Chapter Six

Physical and Climatic Characteristics of Khartoum

6.1. Introduction

This chapter studies the climatic conditions, topography, socio-economic situation and of the study area, Khartoum, as one of the major cities. The study area lies in central Sudan between 10°N and 20°N degrees latitude north, and between 25°E and 35°E longitude east. This area is characterized by hot dry and desert climate.

6.2. Why Central Sudan?

Central Sudan has been chosen as study area for the following reasons:

1- It is one of the most populated areas in Sudan. The population of Khartoum is estimated at 7,000,000 people. Another over populated area is Aljazeera State. It's the second after Khartoum in terms of population and has the biggest agricultural scheme in Sudan.

2- In spite of existing well-planned towns in this area, for instance, Khartoum and Medani, the area lacks wind and air movement studies. This has resulted in negative effects on urban planning.

3- More than 75 % of population in this area are living in the third class neighborhoods.

4- There are building regulations and physical planning law in Khartoum state, however, these laws are not effective in other Sudanese states, also this law lacks of direct instructions about wind and air movement, how to take their effects in concern during planning and architectural design process.

6.3. Study Area

The area of central Sudan is characterized by hot dry and desert climate. See figure 6-1.

The central regions of Sudan lie between the latitudes 10ºN and 20ºN, the longitudes 25ºE and 35ºE. [Babikr, 1999]. The researcher has chosen Al Haj Yousuf neighborhood, Block 10, East Nile Locality, and Khartoum State for investigation. See figures 6-2, 6-3, and 6-4.

This neighborhood is classified as a third class district, it is also considered as one of the high densely populated third class neighborhood in Khartoum town. The buildings were constructed according to the building regulations in Khartoum state. 90 % of the houses contain buildings with a height of one floor, as the buildings are not yet completed four floors according to the number of stories allowed in the third class residential areas.

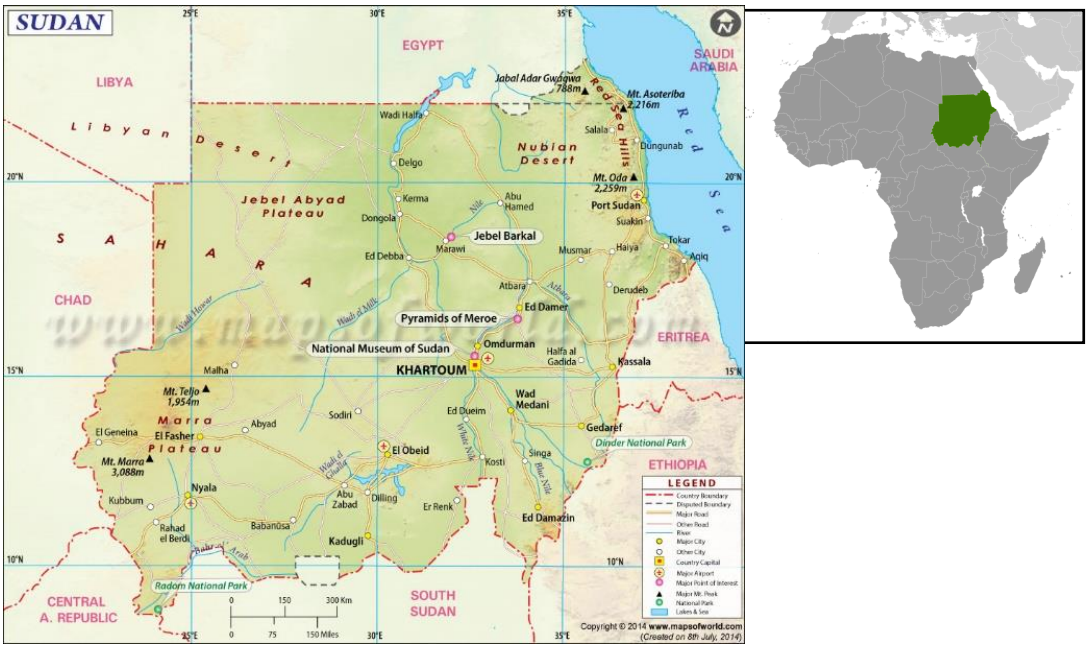

Figure 6-1. Definition the area of study: Map of Sudan. [Source: Ministry of Culture, 2015]

