The objective of this thesis is to examine the relationship between urbanization and flooding in Accra. As a result of the government of Ghana’s implementation of the Structural Adjustment Program (SAP), massive expansion in the built-up area of Accra occurred. Beside the impact of the increased impervious surface due to urban growth, poor land tenure and land delivery system, poor garbage collection and disposal, as well as poor implementation of economic development programs, have been identified as contributors to flooding in Accra. The information for the research was gathered in several ways that include urban change mapping, field observation and measurement, photography and personal field interviews. In order to prevent flooding in Accra, Ghana government uses engineering methods. However, it is suggested that good record keeping and data generation, proper collection and disposal of garbage, and good physical planning be made an integral part of the solution to flooding in Accra.

**Key Words:** Flooding, Urban Growth, Impervious Surface, Land Tenure, Land Delivery, Garbage Collection and Disposal, Accra
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CHAPTER ONE
PURPOSE OF STUDY

1.1: Introduction

Of all natural hazards, floods are by far the most hazardous, frequent and widespread throughout the world (Dar and Nandargi, 2001). This makes flooding an important subject of study, particularly in Third World countries, where consistent and appropriate research on it has been lacking. The original intension of this thesis was to examine the nature of flooding in Accra. Because of data unavailability these intensions were put on hold. I return to these intensions to speak about policy for Accra in Chapter Five.

Accra, the capital city of Ghana, has a metropolitan population of about 2.5 million people (Yeboah, 2003). Each rainy season (April to October) it experiences rain-fed floods that lead to the destruction of property, the loss of life, and a slow down of transportation and economic activity. The population and area occupied by Accra have been increasing (Yeboah, 2003). Reportedly, flooding has also been widespread and severe because of the absence of drainage and sanitation services which the government is expected to provide (Konadu-Agyemang, 2001). Figure one shows workers sweeping and removing water that entered their office after a heavy rainfall. Such is the plight of many a resident in Accra. The workers in Figure one must count themselves fortunate in that some lose their lives in Accra floods and do not have the opportunity they had of retrieving or rescuing what material possessions remained after the flooding event.

The objective of this thesis is to examine the relationship between urbanization and flooding in Accra. The following specific research questions will be answered:

(1) What is the relationship between urban growth and flooding in Accra?
(2) What is the relationship between urban management practices and flooding in Accra?
The logic is that, as urban areas increase, vegetated land is converted to impervious surfaces. As the impervious surface increases, runoff time decreases while runoff velocity increases which then leads to increased peak flow (Campana and Tucci, 2001). So the increase in the urban area, would contribute to increased flooding because it reduces the natural storage capacity of the soil and consequently contributes to increased runoff (Andjeilkovic, 2001).

Poor urban management practices also contribute to flooding. For example, poorly executed garbage collection, an aspect of urban management, contributes to flooding in an urban environment because uncollected garbage can be washed into drains thereby clogging them (Andjeilkovic, 2001). Other poor urban management practices that may enhance flooding include improper land use practices that lead to silting of drains, building in or across waterways, inadequate street cleaning practices and soil erosion related to massive construction works, will also decrease the capacity of drains and cause storm water to spill over (Chan, 1997). Other urban management practices, which can contribute to flooding, are government land management policies, urban land use

practices such as land tenure system, housing, and building permit utilization (Hamza and Zetter, 1998).

1.2: Definition of Terms

Two concepts that guide this thesis are operationally defined here. These are urban flooding and urbanization.

1.2.1: Urban flooding

The definitions of flooding by Chow (1956) and Wad (1978) are used in this thesis. Chow (1956) describes flooding as a relatively high flow, which overflows the natural channel, provided for runoff. Wad (1978) defines flooding as a body of water, which rises to overflow the land. Also important is ponding, a situation in which stagnant water collects on plots of land during heavy rainfall. Rainfall is considered an integral part of the definitions given above. The type of flood, which this thesis is concerned with, is rainfall specific to urban areas.

The primary cause of urban flooding, according to Andjeilkovic (2001), is a severe thunderstorm or a rainstorm proceeded by a long lasting moderate rainfall that saturates the soil. Floods in urban conditions are flashy and occur on both urbanized surfaces (streets, parking lots, yards, parks, etc), and in small urban creeks. Some causes of urban floods are improper land use (Oguntoyinbo and Oguntala, 1982; Chan, 1997; Check, 1997; Scu et al, 1998; Diop, 2000; Campana and Tucci, 2001) and channelization of natural waterways, failure of the city protection dikes, and inflow from rivers during high stages in urban drainage system (Oguntoyinbo and Oguntala, 1982). Other causes of urban flooding are surcharge due to blockage of drains and street inlets by silt and garbage and inadequate street cleaning practices (Kolsky and Butler, 2002).

1.2.2: Urbanization

The definitions of urbanization by Marcus et al (1972), Qadeer (1983), and Hope (1986), are used in this thesis. According to Qadeer (1983), urbanization describes the phenomenon in which an increasing proportion of a country’s population lives in the cities. Hope (1986) describes it as the process of growth in the urban proportion of a country’s entire population, rather than merely in the urban population per se.
Marcus et al (1972) defines urbanization as the process of city establishment and growth. According to Marcus et al (1972), urbanization connotes population increase in the city, resulting from internal growth and immigration, as well as the spatial expansion of the city. Population growth and spatial expansion, according to Marcus (1972), go hand in hand. Both kinds of growth affect each other, and they are both affected by the environment. For the purpose of this thesis the term is used to describe the phenomenal increase in the population of a city, measurable in terms of human numbers or spatial expansion. Urbanization has two main components and these are natural population increase, which is closely linked to the causes of rapid natural increase and rural-urban migration fuelled principally by the desire for economic betterment (Hope, 1986). These definitions of urbanization and flooding help contextualize the setting of fieldwork of the thesis.

1.3: Research Methodology

In order to achieve the purpose of this thesis and to answer the research questions, information was gathered in several ways. Four research methods were employed. These are: urban change mapping, field interviews, and field observation and measurement, and photography. Secondary data also is an important source of information for this thesis. It includes research publications, and anecdotal sources. Published data sources include book chapters and articles from known journals. Anecdotal sources include articles from Ghanaian and Africa newspapers on the Internet and conference proceedings. Interviews were held with high-ranking officials of National Disaster Management Organization (NADMO), Accra Metropolitan Assembly (AMA), Hydrological Services Department and Ghana Meteorological Agency (GMA).

1.3.1: Urban Mapping

To show what changes in area have occurred in the urban environment, two maps were generated from two topographical maps of Accra. Yeboah (2000) generated a map of Accra from a series of maps that include topographical maps and aerial photographs to show how much Accra has expanded.

Urban land cover change maps can also be obtained by processing a series of satellite images together with aerial photographs and topomaps (Xu et al, 2000). In
addition to 1975 and 1999 topographical maps, a Landsat ETM+ image was used to obtain relatively more accurate urban change maps and to calculate the percentage change in area of Accra between 1975 and 1999. The topographical maps were obtained from Ghana Survey Department. The Landsat ETM+ and the aerial photographs were obtained from the United States Geological Survey (USGS). The maps generated helped to determine the extent to which Accra has increased in area and proved useful in exploring the relationship between urban growth and flooding.

1.3.2: Field Observation, Measurement and Photography

During the field study, which took place during the summer of 2003, I made observations of Accra’s environment. In particular, I observed areas that flood yearly, to identify drainage indicators. I measured drains in particular flood-prone areas to determine the extent to which they were blocked with garbage and silt. Clogged drains have diminished capacity to channel flood water away from residential areas. I also took photographs of areas that flood annually which will provide a useful context for this thesis.

