Urban Environment Planning

“Eco-City”

Done by:

Mutaz Sama’neh

Under Supervision of:

Dr. Zahraa Zawawi

Dr. Ali Abdelhamid

This Research Was Submitted as a Graduation Requirement for The Department of The Urban Planning Engineering, Faculty of Engineering and Information Technology, An-Najah National University, Nablus

December, 2017

الاهداء

بسم الله الرحمن الرحيم

"وقل اعملوا فسيرى الله عملكم والمؤمنون"

إلى من بلغ الرسالة وأدى الأمانة .. ونصح الأمة .. إلى نبي الرحمة ونور العالمين .. سيدنا محمد صلى الله عليه وسلم

إلى بسمة الحياة وسر الوجود .. إلى عائلتي الكريمة إلى كل أصدقائي ورفقاء دربي مع التقدير

إلى من علمنا معنى الإصرار والحرية .. إلى شهدائنا وأسرانا البواسل في نضالهم للحرية

إلى وطني الحبيب ..

الشكر والتقدير

يسرني أن أتقدم بجزيل الشكر والتقدير

إلى من ساعدني في إتمام هذا المشروع المتواضع وأخص بالذكر

حضرة الدكتورة زهراء زواوي

والدكتور علي عبدالحميد

اللذان أشرفا علي، وكانا لي نعم الناصح والموجه الأمين

Contents

Table of Map

Table of Figures

Tables

Chapter 1

General Introduction

1-1 Introduction

The most critical changes in the world over the last century have been derived from the
variety of environmental problems. Growing environmental problems now affect entire the
world. The majority of environmental problems originates in human greed and interference.

It is well known that planet Earth is experiencing a so-called environmental crisis (ecological
crisis). This crisis is characterized by three major themes:

- Rapid growth of the human population and its associated economic activity,
- The depletion of both non-renewable and renewable resources, and
- Extensive and intensive damage caused to ecosystems and biodiversity.

The environmental crisis is a predicament of inappropriate design-it is a consequence of
how cities have been developed, industrialization undertaken, and ecoscapes used.
Fundamentally, the problem has been one of inadequate integration of ecological concerns
into planning (Shu-Yang et al., 2004).

The concept of an “eco-city” was introduced in the 1987 book Ecocity Berkeley: Building Cities for a Healthy Future by Richard Register. Similar concepts sprouted around the same time, such as ecopolis, sustainable city, carbon-neutral city, garden city, green city and self-sufficient city. The general purpose behind these movements is to integrate environmental concerns and balance the development of a city within the scope of the carrying capacity of the ecological system.

Eco-city projects started out largely as experiments in which emerging technologies were applied on a small scale. In other cases, incremental improvements were made by simply adding on green areas or reducing the pollution of existing systems. Recent efforts with eco-city development,

however, incorporates broader socioeconomic plans, such as creating business opportunities and jobs in the green sector, providing eco-efficient public transport and utility services and promoting sustainable land use planning. The following table describes several eco-city models and their features.

Type	Description	Examples
Renewable energy city	The city is powered by renewable energy to various scales – from the buildings to the districts and the entire city. Renewable energy can be tapped from such sources as biofuels, sunlight, wind or geothermal, according to the local context. Cities are required to restructure their infrastructure (such as power generation and buildings) and institutions in a way that allows the penetration of renewable energy.	Masdar, United Arab Emirates; Dezhou solar city, China and Vauban, a suburb of Freiburg in Germany
Carbon neutral city; zero-carbon city; low-carbon city	The city aims to be free from carbon emission by improving energy efficiency as well as by replacing fossil fuel with renewable energy sources. There are several initiatives to emit zero carbon on a small scale, such as within a building or at the district level. Greenhouse gas emission reduction has been integrated as an integral part in many eco-city projects.	The U.K. Government mandate that all urban development in the public sector be carbon neutral by 2016 and China's low-carbon cities project
Garden city	The city incorporates intensive greening as part of the urban environment. Green areas can be placed in the lower-density enclaves of a city, such as suburbs, or can be integrated into the urban built environment, such as green roofs. Urban green areas can be also used for urban agriculture, renewable energy crops growing and greening the high- density parts of cities.	A honey bee project now considered as a symbolic urban "satoyama" in Ginza, Japan's commercial district.[1]

Resource-efficient city	The city relies on both upstream and downstream waste management systems. The city encourages the use of sustainable resources in both production and consumption practices while being equipped with citywide infrastructure designed to maximize the 3R habits (reduce, reuse, recycle), waste-to-energy technology and sustainable composting.	Many cities in Japan; the industrial symbiosis in the United Kingdom; China's circular economy and eco industrial parks in the Republic of Korea
Self-sufficient city	Eco-efficiency is realized through localized and self-sufficient production and consumption. The city can save the economic and environmental costs for importing as well as exporting products and services by maximizing the use of available resources inside the city.	The concept of self-sufficiency economy in Thailand and Yusuhara in Japan
Distributed city	The city, relying on small-scale and neighbourhood-based water and energy systems, can save costs occurred in the transmission process of the centralized system.	Small-scale community sewage system in the town of Hill End, New South Wales, Australia, PV-diesel hybrid systems for electrification of 64 schools in Borneo, Malaysia
Smart city	The city uses information technology as part of improving environmental sustainability. For instance, a city can provide real-time information through transport network as well as allow the interactive data management in green building, energy, water and waste system.	Smart city project in Yokohama, Japan

Source: Adjusted from Peter Newman, Timothy Beatley and Heather Boyer, *Resilient Cities: Responding to Peak Oil and Climate Change*(Washington D.C., Island Press, 2009).

As the name implies, an Eco-city builds on the synergy and interdependence of ecological and economic sustainability, and their fundamental ability to reinforce each other in the urban context.

Innovative cities in both the developed and the developing world have demonstrated that with the appropriate strategic approach they can economically enhance their resource efficiency realizing the same value from a much smaller and renewable resource base while simultaneously reducing harmful pollution and unnecessary waste.

By doing so, they have improved the quality of life of their citizens, enhanced their economic competitiveness and resilience, strengthened their fiscal capacity, and created an enduring culture of sustainability. Many of their interventions have also provided significant benefits to the poor. Urban sustainability of this kind is a powerful and enduring investment that will pay compounding dividends.

In a fastpaced and uncertain global economy, cities that adopt such an integrated approach are more likely to survive shocks, attract businesses, manage costs and prosper. It is with the purpose of enabling cities in developing countries to realize this value, and take on a more rewarding and sustainable growth trajectory while the window of opportunity is still open to them, that the Eco-Cities Initiative has been developed.

The environment aspect is one of the three components of the Sustainability as shown in the chart below. Ecological sustainability is the task of finding alternatives to the practices that got us into trouble in the first place; it is necessary to rethink agriculture, shelter, energy use, urban design, transportation, economics, community pattern, resource use, forestry, the importance of wilderness, and our central values. While the two approaches have important points of contact, including a shared awareness of the extent of the global environmental crisis, they embody two very different visions of a sustainable society (Van Der Ryn and Cowan, 1996).

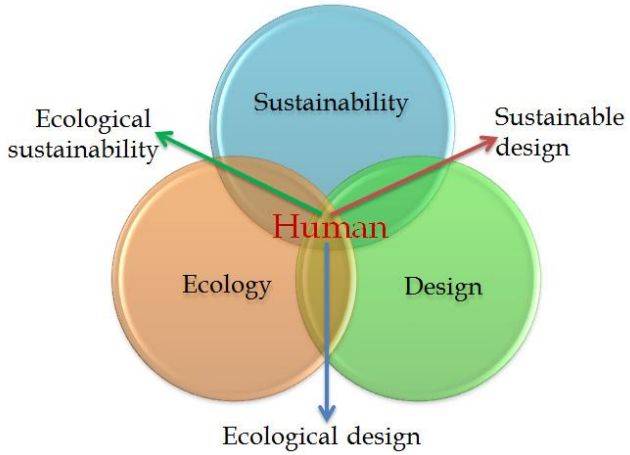


Figure 1 The relationship between ecology, sustainability

1-2 Research Problem

The most critical changes in the world over the last century have been derived from the
variety of environmental problems. Growing environmental problems now affect entire the
world. The majority of environmental problems originates in human greed and interference.
It is well known that planet Earth is experiencing a so-called environmental crisis (ecological
crisis). This crisis is characterized by three major themes:

- Rapid growth of the human population and its associated economic activity,
- The depletion of both non-renewable and renewable resources, and
- Extensive and intensive damage caused to ecosystems and biodiversity.

The environmental crisis is a predicament of inappropriate design-it is a consequence of
how cities have been developed, industrialization undertaken, and eco-scapes used.
Fundamentally, the problem has been one of inadequate integration of ecological concerns
into planning.

Here in Palestine the vacant area decreases and the urban expansion is getting higher and it's increasing rapidly and the are many determinants to use all the available lands such as political determinants so the trend of urban expansion will be on the account of the other uses like agriculture uses, so that there should be an urban management in cities and make a counter planning for this massive expansion and the negative attack on the environment.
We need this kind of planning badly here in Palestine due to these determinants and to deal effectively in each city potential.

1-3 Research Justification

The idea of the Eco-city comes from the need for communities to face the rapid and fast urban sprawl and Due to the fast and rapid urban sprawl & the assault on the vacant land with its different kinds and uses like (forests, Agricultural lands) so the communities faced a lack of open spaces with the city boundary which causes a lot of problems on different sides such healthy, Economical, Social.

Here in Palestine there's a massive need for this kind of development because we suffer from limited land due to political issues and the urban expansion is going toward these vacant land with no control so it's more important to control this expansion of city boundary by applying the ecological principles which can save our resources and manage them without affecting on the chance of the incoming generations to use them and this boosts the concept of sustainability moreover, in Palestine there's lack of studies that talk about the eco-cities and

the strategies that we should follow to achieve the principles of the eco-cities to improve our environment

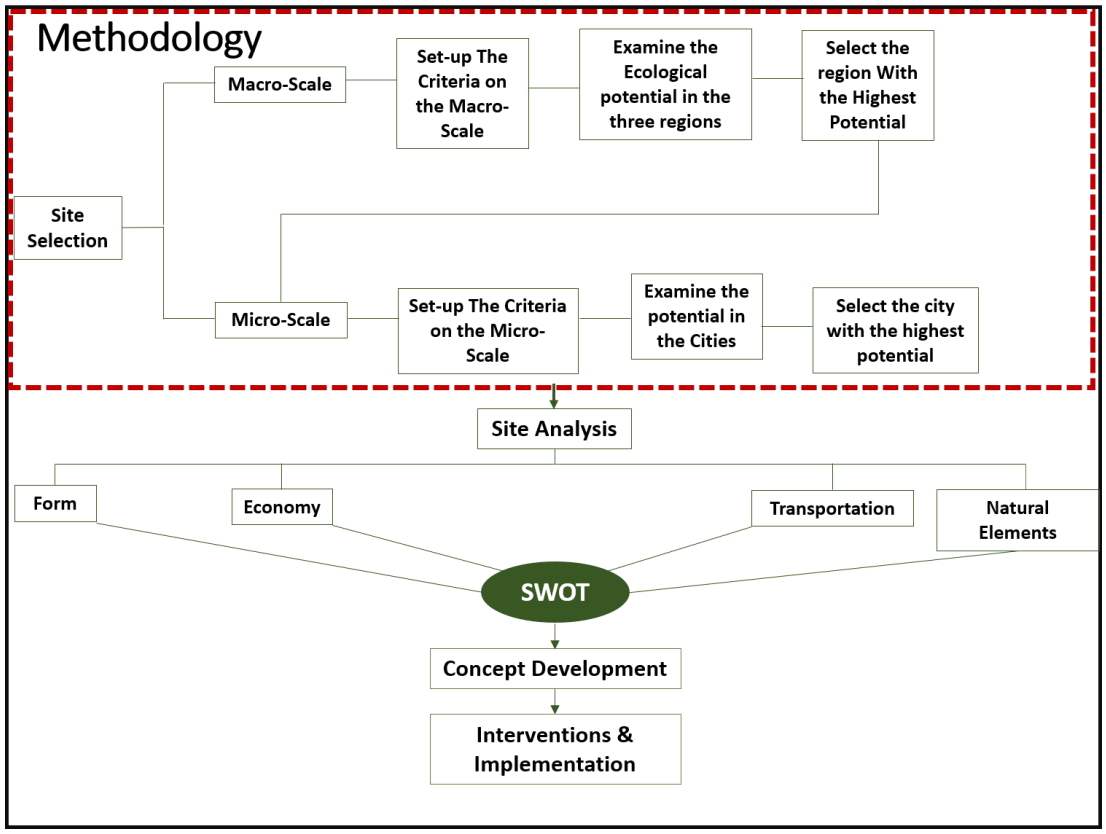
1-4 Research objectives

This research aims to exploit the potential that already exists to make our cities more healthy and sustainable and put a step towards the future by efficient use of resources, and it aims to know how to apply the main principles of the eco city in our region & and to what extent it's applicable.

The immediate objectives of this research are:

1. Investigate the natural and environmental conditions in Palestine.
2. Investigate the physical conditions including infrastructure and accessibility for different land uses.
3. Applying the main principles of the eco city in our region & and to what extent it's applicable.
4. Preparing master plan which consider the environment aspect.

1-5 Plan and Methodology



The research methodology based on the following three frameworks:

1 General and theoretical framework: It includes the studies that discuss the main concept and definition of the eco-city and how it's compatible with the idea of the sustainability and which are the main principles and guidelines to achieve the environment balance in our cities and how to apply these principles.

2 Informational framework: It includes all the information regarding the concept of sustainability and the principles of applying sustainability in housing projects and the housing projects planning methods (plans, photos, maps…).

3 Analytical and deductive framework: This is focused on the data available about the study area to set up the strengths, weaknesses, opportunities and threats (SWOT) in the study area, then we can determine the real potential in Palestine.

The study relied mainly on the following research methods:

1 Historical method: viewing previous researches, theories and models about the Eco-city.

2 Descriptive method: used to examine and describe the cities situation and potential in Palestine and to describe the Eco-city principles.

3 Analytical method: this method used to analyze the collected information about Eco-city to find the best way to apply it on the project.

4 Comparative Method: By comparing the three cities (Salfit, Tubas, and Jericho) and choose the city which has the highest potential to be approached as an eco city based on specific criteria, and this comparison will be done Geographic Information System(GIS).

1-6 Data Sources

During data collection phase, information on urban planning, urban environment management and (the study area) will be gathered and then classified to fit with the research objectives and expected outputs.

1. Libraries: two kind of libraries were used to collect data from Library of the university and Online Libraries, it includes Master researches official books, Papers.

2. Official Sources: Studies and reports which are done by Ministry of local government and (Geo-Molg).

3. Semi-official Sources: Researches and studies which are done by Research offices, Department of planning ,universities.

4. Personal Resources: Interviews, surveys and questionnaires.

Research tools are mainly (GIS, Internet, Academic website which publish researches).

Chapter 2

Conceptual & Theoretical Background

2-1 Introduction

After introducing the idea and the problem of the research, this section comes to talk about the main concepts, theories, models and elements that form the base for Eco-City. These concepts will be the gateway to analyze the case studies after.

2-2 Sustainability & Ecological Development

Sustainability consists mainly of three pillars as seen in Figure1, economic, environmental and social (Brundtland, 1987). The main idea is that we reach sustainability as much as we achieve equal harmony between these three pillars which are defined as following:

1. **Environmental Sustainability:** Environmental sustainability means that we are living within the means of our natural resources. To live in true environmental sustainability we need to ensure that we are consuming our natural resources, such as materials, energy fuels, land, water...etc, at a sustainable rate. Some resources are more abundant than others and therefore we need to consider material scarcity, the damage to environment from extraction of these materials and if the resource can be kept within Circular Economy principles.

   Environmental sustainability should not be confused with full sustainability, which also need to balance economic and social factors (Djalali & Vollaard, 2007).

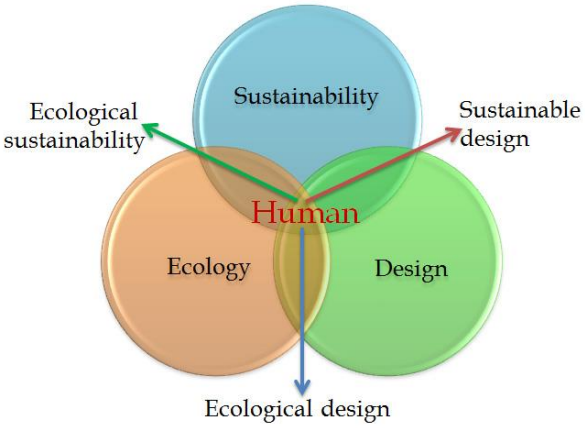
2. **Economic Sustainability:** Economic sustainability requires that a business or country uses its resources efficiently and responsibly so that it can operate in a sustainable manner to consistently produce an operational profit. Without an operational profit a business cannot sustain its activities. Without acting responsibly and using its resources efficiently a company will not be able to sustain its activities in the long term (Djalali & Vollaard, 2007).

3. **Social Sustainability:** Social sustainability is the ability of society, or any social system, to persistently achieve a good social well-being. Achieving social sustainability ensures that the social well-being of a country, an organization, or a community can be maintained in the long term (Djalali & Vollaard, 2007).

From these components, the concept of sustainable development appeared, so what is sustainable development?

There are many definitions about sustainable development, but the most famous one was written by Brundtland (1987) which is “Sustainable Development is a development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs”.

This implies that we need to look after our planet, our resources and our people to ensure that we can live in a sustainable manner and that we can hand down our planet to our children and our grandchildren to live in true sustainability (Djalali & Vollaard, 2007).



2-3 The relationship between Ecology, Sustainability & design

Ecology, sustainability and design are different fields, but they have been merged together
in recent years. This is because human lifestyle is having an increasingly negative impact on
the surrounding environments.

Ecology, in the 100 years since its inception, has increasingly provided the scientific foundation for understanding natural processes, managing environmental resources and achieving sustainable development. By the 1960s, ecology's association with the environmental movement popularized the science and introduced it to the design

professions (e.g. landscape architecture, urban design and architecture) (Makhzoumi, 2000).

“Ecology” in the profession of landscape architecture and planning can’t be understood solely as meaning the relationship between nonhuman life forms and their environment.

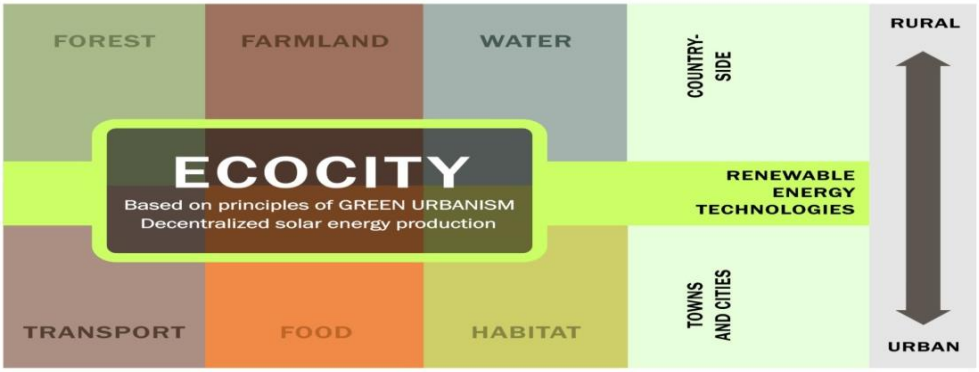


Figure 2 The relationship between ecology, sustainability

The term ecology is traditionally used as shorthand for the sum of the biophysical forces
that have shaped and continue to shape the physical world. Thus there are other dimensions
to be recognized if we are to understand the key nature of ecology: that of process, integration, and humanity (Ahern et al., 2001).

The relationship between design and ecology is a very close one, and makes for some unexpected complexities (Papanek, 1995). Ecology explains how the natural world is and
how it behaves, and design is also the key intervention point for making sustainability inecology. The knowledge gained from ecology can influence landscape design.

Science and design are complementary ways to generate knowledge (and therefore both arecreative endeavors). Scientists solve problems inductively, forming generalized principles from specific observations (Figure 2.). Designers use general principles to solve specific problems deductively. The knowledge available for ecological design would greatly increase if designed landscapes were used as ecological research sites.

Designed landscapes that are typical of the surrounding region, with one to a few clear themes and repeated patterns (replication), are potential ecological research sites (Galatowitsch, 1998).

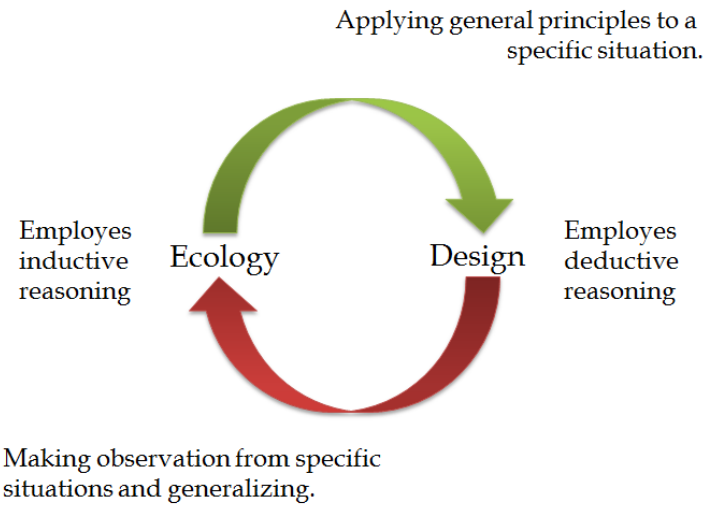


Figure 3Design and ecology are complementary problem-solving techniques (Galatowitsch, 1998)

2-3 Ecological Sustainability

Sustainability is not a single movement or approach. It is varied as the communities and interests currently grappling with the issues it raises. One the one hand, sustainability is the province of global policy makers and environmental experts. One the one hand, sustainability is also the domain of grassroots environmental and social groups, indigenous peoples preserving traditional practices, and people committed to changing their own communities.
The environmental educator David W. Orr calls these two approaches *technological sustainability* and *ecological sustainability*.

While both are coherent responses to the environmental crisis, they are far apart in their specifics. Technological sustainability, which seems to get most of the airtime, may be characterized this way: “every problem has either a technological answer or a market solution.

There are no dilemmas to be avoided, no domains where angels fear to tread.” Ecological sustainability is the task of finding alternatives to the practices that got us into trouble in the first place; it is necessary to rethink agriculture, shelter, energy use, urban design, transportation, economics, community pattern, resource use, forestry, the importance of wilderness, and our central values.

While the two approaches have important points of contact, including a shared awareness of the extent of the global environmental crisis, they embody two very different visions of a sustainable society (Van Der Ryn and Cowan, 1996).

A goal of ecological design is to help meet this vision of ecological sustainability, by finding ways of manufacturing goods, constructing buildings, and planning more complex enterprises, such as business and industrial parks, while reducing resource

consumption and avoiding ecological damage to the degree possible (Shu-Yang et al., 2004).

Ecological design strives to achieve an increasing reliance on renewable sources of energy and materials, while maintaining standards of quality of goods and services and reducing overall resource consumption, waste generation, and ecological damage through efficiencies of use, re-use, and recycling.

Ecological design provides a framework for uniting conventional perspectives on design
and management with environmental ones, by incorporating the consideration of ecological
concerns at relevant spatial and temporal scales. If the principles of ecological design are
rigorously applied, important progress will be made towards ecological sustainability (Shu-
Yang et al., 2004).

Landscape design mostly depends on natural resources, so ecological sustainability is very
important. Landscape design contributes to the ecological sustainability.

2-4 Ecological Planning

Eco-city planning is putting the emphasis on the environmental aspects of planning while sustainable planning treats equally the economic, social and environmental aspects. Eco-city planning and management are based on the principle of a cyclical urban metabolism, minimizing the use of land, energy and materials, and impairment of the natural environment, ultimately leading to zero carbon settlements.

This principle is illustrated by Hammarby Sjöstad (Stockholm)1, as indicated by the editors in their book's introductory chapter (see Brebbia et al. 2010).2 The book starts with a historic account of eco-city planning. Seven thousand years of urban civilization and planning history have clearly more to tell us than a century of functionalist planning, which leaves a questionable legacy of economic, social as well as eco-city planning.

The geographic coverage is truly worldwide, with cases from all continents, both in industrialized countries and developing countries. Both positive and less positive examples are described in each level of observation.

Regional observation is applied to places such as Malaysia (Iskandar). Urban observation is ranging from the emblematic Curitiba city taken as a whole (land use and transport) down to Nairobi (Umoja Neighborhood) and to Istanbul (Büyükdere

Avenue). Micro level observation includes the indoor ambient air quality, analyzing the effects of air conditioning.

As an example of attempt towards quantification at city level one could mention the European Green City Award. Stockholm was selected as the 2010 European Green Capital, through an evaluation based on a 13 areas list of eco-city parameters including quality of life indicators, among others, as follows:

• Emissions
– CO2 equivalent per capita, including emissions resulting from use of electricity;
– CO2 per capita resulting from use of natural gas;
– CO2 per capita resulting from transport; and
– CO2 per kWh use.
• Annual mean concentration of NO2 and PM10.
• Transport modal split – share of population living within 300 m of a public transport stop.
• Percentage of green areas (public and private) in relation to the overall area and specific percentage of areas set aside to protect urban nature and biodiversity.
• Share of population exposed to noise values of L (day) above 55 dB (A)/of L (night) above 45 dB (A).
• Amount of waste per capita; proportion of total/biodegradable waste sent to a landfill, percentage of recycled municipal waste.
• Proportion of urban water supply subject to water metering; water consumption per capita; water loss in pipelines.
• Energy consumption of public buildings, per square meter.

Housing is embedded in a set of natural systems that provide key eco-system services. It is imperative that the relationship between housing and natural systems is understood and taken into account when planning and building houses and settlements. (Daly, 1996), for example, emphasizes the difference between growth, defined as an increase in size or quantity (e.g. of populations or resource throughput) and development, defined as qualitative improvement. Growth will ultimately run up against finite limits, since we only have one Earth.

William Rees (1996) introduced the notion of humanity's Ecological Footprint, the total land and water area needed to support the global population. Currently, our collective footprint is calculated as nearly 25 per cent greater than the capacity of the biosphere to support us (Heinberg. 2007).

Environmental economist Herman Daly has suggested three conditions for sustainability, focusing on the resource base (Meadows & Randers. 2004):

1. The rate of use of renewable resources must be less than or equal to their rate of regeneration.

2. The rate of use of non-renewable resources must be less than or equal to the rate at which they can be replaced by sustainable renewable resources.
3. The rate of pollution emissions must be less than or equal to the rate at which they can be absorbed and processed by the environment.

In terms of the above definition, housing will stand in a sustainable relationship to the natural systems within which they are embedded if their rate of usage of both renewable and non-renewable resources, as well as their rate of waste output, is as expressed above.

There are ten principles should be taken into consideration when we are planning for Eco-city , these principles are :

(Source:www.urbanecology.org)

1. Restore Degraded Land

Use urban development to restore the health and vitality of the land.

Rehabilitate and maximise the ecological health and potential of land as a consequence of the development of human settlement.

•Clean-up contaminated land

•Heal degraded rural areas

•Re-establish native vegetation

•Encourage farming practices which sustain ecological health

•Introduce green corridors of native vegetation in rural and urban area

'It is only possible to make healthy places for humans by maintaining the health of non-human habitats.' (Hough 1995)

2. Fit the Bioregion

Create human settlements which work with the natural cycles of the region. Conform to the parameters of the bioregion, fit the landscape with the patterns of development which follow the inherent form and limitations of the land, understood in socio-biophysical terms.

•Maintain the natural cycles of water and nutrients in the landscape

•Create buildings and urban form that fit the landscape and respond to the climate

•Conserve water and recycle effluent

•Use locally produced building materials as much as possible

•Respond to the culture of the region – 're-habitation'

'…to become dwellers in the land…the crucial and perhaps only all-encompassing task is to understand place, the immediate specific place where we live…' we need to appreciate 'the cultures of the people, of the populations native to the land and of those who have grown up with it, the human social and economic arrangements shaped by and adapted to the geomorphic ones, in both urban and rural settings…' (Sale 1991 p.42)

3. Balance Development

Balance development with the 'carrying capacity' of the land.

Balance the intensity of development against the ecological carrying capacity of the land whilst protecting all viable existing ecological features. Develop and enhance links between urban and rural areas of an integrated city-region approach.

•Reduce the impact of the city on the land beyond its boundaries (the 'ecological footprint')

•Encourage the diversity of land-use: residential, commercial, recreational, educational, etc

•Develop urban food producing gardens

•Recognise the place of all living organisms in the environment – urban design for non-human species.

4. Create Compact Cities

Reverse sprawl and stop ad-hoc development from consuming the landscape. Develop human habitation at relatively high density within inviolable green belts of natural or restored ecologically viable landscape with the overall development density constrained by ecological limits.

•Have clearly identifiable (but not 'hard') boundaries for urban areas

•Provide for most daily needs within the city

•Create 'walkable' cities and promote non-motorised forms of transport

•Develop integrated transport networks which minimise car use

•Access by proximity

•3-dimensional built form

'In living nature, the notion of unlimited sprawl seems to be adopted by organisms at the lower levels of evolution.'(Soleri 1987 p.12)

5. Optimise Energy Performance

Generate and use energy efficiently.

Operate at low levels of energy consumption, using renewable energy resources, local energy production and techniques of resource reuse. All ecological development should seek to be energy self-sufficient. The primary energy base for development should come from renewable sources.

•Minimise energy consumption

•Use renewable energy of solar and wind power

•Generate power locally

•Reduce fossil fuel consumption

•No nuclear power

•Design buildings with solar access and natural ventilation

•Use effective insulation and 'thermal mass' in buildings

•Climate responsive design Materials

6. Contribute to the Economy

Create work opportunities and promote economic activity.

Support and develop ecologically and socially responsible economic activity. Materials and component manufacture should be derived from, or be located in the local bioregion to the maximum practicable extent. Finance for ecological development from ethical sources, exclude financial support derived from exploitative activity. Capital input to ecological development should be local and financial structures should ensure that ownership and control ultimately rests with the users and inhabitants of the development.

•Develop ecologically responsible industries

•Develop exportable 'green technologies' and services

•Create appropriate information technologies

•Provide incentives for innovation and enterprise linked to ecologically responsible performance.

7. Provide Health and Security

Create healthy and safe environments for all people.

Employ appropriate materials and spatial organisation to create safe and healthy places for people to live, work and play in the context of an ecologically resilient environment.

•Reduce pollution and promote environmental quality

•Ensure a safe water supply, Recycle effluent, Maintain clean air

•Provide food security – urban agriculture

•Provide habitat for animals and birds

'The evidence we have all points in the same direction: passers-by help in deterring crime. More visible neighbours is better than fewer, good visual relations to the public domain is better than seclusion.'(Hillier and Shu 1999 p.6)

8. Encourage Community

"Cities are for everyone."

Create cities with strong citizen involvement – community participation, not just consultation. The community should govern itself. Community needs must drive ecological development. Ecological development must meet community requirements including the community of life that is the eco-system.

•Create development as a community driven process

•Ensure community involvement in public administration and management

•Provide community facilities

'…there is room for everybody in the ecocity effort. It is not vicarious but participatory, not to be dictated, but to be created in a million ways simultaneously from the grassroots to the highest levels of planning and back down again, with a role for each of us.' (Register 1987 p.49)

9. Promote Social Justice and Equity

"Equal rights and access to services, facilities and information."

Employ economic and management structures which embody principles of social justice and equity. Ensure equal rights and access to essential services, facilities and information. Alleviate poverty and create work opportunities.

•Involve all levels of the community in development processes

•Provide affordable housing

•Public use of public space

•Direct democracy

'What is interesting to note in the urban context is that certain integrated land use and public transport policies – assuming no other changes – can have an income and substitution effects on the less well-off; for example, if a household does not require two private motor vehicles to travel to work and engage in other everyday activities of modern living, there is more money available for, say, housing.' (Hundloe & McDonald 1997 p.93)

10. Enrich History and Culture

"Respecting the past whilst looking to the future."

Maximize the value of previous worthwhile human endeavor in terms of both heritage and manufactured artifacts.

•Restore and maintain cherished local monuments and landmarks

•Identify and celebrate the spirit of place

•Celebrate and encourage cultural diversity

•Respect indigenous peoples' inhabitation of the land

Diverse cultural and social groups provide the basis for socially vital cities

Support and promote cultural diversity, incorporating ecological awareness into all aspects of the making and maintenance of human settlement. Art and craft should be integral to both the construction and the operation of ecological development from the individual site to the city and its region.

•The whole process of creating ecological development and its subsequent operation requires education and skill development.

•Develop culture by involving all aspects of the arts including music, electronic media and technology

•Develop culture by integrating the arts and sciences with both daily life and special events and occasions

•Promote ecological awareness as part of cultural development

•Support community art and craft events, fairs and functions and develop festivities and events which relate to the locality.

•Encourage multicultural art and festivities

'Spaces should be created for cultural expressions, such as music, amateur theater, and the arts.'

(Streeten 1997 p.204)

2-5 Urban Agriculture

Food security and self-sufficiency have become a problem in many areas due to decreasing supply from agriculture, livestock, and aquaculture, and increased

consumption and higher demands of energy-intensive goods. Food demand globally is expected to rise by 70–90% by 2050 due to population growth and higher standards of living (Varma 2008).

Productive agricultural land area is generally decreasing in part because of urbanization, pollution and climate change impacts. Deterioration of soil quality and overgrazing are reducing food productivity on the shrinking

land area, requiring ever increasing use of chemical fertilisers and yet more nonrenewable energy consumption and associated carbon emissions. Water resources are also becoming depleted. Three-quarters of the world's fish stocks are fully exploited, overexploited or depleted. It is forecast that most fish stocks will collapse by 2050 (UNEP GEO-4 2007).

Tropical forests, important to ecosystems preservation and efficient stores of carbon are being destroyed to make way for food and bio-fuel production.

The 850 plus million hungry people will continue to grow, while others will be

forced to change their spending and give up other necessary goods or services, such

as healthcare and education (Varma 2008). Josette Sheeran, Executive Director of

the United Nations' World Food Programme (WFP), notes with alarm:

For the middle classes, it means cutting out medical care.

For those on $2 a day, it means cutting out meat and taking the children out of school. For those on $1 a day, it means cutting out meat and vegetables and eating only cereals. And for those on 50 cents a day, it means total disaster (The Economist 2008a).

Food is becoming a larger part of one's budget. "The average Afghan household

now spends about 45% of its income on food, up from 11% in 2006" (Ban 2008).

As a result, people buy less and cheaper foods. But cheaper foods, such as processed

or packaged goods are usually less nutritious and require more energy.

The rising middle class faces a different situation with food. As living standards rise we are

consuming more resource intensive foods. For example, moving from cereals to meat results in 2.5–3.5 times more land required for food production (UNEP GEO- 4 2007).

This is most acutely seen in China as its increased living standards have resulted in a 2.5 times increase in meat consumption in less than 30 years.

We actually produce enough food now to feed every child, woman and man and could feed up to 12 billion people. But in reality, while 850 million people (mostly women and children) remain chronically hungry there are 1.1 billion people who are obese or overweight (Economist 2008b). Our food supply is unequally distributed.

Diet, food production efficiency and distribution are key elements of resource efficiency and these are issues that can be tackled. For example, it is likely that we will need to turn to new low energy processes of building and balancing soil fertility and this can be assisted by closing the resource loops between urban living and rural food production. Research is being carried out into food production in buildings in which artificial light is used together with hydroponics culture and nutrient recycling from city waste streams to grow green vegetables and fruit.

This takes advantage of new LED lighting technologies and plant science and recognises that plants only need a proportion of the white light spectrum to grow healthily.

It is likely that by 2050 a proportion of food can be grown commercially by supermarkets withintheir existing facilities in towns and cities and sold directly to customers with low ecological footprint as long as a supply of renewable energy is available. Control of nutrient supply to plants grown in this way will also enable the mineral balance in the food chain to be improved.

Urban co-operative gardens and urban agriculture can be an important contributor to food supply in cities. Storing and transporting food from the rural areas not only widens the rural-urban divide but also creates a dependency relationship on cities. Green walls and roofs can produce agriculture, improve air and water quality and engage the community. There is also substantial opportunity is the growing of food in urban areas using hydroponics and nutrients recovered from the waste stream and the recycling of carbon from energy consumption in urban areas back to the productive

land. This could also free up land for new forests to create other additional carbon absorption capacity and to improve biodiversity.

2-6 Towards Sustainable Production & Consumption

Modern urban-industrial consumption patterns and habits differ in essence from those of the pre-industrial and feudal times characterized by low-productivity and consumption levels meeting largely basic needs. Not only is the modern industrial age much more productive in producing daily needs, but the consumer goods designated for the market place involve use of unnatural sources often harmful to the ecological system. More significantly, the prevailing market economy relies on large scales of consumption to justify its profitability and corporate survival or expansion.

Consumption cultures based on material possessions have increasingly been related to fashionability rather than durability. Consumerism and consumer ethic, according to Corrigan (1997, cited in Jayne 2006: 27), first developed among the aristocrats during the sixteenth century Elizabethan period but only blossomed after the Industrial Revolution in late eighteenth century with the advancement in industrial capitalism and its production technologies, that enabled consumption of rare consumer goods to reach a much larger cohort of consumers and could render them to show social prestige and status. A sharp turn took place in the post-World War II period.

With further technological progress, aided by the Fordist mode of production and world-scale marketing strategies, consumer goods became highly accessible in developed countries, especially private automobiles. Today, in the midst of environmental preservation, consumerism has become a collective consumption lifestyle in the developed world and has also spread to the more affluent social groups in the developing world. In the face of increasing environmental degradation, unsustainable consumerism is being questioned and sustainable consumption is being

elevated to the international forum as a balancing force.

Unsustainable consumerism in daily practice is inherently distinct from environmental ethic in theory discussed earlier. However, individuals with an environmental ethic and awareness could be contradictory in actions if consumption is seen as an individual's lawful right and he/she is not prepared to give up his/her preferences. Environmental ethical consciousness or citizen preferences, as Sagoff (1988) suggested, are judgments about what one should do whereas consumer preferences mean to do what one desires to possess or consume. Satisfying individuals'

massive scales of desires could be ecologically disastrous in some cases.

But if enormous economic sacrifice is needed to achieve insignificant pollution or contamination control, the role of sustainable production and consumption acting as a compromising agent is very useful.

What is sustainable production and consumption? Sustainable consumption must be matched by sustainable production regulated by demand management which does reliable valuations of natural resources and arouses public awareness in recycling, reduction and reuse of materials. Technologies employed in the sustainable production processes are those that protect the environment, are less polluting and handle all residue wastes in environment-friendly ways.

The methods of production would use much fewer resources and generate close to zero waste (Newman and Jennings 2008: 188–189, White 2002). In light of the large gaps between affluent nations and poor countries, meeting the basic needs of the latter is crucial to ensure environmental, economic and social sustainability which are interdependent and mutually

reinforcing.

For the urban poor in many African and Asian countries, for instance, sustainable consumption implies not so much material consumption of consumer goods but more the safeguarding of their living environment often built precariously on poorly serviced quarters of the cities.

The future direction of sustainable consumption would need to promote conserver lifestyle yet maintaining a high quality of life. Looking from the perspective of more developed societies, Newman and Jennings (2008: 191–198) have conceived a series of sustainable consumption strategies, as listed below:

Voluntary simplicity strategy:

Disapproving consumerism and viewing overconsumption as an illness in society,

this strategy aims to assist people to find alternative ways to satisfy their needs and promote simple ways of living.

Demand management strategy:

Education is sought to educate consumers the ways in which to meet one's needs without consuming much non-renewable resources. The premise is however that reducing resource use should not mean lowering quality of life. Application of this strategy needs to be adopted at both household and corporate levels, in order to achieve a meaningful reduction as a consequence.

1. **Sustainable procurement strategy:**

Government and institutions, together with households should adopt purchasing programmes using the notion of sustainability. This sustainable shopping behaviour should build up more sustainable markets by consuming less. More attention should be directed towards more environmentally sound products.
(4) "Slow movement" strategy
"Slow food", "slow cities" and "slow traffic" are three elements of the "slow movement" strategy that are anticipated to help cut down consumption. "Slow food" is to counteract fast food and fast life in an attempt to rediscover the real taste of authentic and local/regional food sources and quality pace of life. "Slow cities" place emphasis on small towns and cities, with preference modelled after the European late medieval and renaissance era. "Slow traffic" calls for traffic calming in favour of small road capacity emphasizing walking, cycling and transit. The above strategies are apparently more relevant to more developed societies. Most of these societies are in post-industrial stage of development where material shortage is not a major issue. The notion of "small cities" appears idealistic and nostalgic in sharp contrast to the current global trend of mega-urbanization, taking place at grandiose scale globally. Given the diverse socio-economic backgrounds between the developed and developing worlds, it is understandable and logical that the strategies of sustainable eco-city development must follow the specificities and circumstances of the adopting countries.

2-7 How Cities Can Enter The Ecological Age

The aim of eco-cities is to build a viable future for humanity with a healthy planet where the Earth, water and air will continue to support our complex solar-powered ecosystems. Presently, our over-dependence on depletable resources is destabilizing

the planet's life-support systems. Three key issues that have exacerbated our problems are:

a. The continued growth of population;
b. The rapid growth of resource consumption associated with urbanization, especially in emerging economies.
c. Climate change. Against this background, this paper analyses current global knowledge and examine if and how we can reach a sustainable future.

The authors believe that this is feasible if cities, driven by urbanization, population growth, and climate change, can lead the way. Working together globally and with the supporting policy framework in low, middle, and high income countries, and new eco-oriented business models, cities can reduce their carbon emissions, retain a limited ecological footprint, and improve their human development to enter the ecological age.

In recent decades it has dawned on many of us that there can be no viable future for humanity without a healthy planet. Earth, water and air support the existence of an immensely complex living system, powered by the sun. We are part of this web of life. But within a few generations, we are using up most of the Earth's stored fossil fuel resources and their transfer from the Earth to the atmosphere is significantly altering its composition. Our globalising, resource over-dependent path is destabilising the planet's life-support systems. The total global resource consumption has gone up substantially, with nearly all of it from non-renewable sources. The direct impacts of this on human development, plus increase in population; rising food and resource costs mean that traditional economic growth is rapidly becoming unsustainable and a global transition is underway to the ecological age of human civilization.

Three key issues that exacerbate our problems are: (i) the continued growth of population – it is predicted to reach 9 billion by 2050; (ii) the rapid growth of resource consumption associated with urbanization, especially in emerging economies; and (iii) climate change.

The year 2008 marked the first time in history that half of the population lived in urban areas. The world urban population is expected to nearly double by 2050, increasing from 3.3 billion in 2007 to 6.4 billion in 2050 (United Nations 2008).

As for climate change, even if we were to stabilize carbon emissions today, increases in temperature and the associated impacts will continue for many decades. And given the outcome of the Copenhagen Accord, pending expiration of the Kyoto Protocol and mixed national commitments, carbon emissions are not likely to stabilize soon.

The drivers for urbanization are strong, with the potential for better living standards, improved health, higher education, and greater gender equality. But this current model is unsustainable. Life in high income urban areas gives rise to a large proportion of CO2 emissions and subsequent climate change impacts.

It is also dependent on outside resources shipped in, and wastes shipped out. Seeing only the economic success of high income countries, low and middle income countries

have followed the same fossil-fuel dependent route, and accelerated inefficient resource consumption.

The rapid economic development of China, with over 800 million people living in cities by 2020 (People's Daily 2004) – 60% of its population – has alarmed many. There would be insufficient resources if every Chinese wanted to live the same high and inefficient standard as an American.

Urban centres and cities of the future need to be refashioned to enable people to live much more lightly on the planet with a huge reduction in greenhouse gas emissions and resilience to climate change impacts. Especially for low and middle income areas, there are opportunities to leapfrog the problems of the current high income world, making much more efficient use of their resources, following the new ecological age model.

This section carefully analyses current global knowledge in an attempt to see if and how we can reach a sustainable future. The conclusion is that we could move to a sustainable way of living within environmental limits over the next few decades, allowing for continued human development and population growth, whilst adapting to climate change impacts. Clear objectives are set out for 2050 Ecological Age, using three performance measurements:

• CO2 Reduction: 50% average from 1990 levels by 2050.

• Ecological Footprint Decrease: Within the Earth's biocapacity of 1.44 gha/person, based on a projected global population in 2050.
• UN Human Development Index Improvement: Raise overall wellbeing in GDP/capita, life expectancy, and education.

Between 2000 and 2005, emissions grew four times faster than in the preceding 10 years, according to researchers at the Global Carbon Project, a consortium of international researchers. Global growth rates were 0.8% from 1990 to 1999. From 2000 to 2005, they reached 3.2%" (New Scientist 2006).

We need to decrease our carbon emissions or risk greater and more frequent impacts of heat waves, drought, typhoons, etc. However, decreased carbon emissions are not enough to transition towards an Ecological Age.We need to ensure that we continue to grow and develop, but within our resource constraints and improve our living standards.

Ecological footprint was developed by William Rees and Mathis Wacknernagel, and is a resource measurement tool similar to a life-cycle analysis. It attempts to account and compare human's demand for ecological resources, and the planet's ability to supply that demand and regenerate.

Its methodology involves calculating "the area of productive land and sea needed to provide a given quantity of energy, food and materials for a defined population in a given land mass, and the area of land required to absorb the emissions" (Global

Footprint Network 2005) – in other words, nature's ability to provide for our lifestyle consumption, or biocapacity.

In 1998 WWF started publishing a biennial Planet Report, which in 2006 showed that we are now living in severe ecological overshoot. Worldwide, the report says that we are consuming 25% more resources than the planet can replace and are drawing down the stock of natural capital that supports our lives (WorldWildlife Fund 2006).
The UN Human Development Index measures overall well-being in three basic dimensions of human development: a long life, formal education, and average per capita income of GDP (UNDP Human Development Report 2007–2008). It has been used by the United Nations since 1990 as an indicator of human well-being beyond sheer economic growth. Together these three objectives serve as our guide in entering an Ecological Age and future ecological age cities.

Each indicator alone has weaknesses, but together, they provide a holistic assessment of where cities should strive for. The three keep us in balance with nature while continuing to promote our growth and development. Happiness will not be attained with material accumulation, but rather in a change in our living conditions and thinking.

Recognizing the different performance levels in each city– along with local conditions and policies – we aim to set recommendations that are relevant to each context while promoting an overall transition towards an Ecological Age.

Existing urban centres are simplified into three basic models (Table 2.1). The first type- emerging economy- focuses on the expansion or creation of urban areas, while the final two look into retrofitting existing areas. The emerging economy's goal is to avoid an increase in ecological footprint as it continues to grow and improve its human development index. The European and USA models aimto decrease their ecological footprint while maintaining a high human development index.

Table 2.1 City models

Urban centre models	Main characteristics	Ecological footprint (gha/capita)	Human development index	Example locations
Emerging economy	Dense living, growing population	1–2	0.4–0.8	Africa, Latin America, Eastern Europe, China, India
European	High density, low car use	4–8	> 0.8	Western Europe, Japan, Korea, Singapore
USA	Sprawl, high car use	8–15	> 0.8	North America, Australia

Source: Collated by authors from various sources

Low and middle income cities need to develop in a way that improves quality of life and creates jobs and opportunities within the new global economy where resource efficiency underpins development. The planning, design and investment model will be a new one following the long term lessons from cities.

For these low and middle income economies this approach can be thought of as a way of leapfrogging from the Agricultural Age to the Ecological Age. At the same time high-income countries need to rebase their paradigms around city living, rural food production, water management, energy supply and manufacturing to take advantage of the ecological age economy.

They need to avoid the ravages of inflation and political risks of shortages of basic needs that result from a continued focus in industrial production. This will require investment to transform existing cities along the lines of the London Climate Change Action Plan and various One Planet Living studies by WWF. We call this retrofitting and envisage this will be carried out at a regional scale of communities of at least 50,000–100,000 people.

2-8 Sustainable Urban Design & Transport

Competition for land in most urban areas is driving up the land part of house prices. This means that rising land value can be used to underpin investments in improved efficiency. Inequalities are widening however, especially between homeowners and renters. For most, the ambitions of those moving to urban centers globally are not being realized. As the former Executive Director of UN Habitat, Anna Tibaijuka,

notes, “People move to the cities not because they *will* be better off but because they *expect* to be better off” (BBC News 2006). These members of the population find it hard to find the economic opportunities they envisioned.

Their dire financial situation and lack of affordable housing, exacerbated by rising fuel and food costs, is leading to homelessness and slum housing. The slum population is forecast to reach 1.4 billion by 2020, with Africa most affected.1 The approach to city living needs to change radically to a much more efficient use of land if we are to live within the carrying capacity of the planet.

Ecological footprint is changed fundamentally by the level of urban density, food and goods selection, energy supply efficiency, fuel choice, and transport. Food and goods are consumer choices while urban density, supply efficiency, and fuel choice are largely planning decisions. Good urban design and planning is therefore a key to a successful change of direction and clarity of legal structure for land use planning is critical.

One of the largest differentiators in the ecological footprint of cities is the relationship between urban density and transport energy use. An average urban dweller in the

United States consumes about 24 times more energy annually in private transport than a Chinese urban resident (Kenworthy 2003). There is a sweet spot of urban density of 75 persons/hectare in which transport energy use is reduced through the economic provision of public transport and there is still ample room for urban parks and gardens (Newman and Kenworthy 2006).

Higher urban density combined with good public transport and a switch to use of fuel efficient and renewable energy powered vehicles can decrease transport-related energy use and improve liveability. Opening up the city roads to walking, biking improves air quality, reduces traffic congestion, and enhances community and healthy living. Real time information can support greater public transport use and scheduling.

Intercity connections can rely on high speed rail, waterways, and green logistics services from freight hubs for goods delivery. Better transport options also improve other infrastructure. A simple example is that the use of quiet electric vehicles and pedestrianised streets can mean the facades of buildings can be lighter in weight with the need for less noise attenuation, therefore consuming fewer resources; or that choosing more sustainable building material results in lower CO2 emissions. Improved air quality from non-polluting vehicles can facilitate natural ventilation of buildings, saving energy costs and improving residents' health.

Increasing biodiversity with green roofs, urban parks and tree planting along streets will reduce the heat island effect and give benefits of improved health through lowering heat stress and improving mental health (Mind 2007). The link between biodiversity and health can be illustrated by Singapore's visionary approach to biodiversity management in parks.

Dragonfly habitats are being introduced to try to help control mosquitoes and the problem of dengue fever in the city. Melbourne also uses species planting to create an eco-system in which mosquitoes do not proliferate. There is a virtuous cycle between the biodiversity of a city, and therefore living in harmony with nature, and the energy consumption and quality of life.

There is strong evidence that access to green space increases demand for developments and opens the door for funding through land value uplift. It will also benefit the natural systems that maintain life. Trees and vegetation also help with water-management, slow down water run-off and improve air quality.

