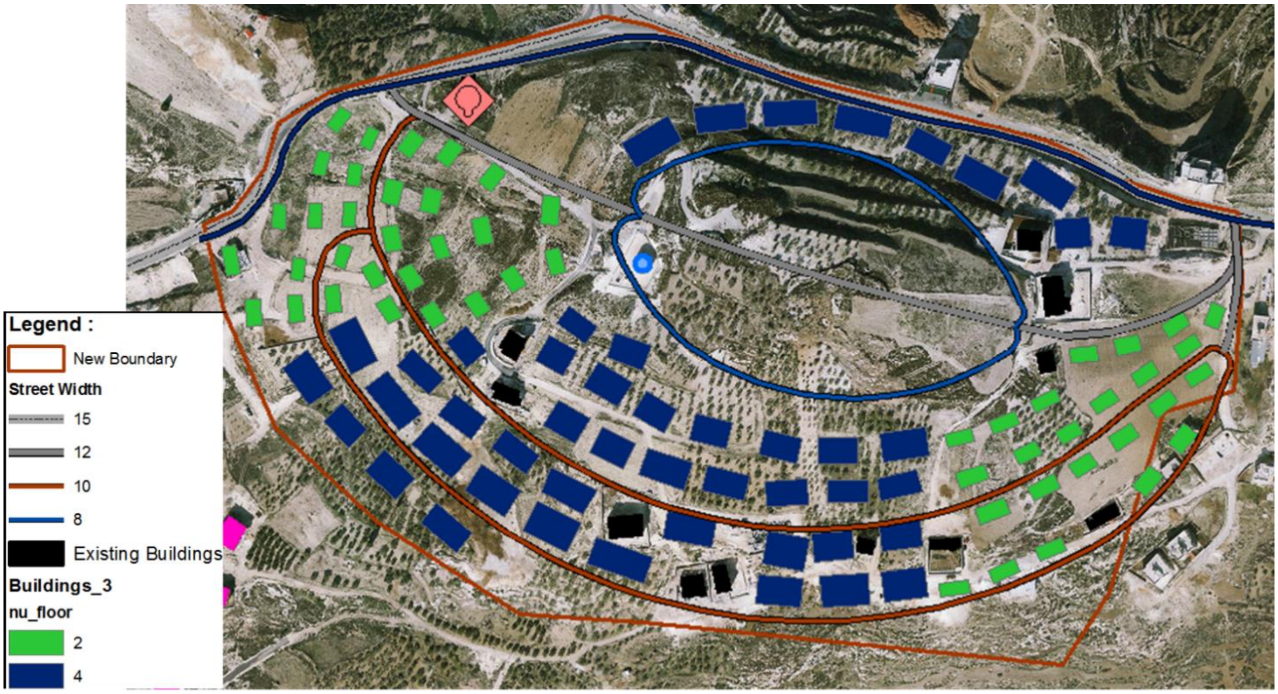


Figure 48: Case3 :less area , more spaces , 2 floors at west and east

3D-Model for the new proposed building in case 3

Figure 49: 3D-Model for the new proposed building in case 3

Winter shadow analysis :

At winter the shadow analysis was made at 9 a.m and 12 p.m and 3 p.m , so these different times at summer will show the shaded area's at the site and this analysis will be made for winter only, depending on the concept of minimize the shadows at winter mainly on streets .

1. Shadows at 9 a.m :

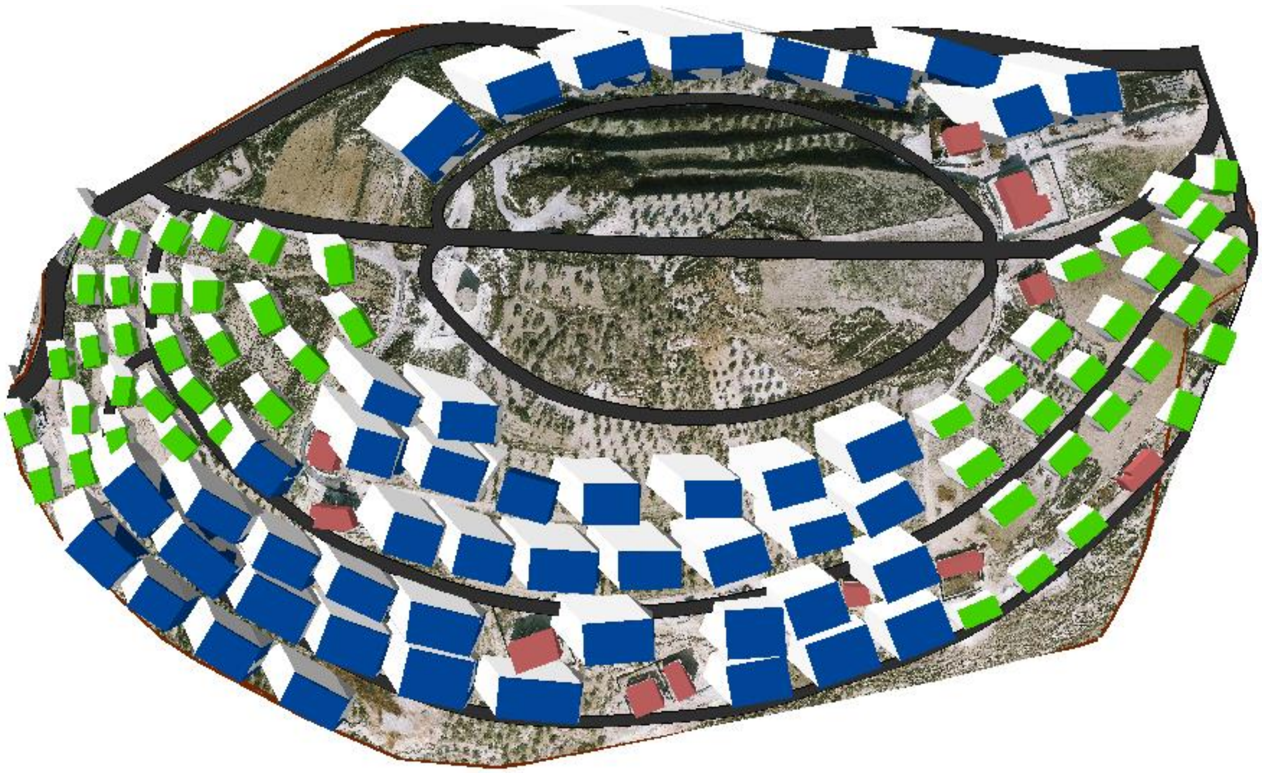


Figure 50: Case 3: Shadows of 2 floors, less area , more spaces , at west and east– at 9 a.m.

2. Shadows at 12 p.m :

Figure 51: Case 3: Shadows of 2 floors, less area , more spaces , at west and east– at 12 p.m.

3. Shadows at 3 p.m :

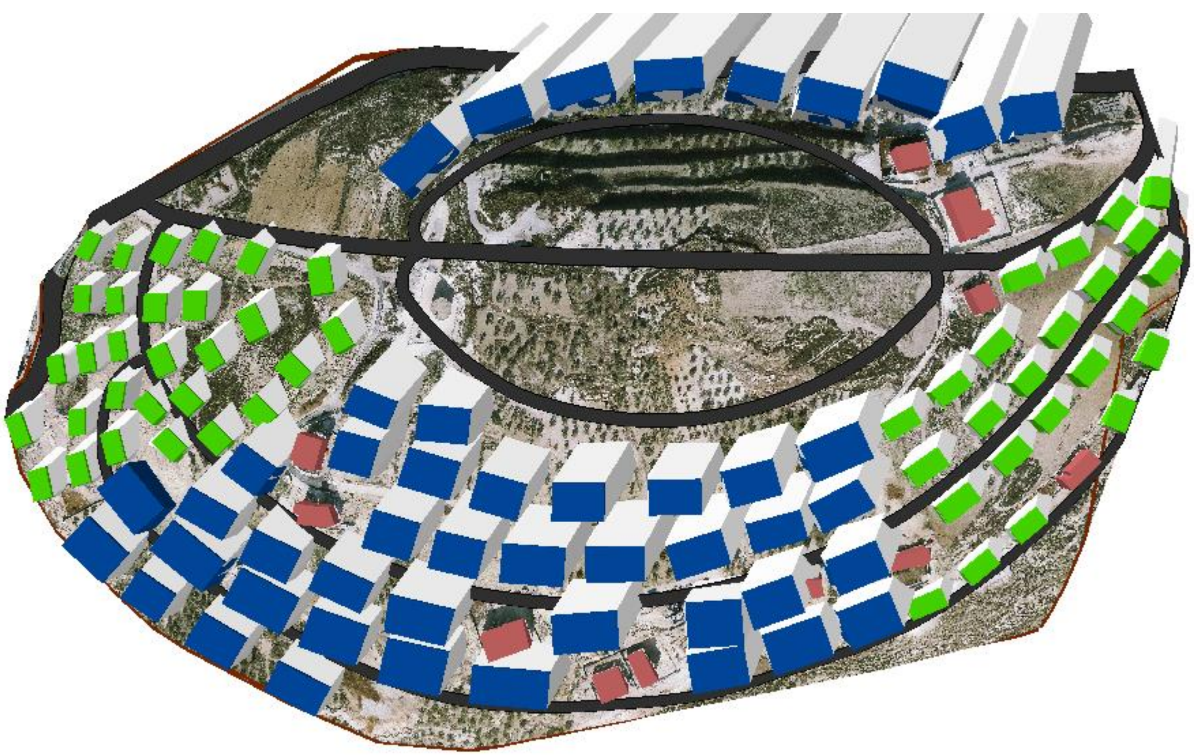


Figure 52: Case 3: Shadows of 2 floors, less area, more spaces, at west and east – at 3 p.m.

After studding shadows from case 3 at winter, it shows that the edited buildings which's 2 floors have better less shadows than before. But there is a problem with buildings near the street as shown in pictures below, mostly at west, so it should be far from streets to minimize shadows at winter.

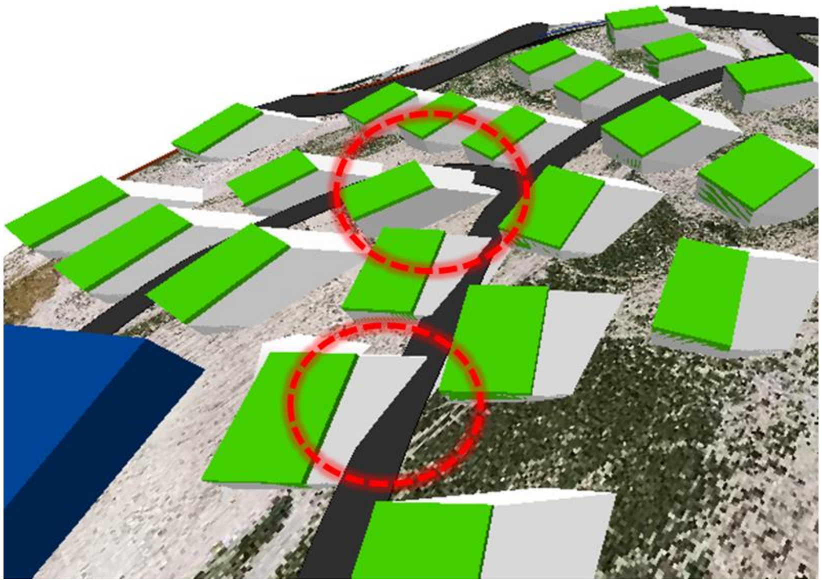


Figure 53: Shadows from case 3, western area, buildings at street at 3 p.m. at winter

Case 4: buildings at the north

At this case we will study the buildings at the north: These building will have two side of shadows :

1. From the hill on building, this results from the topography of the area.
2. The second was made by buildings on the surrounding.

Figure 54: North buildings will be studied at case 4

- These buildings by default have 2 or 4 floors and have the highest shadow at the region.
- The shadows of these building affect the surroundings highly and mainly the main street at the region at north. Also the topography at the north decreasing so it affected by it.

So , to solve the problem :

- The northern buildings will have **2 floors** also we should make a **distance between them**.
- The area of these buildings will minimize to lowest as much as possible , so the **area will arrange from 100 to 150 m2 .**

3D-Model for the new proposed building in case 4

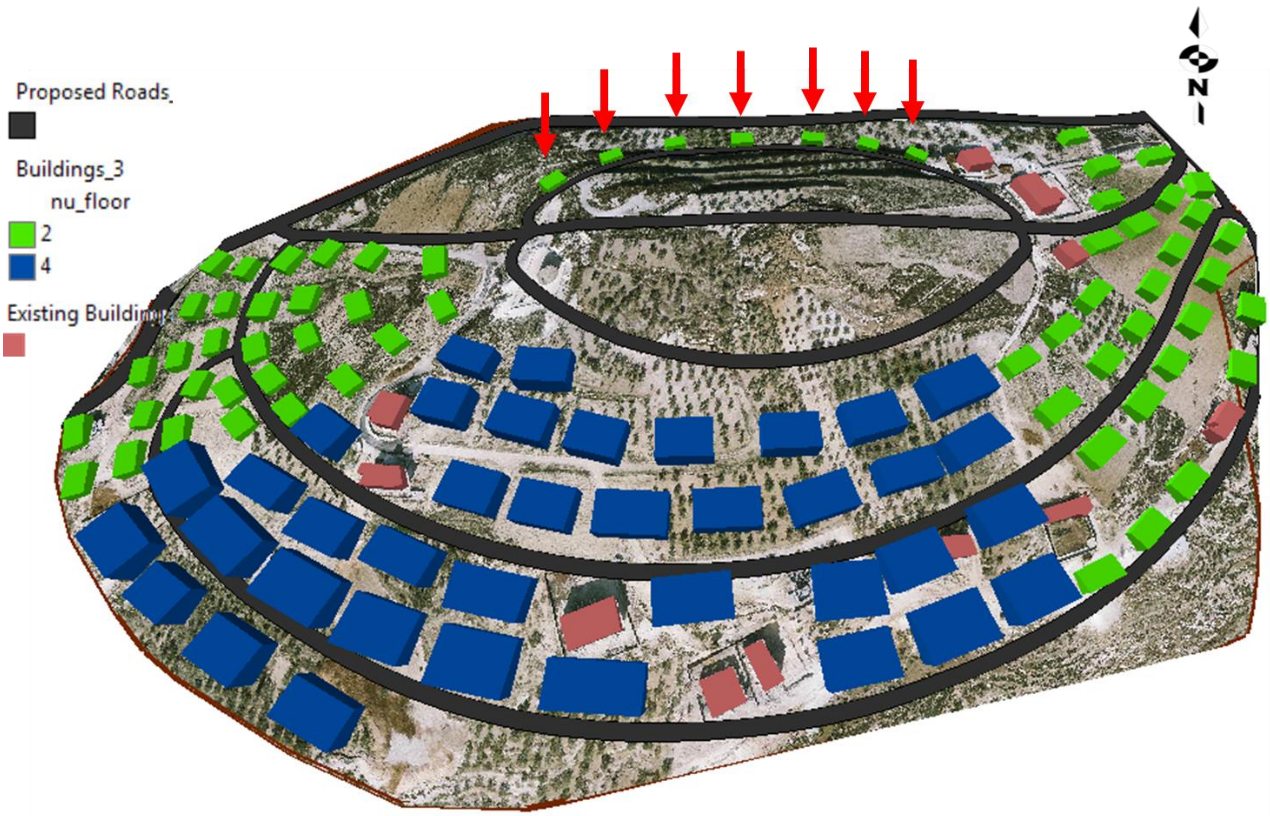


Figure 55: 3D-Model for the new proposed building in case 4

Winter shadow analysis :

Shadows at this case at winter will be affected more from the site topography, this was because the site located on the hill but at the side that hide from sun access, so it affected from the shadow of the hill , in addition to the shadows from buildings.

So this site should has less buildings area , also spaces should be increased in the way tat make sun inters between buildings and decrease the shadows from each on other .

1. Shadows at 9 a.m :

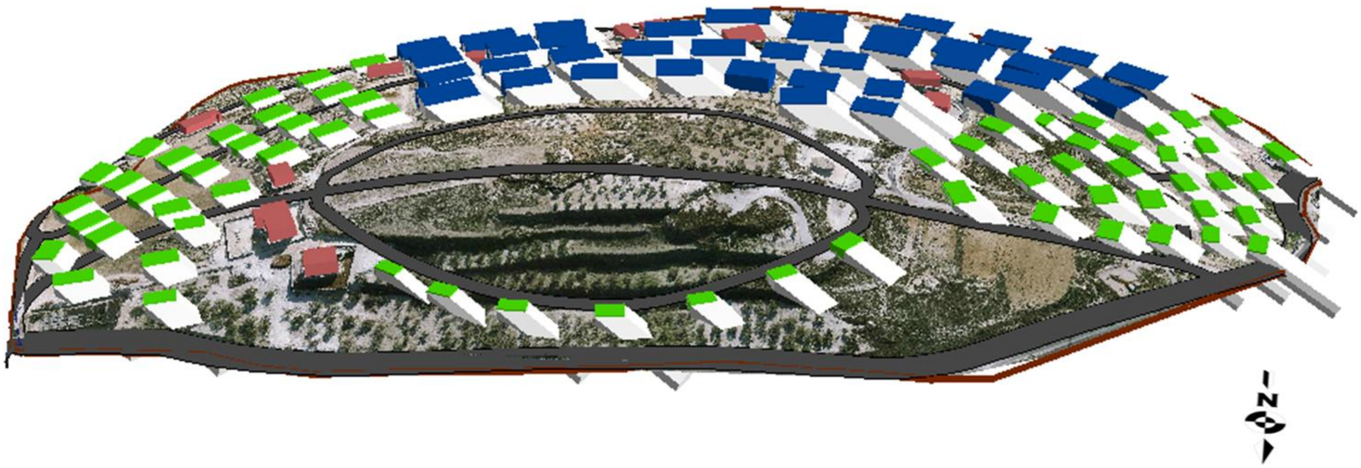


Figure 56: Case 4: Shadows of 2 floors, 150 m2 area , more spaces , at north– at 9 a.m.

2. Shadows at 12 p.m :

Figure 57: Case 4: Shadows of 2 floors, 150 m2 area , more spaces , at north – at 12 p.m.

3. Shadows at 3 p.m :

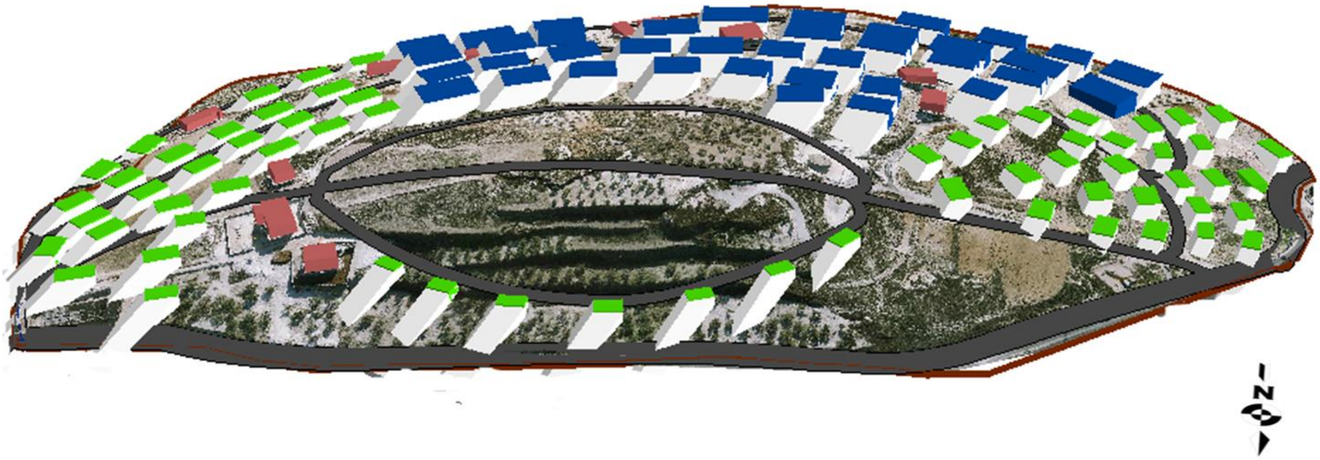
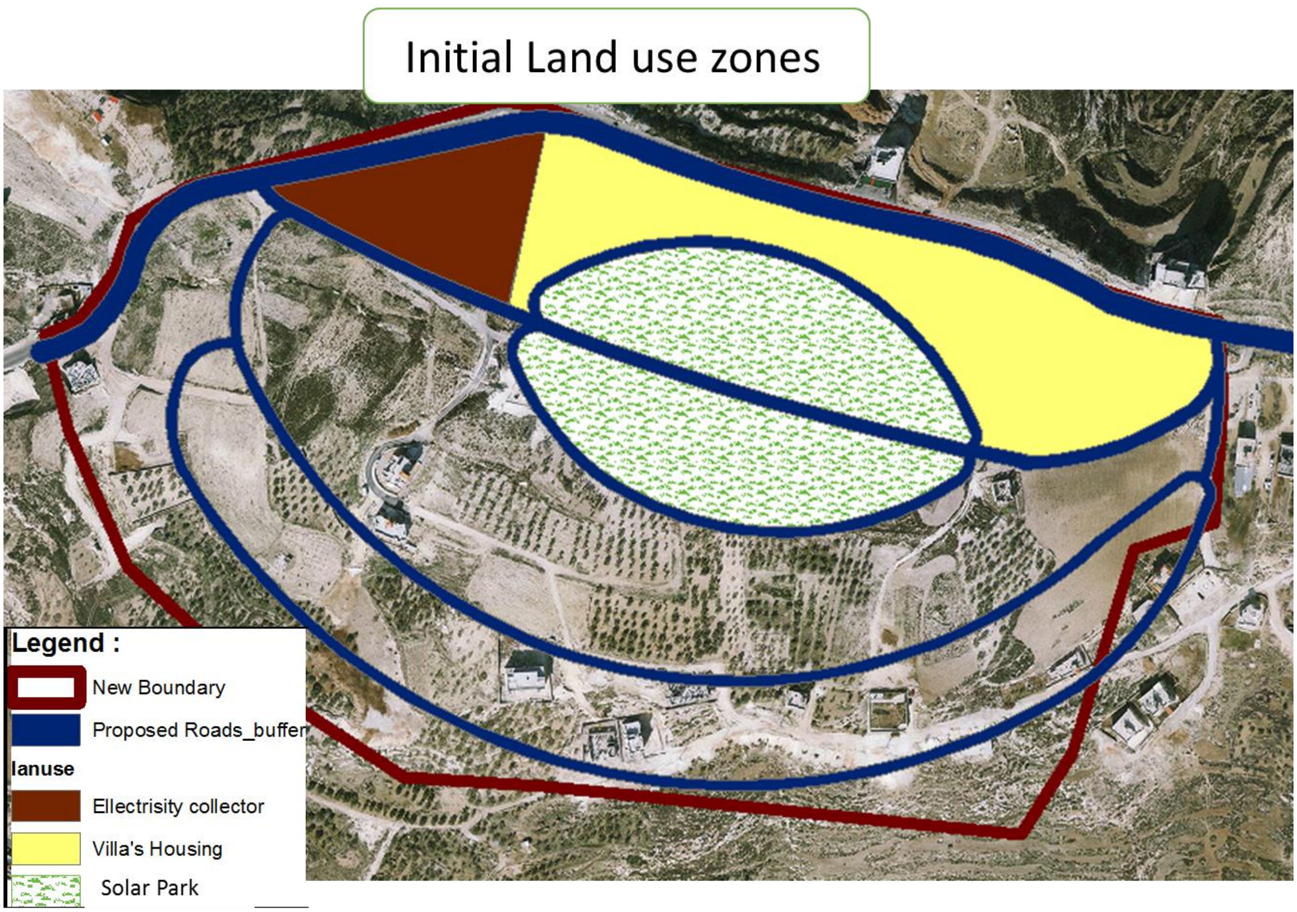


Figure 58: Case 4: Shadows of 2 floors, 150 m2 area , more spaces , at north – at 3 p.m.