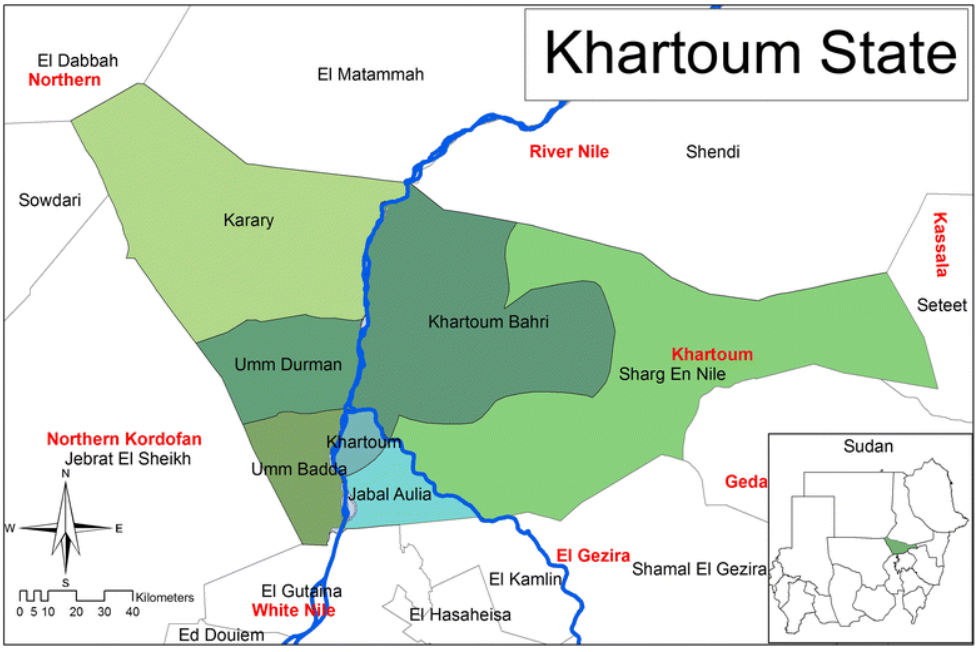

Figure 6-2. Map of Khartoum State. [Source: Ministry of Culture, 2015]

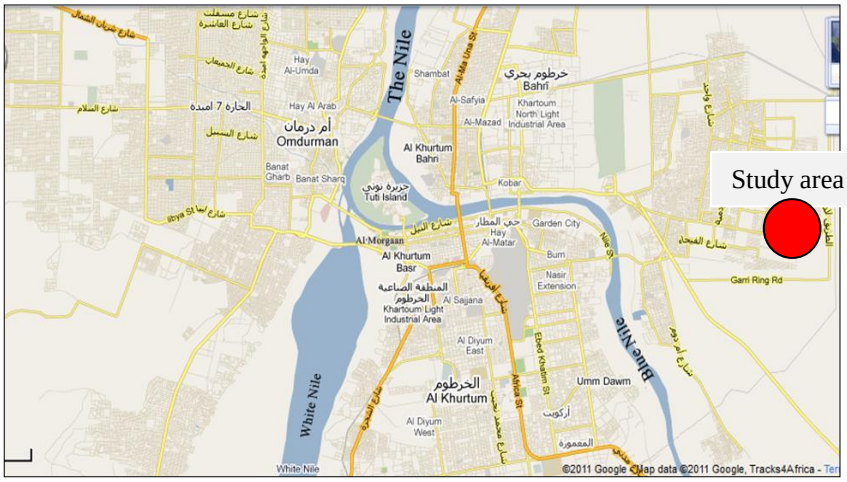

Figure 6-3. Map of Khartoum Town. [Source: Ministry of Culture, 2015]

Figure 6-4. Map of Al HajYousuf Block 10. [Source: Ministry of public Planning &utilities]

Figure 6-5. Aerial View of Haj Yousuf Block 10. [Source: Google earth Map, 2015]

6.4. Climate

The area of the study is characterized by high degrees of air temperature during all months of the year and drought. There is scarcity of rains especially in the areas lying between north of latitude 15ºN. Rainfalls increase as we head south between latitudes 10º and 15º N. The area is also characterized by high temperature, wind movement, dust, lack of vegetation, desert encroachment and high surfaces. [Babikr, 1999].

