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ANALYSIS OF SUSTAINABLE URBAN WATER FRONT DEVELOPMENT BY USING URBAN DESIGN PRINCIPLES IN THE CASE OF ADDIS ABABA, BOLE SUB CITY

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ABSTRACT

The development of the areas at the waterfront has major importance facilitating an appropriate insertion of human activities in a threatened and deteriorating environment. The unique qualities of the water spatial interface have regularly meant that waterfront development has been distinct from general urban development. Waterfront was one of the most valuable resources for a country being limited and precious assets. To secure long-term growth of this resource, it was important for waterfront areas to be used strategically to maintain their economic value and enhance their specific features. This paper was analyzed waterfront development along the Kebena stream by application of urban design principles for conserving the waterfront environment. In development strategy aspect, this paper analyzed the original meaning and content of waterfront development. Addis Ababa Bole sub city was then taken as a thematic area to analyze waterfront development using urban design principles. The waterfront sustainable design address issues such as habitats and cultural heritage preservation, water management, and energy and resource conservation .It also explained that the success or failure of a waterfront development should be evaluated through a set of multi-aspect indexes. According to different types of waterfronts, their spatial needs were also specific. The waterfront development area was located near to the inner-city of Addis Ababa which was usually characterized by dilapidation, poor housing, and economic and social deprivation. The main peculiar features of the study area were decayed infrastructure, unplanned streets, buildings, open spaces and a concentration of people with social difficulties.

KEYWORDS: *Water front, Urban Development, Sustainable Development, Urban Design Principle*

1. INTRODUCTION

The quality of the places we live in has an impact on all aspects of life. How well they are designed will influence how safe we feel, how easy it is to walk round, whether we have shops, community facilities and schools nearby, whether our children have safe places to play. It also affect whether there is good access to public transport and a good choice of

homes in which to live. It is essential that the places we create and improve embody the principles of good urban design (Roger, 1986). Good urban design is essential to deliver places which are sustainable on all counts: places that create social, environmental and economic value. Ensuring that places are well designed should be a priority of everyone involved in shaping and maintaining the built environment (Corner, 1997).

Addis Ababa city has many streams that flow in dry and wet seasons of the year. Those streams potential of the city were not effectively utilized so far due to the possibility of water pollution at up streams and lack of awareness to create sense of place for people. Creating places socially, economically and environmentally comfortable and sustainable development was the most important element of urban design which contributes to create livable place for people. To enhance this through urban design in the city, the study focused on creating sense of place for people and environmentally friendly waterfront development along the Kabana Stream in Bole sub-city (Addis Ababa, Bole sub city information communication office, 2018).

1. OBJECTIVES

The main objective of the research was to analyze the sustainable urban waterfront development strategies by using the application of urban design principles in Addis Ababa, Bole sub city.

2. DESCRIPTION OF THE STUDY AREA

The study area was crossed with Kabana stream and bounded with Addis Ababa to Asmara road in the North direction and bounded with Urael to Bole road in South West direction. Even though the area lacks proper inter connection within the area the geographical location enables to connect and interact with the other neighborhoods.

Addis Ababa lies at an elevation of 2,200 meters (7,200 ft) and is a grassland biome, located at 9°1’48”N 38°44’24”E/ 9.03000°N 38.74000°E Coordinates: 9°1’48”N 38°44’24”E/ 9.03000°N 38.74000°E. Since the study area was the part of Addis Ababa its location also the same to Addis (Ababa Addis Ababa city map, 2018).

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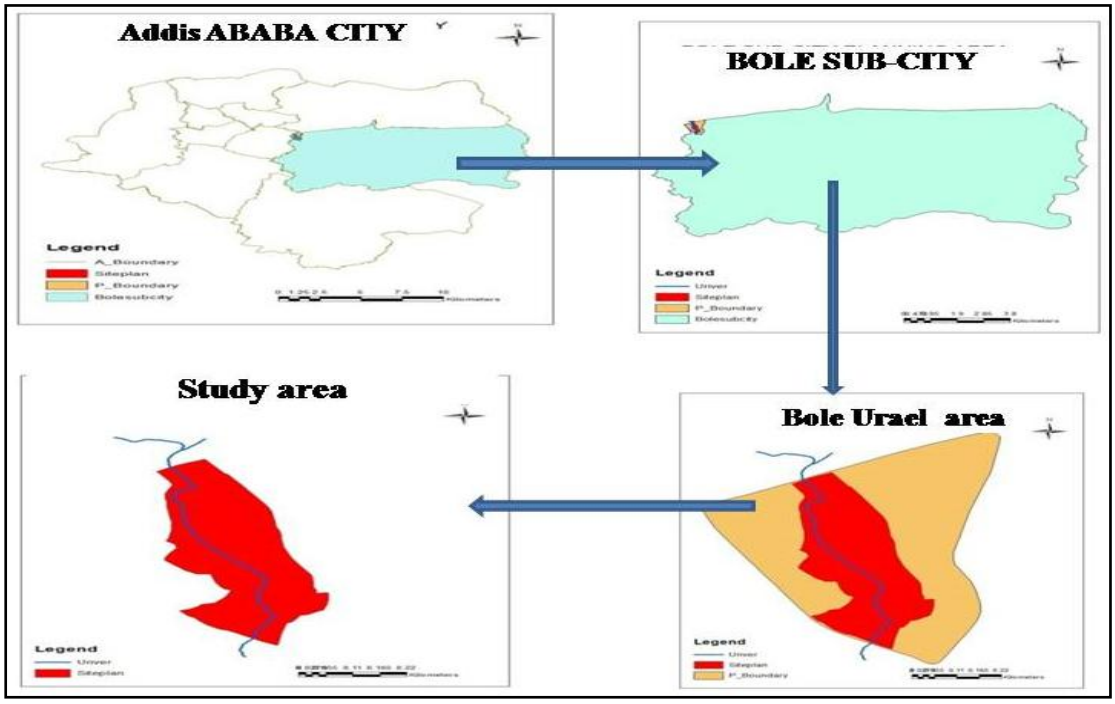

Figure 1: Location map of the study area (Bole sub city-Addis Ababa)

The study area had a subtropical highland climate. The city has a complex mix of highland climate zones, with temperature differences of up to 10 °C (18 °F), depending on elevation and prevailing wind patterns. The high elevation moderates temperatures year-round, and the city's position near the equator means that temperatures were very constant from month to month. As such the climate would maritime if its elevation was not taken into account, as no month is above 22 °C (72 °F) in mean temperatures *(National Meteorological Agency of the Federal Democratic Republic of Ethiopia, 2018)*.

Mid-November to January was a season for occasional rain. The highland climate regions were characterized by dry winters, and this was the dry season in Addis Ababa. During this season the daily maximum temperatures were usually not more than 23 °C (73 °F), and the night-time minimum temperatures can drop to freezing. The short rainy season is from February to May.

During this period, the difference between the daytime maximum temperatures and the night time minimum temperatures was not as great as during other times of the year, with minimum temperatures in the range of 10–15 °C (50–59 °F).

At this time of the year, the city experiences warm temperatures and a pleasant rainfall. The long wet season was from June to mid-September; it was the major winter season of the country. This period coincides with summer, but the temperatures were much lower than at other times of year because of the frequent rain and hail and the abundance of cloud cover and fewer hours of sunshine. This time of the year was characterized by dark, chilly and wet days and nights. The autumn was a transitional period between the wet and dry seasons of the study area.

As of the latest 2007 population census conducted by the Ethiopian national statistics authorities, the study area has a total population of 195,273 with density of 1,653.7 urban inhabitants (CSA, 2007). The economic activities in the study area were diverse. According to official statistics from the federal government, some people in the city were engaged in trade and commerce; in manufacturing and industry; Homemakers of different variety; in civil administration; in transport and communication; in education, health and social services; in hotel and catering services; and in agriculture. In addition to the residents of the city dwellers also participate in animal husbandry and cultivation of gardens. Various luxury services have also become available and the construction of shopping malls has recently increased.