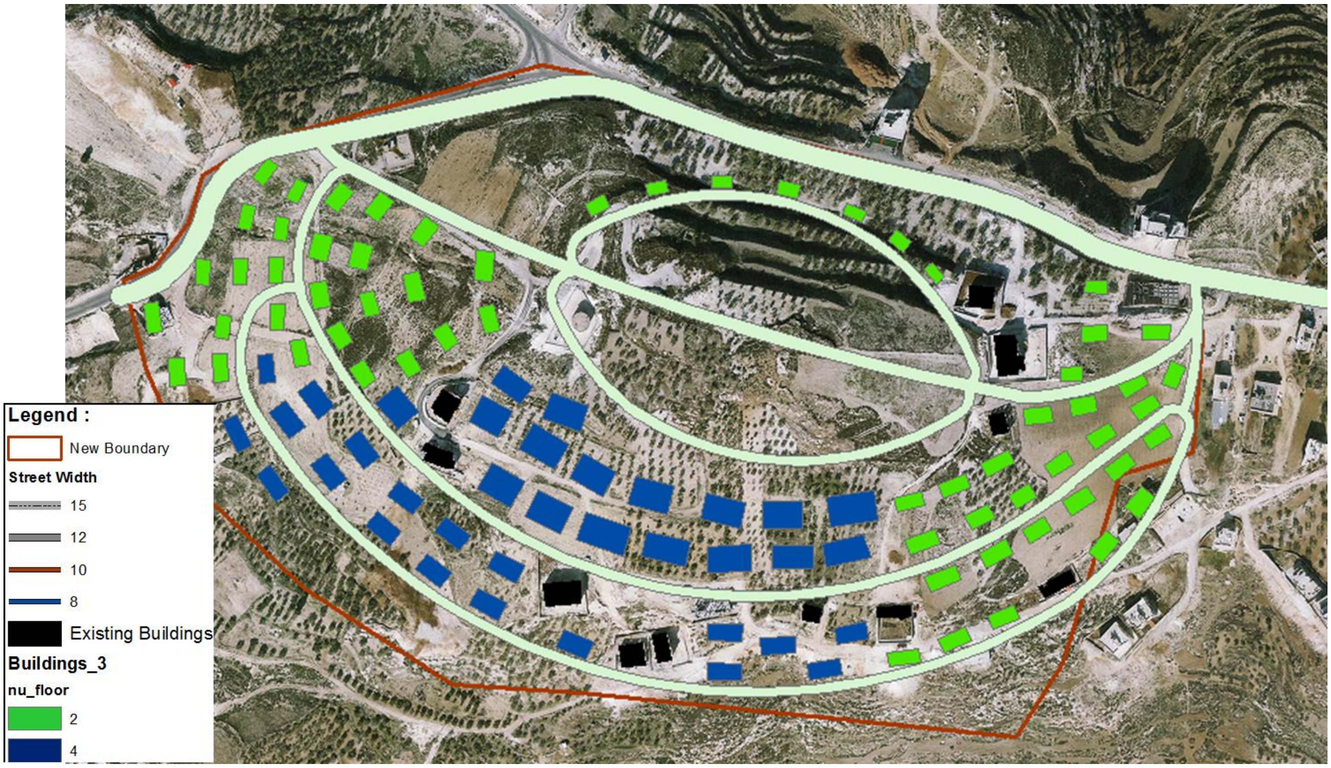
After studding shadows from case 4 at winter, it was clear that the buildings at this region of the site , the building should have at most 2 floors , and the area's should be less than 150 m2 , also spaces should allow the sun access between buildings, so this type of buildings can be used as Villa's housing , as shows at map below.



Map. 32 : Initial land use zones , Villa's zone

Case 5 : southern buildings-more space , 4loors , less area

this case focus on the buildings on the south part of the site , it was clear that these buildings with angle of less than 25 degree , have shadow at winter less than other buildings with angle more than 25 degree, at height of 4 floors, so these buildings will have the same number of floors , but to solve the problem spaces will be decreased increased between buildings , and this logically right choice , because we should increase the spaces when we go vertically with buildings . also area's of buildings should decreased to reduce its effect.



Map. 33: Case 5 : southern buildings-more space , 4loors , less area

Winter shadow analysis:

Shadows at this case at winter will have less than before , because these buildings at the south part so the sun access was at a high range , and this allow to use more height and area for the buildings , so the analysis made for 350 m2 buildings area with a height of 4 floors .

1. Shadows at 9 a.m :

Figure 59: Case 5 : southern buildings-more space , 4loors , less area– at 9 a.m.

2. Shadows at 12 p.m :

Figure 60: Case 5 : southern buildings-more space , 4loors , less area– at 12 p.m.

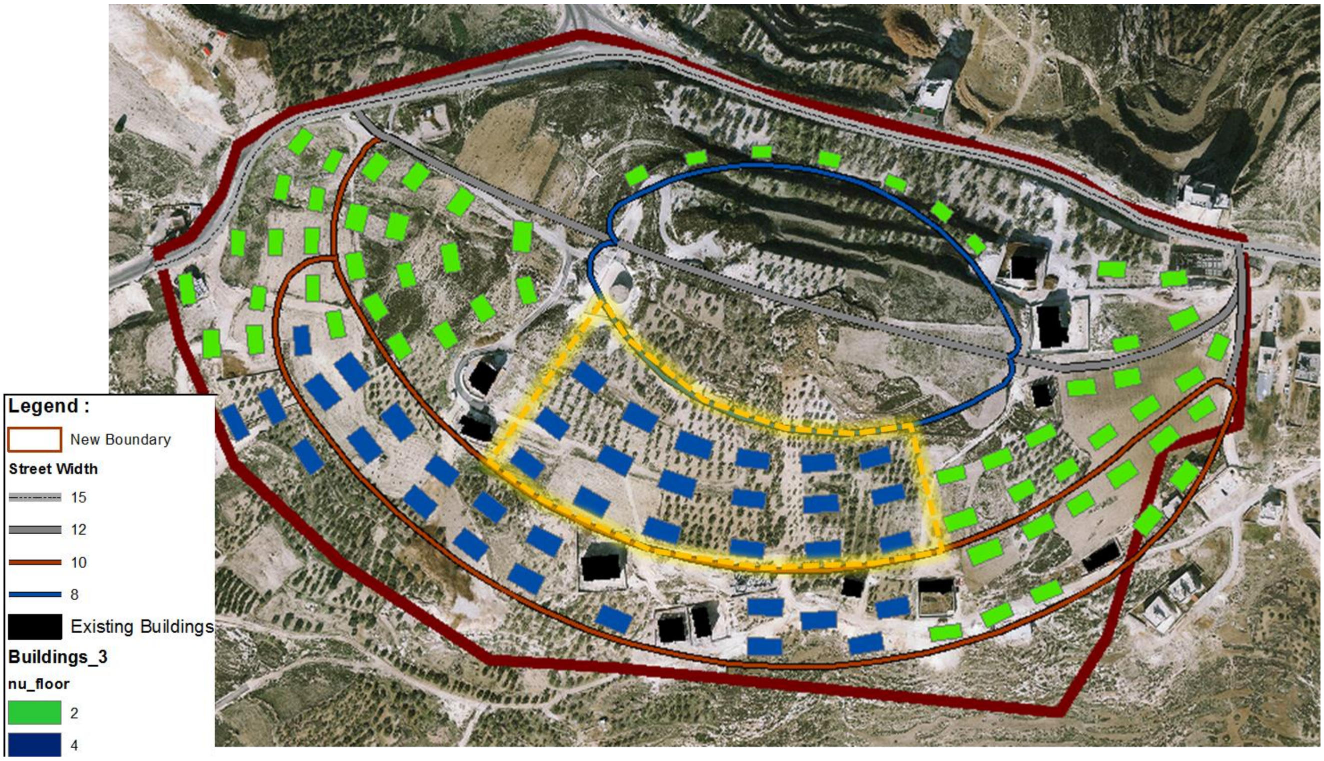
3. Shadows at 3 p.m :

Figure 61: Case 5 : southern buildings-more space , 4loors , less area– at 3 p.m.

After studding shadows from case 5 at winter, it was clear that the buildings at this region of the site ,have shadows with nearly north angle , so the shaded area is at the frontage of these buildings , and as show at case 5 at southern buildings we have 2 types of building forms ,regular and irregular , and as shows the irregular form is better than regular type , because it allow the sun to access between buildings .

Case6 : low density buildings at center,4 floors :

This case will focus at the buildings at the center of the built up area, as shows at the figure below ,before the adjustment of these buildings , the shadows was huge and cover the spaces between buildings , but after editing the new building will have less area, more spaces and the same number of floors(4floors) . and the shadows below show how the shaded area change to better .



Map. 34: Case6 : low density buildings at center,4 floors

Winter shadow analysis:

Shadows at this case at winter will have less than before , because these buildings at the center ,was near the solar park and have a high elevation , so it can't affected from other buildings around , and there direction angle less than 25 degree , so the shadows angle decrease .

1. Shadows at 9 a.m :

Figure 62: Case6 : low density buildings at center,4 floors– at 9 a.m.

2. Shadows at 12 p.m :

Figure 63: Case6 : low density buildings at center,4 floors– at 12 p.m.

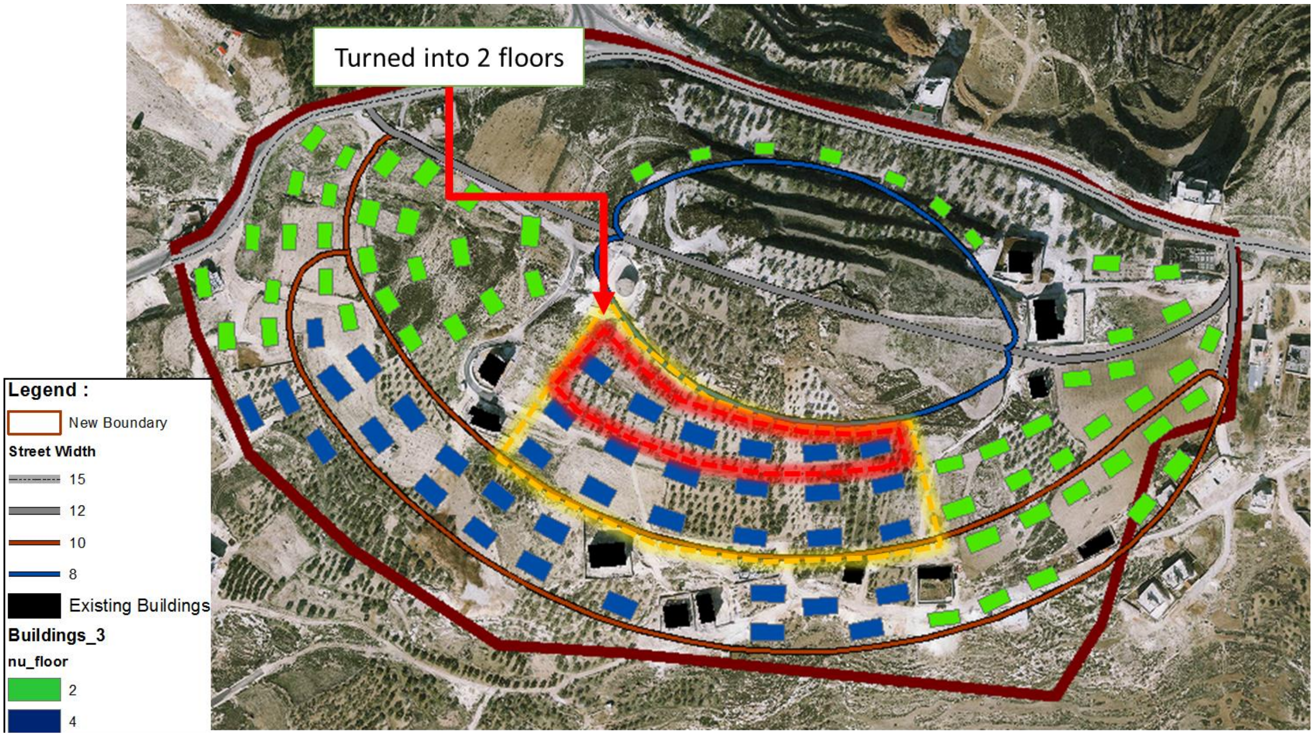
3. Shadows at 3 p.m :

Figure 64: Case6 : low density buildings at center,4 floors– at 3 p.m.

After studding shadows from case 6 at winter, it was clear that the buildings have less shaded area than before , but spaces between buildings covered vertically ,so the problem here was at the building pattern and form , and this will be solved later.

Case 7 : from 4 to 2 floors-regular pattern under the solar park

Buildings under the solar park have 4 floors and this cover the street and the frontage areas , also this prevent the visibility from the other buildings to the park , so these buildings changed to 2 floors as the figure below .



Map. 35: Case .7 : from 4 to 2 floors-regular pattern, under the park

Winter shadow analysis:

This shadow test was made to know how the the shaded area changed with the frontage area, and this affect the area infront of these buildings.

1. Shadows at 9 a.m :

Figure 65: Case .7 : from 4 to 2 floors-regular pattern, under the park– at 9 a.m.

2. Shadows at 12 p.m :

Figure 66: Case .7 : from 4 to 2 floors-regular pattern, under the park– at 12 p.m.

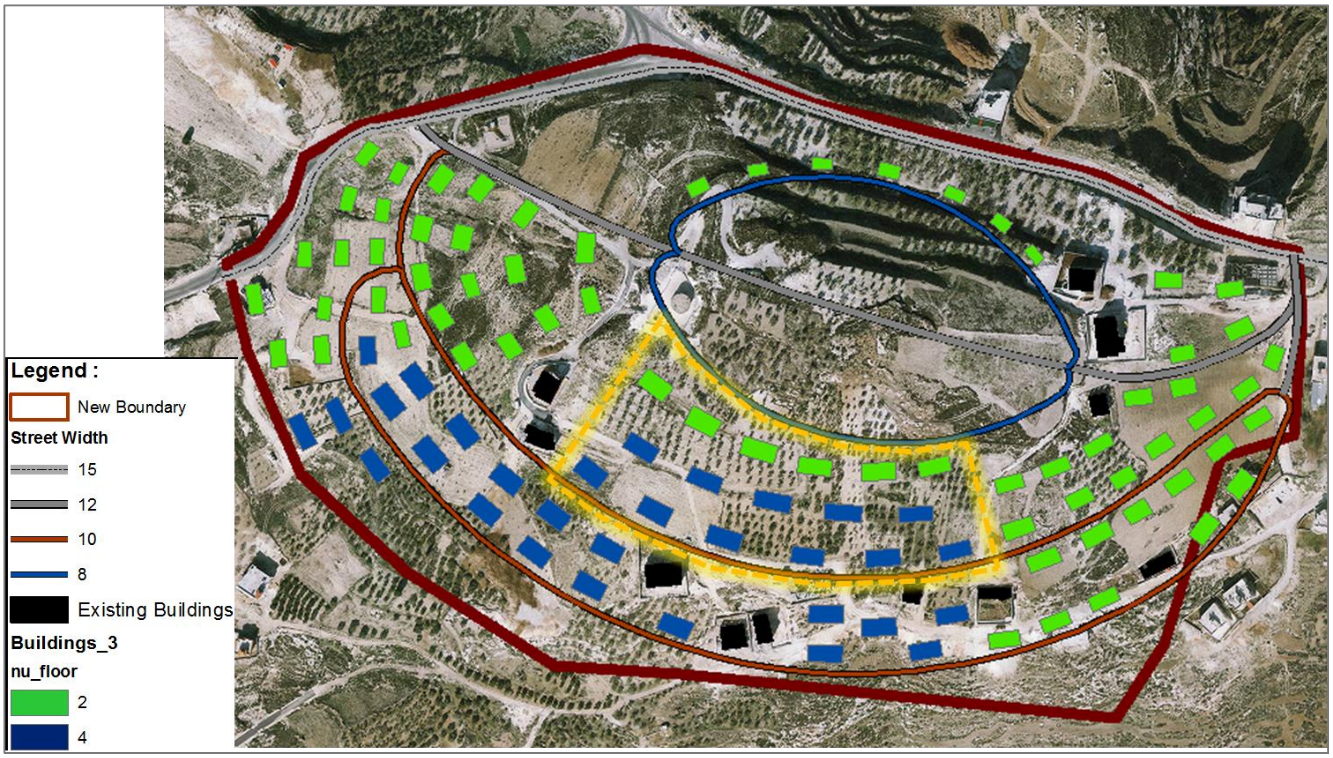
3. Shadows at 3 p.m :

Figure 67: Case .7 : from 4 to 2 floors-regular pattern, under the park– at 3 p.m.

After studding shadows from case 7 at winter, it was clear that the buildings have less shaded area than before, and the solar access became high at the front of these buildings .

Case 8: Irregular building pattern at the center, angle less than 25 :

At this case the buildings at the center was studied at the irregular form, as shown at figure below, so buildings will form with Opposite views to clarify the changes at shaded area.



Map. 36 : Case 8: Irregular building pattern at the center, buildings with angle less than 25

Winter shadow analysis:

This shadow test was made to know how the shaded area changed with the irregular buildings pattern at the center .

1. Shadows at 9 a.m :

Figure 68 : Case 8: Irregular building pattern at the center– at 9 a.m.

2. Shadows at 12 p.m :

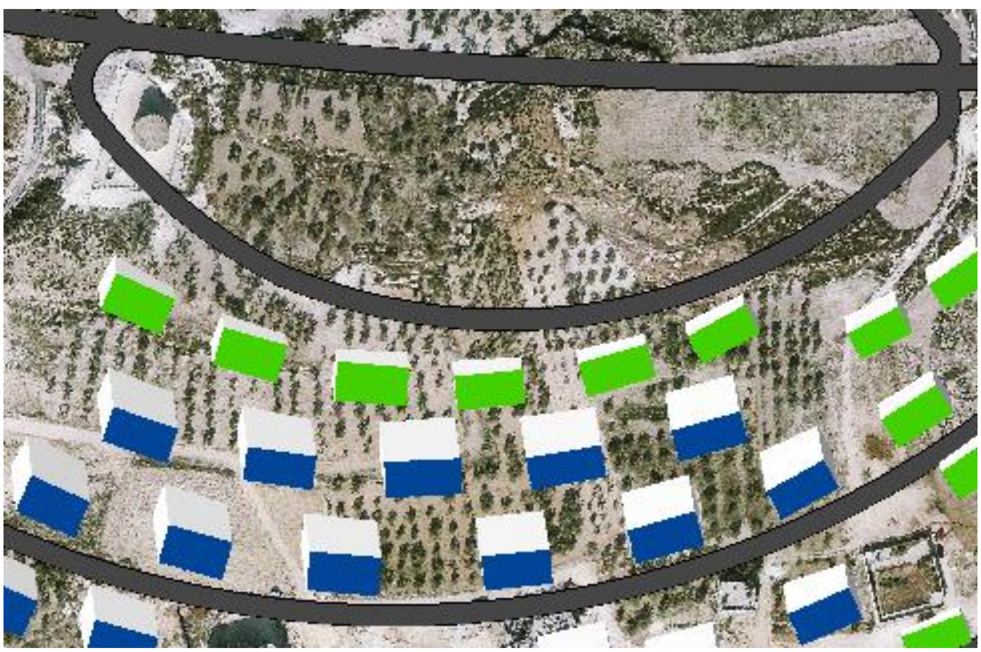


Figure 69 : Case 8: Irregular building pattern at the center – at 12 p.m.

3. Shadows at 3 p.m :

Figure 70 : Case 8: Irregular building pattern at the center – at 3 p.m.

After studding shadows from case 8 at winter, it was clear that the buildings have less shaded area than before, and the solar access increase between buildings than before.

Case 9 : street shadow problems at east and west

At this case , the buildings that shaded the street will solve, so after analysis studies before the buildings that shading the streets at west and east shaded streets highly , specially buildings that not far from streets , these buildings showed below at figures and how if affected the streets at morning and noon .