1.3.3: Field Interviews

My interviews were with five city officials who work at management level positions. The five officials include: one AMA structural engineer, one AMA building inspector, and one hydraulic engineer of Hydrological Services Department. Others are one NADMO Disaster response officer and one Meteorological Services Department data management officer. The interviews lasted between 45 minutes and one hour. There were follow-ups in some instances for further questions and clarifications. The interview process was initiated by telephone calls to the various departments asking for permission to interview staff in management position by appointment.

Some appointments were also made by personally approaching offices concerned to request an appointment. In some instances, I was given immediate access to interviewees and in that instance; the interview was conducted after giving appropriate courtesies and speaking to the topic.

The respondents used maps where necessary to show, for example, which settlements in the city were illegal, and where rapid urban growth occurred. The interviews focused mainly on urban growth and management practices that contribute to
flooding in Accra. The interviews were important in that they generated views from respondents who were directly involved in the management of Accra. All the respondents were policymakers and implementers on Accra and therefore were conversant with urban and flooding problems of Accra.

1.4: Thesis Organization

This thesis is organized into five chapters. Chapter One introduces the thesis by stating the purpose of the thesis and the research questions as well as the methodology. Chapter Two contains the literature reviews, which has been organized around the following themes: urban growth and expansion, government policies, and urban land use practices (e.g. land tenure system, housing, building permits, and garbage collection). Chapter Three investigates the link between urban growth and flooding and discusses the expansion of Accra and how it has influenced flooding. Chapter Four is a discussion of urban management practices and how they contribute to flooding in Accra. Chapter Five is the conclusion and it examines the interventions that need to be made to remedy flooding problems of Accra. It lays emphasis on the need to keep records for the future.
CHAPTER TWO
LITERATURE REVIEW

2.1: Introduction

Urbanization has been increasing in most developing countries (Rakodi, 1996). In terms of absolute numbers, there are twice as many urbanites in the Third World as there are in developed countries. In low-income countries urban growth rates exceed those of the developed world by more than five times (Drakakis-Smith, 2000). Africa has the highest rate of urbanization in the world (Rakodi, 1997) with a growth rate of 3.5 per year (UNEP, 2004).

There are 40 cities in Africa with populations more than a million. High populations in the cities have been beneficial in many ways. African cities, for example, account for more than 60 per cent of the regions’ gross domestic product (GDP). They are important centers for education, employment, and trade (UNEP, 2004). The largest cities also serve as national and regional centers of economic growth, technological and cultural creativity, and homes for the poor and deprived (Rakodi, 1997; Drakakis-Smith, 2000). Most African cities are connected to the world economy through trade, investment and aid relationship (Rakodi, 1997).

Although cities generate the greatest share of economic activities, they also consume most of the natural resources, for example, food, energy and water (Zetter, 2004). Cities are also sites and sources of environmental pollution and produce most of the waste (Oguntoyinbo and Oguntala, 1982; Rakodi 1997; Diop, 2000). Urban sprawl is prevalent in most African cities (Aryeetey-Attoh, 2001). Residential sprawl is associated with unauthorized land development. Buildings are erected without prior authorization from planning agencies (Aryeetey-Attoh, 2001).

Urban sprawl leads to unplanned and unserviced settlements where mostly poor inhabitants do not have access to adequate housing, sanitation, waste disposal, electricity and water supply (Drakakis-Smith, 2000). However, according to Yeboah (2000), urban sprawl in Accra is the result of the rich who are building in the peri-urban areas. Yeboah (2000) describes residential development in peri-urban Accra as quality residential sprawl
with unicentric tendencies (QRSUT). According to Yeboah (2000), housing developments in peri-urban area occur in anticipation of services.

This chapter will be organized under four headings. The first is Government Policy: Structural Adjustment (SAP) and Flooding. The second is measuring urban growth and expansion. The third is Urban Management Practices. The fourth is a conceptual framework, which is used to generate research questions.

2.2: Government Policy: Structural Adjustment Program (SAP) and Flooding

Disaster vulnerability has always been linked to underlying socio-economic processes that prevail in an area (Hamza and Zetter, 1998; Zetter, 2004). Hamza and Zetta (1998) argue that urban areas are not disaster prone by nature but that the structural process that speeds up rapid urbanization; population movement and population concentrations greatly increase vulnerability of low-income urban dwellers to disasters.

However, according to Degg (1994), Third World countries are exposed to hazards because they are geographically located in the most hazardous parts of the world than those in Western countries. Degg (1994) believes that hazard exposure is not a consequence of social or political factors but of the distribution of global tectonic processes. Degg (1994) agrees, though, that adverse socio economic conditions have an impact on hazard exposure but seemed to have assigned it a rather weak role. The view of Degg (1994), in my opinion, could not account fully on causes of disasters. It is one sided, leaning towards the environmentally deterministic aspect of hazard exposure, particularly the concluding part of his work.

The complete explanation for disasters can be offered when both natural and human factors are combined (Andjelkovic, 2001). It is a risky endeavor to give more weight to natural factors than human factors in Third World countries because of their position in the global economy (Zetter, 2004).

Several economic development programs that changed the spatial configuration of Accra have been implemented in Ghana since its independence in 1957. However, the economic development program which receives the most attention from researchers regarding its impact on the spatial configuration of Accra, is the World-Bank-enforced

Structural Adjustment Program is the process whereby national economic policies and relevant institutions are reformed with a view to enhancing economic growth, improving resource allocation, increasing economic efficiency and increasing the economy’s resilience to changes in its domestic or global market (Konadu-Agyemang, 2001). SAP is designed by the World Bank and International Monetary Fund (IMF) and imposed on debtor countries as a pre-condition for debt relief and acquiring new loans as well as attracting foreign investment.

The interaction of global and local forces through trade, investment and foreign currency liberalization led to the physical expansion and population growth of Accra since SAP started in 1983 (Yeboah, 2000; Grant and Yankson, 2003). The increase in economic opportunities in Accra during SAP in terms of establishment of new businesses and jobs has caused movement of population from the rural areas into Accra. The population of Accra metropolis grew at an annual rate of 4% between 1984 and 2000 (Grant and Yankson, 2003). And the increase in the demand for houses has led to the expansion of Accra outward in the peri-urban zone (Yeboah, 2000).

According to Yeboah (2000) the expansion in the peri-urban areas of Accra is due to land litigation which keeps down the price of land. Also, increased importation of vehicles into Ghana due to trade liberalization makes peri-urban areas more accessible (Yeboah, 2000). However, according to Grant and Yankson (2003), the expansion in the peri-urban areas is due to the weak spatial planning of Accra during SAP whereby the formal economic sector was catered to while the informal economic units within the built up environments were neglected. Roadside selling, crowding, congestion, inadequate infrastructure, and environmental hazards in the inner city, led to spatial development outside from the center (Grant and Yankson, 2003).

Greater concentration of economic opportunities in the urban centers, particularly Accra, during SAP, fuelled rural-urban migration (Konadu-Agyemang, 2001). Konadu-Agyemang (2001) attributes the increase in the informal sector during SAP to rural-urban migration. The percentage of Accra’s population attributable to migration during the SAP is not known. However, Yeboah (2003) shows that population growth rate in Accra
Metropolitan and Urban Outliers increased 71 percent and 103 percent respectively from 1984 to 2000.

Migrants, who could not find employment with the formal sector, due most often to their low skills, were forced to find employment in the informal sector (Grant and Yankson, 2003). Also, the informal sector increased due to large retrenchment brought about by SAP. For example, home-based enterprises (HBEs) have increased significantly during SAP (Yankson, 2000). HBEs are more predominant in poor income residential areas and contribute to unsanitary environmental conditions because they are not well served with services such as drains, and garbage removal (Yankson, 2000).