3. RESEARCH METHODS

The paper used questionnaire, field observations, focused group discussion and interviews (Tracy, 2013). The quantitative and qualitative research approach was used, but mostly qualitative approach might great in use (Creswell, 2009). The development of the qualitative approach was the best to analyze the attitudes of different institution or investment professionals for the assessment of waterfront development. Whereas quantitative approach was used to present out comes based on tables, charts, graphs and so on (Kothari, 2009).

The unit of observation in the study covered both the institution and the residents accommodated in Bole sub city of Addis Ababa. The paper was used a purposive sampling technique of households who were living near and around the Kebena Stream. Therefore the total households surrounding the river were the sampling frame of the study.

Both the primary and secondary data were used. The primary data were collected through questionnaires, interviews and focus group discussions. And the secondary data were collected from different documents like books, journals, previous researches, reports, websites and plans. The types of collection data were both qualitative and quantitative.

The data was presented and analyzed against the main variables which were presented in the specific objectives and research questions. The analysis used simple statistical tools like tables, percentages, and frequencies. Apart from the data analysis and interpretation, the data presentation was presented through photographs, maps, figures charts, excel computer program and simple calculations for tabulation and charts. Auto Cad and Arc GIS 10.2 was important software that was used for map generation and presentation in this study.

The governed rules of the ethical considerations in this research were (1) time would be respected and ruled by schedule (2) respecting social values (3) could not affect physical and social (4)confidentiality were very important.

4. RESULTS AND DISCUSSION

5.1 Physical Analysis of Kebena River Basin

According to Addis Ababa city information communication office (2018), Big and Little Akaki Rivers, with their different tributaries, drain the city from North to South. Big Akaki (900 km^2) and Little Akaki basin has a catchment area of about 540 km^2. The streams serve as natural sewerage lines for domestic and industrial wastes.

The Akaki Rivers catchment was a sub-catchment of the Awash River system. The headwaters of the catchment emanate from the surrounding mountains; the Entoto form the Northen drainage boundary, to the East Mount Yerer, to the West the Wechecha range of hills. The highest points of the catchment were in the rugged volcanically formed mountains; the Entoto at 3,200 m above sea level, Mount Yerer 3,100 m above sea level and the Wechecha range 3,390 m above sea level. The catchment's altitude declines abruptly as the rivers descend towards Aba Samuel Lake at 2,060 m above sea level. This demonstrates a fall throughout the catchment of over a kilometer in a distance of only 30 km. This was dramatically demonstrated by the topography; from rugged mountain landforms to the far gentler plain about the lake area.

The drainage of Addis Ababa, the majority of all domestic (urban and industrial) sewage was drain to the river system. This pollutes the water ways and carries pollution along the whole river system into and beyond Aba Samuel Lake. The urban drainage of the capital discharges to surface waters, in many instances helping many septic tank and pit latrines to over top and discharge though the streets to the rivers. There was some surface infiltration to the groundwater levels and this leads contamination to the groundwater (which also moves in a Southern direction). Much of the industrial waste waters were discharged directly to the river systems; it was noted that there has been some limited progress in lessoning their effects in that some companies treat their effluents to a 'degree' prior to discharge. The rivers through the capital were polluted and near biologically dead. An ad-hoc investigation showed little life in the silts of the beds of the rivers, bar sewage worms. No aquatic life was discovered in the waters; no aquatic dependent avian species were found.

The limited sewage facilities were located at Kaliti which carries out a primary treatment function. The same facility and one at Kotebe act as drying beds that took the collected wastes from latrines and septic tanks. The dried waste materials were then removed to sanitary landfill. The facility was unlined and has the potential to be a source of pollution into the future. Some of the Rivers/Streams that were found in and around Addis Ababa were Ginfele, Abo, Kebena, Banteyeketu, Kechene, Buche, and kurtume. (Fig.2)

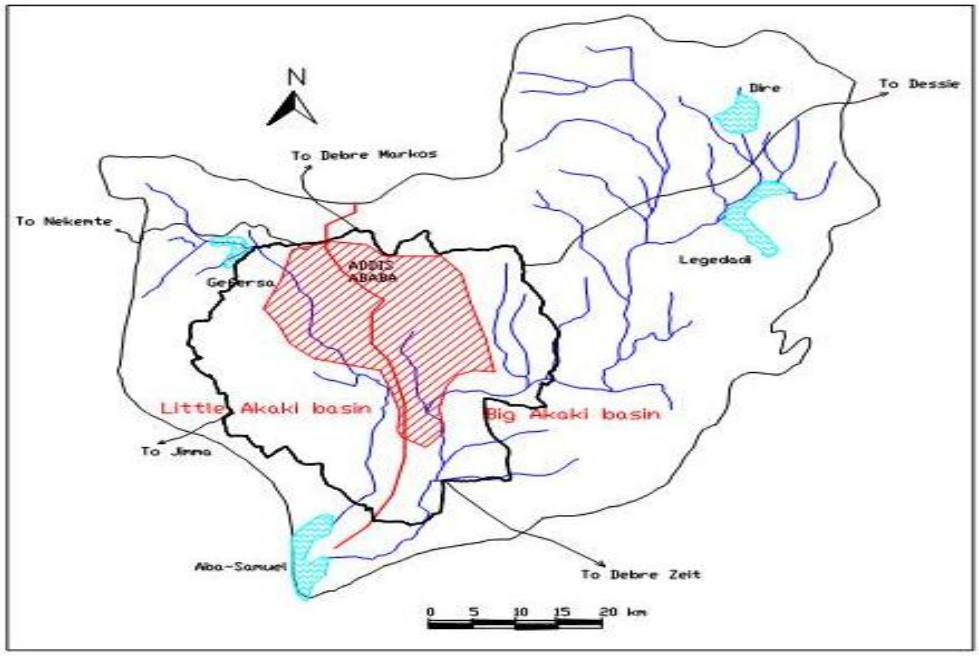

Figure.2: Addis Ababa city drainage catchment influence area (Bole sub city-Addis Ababa)

Among major streams that drains to big Akaki river was Kebena River which drains from Entoto Mountain to main Akaki River; it was the longest river in Addis Ababa. Abo and Ginfele streams were the main tributaries of Kebena stream that join in different places at upper and middle parts of the stream, respectively. Along Kebena stream, there were many populations residing adjacently and influence it greatly by disposing liquid and solid wastes that made the river highly polluted. Especially, municipal drainage system also linked to the Stream and drainage of toilets and different garages and many pollutant materials released to the stream through its long way to Akaki.(Addis Ababa, Bole sub city water and sewerage office, 2018)

The poor sewerage system used old technology, low level of awareness on waste management, weak enforcement mechanisms on pollution prevention and control and low level of income of the city dwellers have been aggravated the pollution problem and considered as the major constraints of waterfront development and waste water management (Pescod, 1992 and Alaci 2010) (Fig.3)