There is also a need to restore rural and aquatic bio-diversity outside urban areas. Future urban centres can be transformed to reflect places where we live in harmony with nature in all its forms.

2-9 The concept of Zero Emission Technology

Zero emission technology aims at 100% reuse of all materials; this concept has been introduced for industrial production. The concept entails a practical approach to satisfying humanity's needs for water, food, energy, jobs, in an environmentally

sustainable manner, by applying science, urban design and technology. From an environmental perspective, waste minimization and reuse of stabilized biosolids and treated effluent represent the ultimate solution to pollution problems that threaten public health and ecosystems at both local and regional levels.

Environmental planning must be adapted in designing our housing project or built up areas, to study the impact of these housing projects on natural resources, to use the potential natural resources in order to keep it and not to deplete it in the future.

The environmental planning deals with health, energy, transportation, water, materials, land use ecology and pollution. The housing rights for each person to have an adequate home with standard of living has been adapted in the united nation resolutions; the policy of publishing and clearing these resolution in schools and universities will improve the awareness of Palestinian people for their rights.

2-10 Theories & Models

Review of sustainable development models:

There have been numerous ways of representing sustainable development in a model that captures this extremely complex concept and a new way ofthinking.

2.7.1 Pictorial Visualization Models:

According to the World Conservation Union (IUCN, 2006), the three dimensions of sustainability (economic, social and environmental) are represented either as

pillars, embedded circles or in the popular Venn diagram of three overlapping circles. The latter model stresses the importance of the intersection between the

three areas (see Figure 2). These models clearly emphasize the need for

interdisciplinary and transdiciplinary (Marinova and McGrath, 2005) approach to

Understand sustainability. Generally, these are popular static models with limited informative value but powerful in terms of reaching a broad audience.

2.7.2 Quantitative Models:

From a policy-making perspective, describe six types of quantitative models, namely "macro-econometric models, computable general equilibrium models,

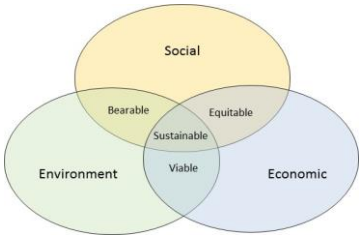


Figure4 ,5 The relationship between Ecology and Sustainability

Source: Kenworthy, 1999 Example for Venn diagram Source: IUCN, 2006

optimization models, system dynamics models, probabilistic or Bayesian network models (this category also includes risk assessment models based on influence diagrams) and multi-agent simulation models" (Boulanger & Bréchet, 2005). Economic models represent a special sub-class of the quantitative models. In fact, this area has been extremely active in academic pursuit generating models representing various economic concepts, ranging from neo-classical, evolutionary, ecological economics to neo-Ricardian (Faucheux, 1996).

These models have attempted to find ways of embracing uncertainty and dealing to a various degree of success with long range perspectives. Despite this, they have been poorly equipped to accommodate a holistic perspective, address the local or global perspective or acknowledge the need for stakeholders' participation. A common characteristic of the quantitative models is the fact that they remain dominated by the discipline from where they have originated, like environmental science, engineering or economics.

2.7.3 Physical Models:

The use of physical models for sustainability has been restricted mainly to its environmental component. They have been applied for water (Hellstrom, 2000), energy, buildings, in urban design, for recreation of habitat, for handling of pollution, CO2 and toxicity in implementing industrial ecology (Levings, 2004), to mention a few examples. Physical models are very specific and predominantly local.

The purpose of their construction is to reduce the uncertainty, however their time range is very restricted. They allow for a participatory approach and interdisciplinary perspectives, but by nature are only a small part of the global sustainability system and can rarely serve to main purpose of modelling for sustainability.

2.7.4 Conceptual Models:

This category of models is very broad and is linked to humanity's waking up to the limits of its natural environment and the negative impacts that population and population development having on it. They started with the work of the Club of Rome (Meadows, 1971), went through the conceptualisation of the implications from the use of nuclear weapon and from ozone depletion and the ozone hole (Litfin, 1994) to go through the various futurist scenarios such as the ones developed by the World Business Council for Sustainable Development (Speth, 2004), to the work on global warming and climate change. Another example of a powerful theoretical idea that crossed the boarders of many disciplines and is also contributing to understanding sustainability is the evolutionary concept.

Figure 6,7 The relationShip Between Components

Source: Giannetti

Based on the co-evolutionary paradigm, it is possible to model the interactions within the global "humanity–global economy–nature" system. The important point is that all three should be modelled and analyzed simultaneously in terms of their global interactions (Norgaard, 1997). An adequate model of sustainable development cannot build on the existing understanding of society and nature. Humans have also created what can be described as "second nature", the human-made material world which by size and importance has become similar to the global natural systems. It not only acts as a buffer between humans and nature (see Figure 7) but has Source: Giannetti, 1993 also become the main objective of human development.

Following its own developmental logic and laws, this second nature is now threatening the planet's nature. Since the 20th century, globalization has become a distinctive feature of development affecting the economy (and making it global), society (with emerging global consciousness and shared global problems) and the environment (with the effects of pollution, for example, becoming of global importance).

In fact, sustainable development is becoming a globalizing development which does not contravene but reinforces and goes along with these processes. The planet Earth can only support such development. A model of this global sustainable development is shown with a state of dynamic balance $\oplus$:

$GS = H \oplus E \oplus N$

Where H is humanity; E –global economy and N – the global natural environment (see Figure 3).

The following three characteristics, informed by the co-evolution principles, are important for this model

1. Heterogeneity:

At the local scale, heterogeneity is expressed in specific socio-ecological systems in which ecological, social and cultural elements are represented as a whole through the complex and complicated interactions of geographic, biological and anthropomorphic

factors (Marinova, 2009). Therefore, the global system is not just a complex of global phenomena of a different nature, but complex and alternately dependent arranged in pace separate socio-natural agglomerates (Marinova, 2009).

2- Equality:

Need to holistically integrate different priorities. It emphasized the deep connection and direct and multilateral interaction between each of the components and the rest. Examples of this are any of the global problems that society currently faces like climate change.

3- Human stewardship:

The leading role that humanity has in transforming, maintaining and/or sustaining the planet Earth (Marinova, 2009). According to Costanza (1993), "models are similar to maps, they have many possible purposes and uses, and no one map or model is right for the entire range of uses". The previously mentioned models are just a brief view for a longer analysis of this subject and it is clearly seen that the need for new models to clarify more phenomena are needed.

2.7.5 Theories review:

The appearance of sustainability in development science has led planners to apply advanced concepts of sustainability to the modern discussions over how cities and regions should be renovated, redeveloped, and reformed. Sustainability is regarded alternatively as either the proper means or the proper end of urban development (BASIAGO, 1999).

Nowadays, it is common in planning circles for urban planners to describe efforts to reverse problems of urban sprawl, congestion, and decline as a search for urban sustainability. This is the case even though in urban theory no consensus exists as to which human settlements embody sustainability (Ewers & kamp, 1990).

As mentioned in section 2-2, Sustainability consists from the three pillars, environmental, social and economic. Each of these pillars has its own use and

practices in the urban planning which will be clarified in the following points:

1- Economic sustainability in development theory

Economic sustainability implies a system of production that satisfies present consumption levels without compromising future needs. The sustainability that economic sustainability works for is the sustainability of the economic system itself. The concept of economic sustainability was originated by a researcher called Hicks in 1939, Hicks defined income as the amount one can consume during a period and still be as well off at the end of the period.

Traditionally, economists, assuming that the supply of natural resources was unlimited, placed excessive emphasis on the capacity of the market to allocate resources efficiently. They also believed that economic growth would bring the

technological capacity to replenish natural resources destroyed in the production process. But nowadays, a realization has come that natural resources are not infinite.

2- Social sustainability in development theory

In the most basic meaning, social sustainability offers a system of social organization that relieve poverty. In a more substantial meaning, social sustainability establishes the connection between social conditions -such as poverty- and environmental dissolution (Ruttan, 1991).

This theory of social organization identifies a negative linkage between sustained settlements, sustained poverty levels, and sustained natural resource exploitation. There is a divergence of opinion in development theory whether environmental sustainability is a necessary condition of economic growth and poverty reduction, or economic growth and poverty reduction are needed before environmental sustainability can even be addressed.

Very poor countries should accept temporary environmental degradation in order to meet immediate needs of food and shelter before they can have permanent economic and environmental improvements. Some view was that developing countries simply cannot afford to put environmental protection before economic development. In contrast to this view, the theory of social sustainability suggest that the reduction of poverty need not entail environmental decline. It aims to reduce poverty within the existing resource base of a society (BASIAGO 1999).

3- Environmental sustainability in development theory

Environmental sustainability requires maintaining natural capital as both a provider of economic inputs called sources. And an absorber called sinks of economic outputs called wastes (Daly, 1986). At the source site, harvest rates of resources must be kept within regeneration rates. At the sink site, waste emissions from industrial production must be controlled so it does not exceed the capacity of the environment to assimilate them without impairment (Goodland, 1995). It has become familiar for sustainable development or sustainability to be defined strictly in terms of environmental sustainability.

This misconception holds that what is wrong with the contemporary pattern of international development is simply that it is destroying the environment. This view is too much simple, however, for it ignores the market forces and social inequalities that are driving environmental degradation (Alexander, 1994).

Chapter 3

Case Studies

3-1 International Scale - Metabolism Rotterdam, Netherlands

Rotterdam, namely: Goods, People, Waste, Biota (e.g. movements of plants and animals), Energy, Food, Fresh, Water, Sand & Clay, Air. The course of the various substance flows was examined, and a way was sought to increase Rotterdam's environmental performance, quality of life and economic vitality. Where does waste occur, where can potential synergies be put to better use and how can waste and synergies be turned into opportunities for the city and region? To complete the picture as much as possible, the profiles can be linked to current developments at local and global level, as a result of which opportunities arise for making the urban system more sustainable. An example is recovering phosphates (as opposed to importing them) from exhaustible resources, such as phosphate mines. This resulted in several perspectives for action being formed for each flow, which the Project Atelier eventually translated into four proposals for taking better advantage of flows inRotterdam.

Material flow analysis of the City of Rotterdam, Rotterdam baseline study. The region has a multitude of materials and energy that flows through the city: approximately 37 kilotons per person
(more than 5,000 adult elephants) per year. By far the largest flow of all physical flows, is river water (98 per cent). The material flow of Rotterdam covers 200,000 kilograms of material per year (of which 93 per cent immediately is exported from the area). This figure shows the relative size of the different physical flows through the region.

1.1.1 Design Features:

The transit trade through the port of Rotterdam, one of the largest transit ports in the world, amounts to 220 million tonnes a year. However, the regional economic spinoff from the port of Rotterdam is considerably smaller than that of nearby ports (e.g. Antwerp, Hamburg, Le Havre, Helsinki). Although the transit trade through the port of Rotterdam is twice that of Antwerp, the
Rotterdam's employment rate appears to be only 17 per cent higher. Measured by the direct added value per tonne of transit cargo, that in Antwerp comes in approximately 10 per cent higher. The freight flows through Rotterdam therefore largely pertain to goods manufactured elsewhere which usually bypass the city. Furthermore, many companies in Dutch cities that are able to create added value have relocated to lowwage countries.

The increase of scale in the retail sector and the decreasing popularity of fixed retail outlets; as a result of online shopping, consumer products are increasingly delivered directly at home. Shops are slowly disappearing from city streets as a result. Limited

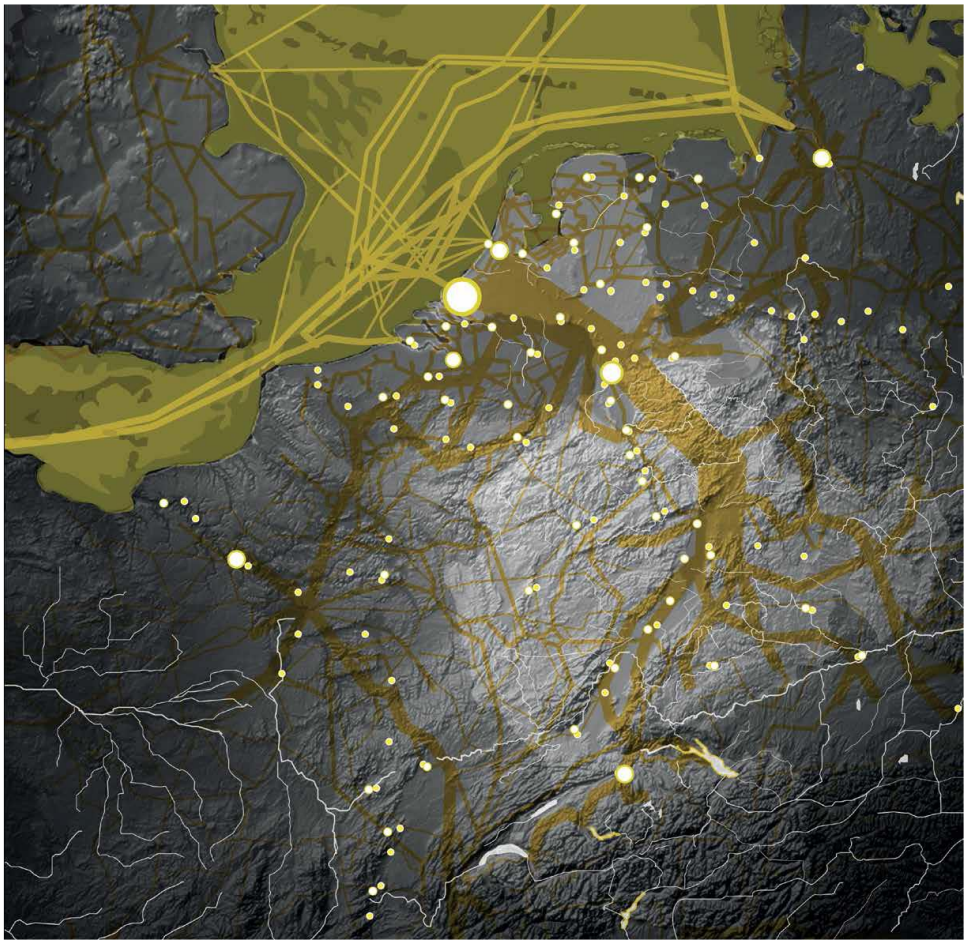
economic spin-off and a smaller role for the retail sector results in emptier city streets, with a reduced market and social value. Can this be turned around? Looking at the flow of goods, the question arises whether it is possible to use a small part of the enormous flow of goods which now largely bypasses the city more efficiently in order to create added value in the city itself?
International trends that have a significant impact on the physical quality of life physical quality of cities are:

- **Goods**
- **People**
- **Waste**
- **Biota**
- **Energy**
- **Food**
- **Fresh Water**
- **Sand & clay**
- **Air**
- **Goods**

  Rotterdam, one of the largest transit ports in the world, amounts to 220 million tonnes a year. However, the regional economic spinoff from the port of Rotterdam is considerably smaller than that of nearby ports (e.g. Antwerp, Hamburg, Le Havre, Helsinki).Although the transit trade through the port of Rotterdam is twice that of Antwerp, the Rotterdam's employment rate appears to be only 17 per cent higher. Measured by the direct added value per tonne of transit cargo, that in Antwerp comes in approximately 10 per cent higher. The freight flows through Rotterdam therefore largely pertain to goods manufactured elsewhere which usually bypass the city. Furthermore, many companies in Dutch cities that are able to create added value have relocated to low wage countries.

Map 1Amerterdam Harbour

(Source :Urban metabolism Rotterdam)



Map 2Amerterdam Container Distribution

❖ **People**:

People have many different reasons for moving. The most common reasons have to do with work, education, family and friends, but also shopping, recreation, cultural and other facilities.

One third of the world population will probably move from the countryside to the city in the decades ahead, seeking a better existence.1 It is therefore expected that over five billion people will live in cities by the year 2030.
Entrepreneurial freedom and access to jobs are some of the important conditions on the way to this better existence. Car access to Rotterdam is good. An analysis of the city's access structure – using the "space syntax" method – shows that there are residential areas and commercial districts in South Rotterdam where access for cyclists and public transport commuters is less self-evident.

For instance, the east-west links in South Rotterdam for public transport commuters and cyclists are definitely underdeveloped. Most commercial districts
and training centres are situated to the north of the Maas, but access to the commercial districts in South Rotterdam is also inadequate for people without a car. This has resulted in a form of "mobility deprivation".

The question is: How can we improve regional and municipal access to work and education, particularly for South Rotterdam?

❖ Waste:

Waste can be defined as "throwing away previously processed raw materials". Because they are compacted or transformed, they do not look like raw materials. However, appearances can be deceptive.

There is growing awareness that the city's waste contains raw materials, disguised as consumer electronics or food. It may be worthwhile to use these raw materials more efficiently in a circular economy. Therefore, in theory, the city may be regarded as an enormous market- place of usable raw materials. An important observation, considering that Europe depends on other continents for a large number of raw materials, and that raw materials are becoming progressively scarce and expensive as a result of global population growth, rising levels of prosperity and the exhaustion of various resources.
It is therefore useful to regard the city as a new mine" for extracting essential raw materials.

In Rotterdam, 49-75 kilos of this is fruit and vegetable waste, which is currently incinerated (for district heating). In addition to organic waste, 3.4 kilos of electronic waste is collected for each Rotterdam resident every year, a substantial part of which is mobile phones. 1 tonne of telephones yields 140 kg of copper, 3.14 kg of silver, 300 gm of gold, 130 gm of palladium and 3 gm of platinum.

Because the techniques for recovering raw materials from household waste, sewage water and electronics are rapidly being developed, we are increasingly often able to recover raw materials from waste, i.e. "upcycling". Just as it applies to recycling, the

recovery of raw materials starts at home. However, the question is: How can we organize our living environment for this?

❖ BIOTA

Rotterdam lies at a point where river, peat- meadow and dune landscapes converge. Because of the urbanization that has taken place over the past few decades, only a few "green" and "blue" structures are linked up.

As a result of fragmentation and more intensive farming methods, many of the species monitored in the peat-meadow areas have decreased considerably in number.3 Other landscapes show a similar trend.

The spatial reservations which businesses make for security reasons – or with a view to possible future expansions – create empty spaces in the port of Rotterdam. When these areas are left alone, spontaneous nature rehabilitation takes place there, with interesting types of plants, amphibians, reptiles and mammals.

A similar situation occurs around power stations and below high-voltage lines. Because of regulations, no human activity may take place there. As a result, there are many square kilometers of empty space in quantitative terms. Because nature rehabilitation often meant that landowners had to deal with numerous restrictions in the past, many businesses have adopted a policy that prevents nature rehabilitation.

However, changing insights, particularly on the side of environmental protection organizations, show that "temporary nature" can be very valuable. In other words, spontaneous nature rehabilitation and spatial reservations for future use are not necessarily mutually exclusive. In fact, it is more a matter of how the space that cannot be used for human activity can serve as a stepping-stone for biota without frustrating economic interests.

❖ Energy:

on average, a Dutch household consumes 466 gigajoules of energy per year. the raw materials for this come from all over the world: coal from Australia, gas from the Netherlands and Russia, petroleum from Saudi arabia, biofuel from brazil and electricity from Germany.

Modern coal-fired power stations realize a return of at most 46 per cent, i.e. 54 per cent of the raw materials are not converted into electricity but are released as residual products in the form of heat and carbon dioxide.

When we add the residual heat from other industrial processes to this, we are talking about a large amount of residual heat: every year, more than twice the equivalent of all the energy generated on the Dutch side of the north sea by wind turbines.
Depending on various calculations and assumptions, we are talking about 80–160 petajoules. a large part of this excess energy is not yet used in district heating, but is discharged into the surface water in the form of heat.

the annual Co2 emissions in Rotterdam now amount to approx 29 megatonnes, over 85% of which comes from the manufacturing industry and energy generation in the port- industrial complex. It is a missed opportunity, both in economic and ecological terms, to continue to waste heat in this way. this was already recognized in 2007 by the Rotterdam Climate Initiative, which set itself the task of cutting Co2 emissions by 50 per cent in relation to 1990. If we wish to achieve the Kyoto carbon dioxide emission targets or the objectives of the province of south Holland, we will have to intervene. and as for heat, it is not likely that we will be allowed to discharge heat on this scale for very much longer.

For example, it is already forbidden to discharge heat in the Copenhagen – Malmö – Helsingborg region. In other words, an important task for us as far as this substance flow is concerned is to take better advantage of the residual products of energy generation.

Food:

When we talk about food, we largely refer to nutrients in this flow. other aspects of this flow that affect daily practice will be dealt with. nutrients are essential materials for living organisms. some of these nutrients (e.g. phosphates) are essential for our survival but, like fossil fuels, are exhaustible.

In the agricultural sector alone, 28 million tonnes of phosphate are emitted (in the form of fertilizer) in the Netherlands every year, which is currently drained into groundwater and surface water.4 these nutrients are therefore not used, and often result in local over fertilization, thereby adversely affecting nature.

However, valuable nutrients are lost at many other points along the entire food production-consumption chain. approximately one third of all the nutrients are eventually lost during our food production. because the largest part of the northern European farmland drains directly or indirectly into the rhine, this river represents Europe's largest open-air drainage channel of nutrients.

All these unused nutrients flow to the sea through the port of Rotterdam, after which they can hardly be detected, except as a breeding ground for excessive algae growth.

Fresh Water:

The catchment area of the Rhine is the main water system in north-western Europe. the dynamics of the river, which is called "(the) Maas" in Rotterdam, has caused safety problems for centuries. Moreover, the nature of this river is changing. Until recently, the Rhine was a glacier river. However, over the past few decades, the river has increasingly changed into a rain-fed river. this means greater discharge peaks and lows. From a fairly constant average discharge of 2,300 m3/sec. to 18,000 m3/sec. for

peaks and a mere 620 m3/sec. for lows. the probability that Rotterdam will be affected by flooding and floods has increased as a result.

Moreover, the combined effect of sea level rise, deepening the new Waterway for shipping traffic, increasing discharge dynamics and the increased likelihood of dry periods make Rotterdam vulnerable to salination. this not only means an immediate threat to flora and fauna, which largely depend on fresh water; it also poses a threat to the agricultural and horticultural sectors, and even to the city's drinking-water production. the question is therefore: How can we guarantee the availability of sufficient fresh water in Rotterdam in the long term?

- Sand & Clay:

Rotterdam lies at a point where the coastal and river landscapes converge, where the watercourses are naturally shallow. although, centuries ago, the dynamics of river and sea provided relatively secured access to the sea, the same dynamics now pose a threat to one of the largest deep-sea harbours in the world: siltation!

Direct access to the port of Rotterdam is an important competitive advantage. nevertheless, this sea link cannot be taken for granted. In fact, the route was diverted several times in Rotterdam's past in order to secure access.

sea access seemed to be guaranteed since the digging of the new Waterway (towards the end of the 19th century). However, to accommodate the increasing draughts of ships, harbour activities shifted towards the West. Moreover, there is a constant need to dredge. to maintain the gateway to Rotterdam at a depth of at least 30 metres so that the port can continue to accommodate the largest ships in the world, over 20 million m3 are currently dredged from the port every year.

This amounts to a large daily transport of harbour sediments to the sea. the largest source of sediments used to be the catchment area of the Rhine but, as a result of restricting the flow of the river, the north sea is now the main source of sand, which accumulates on the river bed and harbor basins (approx. 14 million m3 from the sea, compared with approx. 8 m3 from the Rhine). Dragging sand from the port to the sea is an endless and costly process.

It is noteworthy that transport largely determines these costs, since transport costs make up 90% of the cost of depositing 1 (one) m3 of sediment into the sea. the question is: How long can we continue to work against the current, and would it not be wiser to use the natural process of land formation more strategically?

- Air:

A pleasant urban living environment is to an important extent determined by the air (wind) flows, heat and the ground-level air quality. It is becoming increasingly clear that the ground-level air quality has a direct impact as far as our health is concerned.

Major causes of air pollution on a European scale are: the manufacturing industry, motor traffic, shipping traffic and farming. Each source has its own distribution pattern.

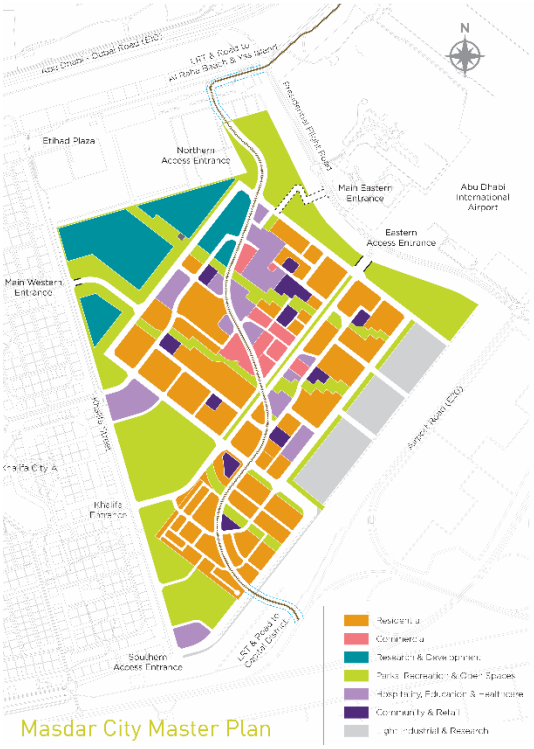
Motor traffic along arteries through and between cities. shipping traffic causes deterioration in the so-called “background concentrations”, the “blanket” that hangs over a region. In the layer of air up to an altitude of 10 kilometers, the highest average concentrations of air pollution in north- western Europe can be found above Central England and the Ruhr area. Inland and ocean-going vessels produce substantial emissions on shipping routes. these routes are therefore clearly marked on the particulate matter map of Europe.

(Source :Urban metabolism Rotterdam)

3-2 Regional scale – Masdar City, Dubai, UAE

The world’s energy requirements are expected to double in the next 50 years, a fact which places energy use and conservation at the heart of the world sustainability challenge. Today, approximately 3.5 billion people (nearly 50% of the world’s population) live in cities, a number which is expected to rise to nearly 6 billion by the year 2050. These urban environments (which only account for 2% of the planet’s land mass) are responsible for almost 80% of the world’s energy consumption and 75% of its

carbon emissions. The problems created by such dramatic urbanization place an increasing emphasis on making the world’s cities more resource-efficient and environmentally friendly. In response to this challenge, Masdar Company is building Masdar city, as a green print for sustainable urban development and strategic Business hub. Located in Abu Dhabi, the capital of the United Arab Emirates, Masdar City is a sustainable urban development and economic free zone.



Masdar City Master plan3 Map

The city provides a green print for cities of the future, with traditional Arabic architecture merged very well with state of the art modern technology to maximize energy efficiency. Masdar City has the potential to host up to 40,000 residents and 50,000 commuters by 2025. This mixed-use development provides a unique, sustainable, living and working environment, with integrated residential and commercial zones that feature food and drinks outlets, along with extensive leisure and entertainment facilities.

3.2.1 Sustainable construction

Every element of Masdar City's 700-hectare site has been designed with sustainability in mind. cutting energy demand and water consumption by 40% while also reducing embodied carbon by 30% compared to business as usual.

The city's streets have been built to be optimally oriented on a southeast- northwest axis, thereby providing shading at street level throughout the day. The

materials used for the building facades are also designed for cooling purposes. Buildings within the Masdar Institute Campus are shielded with special materials

that ensure almost no solar gain on the structures as well as limiting the heat radiated on to the street. While windows not already shaded by adjacent

buildings have a set of slots to prevent direct sunlight from entering the building.

With 10MW solar power plant on the site, supported by a series of smaller rooftop installations, helps to provide the development with a clean, sustainable source of energy.

3.2.2 Sustainable living

With integrated residential and commercial zones that feature food and beverage outlets, alongside extensive leisure and entertainment facilities, Masdar City offers a unique, environmentally friendly, living environment. The development's pedestrian-friendly design looks to encourage a healthier and more active lifestyle, with amenities easily accessible on foot or via public transport, while communal areas have been intelligently landscaped and designed to provide natural shading and cooler air temperatures.

3.2.3 Sustainable Business

Masdar City is more than a sustainable urban development; it is also an environment in which organizations, businesses and NGOs can do business. As an

economic free zone offering 100% foreign ownership, no restrictions on capital movements, profits or quotas, and a favorable tax environment, the city provides

a strategic base from which businesses can explore opportunities available within the United Arab Emirates and beyond.

3-3 Local scale – Rawabi City, Ramallah, Palestine

Rawabi is a city first of its kind for Palestine. The city is intended to host 40,000 middle income families (where the average family size is of five people), a number of cafes,

restaurants, mosques, commercial centers, parks and playgrounds, job, business, and excellent opportunities, and even an outdoor amphitheater.

Moreover, Rawabi is to be Palestine's first planned green and sustainable city. Among the plans for making Rawabi sustainable include harvesting rainwater from roofs, a pedestrian-only city Centre, wind energy turbines, and electric car charging stations. Rawabi is also dedicated to environmental sustainability. The masterplan applies environmentally responsible landscape and development practices designed to preserve the natural features of the landscape.

The vision is to serve as a prototype of the first Palestinian green city and ultimately, "to guarantee a higher quality of life for present and future generations."

In addition to eco-friendly building features, construction uses a large percentage of recycled materials from Rawabi's own natural resources. Furthermore, multiple aspects of the residential lifestyle at Rawabi enhance sustainability, including its community gathering spaces and education, health and cultural facilities.

In order to reduce CO2 emissions, public transport within the city is not permitted, however Rawabi will have its own public transport system based on the usage of electric cars. The city also has its own wastewater treatment plant which will collect, treat and reuse reclaimed wastewater.

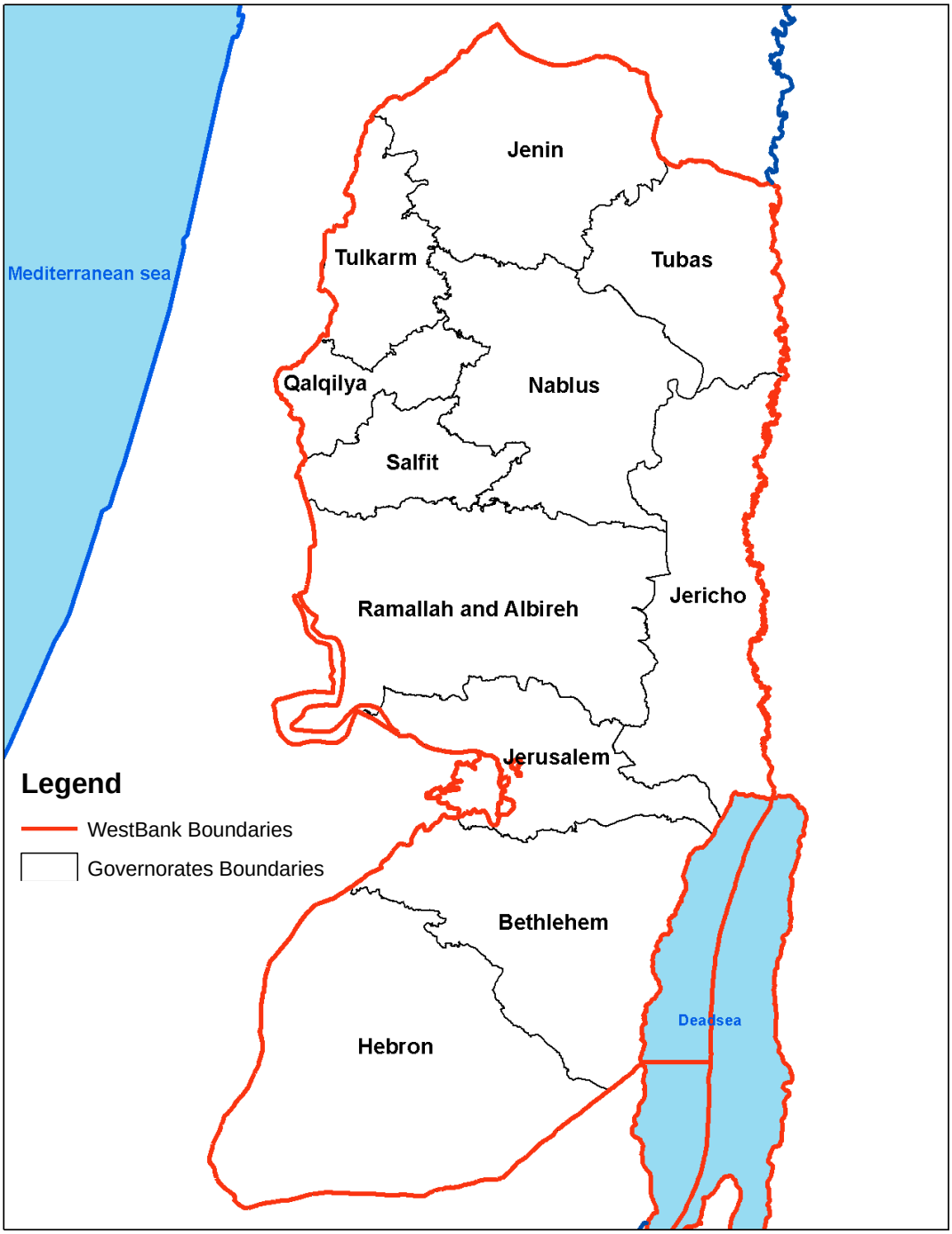
One of Rawabi's core objectives, in addition to the provision of housing for the middle class, is to provide jobs for Palestinians, to attract businesses and to stimulate the Palestinian economy. Unemployment in Palestine is high, and the biggest challenge for the private sector is to create jobs.

Whilst Rawabi has already achieved to create thousands of direct and indirect jobs in the construction sector, the challenge is to create permanent jobs in the city itself, Dajani explains. "Our main focus now is to build a small economic embryo within the city, to create 3,000 to 5,000 jobs for teachers, working mothers, entrepreneurs, and the companies that are interested to launch their operations in Rawabi," he says.

Rawabi's wastewater treatment plant, which will collect, treat and reuse reclaimed wastewater, sits on a 3.5acre plot northeast of the city. Underground wastewater collection pipes run downhill from Rawabi to the treatment facility site, eliminating the need for pumps. The treatment site is accessed by a dedicated 1.5kilometer road, construction of which has recently been completed.

As water is treated and tested, it will then feed into separate reservoir. This reservoir is connected to an underground pipeline dedicated exclusively for the transmission of treated water to irrigation pipes in parks and green spaces and for use in agriculture. The reclamation of treated wastewater is part of a national water consumption reduction plan established by the Palestinian Water Authority for the preservation of scarce water resources in the region.

Chapter 4
Site Selection



Map 4 Westbank Governates

4.1 Site Selection on Macro-Scale

Westbank has variety of ecological potential so different criteria has been set-up on the macro-scale to ensure the best choice to apply the concept of the Eco-City these criteria summarize in four main points as follow:

1. **Availability of natural resources:**

   Natural resources are a critical point to choose the best region with the highest potential because they are considered as the main incentives to be conserved and exploit, these resources are sun, groundwater, soil, rain, natural reserves.

2. **Proximity to biodiversity:**

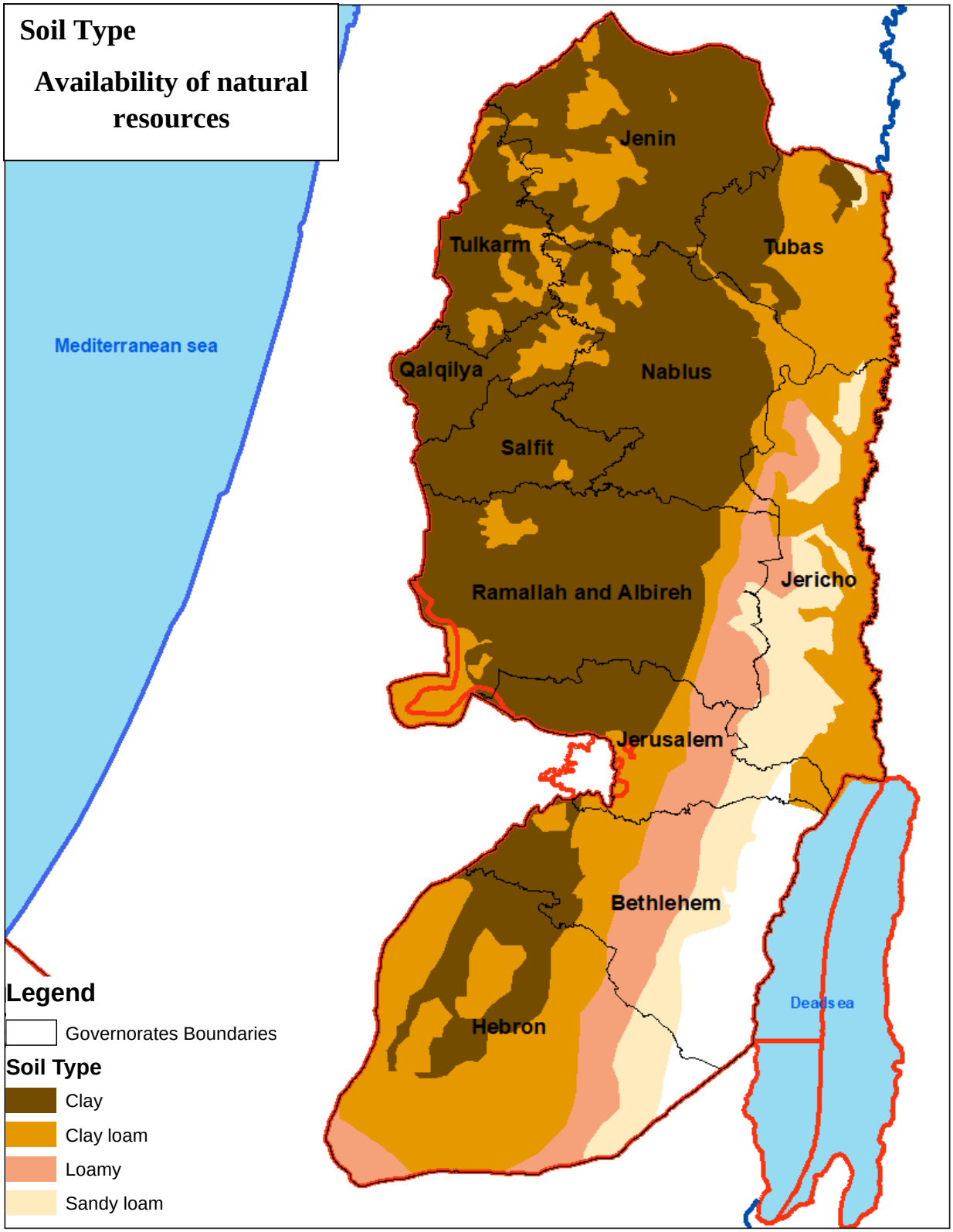
   Biodiversity is the most important ecological criterion, though it is also the most difficult to evaluate, as diversity is inherently difficult to adequately assess using a single or few indicators. Management practises which ensure large size and good connectivity of populations are the best means of ensuring maximal biodiversity. The role of exotic species is also highly significant regarding biodiversity. Invasion by exotic species, as also by indigenous generalist species, can displace more sensitive species, thus reducing species diversity, and can also reduce the overall size and connectivity of populations, thereby reducing genetic diversity within species. Indigenous generalist species do not normally pose a threat for sensitive specialist species, as these species' specializations generally mean that they are well adapted to the habitat feature or resource for which they are specialized. These species' displacement by indigenous generalist species only becomes a threat when such habitat features are lost or degraded, or when other kinds of habitat change provide generalist species with an opportunity to invade.

3. **Availability of agricultural lands:**

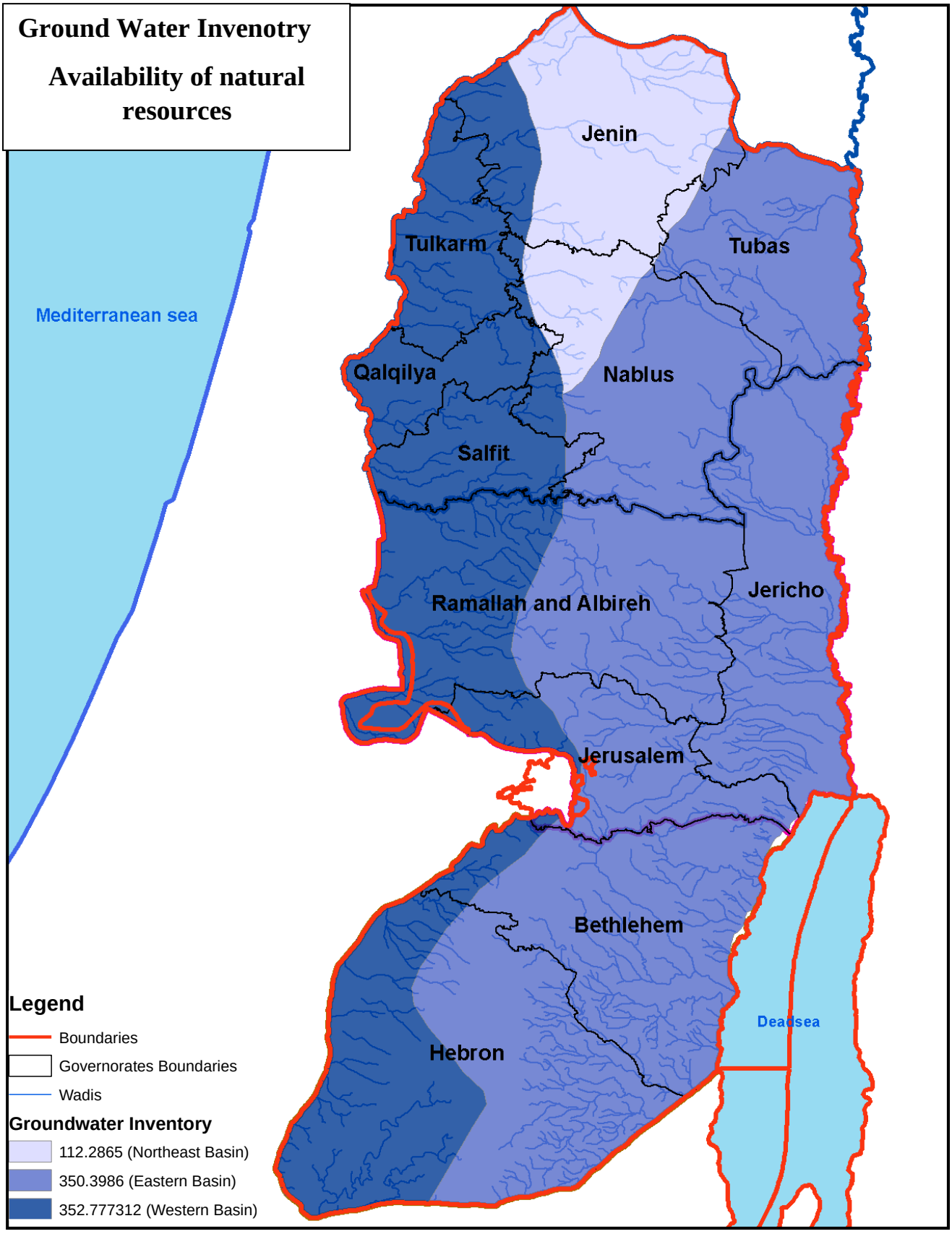
   As a result of the importance of the agricultural land and the need to save them from the urban expansion which cause the most damage to these land so that, lands with high agricultural value should have the highest weight to choose the best potential in the westbank

4. **Level of protection (Land Sensitivity):**

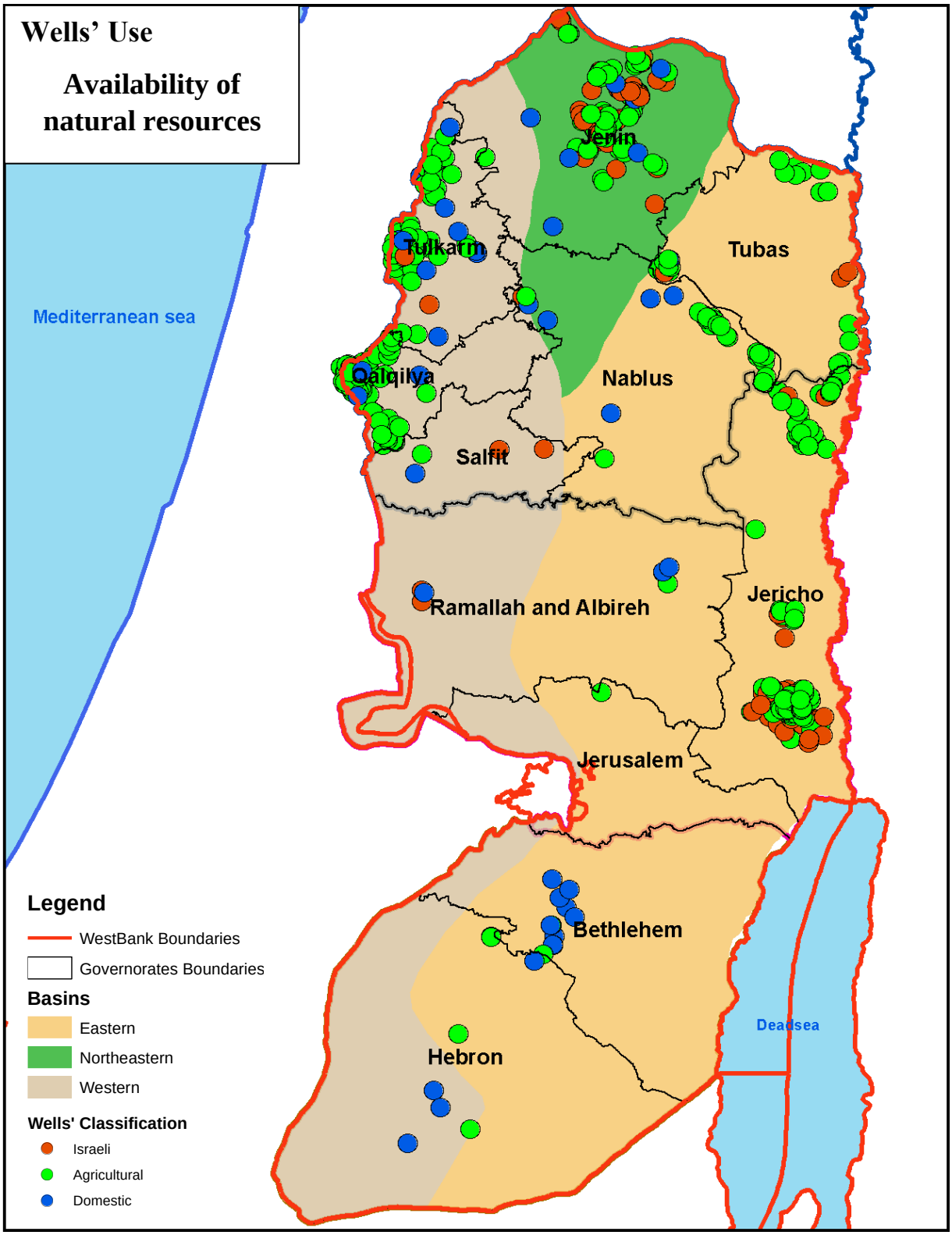
   It's clearly that lands with high sensitivity for pollution needs a special care & intervention which also gives it a special importance and high value of weight, because some natural elements could be damaged like wells & springs and this represents high risk on one of the most essential in our life which is water.