Unemployment during the SAP year’s increased illegal activities such as sand and stone extraction in unapproved sites in the outskirts of Accra causing massive environmental degradation (Grant and Yankson, 2003). Sand and stone extraction activities leave the land bare of vegetation and increase run off. It also generates silt materials which are transported down slope to clog drains causing flooding (Chan, 1997). Although Chan (1997) did his study in China, I have observed similar activities in Accra particularly in the peri-urban areas such as Tantra Hill, Mallam and Weija.

High inflation during SAP reduced income and increased poverty among Ghanaian workers (Grant and Yankson, 2003). Unable to afford quality accommodation, the tendency among the poor to settle or build in flood prone areas is high.

However, according to Yeboah (2000) it is mostly the rich, particularly the middle-class income earners, who are building in Accra. Building projects in Accra take place in anticipation of infrastructure services such as water, drainage, electricity and roads (Yeboah, 2000; Aryeetey-Attoh, 2001). Therefore, the environments of those buildings are conducive for flooding because of lack good drainage and sanitation because they do not have infrastructure done before building begins (Aryeetey-Attoh, 2001).

This review has shown that Accra has experienced spatial expansion and population growth during SAP. This review has also demonstrated that Accra has increased spatially and demographically, however, proper planning and management has not accompanied this development thereby exposing many urban dwellers to flood disasters because they live in places that lack the infrastructure to protect them against it.
This informed the generation of the research question: what is the relationship between urban growth and flooding in Accra?

2.3: Measuring Urban Growth and Expansion

The expansion in the built up areas of cities implies conversion of vegetated areas to paved surfaces (Aboagye, 1996; Chan1997; Stewart et al, 1999; Diop, 2000; Campana and Tucci, 2001). As the paved surface increases, runoff velocity and peak discharge also increase while runoff time decreases (Stewart et al, 1999; Andjelkovic, 2001). In societies where drains are often non-existent (as in Ghana) the extent of the paved surface is, therefore, an indicator of flooding and can be used in flood forecasting (Andjelkovic, 2001). How do we measure the growth and expansion of a city due to urbanization? This section is devoted to reviewing the existing literature on urban growth and expansion.

Various demographic, social, and economic statistical techniques exist to measure urban growth and expansion. Yeboah (2000) identifies two approaches. The first approach is demographic which measures growth either by natural increase or rural-urban migration, and presupposes the availability of demographic data. The second approach is urban change mapping, which involves mapping of built-up areas from topographic maps and aerial photographs taken over at least two time periods (Yeboah, 2000). Satellite images, if available, can also be used if they have high geometric and spatial resolutions (Carlson and Arthur, 1998; Yang and Lo, 2001).

Yeboah (2000) used the second method to determine changes in the built-up area of Accra by mapping out the expansion of the city from a series of multi-date air photographs and a 1975 topographical map. However Yeboah’s method of mapping was not detailed enough.

Remote sensing and geographic information techniques are best used to produce urban change maps from a combination of maps and reference data (Xu and Xiao, 1999; Ward et al, 2000). The real pattern of growth of an urban area is shown through remote sensing data (Carlson and Arthur, 1998, Campana and Tuci, 2001). For example, Campana and Tucci (2001), in their studies on flooding in Brazil used Landsat-TM
images to estimate the impervious layer, which they used in their hydrologic model to predict flooding in urban areas.

There are various methods of analyzing remotely sensed data and other referenced data (such as topographical maps) for mapping urban land cover change. Any change detection requires the comparison of data from two periods but in order to do this the data should be in the same coordinate system. If, for example, the coordinate systems for two maps are incompatible the maps must be reprojected to a common projection. In the case where one of the images is not georeferenced, this should be done by assigning map coordinates to image and resampling the pixels of the image to conform to that in the reference image.

Georeferencing requires ground control points (GCPs) which must be gathered in the image and reference data sets. GCPs are specific pixels in image data for which the output map coordinates (or other output coordinates) are known. GCPs are used for computing a transformation matrix for use in rectifying an image or a map (Avery and Berlin, 1985). Once the maps have been properly georeferenced, the built-up areas can then be digitized using GIS or image processing software. Alternatively urban areas for the different periods can be created through image classifications. Urban change maps can be produced through overlaying and differencing individual urban maps.

This review shows the methods that can be used to produce maps depicting the extent to which Accra has grown spatially. From the impervious layer, a conclusion can be drawn between Accra’s spatial growths and flooding. This is because there is positive correlation between the size of impervious layer and flooding. The review therefore helps to derive the research: what is the relationship between urban growth and flooding in Accra?

2.4: Urban Management Practices

Urban management is concerned with addressing problems of land, environment, infrastructure, poverty, and finance (Wekwete, 1997). Some specific urban management problems that face large cities in Africa are lack of planning, lack of sanitation services, and lack of drainage (Larbi, 1996). Other problems are urban sprawl, and squatting.
Absence of planning and management during the urbanization process can lead to flooding (Diop, 2000).

In the absence of planning, essential emergency services such as hospitals, fire stations, police stations, and life serving services (water, gas, electricity and telecommunications, and safety routes) increase disaster vulnerability of urban residents (Degg, 1994). Also, imprudent practices in urban areas such as garbage dumping, squatting and uncontrolled artificial development contribute to flooding (Chan, 1997).

The objective of this section is to address specific issues of urban management in Accra as they relate to land tenure and land delivery system, building permits and garbage collection.

2.4.1: Land Tenure and Land Delivery System

Land tenure systems refers to a set of prescribed customary or procedural rules concerning peoples rights to land along with the institutions that administer these rights, and the ways in which people hold that land (Aryeetey-Attoh, 1997). The government of Ghana recognizes three types of land ownership. These are customary, state-owned and public lands, (Acquaye, 1989; Tipple and Korboe1998; Gough and Yankson, 2003).

Customary land ownership is a system of land ownership in which land is owned by kin-groups which consist of those who have died, those who are alive and those yet to be born (Aryeetey-Attoh, 1997). According to Acquaye (1989), in Accra, stool heads or chiefs hold customary land in trust for their communities and any member of the community has a right to use the land.

It is also possible for the individual to be given a large tract of stool/family land as a reward for a meritorious service in their communities (Acquaye, 1989). Non-community members who are interested in any stool land are given plots of land under different conditions (Acquaye, 1989). For such groups customary lands are leased out to those who are interested for ninety-nine years after which the land reverts to the owners. There is no permanent outright sale of land (Yeboah, 2000).

There is disagreement among researchers as to what percentage of land in Accra constitutes customary land. Acquaye (1989) estimates that about 11 percent of total state planning area is customary land. Grant and Yankson (2003), however, estimate that about 86.9 percent of Accra lands are customary lands. Tipple and Koboe (1998), and
Aryeetey-Attoh (2001), have not given the percentage of land that is customary land but they are of the view that the greatest proportion of Accra lands is customary land. While the actual proportion of the customary land in Accra may never be known, the discrepancy in the proportion of customary land as given by Acquaye (1989), and Grant and Yankson (2003), might be due to definitional issues of what constitute Accra.

There are many problems associated with customary land in Accra. Obtaining land in customary land system has always been difficult and expensive. Anyone who is not a member of the family is considered a stranger, and therefore, has to pay higher fees than the family member to obtain land for housing (Aryeetey-Attoh, 2001; Grant and Yankson, 2003). Also, allocation rights by the various representatives of customary lands are complicated and often overlapping leading to many confusing titles, which slow down development, raises legal cost and multiple payments for the right of use of the land (Acquaye, 1989).