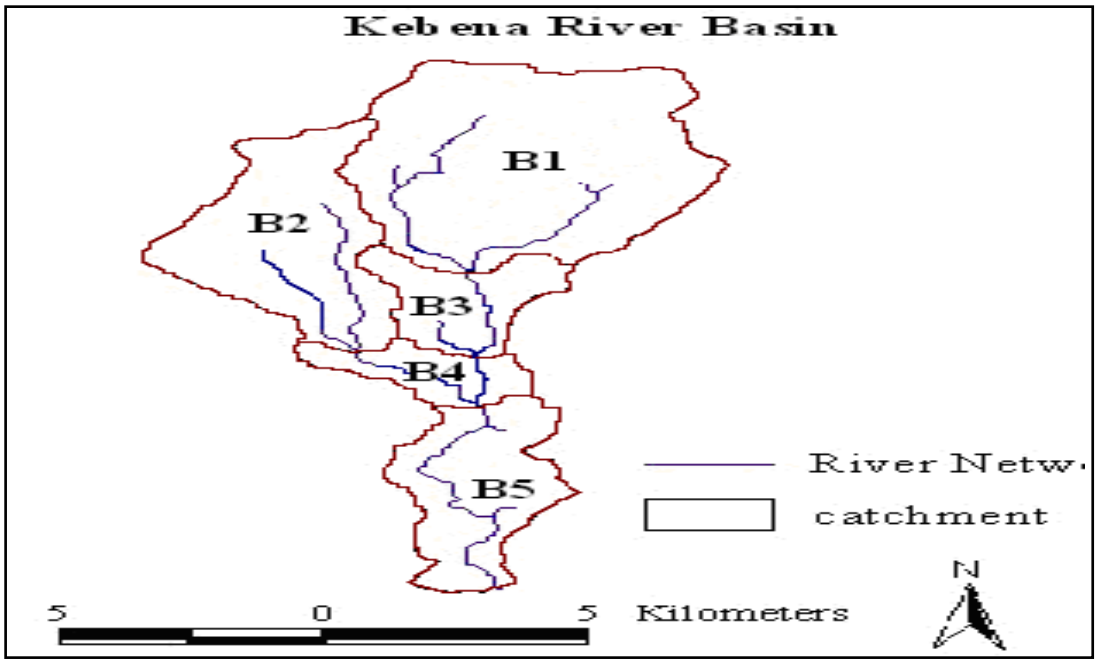

Figure.3: Kebana Stream catchment areas (Bole sub city-Addis Ababa)

Table 4: Catchment of Kebena Stream-Basin

Basin	Area m3	Elevation (m)	Length (m)	Slope %
B1	42,296,696	2800	685	60
B2	23,500,000	2570	600	45
B3	9,403,000	2450	710	25
B4	6,420,000	2350	450	11
B5	163,267,000	2300	553	30

According to the field survey almost all sampled houses (86%) were made from mud wall that are plastered with cement in the internal and external sides. A few of them (9.3) were made from hollow concrete block. Due to this poor quality construction material, most parts of the study area were not aesthetically pleasing and comfortable for different services. This was result in relatively low cost of house in the study area which may not incur higher compensation cost during any development intervention. (Fig.4)

Figure 4: Building wall material of the study area (Bole sub city-Addis Ababa)

Flooring materials is an element that shows housing or building conditions. According to the interview conducted during house to house socio economic data collection the house of the study area was too old. Most of the houses built before 50 years ago. This indicates that the study area was not developed and no intervention has been conducted so far. The function of most houses in the study area was for residence which accounts 75%. (See Table 5)

Table 5: Functions of the Houses in the study area

Functions	No	%
Residence only	48	75
Residence and Business	16	25
Business (state the type)	0	0
Total	64	100

Most houses in the study area were owned by private who accounts 50% followed by rental-kebele houses 31.3%. This shows most of the study area occupants had land tenure security that has the possibility of self-development with minor intervention. However to maximize the potential of the waterfront development, the development option were not critically analyzed during urban development design (Bruttomesso, 2006). (Table 6

Table 6: Ownership of dwellings

House ownership	No	%
Private	32	50
Rental-kebele	20	31.3
Rental-Agency for rental housing	0	0
Owned by other Government body	0	0
Owned by private local agency	4	6.3
Owned by international agency	0	0
Rented from private	8	12.5
Total	64	100

4.2 Analysis of the Existing Utility in the Study Area

According to the field survey 9.4% of the residents have no access to water services in individual as well as communal base in the study area. Letourneur (1993) indicated during design there was a lack of consideration about water services at individual level to enhance vibrant economy in the urban area (Table 7)

Table 7: Availability of Utilities for Respondents

Facility	Modality of use						
	Private		Shared		Not available		Total
	No	%	No	No	%	No	
Toilet	28	43.8	30	46.9	6	9.3	64
Kitchen	42	65.6	14	21.9	8	12.5	64
Water	40	62.5	18	28.1	6	9.4	64
Electricity	52	81.3	12	18.8	0	0.0	64
Telephone	44	68.8	4	6.2	16	25.0	64

Communication facilities such as telecommunication phone services were the most important communication tools in the process of social, economic, cultural and political interaction and development. As the sample field survey indicates 25% of households have no use access to line phone. This implies that there was poor access of telecom service in the area which needs consideration during design

According to the sample survey 9.3% of the residents have no any toilet facility and 46.9% have shared toilet facility without flush. This implies that it has negative effect on the environment in which it hinders the waterfront development in the study area. Therefore to achieve sustainable development health and environmental issue consideration was needed in the design.

Most of the households in the study area used the waterfront for solid as well as liquid waste disposal. This affects the environment and dwellers in the downstream with both visual and smell pollution. Even though there were small micro enterprises engaged in the collection of wastes house to house and collect it in the container that located near by the Stream. There were also waste disposal along and in the stream (Vallega 2001). This calls attention in time of design to select the best place for container transit site for waterfront development. (Fig.5)

Figure 5: Transit solid waste disposal site near and at edge of buffer on different parts of Kebena stream banks (Bole sub city-Addis Ababa).

5.3 Analysis of the Physical Infrastructure in the Study Area

The existing road pattern looks organic pattern of road. In this pattern roads were winding forming acute curves and odd junctions. This kind of pattern was formed due to the unplanned and haphazard development of the cities (Chang and Peng 2001). In the study area most of the access roads were narrow and bottlenecks which were difficult for vehicular movement. The access roads found in the study area were most of them forming Cul-de- sack. (Fig.6)

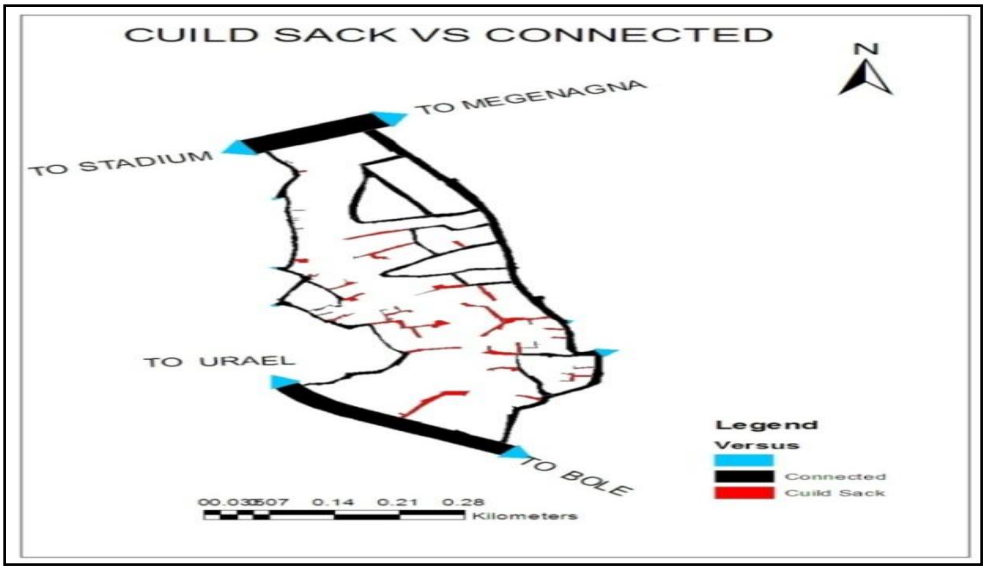

Figure 6: Road Connectivity map of the study area (Bole sub city-Addis Ababa)

Due to the above fact, it needs consideration as per standards during the design to minimize wastage of spaces and congestion as well as to enhance circulation within the area by promoting connectivity.

According to the standard, urban road network should be 15-25% of the land use coverage in the preparation of structural plan and its implementation plan programs (LDP, Urban Design and Redevelopment plan) (Gordon, 1997).

Table 8: Road coverage of the study area

ID	Land use	Count Land use	Sum Area
0		5	0.024014
1	Buffer	3	2.134721
2	Commerce	1	0.415573
3	Mixed Use	4	3.542793
4	Residence	16	7.730823
5	River	1	0.728582
6	Road	11	3.915591
7	Road direction	11	0.351161

According to the GIS analysis of the study area, the road coverage was 22% but the standard was 15-25% so the road coverage was within the standard.