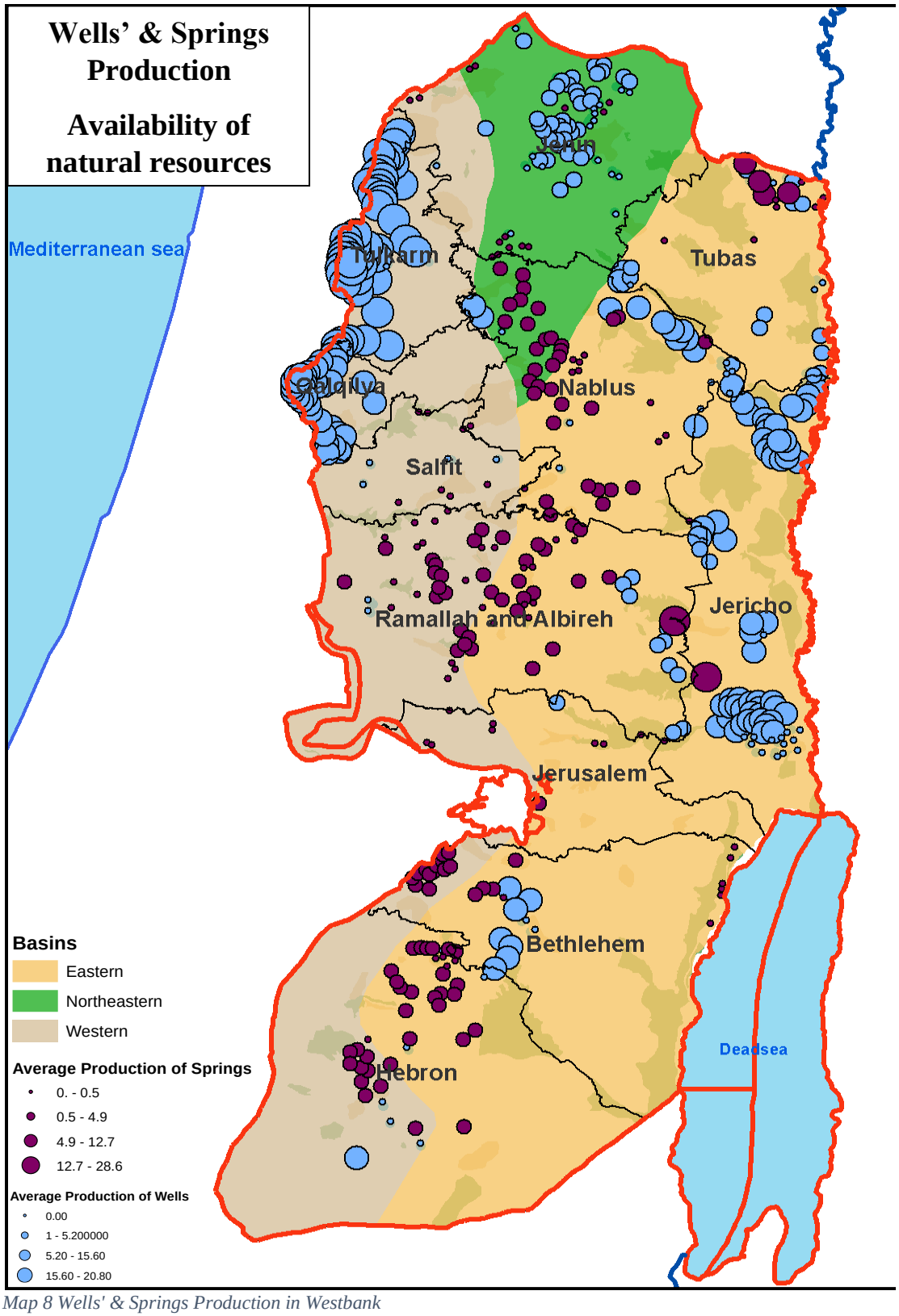
Map 5 Soil Type in Westbank



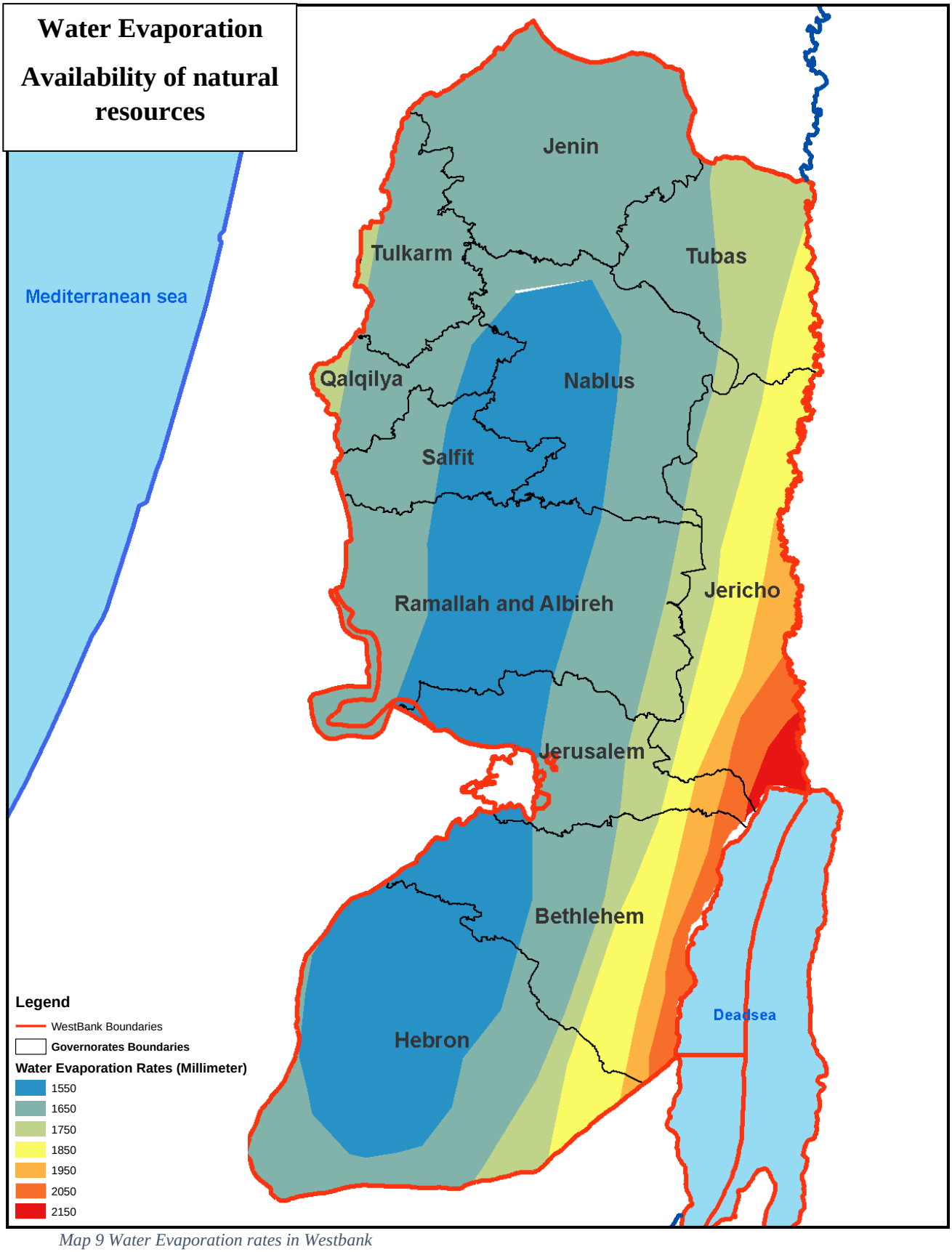
Map 6 Groundwater inventory in Westbank



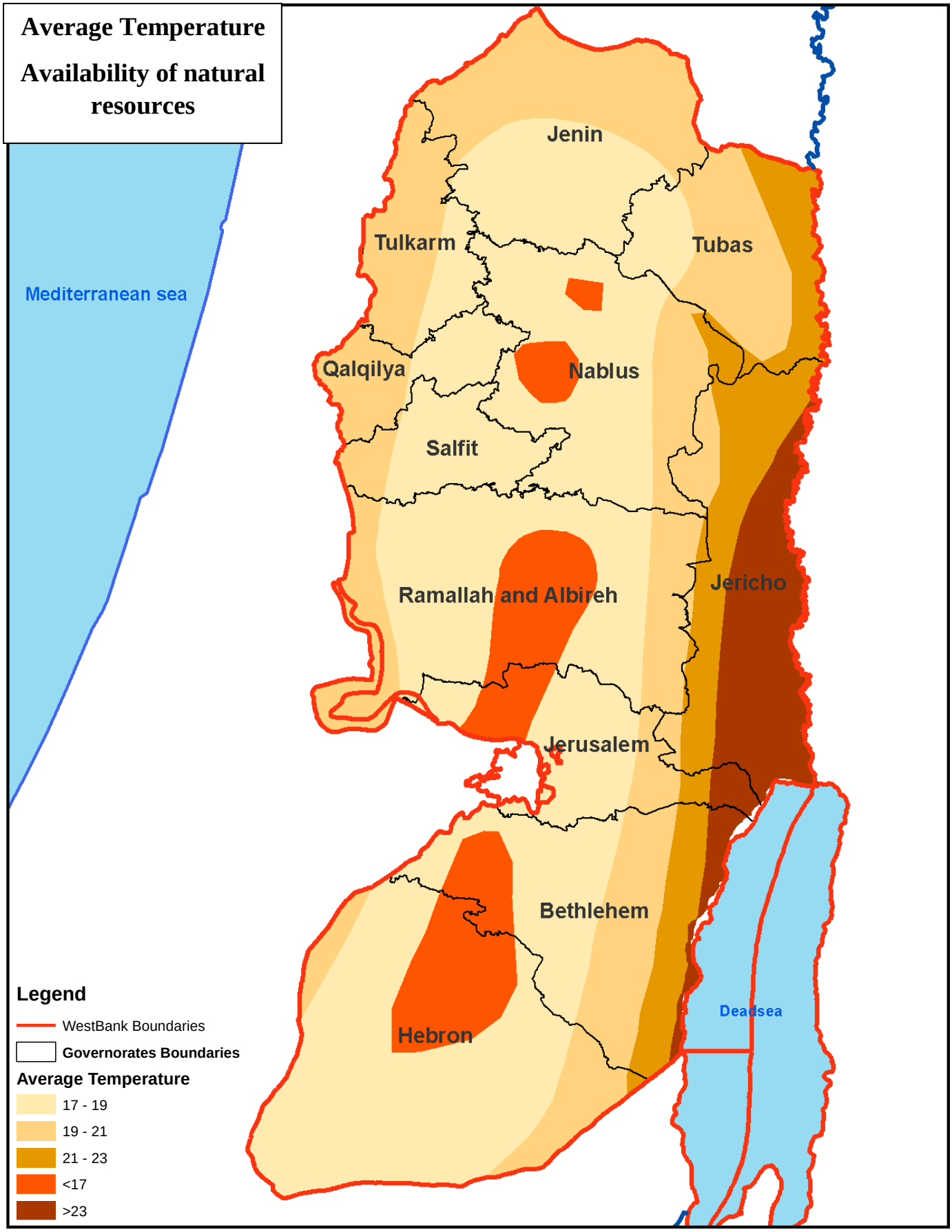
Map 7Wells' Use in Westbank



Map 8 Wells' & Springs Production in Westbank



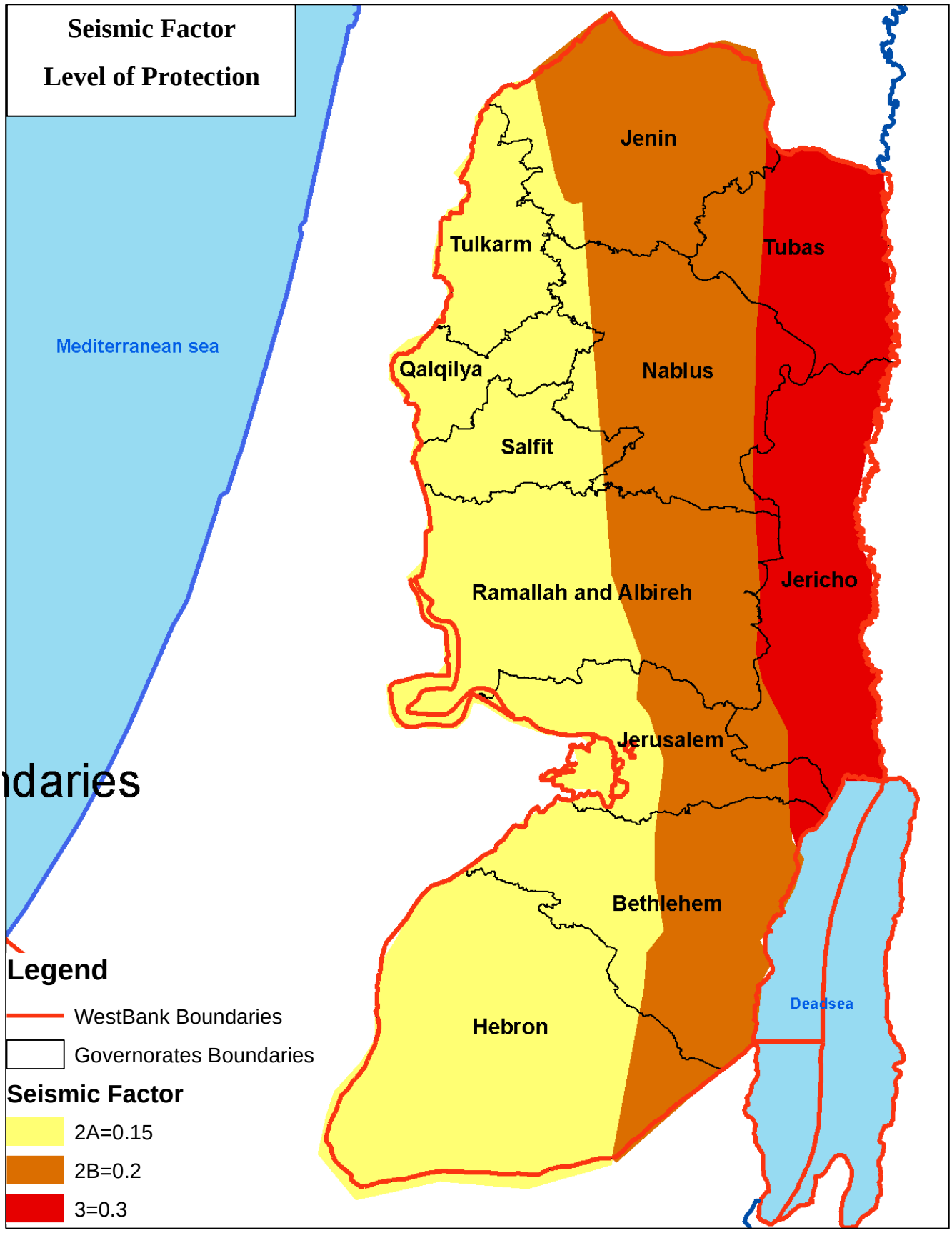
Map 9 Water Evaporation rates in Westbank



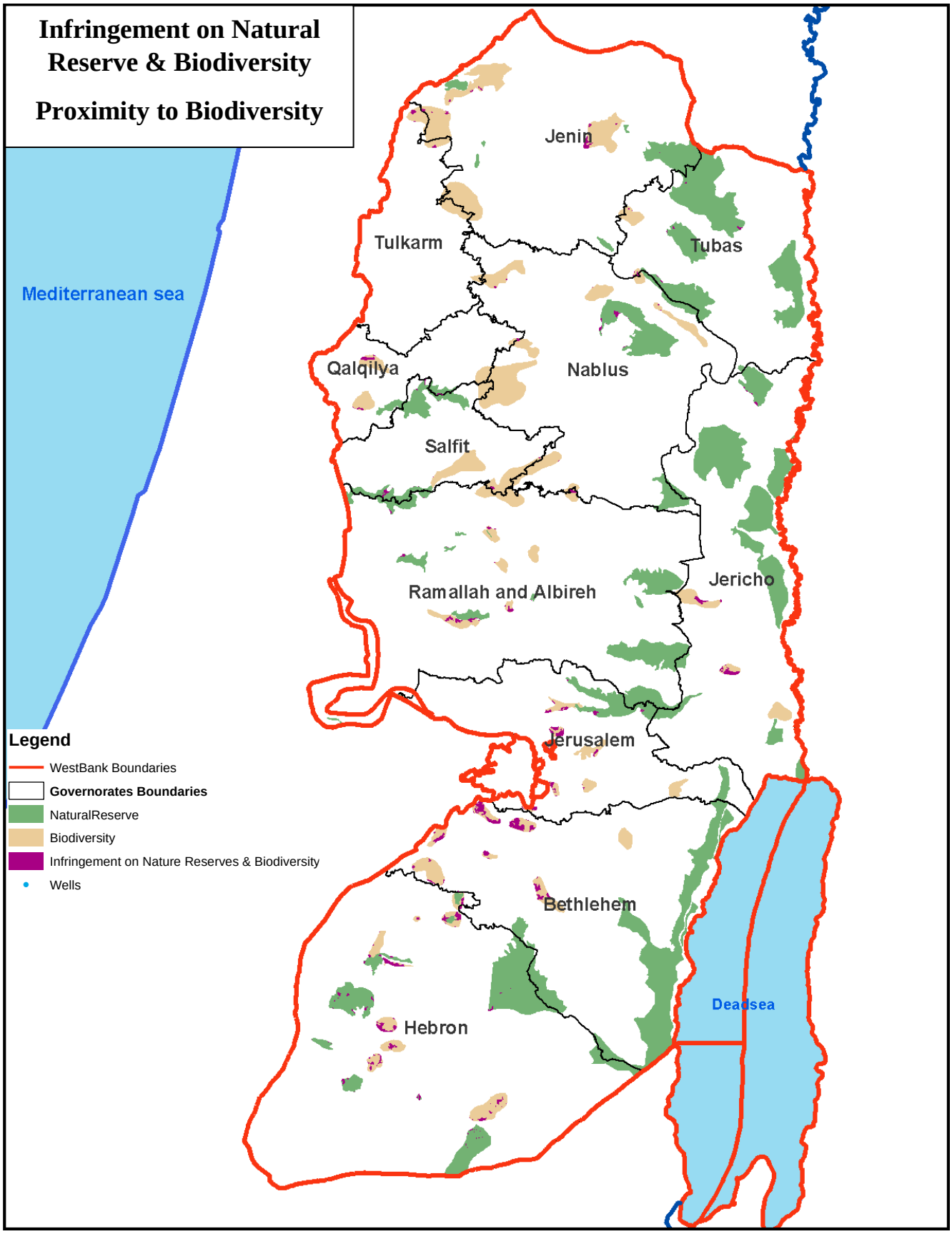
Map 10 Average Temperature in Westbank

Map 11 Agricultural land Value in Westbank

Map 12 Land Sensitivity in Westbank



Map 13 Seismic Factor in Westbank



Map 14 Infringement on Natural Reserve & Biodiversity in Westbank

- **Soil Type:** Soil is considered as one of the most important natural resources, the majority of Westbank has clay soil which is suitable for agricultural uses as map 5 shows.

- **Groundwater Inventory:** The west basin has the most amount of the groundwater which makes the west side of it rich of water as map 6 shows. We can notice from the Figure 5 that cities which are located in the west basin have great amount of ground water except Jericho which lies in the eastern basin but also has the highest rates of groundwater inventory.

- **Wells' Use:** As I mentioned before the west basin has the majority of wells & springs as map 7 shows, but at the other side Jericho has the most wells although it lies in the eastern basin

- **Wells' & Springs' Production:**
- **Water Evaporation:** The highest rates of water evaporation are in almost in Jericho due to its geographic location.

- **Average Temperature:**
- **Agricultural Land Classification:** The northern region of Westbank has the highest potential for agricultural uses due to the high land value for agricultural use as shown in map 11.

- **Land Sensitivity:** It's considered as the most important point to take into consideration to conserve the environment, as we can see from map 12 the western side of Westbank is extremely sensitive to pollution of ground water.

- **Seismic Factor:** As we can see from map 13, the eastern part of Westbank is risky and requires special regulation to avoid any natural disaster could happen.
- **Infringement on Natural Reserve & Biodiversity:** As we can see from map 14 the Southern region is the most region that affected from violation on natural reserve & biodiversity.

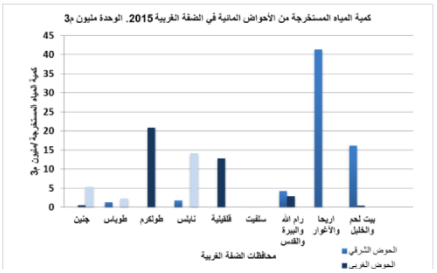


Figure5 Average Production of basins

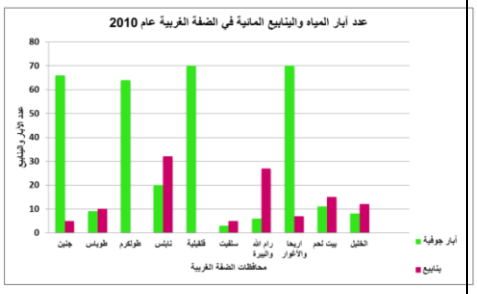


Figure6 Number of Wells & Springs in Westbank

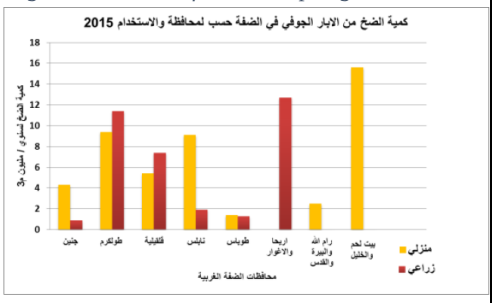


Figure7 Average well production in Westbank

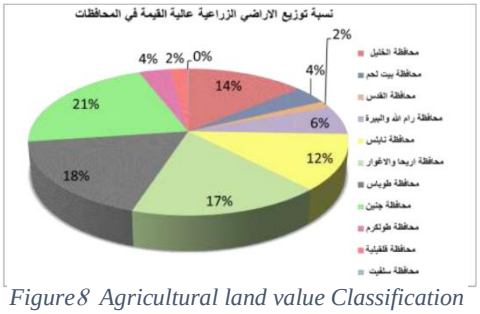


Figure8 Agricultural land value Classification

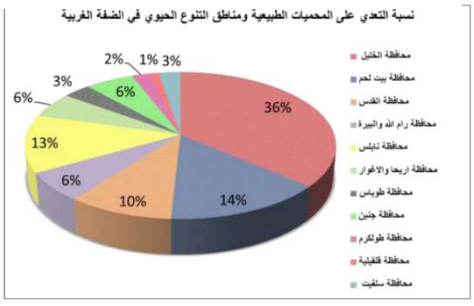
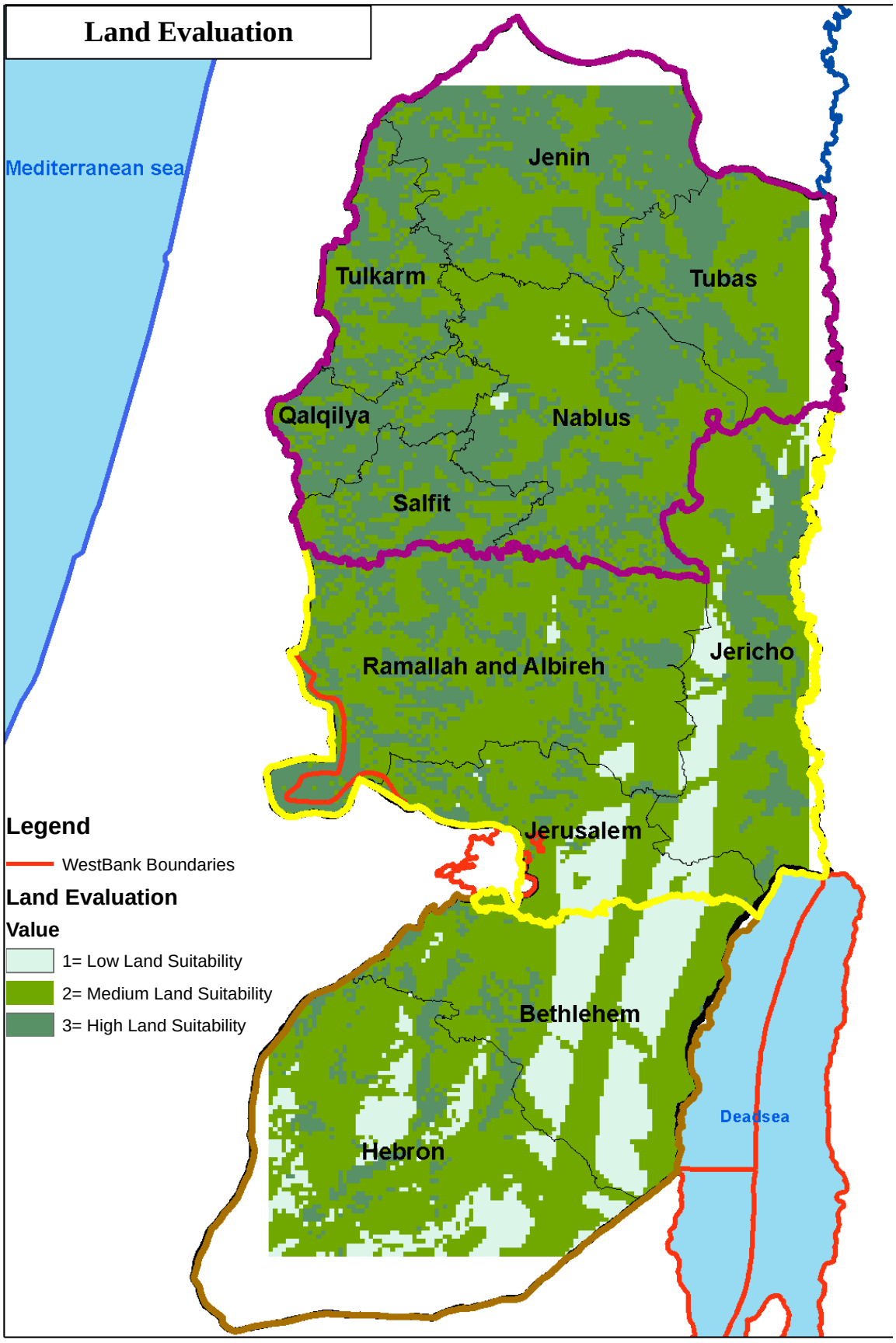


Figure9 Percentage of infringement on biodiversity & Natural reserve



Map 15 Land Evaluation in Westbank

Land Evaluation: After setting up and examining the criteria, we need to know which region & governates are the most suitable & have the highest potential for Eco-city, so the previous criteria lead us to choose the northern region due to its high potential as shown in map 15 which reflects the all criteria together in one map that make the suitability of the land clear to us.

4.2 Site Selection on Micro-Scale

Component	Criteria
Form	• Applicability the Concept of Compact City (Density) • Availability of open spaces
Natural Elements	• Availability of Natural Elements • Accessibility to biodiversity for recreation • High sensitivity of pollution
Economy	• Availability of agricultural lands • Existing potential for Agro-industry
Transportation	• Acceptable slope of streets • Applicability of walkability

There are different criteria will be set up on the micro-scale, their importance lies to ensure a safe interaction between the city and its surrounding environment and to ensure applying the concept of the Eco-City in the city and it's principles properly.

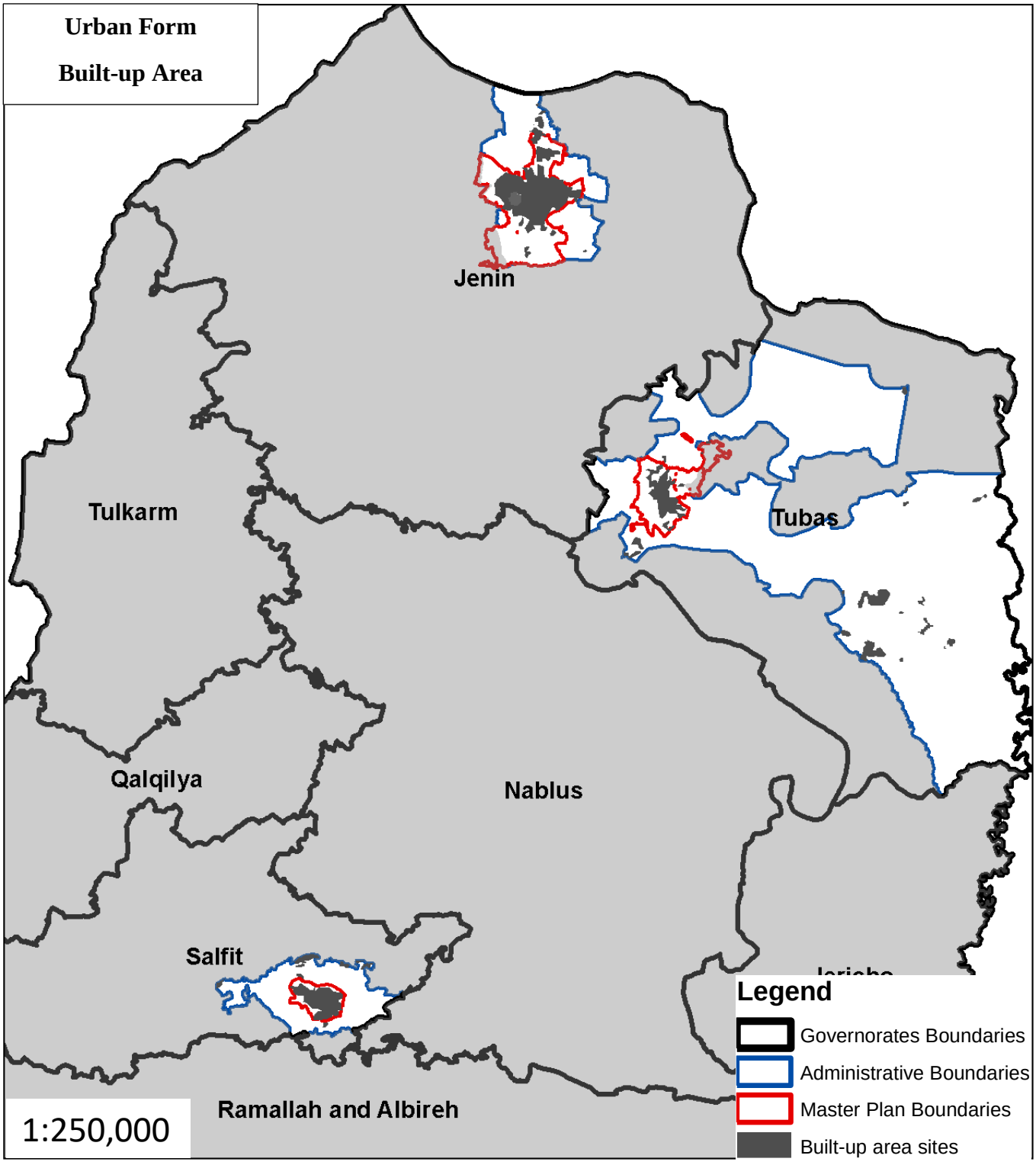
These criteria summarized in the following table:

Table 1 Criteria on Micro-Scale

So that as long as these criteria are available in the city the more the Eco-City we can achieve the Eco-City principles.

The three cities that I will compare between are Jenin, Tubas and Selfit to choose the city with the highest potential.

4.2.1 Urban Form



Map 16 Built-up area in Jenin & Tubas and Selfit

As map 16 shows, both in Jenin & Tubas there's a concentration of built-up area, this concentration is clearly in the center of the master plan boundaries starting from the old town of the city ending up with the outskirts of the city. We can notice in Jenin that Jenin camp plays a main role in the density there because it lies within the city boundary and makes huge pressure on the services and infrastructure there. As we can see from the graph 10 that only 44% master plan area is built-up which can give us an indication to the possibility for future expansion there.

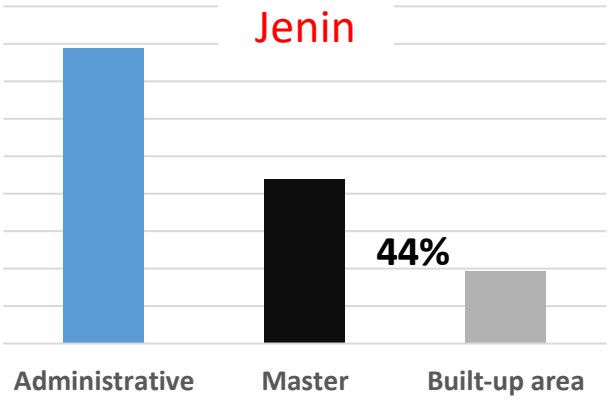


Figure 10 Built-up Area Percentage in Jenin

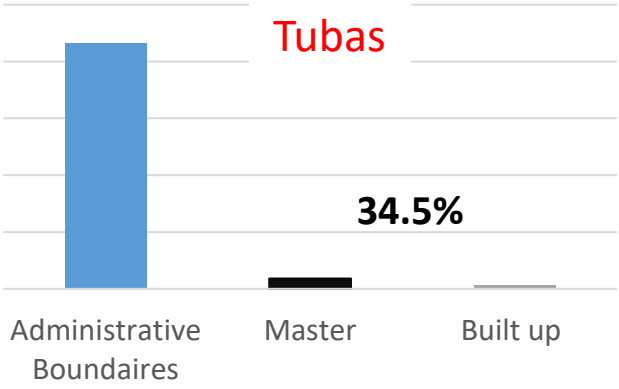


Figure 12 Built-up Area Percentage in Tubas

In Tubas as we can see from the graph 11 and map 16 the built-up area is still less than Jenin which the percentage of the built-up area reaches 34.5% and all the built-up area is concentrated in the center of the master plan boundaries with no built-up area in the outskirts due to many reasons like Topography and availability of services. We can also notices that the administrative boundaries are always larger than master plan in a way that could accommodate the future expansion of the city in different ways and sides.

As Figure 12 shows that in Selfit the situation is different because difference between the master plan area and the built-up are almost the same which gives us an indicator that current distribution of the building are in different ways and sides of the master plan boundaries as map 16 shows and there are a lot of barriers in the expansion there we will discuss them later in this report.

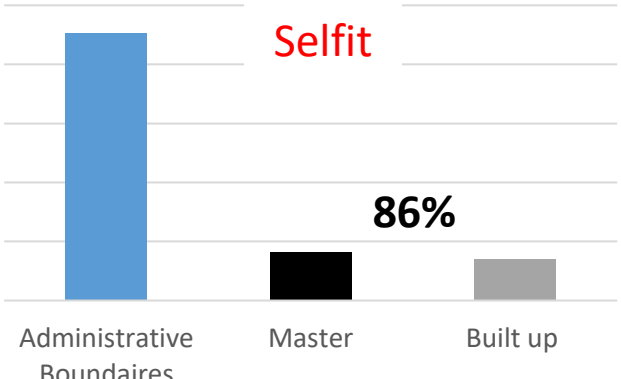
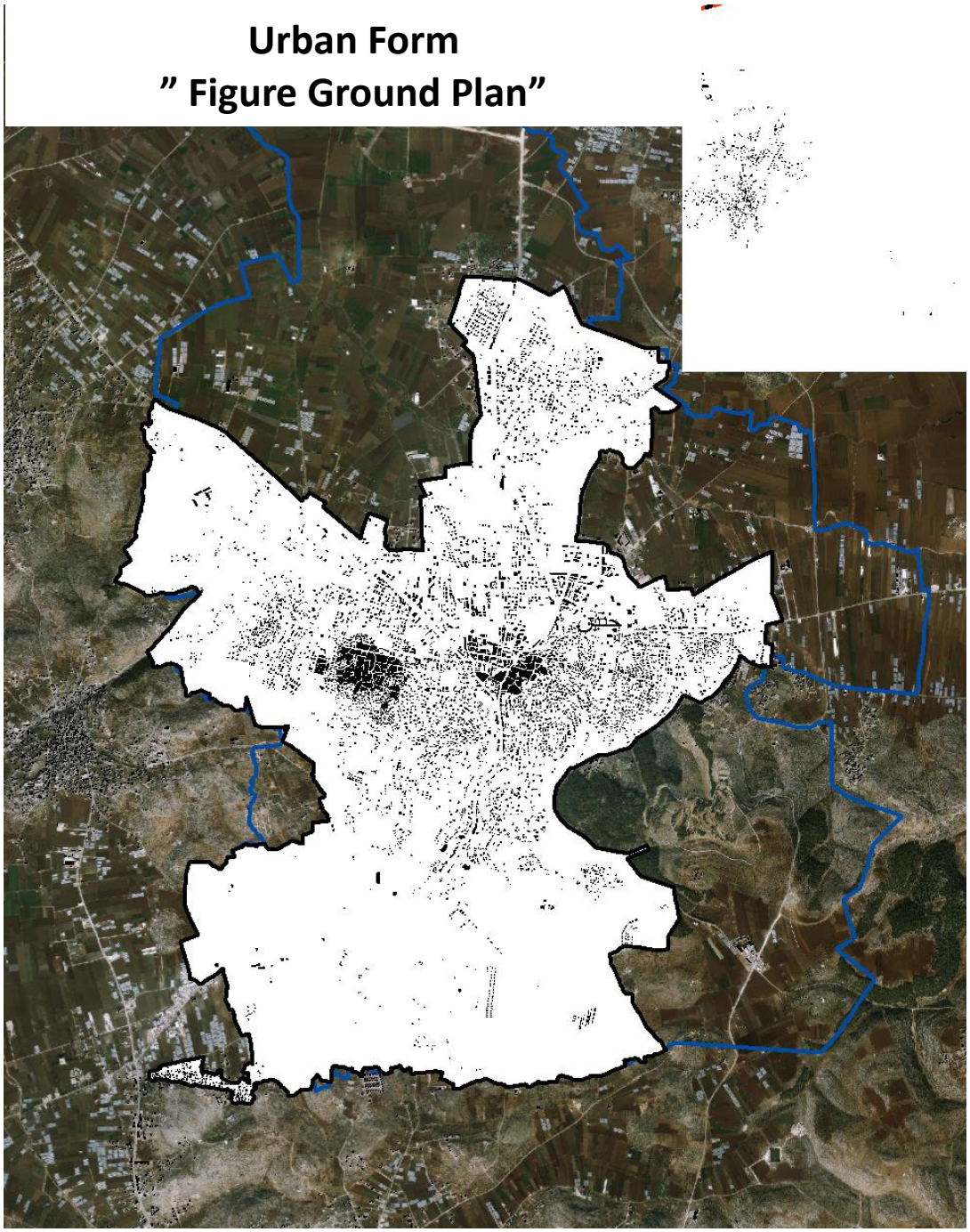
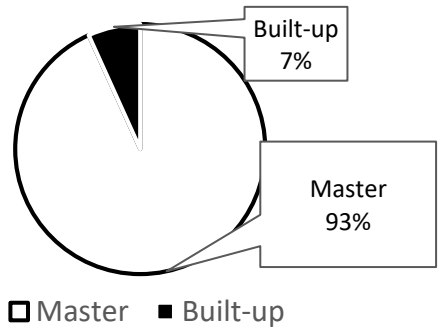


Figure 11 Built-up Area Percentage in Selfit



Map 17 Figure Ground Plan in Jenin

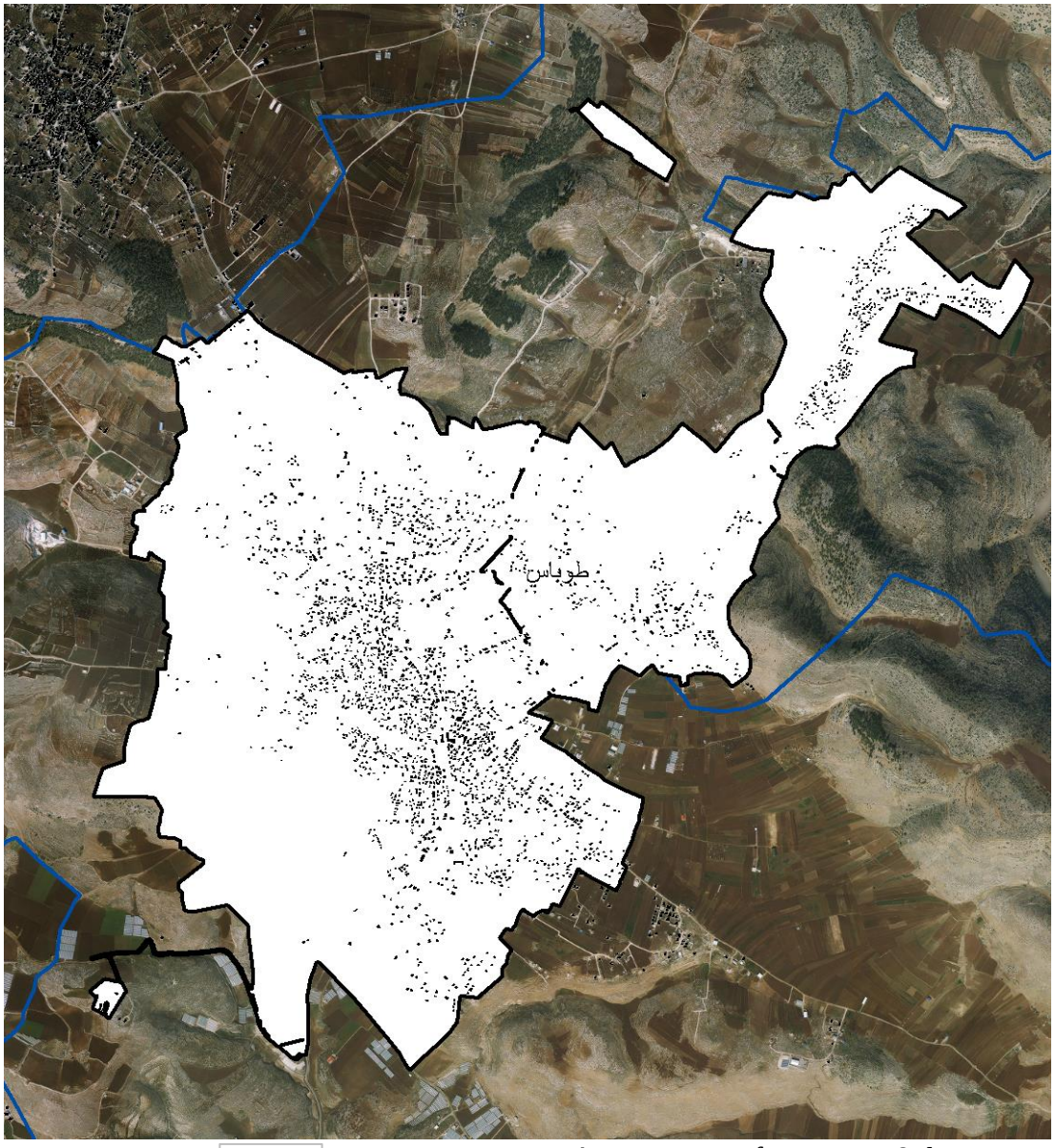


As map 17 shows, that the concentration of buildings are clearly in Jenin camp and in old town of Jenin, but there is still open spaces in the city regardless its type if it’s private or public. The percentage is still 7% which is very slight

Figure 13 Percentage of Built-up area in Figure Ground Plan

Urban Form
” Figure Ground Plan”

Map 18 Figure Ground Plan in Tubas



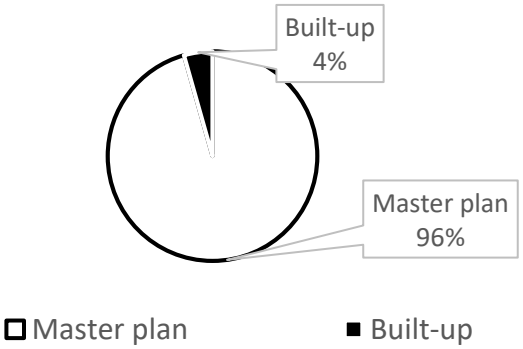
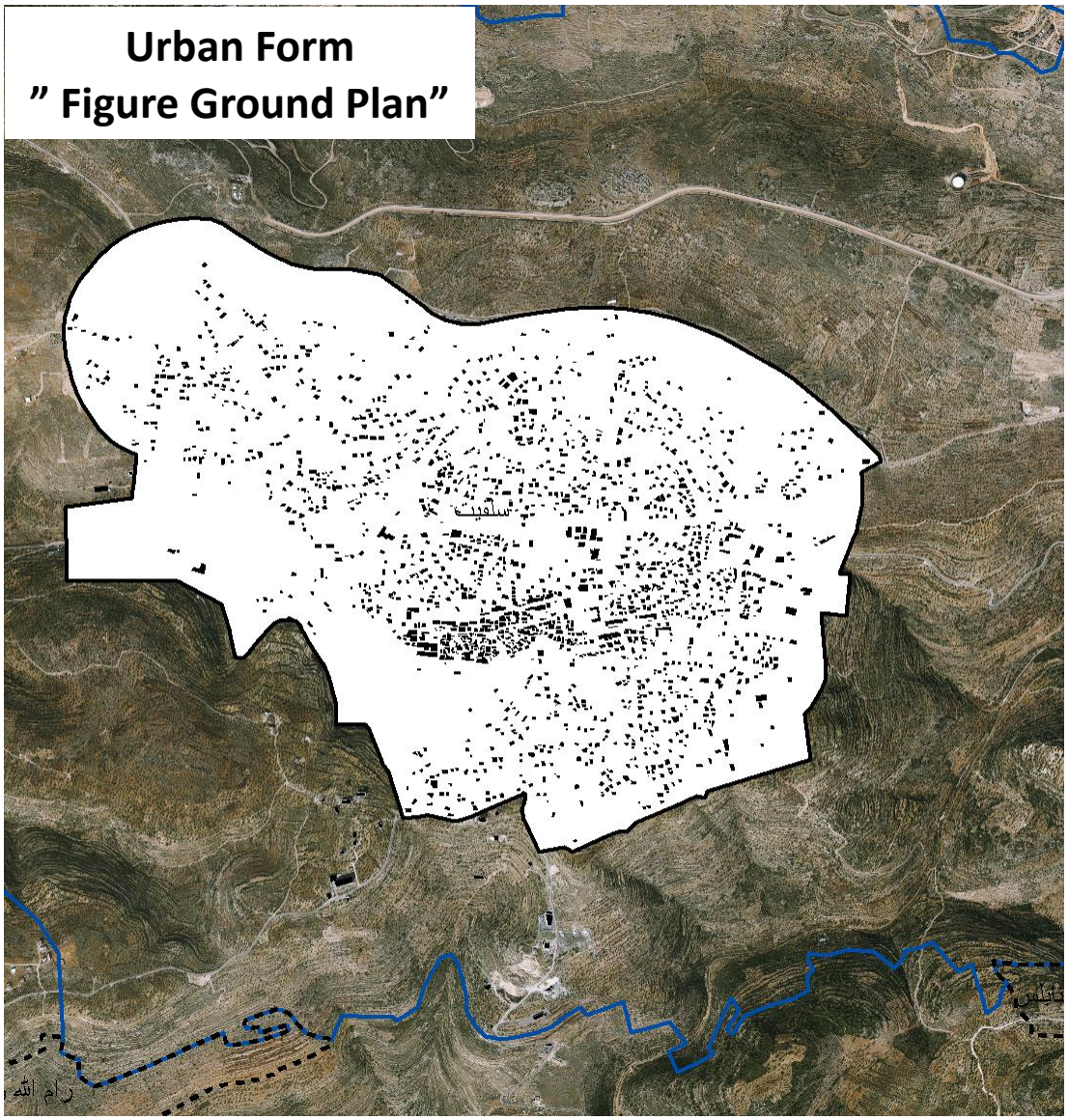
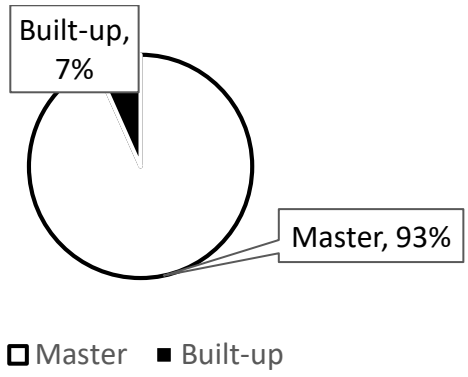


Figure 14 Percentage of Built-up area in Figure Ground Plan

As we can see from map 18 that there's no concentration of buildings in Tubas due to the absence of Refugees camps in the city which directly lower the percentage of the built-up area to 4% as we can see from Figure 14 and we can notice large open areas in the city could give us an indicator about its agricultural character.



Map 19 Figure Ground Plan in Selfit



Although the built-up area in Selfit high compared to Jenin and Tubas, the open spaces in Selfit is still very good indicator as we can see from the figure 15 about its potential to make green spaces as map 19 shows, So Selfit has the highest potential to bea compact city due to the distribution of buildings and the exist potential for green open spaces

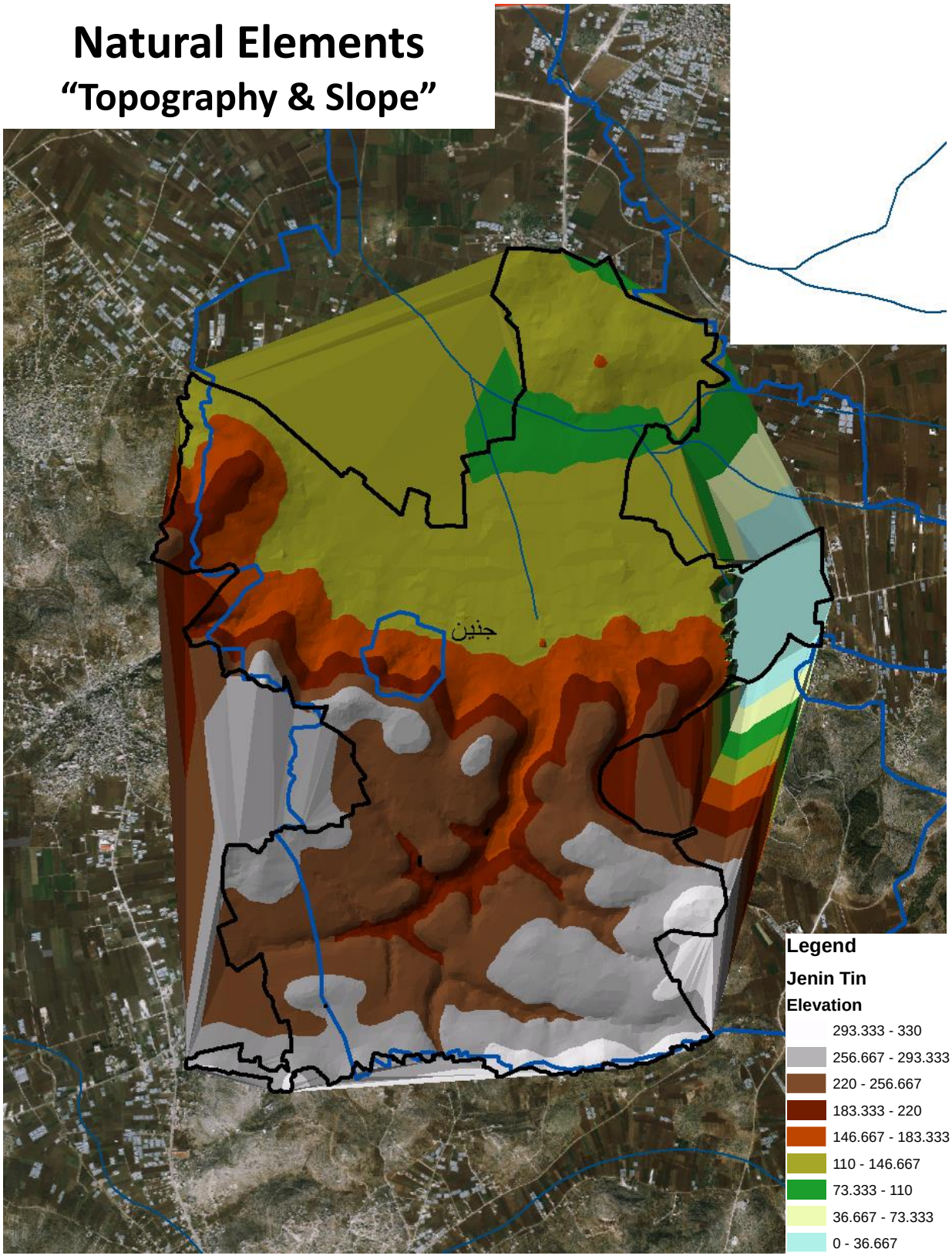
Figure 15Percentage of Built-up area in Figure Ground Plan

4.2.2 Natural Elements

In this topic we are going to examine some specific natural elements and compare between the three cities to know which city has the most of these elements.