Figure 71 : Case9 :buildings at the east that shaded streets

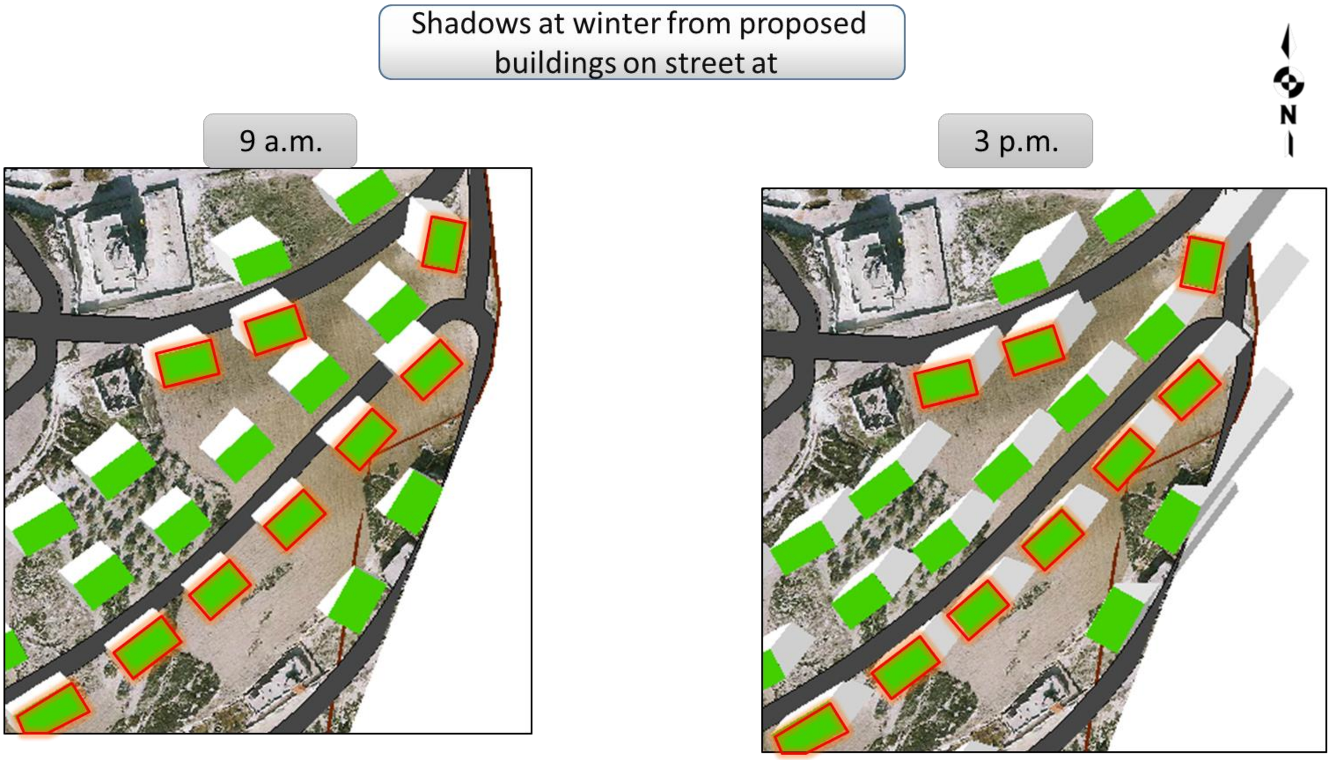


Figure 72: Case 9 :shadow at winter from buildings at east , at 9a.m and 3 p.m

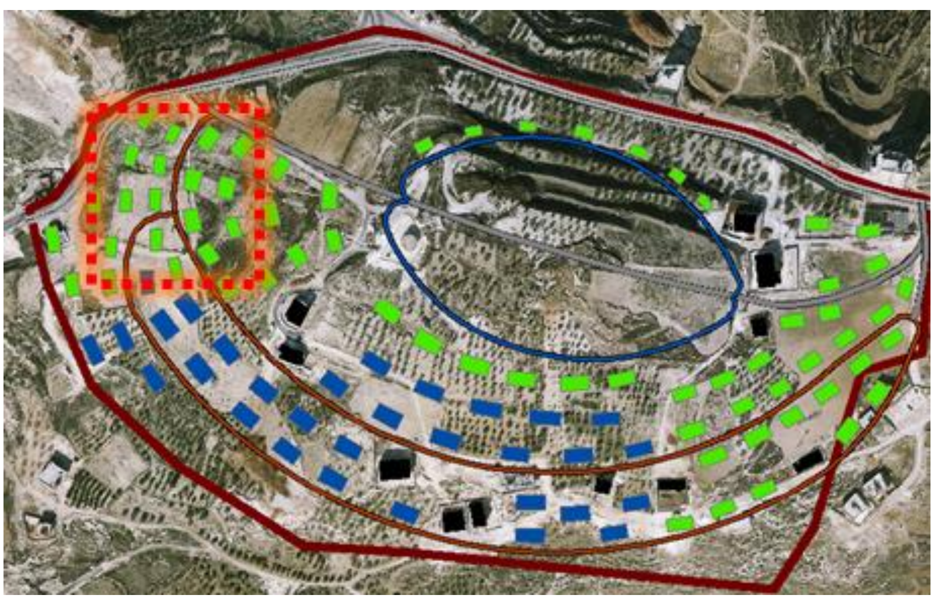


Figure 73: Case9 :buildings at the west that shaded streets

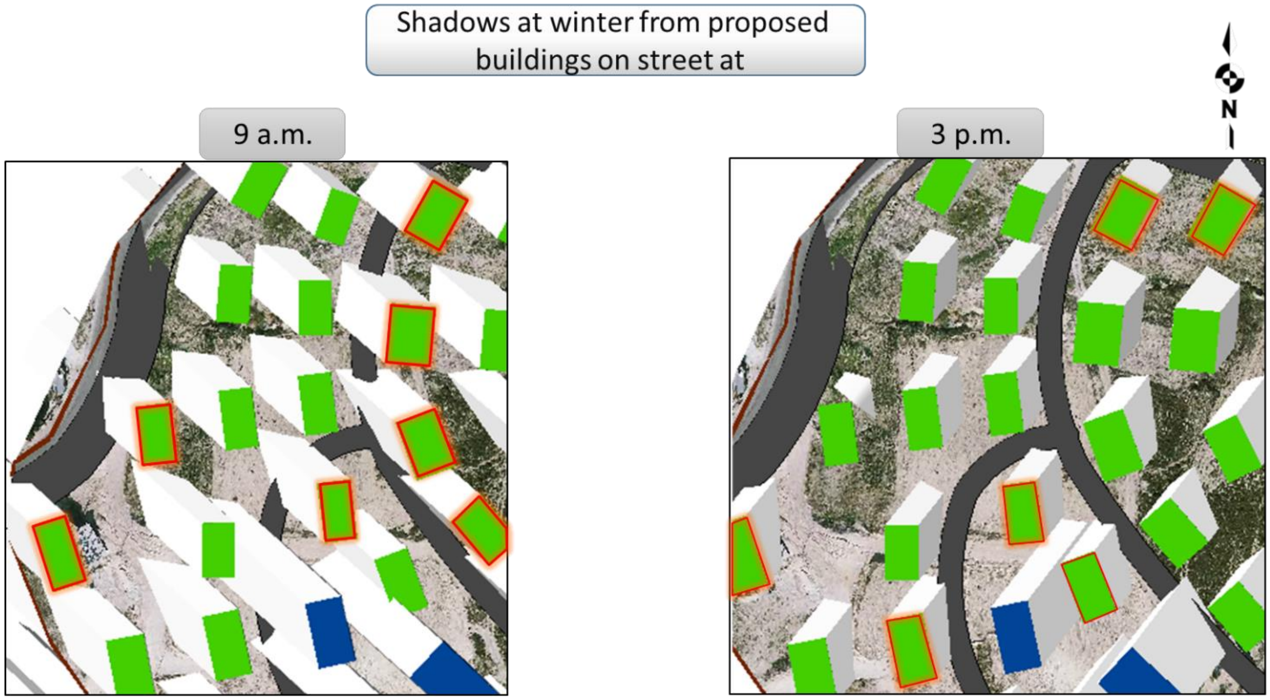


Figure 74: Case 9: shadow at winter from buildings at west, at 9a.m and 3 p.m

As shows , it was clear that these buildings affect the solar access at winter to these streets , and this make a problem for solar access and heating at winter, so to solve these problems , the most suitable solution for these buildings is to increase the set back from streets , but increase the frontage setback more than the backyard .

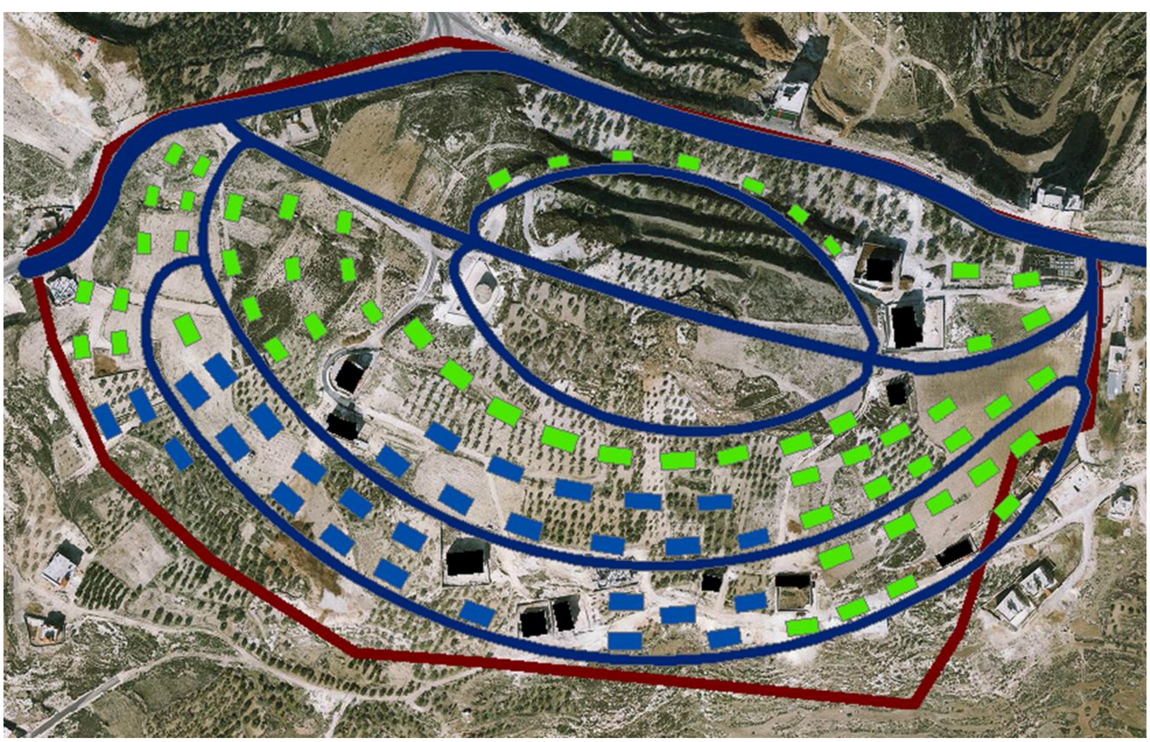


Figure 75: Case9 :New change in buildings at east and west

Winter shadow analysis:

This shadow test was made to know how the shaded area changed with the frontage setback from streets, and this affect the area in front of these buildings and these streets.

1. Shadows at 9 a.m :

Figure 76: Case 9 : street shadow for the increased setback buildings at east and west-9 a.m

2. Shadows at 3 p.m :

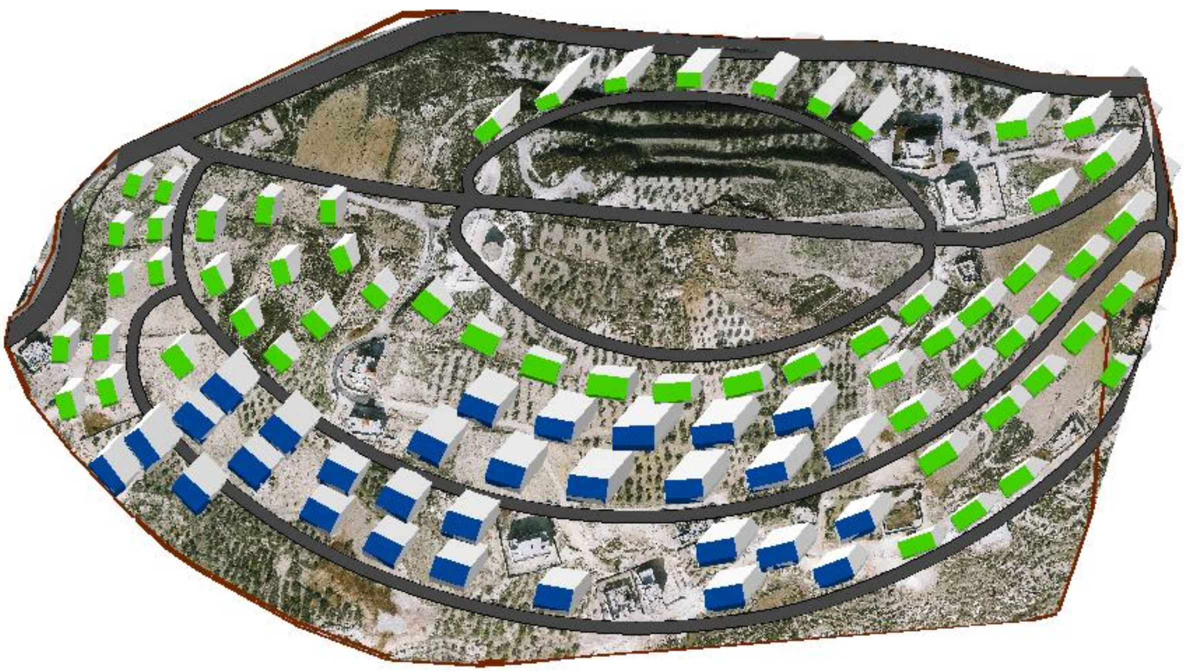


Figure 77: Case 9 : street shadow for the increased setback buildings at east and west-3 p.m

After studding shadows from these buildings near streets , shadow problems minimized to increase the solar access at these streets at winter, and that was clear from shadow above , depending on increasing the setback of streets .

Case10: street shadow problems at south and middle area:

Also buildings at the south and middle affect the roads at the site, and make shading area that prevent sun access at winter, and these building was showed at the figures below.

Figure 78: Case 10 :shadow problems from south and middle buildings.

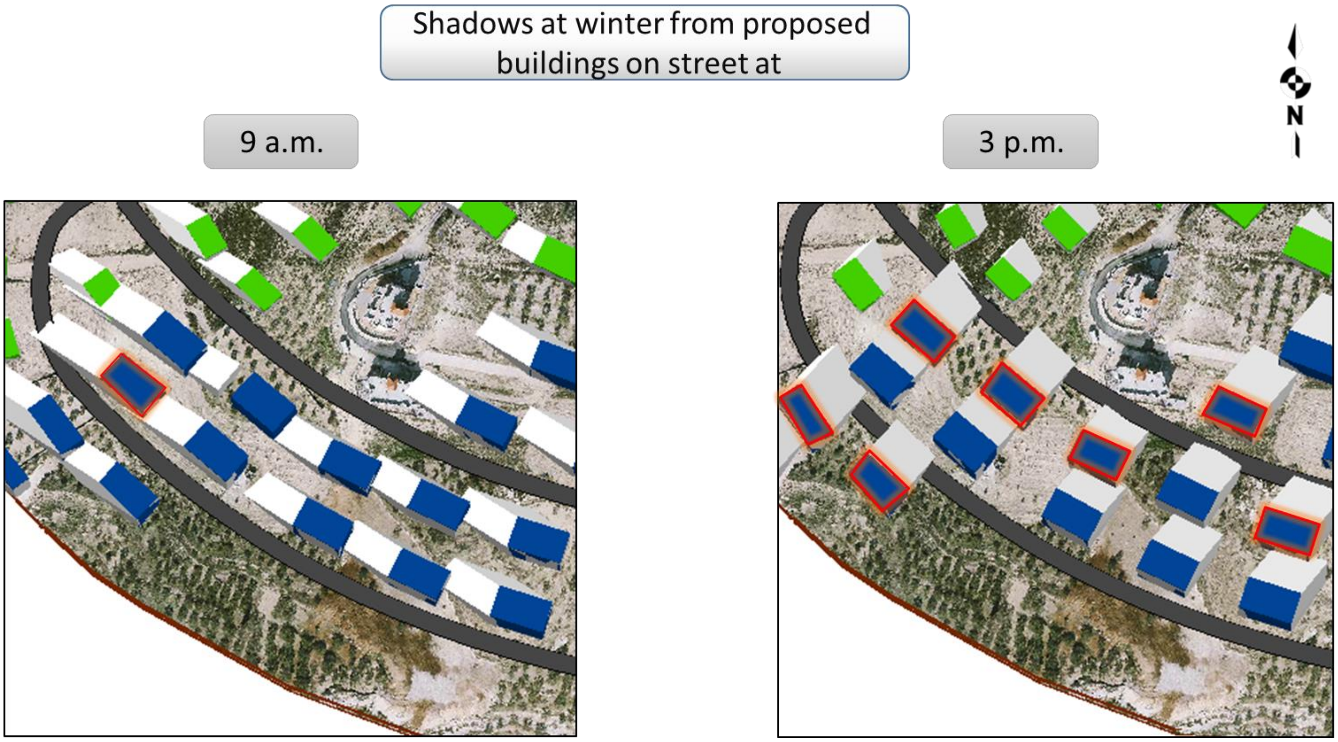


Figure 79: Case 10: shadow problems from south and middle building sat 9 a.m. and 3 p.m.

Also . the solution for street problems her is to increase the setback from streets, but in a different range, because here the buildings with 4 floors height that increase the setback but the angle of these buildings less than 25 that decrease the setback , and the final changes shows at figure below.

Figure 80: Case10 :New changes in buildings at south and middle

Winter shadow analysis:

This shadow test was made to know how the shaded area changed with the frontage setback from streets, and this affect the area in front of these buildings and these streets.

1. Shadows at 9 a.m :

Figure 81: Case 10: street shadow for the increased setback buildings at south and middle-9 a.m

2. Shadows at 3 p.m :

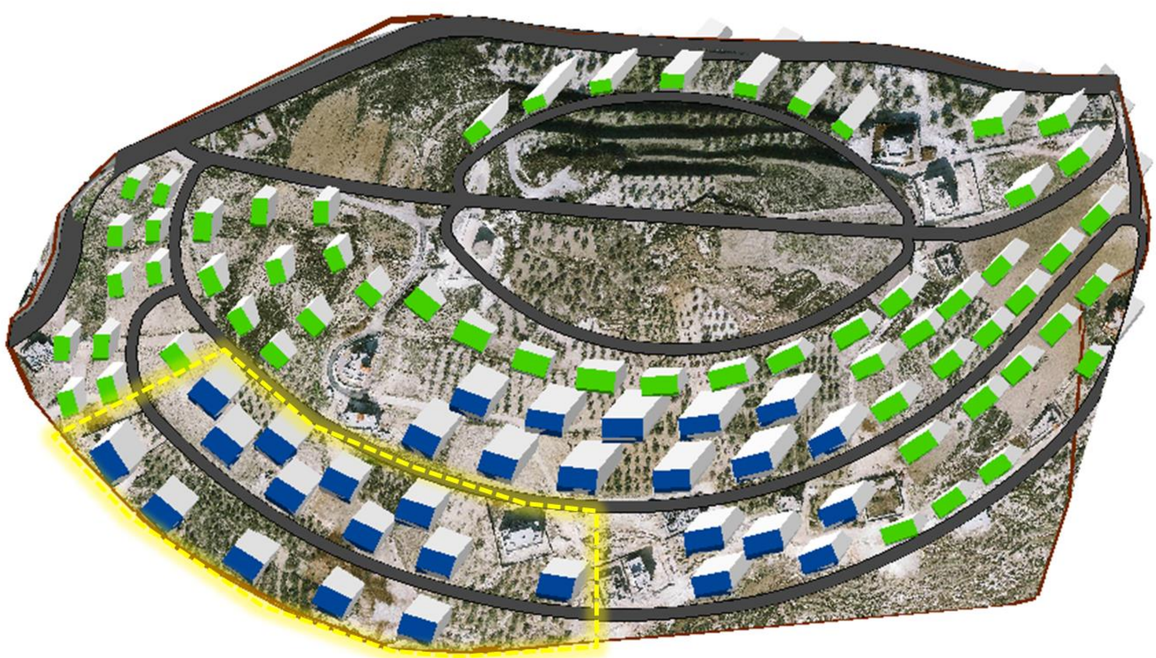
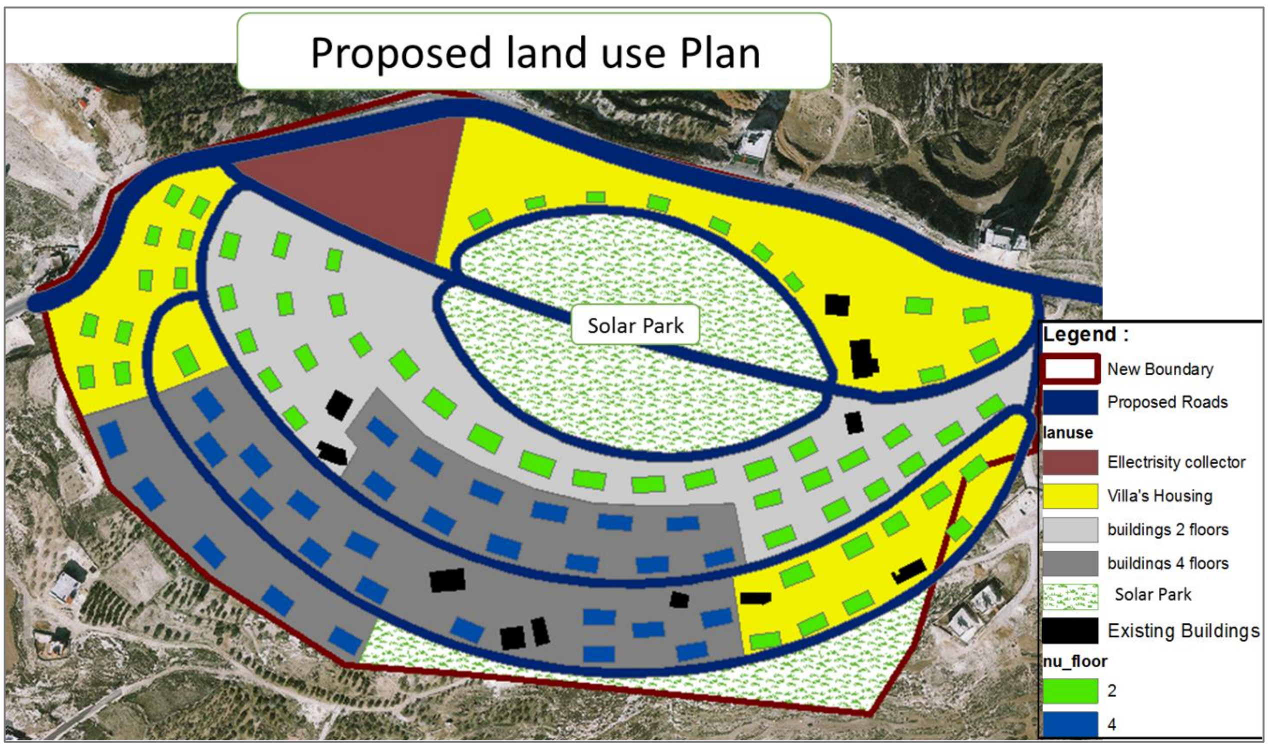


Figure 82: Case 10 : street shadow for the increased setback buildings at south and middle-3 p.m

After studding shadows from these buildings near streets , shadow problems minimized and solar access was in a better case at all streets at the site.