Road hierarchy was very important to provide traffic movement smoothly. In the planning area there were clearly observed road hierarchies, while in the action area there were only collector and access roads which were not to the standard. Most of the existing road width was range from 1 meter to 6 meter which acts as access and collector. The mobility of the vehicles due to the narrow road width was restricted to some roads. During design considering road hierarchy was the critical issue.

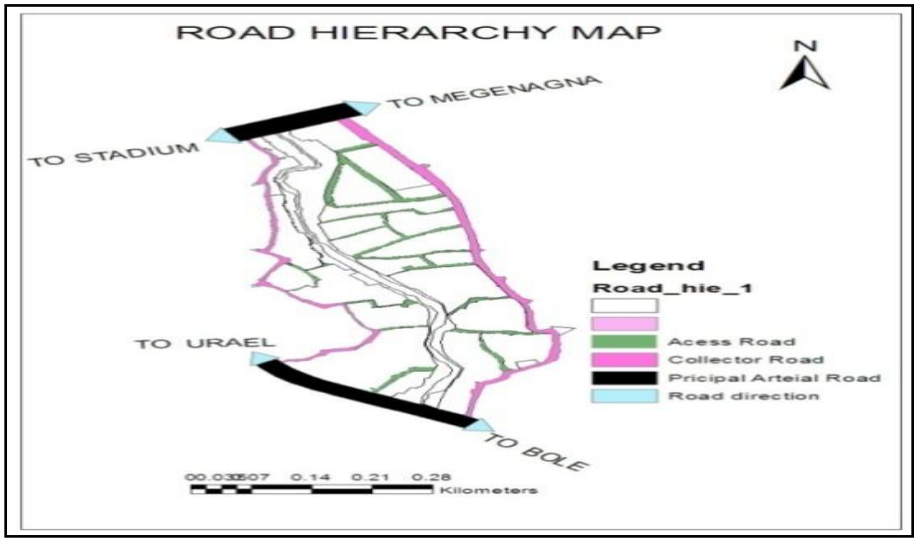

Figure 7: Road hierarchy map of the study area (Bole sub city-Addis Ababa)

Principal Arterial Street which bordering the study area in the North and South-West direction was all surfaced with asphalt, but most of the collector and access roads were constructed with cobble stone and the remaining roads covered with stone paved and gravel materials. The road surface coverage was dominated by paved stone which accounts about 53.9%. (Table 9)

Table 9: Road surface conditions of the study area

No	Type of road	Length(m)	%	Situational condition
1	Paved stone road	2658.6	53.9	It was in good condition, but it needs to connect properly with other road networks using comfortable materials.
2	Coble stone road	1237.5	25.1	It was newly paved
3	Asphalt	415.3	8.4	Newly constructed.
4	Gravel	624.3	12.6	
Total		4935.7	100	

The road surface coverage of the study area was also dominated by cobble stone which accounts about 32.3% of the total next to paved stone. This shows that this road surface helps for water harvesting system which reduces the runoff and construction cost of the drainage system in the waterfront development. (Fig.8 & 9)

Figure 8: Existing road surface of the study area (Bole sub city-Addis Ababa)

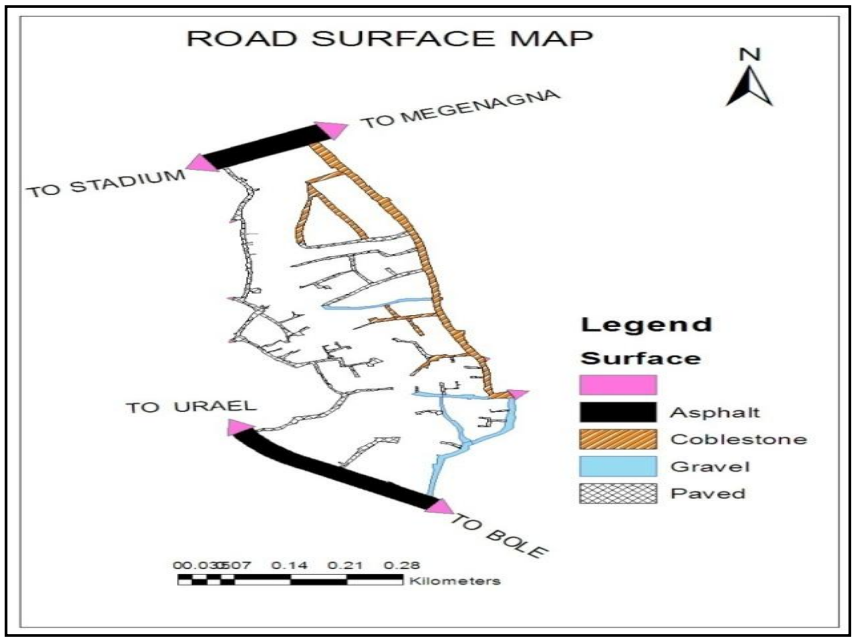

Figure 9: Road surface map of the study area (Bole sub city-Addis Ababa)

Considering urban block size and road pattern in urban design were an important factors to determine the pattern of movement. Gridiron street pattern and medium size of the block in the study area resulted in high permeability. Most of the block sizes in the study area ranged from 55 meter to 280 meter and created organically which could retard the greatest

mobility in the study area (Krauss 1995). This shows that during design road pattern and block size of the study area needs readjustment as per standard for waterfront development. (Fig.10)

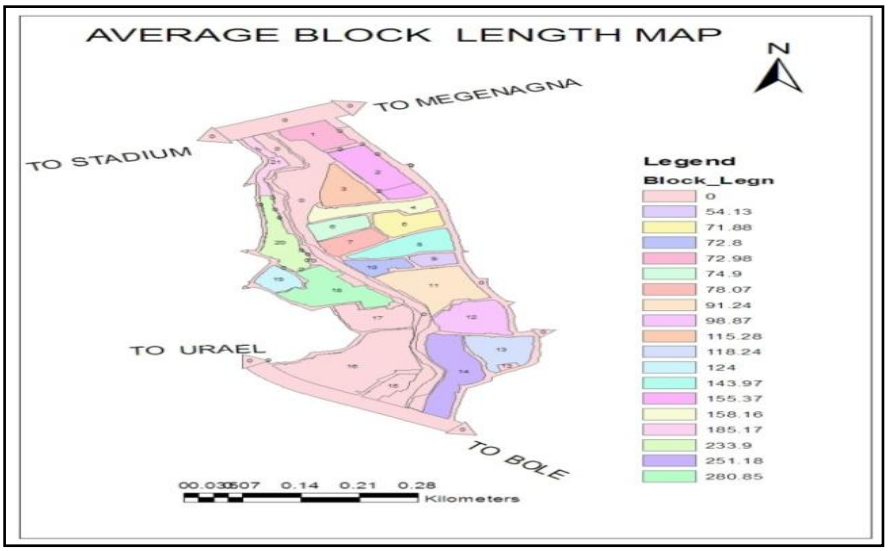

Figure 10: Block length map of the study area (Bole sub city-Addis Ababa)

5.4 Analysis of the Urban Design Principles in the Study Area

Permeability was one of the most important urban design principles (Zhang 2002). It allows ease movement in the well-connected road network. The Kebena waterfront development study area was not easily permeable. Especially the area was sub divided in to two parts by the kebena stream which impedes the movement between the two stream parts. Therefore to enhance the permeability the waterfront development design needed integrated into the existing urban form and the natural and built environments of the stream. (Fig.11)