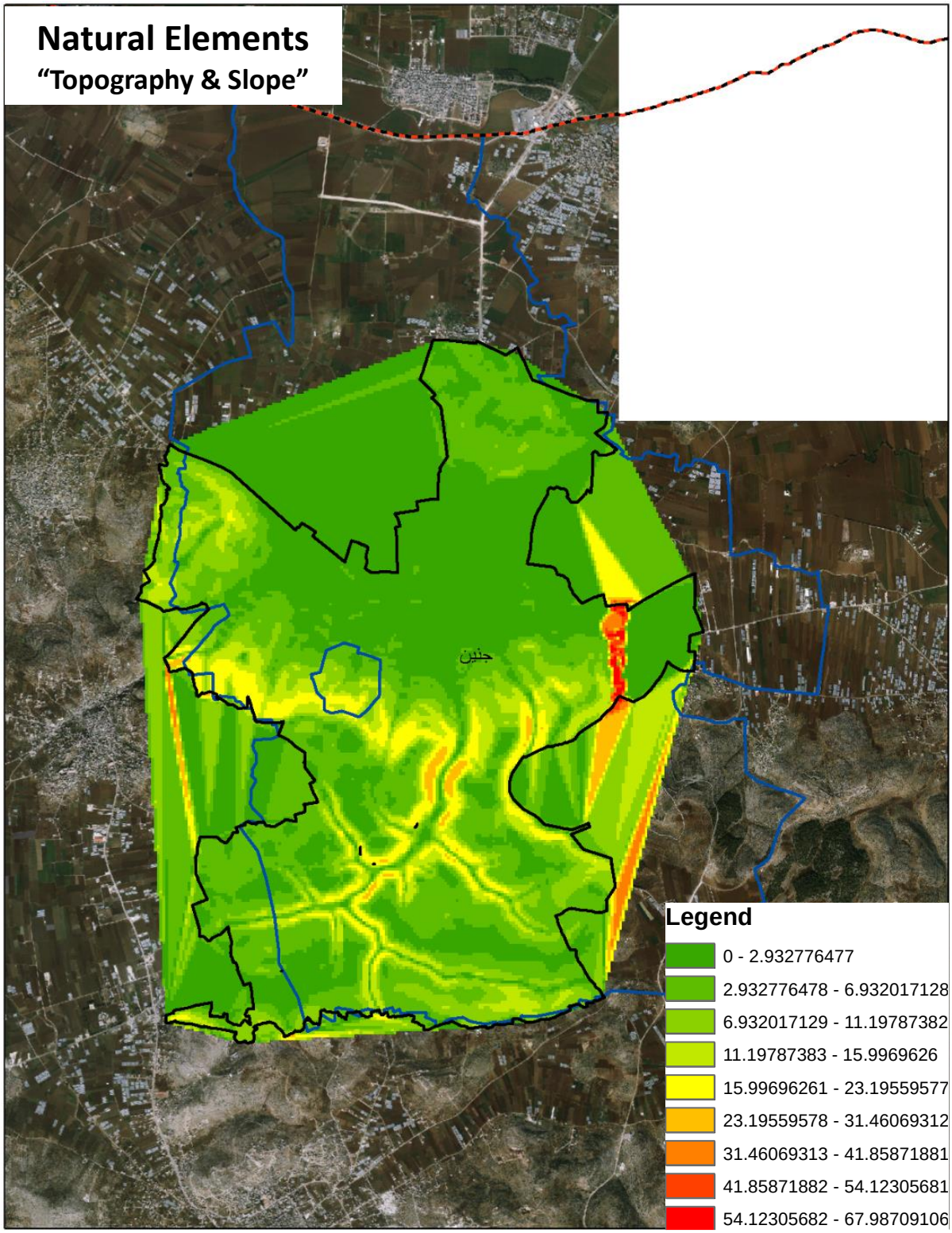
These Elements are:

- Topography & Slope
- Biodiversity
- Natural Reserve
- Wells & Springs
- Agricultural land
- Land Sensitivity



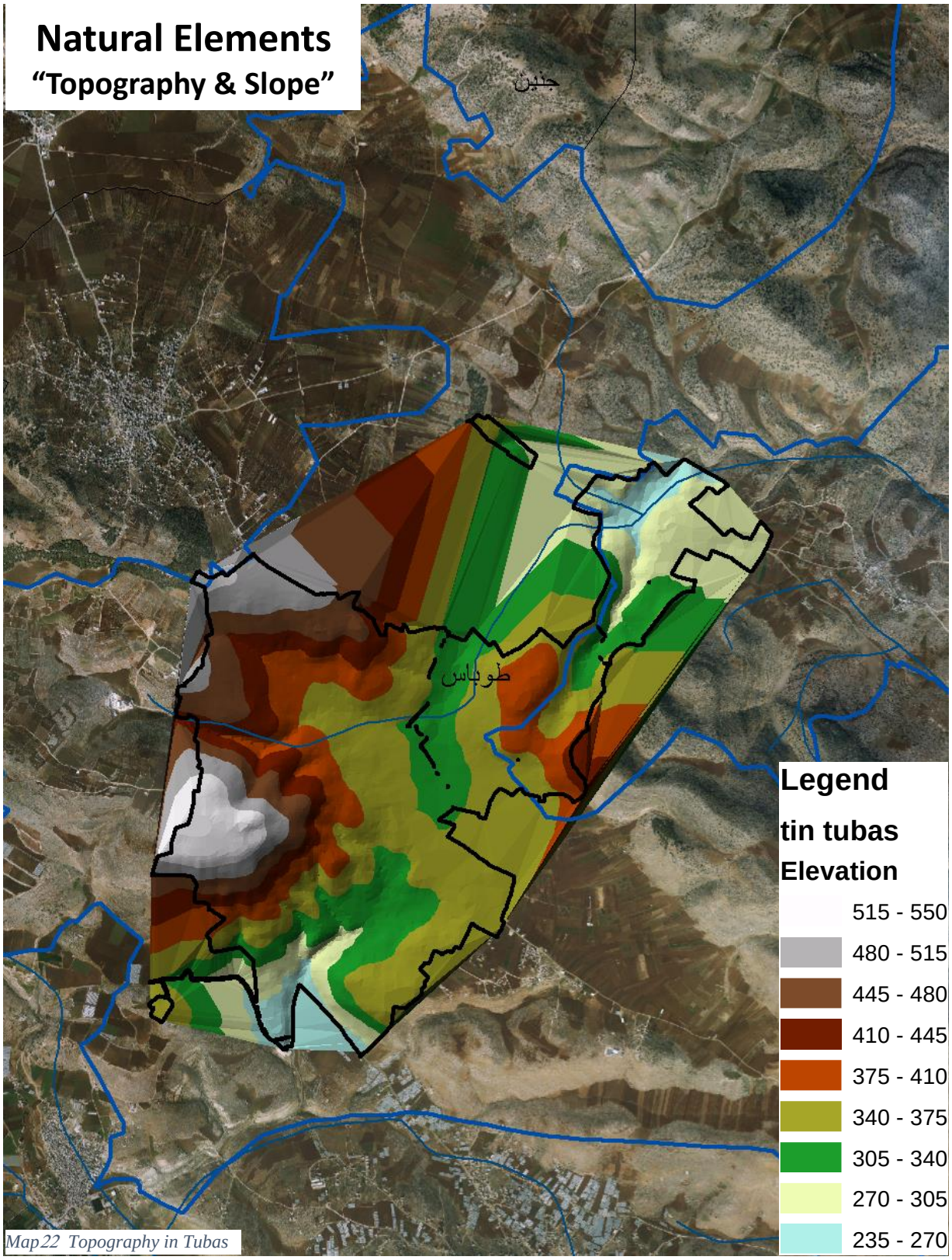
Map20 Topography in Jenin

As we can see from map 20 that the difference of the highest and the lowest point in Jenin is 330 meter.



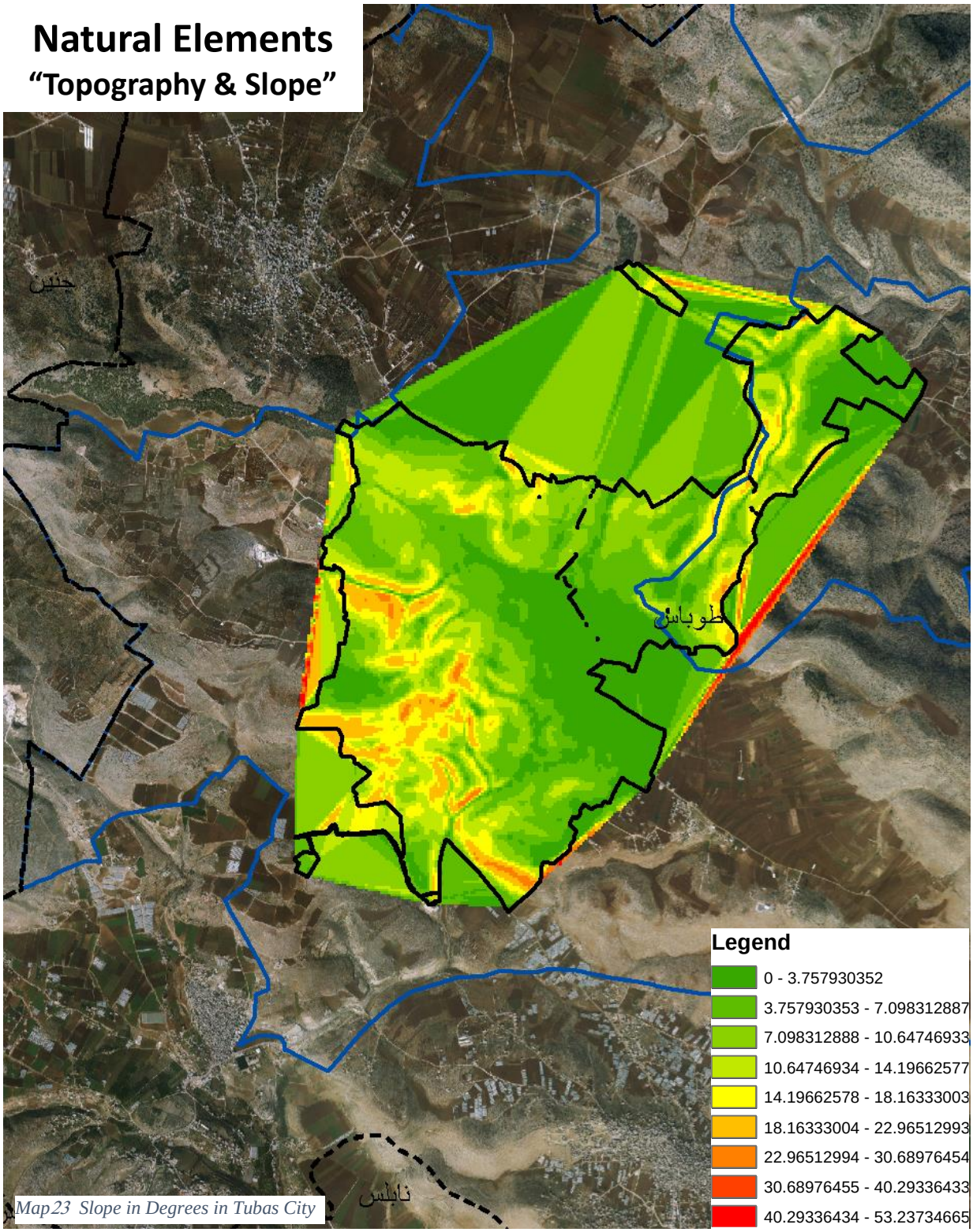
Map 21 Slope in degrees in Jenin

Jenin is known as a flat city due to the uniform slope of its streets and map 21 proves that the slope of city is almost easy and not hard.



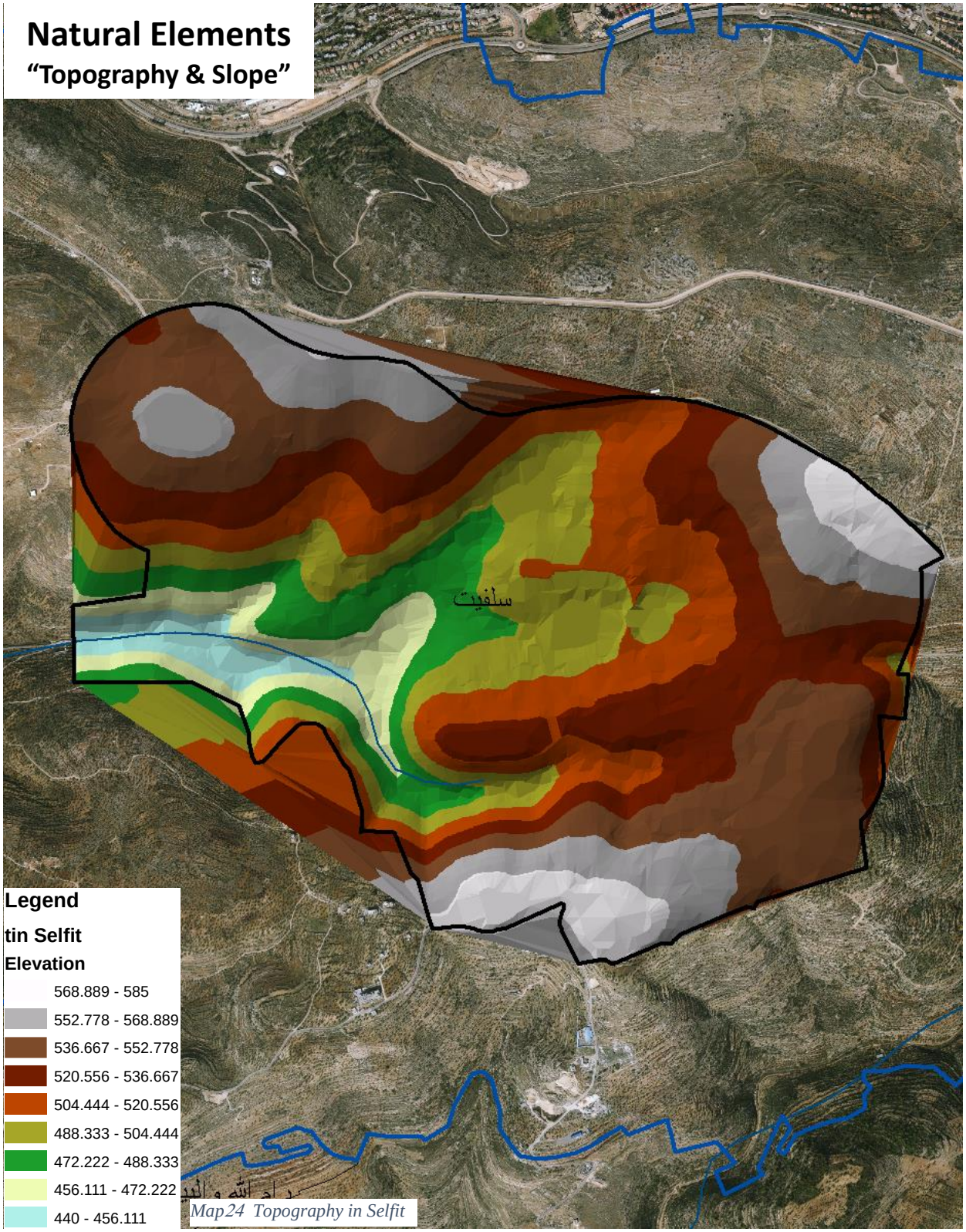
Map22 Topography in Tubas

In Tubas the difference between the highest and the lowest point is 297 meters which the lowest point was on height 235 and the highest point was in 550 meters above mean sea level and the difference is clear between Tubas & Jenin if we notice the map 22 above.



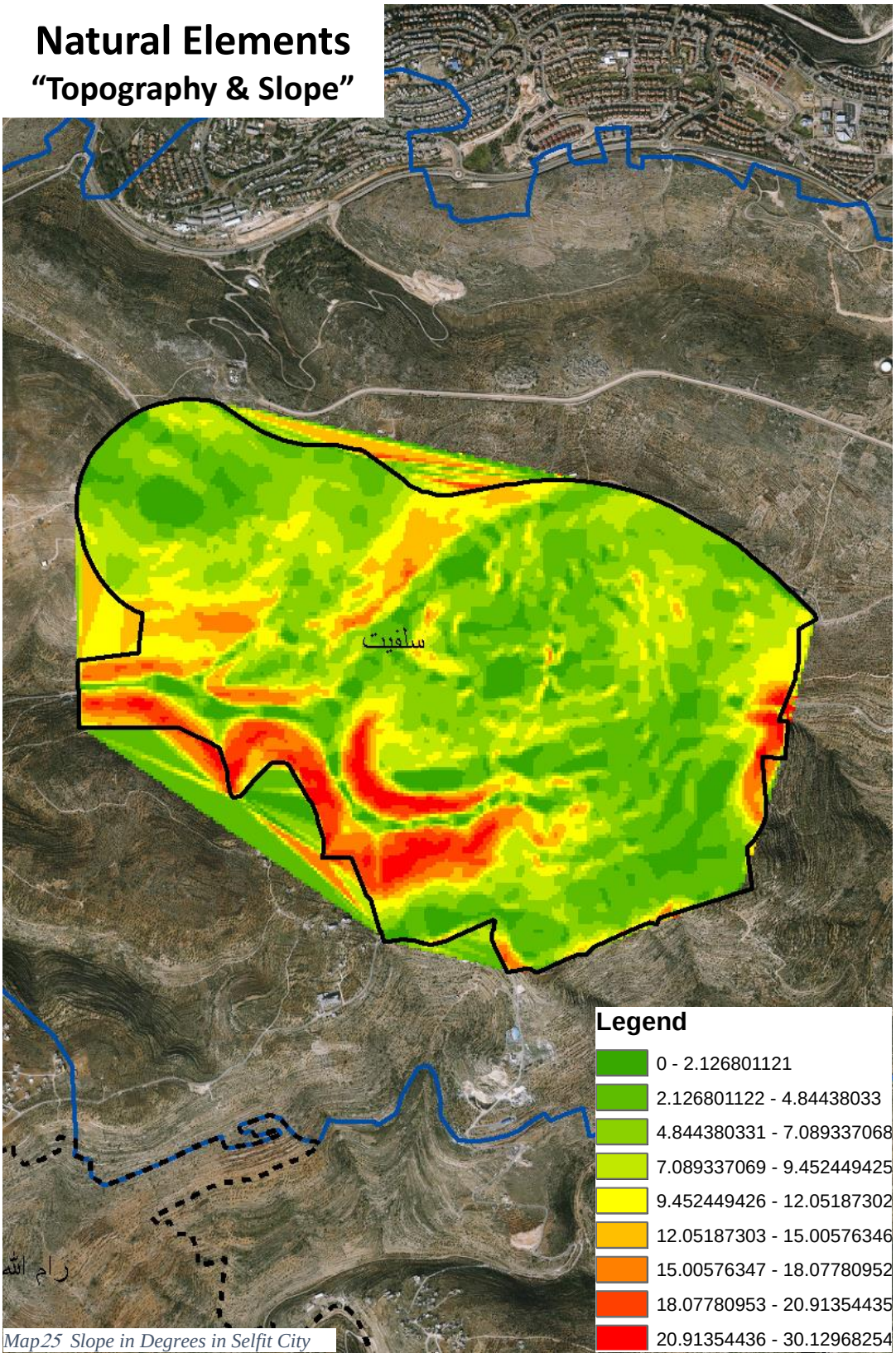
Map23 Slope in Degrees in Tubas City

That difference of levels affects directly on the slope of the city so we can clearly notice that the slope in Tubas is harder a bit than Jenin which can makes the walkability in the city harder in some areas, but in general it still acceptable within the city boundary.



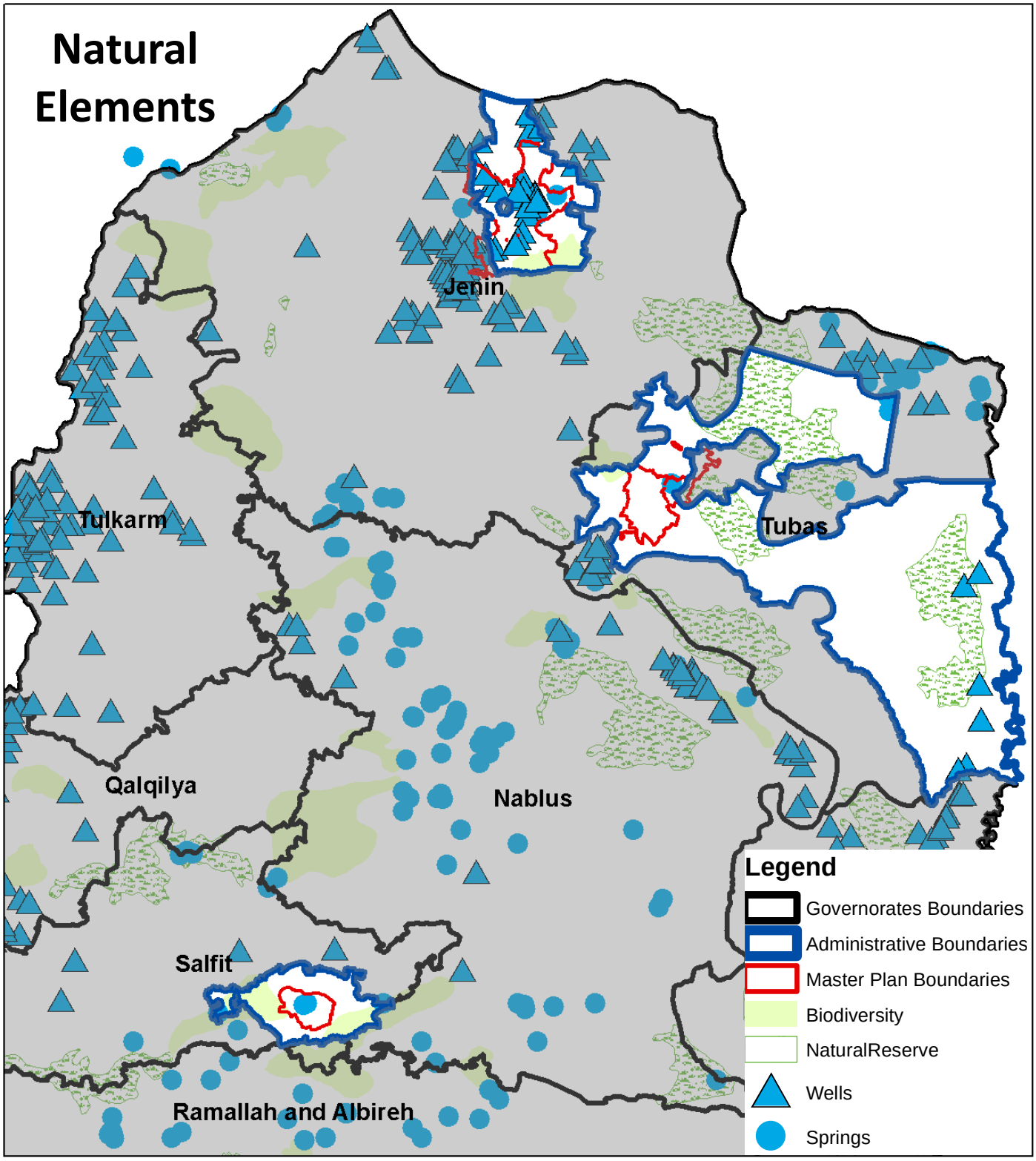
Map24 Topography in Selfit

The difference of levels between the highest point the and the lowest point in Selfit city is 100 meters which is lower than Jenin & Tubas.



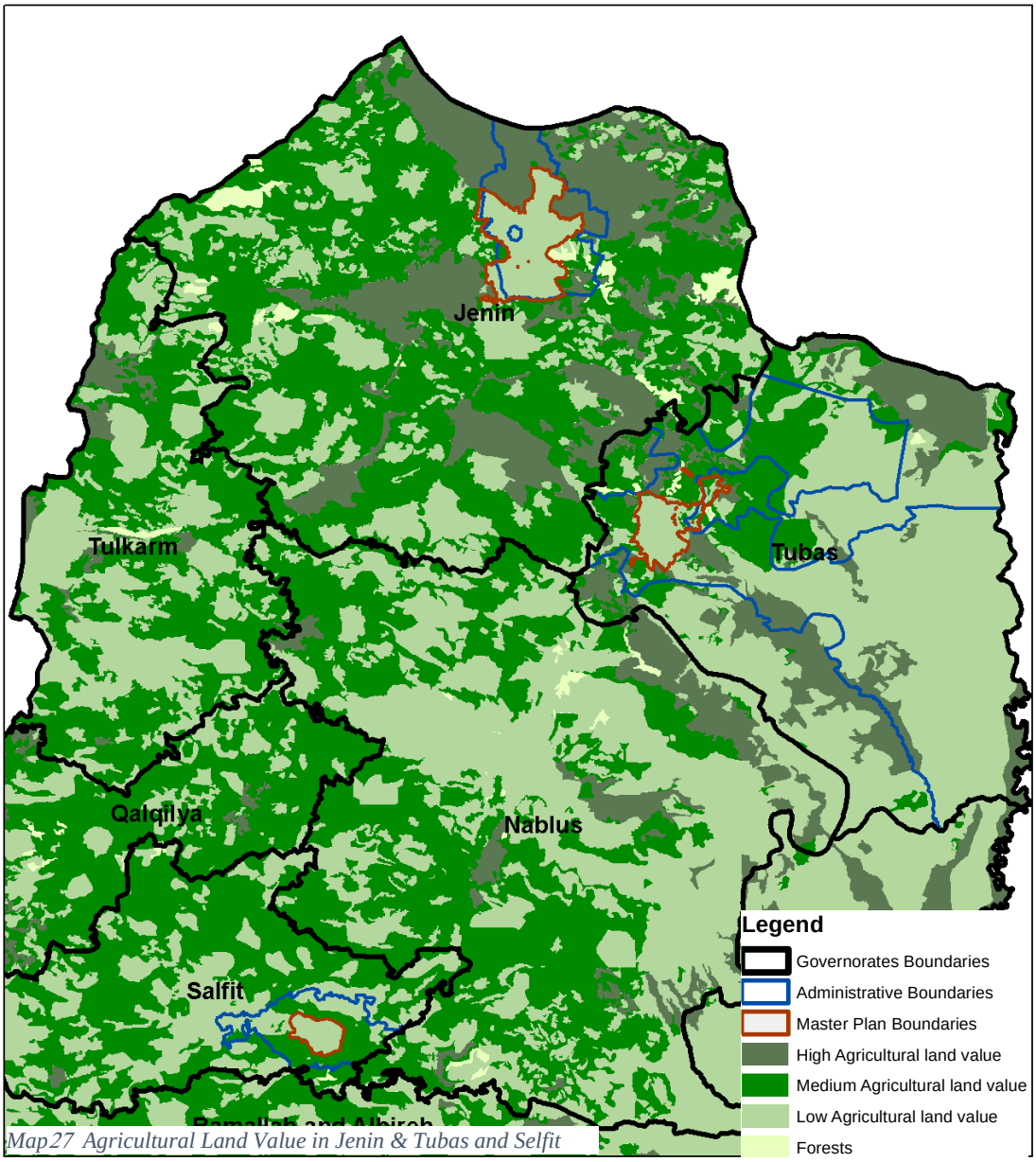
Map25 Slope in Degrees in Selfit City

In selfit city the high slope is concentrated in the southern side of the city and the rest of the city has no high slope which is a very good indicator for walkability. In map 25 we can notice that the highest degree of the slope is 30 which is still not that high too.



Map 26 Natural Elements in Jenin & Tubas and Selfit

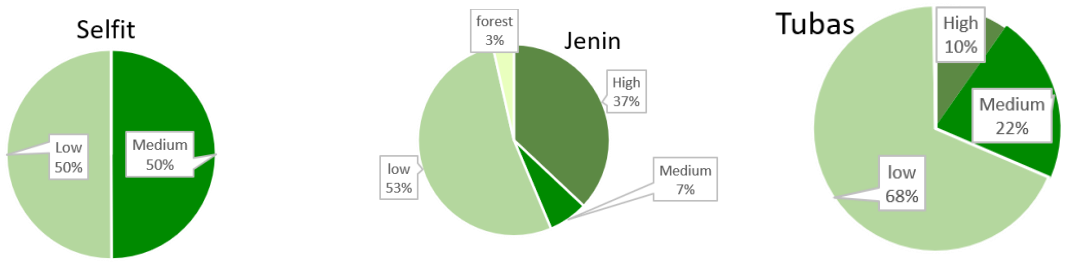
We can notice from map 26 that the concentration of well and springs are clearly in Jenin but in Selfit we can notice large areas of biodiversity with a humble existence of springs in the city.

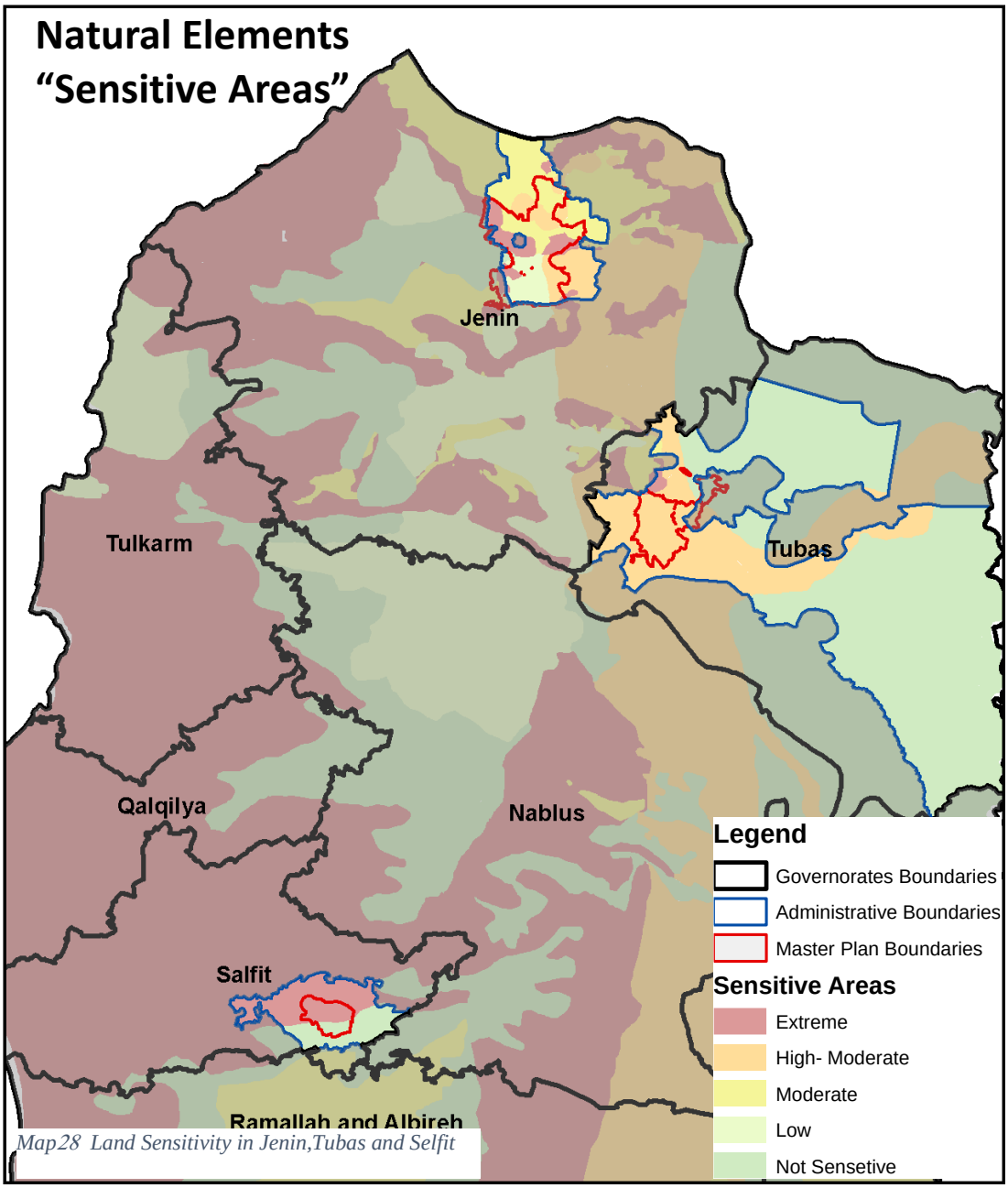


Map27 Agricultural Land Value in Jenin & Tubas and Selfit

Within the administrative boundaries we can notice that Jenin city is the only city that has high value of agricultural land but in Selfit we can see large areas of medium value of agricultural land which is considered as an opportunity to expand under the title of agriculture. As shown in map 27 and figure 16.

Figure 16 Percentage of each land value in each city





Map28 Land Sensitivity in Jenin,Tubas and Selfit

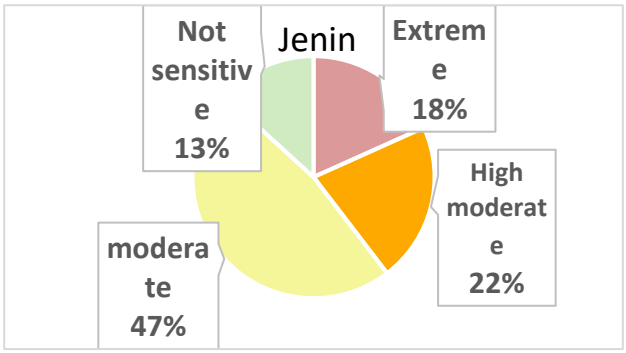
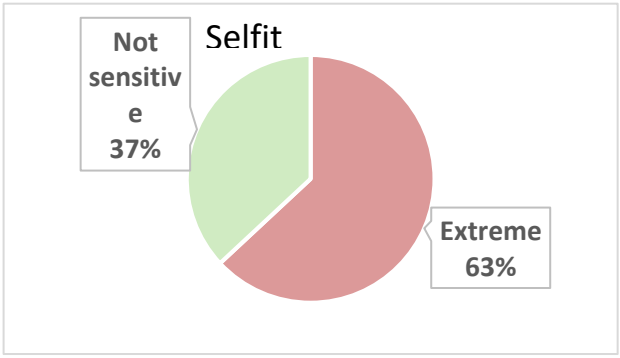


Figure 17 Percentage of type of Land sensitivity



As shown in Map 28 and figure 15 that Selfit is the most Sensitive city for ground water pollution which is very critical and require special attention and treatment.

Criteria	Weight	Mark	Weight	Mark	Weight	Mark
	Jenin		Tubas		Selfit	
Agricultural lands	1	4	1	2	1	3
Sensitive areas (Soil sealing)	1	2	1	3	1	4
Low Density	3	3	3	4	3	2
Open Spaces	2	2	2	3	2	5
Natural Resources	1	4	1	2	1	2
Biodiversity	1	1	1	2	1	3
Topography & Slope	2	4	2	2	2	3
Total		20		18		23

Table 2 Evaluation the current situation of the cities based on the Criteria

"SELFIT AS AN ECO-CITY"

After examining the all criteria in the three cities, I set the marks and weight as shown in table 2 and the highest potential is in Selfit city which has 23 points which makes it the city that I will do my analysis on it based on different criteria and components which is similar to some point to the previous criteria in macro-scale.

4.3 Site Analysis

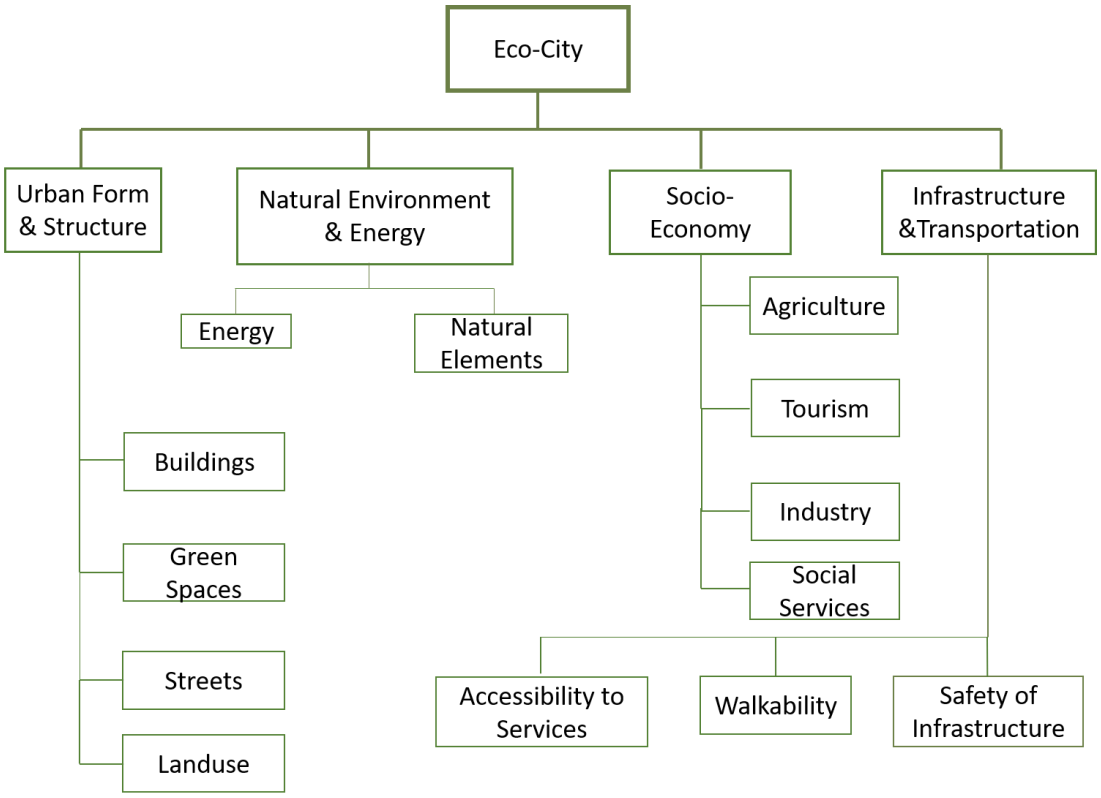
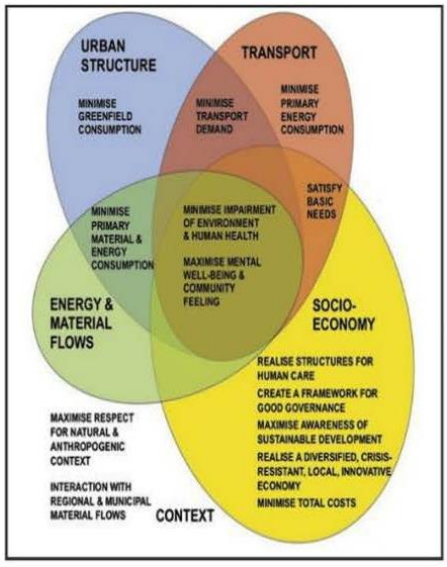


Figure 18 Site Analysis Flow chart

After choosing Selfit to apply the principles on it, analysis should be done based on four main components as figure 18 shows. The four components are:

1. Urban Form & Structure
2. Natural Environment & Energy
3. Socio-Economy
4. Infrastructure & Transportation

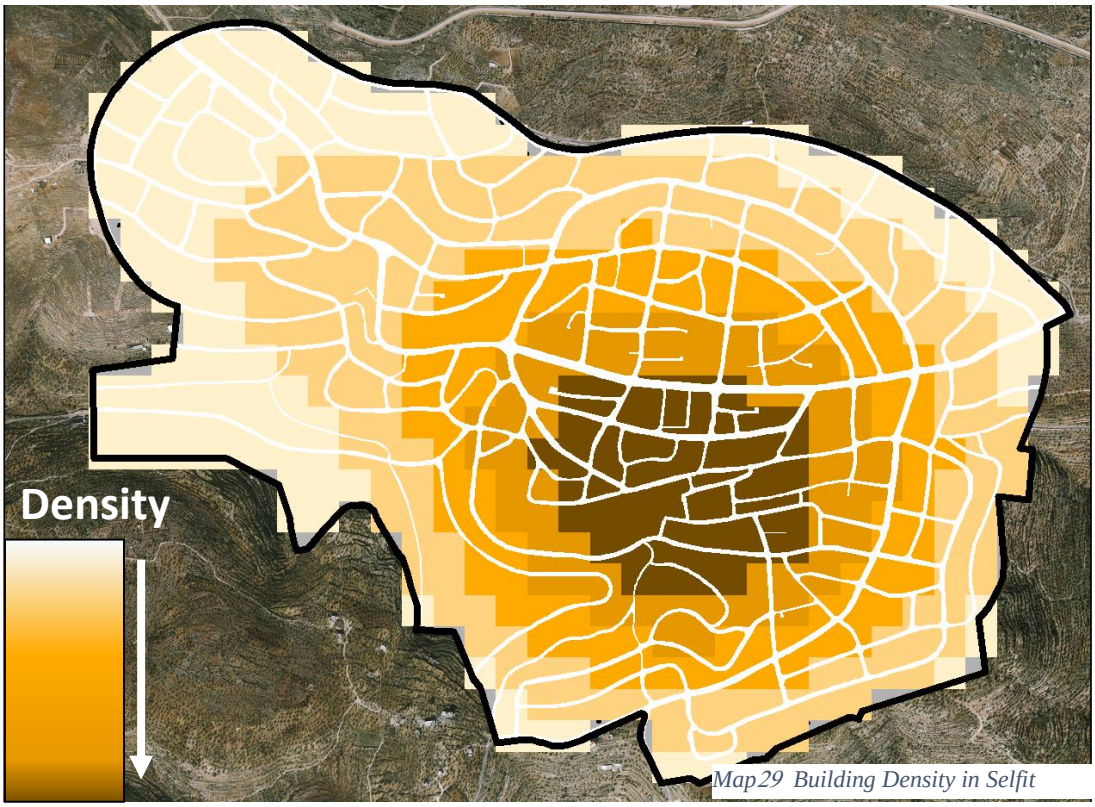


Principle	Component
Restore Degraded Land.	▪ Open & Green Spaces ▪ Landuse
Fit the Bioregion.	▪ Water ▪ Industry ▪ Buildings ▪ Waste Water
Balance Development.	▪ Urban Form & structure
Create Compact Cities.	▪ Urban Form & structure ▪ Transportation
Optimize Energy Performance.	▪ Natural Elements ▪ Buildings ▪ Transportation
Contribute to the Economy.	▪ Economy ▪ Landuse
Provide Health and Security.	▪ Services & Infrastructure
Encourage Community.	▪ Social (Community)
Promote Social Justice and Equity.	▪ Social Aspect (Activities)
Enrich History and Culture.	▪ Socio-Economy

Table 3 Ten principles of Eco-city and the related component

4.3.1 Urban Form & Structure

The urban development in idiom of locative and formal growth plays a vital role in realizing the eco-city concept. When Richard Register, the man who first defined the term 'Eco-City' visualized it, Richard considered it to be high density mixed use transit oriented developments. by Looking at the urban form and fabric of highly dense mixed use cities which have living and working within walking distance consume less energy and produce less co2 as compared to sprawling cities. The city of Barcelona can be considered as good example of the first type but on the other hand the latter one the latter one.

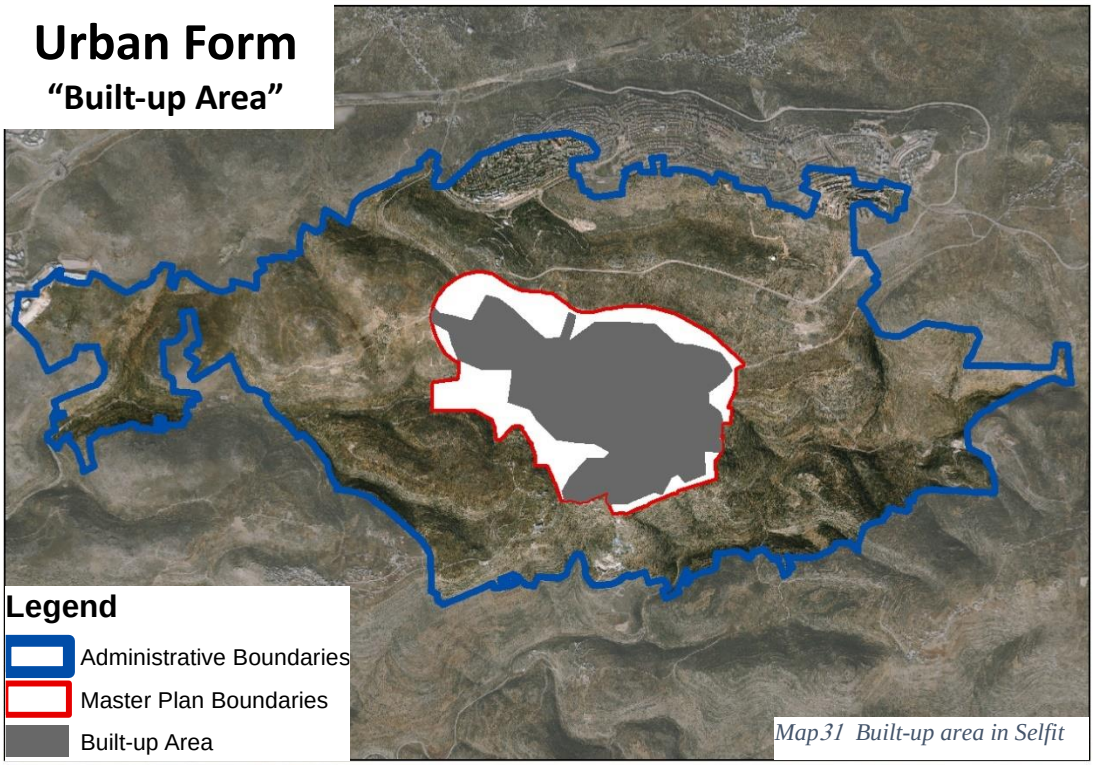


Map29 Building Density in Selfit

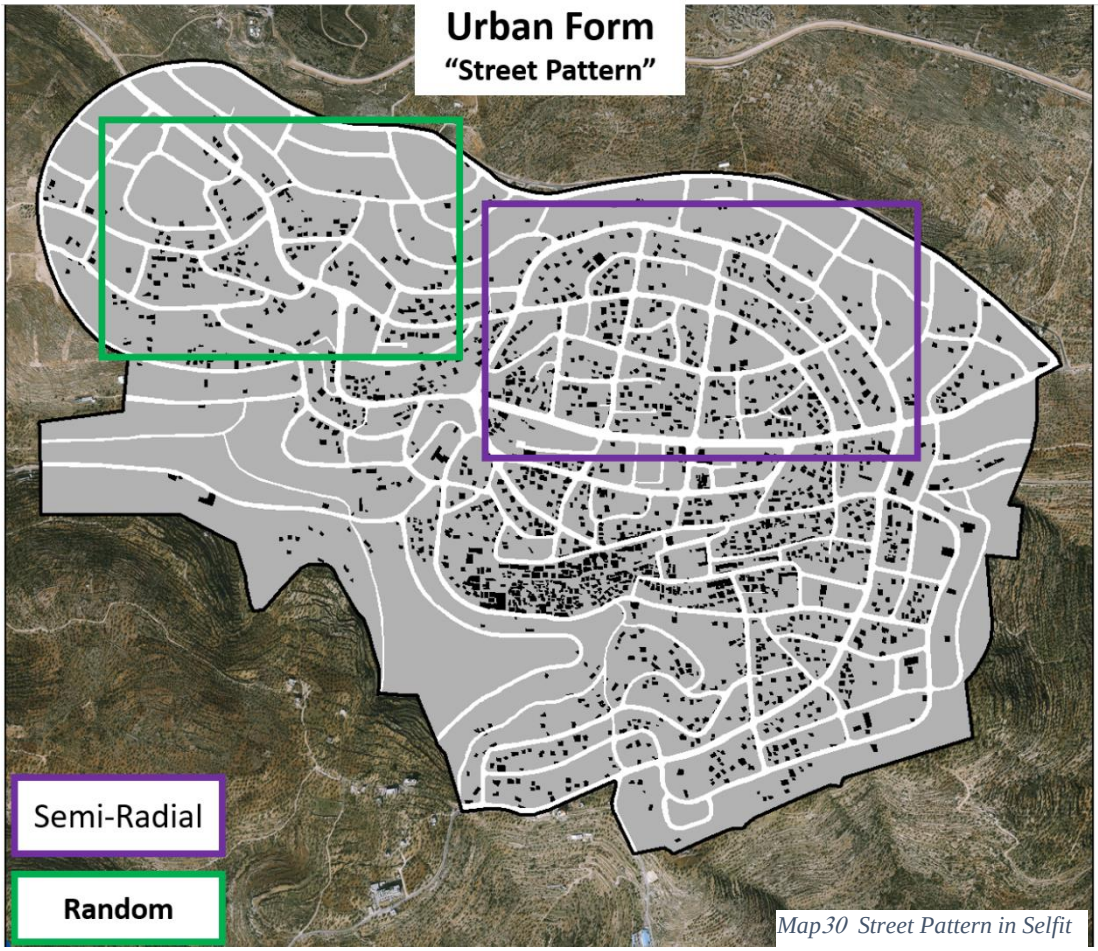
As we can see from map 29 highest density was in the center of the city where the old town is, then the density moves toward the western side of the city where there are less barriers & limitation of expansion.

In map 30 the built-up area is almost distributed in the all parts of the city.

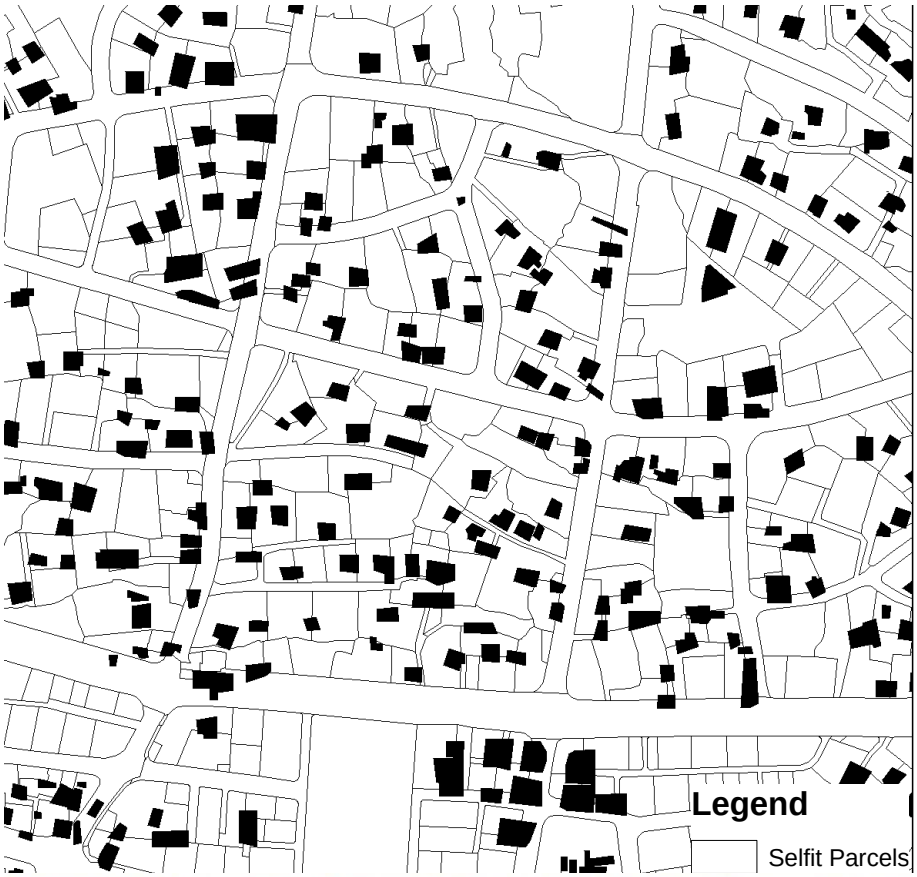
Map 31 shows the street pattern in the city which we can see clearly that in the middle of the city which was planned by the British mandate was about radial while the western side which is the new one is random with no clear pattern.