6.5 Wind Movement

Most of the prevailing wind in this area comes from the north during the period from October to June. This period represents the months of drought, where there is an increase in sandstorms and high dust. [Babikr, 1999]. Wind blows from the western-south during the rainy season (between June and September). In this period relative humidity rises up to 40% especially in the period from June to September. [Babikr, 1999].

North wind prevails in this area for eight months of the year. The wind is dry because it passes through the Saharan. This wind is characterized mostly by high air temperature. [Babikr, 1999]. It carries water drops from the western south direction during the period between June and September. [Babikr, 1999]. Wind speed mostly becomes strong and turns to sandstorm especially between April and October. The tropical line becomes more active and henceforth it moves towards the north in this period. See Table No (6.1).

Table (6.1): Mean wind velocity and the dominant direction in the area of study (1980-2010). [Babikr, 1999]

No	Month	Wind direction	The wind velocity (m/s)
1	January	N	4.5
2	February	N	5
3	March	N	5
4	April	N	4.5

5	May	N	4
6	June	WS	4.5
7	July	WS	4.5
8	August	WS	4.5
9	September	WS	4
10	October	N	3.5
11	November	N	4.5
12	December	N	4.5

6.6. Socio-Economic Aspects

The Central Sudan is the most populated area. Khartoum, the capital of Sudan, lies in this region. It lies at the confluence of the White Nile and Blue Nile. The three towns- Khartoum North, Omdurman and Khartoum are connected forming the greater Khartoum. Khartoum is the center of commerce and government; Omdurman is the national capital; and North Khartoum is the industrial center, home to 70% of Sudan's industry. This area is the most developed and settled area. Facilities and other service institutions including educational and health exist in Khartoum, where cultural and educational level is also high.

6.7. Planning of Khartoum through different ages

This section traces the development of planning of the study area over time and highlights planning process and the general conditions of building and construction.

6.7.1. Historical Background

An ancient town was discovered in 1929 in the western area of Khartoum north. The town goes back the 7th century AD. Tracks of ancient life were also found in Al Shajara neighborhood as the Egyptian wild port have established. [Abu Saleem, 1991]

Historians have reported little about Khartoum during the Christian Nubian Kingdom and during the following eras up to Fonj Kingdom. [Abu Saleem, 1991]

Khartoum started as a small village, when Sheikh Arbab Alaqaaid crossed the Nile from Tuti Island establishing the first village in this area. He built a mosque for conducting religious rites and teaching Holly Qur'an. [Abu Saleem, 1991]

In 1820 during Turkish rule, the first map of Khartoum was considered. The Turks have realized Khartoum location is a link point for convoys coming or heading to the east, west, north and the south. [Abu Saleem, 1991]. However the actual beginning of Khartoum town came in to being when Defterdar Bey built a permanent camp for his army in 1823.Since then the town had taken wide steps towards construction. [Abu Saleem, 1991]. Khartoum town greatly become wider under Egyptian Governor-General, Khurshid Pasha.

He had extended the mosque; built barracks for Gihadiya, encouraged the citizens to build houses and provided them with building materials such as baked bricks which were made in Suba area. [Abu Saleem, 1991]

During Abdulateef Basha, new installations were built with baked bricks including proconsul's palace, Khartoum principality, printing and press office, court of (notables) (commons), hospital and the barracks of Topjia (brigades). [Abu Saleem, 1991]

Generally speaking, Khartoum has passed through various stages. In the first stage it was merely forests. In the second stage, Arbab Alaqaaid used it as a center of his religious centre and began constructing it. However, in the third stage, Turks set up a military encampment. Consequently, the military centre had become a capital for the whole Sudan.

During Turkish rule, Khartoum was situated in the north side about one mile south of the Blue Nile. Government offices, houses of civil servants and the army barracks were located at the current place of the railway station. The civil district, known as *Salama Albashs* district, was situated in the north direction of the said buildings. [Abu Saleem, 1991]

The town grew and extended to the north and north east. Hay Al Jamie (Mosque district) and governorate district were constructed in addition to government buildings including both paper and gunpowder facories. [Abu Saleem, 1991]

Building materials used in Turkish era comprised mud, stone, unbaked bricks, baked bricks, lime, and wood. [Abu Saleem, 1991]

Khartoum came at a maximum level of stretch in the late of Turkish tenure. It included the area lying between Alfatih Tower (now Corinthia Hotel) and Ministry of Health. The town was surrounded by gardens along the western side an area covered by flood. There was a street adjacent to the Nile starting from this area of water and ending at the other part of the town. Another street was starting from this area but ending at the market.