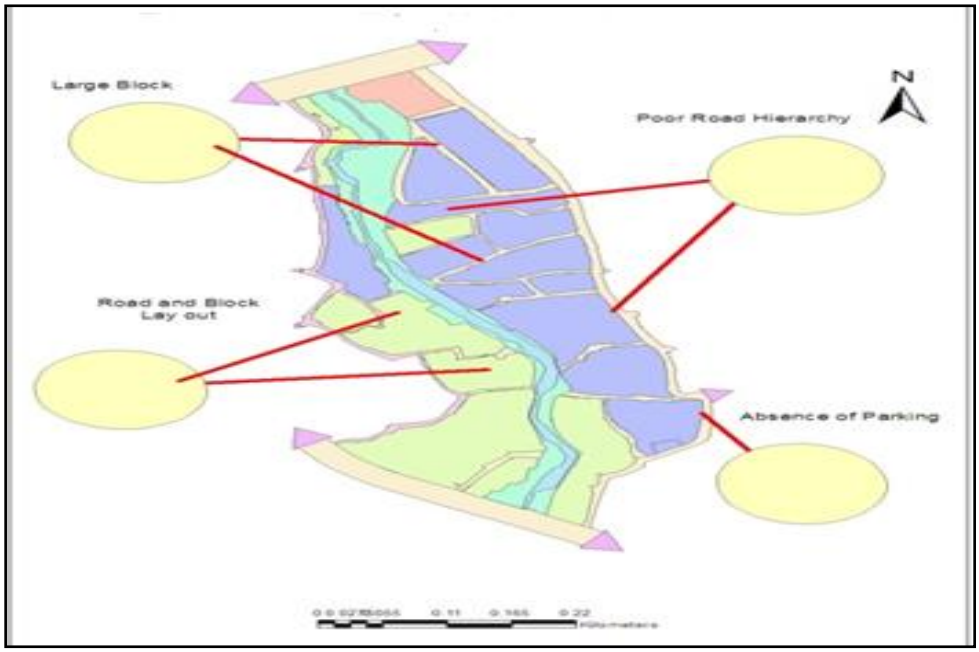

Figure 11: Permeability Map of the Study Area (Bole sub city-Addis Ababa)

Legibility addresses the connections between people and places by considering the needs of people to access jobs and key services and it enables the people to grasp a place (**Hall, 1992).** The major land marks that made legible to the study area were Urael Church and water development office which found in the study area. In the time of design those land marks needed

attention to be considered in the design for better waterfront development. (Fig.12)

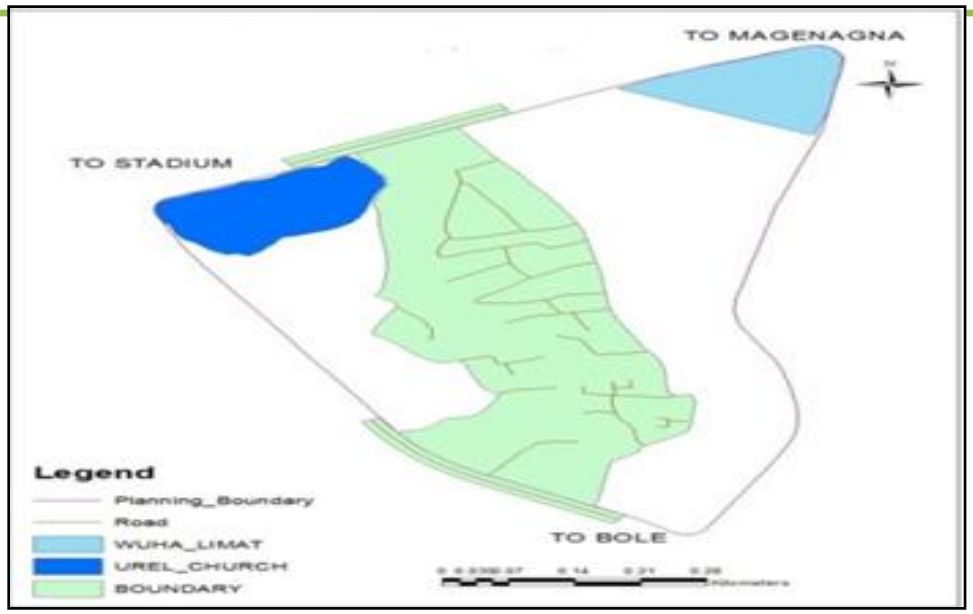

Figure 12: Legibility map of the study area (Bole sub city-Addis Ababa)

Safety and sense of safety were vital elements in any waterfront development in the urban area. The creation of a sense of personal and community safety in cities was a complex issue (Sairinen and Kumpulainen 2006). The study area lacks security resulted from crime, flooding and bad visibility. To feel comfortable and confident using areas to enhancing everyone's sense of well-being and making places more user-friendly, easy to understand and secure the safety needs to be considered during the urban design.

The drainage network was the systems that collect the water from the entire area and convey it safely to the out let (FAO 1976) and (West 1989). According to the physical observation in the study area the drainage network was poorly designed. Most of the roads were without drainage ditch while the others were with inadequate size that was not covered. However, drainage facilities were poorly constructed and provided in the majority part of the study area. Therefore, to achieve better sense of place for people and conserve the environment consideration adequate and safe drainage system needed attention in the time of design for waterfront development in the study area.(Addis Ababa, Bole sub city water and sewerage office, 2018 (Fig.13&14)

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Figure 13: Existing drainage network of the study area (Bole sub city-Addis Ababa)

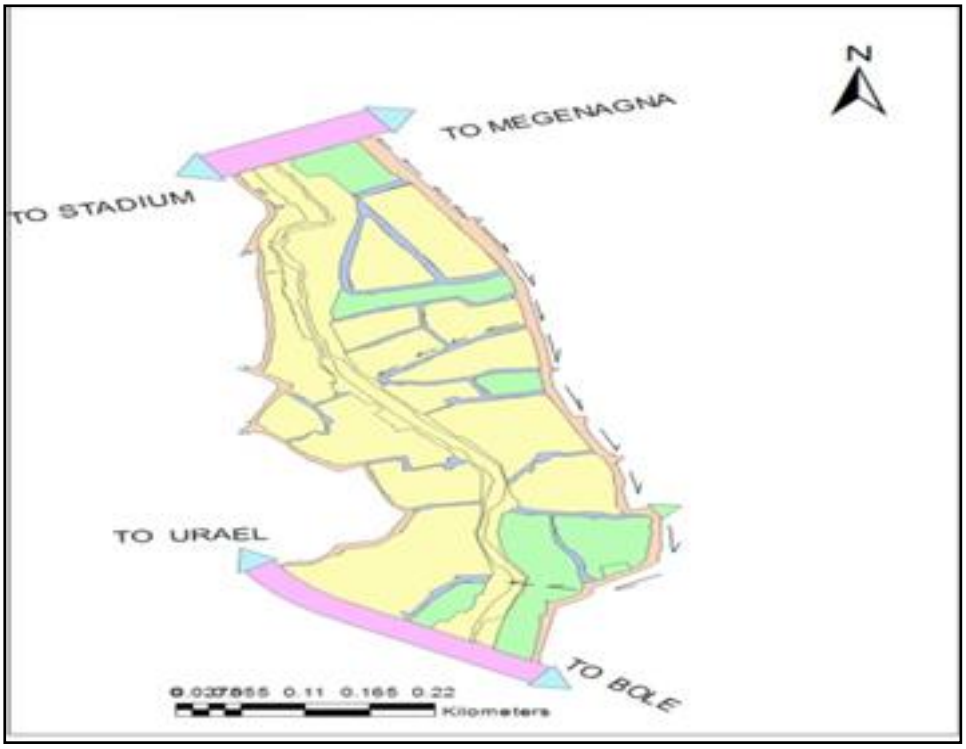


Figure 14: Drainage flow map of the study area (Bole sub city-Addis Ababa)

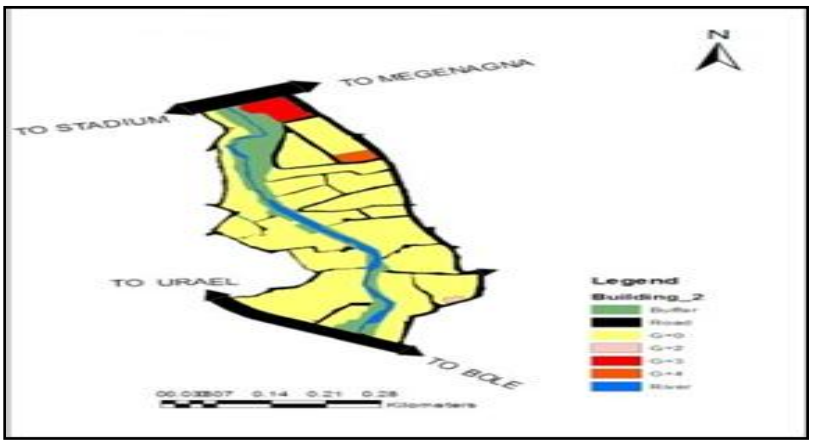
Walk ability for local facilities bring residents together, reinforce community and discourage car use (Roger 1986). In the study area except the Principal Arterial Street in the North and South-West direction all roads were without the pedestrian way that discourages to walk.