Map31 Built-up area in Selfit



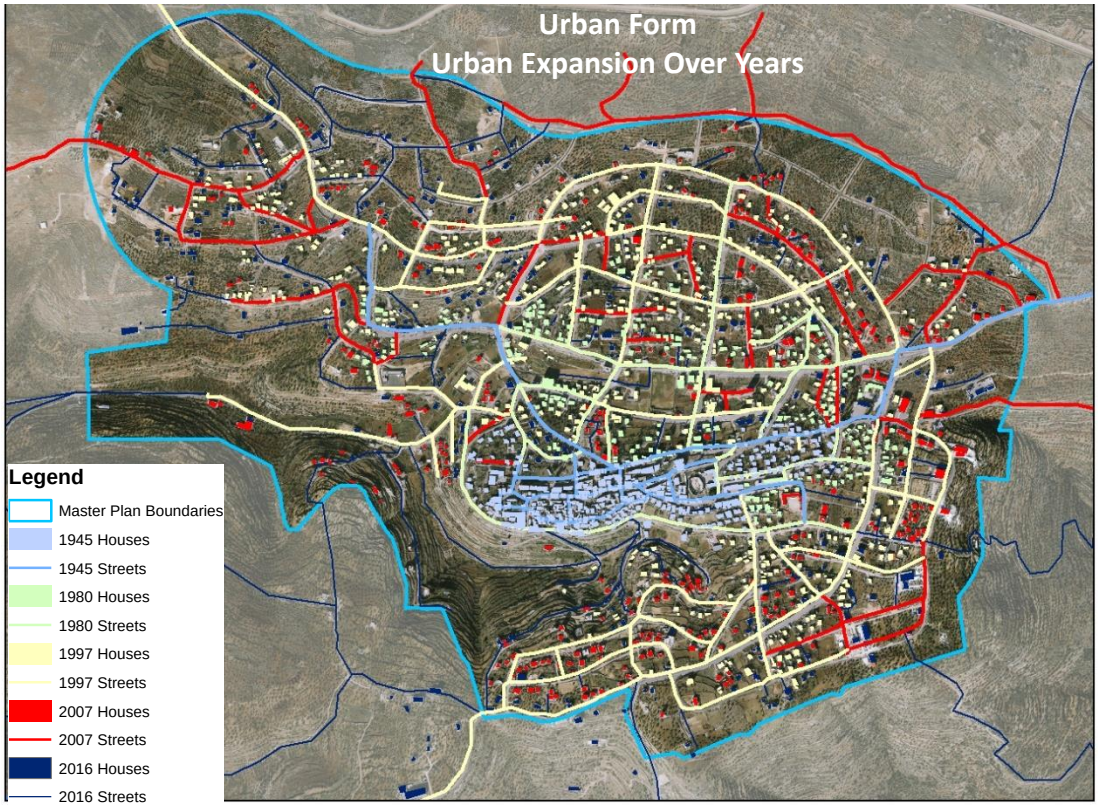
Map30 Street Pattern in Selfit



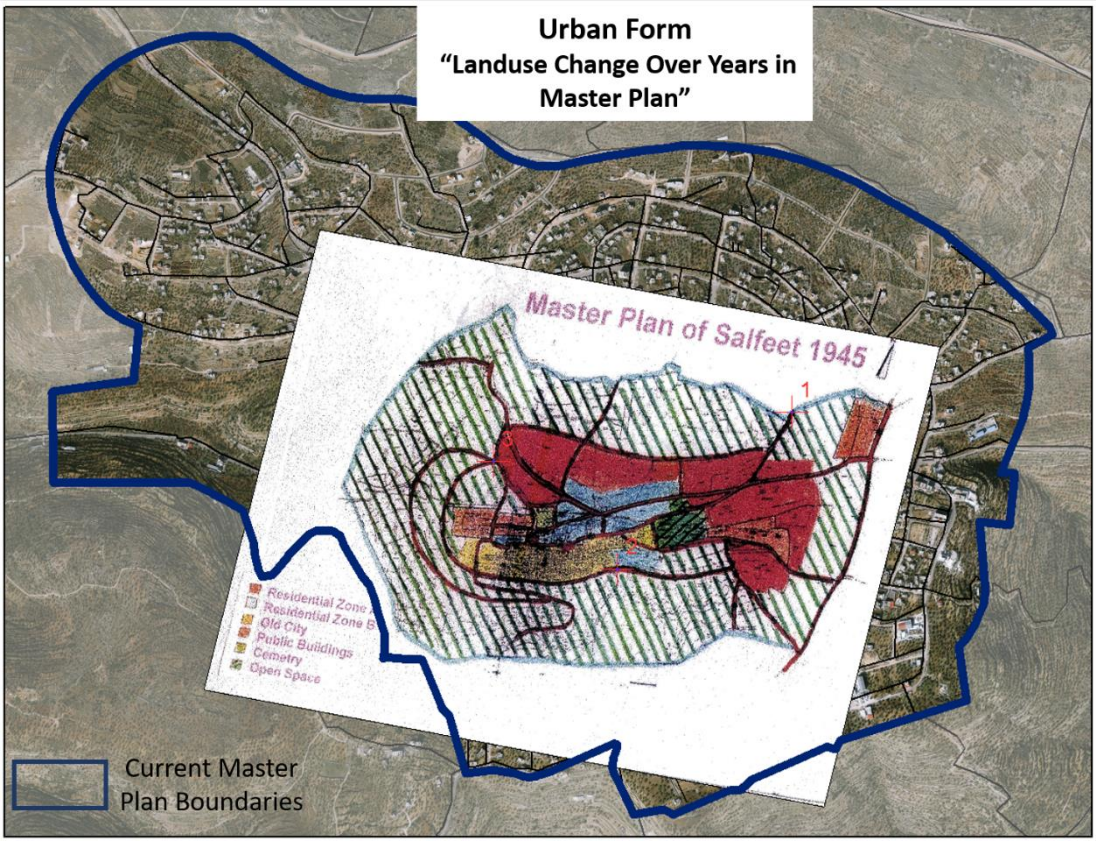
Map32 Parcels & Buildings Distribution in Selfit

Although Selfit city has high percentage of built-up area, it has continuous distribution of open green spaces and these open and green spaces could be private.

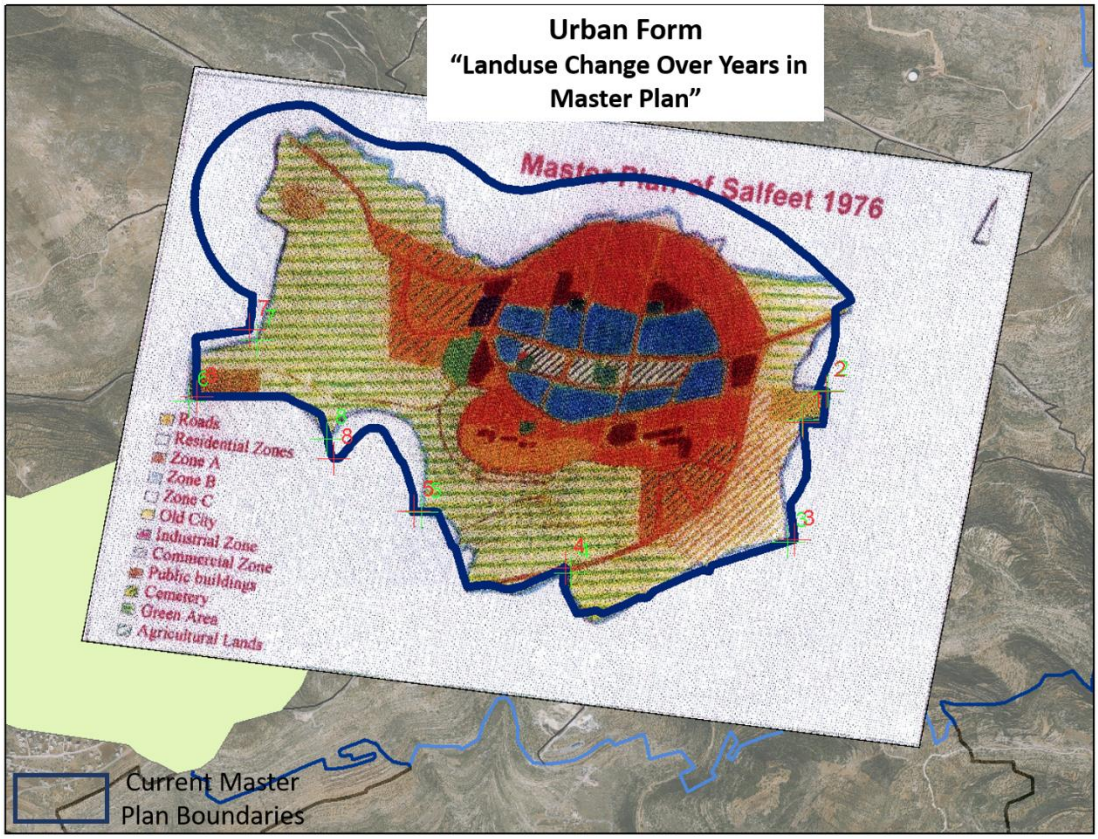
This type give us an indication about the character of this city, which is somehow still near to the rural type and pattern.

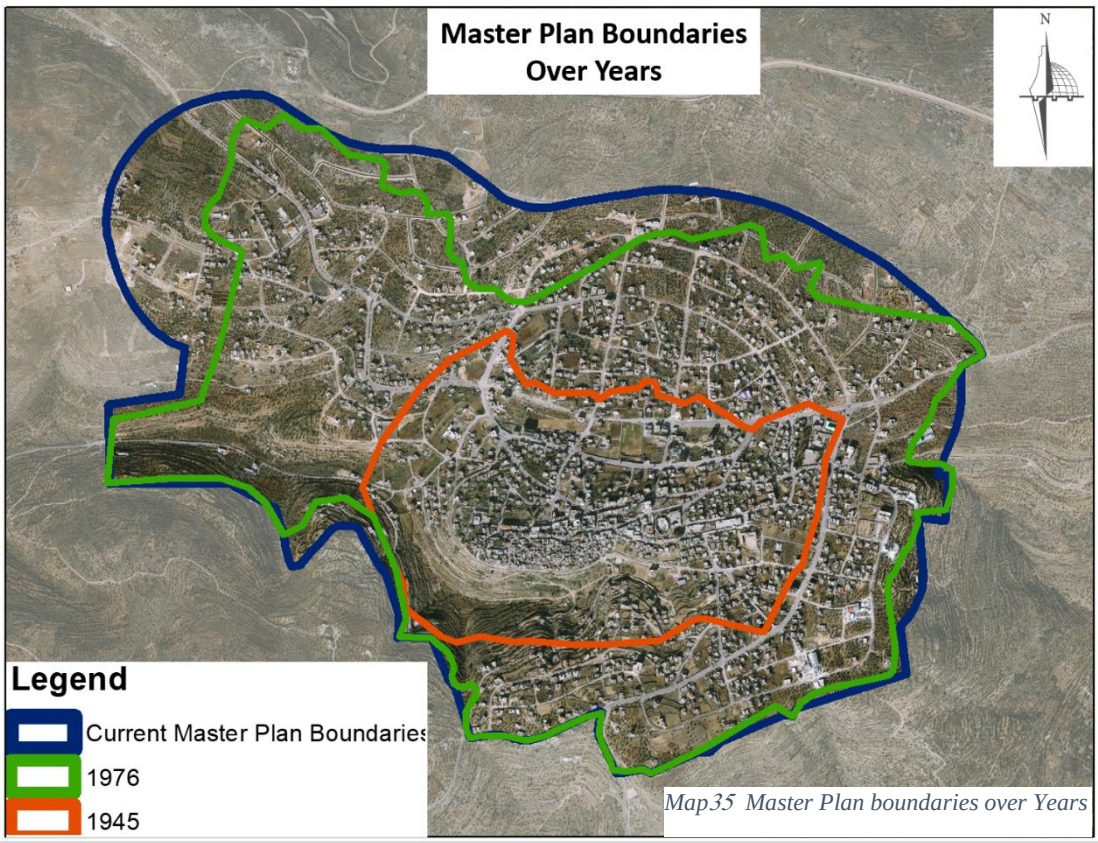


Map33 Urban Expansion over years in Selfit City

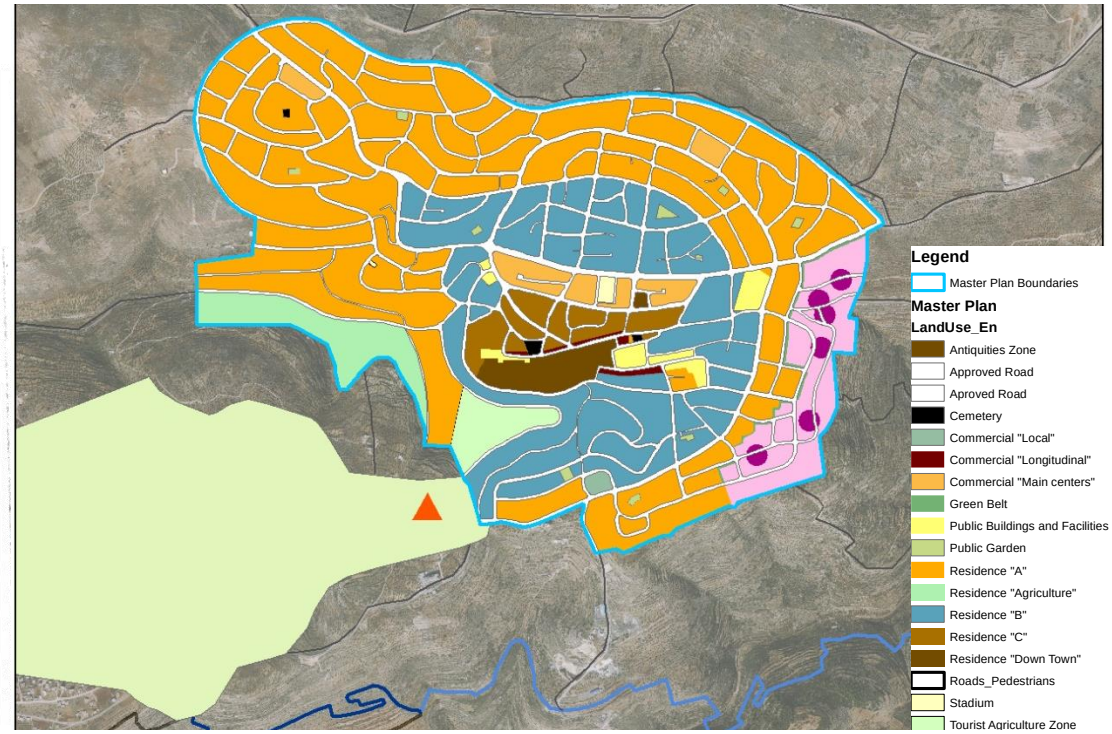


Map34 Master Plan of Selfit "1945"





Map35 Master Plan boundaries over Years



Map 38 Current Master Plan of Selfit

Master Plan of Selfit "1976" 36 Map

As we can see from previous maps of master plans over years, it's clear that there's a decrease in the agricultural uses as figure 19 shows where the percentage of the agricultural uses were 70% in 1945's master plan and 7% in the current master plan.

While some uses are still the same like the industrial area in the western side of Selfit city.

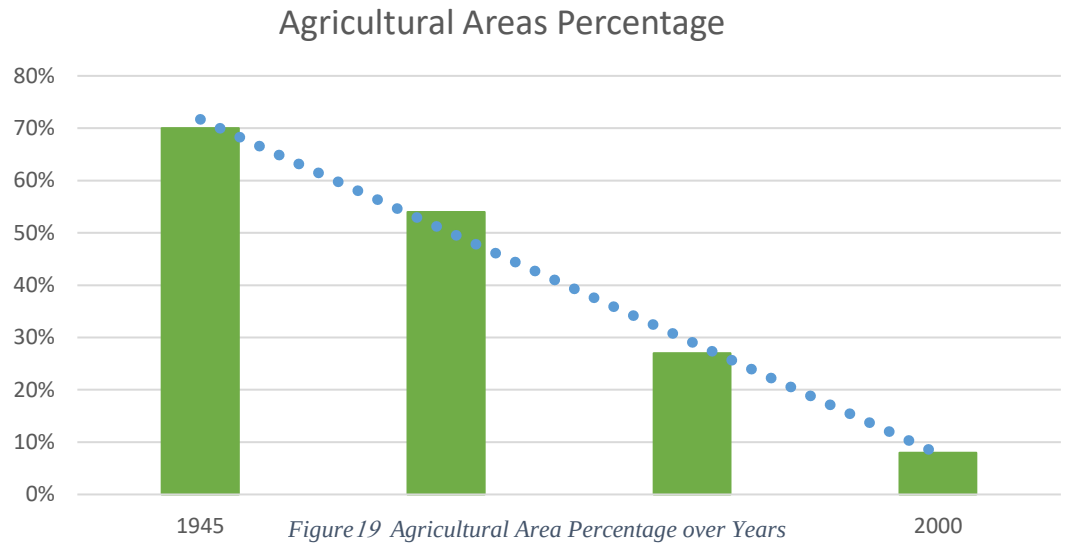
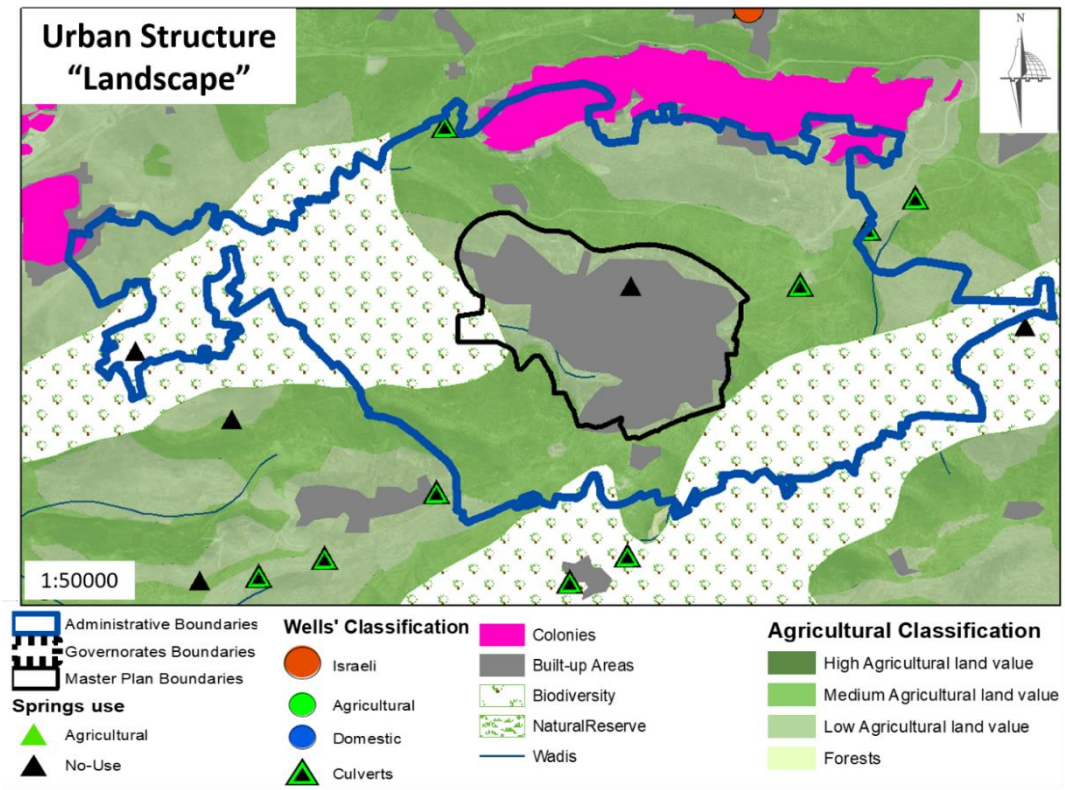
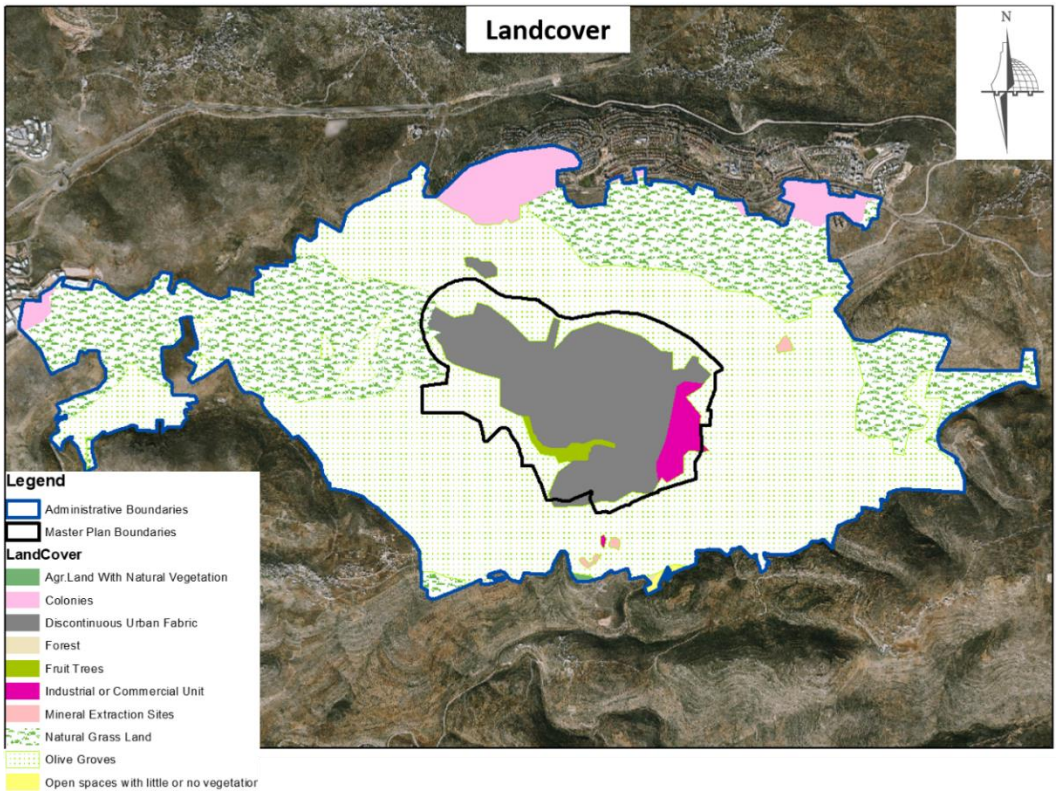


Figure 19 Agricultural Area Percentage over Years



Map39 Urban Structure "Landscape" in Selfit City

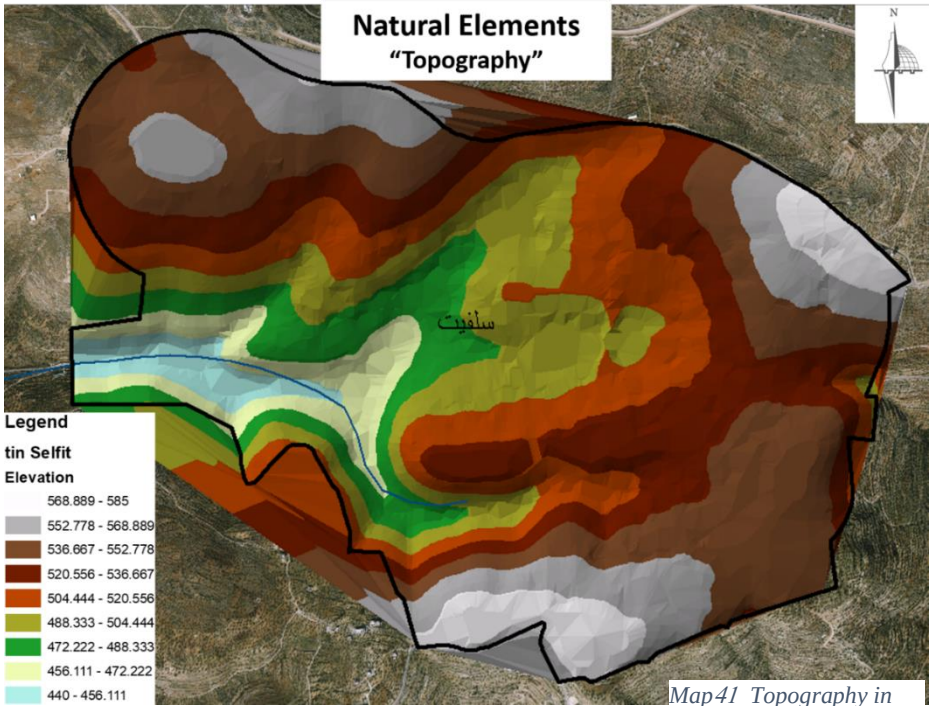


Map 40 Landcover in Selfit City

City of Selfit is rich of green land cove r and natural elements as we can see from map 39, 40.

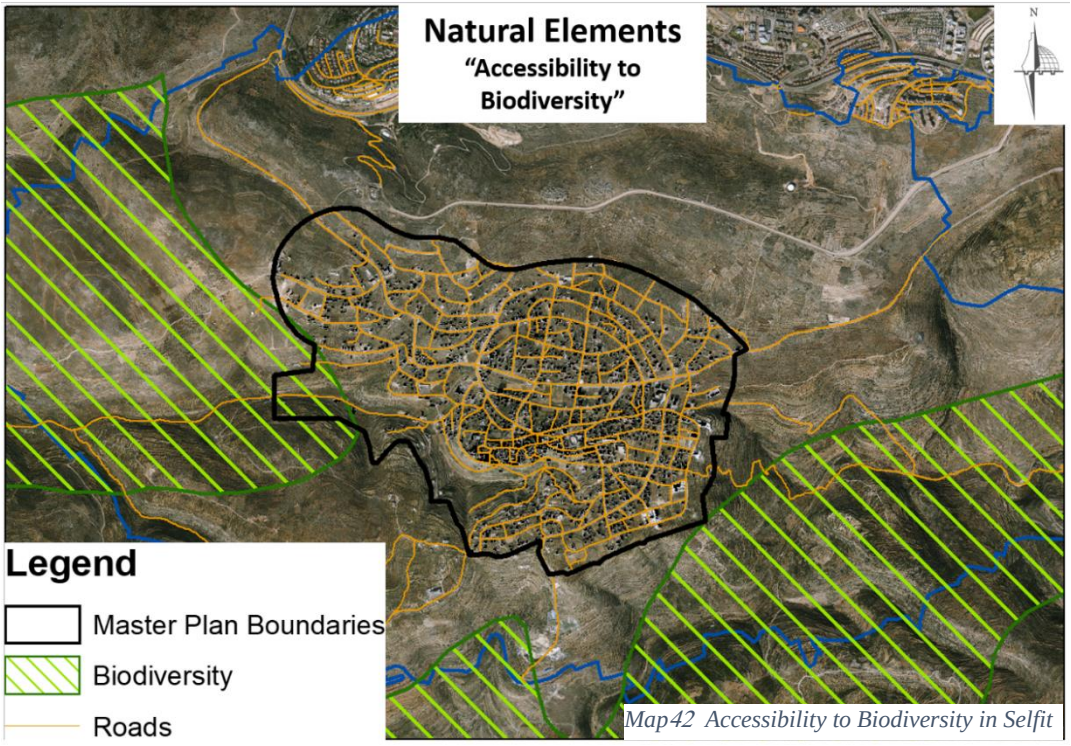
4.3.2 Natural Elements & Energy

Eco-City aims at zero carbon emissions and energy self-sustainability. Energy systems are rated by the share of renewable energy production and carbon emissions. Assessment indicators are share of renewable energy production, specific CO2 emissions of energy production.

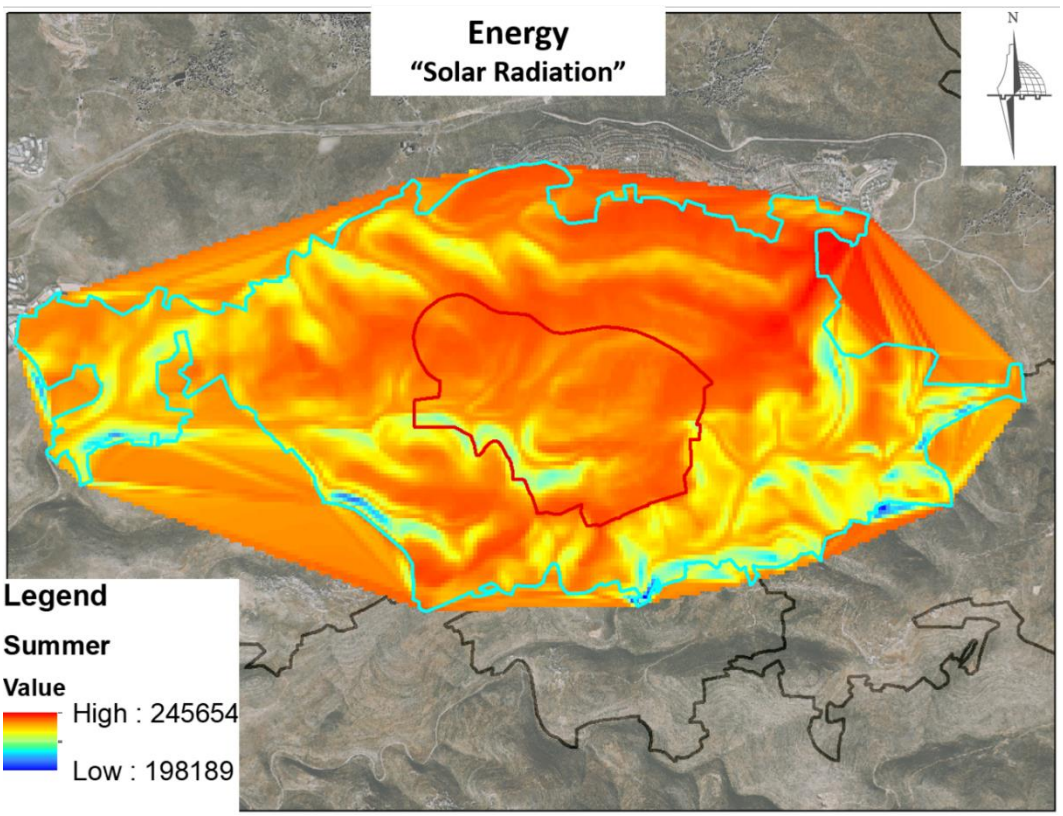


Map41 Topography in

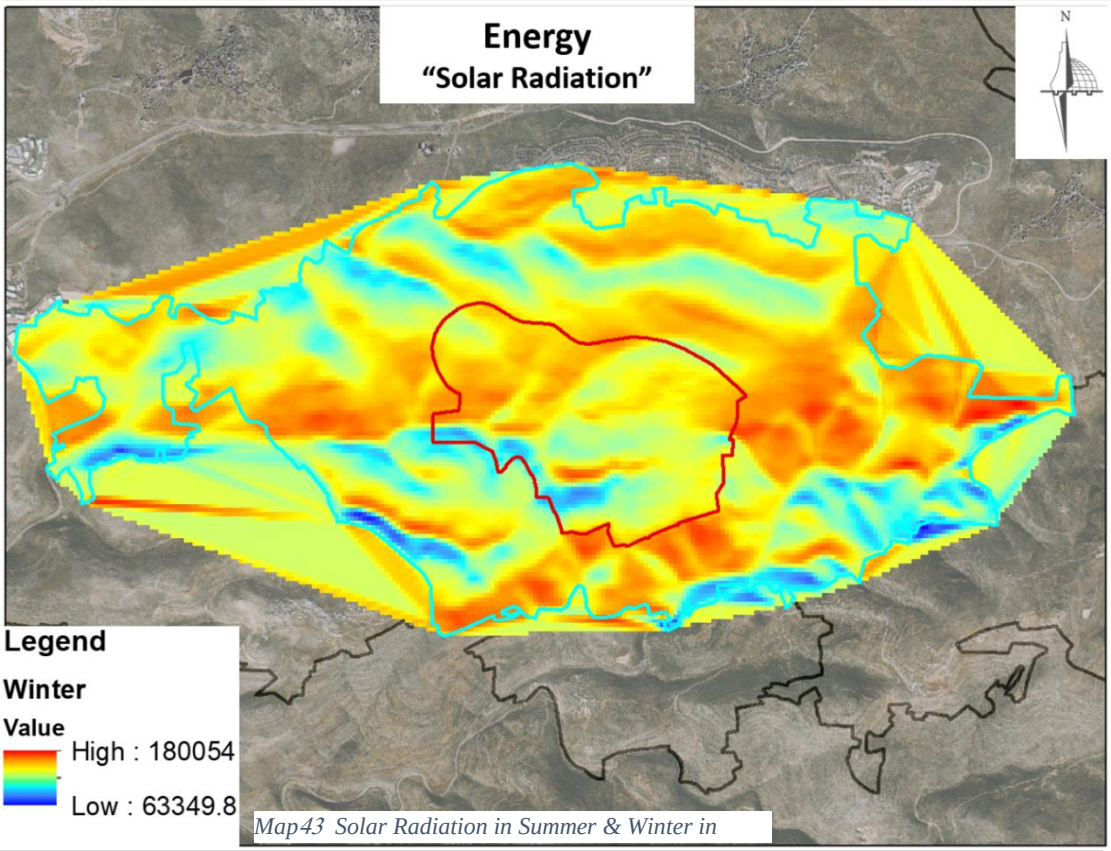
In map 42 we can see clearly that no direct access for pedestrians to the biodiversity all the roads we can see are just for cars which prevent people to enjoy the beauty of the biodiversity



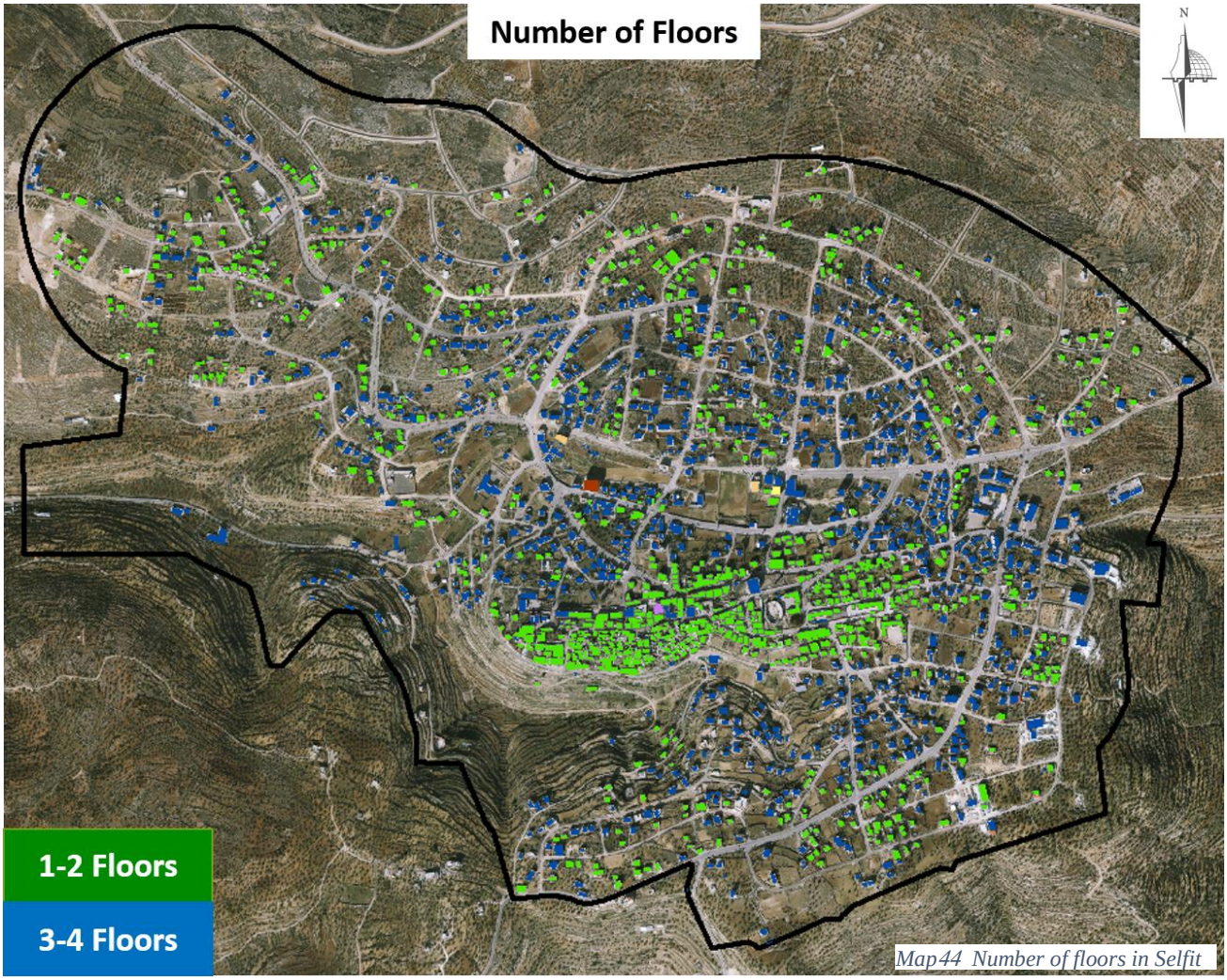
Map42 Accessibility to Biodiversity in Selfit



In these maps we can see clearly that sun radiation can reach to the most area here in Selfit which is a good indicator about using the solar energy in the city to produce electricity.



Map43 Solar Radiation in Summer & Winter in



Map44 Number of floors in Selfit

In the following sequence of maps I'm going to examine if the existing number of floors of the buildings affect on each other based on their height, in map 45 we can see that buildings don't prevent sun rises from each other which is also a very good indicator, figure 20 shows the percentage of the number of buildings.

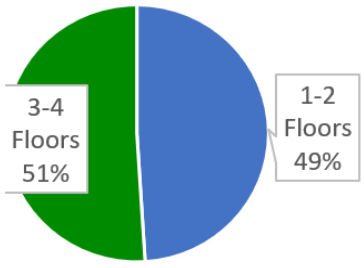
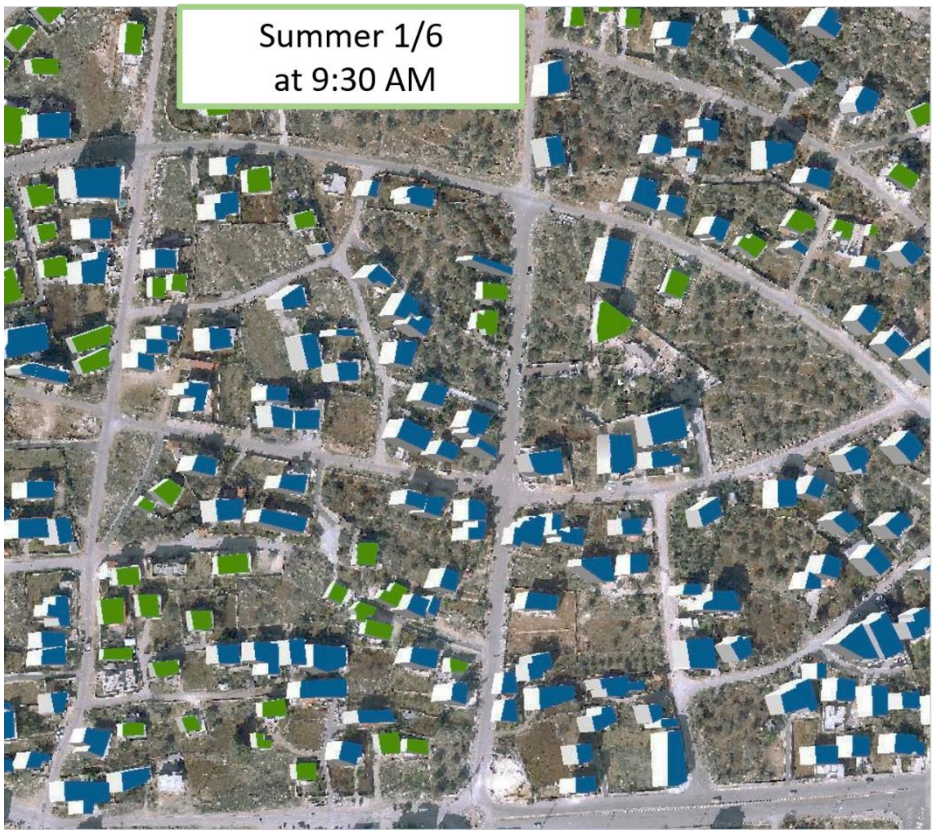
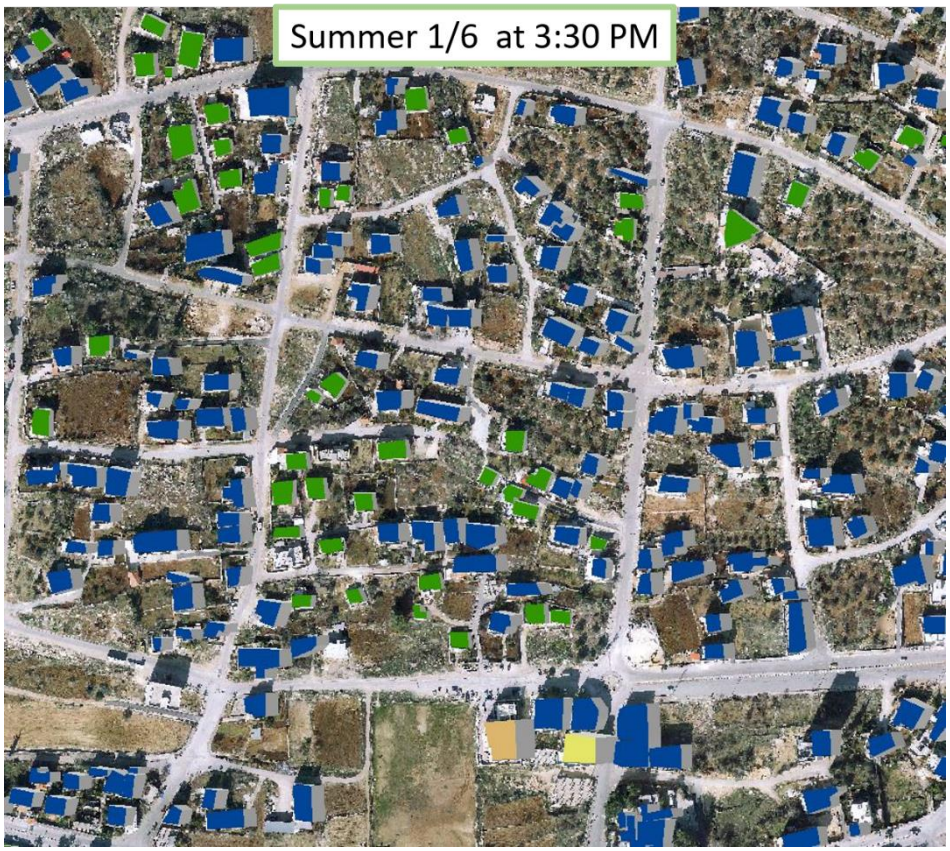
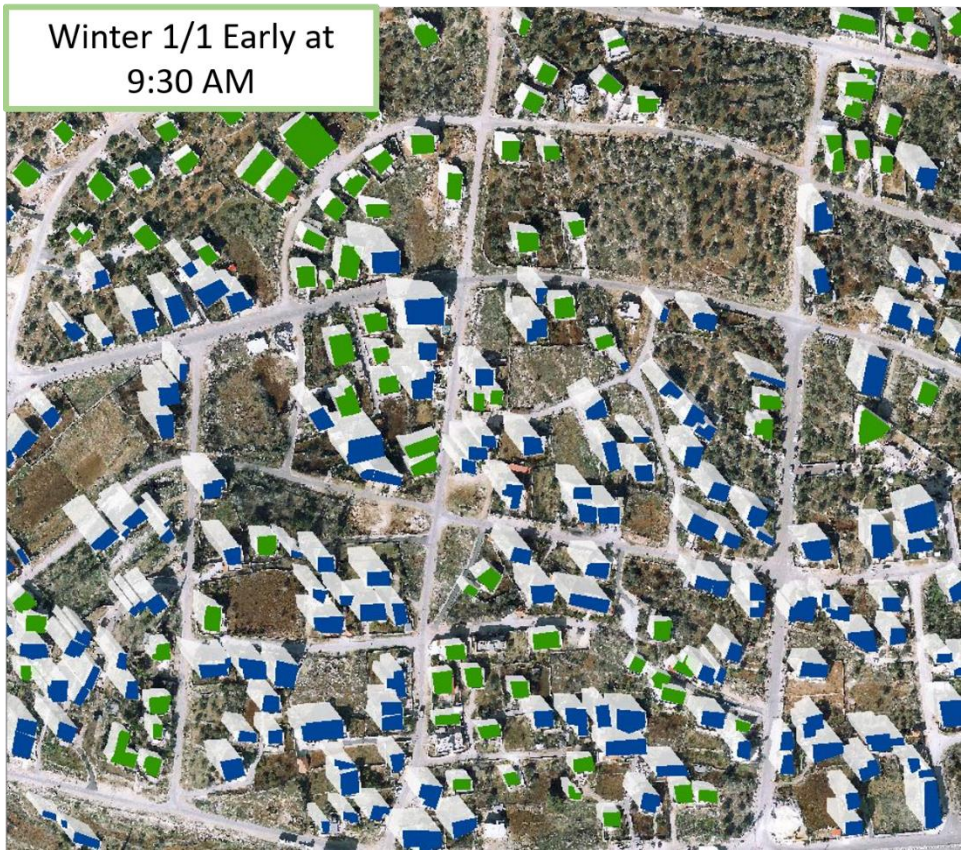
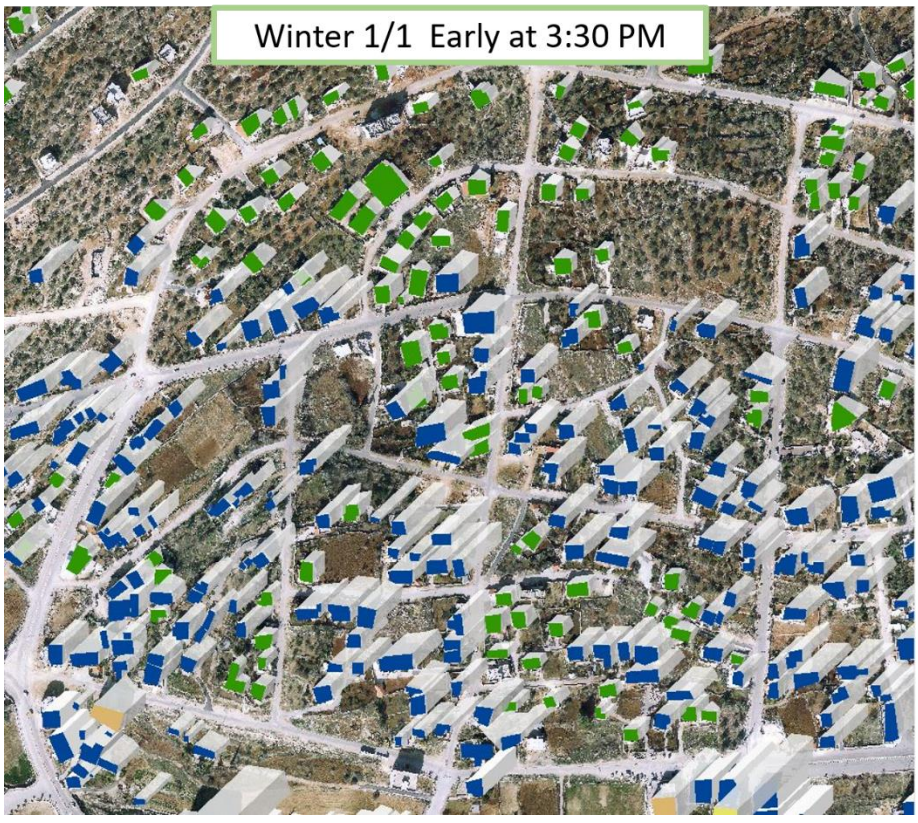


Figure20 Percentage of Number of floors in Selfit

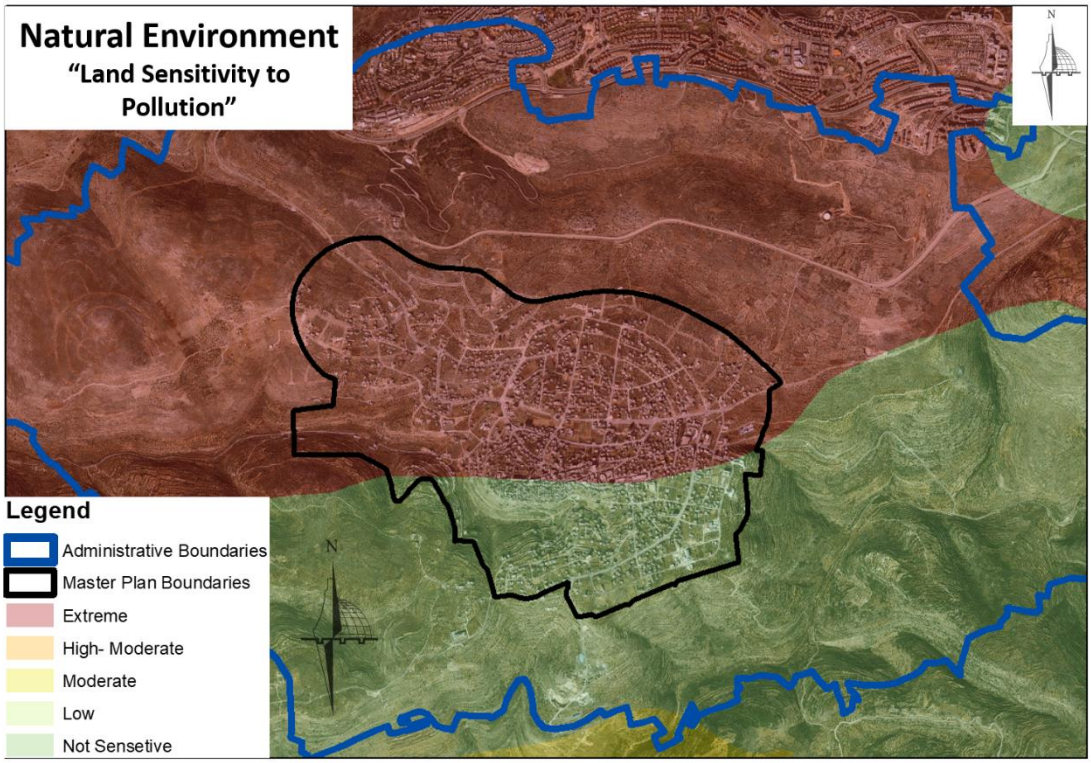

Summer 1/6
at 9:30 AM


Summer 1/6 at 3:30 PM



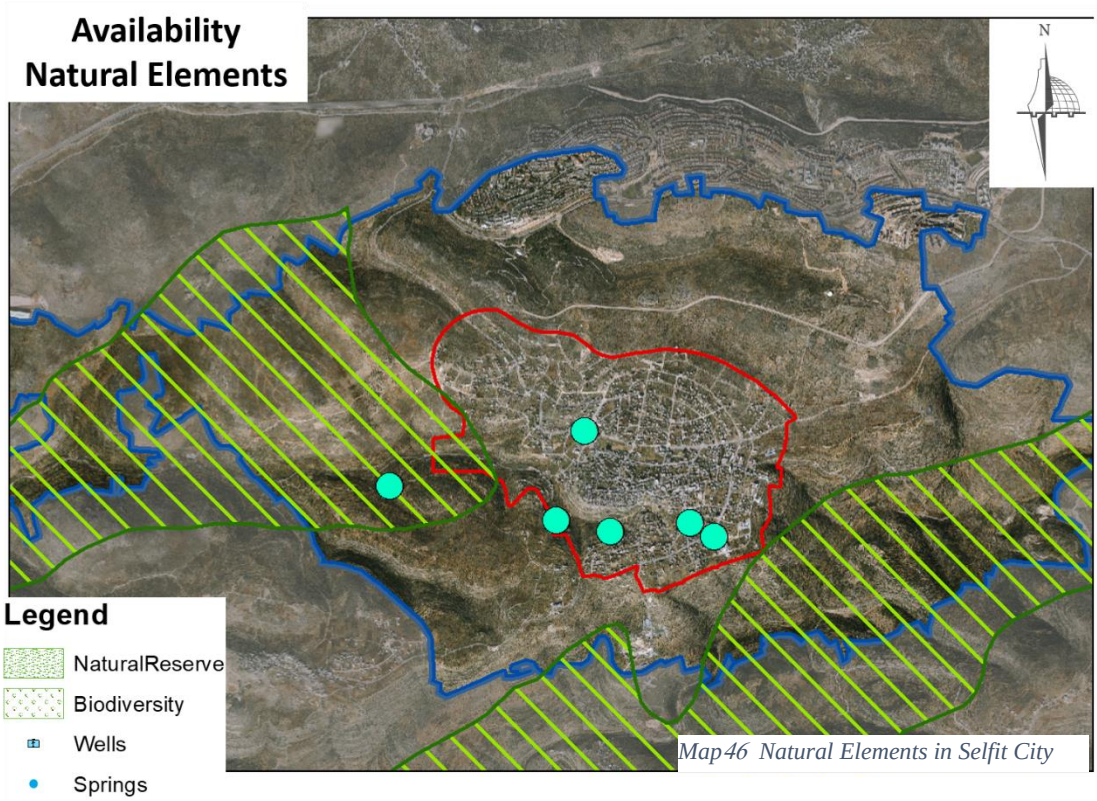


Map45 Shadow of buildings in different times in the year

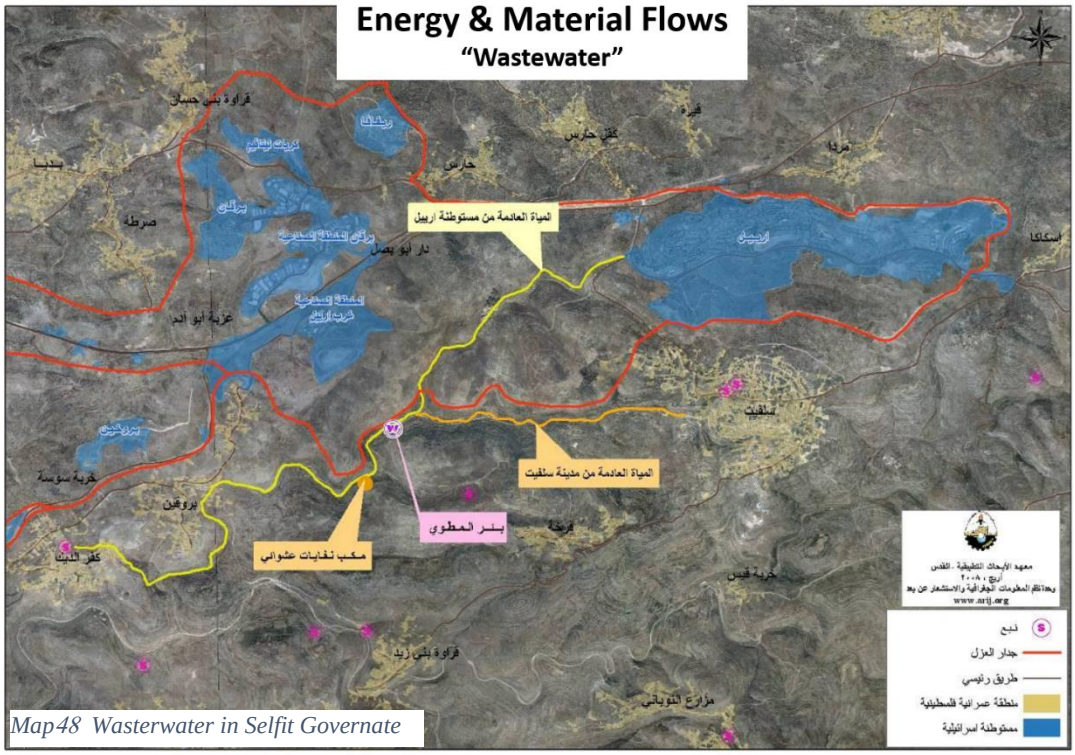


Map47 Land Sensitivity to pollution in Selfit

City of Selfit has six springs, no well over there without any natural reserve, but it's surrounded by biodiversity from different sides which makes it a special case in the region as shown in map 46.