So , after shadow analysis for the site buildings , the proposed land use plan include

1. **3 types of buildings :**
   - **Villa's housings** : single buildings that have area less than 150 m , and the number of floors less than 2 floors , spaces between buildings allow to sort this type of villa's housing.
   - **2 floor buildings** : these buildings have area less than 250 m , with 2 departments and 2 floors, area's between buildings should allow solar access at winter .
   - **4 floors buildings** : these buildings have area with 350 m, with 2 to 3departments , aria's between buildings should be more than the other buildings because of these buildings size and the shaded area covered by them .
2. Also , the land use plan include the **solar park**, at the height elevation and highest solar radiation points , with area of 45 hectare that can be used as public green area , also for energy production using solar access.
3. Then, the land use plan also include the **power adapter** and collector and it's buffer zone, and tha area around reaches about 10 hectare.



Map. 37: Proposed land use plan depending on solar analysis

6.4. Final Building Regulations:

This chapter will summarize the final regulation was reached to from the shadow analysis, these regulation include residential areas locations, street orientation, buildings orientation , heights , area's and setbacks from streets . These regulation defers from site to another depending on the site climatic analysis, shadows and topography.

so these regulation include :

- Area’ with **high radiation** percent mustn't be used as residential area’s , but green area’s or solar collectors .
- The best **street orientation** with the line of sun access, to maximize it at winter .
- **Built Up area formation :**
  - **Distance** between building & buildings **height** and their area’s can be assumed by winter sun
  - Depending on the idea of maximizing the sun access at winter and minimizing it at summer
  - How ? By shadow analysis !!

  shadows from any building mustn't cover the other

I. **East-west Buildings with angle of(25-45) :**

- Area should be less than 250 m2
- Spaces between building minimum 14 m
- Building heights reach 2 floors .

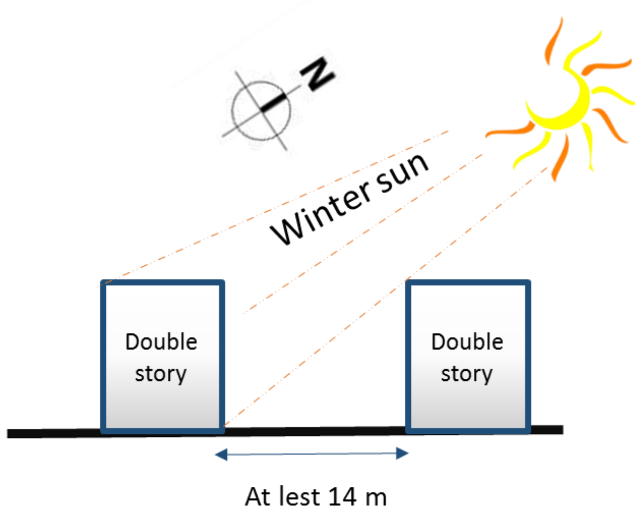


Figure 83: spaces between 2floors ,East-west with angle of(25-45)

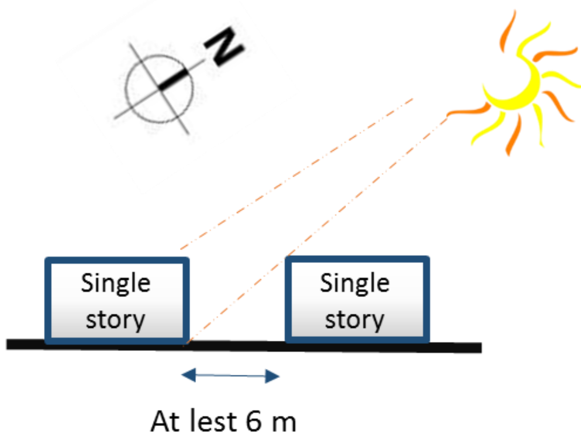


Figure 84: spaces between single stoor ,East-west with angle of(25-45)

II. East-west Buildings with angle of(0-45) , but behind Hill :

- Area should be less than 150 m2
- Spaces between building minimum 20 m
- Building heights reach 2 floors .
- Sorted as Villa's housing .

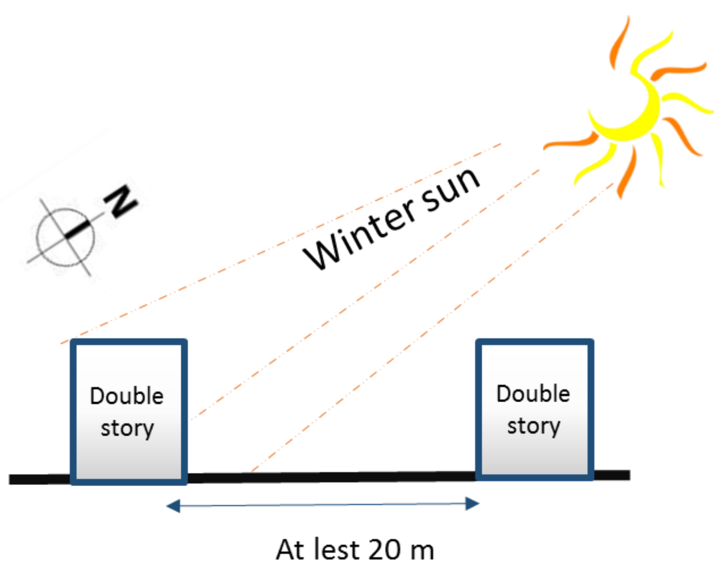


Figure 85: spaces between East-west Buildings with angle of(0-45) , but behind Hill :

III. East-west Buildings :

- Area should be less than 350 m2
- Spaces between building minimum 25 m

- Building heights reach 4 floors .
- Sorted as Residential Buildings .

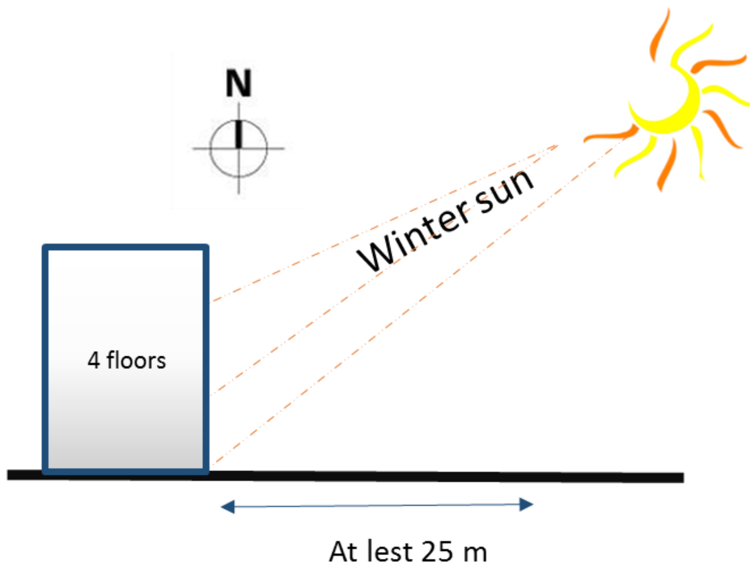


Figure 86: spaces between East-west Buildings :

The following table summarize the setback from streets for every type of buildings at the solar neighborhood:

TABLE٧ : SETBACK FROM STREETS FOR EVERY BUILDING TYPE

Set back		**Frontage set back**		**Beyond set back**	
Number of floors		**2 floors**	**4 floors**	**2 floors**	**4 floors**
with angle of(25-45)	**At east**	**7m**	**15 m**	**---**	**---**
	At west	**----**	**----**	**10 m**	**20 m**
angle less than 25 degrees		**3-5 m**	**12 m**	**---**	**---**

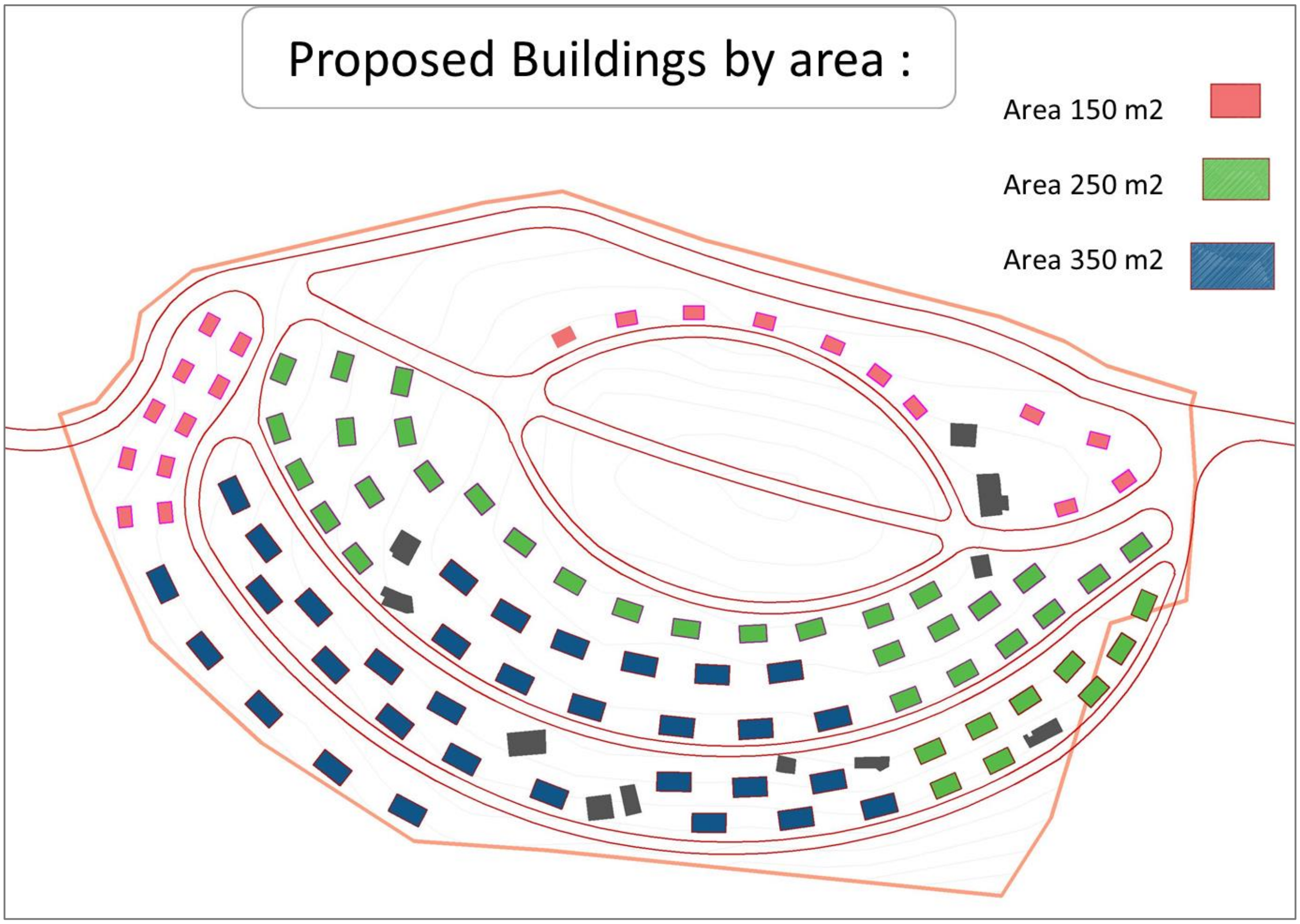
According to building regulations at the selected area = ---

6.5. Solar Neighborhood planning Elements

1. Buildings :

The proposed buildings at the site was classified by the area and the ight or number of floors, and these resulted buildings showed at figures below.area clasification include three area's for these buildings :

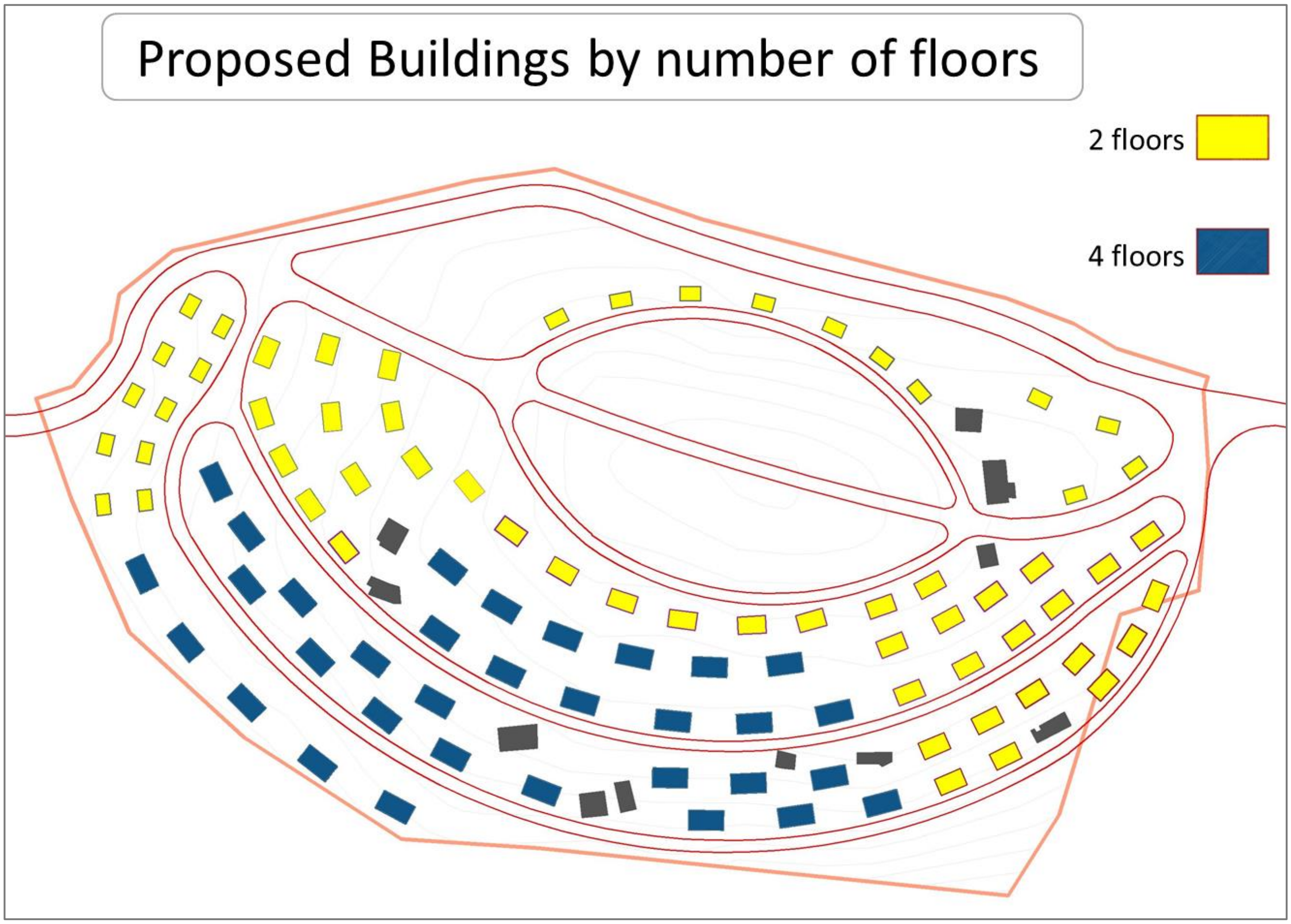
1. 150 m2 for Villa's located at the north and north-west of the site .
2. 250 m2 for buildings at the east and under the park with highest elevation points.
3. 350 m2 for buildings at the middle and the south of the site.



Map. 38: Proposed Buildings by area

Also buildigs clasified by the number of floors , that resulted for the analysis done before, so there are tow types :

1. 2 floors for villa's and 250 m2 buildings
2. 4 floors for buildings with 350 m2 .



Map. 39: Proposed Buildings by number of floors

2. Road Network :

The road network was explained before at the planning stage that planned related to the sun access , but after studying the network and after building distribution , there are unserved area's at the site, that explained at the figure below , these buildings was suffered from unexacting road services.

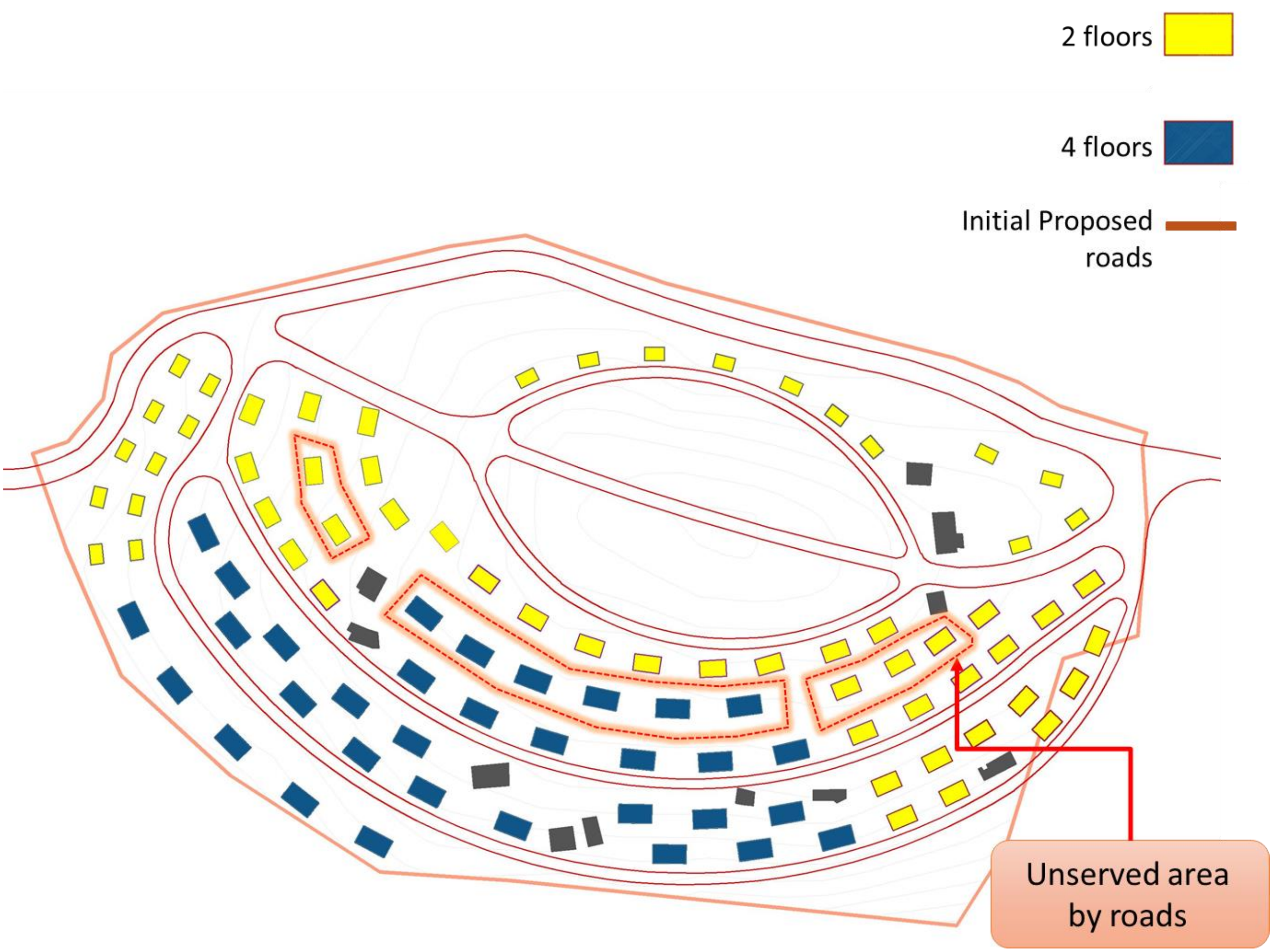


Figure 87: Unserved area's at the site with road network

And therefore the solution for this problem is to provide the region through sub-streets or service streets to areas that are not connected with streets, as shown below.

But the proposed new streets intersect with the existing buildings and to create these streets should existing buildings that are incompatible with it be excluded as shown at the next figure .

Figure 88: New proposed road services sites

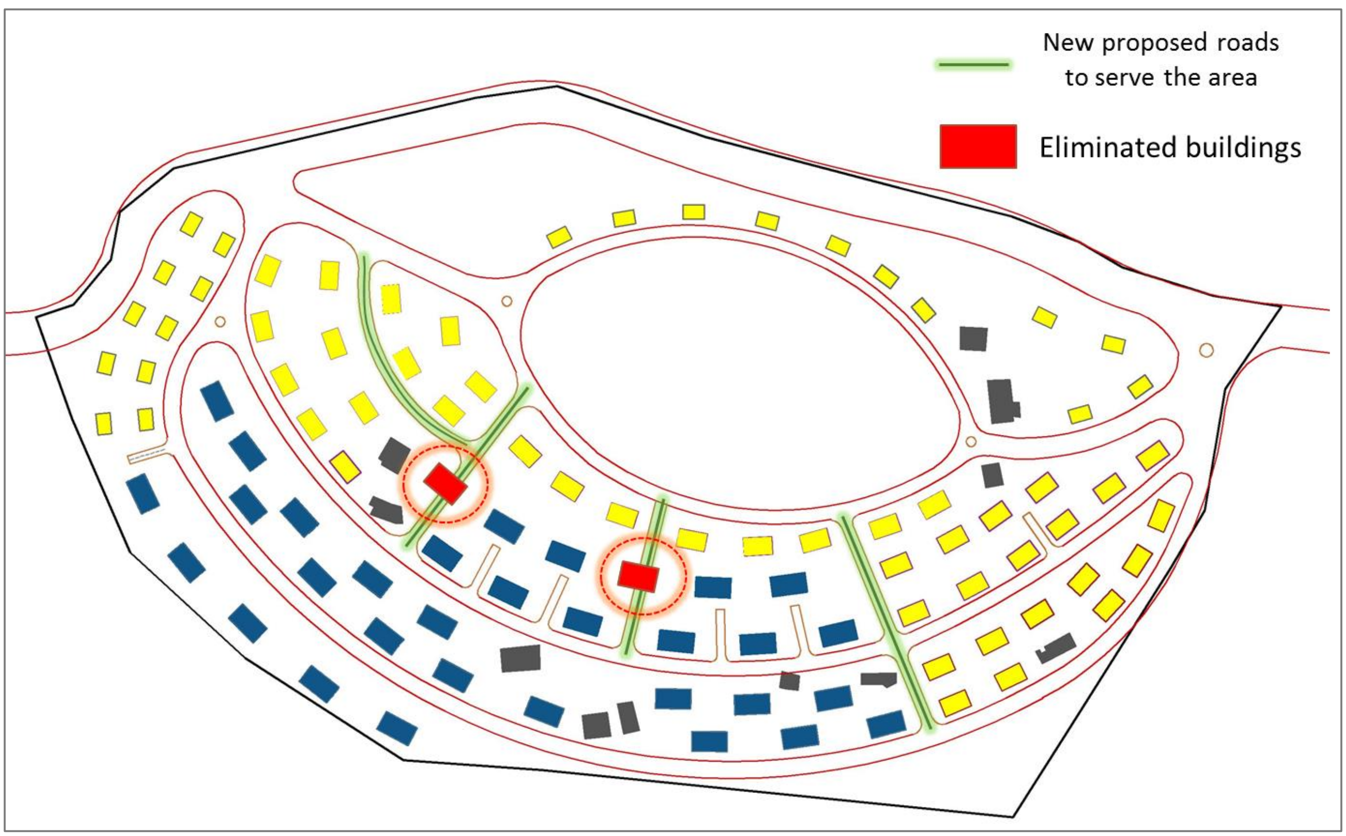


Figure 89: Eliminated buildings result from new proposed road services sites

As shown at the figure above there are new spaces result from the buildings that excluded from the area' but we can move the buildings around because the all the shadow analysis will changed and the system of arranging these buildings will damage depending on the sun access .