Government offices were constructed near the Nile. The mosque district, south of the government offices, was the most prosperous district. However, public districts were situated in the far ends of the town. [Abu Saleem, 1991]

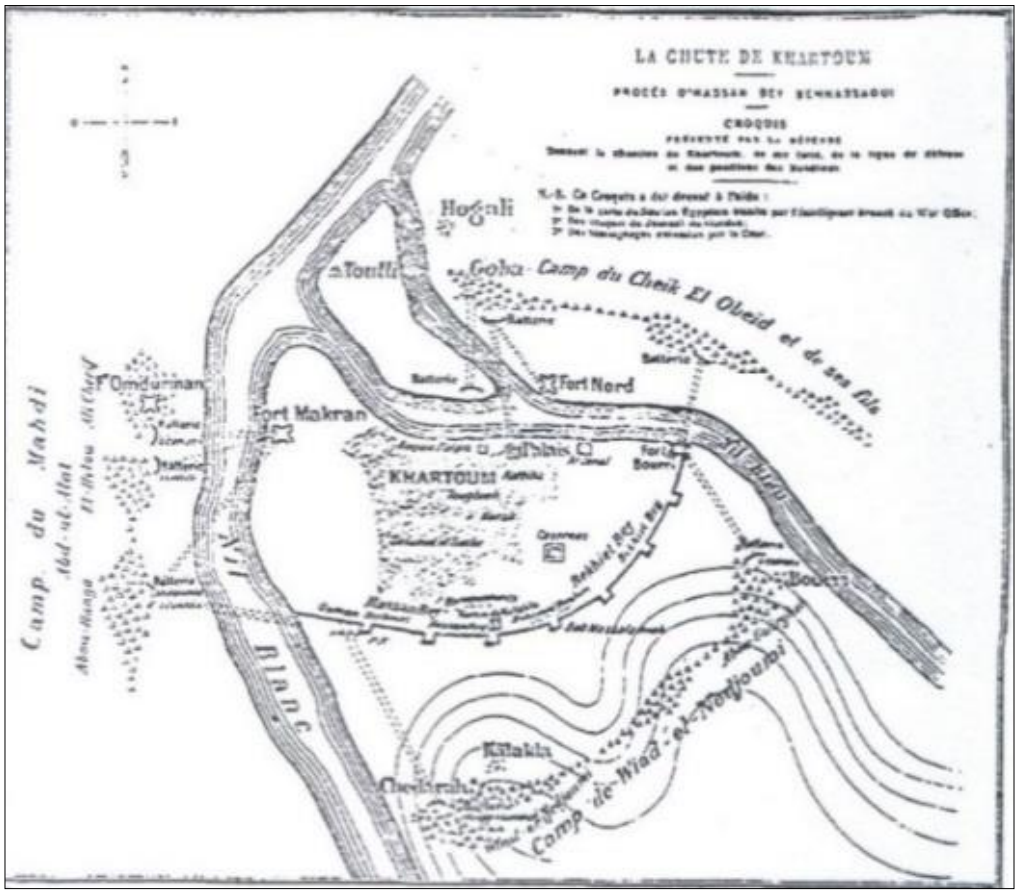

Figure 6-6: Study area during Turkish Rule. [Abu Saleem, 1991]