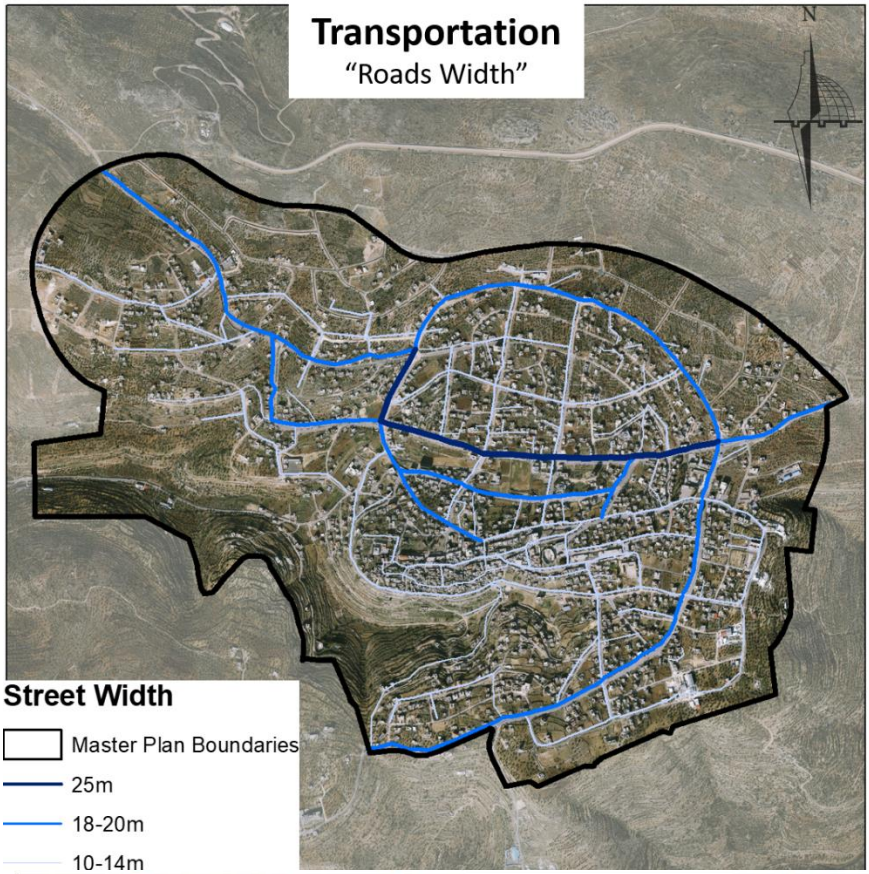
Map46 Natural Elements in Selfit City



Map48 Wasterwater in Selfit Governate

As shown in map 48 the wastewater that resulted from Selfit and the colonies are passing across Wadi Al-Matwi which is already inside the biodiversity which is considered a real risk on the habitats there and causes different kind of pollution and threatens and safety of the underground water there.

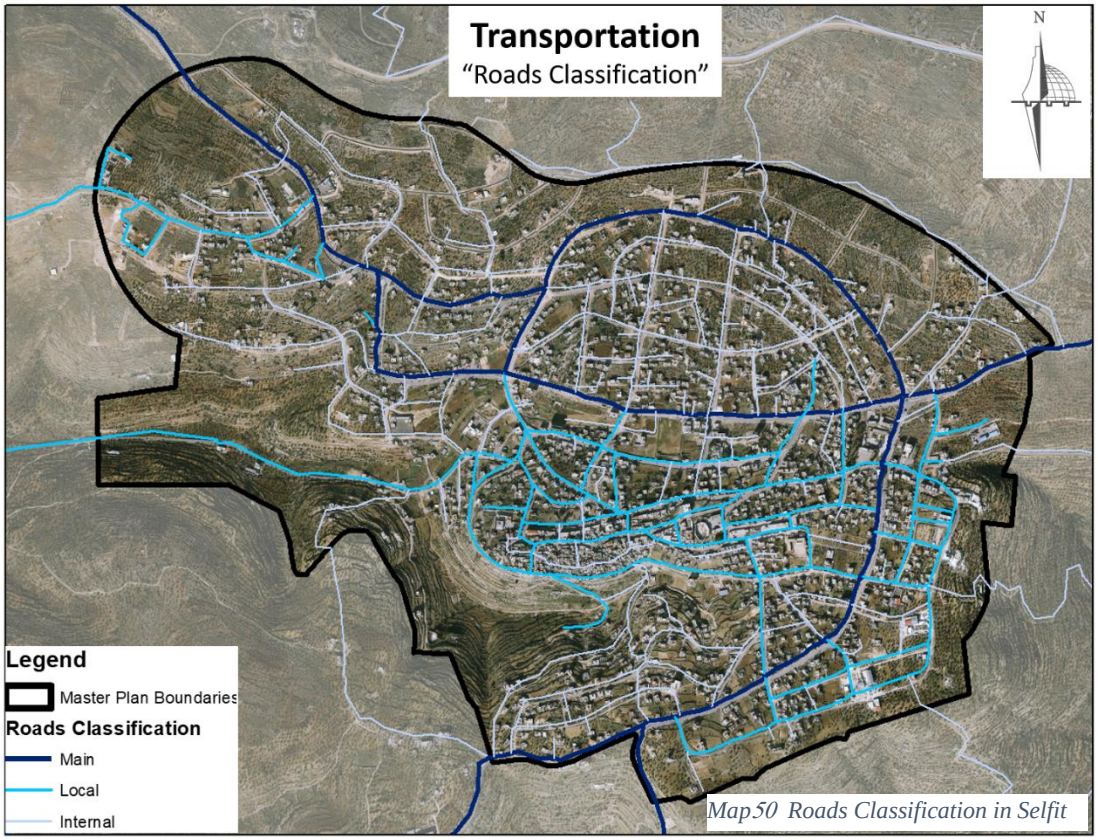
4.3.3 Transportation & Infrastructure



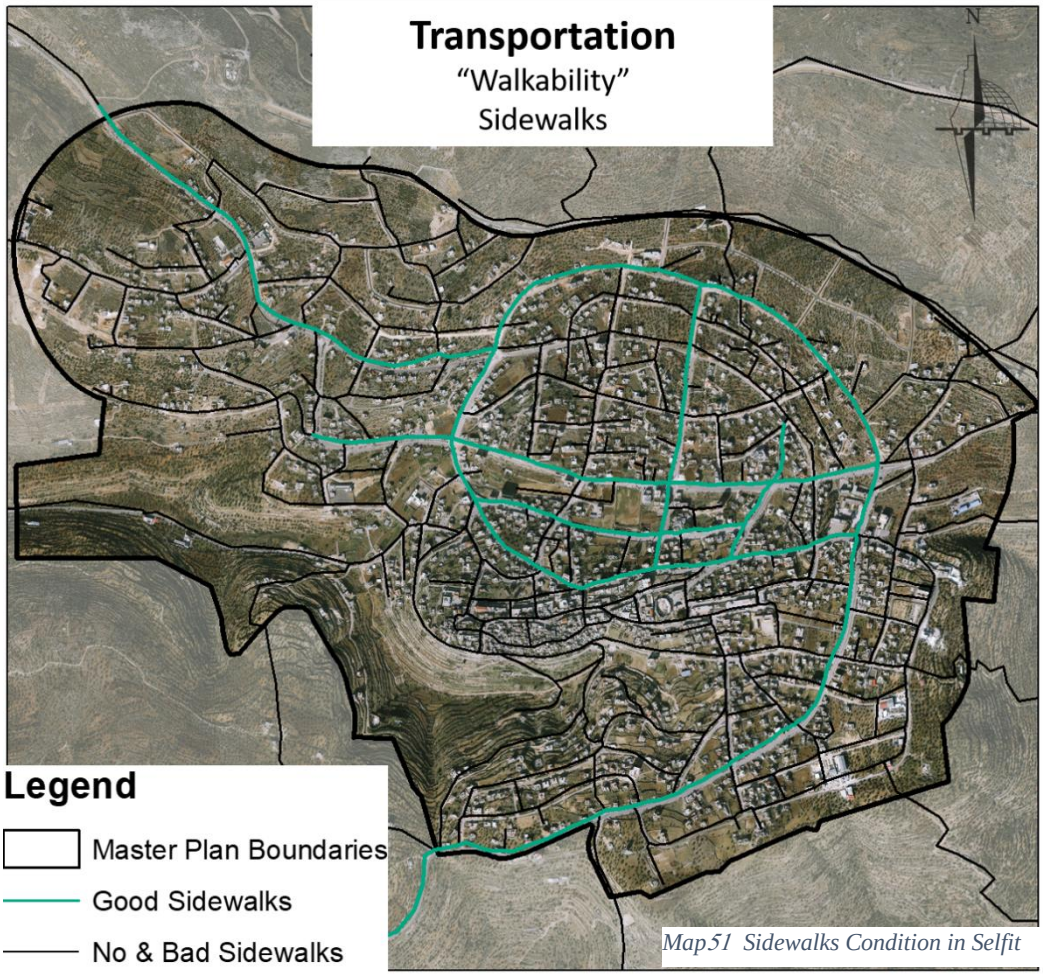
As we can see from map 49,50 that most important round which cross the city from the middle is the widest street and it's a main street that connect the city with its interior parts and with the surrounding areas.

In addition the streets that shapes the radial are also critical in the city and form its shape and the function of the city.

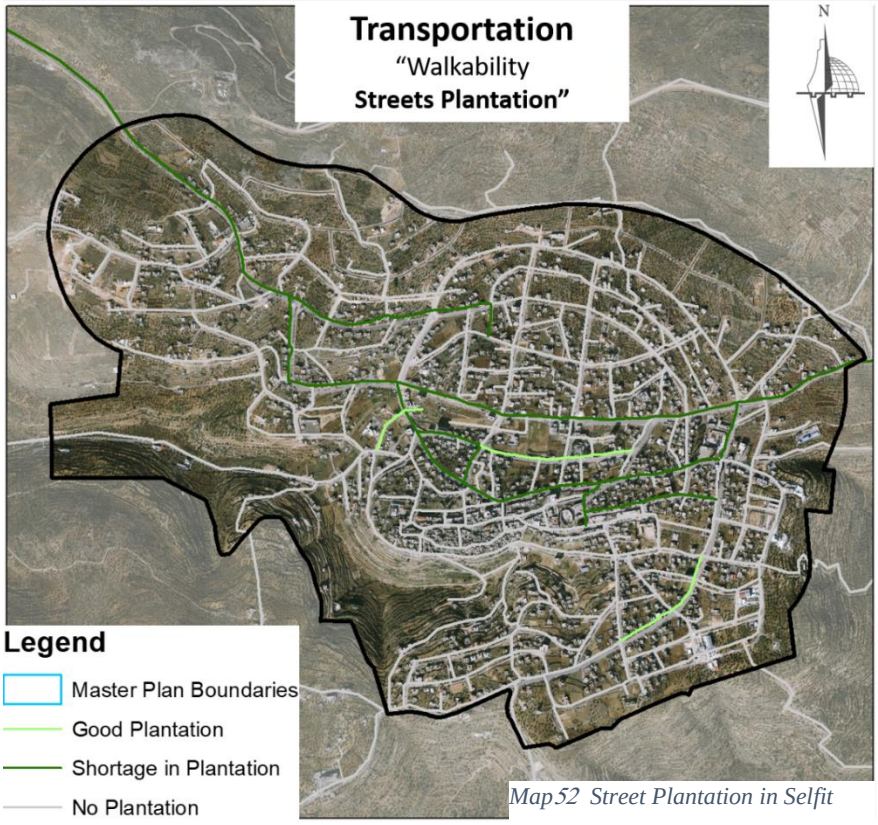
These street should take a special vision when form the landuse and the capacities.



Map50 Roads Classification in Selfit



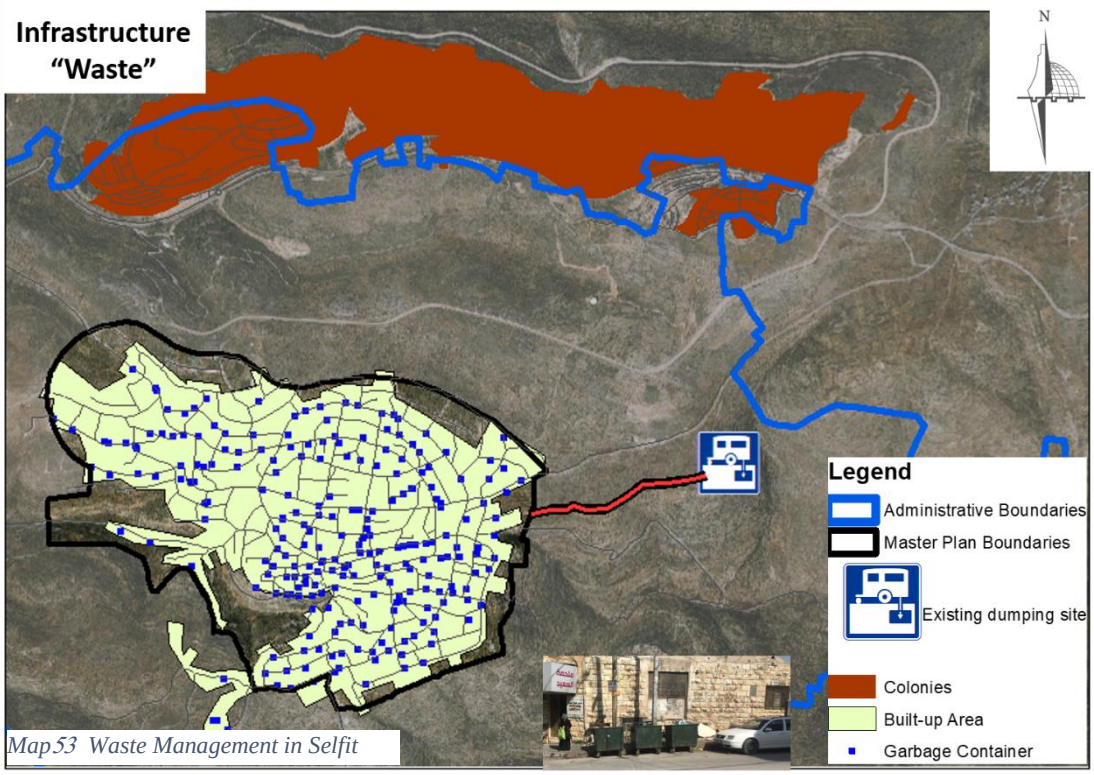
Map51 Sidewalks Condition in Selfit



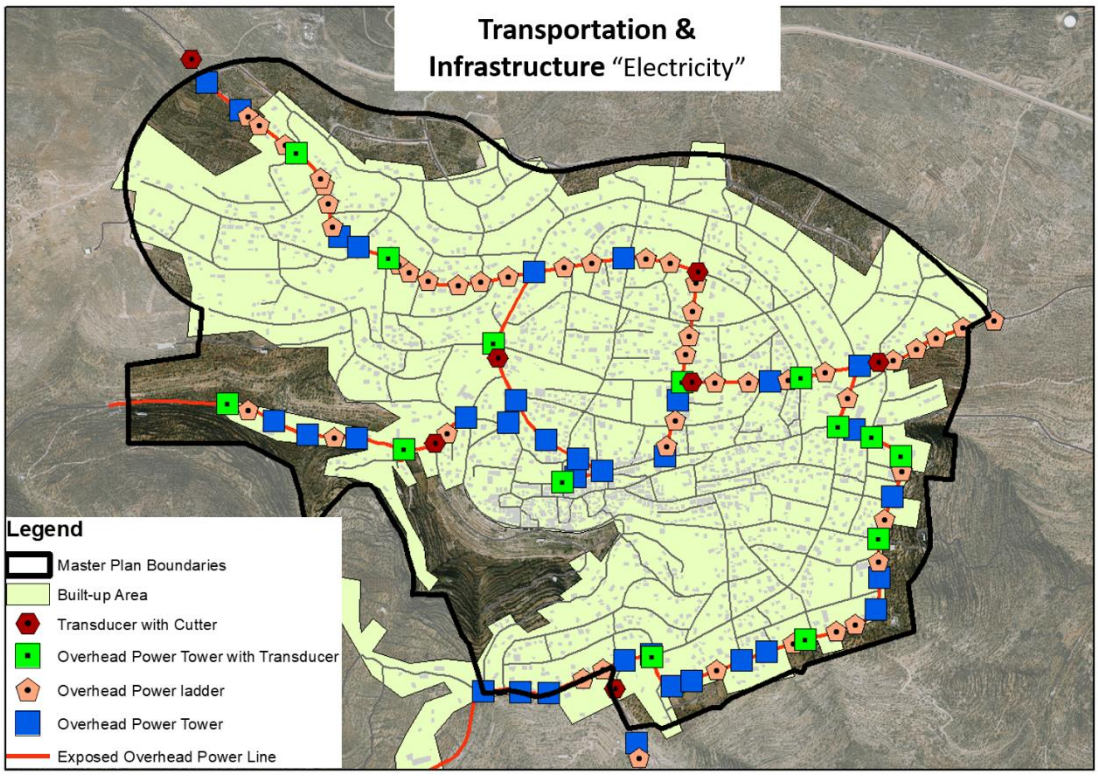
Map52 Street Plantation in Selfit

In these maps we can notice that a lot of streets has bad sidewalks with lack of street plantation which make the walkability there much harder even if the slope is acceptable.

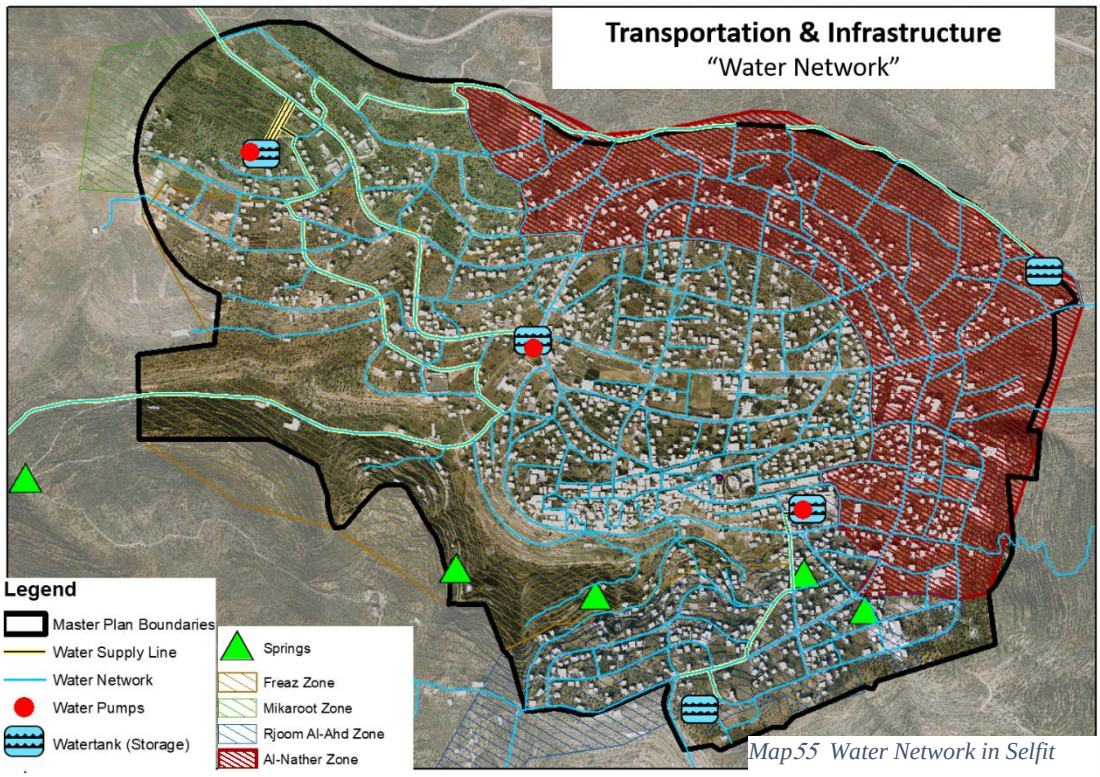
Luckily Selfit don't suffer from high dense areas so we can fix street problems before any possible problems could happen in the future.



Map53 Waste Management in Selfit



Map 54 Electricity Lines in Selfit

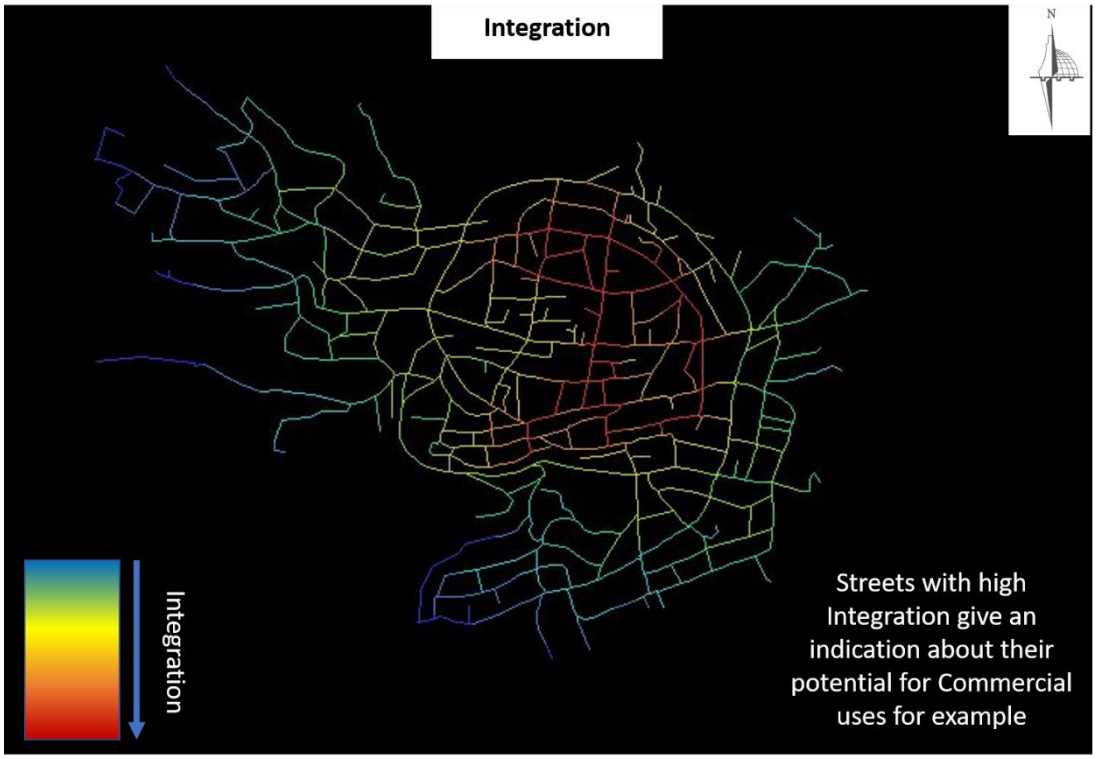


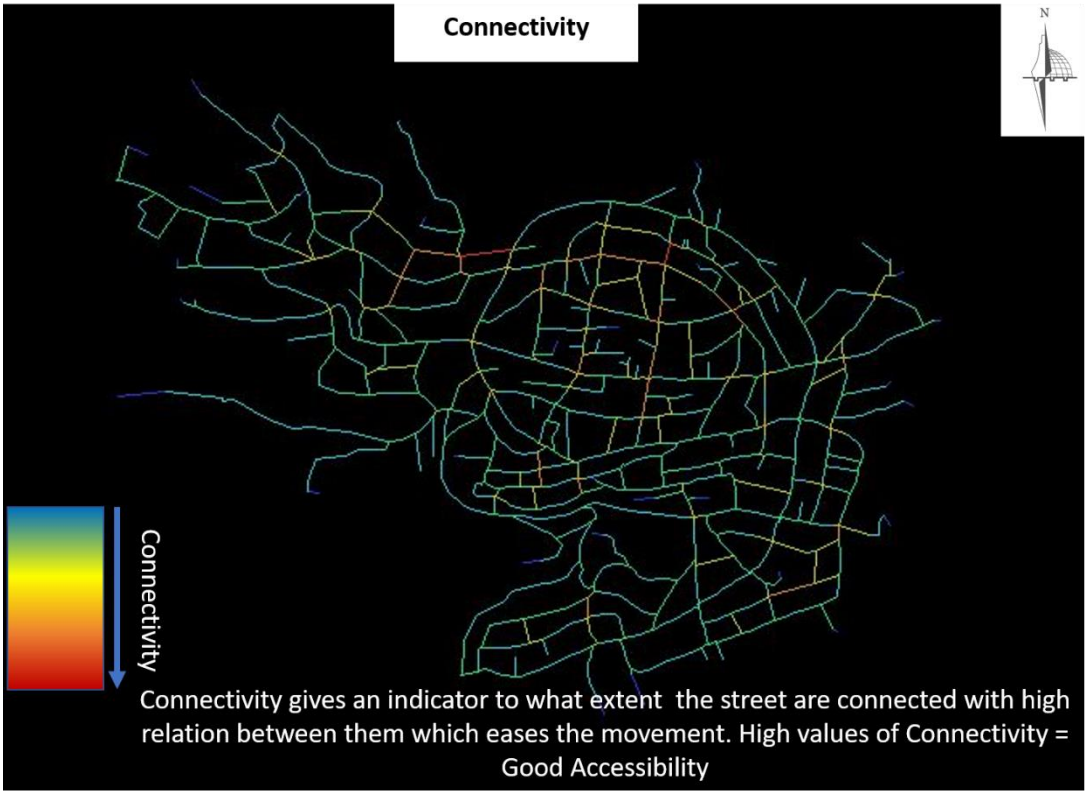
Map55 Water Network in Selfit

Waste Management: In selfit city there is no separation between the different types os the waste (Plastic, cartoon, metal, glass, etc …) even there are more than 350 solid waste containers in the city, the dumping site is located in the eastern side out of its boundaries as map 52 shows.

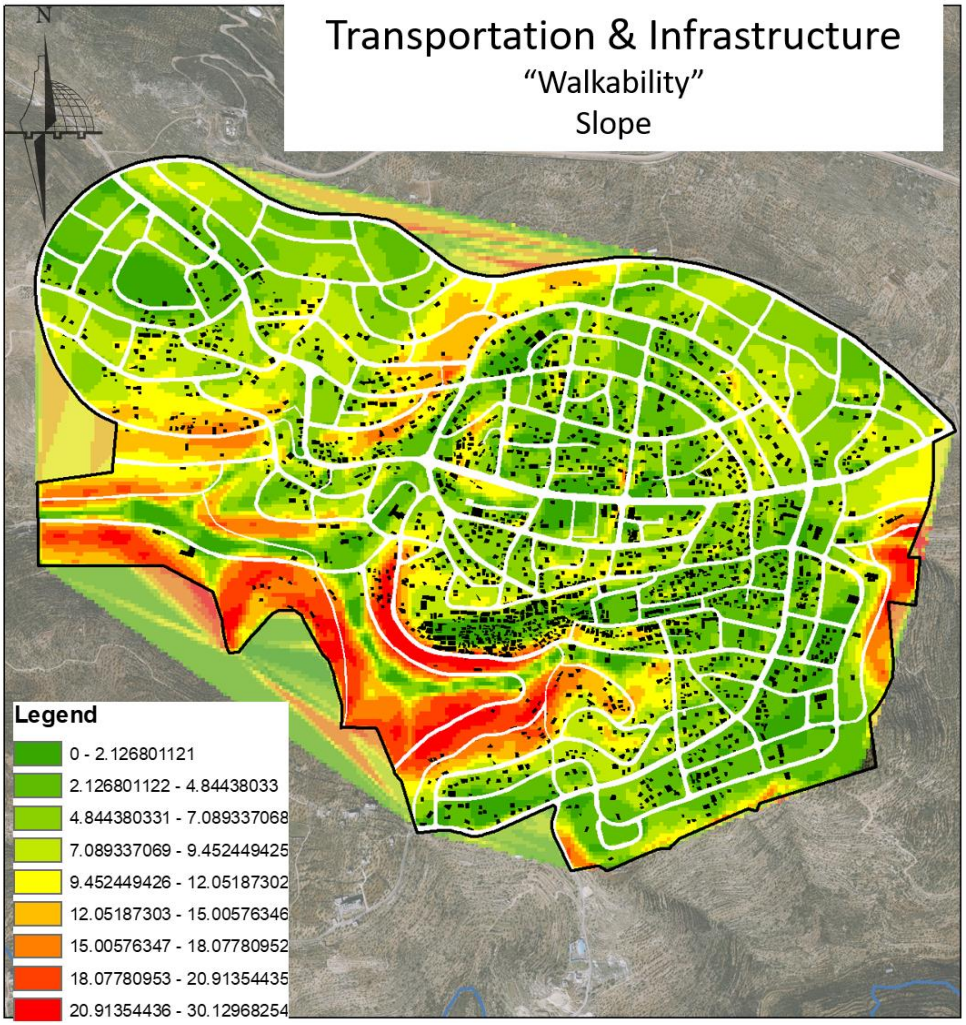
Electricity: Electricity network in Selfit covers all the city parts with exposed overhead power lines passes through the main streets in the city which is considered one of the main risky points there, as map 54 shows.

Water Network: All selfit city is served with water network, it has four water storage tanks, two springs and makroot line provides the city with the water, water pumps are required to ensure safe move of water to the dwellings, as shown in map 55.



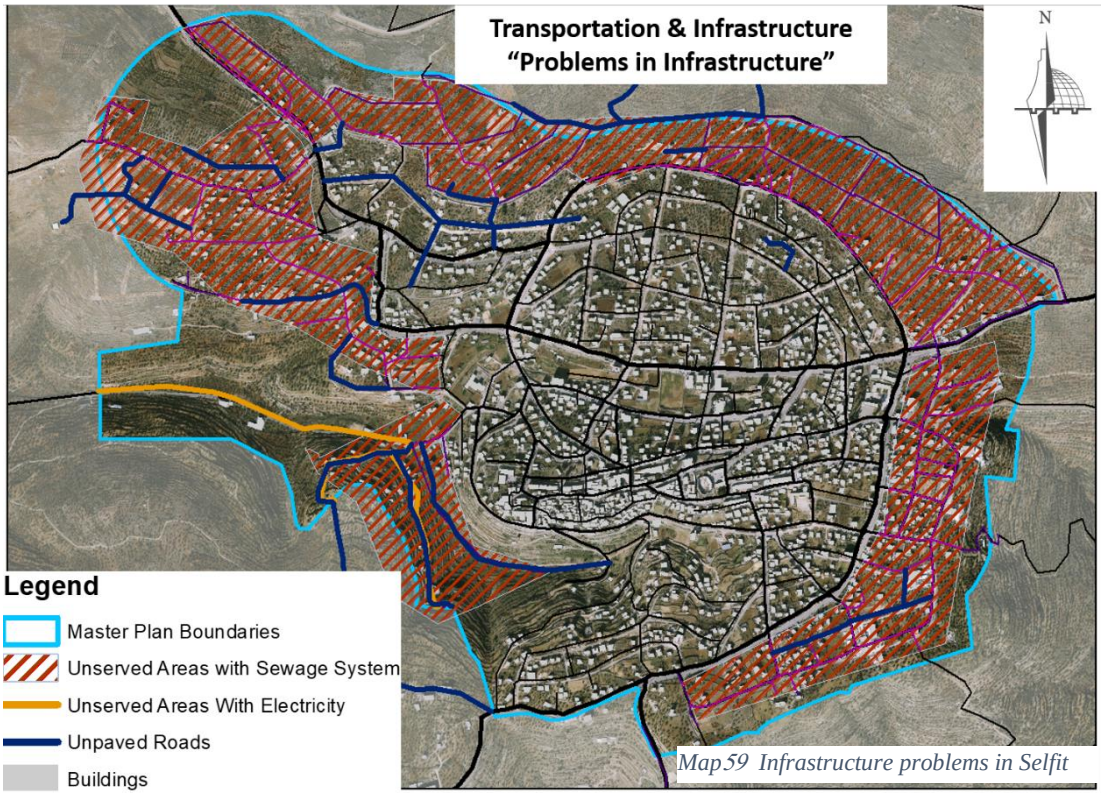


Map56 Depth Maps (Integration & Connectivity)



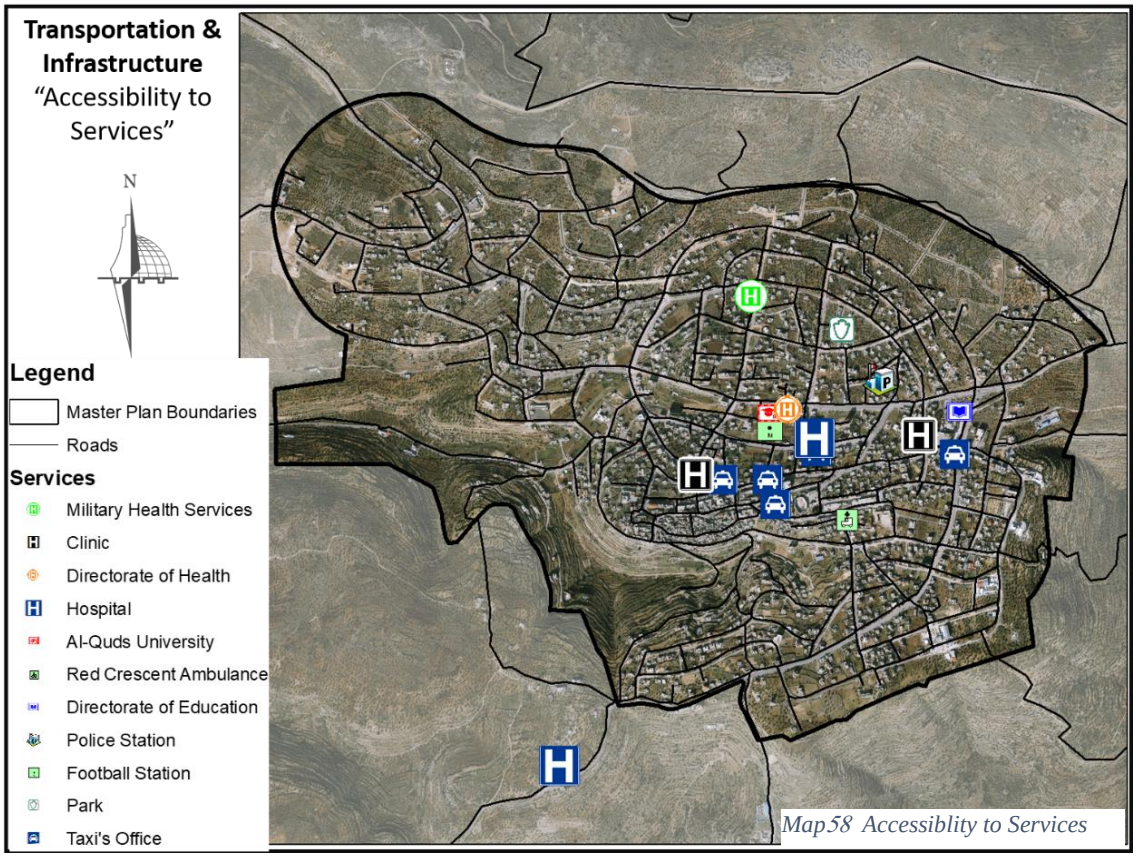
Map57 Street Slope in Selfit City

This map shows the slope of the street, as we can see that the streets has degrees of slope which is a good indicator for walkability, the high value which is between 20-30 are not considered that high, and these values located in nonresidential areas without any dense which could give us a chance to deal with them in a way could make them better.

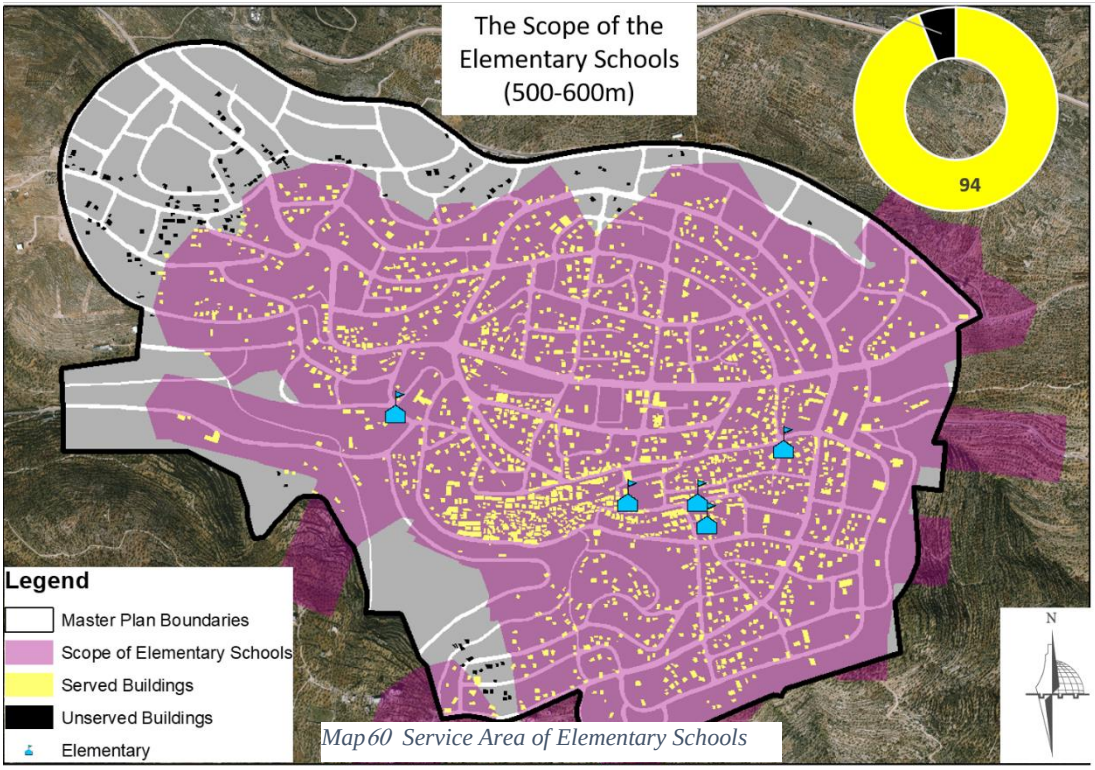


Map59 Infrastructure problems in Selfit

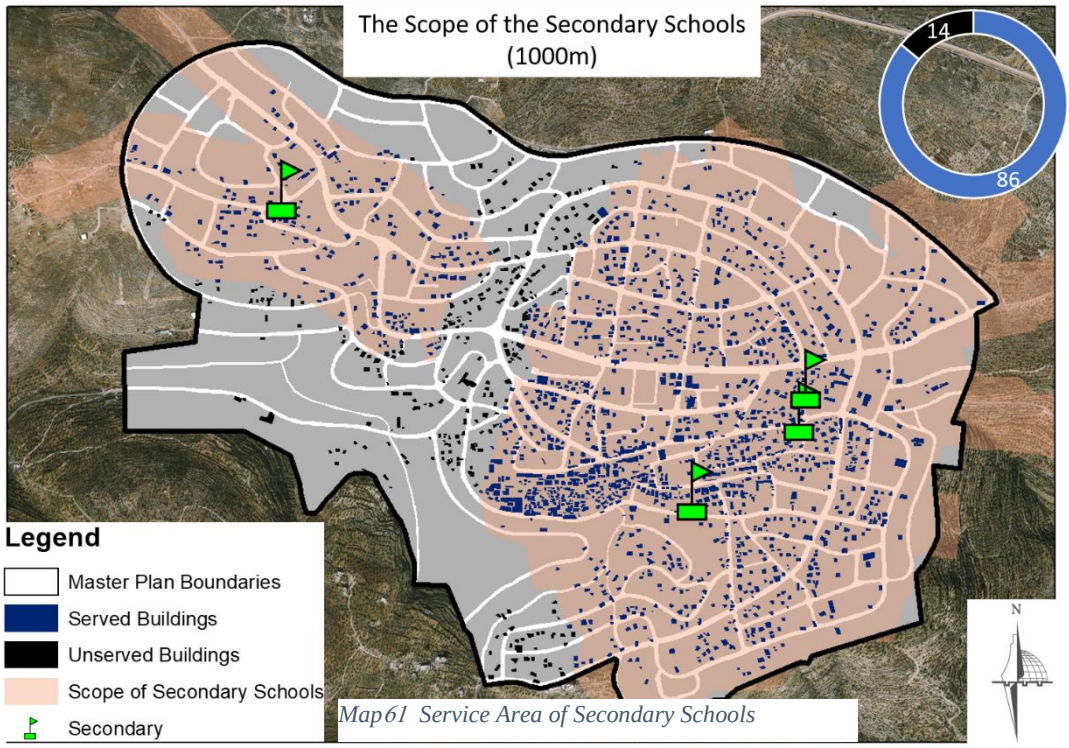
Due to the small area of the Selfit city we can notice the concentration of the main services in the center as shown in map 58, where there is high accessibility and it's easy to reach from different part of the city with no difficulties.