Land, which has been acquired through the customary system, has to go through laid down government authorization process before it becomes legal to develop (Larbi, 1997; Aryeetey-Attoh, 2001). However, the authorization process is cumbersome and involves many agencies. Acquaye (1989) identifies four agencies, which are involved in processing land title documents. These are the Land Commission, Town and Country Planning Department (TCPD), Deeds Registry, and the Survey Department. Aryeetey-Attoh (2001) identifies two additional Agencies which are Land Valuation and the Internal Revenue Service. According to Aryeetey-Attoh (2001), it can take anywhere from 6 months to 3 years to obtain the final title to the land and an additional 1 to 3 years to secure a building permit. The consequences of these delays are building outside regulations and uncontrolled development.

Other problems affect customary land holdings. For example, no attempt is made to reduce land boundaries into maps because the stool or family relies on memory (Acquaye, 1989; Grant and Yankson, 2003). Another problem is that some chiefs grant land without proper records or understanding of the legal implications (Acquaye, 1989).

Also, chiefs and stool heads prepare their layout without approval of TCPD so their layouts do not match that of TCPD (Larbi, 1997) and as a result are not approved (Acquaye, 1989; Yeboah, 2000). Finally, the purchasers of customary land start
development of the land without building permits and this culminates in building outside regulations, which contribute to uncontrolled development (Acquaye, 1989; Konadu-Agyemang, 2001)

The above-mentioned problems have led to long delays and numerous court cases as a result of titles, boundary marks, and delays in processing land titles. Acquaye (1989), for example, observes that often court suits would arise between two litigating chiefs over a piece of land. A third chief that also claims party to the same land is, however, not part of the suit and as a result there is always the possibility of further litigation. This litigation is not limited to the chiefs. It also happens among individuals due to different people selling the same lot of land (Acquaye, 1989).

Unlike customary land ownership, state-owned lands are absolutely controlled by the state and acquired by the government by executive instrument and for which owners, by law, must be compensated (Acquaye, 1989; Gough and Yankson, 2000). The Land Commission administers state-owned lands, which constitutes 13% of the land in Accra. Unlike customary lands, state owned lands are planned (Larbi, 1996). State owned lands are supposed to be used for institutional purposes such as, government ministries buildings and industrial purposes. They are also used for residential and agricultural purposes. Also, a negligible proportion of Accra lands are a freehold. Freehold rights mean outright individual ownership to the land (Aryeeetey-Attoh, 1997).

The above-mentioned deficiencies in the allocation of land contribute to the unplanned growth of Accra, which in turn contributes to flooding. As mentioned earlier, customary lands are lands that are not properly demarcated and planned before they are leased out to people for development. As the boundaries of these lands have never been officially recorded most communities have relied on memory and natural landmarks to determine their location (Tipple and Koboe, 1998). This has led to the situation where landowners have sold the same piece of land several times over to unsuspecting buyers. Builders, for fear of their land being sold to other interested people, would hastily erect their buildings before applying for permits to cover them. It is not surprising therefore that people unsuspectingly build on lands earmarked for essential infrastructure services that include drainage systems, roads, and high electric tension lines (Yeboah, 2000).
The administration of Accra lands falls on many government agencies that include the Lands Commission and Town and Country Planning Department but there is no coordination between them. Also, there is no coordination between the government agencies and the customary landowners.

The lack of coordination has resulted in situations where individual developers buy land from landowners; begin to develop their land with no regard for planning regulations (Yeboah, 2000). Furthermore, the lack of coordination between the state institutions and landowners has led to cheap land in the outskirts of Accra, where residential development is occurring without any regulation (Yeboah, 2003).

This review shows that allocation rights between various representatives of customary lands are complicated and lead to confusing titles; government agencies delay registration of land and their corrupt practices discourage people to use their services. The review also shows that there is lack of coordination between the state agencies that are involved in the land registration process resulting in unnecessary delays. There is also lack of coordination between those agencies and the traditional rulers who sell land. These land delivery and land tenure problems contribute to building outside regulation and lead to uncontrolled development. Uncontrolled urban development contributes to flooding hence the research question: what is the relationship between urban management and flooding?

2.4.2: Building Permits and Land Delivery

The administration of Accra lands fall under the auspices of three main institutions, namely Town and Country Planning Department, Accra Metropolitan Assembly (AMA) and the Land Commission. These are government institutions whose duties include ensuring that all developers observe laid down building regulations. Under these regulations no buildings can be put up in any of the cities without the approval of the City Engineer and the Medical Officer of Health, and it is, also, a requirement that all houses built in the cities should have sandcrete blocks as wall materials (Konadu-Agyemang, 2001).

Some of those standards have been considered too high and sometimes unsuitable, as far as the needs of a developing country, such as Ghana, are concerned (Tipple and Korboe, 1998; Konadu-Agyemang, 2001). However, Yeboah (2000) notes that these
institutions are not adequately provided to ensure compliance of those regulations. Moreover, some of the officials are so corrupt that they condone and connive with illegal builders for various sums of money, allowing them to carry out their illegal activities without fear. Yeboah (2000) observes that in Ga Rural Assembly alone 50 per cent of buildings were constructed without building permits. One major factor that has led to the flouting of building regulations is the fact that there is no coordination between land owners/stools and the official land agencies.

This review shows that for a building to be approved it must meet the laid down official standards which are required on all lands. However, those standards may not be consistent with culturally specific standards of building, as for example, when constructing a compound house. The argument being made is that because of the differences in standards the typical Ghanaian builder would not be encouraged to seek approval from state institutions in charge of enforcing those standards. This is a management problem that encourages uncontrolled development in Accra. Therefore the issue of building permits is important and lead to the generation of the research question: what is the relationship between urban management and flooding in Accra?

2.4.3: Sanitation: Garbage Disposal and Collection

It is estimated that during the 1980s the number of urban residents in the Third World without access to adequate sanitation increased by almost 25 percent to 400 million (Drakakis-Smith, 2000). Even where such systems exist, waste is often dumped untreated into river with disastrous effects that include flood damage. Waste that is not collected contributes to flooding whenever it washes into drains and clogs them. Oguntala and Oguntoyimbo (1982) observe that urban flooding occurs because of dumping of refuse into drains and streams that pass through urban area. There are many articles on waste collection in Accra but none addresses the specific issue of waste management and flooding (Post, 1999; Obiri-Opare and Post, 2000; Boadi, 2003).

The Waste Management Department (WMD) of Accra has been battling with the problem of waste collection without success (Boadi 2003). The practice of sweeping the home before doing the rest of the day’s activities is a cultural practice in Ghana. But by what means are waste disposed? To what extent are the present waste management resources being used to battle the problem of waste collection? Have they been
successful? And how do waste management practices contribute to flooding? The answers to these questions are dealt with here.

The current waste management resources are insufficient to meet the growing needs of urban residents particularly in Accra and Kumasi (World Bank, 1996; Post, 1999). This situation makes it impossible for urban residents to dispose of their waste appropriately. In 1997, the WMD of Accra, which is responsible for garbage collection and disposal, and general sanitation, was privatized and contracted to 15 different contractors due to its ineffectiveness in waste collection and management (Obirih-Opare and Post, 2002).

There are two methods of solid waste collection, which are house-to-house collection and central container collection (Boadi, 2003). Whereas house-to-house collection is common in high-income residential areas, the residents of poor income areas depend largely on central container collection. The central waste depositories are located within 200 to 300 meters of densely populated communities (Boadi, 2003). The government of Ghana used to impose fees on garbage and solid waste disposal but this gave rise to illegal dumping resulting in the suspension of the fees. Current house-to-house waste disposal method in Accra service 11% of the residents whereas the remaining 89% dispose of their waste at community dumps, in open spaces, in water bodies and storm drainage channels (Obirih-Opare and Post, 2002).