So the first component of a movement framework should be the walking distances from facilities. To provide quality of the routes for walking; design for ease of walking was important agenda that should be considered in waterfront development design.

Public open space was necessary to assess the quality of existing provision in the wider context and use this as the basis for deciding on the elements of open space hierarchy (Letourneur 1993). Most of the open spaces along the Stream were encroached by buildings. However, there was open space that reserved for Urael church along the Stream in the West direction which had the quality for the waterfront development. Therefore during design considering this potential of space for public open space was important to create quality sense of place in waterfront development.

A common building lines and set backs were creates continuity of frontage and provides definition and enclosure to the public realm. It can also help to ensure new development in properly integrated into an existing street and water buffer. In the study area the buildings line and set-backs were not realized. Due to this most of the buildings interact with the public realm. So during design consideration should be given to building lines and set-backs for waterfront development.

Building height was an important element in any urban design (May 2006). The study area was mainly characterized by low raise residential buildings G+0 Villa houses with exceptional of one G+4 Administration Office, one G+3 Plaza hotel and one G+2 resident. This shows that there was no continuity and harmony among the buildings in the study area which needs consideration during urban design. (Fig.15)



Ma15:Building height map of the study area (Bole sub city-Addis Ababa)

5.5 Analysis of the Physical Environment in the study area

The landscape, development block, and movement framework were the three main design elements of an urban planning of any scale (Corner 1997). The landscape of the study area especially in the West direction of the Streams has quality view to be developed. During design considering the landscape was vital to create a sense of place for people along the Stream.

Different land use needs different slope classification. Knowing slope classification was important to identify land suitability for different land uses in urban planning (Rafferty and Holst 2004).). It was also important to set alternative solutions for the challenges occur due to slope difference while implementing different land use activities in the waterfront development. According to the slope analysis the classification was indicated in the following. (Table 10, 11 and Fig.16)

Table 10: Slope classification

Slope	Total	Slope classes					
		0-2%	2-4%	4-7%	7-10%	10-15%	>15%
Area coverage in Ha	17.56	1.50	3.94	5.53	2.64	1.94	2.01
Area coverage in %	100	8.54	22.44	31.49	15.03	11.05	11.45

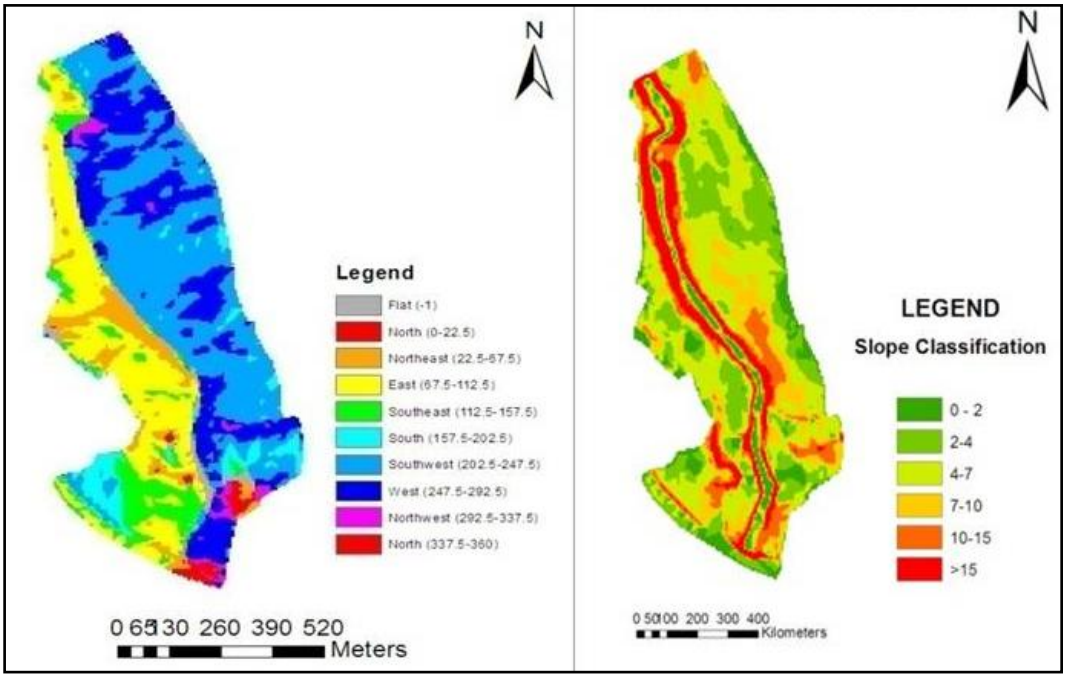


Figure 16: Aspect and slope classification map of the study area (Bole sub city-Addis Ababa)

Table 11: Summarized Slope analysis of the study area

Slopes	Opportunities	Challenges
0-2%	Favorable for: - urban setting elements, construction of low cost houses and big industries, big ware house.	Subjected to flood, drainage problems, requires flood diversion channels.
2-4%	Favorable for: - urban setting, construction of low cost house, any kind of construction	No significant problem
4-7%	Urbanization with no difficulties to realize different infrastructural elements to any direction (road, drainage, water supply lines, building orientation etc).	Not preferable for big industries and warehouses.
7-10%	It is acceptable for urban system /setting	Subjected to erosion, requires retaining wall, requires high construction cost for urban development
10-15%	It is less acceptable for urban system /setting	Subjected to erosion, requires retaining wall, requires high construction cost for urban development
15-20%	It is less acceptable for urban system /setting	Subjected to erosion, requires retaining wall, requires high construction cost for urban development
>20%	Favorable for: - Urban green belt, Urban forestation and greenery.	Difficult to urban setting.

Therefore, the favorable slope area coverage was 69% and unfavorable slope area coverage was 31%.This shows that in the area there was good opportunity for any development activities even if high portion of the unfavorable slope coverage was part of the river and river banks.

Understanding soil was important in planning and engineering construction (MUDC 2018). The soil depth was not more than 1m as observed from the ongoing excavation of construction in the study area and it was under lied by bed rock. The study area was used as quarry site for a long period and even currently construction stones were extracted from the area. This implies that the soil in the study area has good load carrying capacity that could be considered during planning for waterfront development in the stream bank.