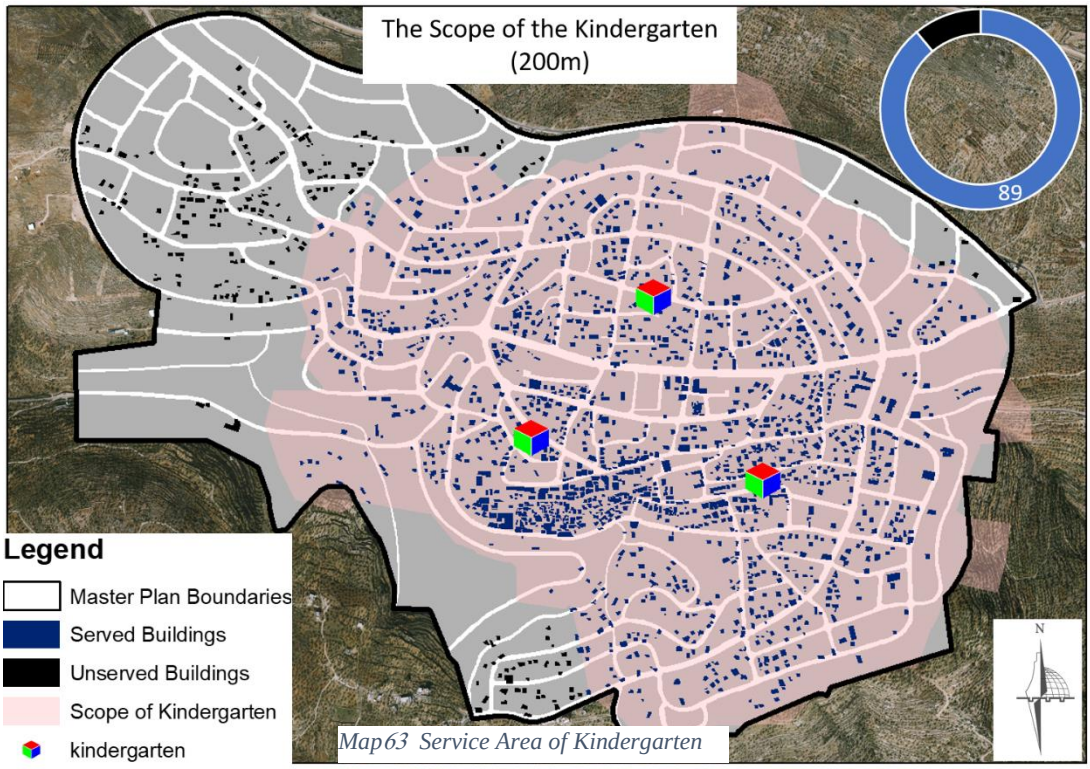
Map58 Accessiblity to Services



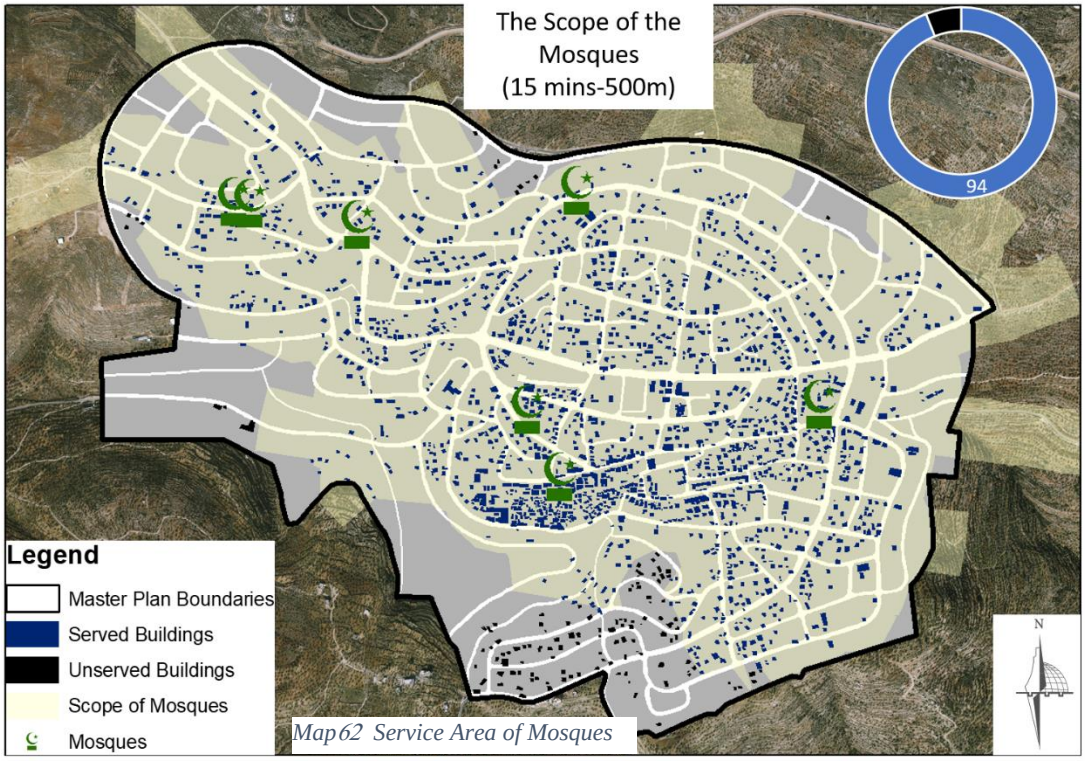
Map60 Service Area of Elementary Schools



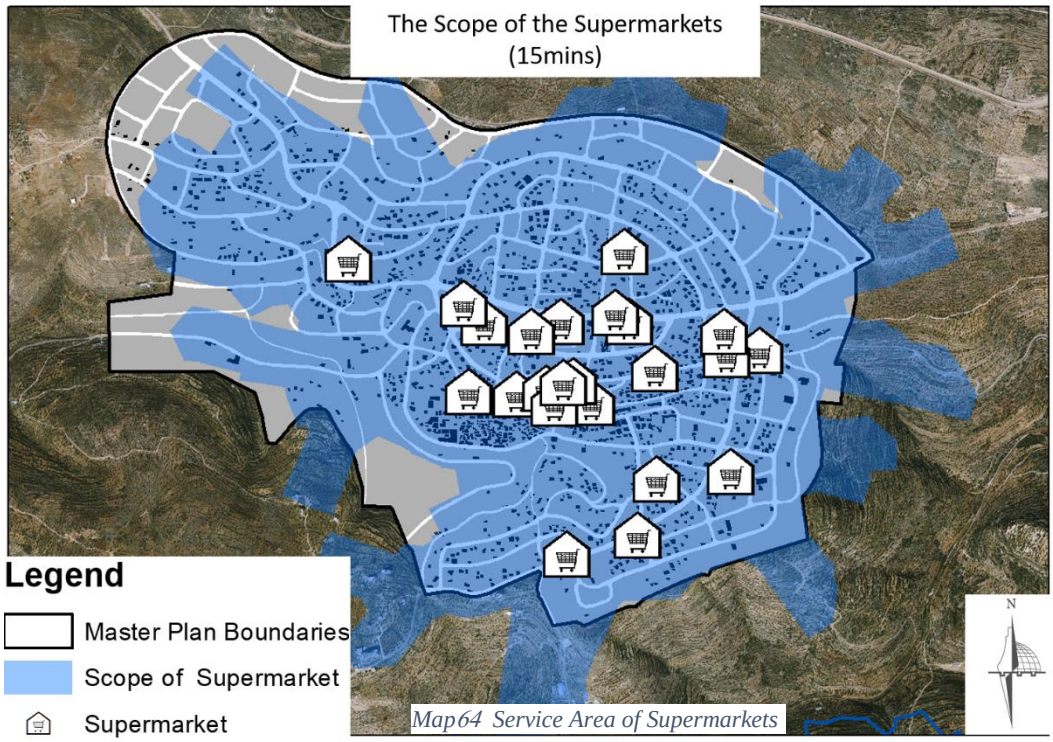
Map61 Service Area of Secondary Schools



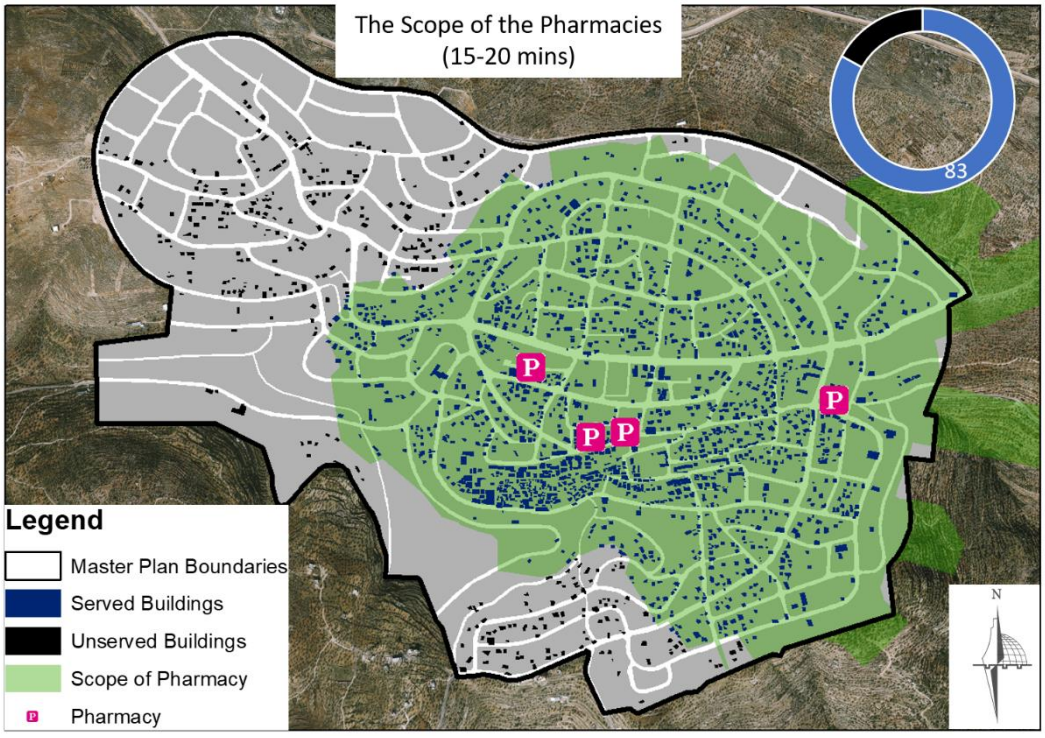
Map63 Service Area of Kindergarten



Map62 Service Area of Mosques



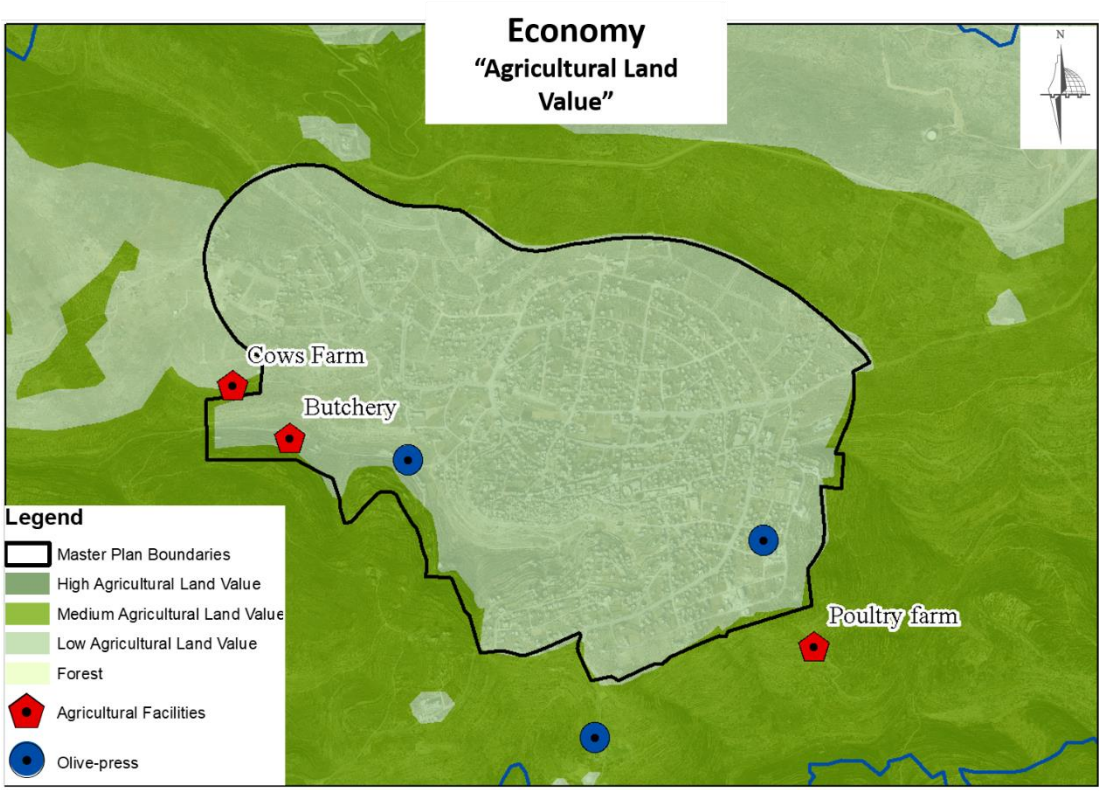
Map64 Service Area of Supermarkets



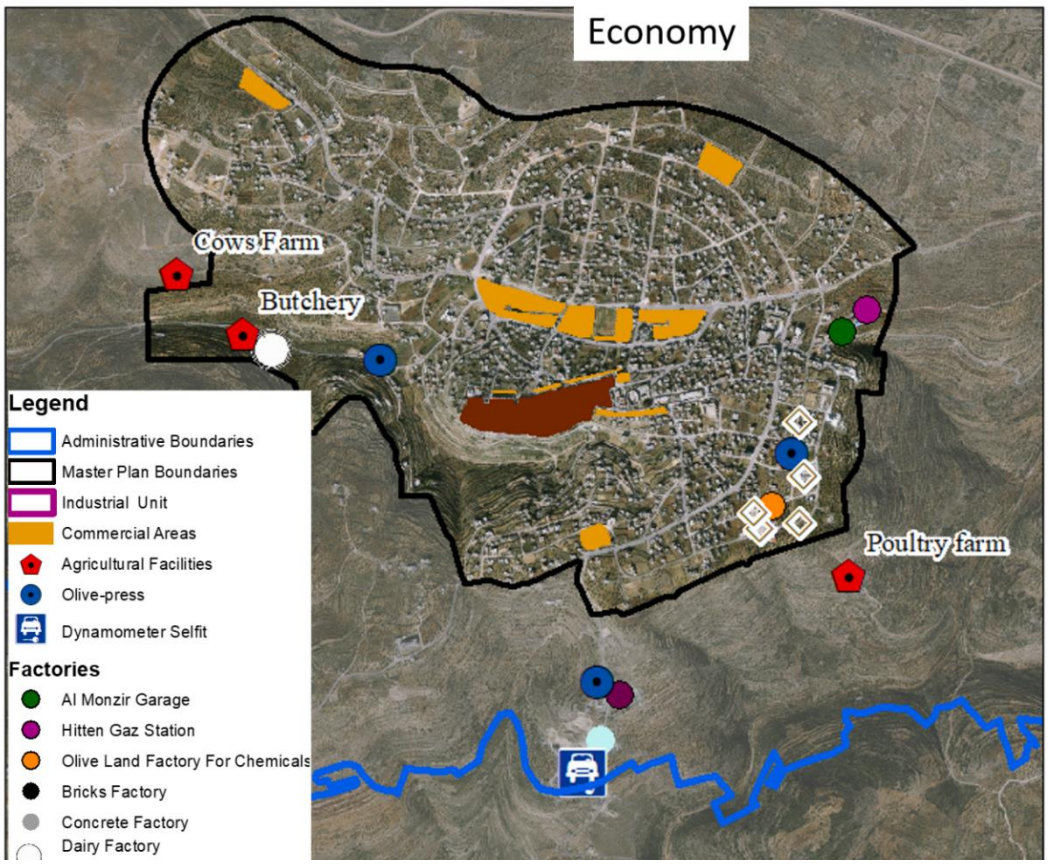
Map 65 Service Area of Pharmcisies

In these sequence of maps from 60-65 we can see clearly that most part of the cities are served by different kind of services despite the western part (new part) of the city which sometimes we can notice areas there not served with specific services.

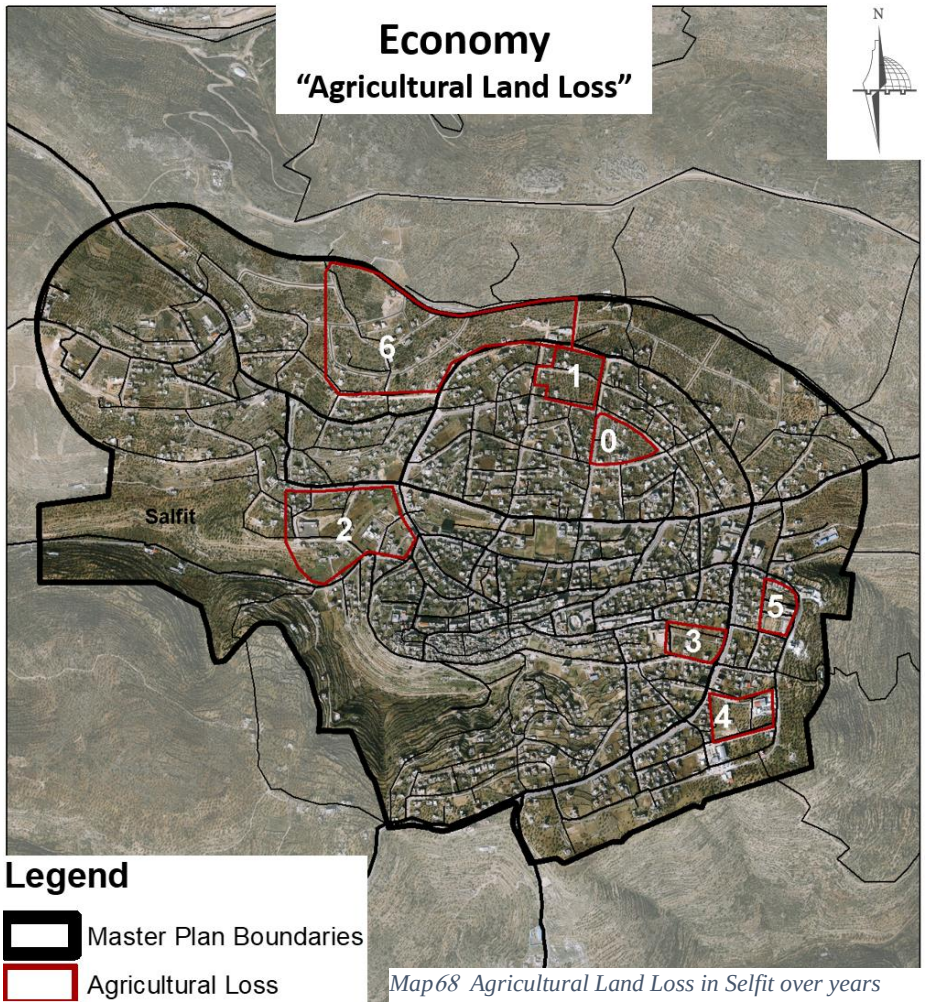
4.3.4 Socio-Economy



Map67 Economic Facilities and agricultural land value



Map66 Economic & Commercial uses



Map68 Agricultural Land Loss in Selfit over years

ID	Area (Meters Square)
0	25065
1	33392
2	101773
3	20739
4	27946
5	17977
6	209110
Total	436002

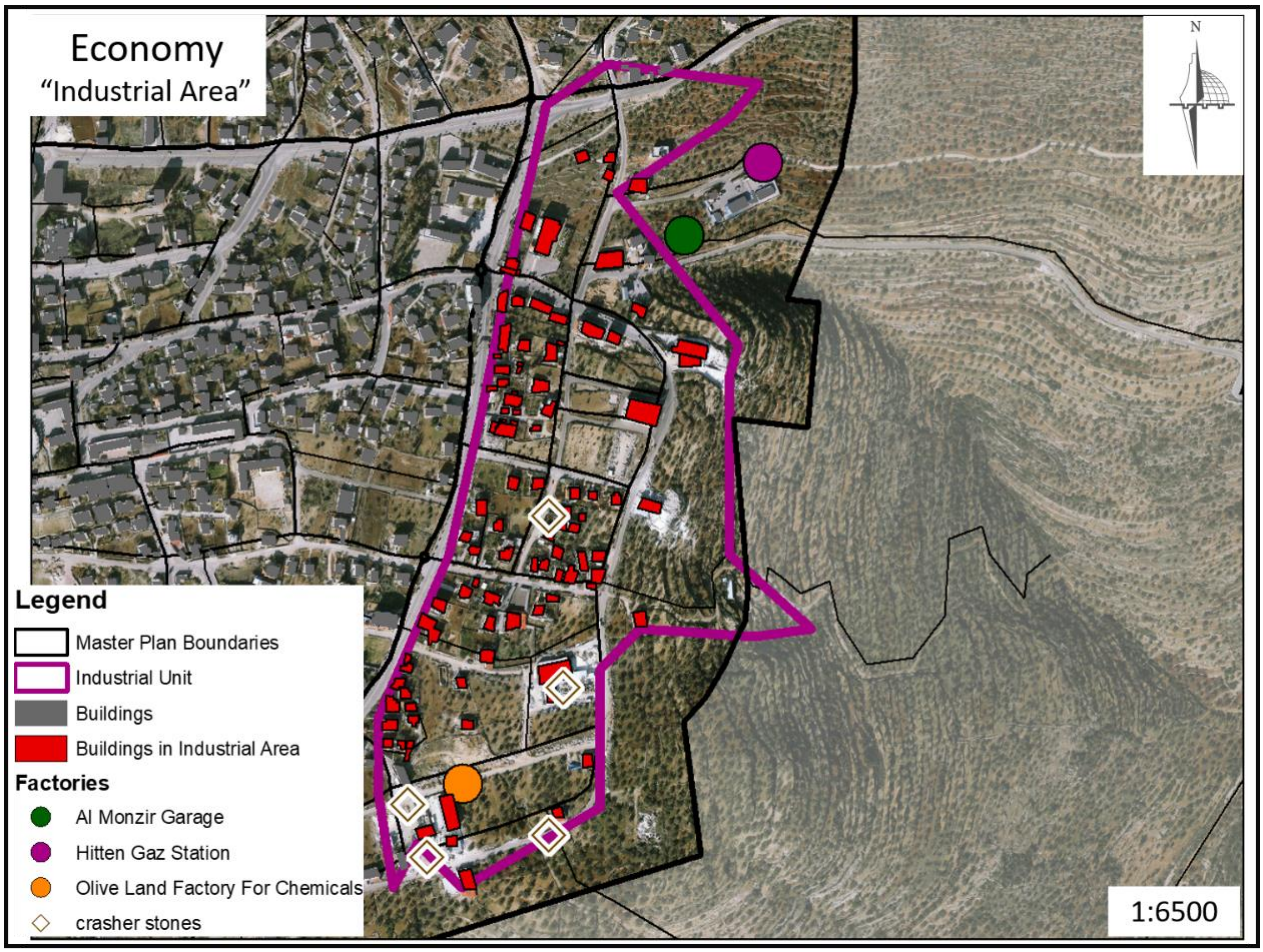
Table4 Area of Agricultural Land Loss

In map 67 we can see many agricultural facilities in Selfit city like cows farm, poultry farm, butchery and olive press.

Some Material that resulted from olive press needs special treatment and the same thing in these different facilities so it's necessary to ensure safe treatment to these materials.

In map 67 we can notice the types of the factories in the industrial area which suffers from absence of greenbelt around it specially because it contains a lot of stones crush factory.

In map 68 we can see some areas highlighted with red outline color, these areas lost their potential of agricultural uses due to urban expansion, and this was known after comparing the historical series of aerial photos.



Map 69 Indusrial area in Selfit and buldings' use

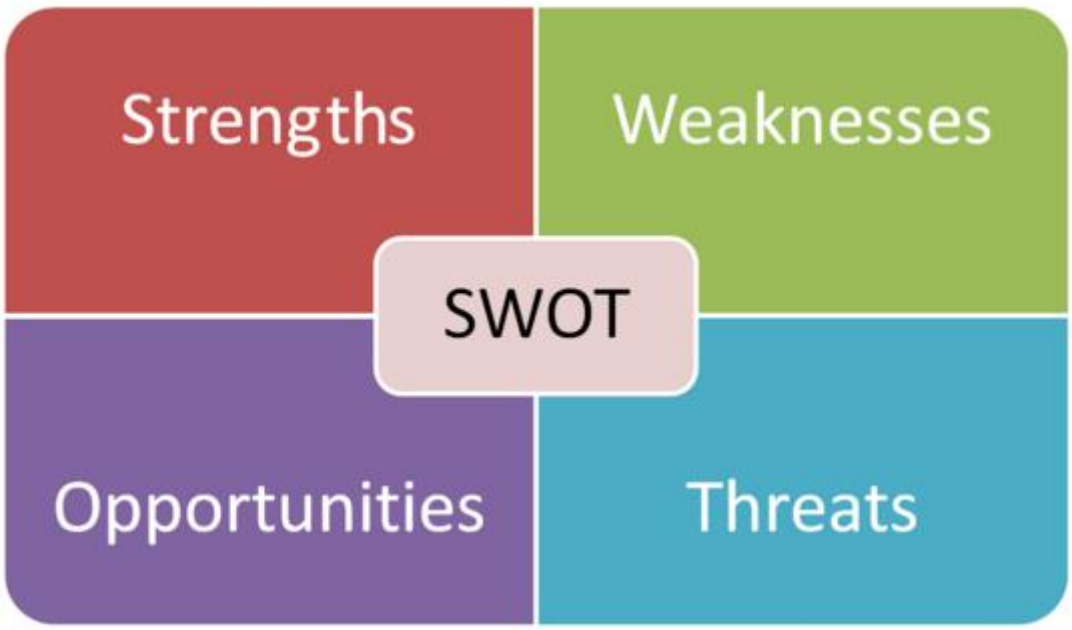
As we can see from map 69 that the majority of building in the industrial area are residential which makes these buildings exposed to direct pollution to these factories, so that a fast move and procedure should be taken to reduce the effect of these factories on the surrounding area.

4.3.5 Swot Analysis

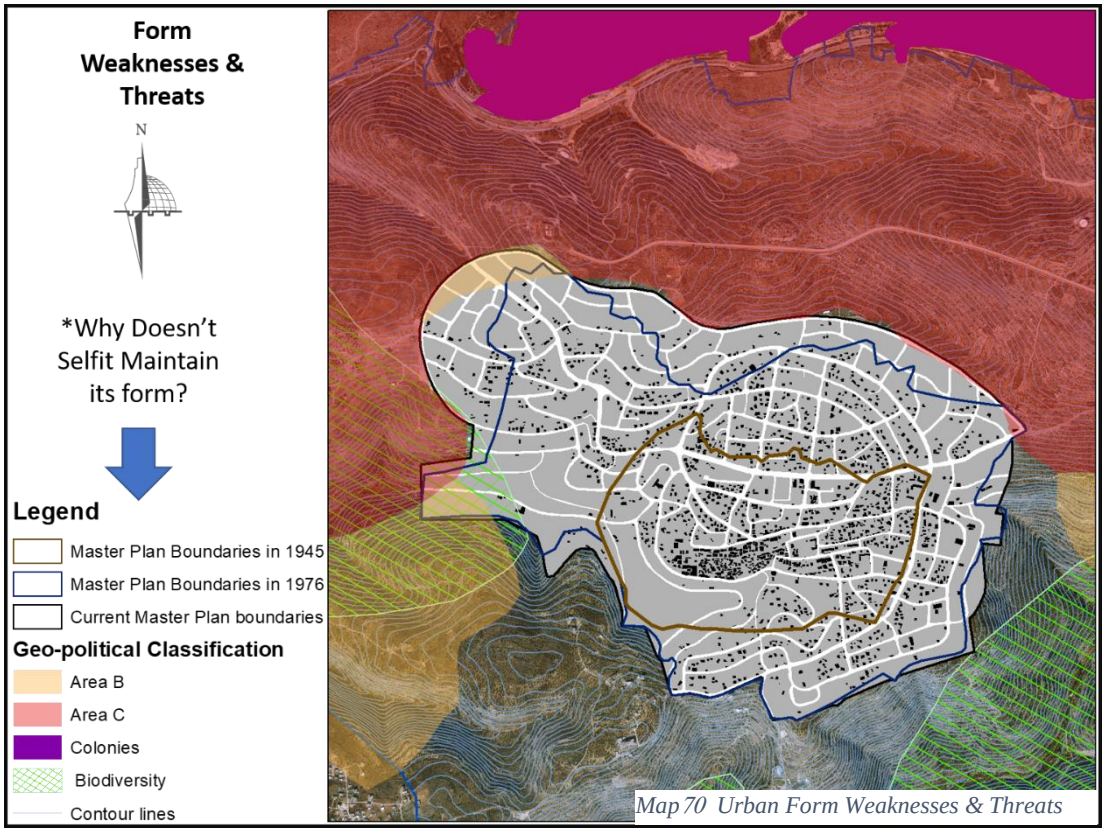
In order to Summarize our analysis in a way could ease the way we understand our analysis, and makes them clear so we can reach clear and readable result in a logical way with no misunderstanding.

All the previous points will be under two main topics which are Weaknesses, Threats under Negative Effects topic, and Strengths, Opportunities under Positive Effects.

All this process is named SWOT Analysis.

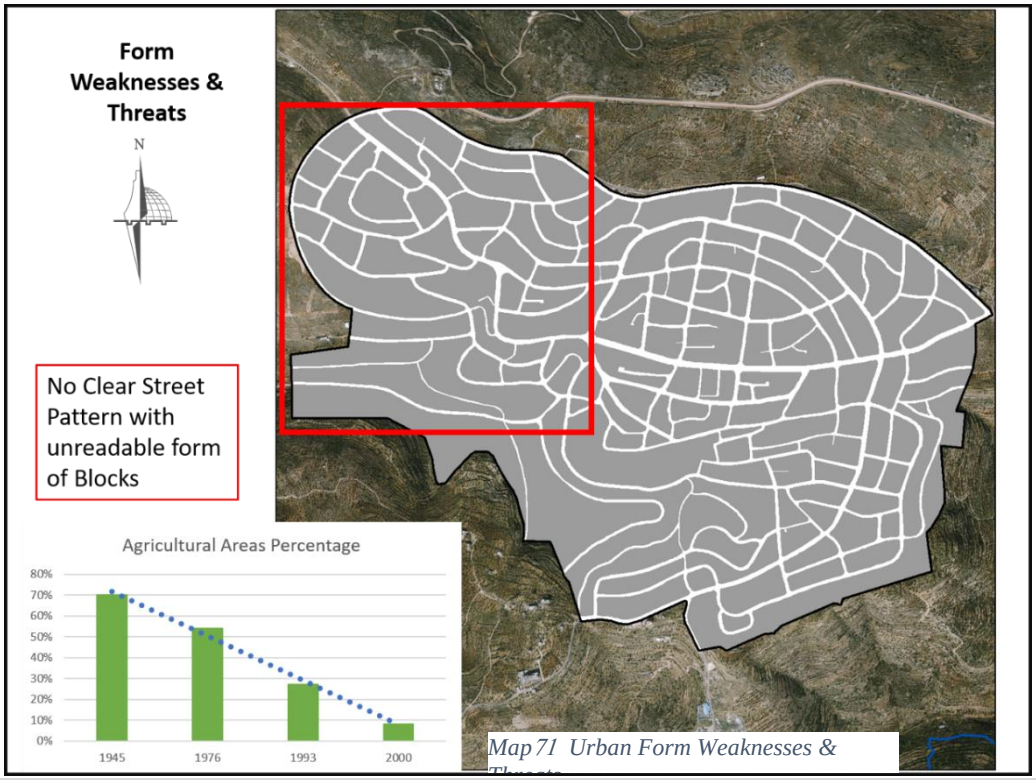


4.3.5.1 Urban Form Weaknesses & Threats



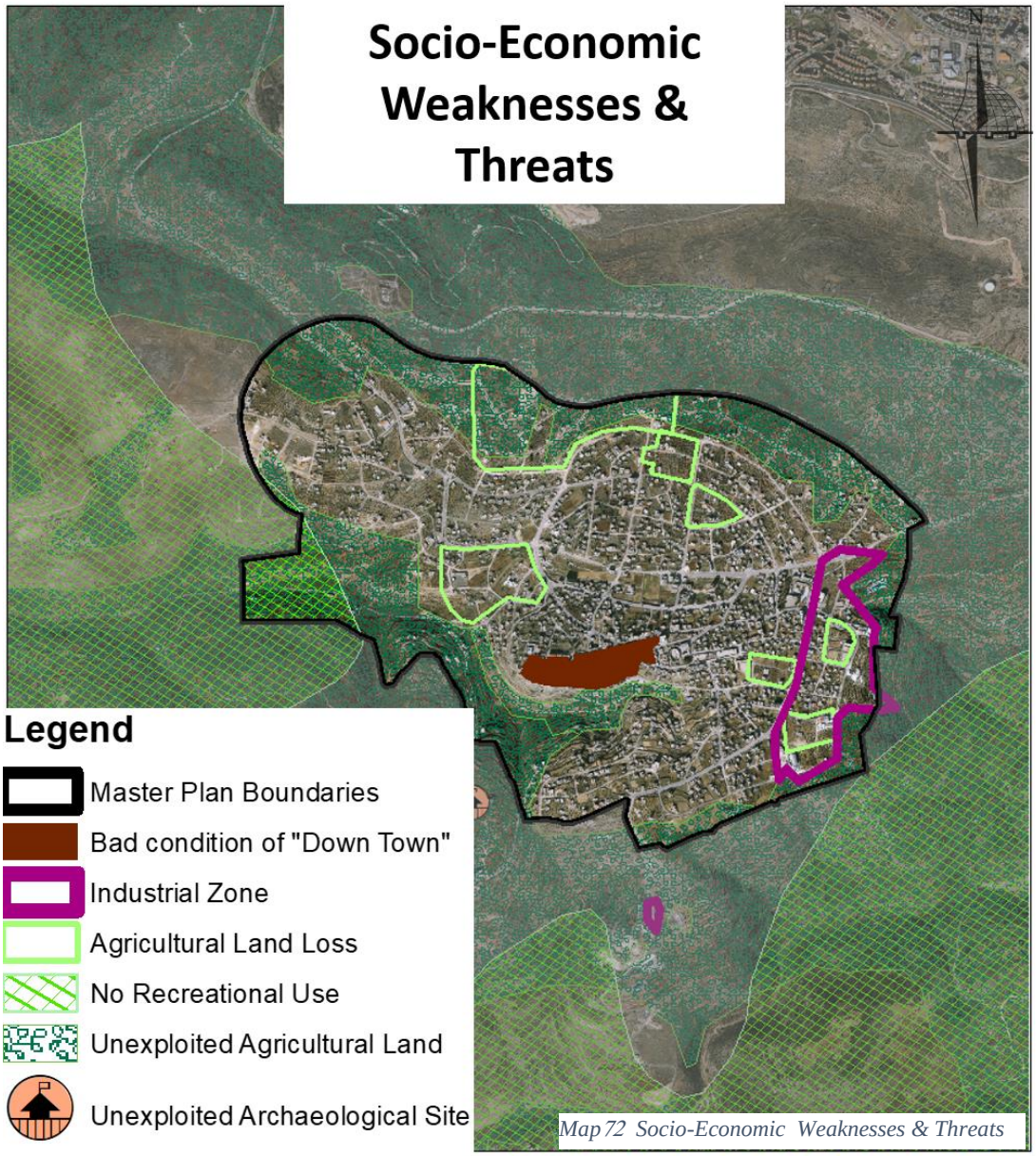
Map 70 Urban Form Weaknesses & Threats

Selfit city suffers from the limited directions that it could expand in as the map 70 shows these limitation like, Area C, Steep slopes, Colonies. We can also see in map 71 that western side of Selfit has no clear street pattern which crosses the land in properly.



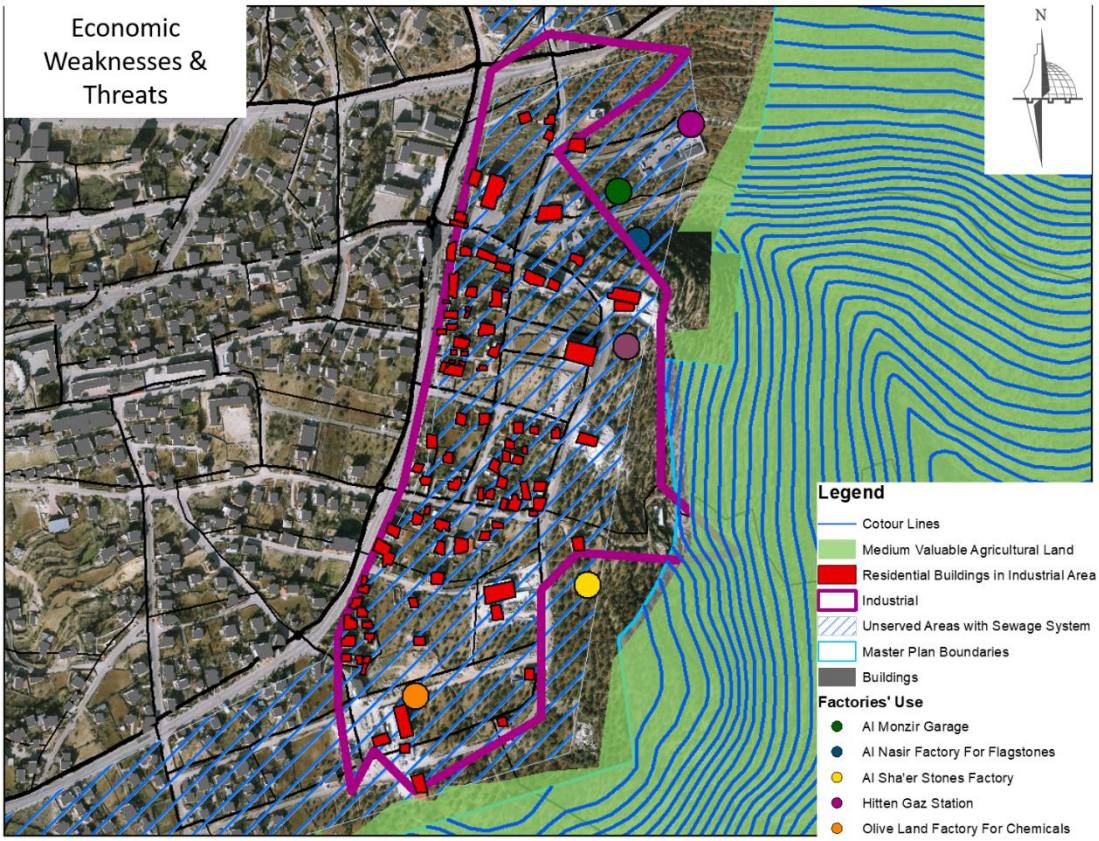
Map 71 Urban Form Weaknesses &

4.3.5.2 Socio- Economic Weaknesses & Threats

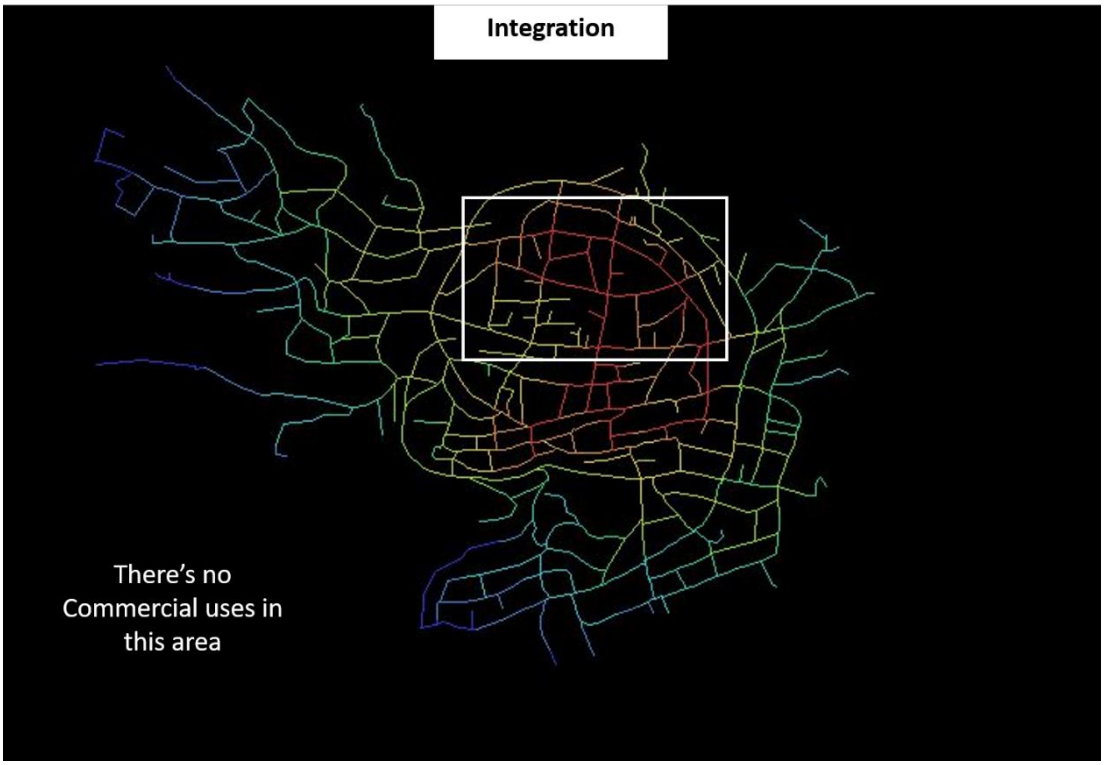


Map 72 Socio-Economic Weaknesses & Threats

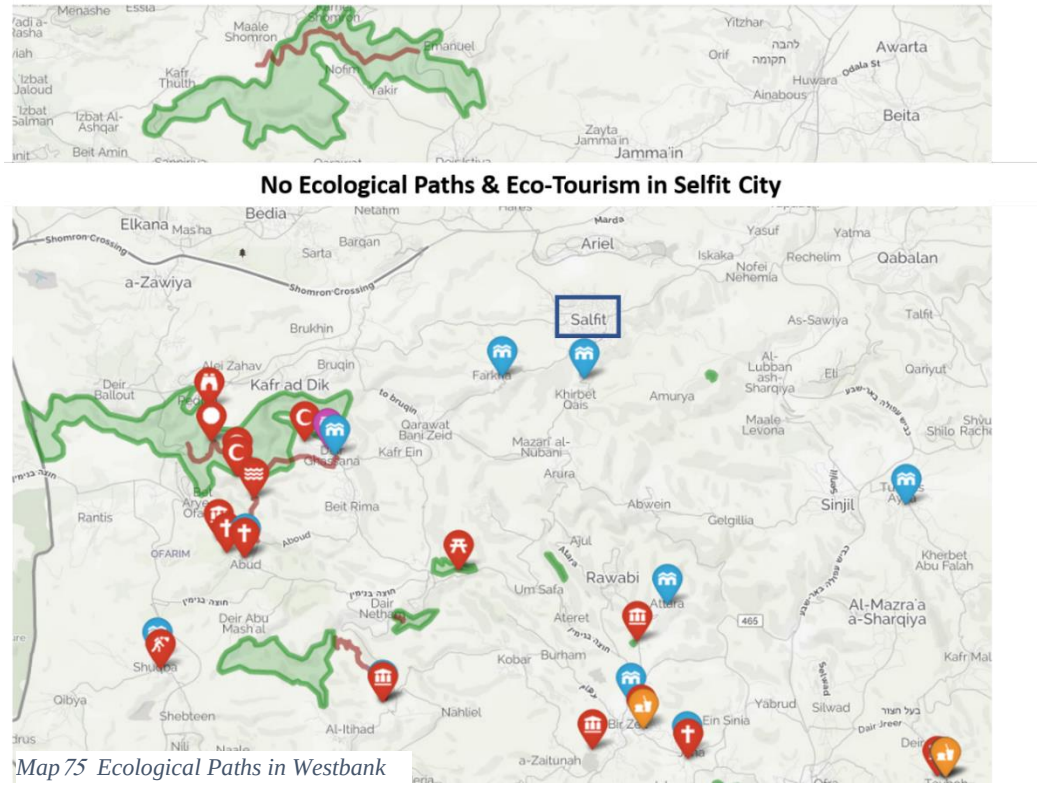
We can see in map 72, 73 that Selfit city has very high potential for agricultural lands but they are not well exploited, and there are some areas with high commercial potential but there are no commercial uses there too, in addition the industrial area has no agro-industry uses, moreover there are no tourist in the city, although it has some important elements there.



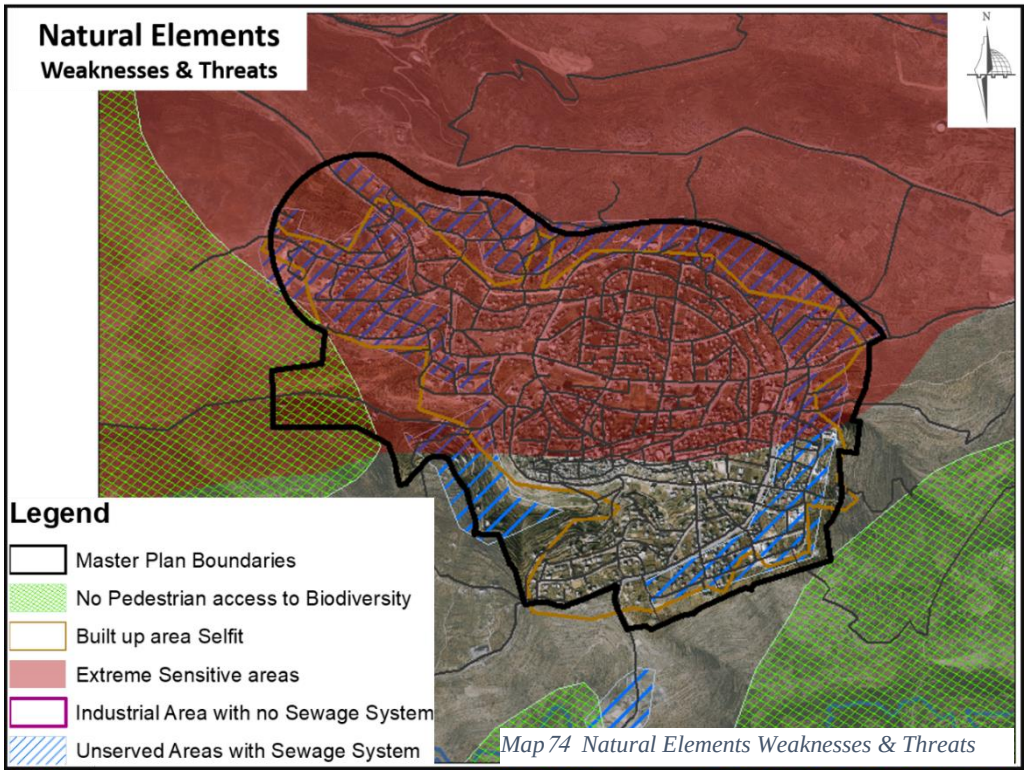
Map 73 Socio-Economic Weaknesses & Threats



4.3.5.3 Natural Elements Weaknesses & Threats



Map 75 Ecological Paths in Westbank

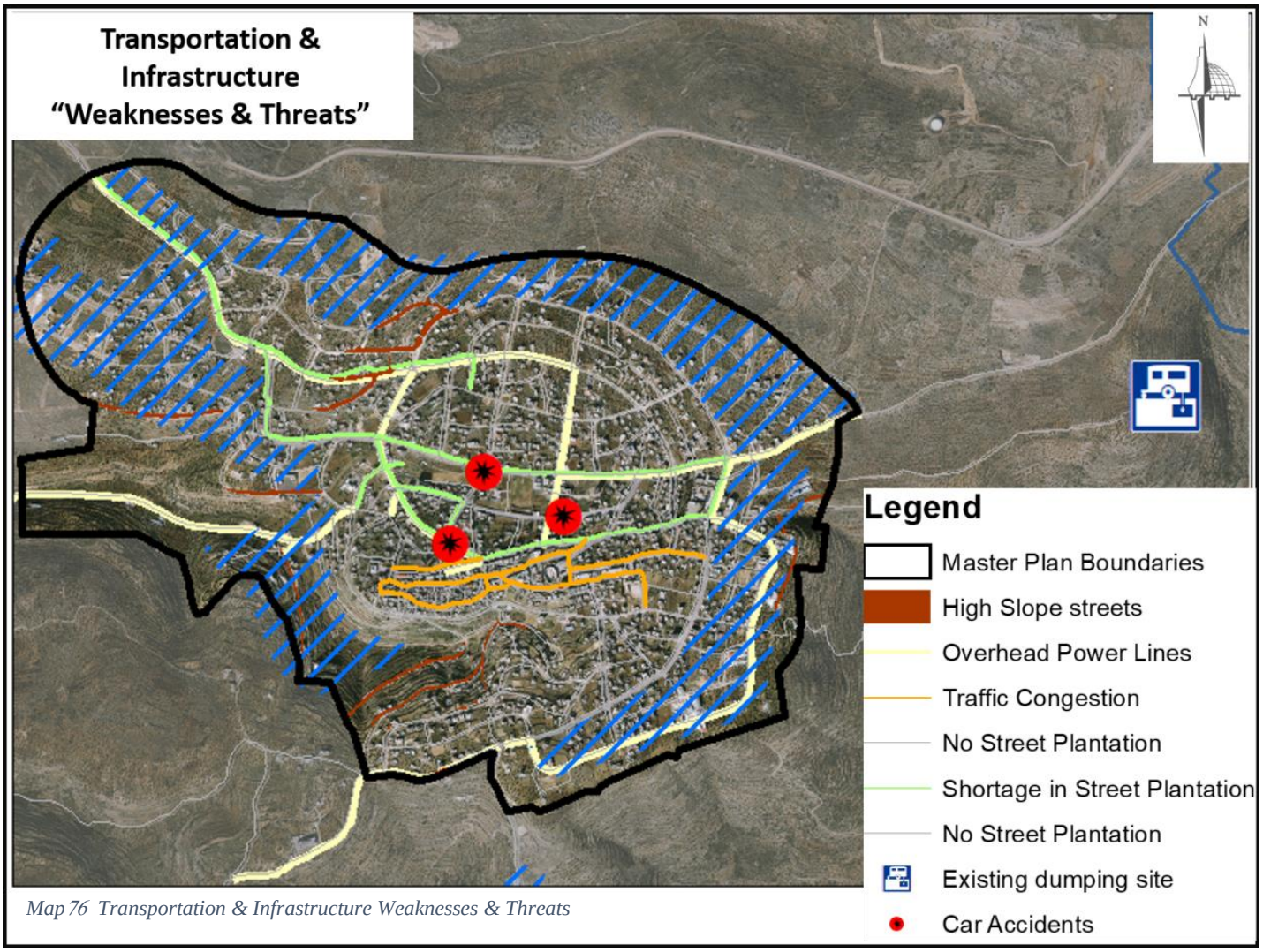


Map 74 Natural Elements Weaknesses & Threats

In map 74 we can see that there's no Ecological path crosses city of Selfit, although it has a lot of natural elements that could make it one of the most important cities for leisure uses, Selfit as I mentioned is almost located in high sensitive area with unserved areas with sewage system like the industrial area as shown in map 75.

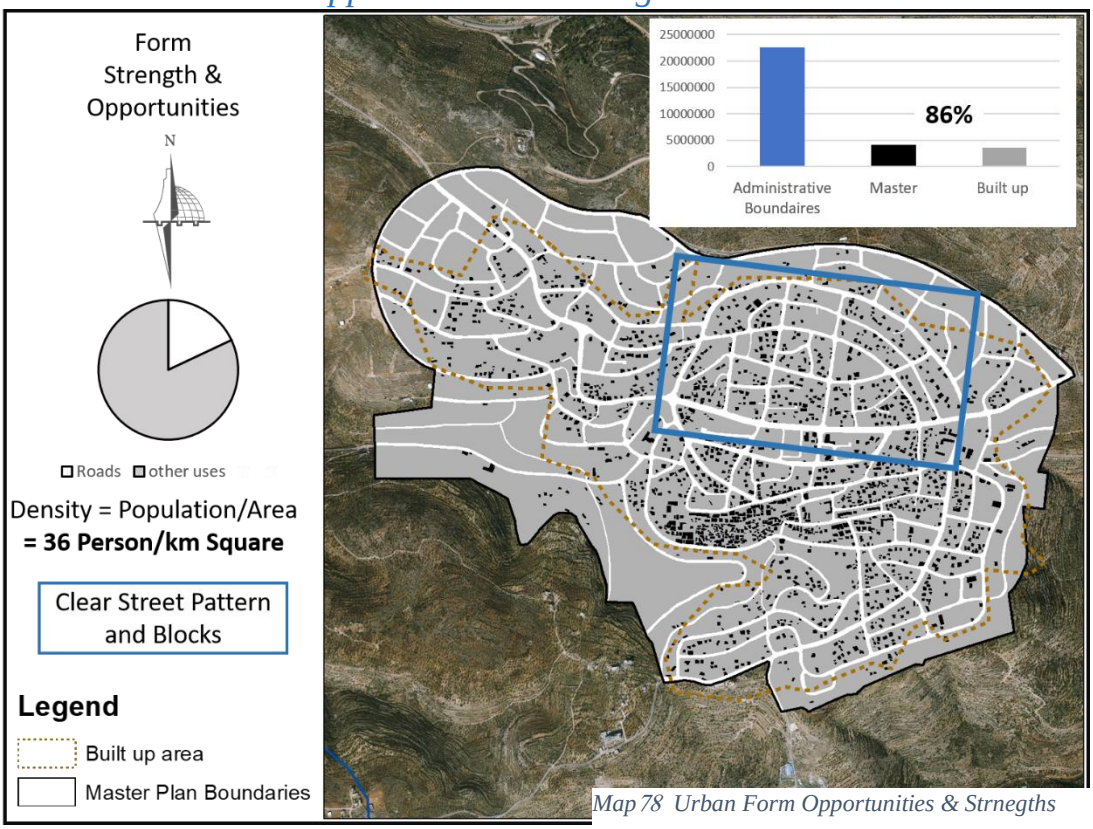
4.3.5.4 Transportation & Infrastructure Weaknesses & Threats

In transportation and infrastructure side we can notice very important points like the exposed overhead powerlines and dumping site in the eastern part of the city and the streets aren't suitable for walkability purposes and unsafety on some intersections. These main points require fast move to ensure safety in the city as shown in map 76.