Even though WMD has been privatized, only 60% of waste generated is collected. The remaining 40% is not collected at all and is dumped directly or indirectly in drains (Boadi, 2003). Approximately 1250 tons of waste is collected daily of which 85 to 90% is hauled to landfill sites and the remaining 10 to 15% is composted (Boadi, 2003). It is also believed that some residents dump waste into drains and other water bodies, not for lack of access to the appropriate means of disposal, but rather due to ignorance, bad behavior, lack of education, and lack of environmental consciousness (Post, 1999). Other reasons why people dispose of waste unwisely are distance from containers and poor enforcement of the law against indiscriminate offenders.

This review of garbage collection and disposal has shown that not all waste that is generated in Accra is collected and disposed of properly. Despite WMD’s privatization in order to improve services to residents of Accra, only 60 percent of waste generated is
collected and disposed. The remaining 40 percent is dumped openly and sometimes in drains (Obirih-Opare and Post, 2002). This constitutes a serious management practice that affects the environment of Accra. It therefore generated the research question that seeks to analyze the relationship between urban management practices and flooding. That is, what is the relationship between urban management practices and flooding in Accra?

2.5: Conceptual Framework

A consideration of the literature on urbanization has shown a topic-by-topic discussion of some of the problems of increased urbanization in Accra. It has been identified that the rate of urbanization increased in Accra during the implementation of World Bank Structural Adjustment Program (SAP) (Yeboah, 2000). The expansion of Accra led to the clearing of the green spaces within and outside the city consequently increasing the built-up/impervious layer.

Despite the tremendous expansion, which occurred in Accra, no planning was put in place to control it leading to the development of urban sprawl (Grant and Yankson, 2003). This situation is also believed to have arisen due to delays and imperfections inherent in the land delivery system; particularly the way land is disposed of in the communal land system (Acquaye, 1989; Aryeetey-Attoh, 2001). Long delays have been due to bureaucracy and corruption in the government agencies responsible for land title registration and building permit issuance (Yeboah, 2000; Aryeetey-Attoh, 2001).

Generally, it is believed that many informal settlements have occurred on lands, which have been acquired through the communal land system, where land is cheap because of absence of premiums (Habitat, 1996). Premium is the amount of money you pay for the cost of development of land when it is sold and include among other things cost for providing electricity, water, drains and so on (HABITAT, 1996). Most of those settlements have evolved without basic infrastructure services such as artificial drains, water, electricity, and roads. They have been identified as more vulnerable to disasters. Most household-generated solid wastes are not collected because such services are either absent or inadequate in most urban communities in Accra including the peri-urban areas.

Obviously lacking in the literature is the connection between urbanization of Accra and the wet seasonal flooding that the city experiences each year during the wet
season of May to June and August to September. Aryeetey-Attoh (2001) mentioned that the lack of drainage services and basic infrastructure in general in most communities in Accra have rendered them victims to flooding. However, no comprehensive discussion of urbanization and flooding has been done. Yeboah (2000, & 2003) discussed the growth of Accra during the SAP period and the management implications. Yeboah (2000) also discussed how the method of land acquisition and building as well as lack of coordination between government agencies have combined and led to the situation where people build in anticipation of services but no clear links have been made to show how the structural change of Accra has contributed to flooding.

Yet urbanization contributes to flooding when green spaces are taken over by concrete, cement, tar or exposed soil (Aboagye and Nai, 1998). Rapid urbanization changes the hydrological characteristics of drainage catchments, by increasing paved surfaces, which then increased runoff and cause flooding (Check, 1997). Also, lack of planning and urban management before urbanization contributes to flooding (Diop, 2000). According to Andjelkovic (2001), inappropriate urbanization of the flood plain, unwise land use, insufficient attention to drainage in urban planning, ineffective updating of existing storm water control facilities and lack of enforcement of zoning ordinances contribute to flooding. Garbage dumping, siltation, squatting and other artificial development in urban areas contribute to flooding. Urban areas are not disaster prone by nature, rather structural processes that accelerate rapid urbanization, population movement and population concentration increase disaster vulnerability of urban dwellers (Hamza and Zetter, 1998). None of those studies linking urbanization to flooding was done in Accra. There is therefore lack of comprehensive knowledge on how rapid urbanization in Accra contributes to flooding.

This conceptual framework relates to specific research questions. These are: (1) What is the relationship between urban growth and flooding in Accra? (2) What is the relationship between urban management practices and flooding in Accra? The succeeding chapters would be devoted to answering the above questions.
3.1: Introduction

This chapter addresses the research questions on urban growth and flooding. It looks into the connection between increase in the physical expansion of Accra and the seasonal flooding that ravages the city. The discussion in this chapter is predicated upon the view that urbanization leads to increased paved surfaces in hitherto vegetated areas (Aboagye, 1996). The natural storage capacity of the soil, which is made available by the effect of infiltration, vegetation wetting, interception, and depression storage decreases when vegetation is replaced by impervious surfaces (Andjelkovic, 2001). An increase in the impervious surface leads to an increase in storm water runoff rates and the total runoff volumes.

This chapter will demonstrate that the size of the impervious layer has increased in Accra over the years and that it is contributing to flooding. Since the expansion in the built-up area of Accra is due to residential development particularly housing (Yeboah, 2003), there is a discussion on housing delivery in Accra, particularly the kind of housing development that accompanies its expansion. This chapter also discusses the link between increased population and the expansion in the built-up area to show further the link between urban growth and flooding.

3.2: Mapping the Built-Up Area of Accra

I used two topographical maps of Accra, which were prepared by the Ghana Survey Department in 1975 and 1999 to determine how much change has occurred in the built-up area of Accra. I chose this time period because it is the only period for which topographical maps of Accra are available over the last 25 years. This period does not coincide with Ghana’s SAP (1983-1999) but can be used to account for SAP because the growth of Accra was less remarkable between 1975 and 1983.

According to researchers, Accra’s growth during SAP was unprecedented (Yeboah, 2000; 2003; Grant and Yankson, 2003). In 1970 the population of Accra was 728,063, and this increased to 1,179,995 in 1984, and then to 2,086,211 in 2000 (Yeboah,
The delineation of Accra to include SAP years, therefore, provides the opportunity to explain what physical planning, if any, governs its expansion and how the lack of it contributes to flooding.

The 1975 topographical map was of some obscure projection (i.e. War Office), the 1999 map was in commonly used Mercator projection. Given the different projections it was necessary to put both in a common projection system. I used a Landsat ETM+ of Accra acquired in February 2003 as the reference image in georeferencing each topographic map. Each topographic map was georeferenced to the Landsat ETM+ image at a spatial resolution of 15m using nine GCPs and a first order polynomial and resulted in a root mean square error of less than 0.35 pixels. The two maps were hard copies and were scanned at 300 dpi to convert them to digitized copies, allowing additional preparation such as projection and digitizing to come up with individual urban maps for Accra as displayed in Figure 2 and Figure 3.

3.3: Results

Figure 2 and Figure 3 are two maps representing the built-up areas of Accra in 1975 and 1999. Visual examination of the two maps shows vast differences in the built-up areas. Massive built up occurred to the north, west and the southeastern part of Accra on 1999 map compared to the 1975 map. In 1975 most areas of Accra particularly to the north, northwest and the western part were either sparsely populated or were not inhabited. However by 1999 Accra had expanded to engulf them.