There were natural and manmade vegetation in the study area. The natural vegetation was found along the side of the Stream while the manmade vegetation found in the compound of some individual households. The type of vegetation was dominated by eucalyptus tree. The total land covered by the vegetation was 2ha which accounts about 11.5% of the total area. To create the sense of place for people the green area needs consideration during design of the waterfront development (**Wrenn 1983).** (Fig.17)

Figure 17: Existing vegetation type of the study area (Bole sub city-Addis Ababa)

According to the above figure and field observation the individuals in their plot exercise planting vegetation with the concept of environmental problem protection and which also absorb sound, dust and modify the micro climate condition of the neighborhood around the stream.(Fig.18)

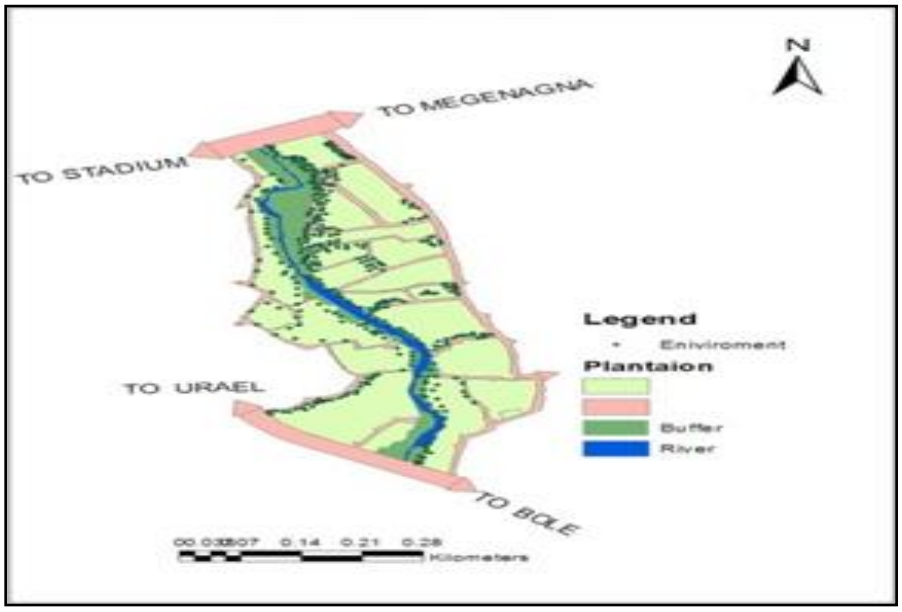


Figure 18: Vegetation map of the study area (Bole sub city-Addis Ababa)

The study area was crossed by Kabana stream which has 1200m length within the area. The stream flows in dry and wet seasons of the year with an approximate base flow of 2m/se. The water flowing in the stream was polluted from liquid and waste disposal from each household. Management of water was a key issue with increasing concerns over flooding and the need to reduce water consumption. Good design and management of water could

turn waste water into an asset (Pescod 1992). For example, sustainable urban drainage systems could enhance the landscape and canals that can be brought back into use to create attractive waterside locations (Parkinson and Tayler 2003). So these water resources needed consideration during design to maximize the utilization of the natural resources for better waterfront development. (Fig.19)

Figure 19: Polluted water body in the study area (Bole sub city-Addis Ababa)

The wind direction was very important factor in urban development process and to bring sustainable development of waterfront .The river across the study area was polluted and it had bad odor which brings social, economic and environmental problem to the surrounding. So knowing the wind direction would help to design properly the place that has sense of place for people and also reduce further expenditure, complain and environment problem (Sairinen and Kumpulainen 2006). According to the Ethiopia meteorological services agency (2018), the wind direction of the study area during dry season (September to May) mostly

moved from North-East to South-West with speed 6-12 m/s. During wet season, the direction may reverse i.e. from south-west to North-East at 4-8m/s which were similar to the whole Addis Ababa city. So in urban process like architectural activities, planning and urban design activities to bring environmental, economic and political dimensions and to determine building orientation and waterfront development considering wind direction, speed and duration were important. (Fig.20)

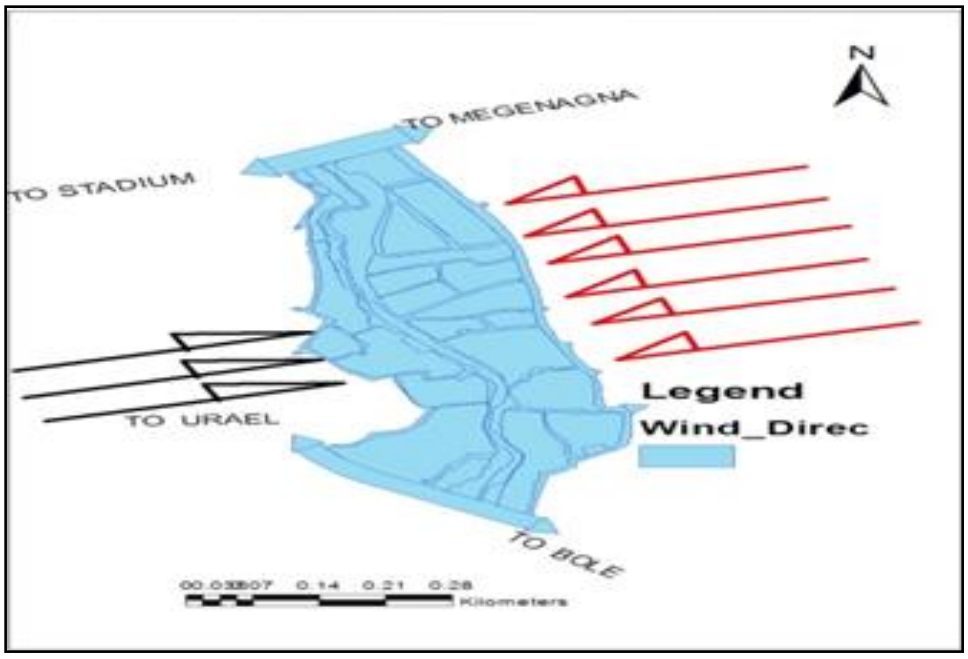


Figure 20: Wind direction map of the study area (Bole sub city-Addis Ababa)

According to the study area observation and interview the solid waste was disposed from households to the river and ever where in the river. However, the waste disposed was scattered from the disposal to the neighborhood due to the wind blowing. So the development and environmental management system should consider the direction of the wind and its management mechanism for waterfront development (Marshall 2001).

The existing land uses of the study area were residence, mixed use, commerce, stream buffer, stream course, and some open areas including the road network and the study area was dominated by residence. There were incompatible land uses due to encroachment of the Stream sides by buildings. Some of the buildings were in the Stream buffers which were in danger during rainy seasons from runoff. During the design (Thames and Hudson 1996) the existing land use which were incompatible with Stream buffer should be considered to be relocated and others needs to be interconnect with the study area in terms of social,

economic and environmental aspects to enhance the sense of place to people in waterfront development (Breen and Rigby 1996) .(Fig.21&22)

Figure 21: Stream encroachment by Buildings in the study area (Bole sub city-Addis Ababa)

Table 12: Existing land uses in the study area

Land Use Type	Area Coverage(Ha)	Percentage (%)
Residence	7.6	43.28
Mixed	3.4	19.36
Commerce	0.4	2.28
Stream Buffer	2.0	11.39
Road	3.56	20.27
River	0.6	3.42
Total	17.56	100

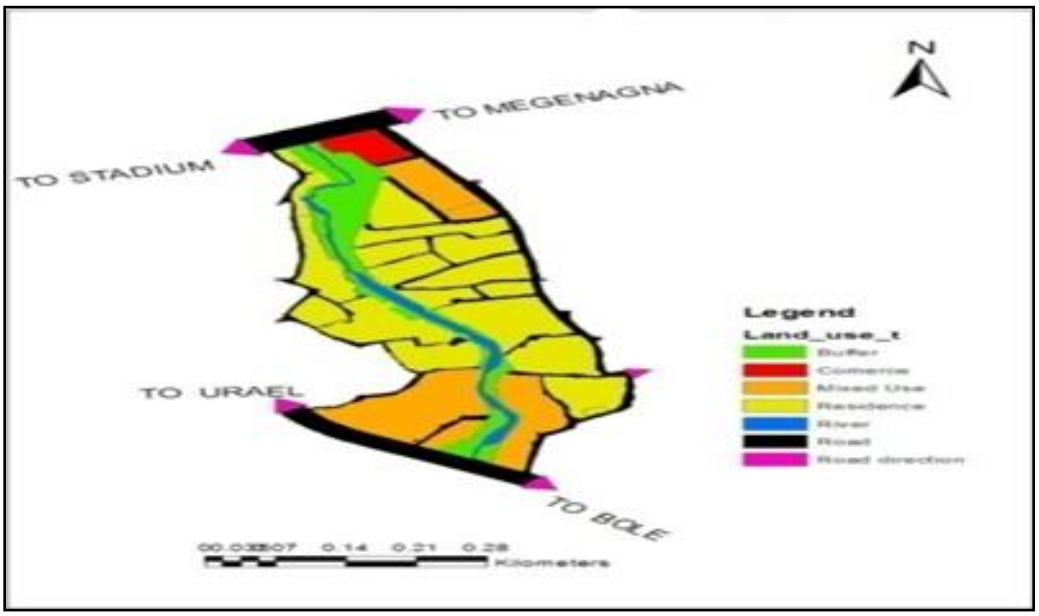


Figure 22: Land use map of the study area (Bole sub city-Addis Ababa)