Also the central road the access the solar park will changed to walkable road to prevent cars from passing the solar park, this explained at the figure below.

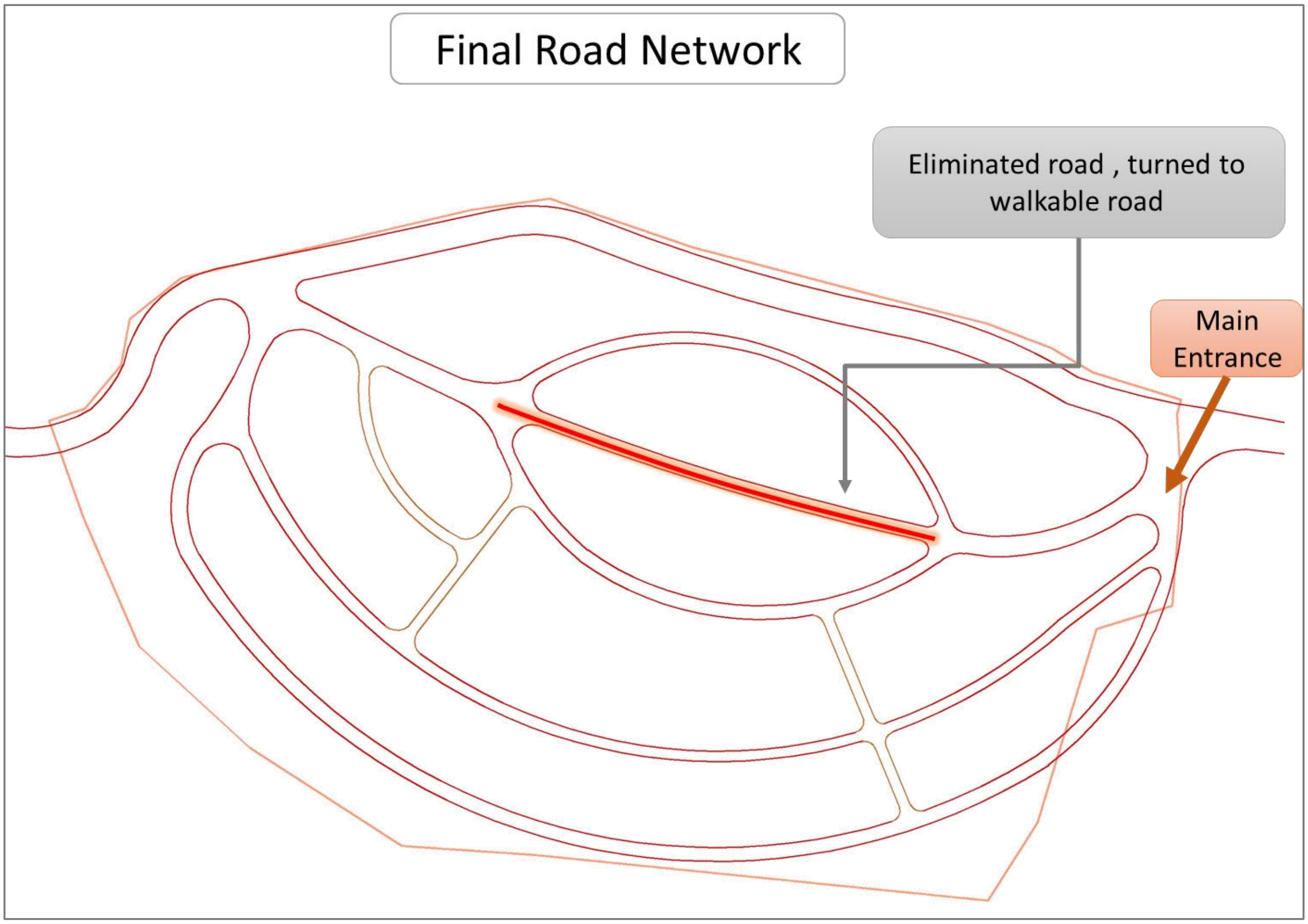
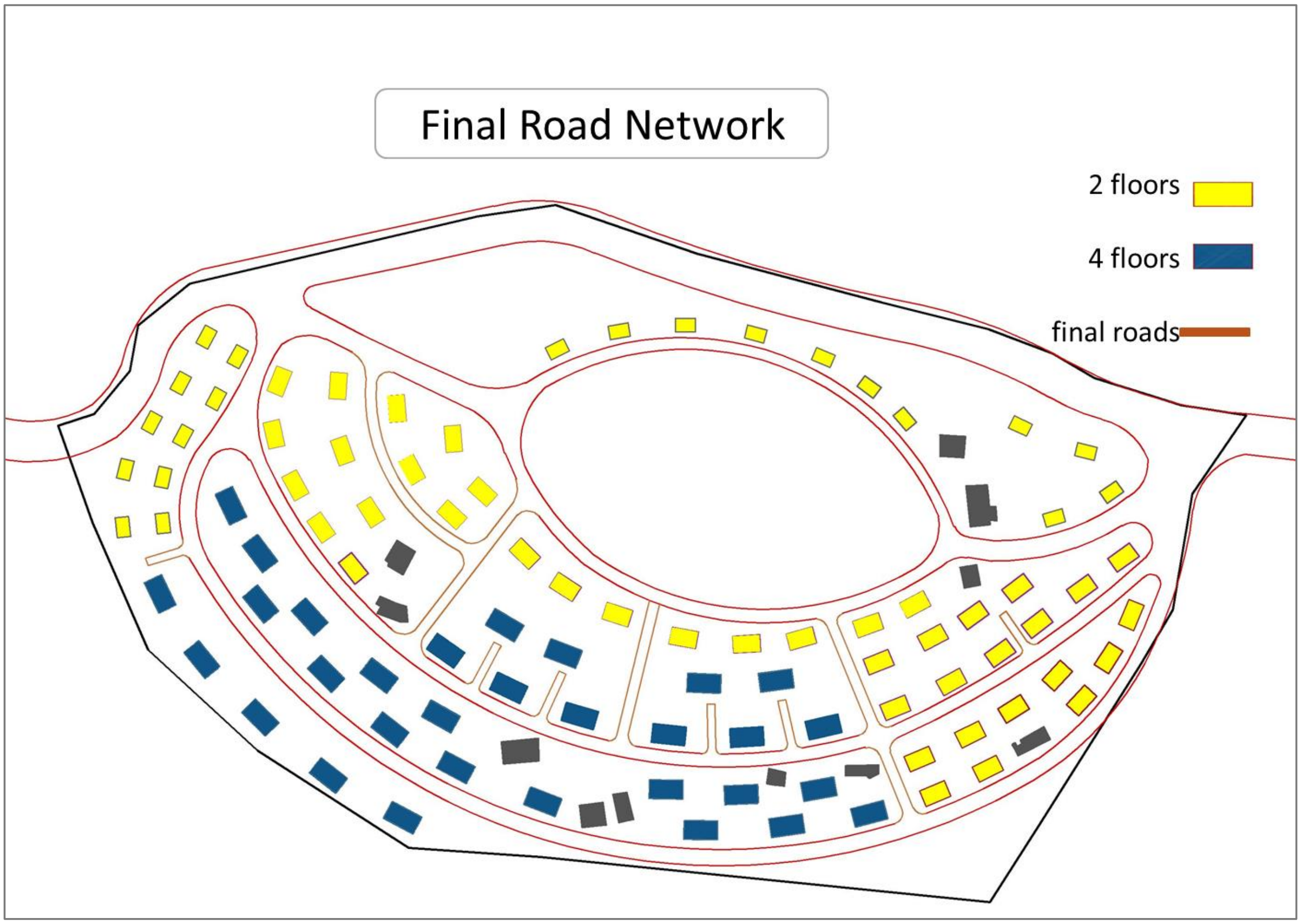


Figure 90: Final road network before turned the park road to walkable road

So the final road network explained at the plan below after making the changes , by adding service roads , so this plan serve all the site area .



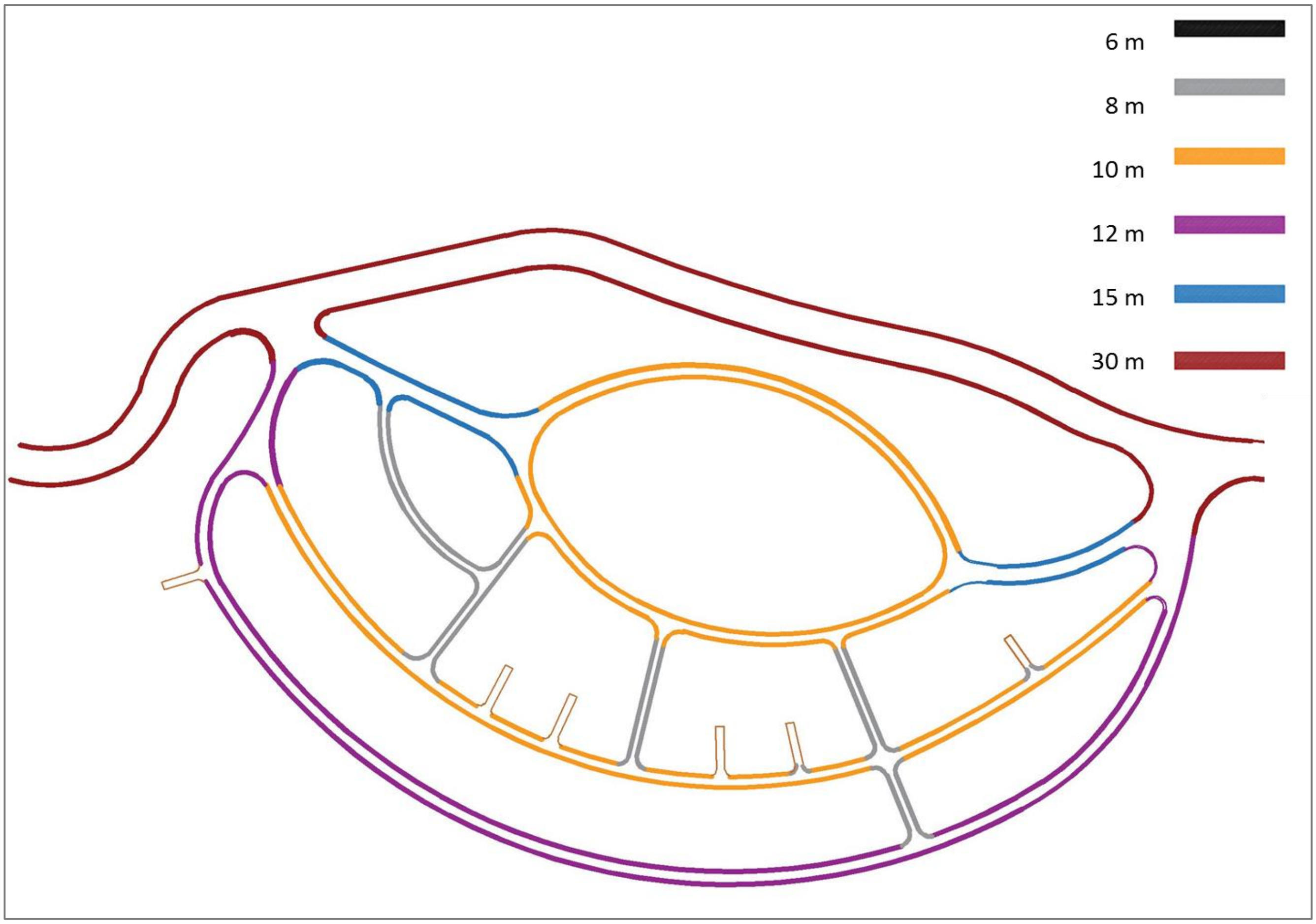
Map. 40: The final proposed road network at the site

Road Hierarchy , by width :

Road network was classified depending on the width to sever the site area, these sorts classified below at the figure, so it sorted to :

- 30 m width, for the main street, this street already have 10 m width but as for the master plans it sorted by 30m , and it should be expanded to serve the site and the projects around the site .
- 15 m width , the roads that have direct access to the site sorted with 15m width , to accommodate the pressure on the project network and access .
- 12 m width , the ring road of the project have 12 m , to make the accessibility easier and have lanes with more width for wider cars access .
- 10 m width , central roads at the project that have 2 lanes with width of normal lane and offer walkable side from the street .
- 8 m width , for the new added streets that serve the area vertically.

- 6 m width for call de sakes and service roads that serve one building to 3 buildings at the neighborhood. m width, for the main street, this street already have 10 m width but as for the master plans it sorted by 30m , and it should be expanded to serve the site and the projects around the site .



Map. 41: Final Road Hierarchy , by width

3. Public Services:

The neighborhood should served by the important and needed public services that include Mosque , kinder garden, shopping Centre, health center and the community center. These service have to be reached by all users and have a high accessibility, also the size of these services should sufficient the entire region. The site selected for the services explained below at the figure.

Justification for the selected site:

- Near the Neighborhood center, all services was near the center that conceded as a focal point for the site.
- The Mosque at the main road entrance, so that the mosque can used by the users from near housing projects and reached easily by all users at the region ..

- Easy of accessibility, located at the main road of the neighborhood , and the entrance road .
- Kinder garden is about 400 m from buildings at the entire region, so it serve all the area. .

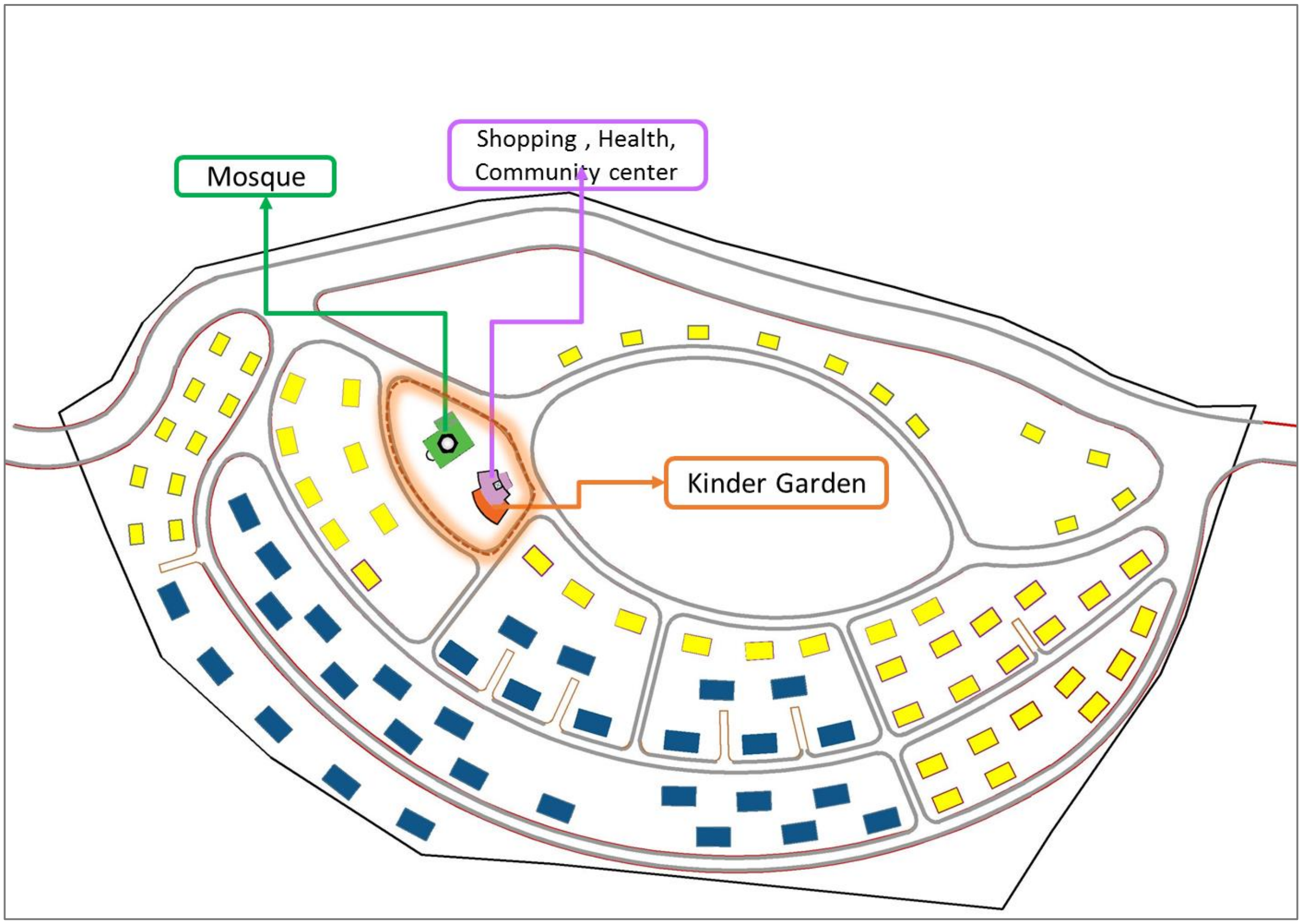


Figure 91: Public services location at the neighborhood

4. Parcelation :

This depend on the building orientation, size and location, and this will different at each type, so the following steps used to make buildings parcels :

- Parcels different by the buildings area , and floors .
- Villa’s parcels reach's 1000 m2 .
- Parcels of 2 floors less than 4 floors .
- Existing buildings extended their parcels around to reduce its shadows effect.
- Power adapter has about 10 hectare.

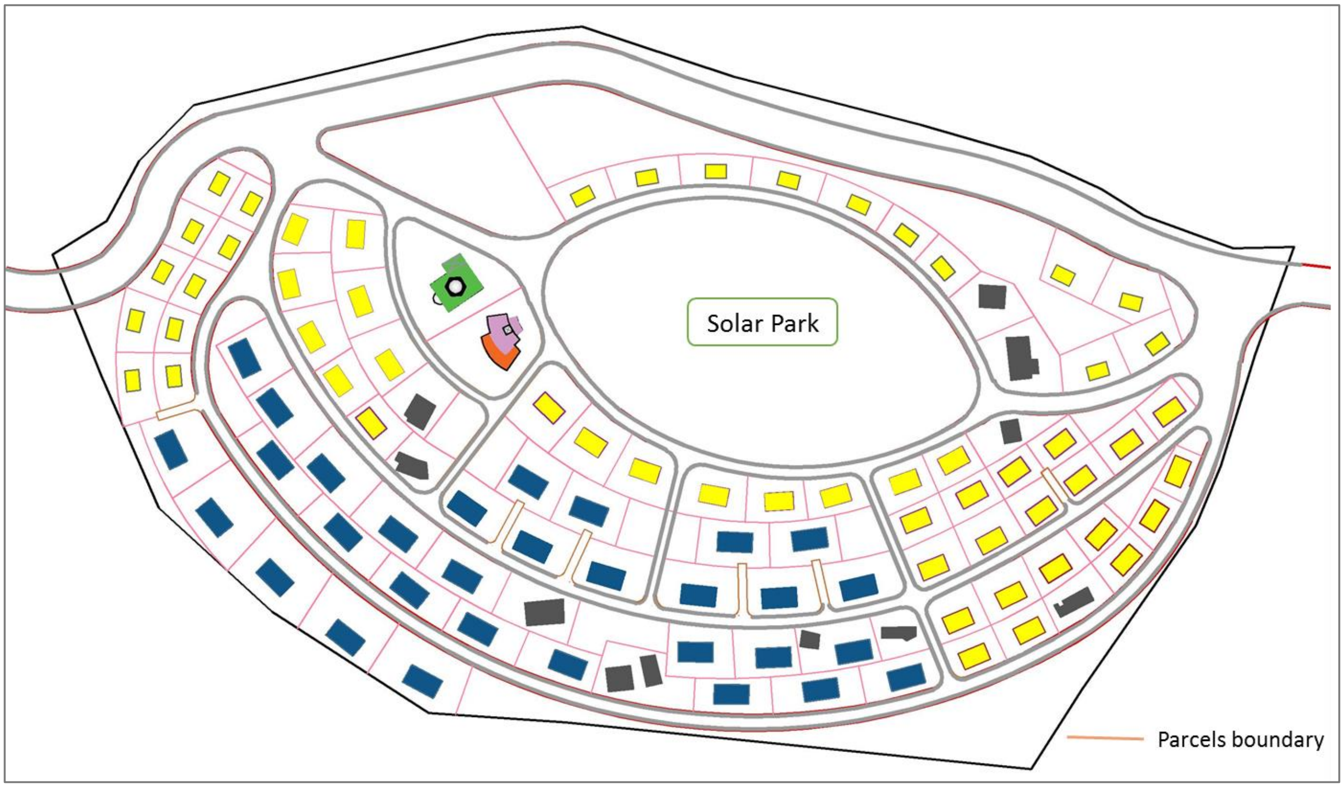


Figure 92: Parcels of the neighborhood buildings

5. Green Area’s :

All area's that not in the range of buildings parcels will used initially as green area's, and later these area's will be used as public green area's , Green belt ,Protection zones from noise or pollution and the parking's zones. And these area's explained at the figure of green area's below can be resulted from the following:

- Area around Power adapter will be Green barriers, to prevent pollution from rays.
- Area’s around the neighborhood will be Green barriers, mainly at the main street to prevent the noise, and at the south to increase the privacy of the project .
- Spaces between parcels will be green areas.

Figure 93: Green area's distribution at the site

So after installing the existing buildings and the proposed for the project, the figure below shows a three-dimensional model of the neighboring residential buildings.