Afeku’s mapping of Accra based on 1975 and 1999 data and Yeboah’s based on 1997 data are both presented in Table 1 below. In addition population data from 2000 census is also presented. These three sets of data reflect the exceptional growth of Accra. In 1975 the total built-up area was 69 square miles whereas in 1999 this has gone up to 196 square miles, representing 184 per cent increase. Again this is a massive expansion in built-up area. In ratio terms, the 1975 to the 2000 built-up areas is approximately 1:3 confirming the results of an earlier study conducted by Yeboah (2000), which found a ratio of 1: 4. The population of Accra during the same period shows a ratio of 1: 3.4. This confirms Marcus et al (1972) assertion that population growth and spatial growth go hand in hand.
**Figure 2: Built-Up Map of Accra 1975**

Source: Afeku (2005)

**Figure 3: Built-Up Map of Accra 1999**

Source: Afeku (2005)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Afeku</td>
<td>69</td>
<td>196</td>
<td>1:3</td>
<td>284</td>
</tr>
<tr>
<td>Yeboah</td>
<td>63</td>
<td>263</td>
<td>1:4</td>
<td>417</td>
</tr>
<tr>
<td>Population</td>
<td>0.732</td>
<td>2.5</td>
<td>1:3.4</td>
<td>341</td>
</tr>
</tbody>
</table>

3.4: Population Growth and Change in Accra

Table 2 below shows the population growth and change of Accra Metropolis and its urban, rural and peri-urban localities for 1970, 1984, and 2000. In general Accra’s population has increased significantly from 1970 to 2000. The population of Accra region and Accra metropolis increased more than threefold between 1970 and 2000 and for the same period its urban outliers increased almost threefold. Yet for the same period, the most significant increases in population occurred in the rural and peri-urban areas.

For the rural outliers population increased from 6955 in 1970 to 233,713 in 2000 which is approximately 33 times the 1970 figure. With zero population in 1970, the population in the peri-urban localities increased to 241,854, representing the new localities that did not exist prior to 1984 (Yeboah, 2003). The increases in the population support the massive expansion in built-up areas as shown in Figure 2 and Figure 3. However, most of the expansion in the built-up areas associated with the increased population of Accra since 1970 is due to housing development particularly during the SAP (1983-2000) (Yeboah, 2000). Housing delivery and development during this period is the subject of the next section.
Table 2: Population Change of Accra and its Regions

<table>
<thead>
<tr>
<th>Region</th>
<th>Population 2000</th>
<th>Population 1984</th>
<th>Population 1970</th>
<th>Population Change 84-00</th>
<th>Population Change 70-84</th>
<th>Growth Rate 84-00</th>
<th>Growth Rate 70-84</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accra Region  &amp; Accra Metro</td>
<td>2,548,975</td>
<td>1,203,292</td>
<td>734,896</td>
<td>1,345,683</td>
<td>468,396</td>
<td>1.19</td>
<td>0.64</td>
</tr>
<tr>
<td>Urban Outliers</td>
<td>2,086,211</td>
<td>1,179,955</td>
<td>728,063</td>
<td>906,216</td>
<td>451,932</td>
<td>0.62</td>
<td>0.77</td>
</tr>
<tr>
<td>Accra Metro</td>
<td>1,658,937</td>
<td>969,195</td>
<td>624,091</td>
<td>689,742</td>
<td>345,104</td>
<td>0.71</td>
<td>0.55</td>
</tr>
<tr>
<td>Urban Outliers</td>
<td>427,274</td>
<td>210,800</td>
<td>103,972</td>
<td>216,474</td>
<td>106,872</td>
<td>1.03</td>
<td>1.03</td>
</tr>
<tr>
<td>Rural Outliers</td>
<td>233,713</td>
<td>15,039</td>
<td>6,955</td>
<td>218,674</td>
<td>8,084</td>
<td>14.54</td>
<td>1.16</td>
</tr>
<tr>
<td>Peri-urban</td>
<td>241,854</td>
<td>8,551</td>
<td>0</td>
<td>233,303</td>
<td>8,551</td>
<td>27.28</td>
<td>N/A</td>
</tr>
</tbody>
</table>


3.5: Housing Delivery and Growth in Accra

Two different housing sectors can be identified in Accra. These are formal and informal housing. Whereas government and private estate developers engage in formal housing production, individuals do informal housing. In terms of cost, formal housing is more expensive and less accessible to most people than informal housing (Tipple & Korboe, 1998).

Many researchers have different opinions on the difference between informal and formal sectors. The formal sector according to Aryeetey-Attoh (1997) includes public and private sector enterprises that are officially recognized, nurtured, and regulated by the government. On the other hand, the urban informal sector consists of those individuals and enterprises, which operate outside the mainstream of government activity, regulation, and benefits (Aryeetey-Attoh, 1997). Yeboah (1998) argues that the two terms should be considered as being on the same continuum rather than on different scales. Antwi (2002), uses the term informal interchangeably with ‘customary’ or ‘traditional’ and refers to transactions outside the government system for which the necessary government demands
for formalization have not been met. According to Aryeetey-Attoh (2001), any development undertaken by private individuals, groups or parastatal organizations in any part of Accra without approval from the planning committee and the city council is unauthorized.

In Accra, the dominant form of housing is the informal housing (Tipple and Korboe, 1998). Houses in the informal sector are built in anticipation of services such as drainage systems, piped water and electricity (Yeboah, 2000). The popularity of the informal housing is as a result of absence of premiums on informal lands, which makes them less expensive, compared to formal lands (HABITAT, 1996).

Table 3 below shows the housing change and growth of Accra and its regions from 1984 to 2000. Residential development accounts for most of the buildings in Accra (Yeboah, 2000). Accra experience percentage increases in the number of housing ranging from 1.83 to 43.55 percent from 1984-2000.

**Table 3: Housing Change and Growth of Accra and its Regions**

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of Houses</th>
<th>Change</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#Localities</td>
<td>2000</td>
<td>1984</td>
</tr>
<tr>
<td>Accra Region</td>
<td>39</td>
<td>238,078</td>
<td>84,112</td>
</tr>
<tr>
<td>Accra Region</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accra Metro</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Outliers</td>
<td>5</td>
<td>170,086</td>
<td>80,969</td>
</tr>
<tr>
<td>Accra Metro</td>
<td>1</td>
<td>131,355</td>
<td>62,975</td>
</tr>
<tr>
<td>Urban Outliers</td>
<td>4</td>
<td>38,731</td>
<td>17,994</td>
</tr>
<tr>
<td>Rural Outliers</td>
<td>13</td>
<td>33,509</td>
<td>2,370</td>
</tr>
<tr>
<td>Per-urban</td>
<td>21</td>
<td>34,438</td>
<td>773</td>
</tr>
</tbody>
</table>

Source: Yeboah, 2003

The rural outliers recorded the greatest growth rate of 43.55 percent followed by the peri-urban localities with a growth rate of 13.14 percent. Before SAP most of the rural and
peri-urban localities had very low housing density of 2370 houses and 773 houses respectively.

The growth in housing as shown in table 3 represents modification to the environment. Culturally, spaces around houses are left green in North America have concrete put over them in Ghana. Housing development is occurring over green spaces and decreasing the natural storage capacity of the soil leading to increased runoff in those areas. In terms of the quality of the physical structure of buildings and the materials used, they could be described as high quality buildings (Yeboah, 2000), but environmental-wise, they are not and are prone to flooding (Aryeetey-Attoh, 2001; Abusa, 2004).

The World Bank defined housing as:

*environment, neighborhood, micro district or the physical structure that mankind uses for shelter, and the environment of that structure, including all necessary services, facilities, equipment and devices needed for the physical health and social well-being of the family and the individual* (Abusa, 2004).

In some cases the sprawl in the peri-urban areas enclosed existing rural settlements, for example, in Achimota Atto, Pokuasi, Oyarifa, and Agbogba. These places are characterized by the situation where the old rural towns have been enclosed by the newly built residential buildings. One can still find the old dilapidated rural buildings in these places alongside the new residential buildings (Larbi, 1996).