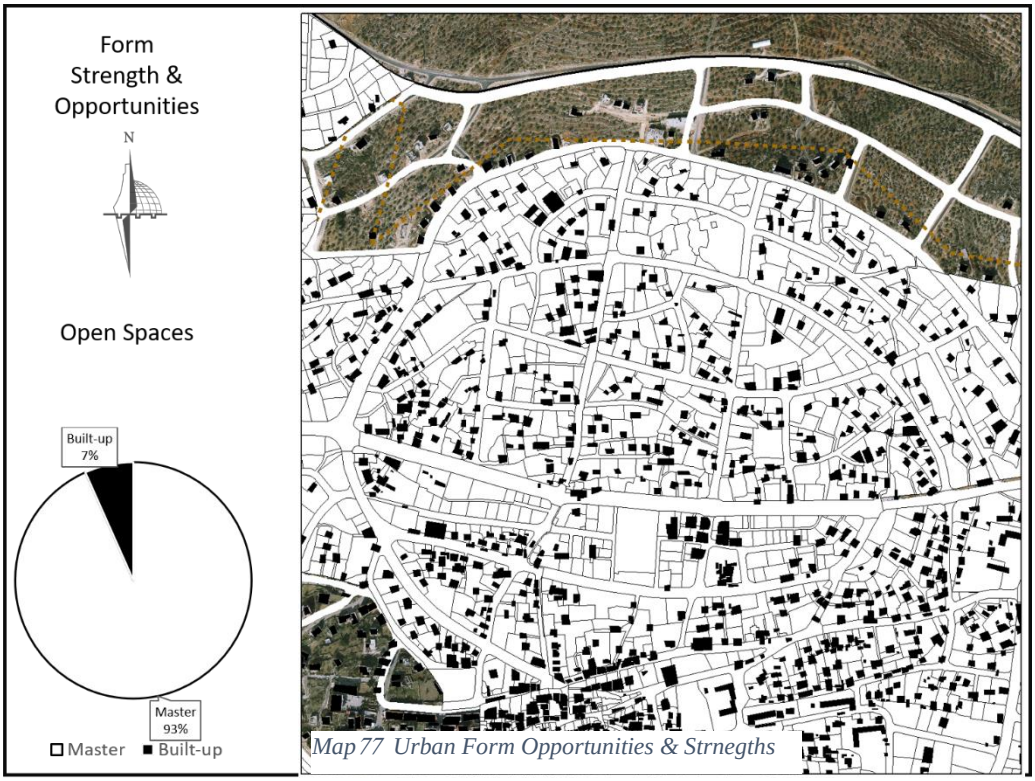


Map 76 Transportation & Infrastructure Weaknesses & Threats

4.3.5.4 Urban Form Opportunities & Strengths



Map 78 Urban Form Opportunities & Strnegths

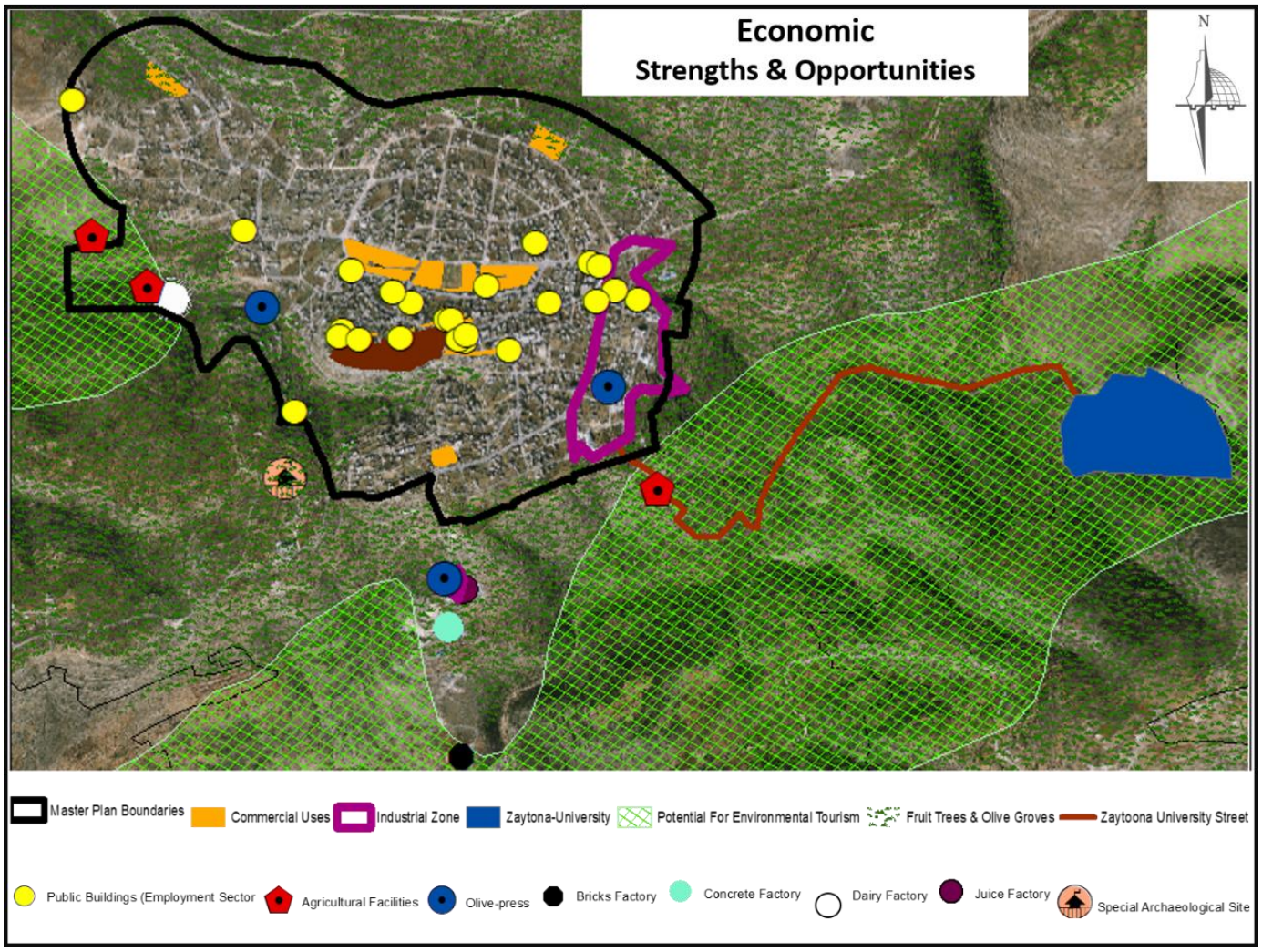


Map 77 Urban Form Opportunities & Strnegths

One of the main strengths and opportunities in Selfit that it still has a lot of vacant area and open spaces which secure the nature side of the city and makes it more health comparing with the other cities.

4.3.5.5 Economic Strength & Opportunities

There are a lot of agricultural facilities in Selfit and different factories as shown in map 79, which is considered as an important strength.



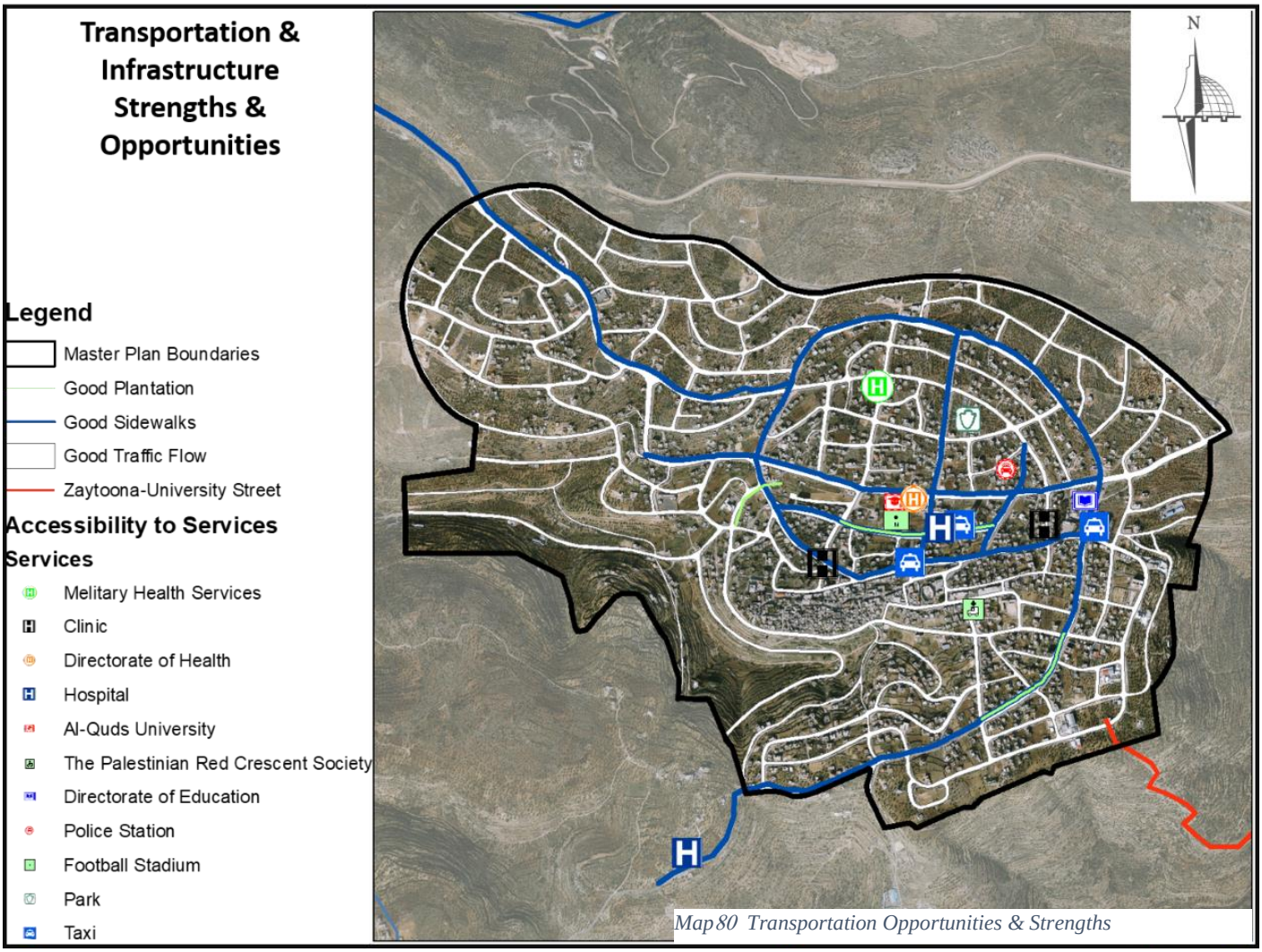
Map 79 Economic Opportunities & Strengths

It's also the center of the governate which makes all the public and governance directorate in the city and this ensure move for the employees to Selfit, in addition the construction of Zaytoona university and military college.

The existing potential for agriculture will help the economic of the city to share it's products in the national market too.

All these points will improve the economic side of the city and make it stronger and more reliable in the future.

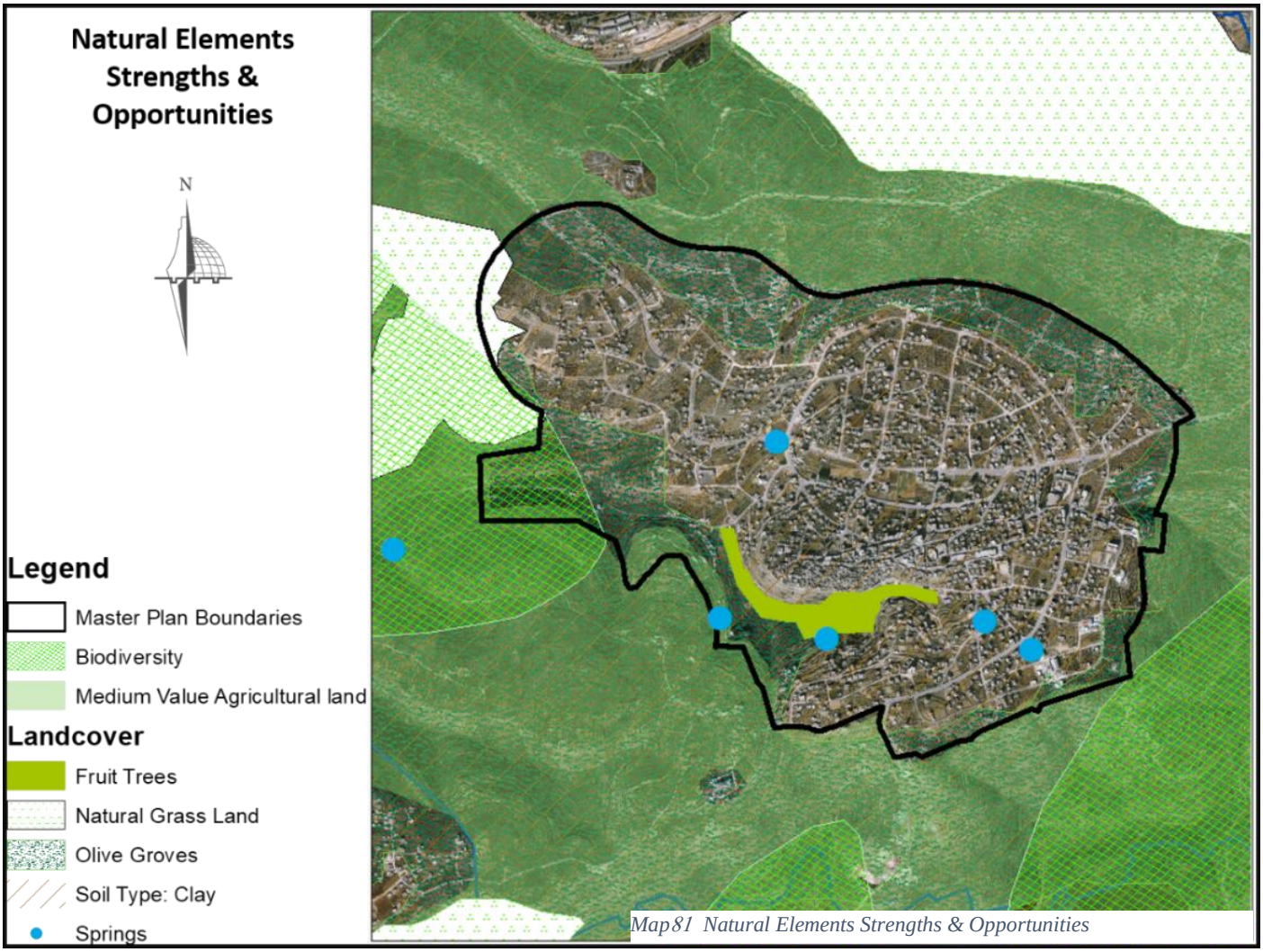
4.3.5.6 Transportation & Infrastructure Strengths & Opportunities



Map 80 Transportation Opportunities & Strengths

The main streets in Selfit city is in a good condition for walkability and have suitable widths, moreover due to the small area of Selfit city makes the accessibility to different type of services (Educational, Medical, Social, Recreational, etc …)

4.3.5.7 Natural Elements Strengths & Opportunities



Map 81 Natural Elements Strengths & Opportunities

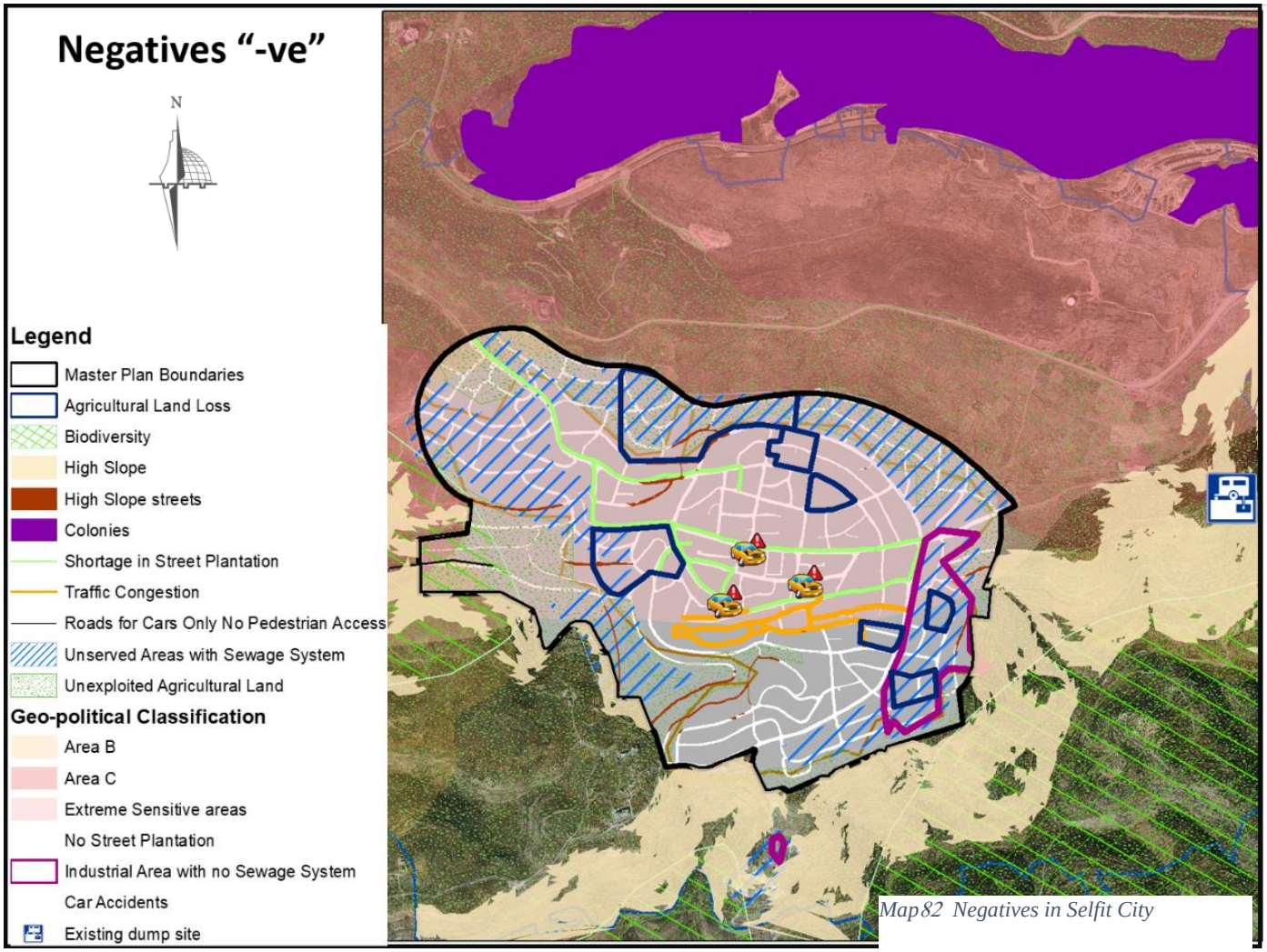
Selfit city lies in the western basin of the Westbank which is very rich of water, we can see from map 80 that city of selfit have six springs with huge landcover of Olive groves and other fruit trees and natural grass land, in addition to biodiversity around the city with beautiful view there.

All these elements work together to emphasis the environmental importance of the city.

4.3.6 Negatives & Positives

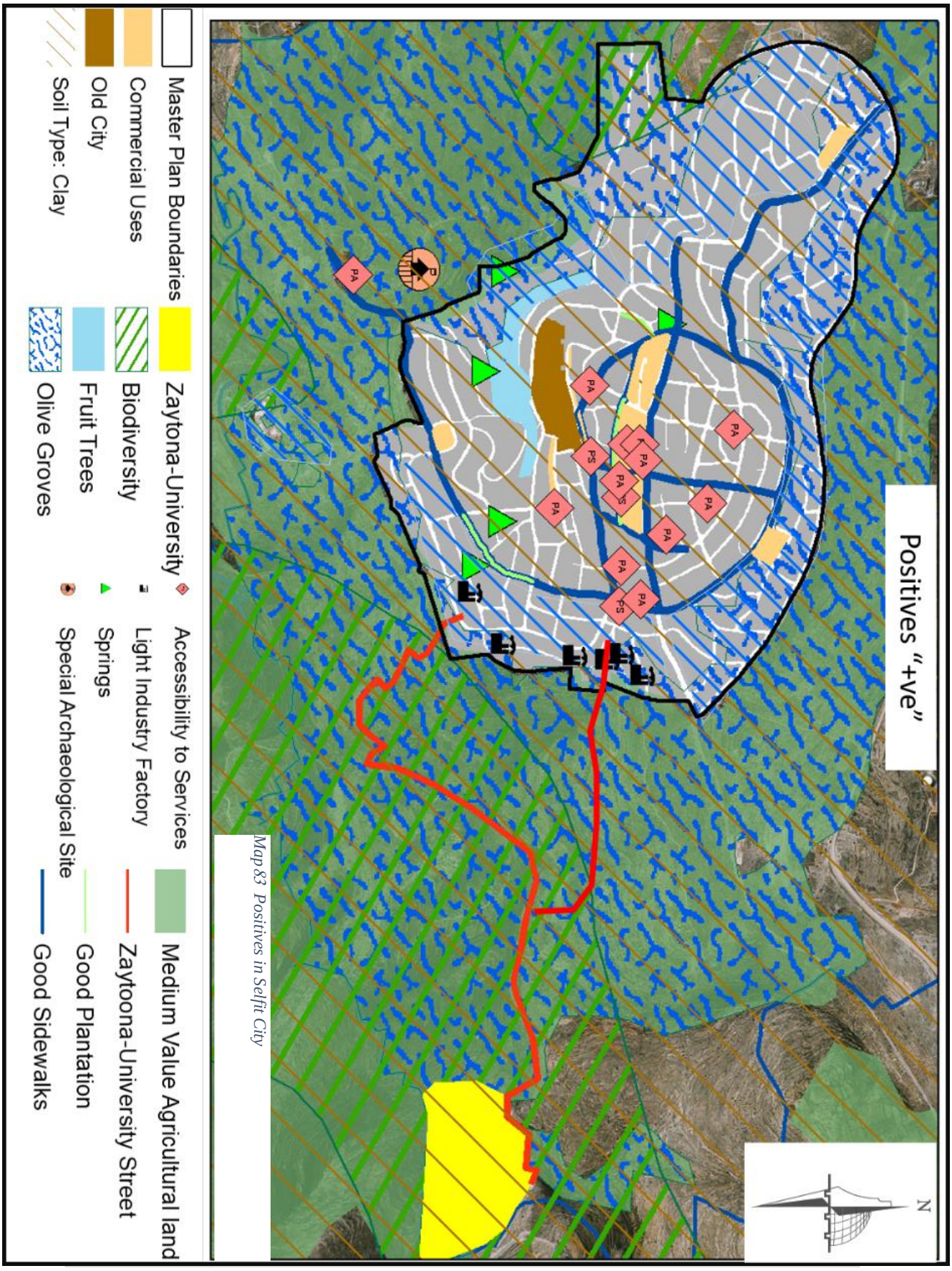
To end up the stage with a useful summary for all components I summarized all the positives and negatives that are related to Eco-city principles as follow:

4.3.6.1 Negatives:



Map 82 Negatives in Selfit City

4.3.6.2 Positives:



Map 83 Positives in Selfit City

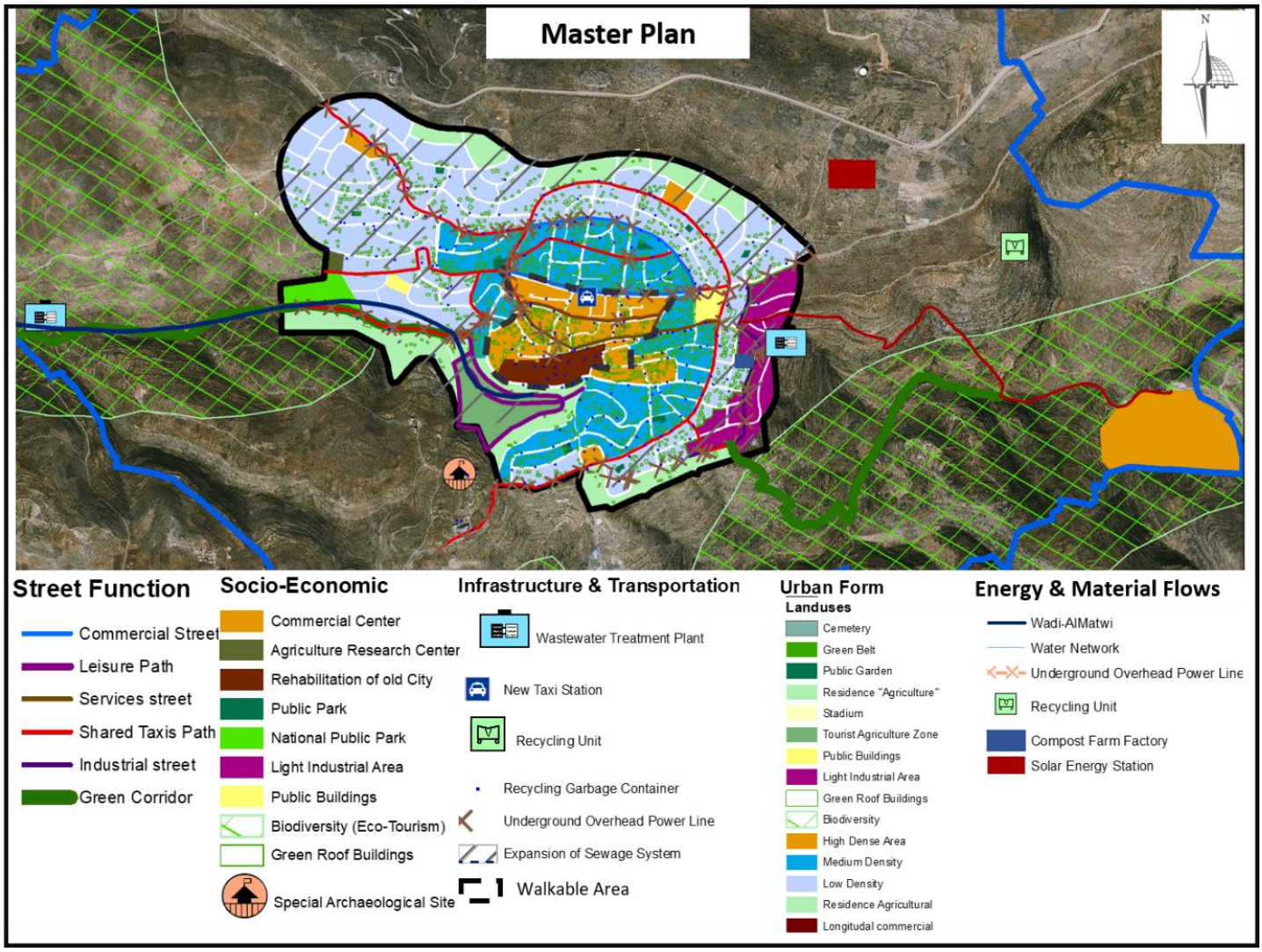
Principle	Condition*		
	Good	Fair	Bad
Restore Degraded Land.			
Fit the Bioregion.			
Balance Development.			
Create Compact Cities.			
Optimize Energy Performance.			
Contribute to the Economy.			
Provide Health and Security.			
Encourage Community.			
Promote Social Justice and Equity.			
Enrich History and Culture.			

*What is the current condition for this principle in the city?
To what extent is this principle achieved in the city?

Table5 Principles Evaluation based on Previous Analysis

We can notice that after all the analysis, the majority of principles need interventions to achieve the Eco-city, these intervention should be done based on our analysis and our clear vision for the city of Selfit.

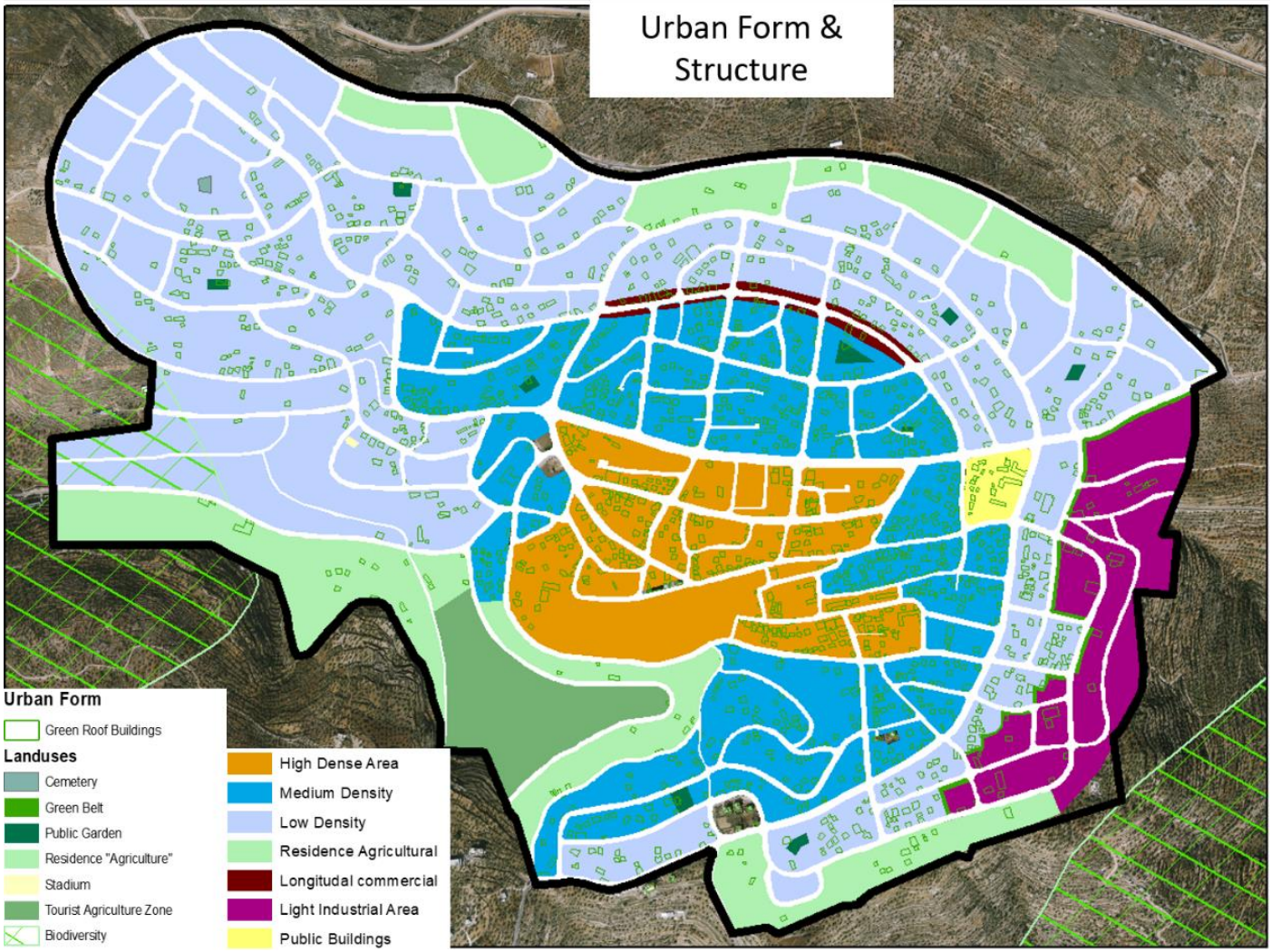
Chapter 5
5.1 Development Concept



Map 84 Selfit as an Eco-city Master plan

5.1.1 Master Plan Components

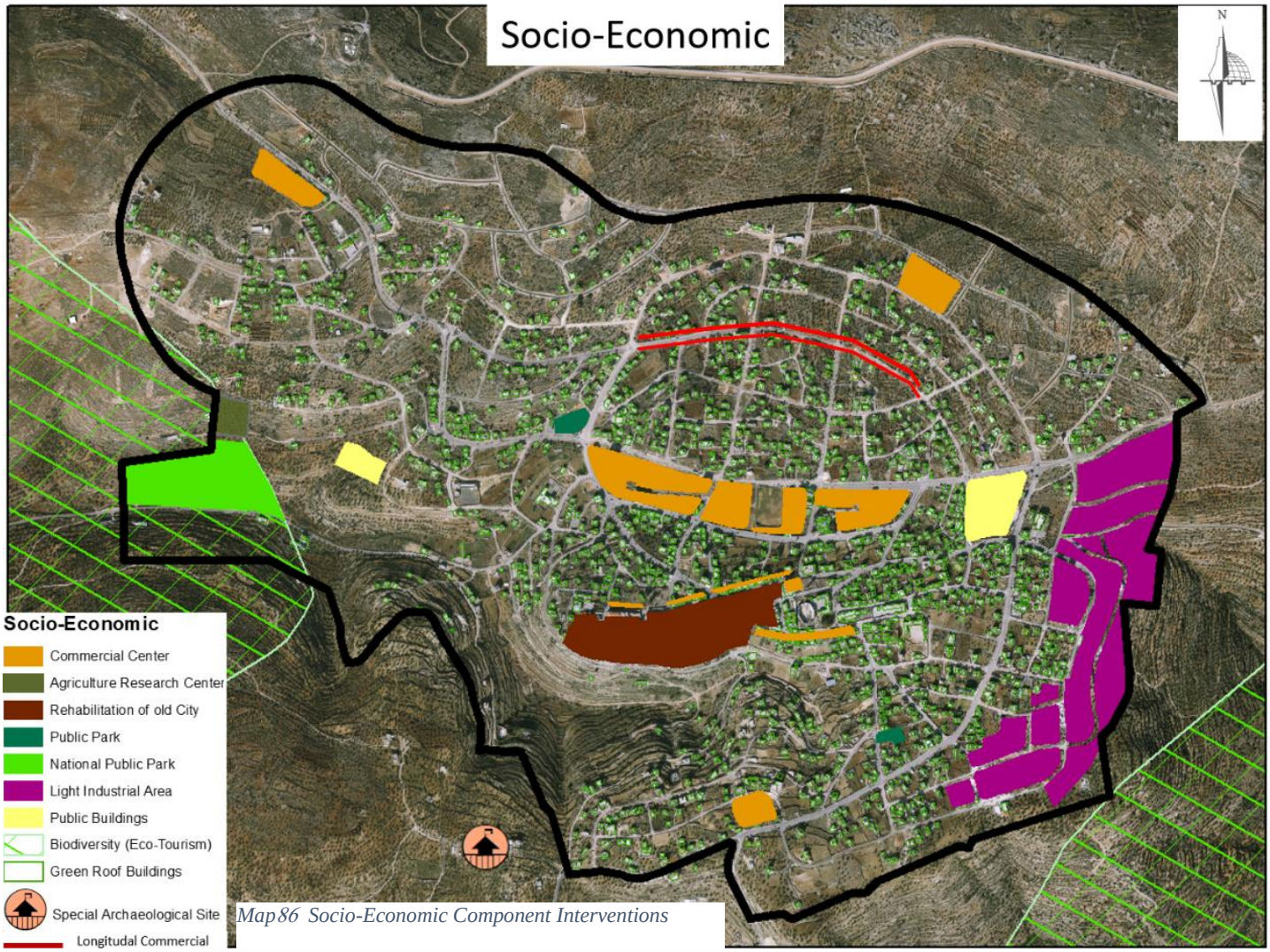
5.1.1.1 Urban form & structure Component



Map 85 Urban Form & Structure Component Interventions

In order to save the form of the city in the proposed landuse the Residence agricultural which will emphasis on its character and identity, moreover reduce and change the area of the industrial zone to exclude the residential units and surround the industrial area with greenbelt, in addition to that a commercial area is proposed in the street which shape the radial in the city, and more green spaces and open spaces distributed in the city.

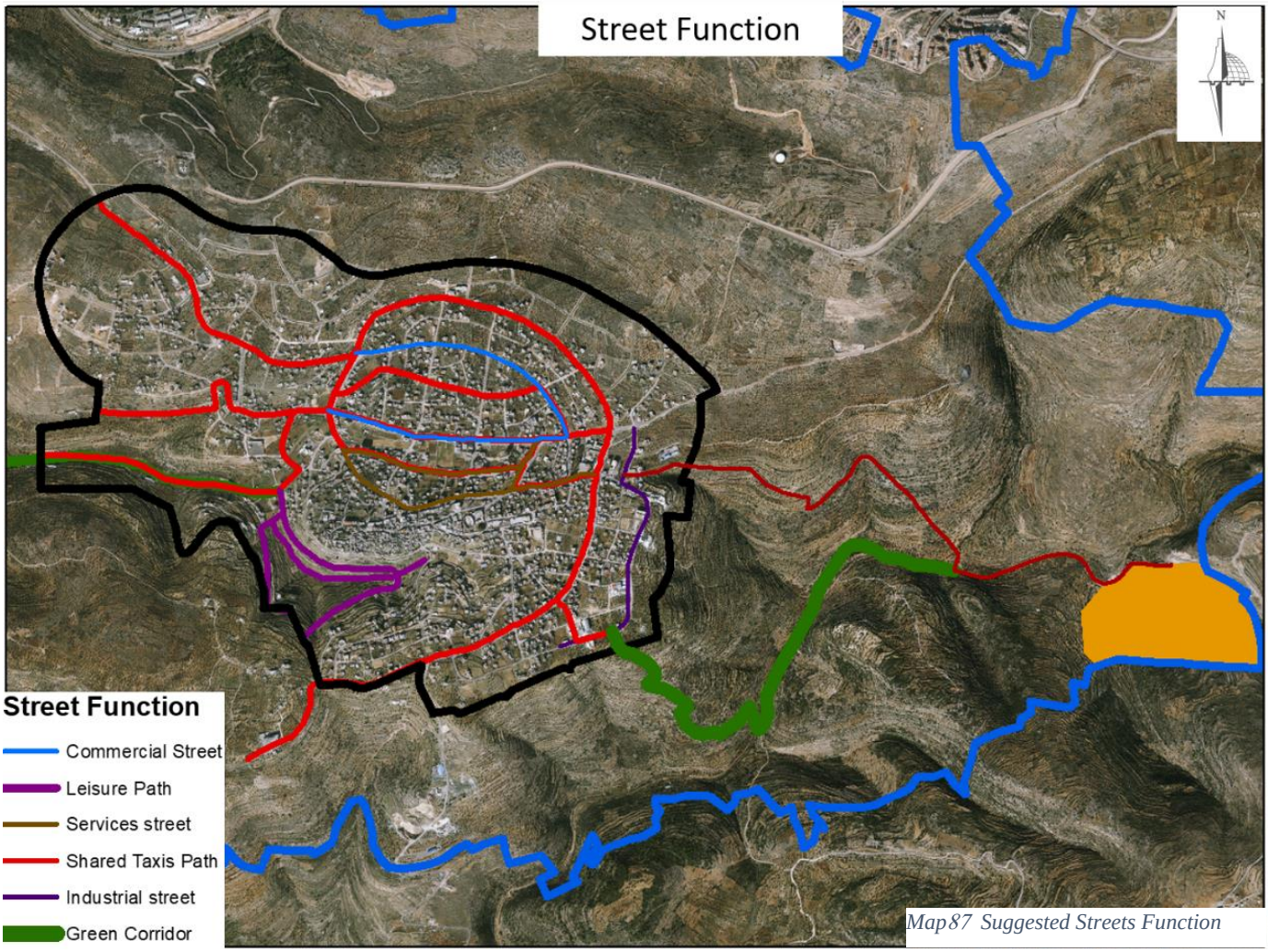
5.1.1.2 Socio-Economic Component



Map 86 Socio-Economic Component Interventions

- Reduce the area of industrial zone to exclude the residential units.
- Proposed Longitudal Commercial zone
- Rehabilitation of old city
- Green roof buildings to increase the green productivity in the city
- Ecological paths to improve the tourism
- Create recreational facilities like national parks

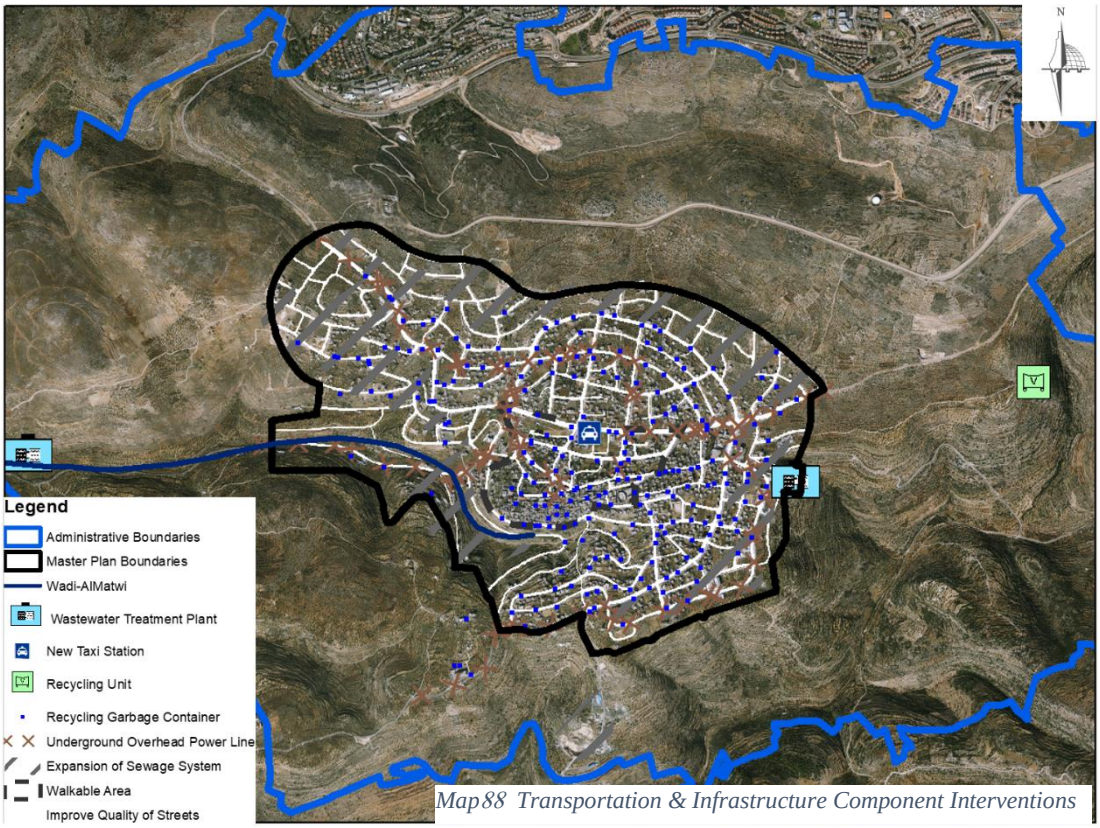
5.1.1.3 Street Function



Map87 Suggested Streets Function

- **Commercial Street**: it's located in the radial street, based on the analysis on depth map that area has potential to be commercial.
- **Leisure path**: this path lies beside the old city where the best view is.
- **Shared Taxis Path**: City of Selfit suffers from absence of any shared taxis except taxis offices so it's necessary to suggest a path for these taxis.
- **Industrial Street:** This street connects the industrial zone with the city this street is specially for trucks and heavy vehicles.
- **Green Corridor:** These corridors pass through the biodiversity to ensure accessibility to these biodiversity and ensure safe access for recreation.

5.1.1.4 Transportation & Infrastructure Component



Map88 Transportation & Infrastructure Component Interventions

- **Wastewater Treat Plant:** Two waste water treatment plant one is suggested in the industrial zone and the other one is away five kilometers from the city alone the line of Wadi Al-Matwi.

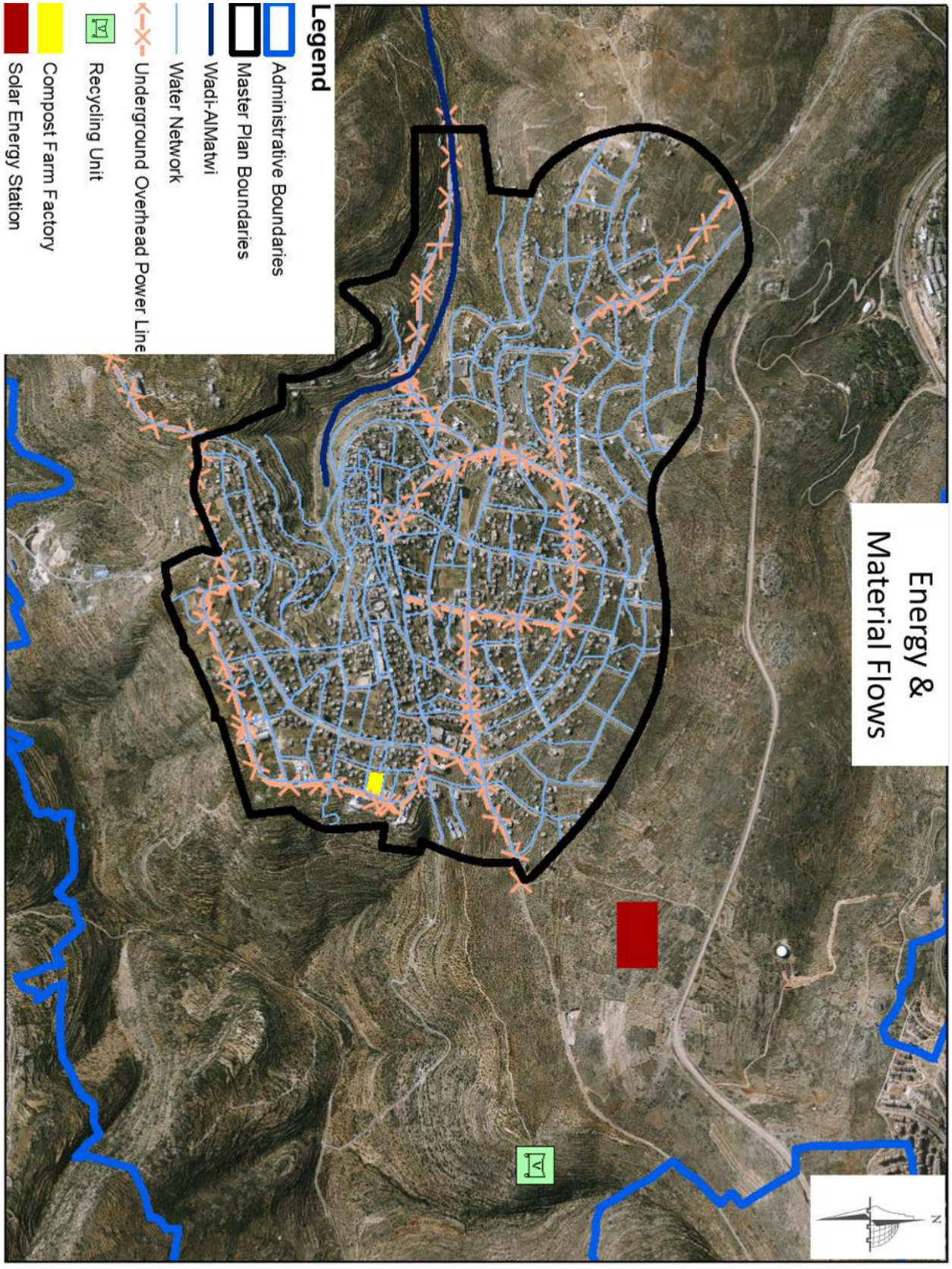
- **Suggested Taxi Station:** In the center of the city due to high accessibility there for pedestrian and cars and suitable width of street to accommodate the movement there.

- **Recycling unit:** It's located in the eastern away of the city in the same place of the dumping site. In this recycling unit all the garbage should be treated there for all the region.

- **Underground Overhead powerlines:** These power lines are considered as risky lines in the city so increase the safety there.

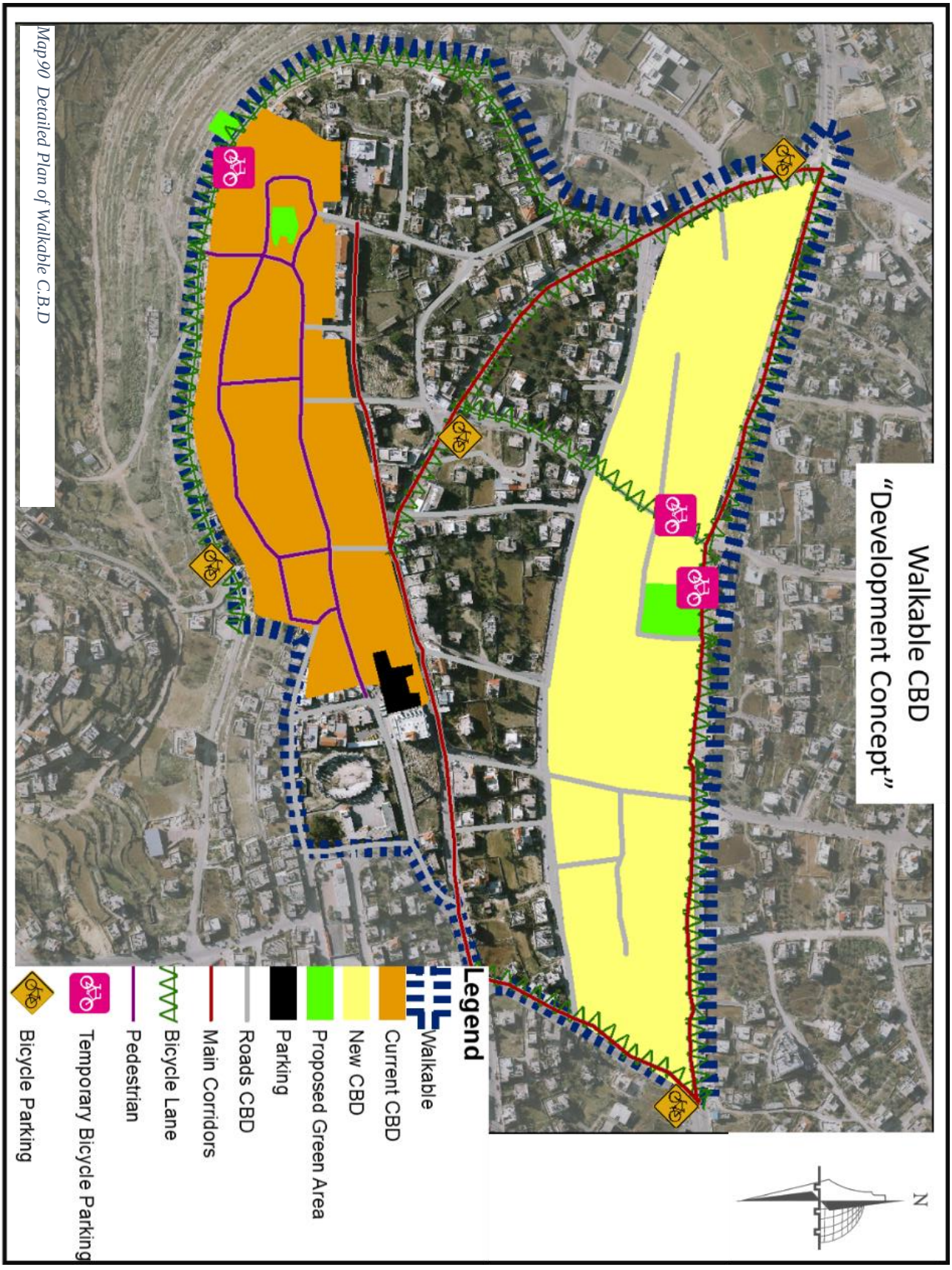
- **Expansion of Sewage System:** The sewage system should serve all the residents of the city to ensure safe disposal of the wastewater.

5.1.1.5 Energy & Material Flows Component



Map 89 Energy & Material Flows Component Intervention

5.2 Detailed Plan for Walkable C.B.D



Map 90 Detailed Plan of Walkable C.B.D

Chapter 6
6.1 Conclusion

Ecological city is not just a principle to be applied it's a behavior of people.

It could be applied on different levels and stages, all we need is just to order the procedures in a way fit with the conditions.

The importance of the Eco-city increases by the time due to the pressure on the resources all over the world, and this requires a fast reaction from people and the official agencies and non-official agencies.

The first step towards the Ecological approach is to increase the awareness of people about the importance of saving out environment.

One day the ecological approach will be the only way to complete in this life as long as we aren't aware of the importance of our existing resources and our health and incoming generations health.