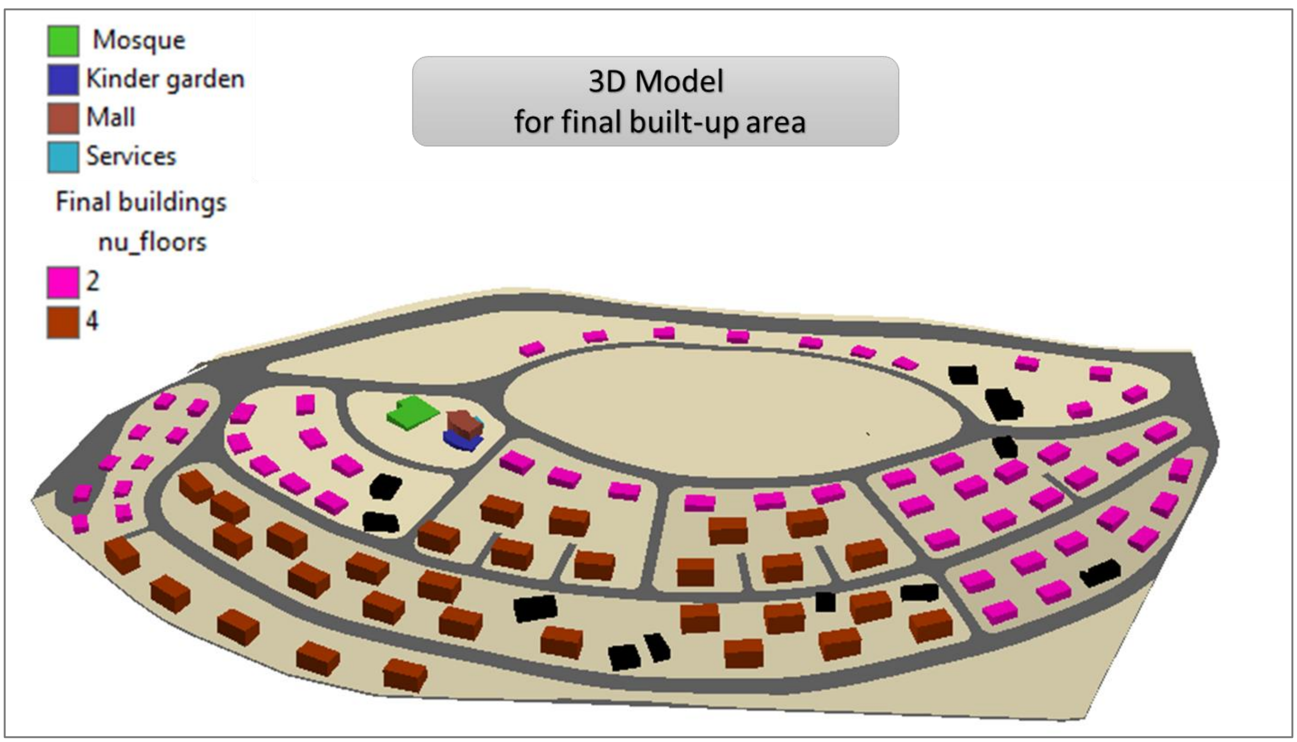


Figure 94: Final 3d model for built-up area

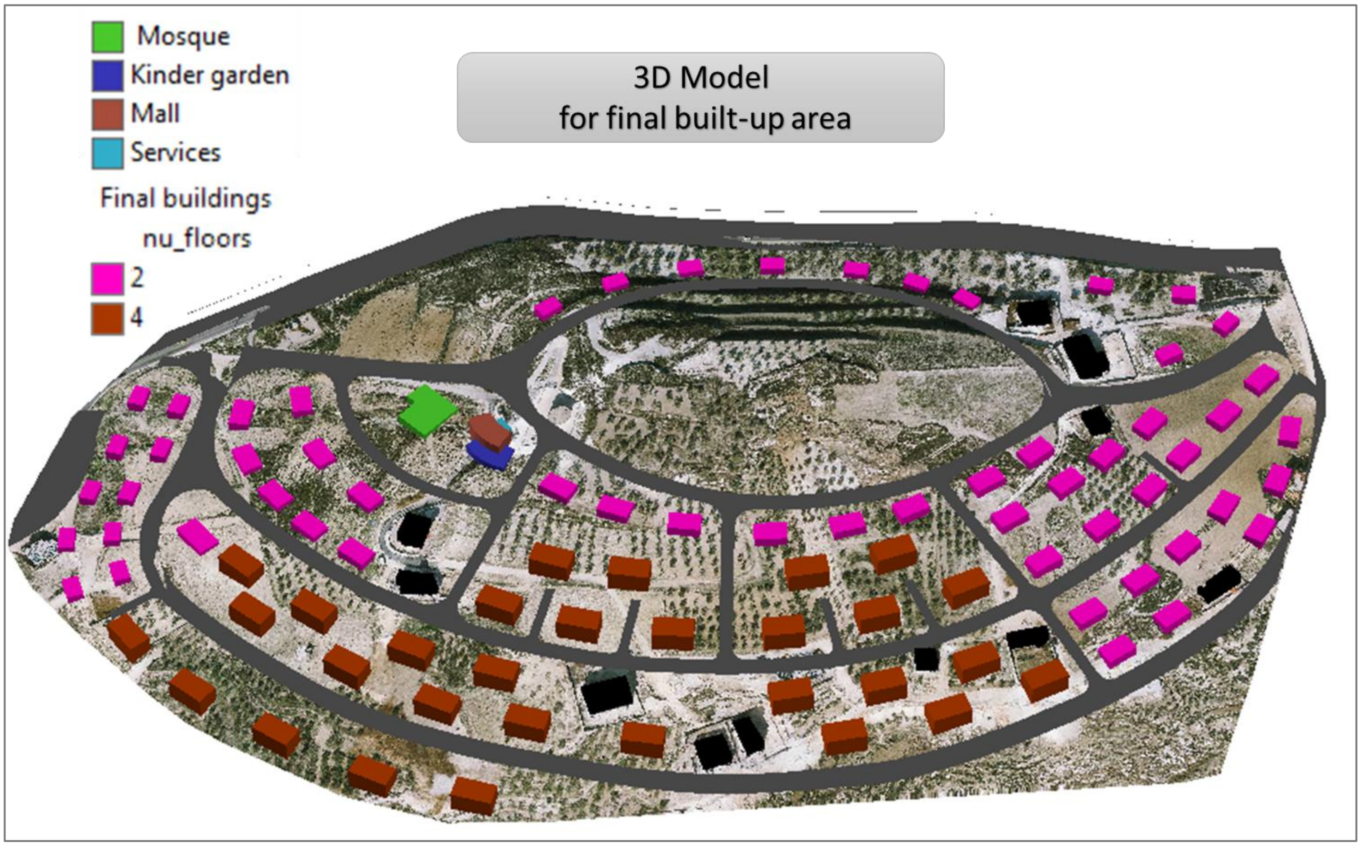


Figure 95: Final 3d model for built-up area at the Arial photo

So the shadow analysis will made to the built-up area after all changes to determine if these changes confirm the solar access aspects or not.

Shadow Analysis: for the final built-up area

Winter – at 9 a.m :

Figure 96: Shadow Analysis For the Final Built up Area at Winter – at 9 a.m.

Winter – at 12 p.m :

Figure 97: Shadow Analysis For the Final Built up Area at Winter – at 12p.m.

Winter – at 3 p.m :

Figure 98: Shadow Analysis For the Final Built up Area at Winter – at 3 p.m.

Summer – at 10 a.m :

Figure 99: Shadow Analysis For the Final Built up Area at summer – at 10a.m.

Summer – at 2 p.m :

Figure 100: Shadow Analysis For the Final Built up Area at summer – at 2 p.m.

Summer – at 5 p.m :

Figure 101: Shadow Analysis For the Final Built up Area at summer – at 5 p.m.

So , after studding the shadow analysis for the built-up area, it was clear that the sun access concept was taken into account at all sides , that improve the aspects of solar neighborhood and its attitudes.

chapter 7 :Solar Neighborhood Design

This phase includes the design of residential neighbors after the completion of the planning process .This is through the Development of the elements in accordance with the idea of maximizing the entry of the sun and benefit from it, whether as energy or sun access to serve neighboring completely.

The design stage will include building units, streets, parking's, green areas , solar park and power adapter buffer zone. Also this stage will explain how we use the vegetation serve the concept on maximizing sun access.,

Neighborhood Units :

These units controlled by the direction , orientation , height(number of floors) and the area, at the planning process , here at this stage the units will design every type alone.

Every unit will have clear entrance from the nearest street , also the area of the unit parcel explained before and different from type to another .

1. Pattern and form :

Units form also chose to serve the concept of solar access, so housing units that form a fixed or rigid benefit from the sun access less than the units in which have shape on the direction of passage of the sun. so the units have two types explained below at the figure.

The units of 2 floors and Villas have the unrigged form , but the buildings of 4 floors have a rigid form. Also, units of area of 250 m2 have 2 apartments , and the buildings of 350 m2 have 3 apartments .

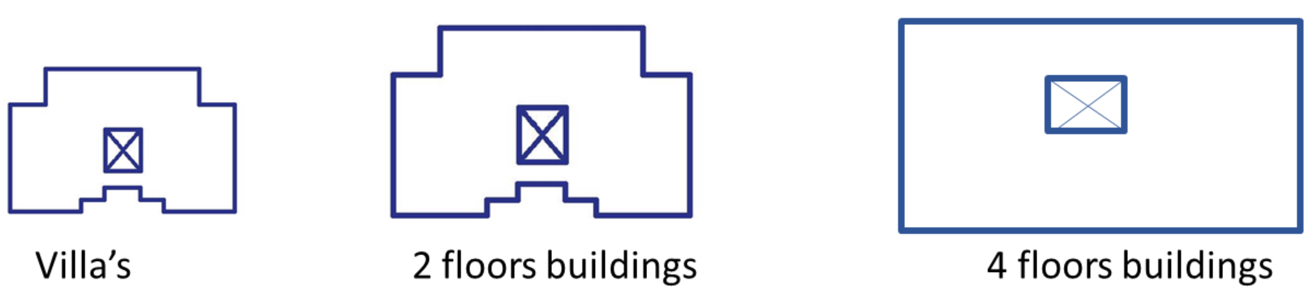


Figure 102: Buildings Pattern and form at the Neighborhood

2. Population capacity:

The project will have 21 Villa's and buildings of 66units , 35 of 2 floors and 315 of 4 floors , to calculate the population capacity of the project , eyry unit will have about 5 people , so the population as follow :

- From Villas = 21* 5poeple = 105 person
- From 2 floor buildings = 35*2 floors * 2 apartments* 5 people = 700 person
- From 4 floor buildings =31* 4 floors *3 apartments * 5 people = 1860 person

So the total population for the sola neighborhood capacity reaches about 2665 person.

Table 8: building units and population at the neighborhood

Type	Villa’s	Building	Building
Number of floors	2	2	4
Area	150 m2	250 m2	350 m2
Departments	-	2	2-3
Number of Units	21 units	35 units	31 units
Population	21*5	35*2*2*5	31*4*3*5
Total . pop	105 person	700 person	1860 person
Total Population = 2665 person			

Parking's :

The parking at the area will also designed and planned with solar, so parking locations will be chosen by solar access locations, therefore the parking shading will be solar cells shading, this improve the project concept and increase energy production and decrease fossil fuel consumption.

So firstly the parking area chose after calculating the parking demand, and this also depending on the population and units the area, as follows

a. **Demand & supply :**

Every parking lots will have the area of 2.7 *4.5 as a standard , so the area for each lots can be calculated below :

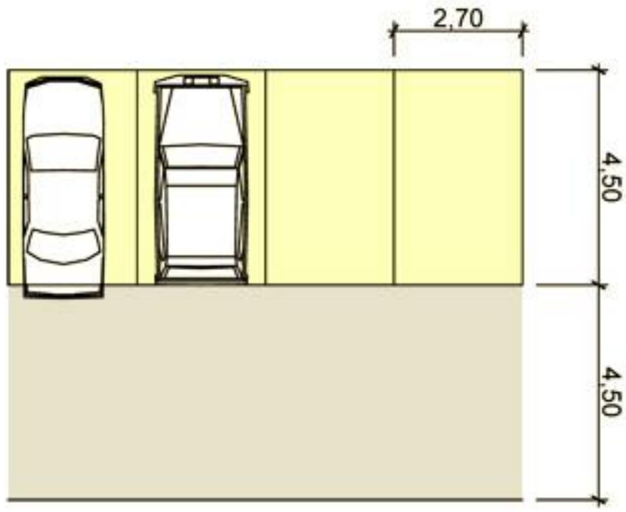


Figure 103 : Parking lots dimensions

2 floors, Villa's = **2** units for every one , at area it self

2 floors , buildings = 4 departments * 1 lots = 4 for every one

4 floors , buildings = 12 departments * 1 lots = **12** for everyone .

Total parking area:

From Villa’s : **21*2 = 42 unit**

From 2 floor buildings : **4*35 = 140 unit**

From 4 floor buildings : **12*31 =372 unit**

Total demand = 554 unit

Needed area = 2.7 * 4.5 * 554 = 6731 m2

b. **Parking types** :So to serve the area by parking and related to solar aspects, we have two types of parking's,

1. **Normal parking**, that parking located at area's that the solar access was low so that it can't use the solar shading
2. **Solar parking**, that located at area's with high solar access and low shadows , so these parking's can use solar shading cells to improve energy production , and the site selected depending on non –shadows area's, and these area's explained at the figure below .

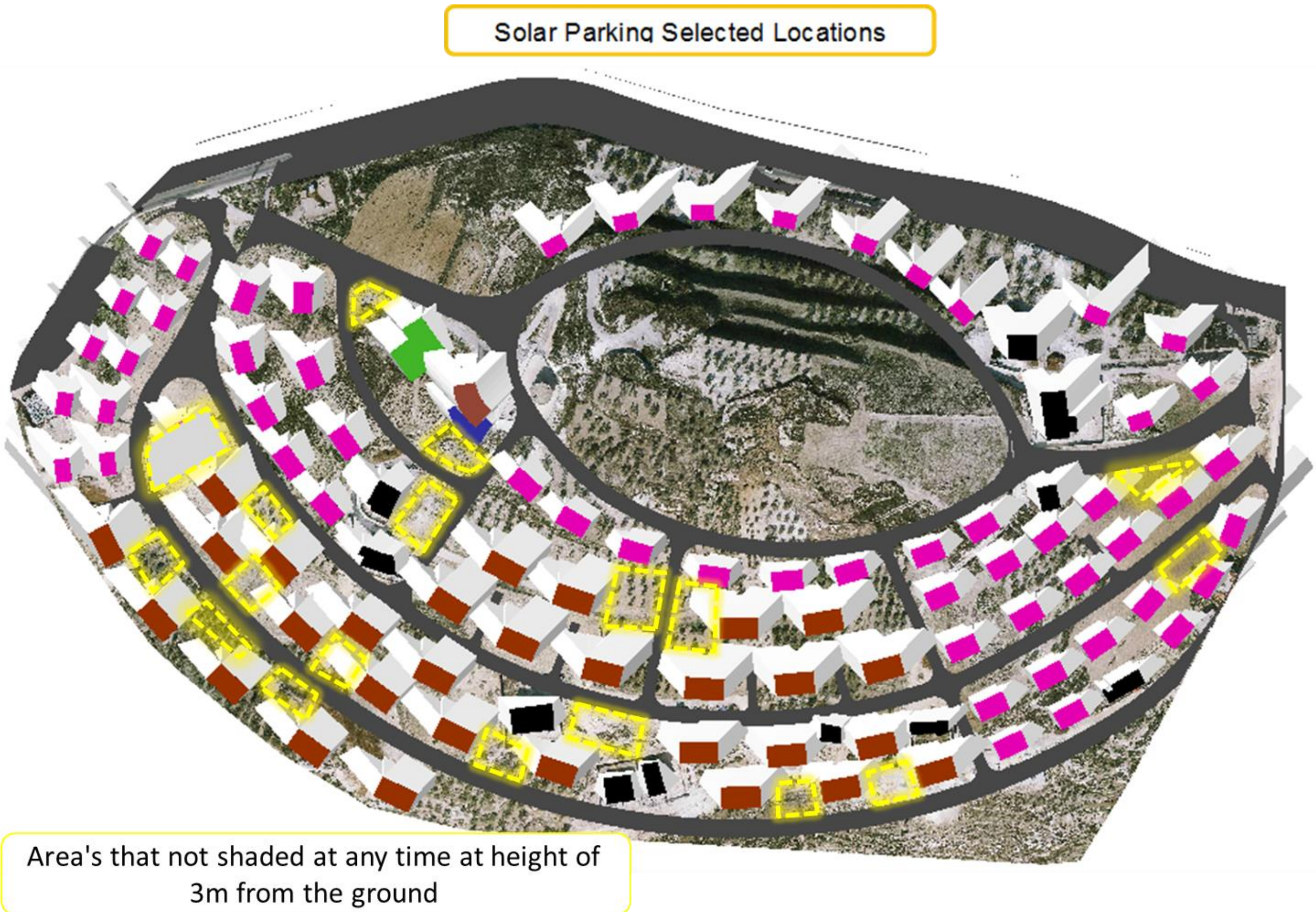


Figure 104: Solar parking location with shadow analysis

so the normal parkin locations was to the area's that far from solar parkings , and these area's was at the north area, becouse these location have low solar access and the exixtance of the hill affect thhat objective, the units that don't use the solar parkin was Villa's units and explaind below.

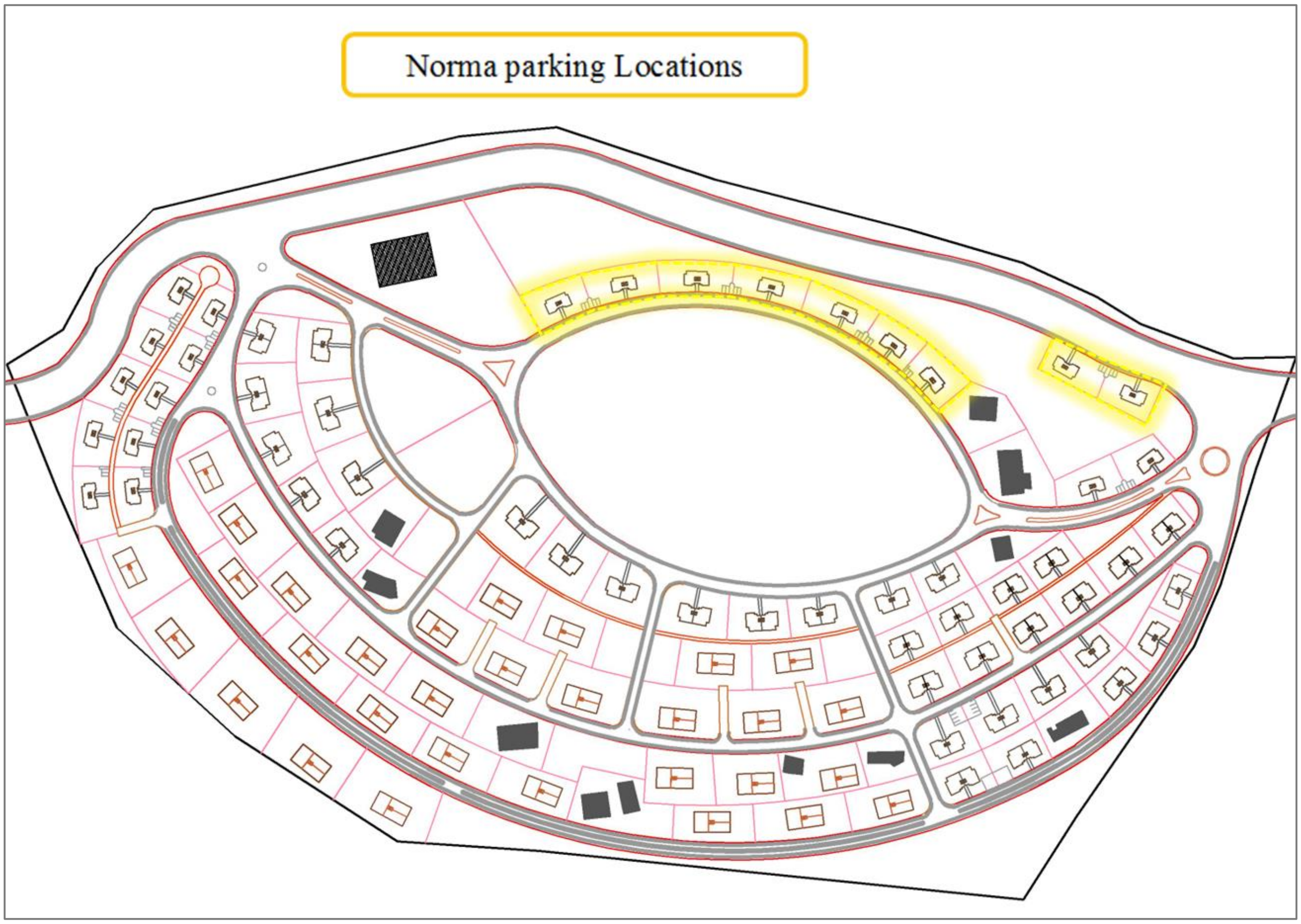


Figure 105: normal parkings locatons at the site

c. Parking's design:

1. **Normal parking :**the parking of villa's have 2 lots , to each villa, the site will be between each 2 villa's as the explained below at the figure.

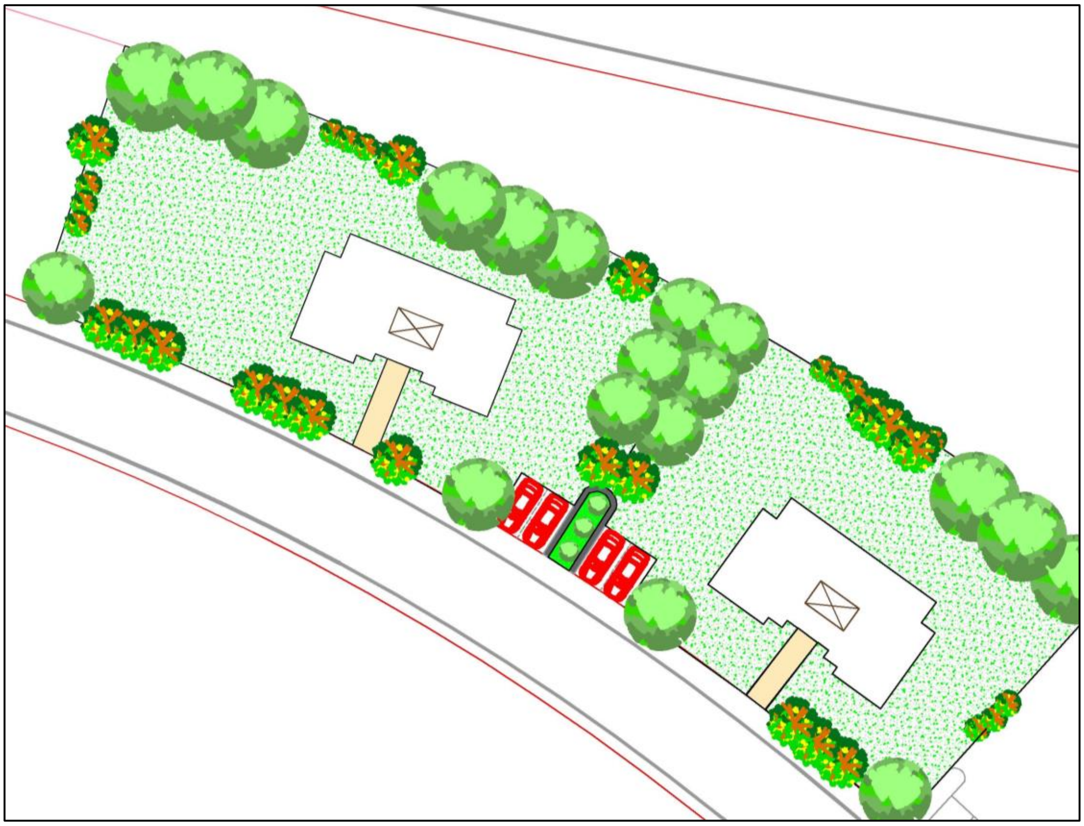


Figure 106: Villa's Parking design

the detailed plan for the parking also at the plan below , each parking separates from the other by green separator ,also have trees around to make shading at summer .