In places such as Pambros (in Accra) different types of buildings exist, from the very attractive to the less attractive as shown in Figure 4 below. The building in Figure 4 looks magnificent and the physical structure is made of high quality building materials including roofing tiles and concrete walls. In the picture however, erosion is threatening the foundation of the building. In the left bottom corner of the photograph, there is a piece of broken open drain. With time the foundation of this building would be eroded because of lack of good drainage.
Such is the drainage condition of many buildings in Accra particularly in the peri-urban areas. Generally, peri-urban buildings in Accra are spontaneous. They are built with the hope that government would, some day, extend infrastructural and sanitation services to them (Yeboah, 2000) and this makes them vulnerable to flooding (World Bank, 1994; Aryeetey-Attoh, 2001).

3.6: Conclusion

Tremendous urban growth in population and built-up area of Accra occurred between 1970 and 2000. The increase in population was due to natural increase and migration particularly rural urban migration fueled by SAP. Ghana’s SAP led to trade liberalization, foreign currency deregulation and significant increase in housing provision.

Housing development and ownership occurred among the rich and middle-income earners. Most of the buildings occurred in the peri-urban areas and on lands, which have been acquired informally. The buildings are high quality buildings but they are
spontaneous and unplanned. They also lack basic infrastructural services such as drainage and garbage facilities because the buildings were put up in anticipation of such services. In the absence of good spatial planning, drainage and garbage facilities, the buildings in Accra become liable to flooding and subsequently get flooded during heavy rainfalls. As discussed in Chapter Five it is impossible to pinpoint specifically how much flooding occurred from year to year, the extent of the drainage as well as the specific locations that flood each year. Yet the remarkable growth in urban area and its impervious surface cannot be separated from flooding in the city.
4.1: Introduction

Chapter Three focused on the physical growth of Accra and its impact on flooding. It shows that Accra grew rapidly in area, particularly between 1975 and 1999, on the average rate of about 18.4% per annum (see table on page 26, chapter 3). It shows that the sheer growth in the area covered by the city would increase the impervious layer with the corollary effect of increased runoff generation and flooding.

This chapter continues to discuss the factors responsible for flooding in Accra. It demonstrates that the growth of Accra out-paced the provision of sanitation and infrastructure services. In particular it considers at the management practices that influence seasonal flooding. Many management practices have been identified. These include permit issuance, drainage and garbage disposal (Acquaye, 1989; Larbi, 1996; Aryeetey-Attoh, 2001; Boadi, 2003). In this chapter, the influence of poor drainage, garbage, and permit issuance on flooding will be discussed. In order to show the effect of these factors on flooding, specific locations that I visited during the field study will be used as case studies to analyze and show further how urban management contributes to flooding in Accra. These case studies are Circle, and Pambros.

4.2: Land Delivery and Building Permit Issuance

With the exception of a few cases, most urban development projects that have been executed in Accra are divorced from land management. For example, urban land management was not included in the urban management under Ghana’s Economic Recovery Program. In all the three phases of the project (Urban I, Urban II, and Urban III), no land management was included (Larbi 1996).

The absence of land management in government urban development projects has impacted negatively on land delivery in Accra (Larbi, 1996; Aryeetey-Attoh, 1997, Grant & Yankson, 2003). One reason is that most of Accra lands are informal lands whose management lies with the traditional rulers. Only a few cases of government owned lands have management plans. Another reason is the absence of coordination between government land managers such as the Town and Country Planning Department (TCPD).
and the traditional landowners who sell lands (Aryeetey-Attoh, 1997). Also, lack of consistency in the layout of informal lands and state owned lands (Larbi, 1996). The inconsistency in layout is due to absence of consultation by TCPD with traditional landowners despite the fact that the latter controls most of Accra lands (Larbi, 1996).

The continuous disregard or exclusion of land management in the spatial planning of Accra over the years has led to unplanned spatial expansion and urban sprawl in Accra (Aryeetey-Attoh, 1997). Encroachment on open spaces and road reservations by the rich and people with connections is common (Larbi, 1996). This occurs through bribery and corruptive practices by the land managers who subvert the rules making it possible to build in Accra without planning permission (Larbi, 1996). As a result residential development occurs along drainage ways and in areas that are prone to flooding. Some of those residential areas include Alajo, Dzorwulu and Airport Residential Area (Larbi, 1996).

Corruption is also common among traditional landowners and traditional rulers (Africanews, 1999). It is possible for one piece of land to be sold by one traditional ruler to many unsuspecting buyers. As a result land litigation is common and this delays timely development of land (Ghanaweb, 2003). But the most serious problem of land delivery and permit issuance occurs due to poor management by state agencies. The state agencies lack the human and technical expertise and other resources to carry out their responsibility effectively.

During my field study, I asked the Record Officer of AMA, who works with the Permit and Record section, what records existed on permits. The Record Officer replied while pointing to a pile of dust-covered papers,

\[\text{Let me be frank with you. There are no comprehensive records on building permits. Perhaps with computers, I could bring some order to the confusion here. But my request for one for the past ten years fell on deaf ears (Personal Interview, July 22, 2003)}\]

The above response from the Record Officer indicates that their work has been impeded by lack of technical resources. Accra has a population of 2.5 million and rapid residential development is occurring (Yeboah, 2003) yet there is no efficient organization and management to control its spatial growth (Larbi, 1996).
The Record Officer recounted to me the importance of permit records during legal disputes over building and land ownership and how on numerous occasions his outfit was unable to provide contestants with credible and comprehensive records. The Record Officer told of situations where many legal owners of lands were dispossessed of their property because of lack of proper record keeping (Personal Interview, July 22, 2003).

AMA has a building inspection department whose duty is to enforce building regulations and ensure that only those who have licenses to build do so. During the field study, another AMA Officer of the Inspectorate Unit told me that his outfit had only 30 building inspectors and one vehicle to work with at that time. According to this Officer this situation makes it impossible for them to keep track of every on-going building project in Accra (Personal Interview, July 23). The result is that many development projects go on without inspections. Some building projects would start and finish before the next routine inspection of the area the building is located. Those who build without building permit write the inscription of “Stop Work produce permit” on their buildings to stave off any suspicion.

The stop-work sign is an inscription that building inspectors use to warn land developers of the unlawfulness of their project (Abusa, 2004).

If the stop-sign warning goes unheeded, the builders become liable to prosecution or their buildings can be demolished. Some illegal developers, however, have devised means of writing similar inscriptions on their buildings and later write a permission to continue work inscriptions including fake permit numbers that inspectors are unable to verify. By so doing, the illegal builders are able to continue building and they may never be caught. This is because verification of suspicious permit numbers may take a long time and effort to do due to poor record keeping.

Since multiple sale of land is common, people hastily erect structures on their plots of land before they seek permit because they fear their lands might be taken over by other possible legal owners of the land. In their haste, many building regulations are flouted resulting in buildings being erected on lands, without basic infrastructure services including good drainage facilities (Aryeetey-Attoh, 2001).

Closely linked to improper acquisition of land and lack of permit records is the issue of Land Guards (The Ghanaian, 2001). Land guards are illegal private security men.
who some land developers, and owners have hired to guard their lands against encroachers. It is believed that the problem of land guards has arisen because of improper record keeping by various government agencies that deal with lands. Most residents and landowners in Accra have lost confidence in land registration, the permit system and proper enforcement of building regulations. Even if the residents registered their lands and have building permits, they cannot trust AMA to support them in the event of land disputes. Hence, they resort to the use of land guards.