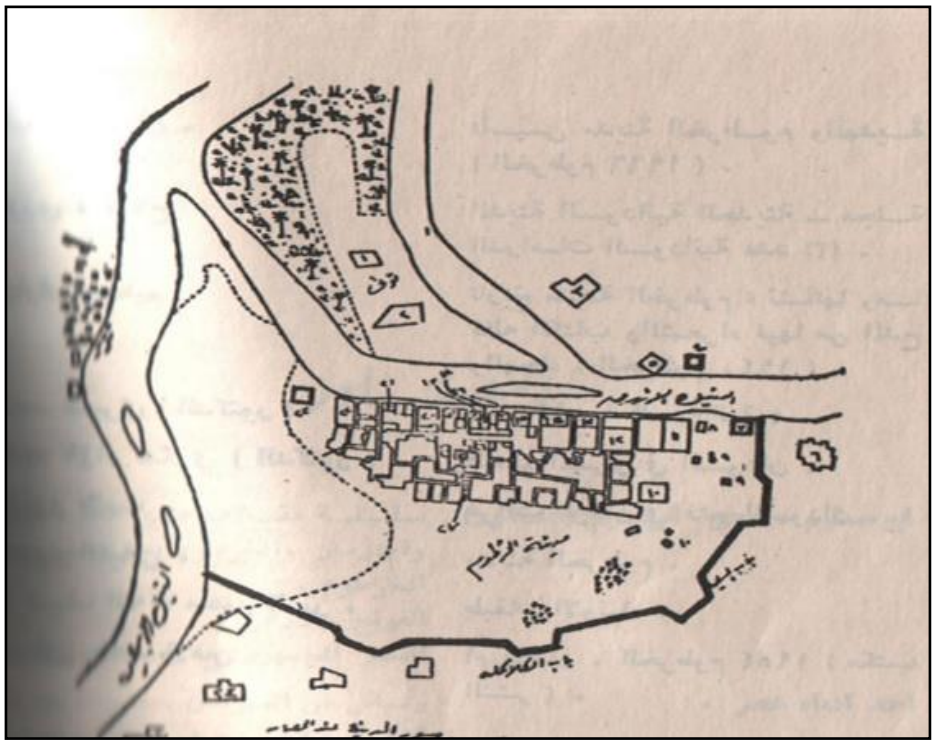

Figure 6-7: Study area during Turkish Rule. [Abu Saleem, 1991]

Urban planning and design process in Khartoum appeared when the governor ordered the authority to plan and construct Khartoum on a modern style.

He had held that it would have been suitable to build government offices including (office of Khartoum principality, government house, court house…etc.) in one harmony. [Abu Saleem, 1991]. Despite the absence of law to control urban design and planning process, verbal orders given by the governor have necessitated organizing the town, arranging and distributing its residential districts and building it with specific materials (baked bricks, stone, and mud) that manifested in the harmony of the town. [Abu Saleem, 1991]

6.7.2. Khartoum during the Condominium (Anglo- Egyptian Rule)

During this period, the governor sought to construct a town similar to the European fashion, so the town was divided into different sectors. [Abu Saleem, 1991]

The first sector between Kitchener Street (now Al Jamia or University Street) and the Blue Nile, has been allocated to government offices and houses of civil servants. Then came the second sector (commercial sector) was situated south

of Kitchener Street and stretched west to the Grand Mosque, east to Victoria Street, currently known as Al Qasr (palace) Street, and south to Abbas Basha Square currently known as (Wahat Al Khartoum Mall). Behind the square we find the national market, currently known as Al Souq Al Araby. East of Victoria street there is the industrial area for small scale crafts.

There were two ideas for planning Khartoum town: First, to link the sectors with streets marching from a square to a square to provide services. Offices were converged in one place to make the employees in contact. Business and treasury sector was located in one place near the government offices. [Abu Saleem, 1991]. Another voice called for planning urban residential area.