Figure 107: detailed normal parking plan

2. **Solar Parking Design :**

the design of the solar parking depending on making a shading by solar cells, for Area's that not shaded at any time at height of 3m from the ground ,so to explain the design of these parking , the parking example below illustrate the design aspects :

Figure 108: Parking example location and the served area

the parking have the capacity of 45 cars , and this serve the area explained at the figure above at the blocks, this parking area have no shadow so it can be used as a solar park, and the shading of the cars will be solar cells .

- Total capacity = 45 car
- Serve buildings at the block
- No shadows
- It will be shaded by solar cells

the figures and plans below show the design of the parking that selected , also show the movement at the parking and how to enter the parking rom the main road.

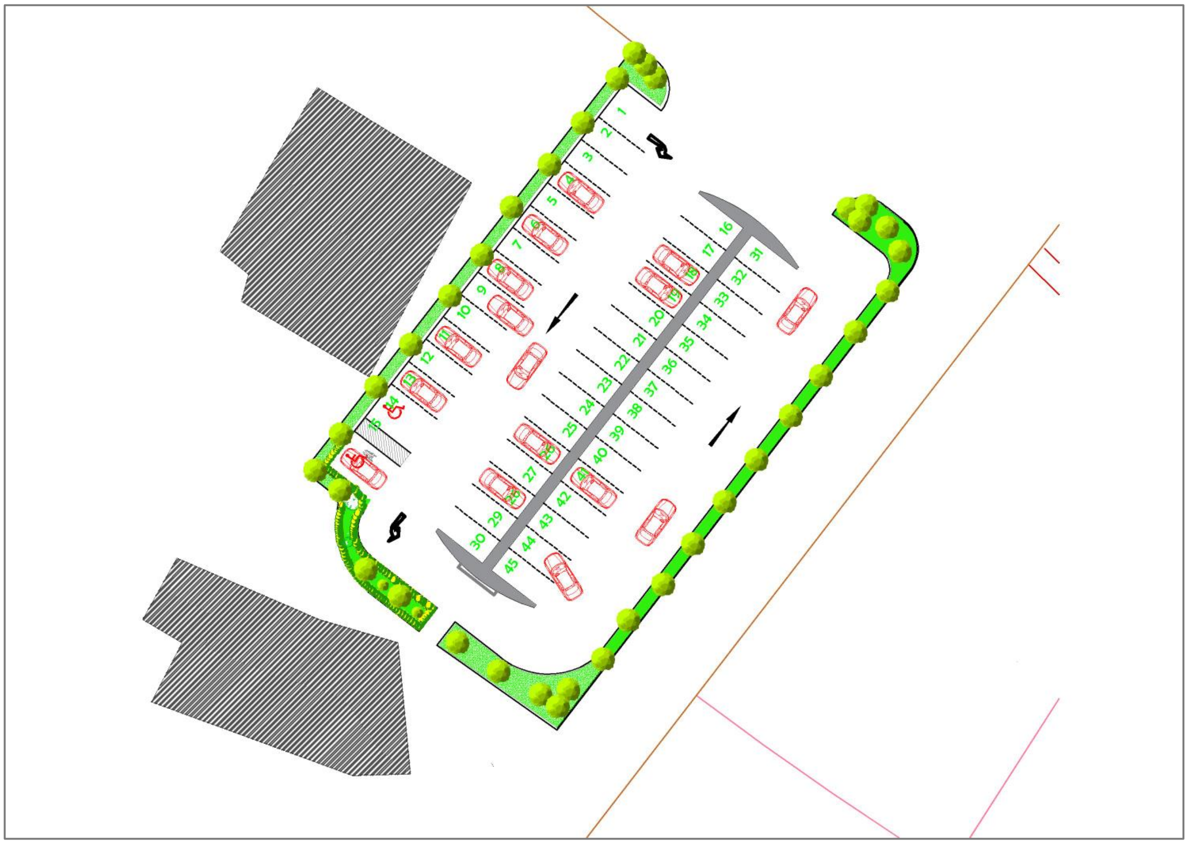


Figure 109: Parking Design and movment and lots .

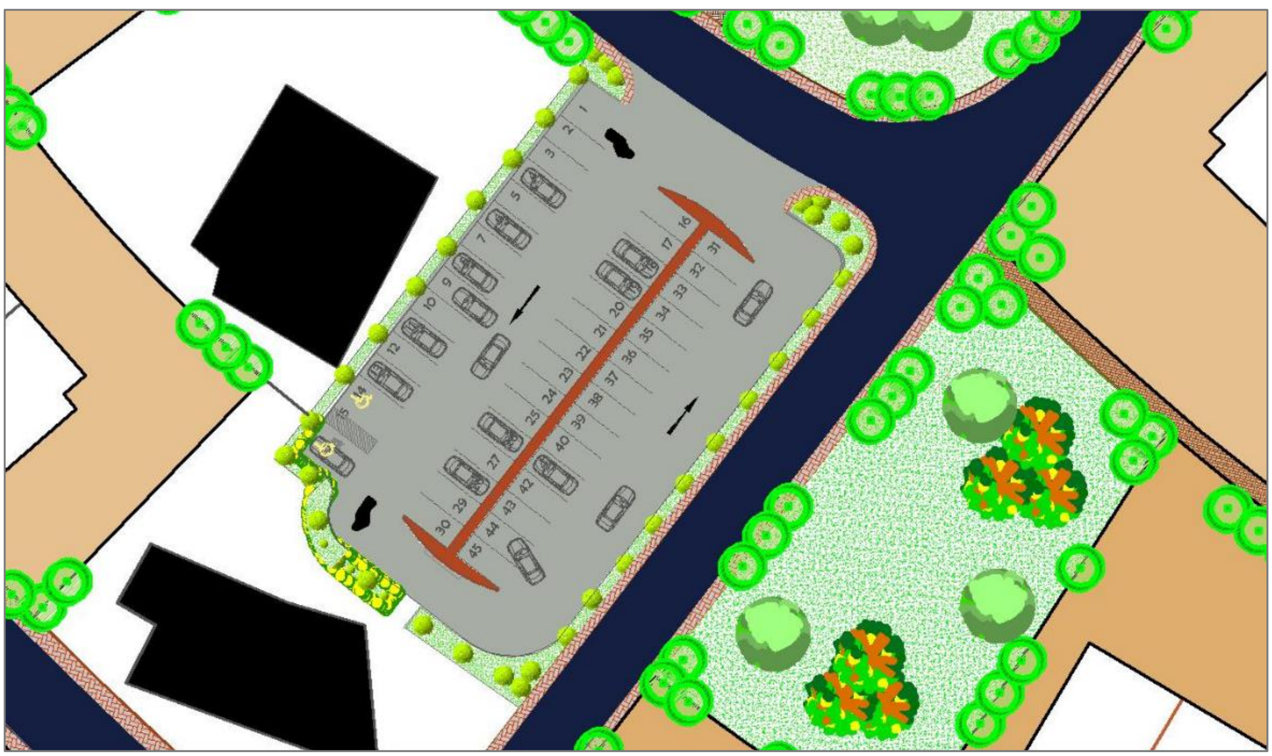


Figure 110: final parking Design at the urban scale

and the figure below show the covered area with the solar cells that used to make the shading.

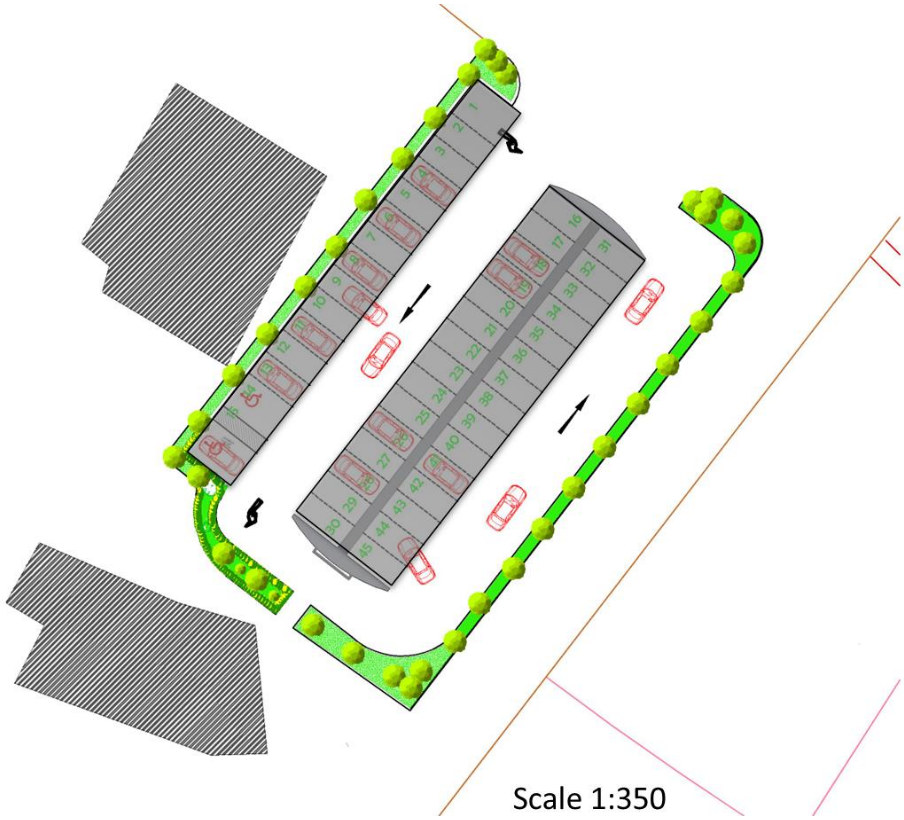


Figure 111: solar shaded parking area

the models and figures below show the solar shaded parking and how it seems after adding the solar cells for shading.

Figure 112: solar parking 3D-model

and the figure below explain how the solar parking seems from the screenshot .

Fig. 16: Solar parking screenshot using solar cells

The area of solar cells used and energy produced will be calculated later , and the master plans show the parking in detail.

Streets and paths :

streets explained before at the planning stage , all streets should allow the pedestrian walkability , to improve the concept of livability , by using cars less than normal state , so for this reason , paths for pedestrian was suggested between units and at the areas that shouldn't reach by cars , paths width reaches to 3m , that width allow the cars to enter the paths to carry or download people around ,for one car only, and the ground covered by Streets tiles as shown at the figure below for roads , sidewalks and paths .

also to make streets improve the concept , the lighting of streets use the solar cells, so solar light systems are widely used to increase efficiency in lighting systems for main roads, avenues, main city streets, highways and other constructs that require a high amount of lighting at night. Green shine's solar street lights use premium LED light fixtures as lighting sources producing an excellent and steady source of light while reducing electrical needs . so this system cover the need of energy to light streets .

the figures below shows that the ring road section and the top view .

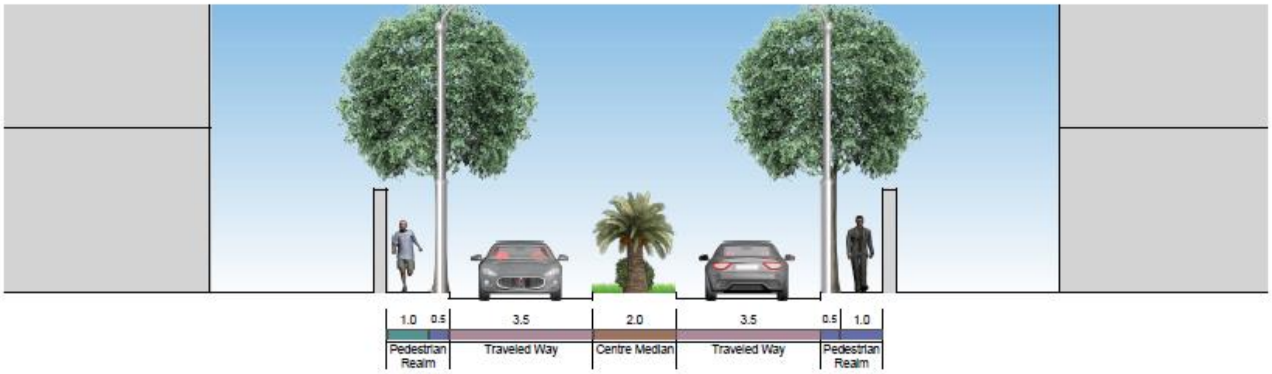


Figure 113: Ring Road section of 12 m width

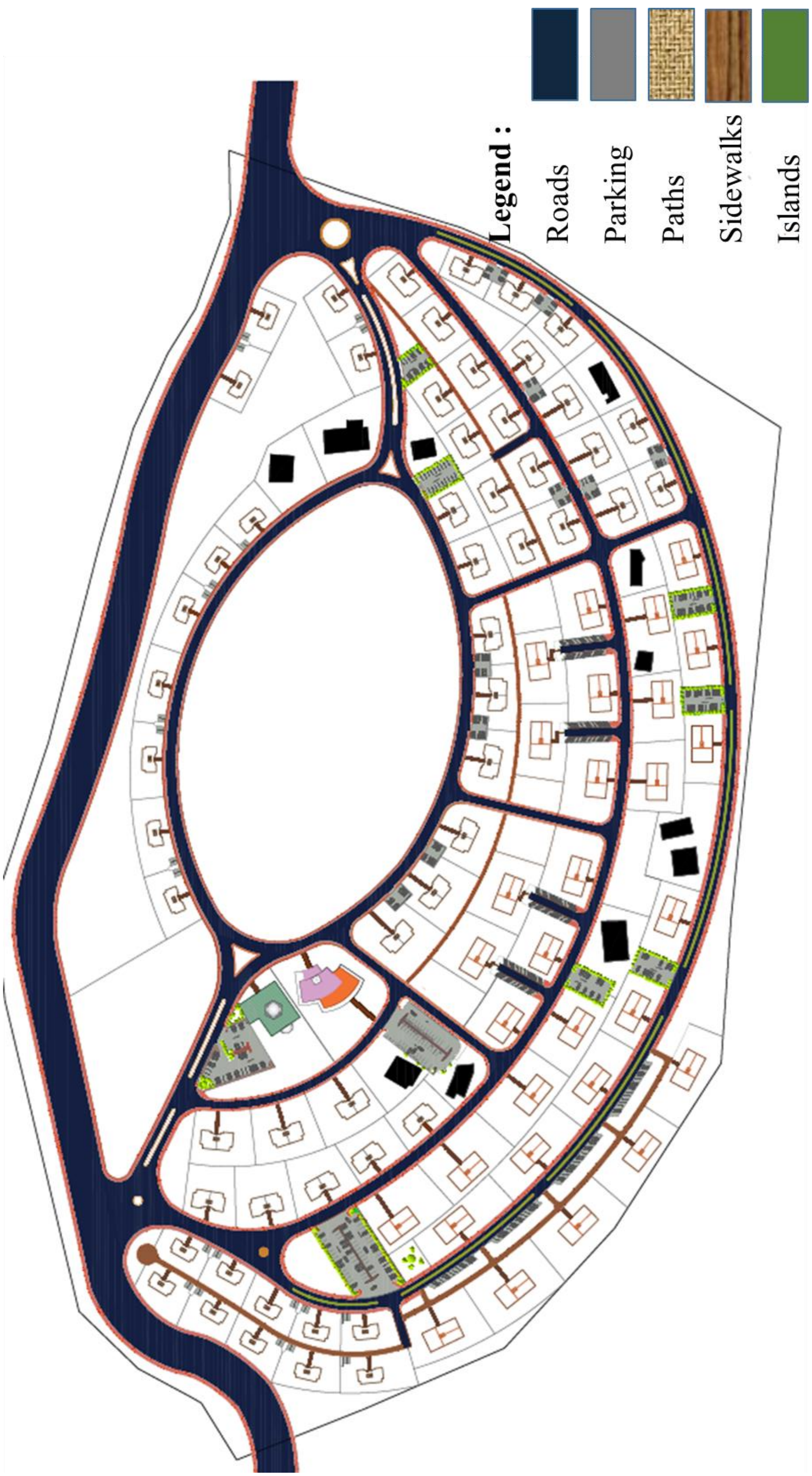
Figure 114 :Ring Road top view of 12 m width

Fig. 17: street lighting solar system

also the parking will use the same system to cover the energy used to light these parking's , as the figure below.

Fig. 18: parking lighting solar system

Roads and Paths Master Plan



Map. 42: Rods and Paths Master Plan

Vegetation:

vegetation used at the solar neighborhood should also take into account the sola aspects, so the trees should allow the solar access at winter and decrease the harmless solar rays at summer, so at every area at the site we should choose tree type that connect with this goal. so for this reason the types of trees used at the solar neighborhood contain :

- **Jacaranda trees**

This tree is characterized by feature it is paper Deciduous in winter and Flowering in summer. And therefore, the introduction of a property allow sun access in winter and reduced shadows in the summer , it has radius of about 10 to 15 m.it can be used at the street side wakes and parking's also at area's with high solar radiation at summer.

Fig. 19: Jacaranda trees that used at streets and paths

Vegetation at the main road:

Trees should prevent the noise ant the pollution comes from the main road and the factory , so we should use trees that not drop full papers , and make a green fence for the project .

These trees include many types like:

- **Totem** with height reach 10 to 15 m

Fig. 20: fence trees used at the main street

- **Ficus Nitida** :Used on the main street to prevent pollution and limited noise at the main street and make a high shadow .

Fig. 21: ficus Nitida trees used to provide shadow at the main road

also many trees can be used like , cocus , washintonya cypruse ,pine ..etc

But vegetation used at the power adapter buffer zone should be as following :

– at the boundaries we should use a fence of streets that prevent the pollution of rays that can harm people at the site.

– Between the fence and the power adapter we should use bushes and shadow trees like: ficus carica, juglans nigria , pine , olia … etc.

But at green area's the vegetation used as a landscape recommended but with joined with the previous roles . And as shown below at the figure how the power adapter covered by fence trees

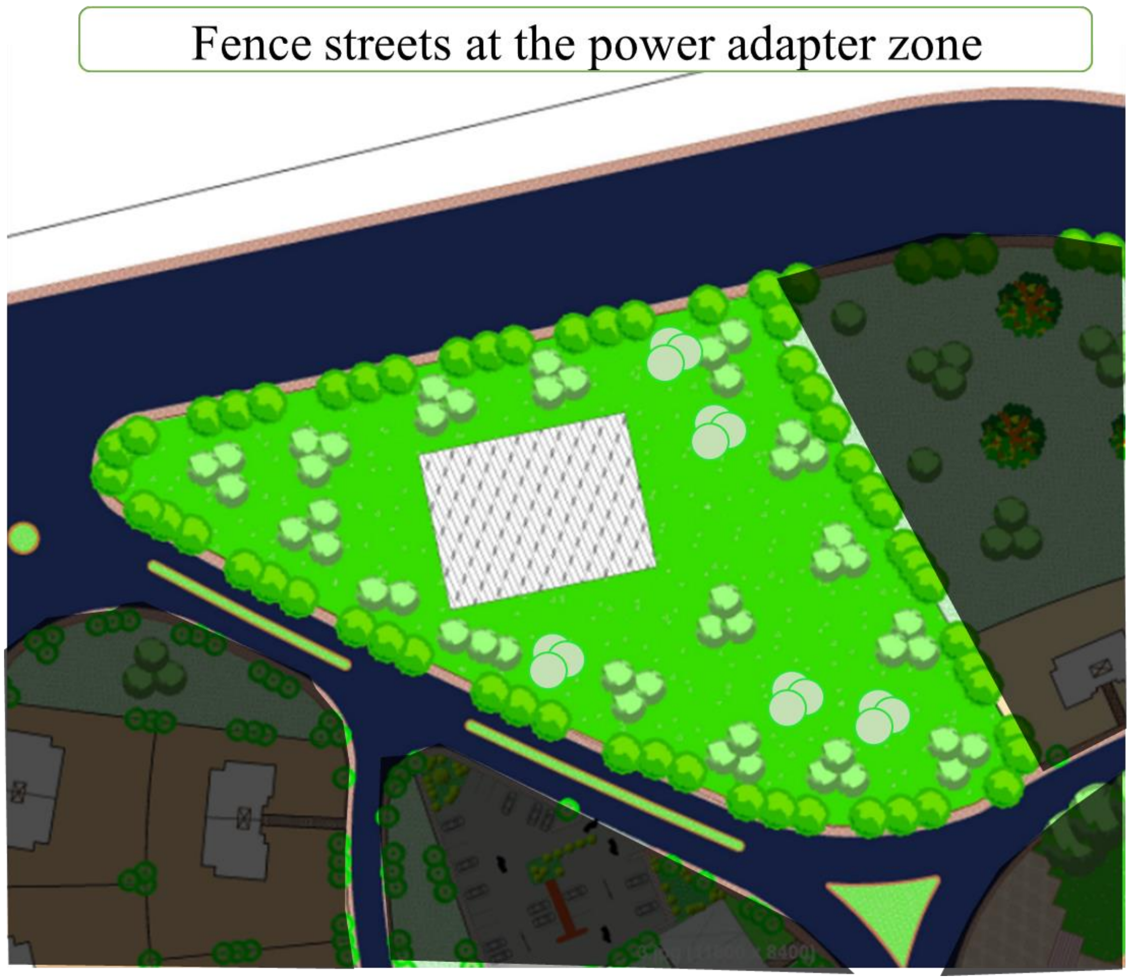


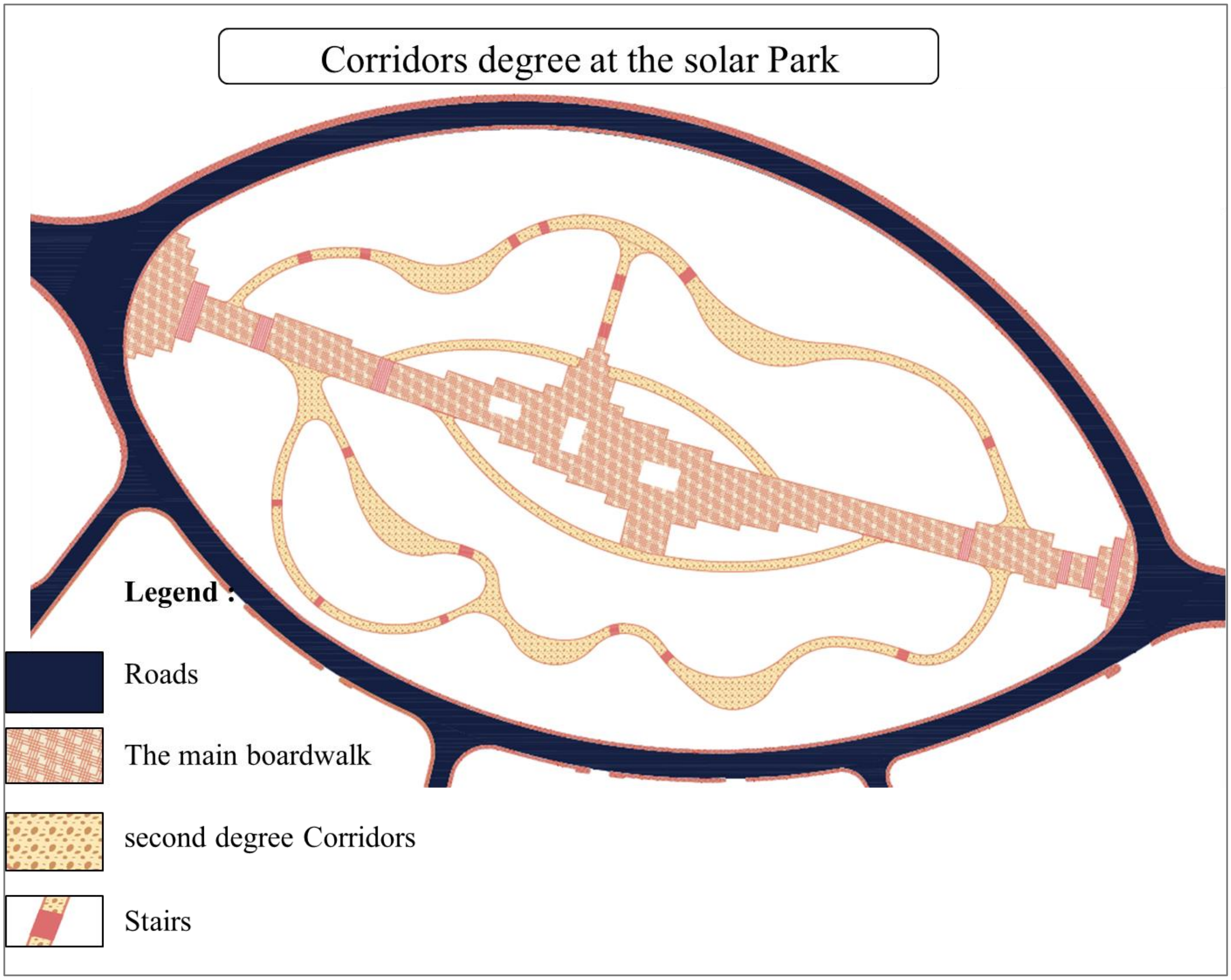
Figure 115 : power adapter fence streets