Integration was very important to efficiently utilize the scarce resources (May, R. 2006). The study area lacks social services such as education, health, and market and recreation area. To insure development activities, it needed to be integrated economically, socially, and environmentally to the influential areas of the city to create good waterfront development and sense of place (Kojima and Kinoshita 2013). (Fig.23)

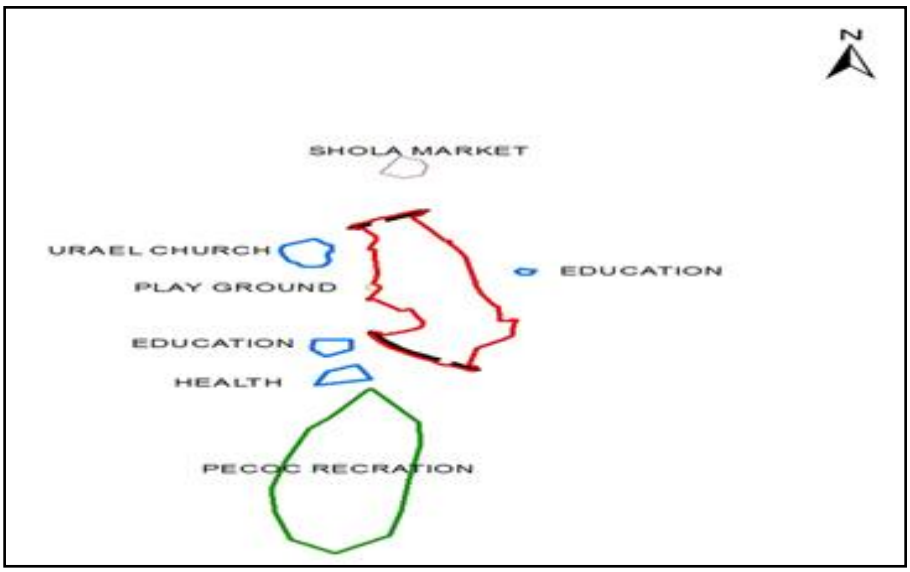


Figure 23: Integration map of the study area (Bole sub city-Addis Ababa)

CONCLUSION

There were different socio-economic situations that were got from the data discussion and analysis of the research. These were shortage of drainage facilities; poor waste management system; private land ownership was dominating; existence of poor housing condition; the study area totally dominated by G+ 0 buildings and only three buildings with G+2 and above; most houses of the study area were above 50 years old aged; encroachment of stream buffer with buildings; absence of active neighborhood market and lack of waterfront development.

The other different issues related to communities or stakeholders in the study area were problem of safety and security; pollution of the stream; lack of adequate provision of infrastructures and utilities; problem of accessibility and poor street connectivity and below standard in width. And also there was no intervention for the long time, irregular block arrangement, fragmented land development, lack of green area, problem of service and utilities, poor housing condition, lack of integration, water pollution from upstream and flooding along the study area.

REFERENCES

[1] Addis Ababa, Bole sub city information communication office, 2018

[2] Addis Ababa, Bole sub city land development and management office, 2018

[3] Addis Ababa city map, 2018

[4] Addis Ababa city information communication office,2018

[5] Addis Ababa, Bole sub city water and sewerage office, 2018

[6] Alaci, A., (2010), Regulating Urbanization in Sub-Saharan Africa through Cluster Settlements: Lessons for Urban Mangers in Ethiopia. Theoretical and Empirical Researches in Urban management 5(14).

[7] Breen, A. and Rigby, D. (1996), “The New Waterfront – A Worldwide Urban Success Story”,

[8] Bruttomesso, R. (2006). Waterfront development: A strategic choice for cities on water. Paper presented at the Waterfront Development Forum: China Maritime (02 March 2006), Hong Kong.

[9] Central statistics Authority (CSA), 2018

[10] Chang, T., Feng, H and Peng, C. (2001). Design and Development of Urban Waterfront, Tong Ji University Press, Shanghai.

[11] Corbetta, P, (2003). Social Research: Theory, Methods and Techniques. SAGA Publications, London.

[12] Corner, J. (1997). "Ecology and Landscape as Agents of Creativity." In Thompson, G. and Steiner, F. (eds.), Ecological Design and Planning Pp. 80-108. New York: John Wiley & Sons, Inc.

[13] Creswell, J (2009), "*Research* Design; Qualitative, Quantitative and Mixed Method Approach", 3rd edition, University of NEBRASKA-LINCOLN

[14] FAO (1976), Water quality for agriculture. *Irrigation and Drainage Paper 29*, FAO, Rome.

[15] Gordon, A. (1997). Managing the changing political environment in urban waterfront redevelopment. Urban Studies, 34(1):61-83.

[16] **Hall, P. (1992),** *"Waterfronts: A New Urban Frontier",* **Aquapolis, Vol. 1/92, 6-16,**

[17] Kojima H., Kubo T. and, Kinoshita A. (2013). Integrated coastal management as a tool for local governance of coastal resources: A case study of Munakata coastal zone. Ocean & Coastal Management, 81:66-76.

[18] Kothari , C (2009), "Research Methodology, Methods and Techniques"

[19] Krausse, H. (1995). "Tourism and Waterfront Renewal: Assessing Residential Perception in Newport, RI." Ocean and Coastal Management. Volume 26, Number. 3

[20] Letourneur, C. 1993. Life at the water's edge: An analysis of human behavior and urban design of public open space at the water's edge. The University of British Columbia Vancouver, Canada

[21] Marshall, R. 2001. Waterfront in Post-Industrial Cities, London: Span Press.

[22] May, R. (2006), Connectivity in urban rivers: Conflict and convergence between ecology and design. Design technology in society.

[23] Ministry of Urban Development and Construction Information , (MUDC, 2018)

[24] *National Meteorological Agency of the Federal Democratic Republic of Ethiopia, 2018*

[25] Parkinson, J. and Tayler, K (2003), 'Decentralized wastewater management in periurban areas in low-income countries', *Environment and Urbanization*,

[26] Pescod, M.B. (1992), 'Wastewater treatment and use in agriculture', FAO Irrigation and Drainage Paper 47, Food and Agriculture Organization of the United Nations, Rome.

[27] Rafferty, L & Holst, L (2004). An introduction to urban waterfront development. *Remaking the Urban Waterfront*, Urban Land Institute: Washington,

[28] Trancik Roger (1986), Finding Lost Space: Theories of Urban Design.

[29] Sairinen, R.and Kumpulainen, S. (2006) "Assessing social impacts in urban waterfront regeneration", Environmental Impact Assessment Review 26: 120– 135

[30] Thames and Hudson, 1996 *(PDF) Waterfront Planning for Sustainable Development of Natural and Archeological Heritage*

[31] Tracy, J. 2013. Qualitative research methods: collecting evidence, crafting analysis, communicating impact. Chichester, West Sussex/ UK: Wiley-Blackwell.

[32] Vallega, A. (2001). Urban waterfront facing integrated coastal management. Ocean & Coastal Management, 44:379-410.

[33] West, N. (1989). "Urban waterfront developments: A geographic problem in search of a model." Geoforum 20.4.

[34] **Wrenn, M. (1983).** *"Urban waterfront development"***. Washington, D.C.: The Urban Land Institute.**

[35] Zhang, L. (2002). "An evaluation an urban riverfront park, Riverfront Park, Spokane, Washington- Experience and Lessons for Designer". Unpublished master thesis, Washington State University, United States