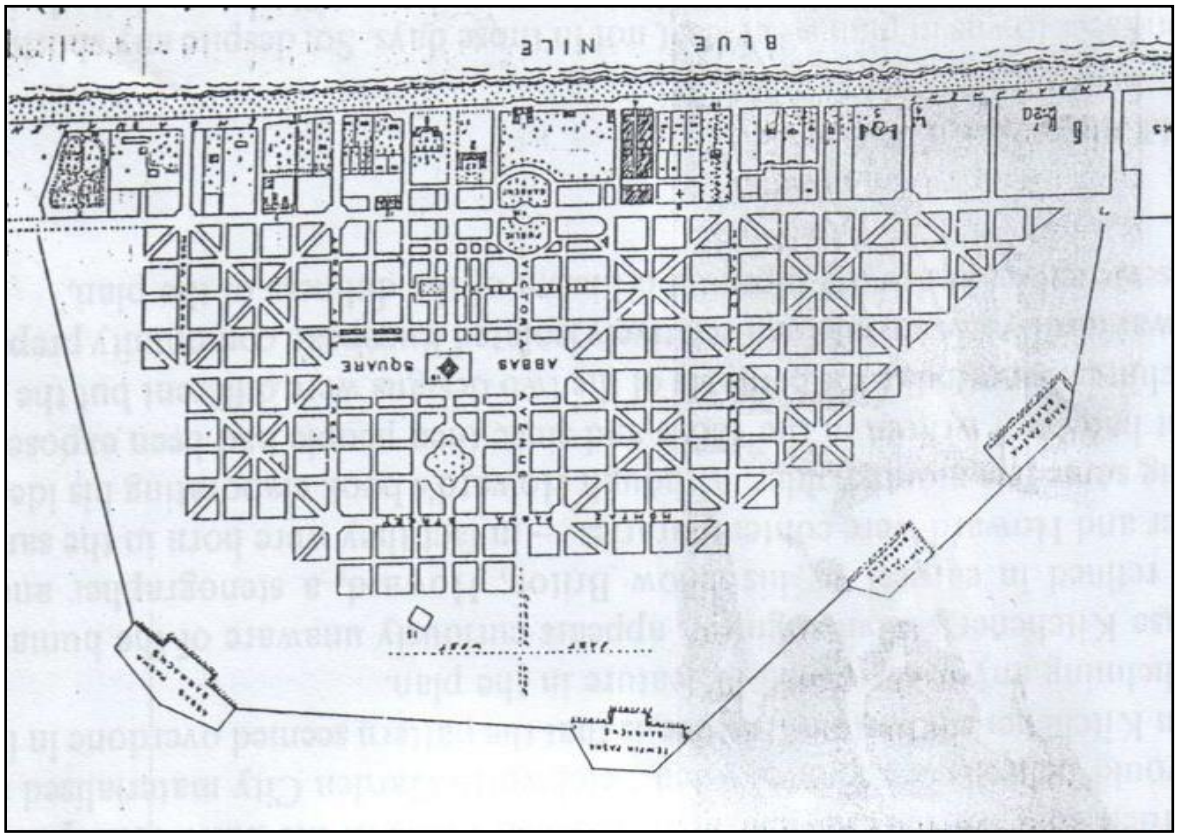

Figure 6-8: Study area during Condominium (Anglo- Egyptian Rule) [Abu Saleem, 1991]

6.8. Development of Khartoum during Condominium

6.8.1. Amendment of Kitchener Plan

Mr. Stand was the first to amend Kitchener plan to extend Khartoum. He took over the administration of Khartoum principality in the period between 1901 and 1909. He became a head of planning committee several times under Sir

Francis R Wingate, Governor General of Sudan. He was in charge of supervising new construction of the city. The plan aimed at constructing the western area of the city, which stretched from the Blue Nile up to the Zoo. [Abu Saleem, 1991]

However, the area was filled up and turned into a residential district of high class. A pavement was established along the Nile, and a port was constructed near the Blue Nile. [Abu Saleem, 1991]. The Blue Nile Bridge was built in 1909 and railway station was placed in the southern part of the city in the end of Victoria Street. [Abu Saleem, 1991]

6.8.2. McLean's 1912 Plan of Khartoum

Mr. McLean, the designer of Khartoum Locality, proposed in 1912 a plan aims at extending the south, east and west direction and providing poor class with houses in far ends of the town. [Abu Saleem, 1991]

6.8.3. Mr Misfiled Plan 1929- 1931

Mr. Misfiled who took over the administration of Khartoum principality sought to provide an area for local manufacture to the west of Victoria Street. He made amendments to the intersecting streets to suit traffic. He constructed the areas around the railway line, providing an area for poor class, courtyard, spaces and public gardens. [Abu Saleem, 1991]

6.8.4 Plan of 1947

A new plan for extension was set in 1947. New districts came into being in Khartoum south. [Abu Saleem, 1991]

6.8.5. Previous Plan for Urban Design Process

Three structure plans of Khartoum appeared in the years 1958-1976 and 1990. Each plan had its own policy keeping up with the growth. However, the nature of the physical problems has surfaced when such plans were set. However, the future vision of all these plans was different in terms of method, treatment and urban design detail. [Babikr, 1999]

6-8-5-1-The Master Plan of Khartoum 1958

This plan was based on dynamism theory which necessitates dynamism of physical growth of urban fabric to link the present with the future visions in line with grid iron planning. This could allow flexible growth and extension of skeleton service. Accordingly, the master plan of Khartoum has recommended strategic guidelines for future urban planning. [Babikr, 1999]

Based on the theory of construction dynamism and mobile center, the plan has recommended large spaces connected to the existing centers adjacent to the Nile in the south and east, and west transit for the Nile. The plan has called for linking these parts and centers by roads and bridges, separating commercial areas from administrative places. One of the most outstanding features of this plan, is that it treated the future center in a reasonable manner and treatment of the physical frontage of the Nile and its branches. [Babikr, 1999]