Solar park :

the solar park from its name should take into account maximizing the solar access at winter and provide shaded park for the public at summer , but also this park have another task this include energy production , so this park should have solar cells to produce energy that used to produce energy used at the region , so the solar park elements include :

1. **The main boardwalk**: begins with a 15-meter so that he is an extension of the internal main street of the project and this corridor is in line with the design of the landscaping of the site and display different as we head to the center so that there is formed Plaza are used public activities by people

2. **Corridors of the second degree**: the Corridors that link the main boardwalk in various areas in the park, and therefore these corridors irregular movement and moving by the contour, so that its location at the highest point in the project, so it is in her use stairs and the width reaches 3m.
3. **Stone corridors**: they are within the green areas to move and walk around inside.



Map. 43: corridors degree that used at the solar park

after that the solar cells location at the solar park was distributed at the way the connected with the sun access, and as explained before from the analysis that the site of the solar park located at the height radiation point , so that all the area was joint with the solar access concept , but the direction of the slope affect the north part of the area that located at the north of the main corridor was go down to the north, so the direction of solar cells can't be used at the side of the north , mainly from the north of the second degree corridor.

so the direction of the solar cells will be with the sun direction with angle of about 156 degree from the north counter clock direction ,with difference of 2-3 degrees . so solar cells connect also with the design of the solar park , it distributed around the corridors with angle above to improve the design concept .

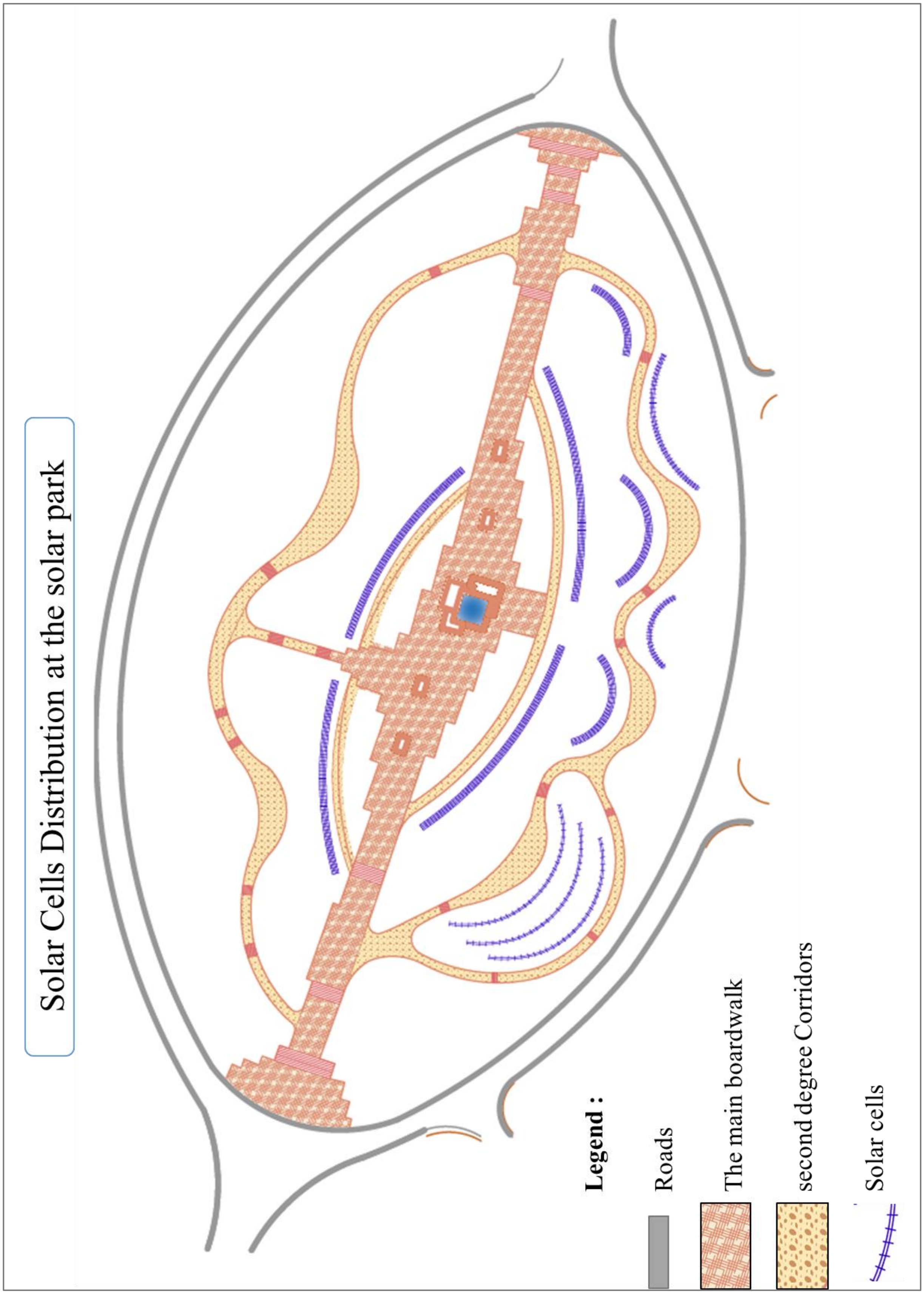
Solar cells calculation was made at the solar cells section , but it was distributed in line with the solar access and the topography of the site , because it was located at the hill, so the southern part has the most amount of solar cells as shown at the figure plan below.

also the vegetation used at the solar park take into account the solar access to the park at general and to the solar panel specially , so that at the roads we used winter fallen paper trees , to make shadows at summer ,and at the corridors we use the same trees kind ,also we use shadow trees at the site people use for rests , but around solar panels we shouldn’t use shadow trees or trees with high tall because that prevent the solar benefit , so around solar panels we should use hedge plants with height at maximum 1 meter , and far from them 2 m to minimize there shadow , and these type of trees used to prevent the reach of people to the solar panel to keep them safe.

bushes around the solar cells used will be like : ligustrum ,pedonia, Quercus microphylla , Buxus,..etc. the figure of the Solar Park master plan shows the types of trees used at every area of the solar park . Elements used at the solar park also included the elements used at the general parks , like Seating, Kiosks ,Sessions ,Vials ,In addition to lighting, solar powered to improve the solar concept, evry solar lighting use a solar panel and the model of solar lighting explained at the figure below.

Fig. 22: park lighting solar panels

All of these elements explained at the solar park master plan the attached with the project.



Map. 44: solar Cells distribution at the solar park

also the solar park will use the solar trees , these tree defined as follow :

Solar Energy Trees:

A **unique lighting concept** that combines avant-garde design with renewable energy technology. A solar tree is an aesthetic means of producing solar energy. It uses multiple solar panels which form the shape of a tree by assistance of poles. This is a project that would symbolize the inherent atmosphere of art, culture and science on campus.

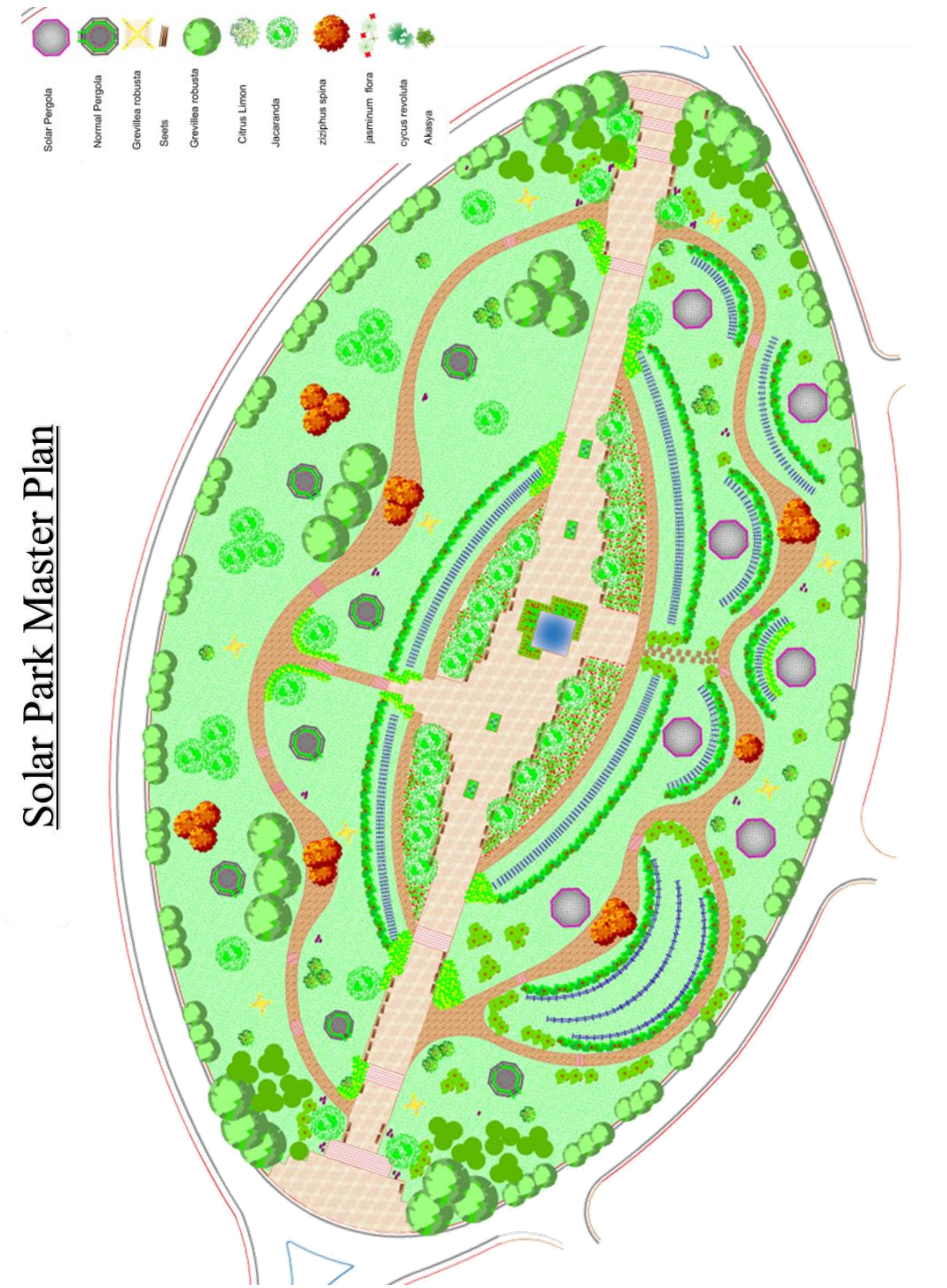
these trees used to make shading and to produce solar at paths at the solar park as shown at the figure below .

Fig. 23 : using solar trees at corridors shading

also it can be used at trees at green area's to make shading with beautiful shape to improve the green concept , like the following figure.

Fig. 24: Solar trees at green area's shading

the following solar master plan attached shows how the project solar park design in line with solar concept, and how it use the solar cells and there location, also the green area's and vegetation types used.



Map. 45: Solar Park Final Master Plan

Chapter 8: Energy production and economical study:

- Solar cells calculations :

The energy production be depends on the using of solar cells , the solar cells used at the following places , to produce energy used at the solar neighborhood :

1. Building shading
2. lighting of streets
3. parking shading
4. solar park
5. solar area's , each of these types use the solar panels in a different way, so each type has a different calculation as follows :

And the rating of solar panels use the rating of 300 watt

Efficiency = 15.4 %
Voltage=35.95

Open cct voltage= 44.77

Short cc current=8.35
the project cost 7000 NIS for 1kw when the energy connected with network , if we use batteries it reaches 1400 kw.

Energy Needed for the Neighborhood :

There are 2 type of solar cells :

1. **On Grid**

for area of 150 m2 it produce energy of 300kw/month and 3600/year

- **Every 1600 kw need 1k solar cells , 1k solar cells = 10 m2**
- **So , 150 need 3600/1600 need 2.25 k solar cells**

2. **Off Grid**

for area of 150m2 it needs 15 ampere and need 2.5 k solar cells

Cost :

On grid for 1k solar cells = 1700 $, off grid for 1 k solar cells =2200 $

The project will use on grid solar cells

Energy Needed for the Neighborhood:

Total built up area = 150 * 21 * 2 + 250 * 35 * 2 + 350 * 31 * 4 = 67.200 m2

Solar factor =0.4 , from electricity engineers

Total solar cells needed = (67200/150) * 2.25 *0.4 = 403.2k solar cells / year

Total cost every year = 403.2 * 1700$ = 685440 $ cost for supply the whole buildings

Total area requested for supply the buildings with energy

= 403.2 * 10 m2= 4032 m2

1. Solar Street Lighting :

Every street lighting need solar cell

Every solar = 1 m2 , 4-5 kw cover lighting

2. Area covered by building :

Every building used solar shading

Villa’s = 4m * 21 = 84 m2 , Buildings = 8m * 66 = 528 m2

Total area = 612 m2

Other area cover by parking's

Area used by parking's = 3000 m2, 450 m2 used at solar area at the south

3. Public Buildings :

Total area = mosque 800m2 + shopping, community, kinder garden =1500m2,

So total area = 2300m2

(2300 m2 /150) * 0.4 * 2.25 = 13.8 k solar cells

area needed = 138 m2 , covered by solar cells at the Solar Park as showed at the Master plan

i. Total Solar Cells Area :

Needed by residential buildings = 4032 m2 , needed by Public Buildings= 138 m2

Total Area Used = 4170 m2

ii. Total Solar Energy Produced:

Total Energy = 403.2k solar cells / year + 13.8 k solar cells / year

Total Energy = 417 k solar cells

iii. Total Solar Cells Cost:

1k solar cells cost 1700 $ (417 * 1700)

Total Cost = 708,900 $

iv. Total Cost without using solar energy :

150 m2 need 300 kw/month ,,

So , every 150m2 cost 200 Nis /month , 2400 kw/year ,

Total area =69500 m2

Total Cost per year =(69500/150) *2400 *0.27

Total Cost = 300540 $ / year

But !

By using solar Cells , **Total Cost = 708,900 $ per** 20 years

Time needed for Recovery of capital = 2.3 years

So , the project is Economically effective project

This project seems at first sight that it is not economically feasible, but if it has been implemented and provided with the capital it will save many profit and will have large return to investors.

Conclusion:

After the completion of the project study and analysis, and planning and design, the importance of this project became apparent at the local and regional levels, and through environmental importance in the preservation of the environment from pollution and prevent it clearly, as well as in terms of maximizing the sun access and take advantage of them at winter and provide clean air in residential areas, and provide warmth in winter and reduce the temperature in the summer by using the shading and building orientation, and this contributes significantly to the process of energy consumption for heating and air conditioning, so naturally been provided.

Apart from the importance of the project in Energy production despite the high cost, but the profit from this is a great..

so the project evaluation results contain :

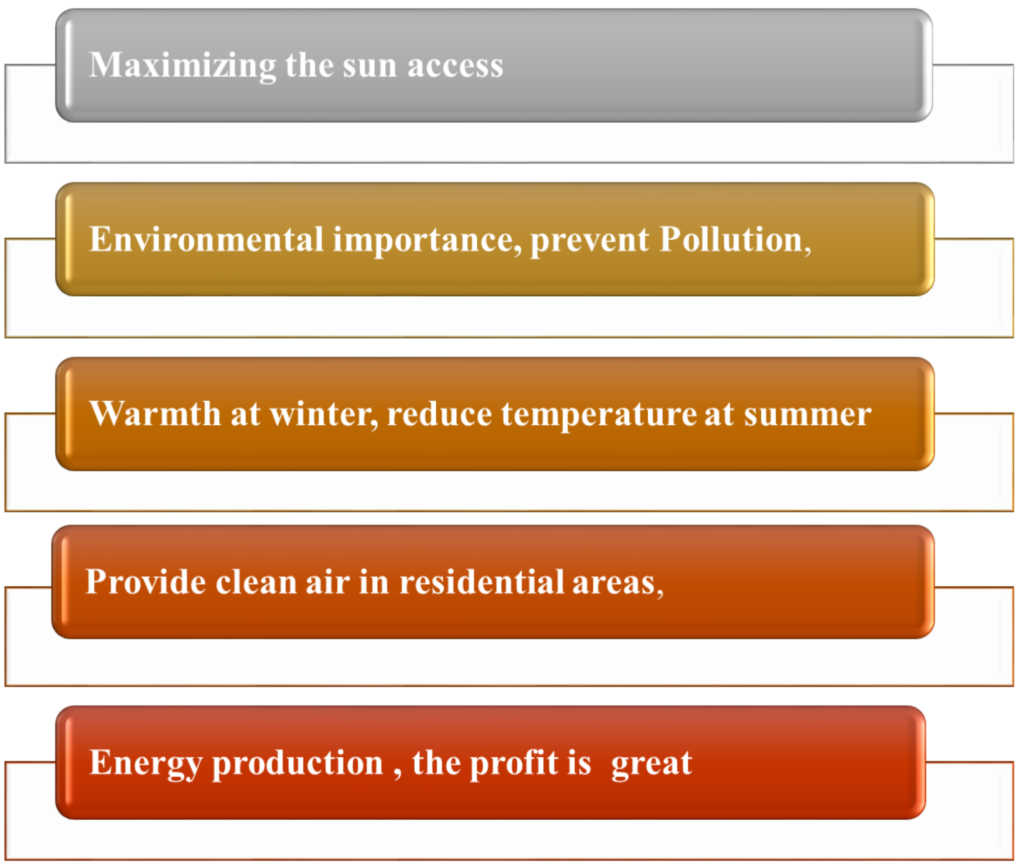


FIGURE 116 :PROJECT EVALUATION RESULTS

Recommendations:

This project is a pilot project, and there is no similar projects to it on the real state, so the implementation of a project like this is a big step forward, whether in Palestine or in the Arab world, so the foot on such projects is an important step in the future of the peoples and their development, as affect the urban environment and civilized society, and is a turning point in the world of construction and organization point, and this is because of its great importance to the current reality and the surrounding environment and the economy as a whole.

So governorates must put a policy to encourage such projects and adoption and provide investment and capital for these projects.

So the recommendation include the following points:

- **start new policy for planning neighborhoods depending on solar concepts**
- **use solar regulations for designing and planning at large scale of cities**
- **Insert this kind of projects at the priorities of the local and Power ministry.**
- **Use programs that cants used at planning process like GIS, DIVA, Solar design ,,etc.**
- **Encourage investors to invest in such as projects.**

Attachments:

The attachments include Mater plans that include :

- Land use plan for the solar Neighborhood.
- Detailed Solar Neighborhood Master Plan
- Solar Park Master Plan
- Solar Parking Plans and 3D model

Solar Master Plan Legend :

Legand

Symbol	Element Type
	Villa's
	2 Floor2 Building
	4 Floors Building
	Exixting Buildings
	Kinder Garden
	Health Center
	Shopping Center
	Mosque
	Power Adapter
	Buildings Intrances

Symbol	Element Type
	Roads
	Sidewalks
	Public Corridors
	FootPaths
	Main Park Corridor
	Islands
	Roandabout
	Parking
	Movment directions
	Cars

Symbol	Element Type
	Public Green Area
	Solar Park area
	Green buffer Zone
	Kids Playground
	Water Fountian
	Stairs
	Pergola
	Seats
	Dense Trees
	Shadow Trees
	Green Hedge
	Aromatic Trees
	Deciduous Trees
	Solar Cells

FIGURE 117 :SOLAR NEIGHBORHOOD MASTER PLAN LEGEND

Solar Neighborhood Master Plan

MAP. 46 :SOLAR NEIGHBORHOOD MASTER PLAN