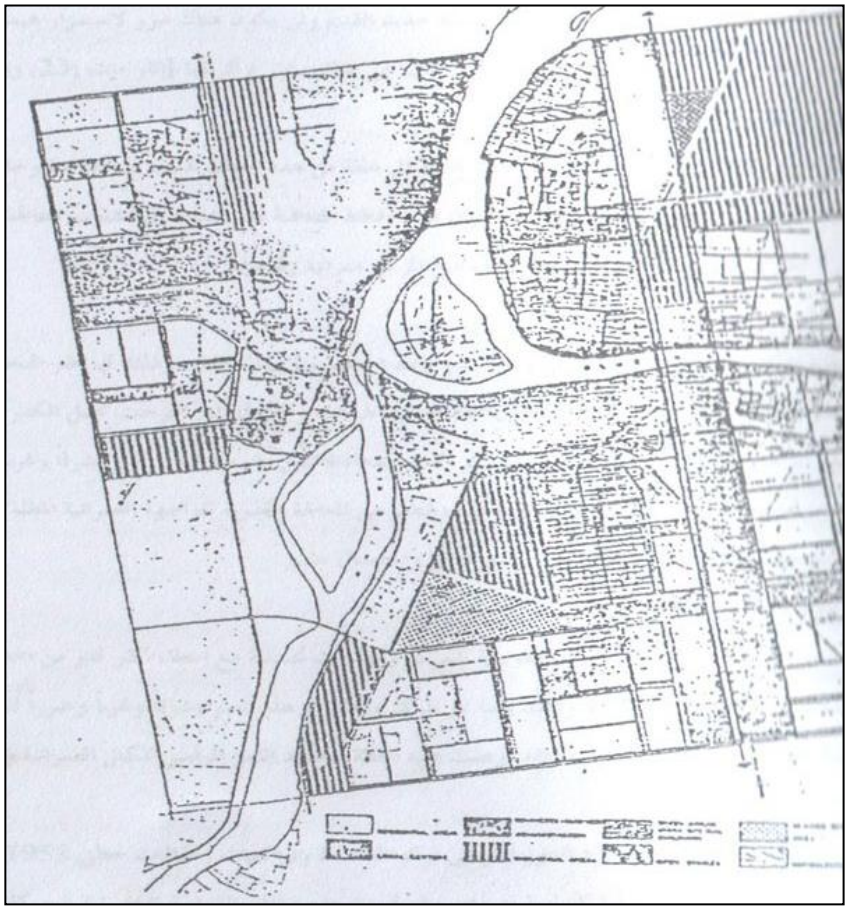

Figure 6-9: Docxiados master plan of Khartoum 1958. [Babikr, 1999]

6-8-5-2-Urban plan of Khartoum 1976 (MEFIT)

The urban master plan for Khartoum in 1976 (figure 6-10) was concerned with developmental and attractive centre. It has maintained the exiting physical fabric as regard the colonial touch. [Babikr, 1999] It also presented the beautification program for the town of Khartoum.

The plan has put into consideration the guides and recommendations by the principles of 1958 plan. The plan has urged all aspects of development of the center. It has also recommended vertical development of the physical masses and concentrating on structure of cultural touch along the Nile. [Babikr, 1999]

6-9- Houses Pattern in Khartoum

In the colonial period, the government divided the residential areas into four classes. The houses varied in space, period of ownership, construction conditions and the status of occupants. [Osman, 2008]

Residential zoning in that period depended on the economic level of the individual, where residential buildings were divided into the first class for English officials and second-class for the Europeans, and third class housing for the Egyptians, and fourth class houses for the Sudanese working in the public sector and service. [Osman, 2008]

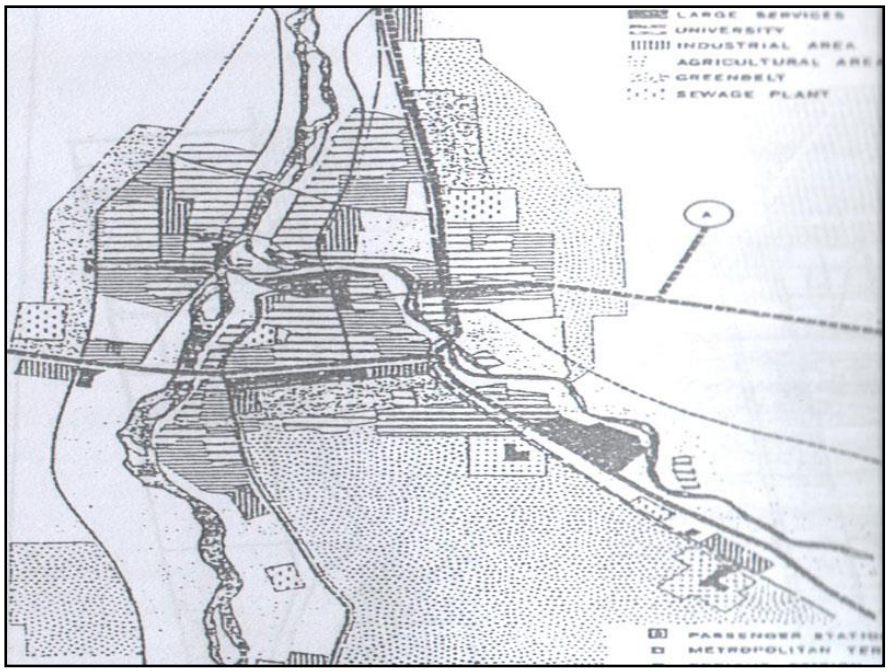

Figure (6-10)-Master plan of Khartoum 1976 [Babikr, 1999]

The total area of a house in the first and second classes ranged between 800 to 2000m2, the built up area varied between 200 to 400m2, and the houses extended horizontally only. [Osman, 2008]

In the third and fourth classes, the area ranged between 400 to 800 m2, the built up area is between 150 to 250m2. [Osman, 2008]

During the first national government after independence, new housing policy for all sectors was made. The government was committed to provide ready houses for each employees, so it constructed houses ranging between 400 to 2,000 square meters for other categories.

[Osman, 2008]

In 1970, and according to the increasing in housing demand, due to the increasing in immigration from the rural areas, a new strategy for housing emerged. It was based and concerned with the site and services. [Osman, 2008]

Residential areas were divided into three classes: first class area is assigned the high income citizens, second class is allocated to middle income people, and the third class is for the low income beneficiaries. The three classes differ in building materials and the area of the lots. [Osman, 2008]

In the first and second class, the total area ranged between 500 to 1000 square meters, and permanent building materials are required for construction. In the third class, the total area of lots ranged between 300 to 400 square meters. In this class, the Occupants are allowed to use any type of building materials. [Osman, 2008]

6-10- Residential Building Law

Building regulations law was issued in 2008 in Khartoum, and modified in 2010, and 2016. [Building Regulations, 2008]. Below are the regulations stipulating building conditions which must be followed in residential buildings in Khartoum. [Building Regulations, 2008] Residential buildings regulations intended areas planned for residential purpose, and categorized residential areas

as first, second or third class. This research, however, is concerned third class residential areas.

- Some residential areas such as investment houses or locations have special conditions.
- The built up area does not exceed 75% of the total.
- The distance between the building and northern and southern neighbor is not less than 2.5m, and 1/3 high in case of multistory buildings.
- According to the law, it is allowed to build on the border which separate houses in the third class.
- Natural ventilation outlets and lighting must open directly to outdoor, and internal yard, or to vertical ducts.
- The boundary wall that separates the building and the streets does not exceed 2.5 meter from the level of internal yard.
- The number of stories allowed in the residential areas as follows:
- Five stories (ground + 4) in the first and second class.
- Four stories (ground + 3) in the third class.
- The distance between the building and east and wet neighbor is not less than 1.5m.

6-11- conclusion

1. Study area lies in central Sudan, area lies between 10°N and 20°N latitude north, and between 25°E and 35°E longitude east. This area is characterized by hot dry and desert climate.

2. The area was chosen for study because it is highly populated compared with other parts of Sudan and embraces many well-planned towns. The researcher has chosen Al Haj Yousuf neighborhood, Block 10, East Nile Locality, Khartoum State.

3. The study area is classified as a third class residential area.

4. Studying climate elements and wind movement and its effects on urban residential areas is necessary for urban planning legislations. Where the mean wind speed in this area is 4.5m/s.

5. The study has traced Khartoum maps and the development of the city since the Turkish rule in Sudan.