The Ghanaian Chronicle of May 18, 2001, reports of falsification and alteration of land documents at the Land Commission to deprive rightful owners of their lands. Such lands were then appropriated to land guards to sell. The Ghanaian Chronicle reported further that a church, Living Testimonies for Jesus Bible Ministry, lost a piece of land it acquired in 1995 because individual employees of the Land Commission falsified documents belonging to the church and gave the land to the land guards for sale. Sometimes people are maimed and killed due to the ruthlessness with which land guards protect the land they are paid to guard (Africanews, 1999).

The chaotic situation arising from improper documentation and development of land has benefited the powerful and the rich in Accra including traditional rulers who have made large amounts of money by engaging in multiple land sales (Ghanaweb, 2003). But multiple sale of land is possible because of lack of records that list all lands in Accra, their owners and the purchasers (Daily Graphic, 2004).

Also, multiple sale of land and the complicity of landowners in it arise because land transactions are organized informally and outside the official economy so none of the formal institutions keep records of them (Antwi, 2002). By law, any land that is acquired informally or traditionally has to be registered with government land agencies to make them legal (Larbi, 1996; Tipple and Korboe, 1998). However, this rule is seldom adhered to due to long delays and corruption of land agencies (Larbi, 1996). This, however, does not exonerate the traditional landowners. They are part of the problem particularly where multiple sales of the same plot of land occur.

According to Acquaye (1989), the land tenure system is evolving towards individual ownership and it is resulting in land fragmentation. This situation has led to increased land disputes between stools and among family members (Acquaye, 1989).
With regards to chiefs, the installation of more than one chief in a village, for example, has contributed to land litigation as the chiefs compete for the sale of lands resulting in the multiple sale of the same piece of land (Africanews, 1999). It appears from this, therefore, that the traditional land tenure system has contributed to the problem of haphazard residential development in Accra.

Antwi (2002), however, disputes this view. In the view of Antwi (2002), it is wrong to attribute the spatial problems of urbanization to the overriding traditional land tenure system in Accra. Antwi (2002), however, agrees that ownership among indigenous population was less organized because of lack of a proper framework within which land can be delivered. But the issue of greed and corruption among traditional landowners in Accra cannot be whittled away. The issue of multiple sale of the same plot of land is not something that can be entirely blamed on lack of framework. The traditional rulers, therefore, stand to blame for the uncoordinated residential development and urban sprawl leading to flooding in Accra.

The conclusion that can be drawn from the problem of land delivery and building permits is this: they have contributed to the haphazard development that is taking place in Accra. Firstly, lack of confidence and unnecessary delays by government institutions responsible for land registration has discouraged builders to register their lands properly. Secondly, poor organization of the traditional tenurial system has contributed to the problem particularly when traditional rulers engage in multiple sales of land and the undue litigations that follow such actions. Thirdly, lack of coordination among traditional rulers who sell land and government agencies who register lands has worsened the situation. This culminates in the situation where people build everywhere including flood plains and government protected lands. Since these lands do not have infrastructure services such as good drainage and garbage disposal facilities they become liable to flooding.

4.3 Engineering and Human Problems of Flooding in Accra

Accra’s drainage, garbage collection and disposal problems have been identified as contributors to flooding because they are either non-existent or are in poor conditions (World Bank, 1996). According to Ayitey-Attoh (2001), increased urbanization in Accra
and the inability of city authorities to match planning with it resulted in about 1.7 million people living in areas with minimal infrastructure. World Bank (1996) report on Accra also notes that lack of routine maintenance had halted the functioning of the drainage system leading to severe flooding conditions during the rainy season. Kwame Nkrumah Circle (popularly called Circle) and Pambros (see Figure 5) are examples of two settlements that frequently experience flooding in Accra. Each of these settlements constitutes a case study under which engineering and human causes of flooding are further discussed.

**Figure 5: Sketch Map of Accra showing Pambros and Circle**

Source: Afeku (2005)

### 4.3.1: Case Study 1:

**Engineering and Human Problems that contribute to Flooding at Circle**

During the field study I observed and measured the drainage conditions at Circle. In assessing the drainage condition of Circle, I used the alternative methods of drainage assessment developed by Kolsky and Butler (2002). These are performance indicators and process indicators. Performance indicators of drains include solid levels, inlet
blockage and built capacity. Process indicators include frequency of street cleaning, staff time committed to operation and budget. I used both methods in assessing the drainage situation in Circle. Obtaining performance indicators involved measurement of the width, the depth and the percentage blockage of drains. Table 4 shows drain width, depth and percentage blockage of four drains at Circle.

The conclusion that can be drawn from table 4 is that Circle drains are not performing at full capacity because they are blocked at various levels ranging from 20% to 50%. The GBC drain, which is the most blocked, has a width of 90 cm and depth of 80 cm and a percentage blockage of 50 percent. What this means is that the GBC drain can perform at 50 percent less its capacity due to the accumulation of silt and garbage. The least blocked drain is the Nima-Circle drain, which has a width of 400cm and a depth of 350cm and can perform at 20 percent less its capacity.

It was noticed that there were six small sub drains, which were no longer in use and have not been replaced. The blockage of drains occurs because of dumping of garbage into the drains. According to Boadi (2003) people dump garbage into drains due to ignorance. During the field study, drainage construction works were underway to remedy the situation at Circle.

I learnt from a Hydraulic Engineer who works with the Hydrological Services Department about other factors that have accounted for floods at Circle. Some of those accounts show negligence on the part of authorities as well as ignorance on the part of drainage contractors. The Engineer told me that flooding occurs at Circle, for example, when the Nima-Circle drain overflows its banks and inundates nearby houses.

<table>
<thead>
<tr>
<th>Drain Name</th>
<th>Width</th>
<th>Depth</th>
<th>% Blockage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overhead P&amp;T</td>
<td>190cm</td>
<td>160cm</td>
<td>25%</td>
</tr>
<tr>
<td>Nima-Circle</td>
<td>400cm</td>
<td>35cm</td>
<td>20%</td>
</tr>
<tr>
<td>Behind GBC</td>
<td>90cm</td>
<td>80cm</td>
<td>+50%</td>
</tr>
</tbody>
</table>
Figure 6 below depicts the aftermath of flooding at Christian Methodist Secondary School which is located near the Circle Nima drain (not visible in the photograph). The grill of the gate is strapped with garbage and polybags. There is also a pile of garbage and polybags in between the two halves of the gate. Visible in front of the gate are broken slabs from the cemented floor and a pool of water in front of the gate.

Part of the Circle channel, about 300cm, is underground and consists of two channels one of which was visibly blocked with garbage during my field study. According to the Hydraulic Engineer one of the underground channels had been malfunctioning due to blockage with silt and garbage. He explained that this situation reduces the channels discharge ability, which causes backwater effect during heavy downpours leading to flooding in Circle.

He told of a sand filter on each of the underground channels, which were destroyed during the Odaw Channel rehabilitation works on a nearby drain- Odaw Channel some years ago. Sand filters in a storm drain function to reduce the load of water passing through the channel by filtering sand. When the sand is filtered, the discharge capacity of the storm drain would increase and prevent backwater effect. In the view of the Engineer, the absence of these filters in the channels is the main cause of flooding in Circle and Asylum Down.

**Figure 6: Aftermath of Flooding at Christian Methodist Secondary School**

Source: Afeku (2003)
Another engineering problem that occurs on the Nima-Circle channel is its near 90 degrees entry into Odaw Channel. For any subchannel to discharge sufficiently into a main channel, the angle at which it discharges has to be less than 90 degrees. The less the angle, the better the discharge capacity. Thus the near 90 degrees of confluence of Nima-Circle channel on Odaw Channel is an anomaly that contributes to flooding.

4.3.2 Case Study 2:

Engineering and Human Problems that contribute to Flooding at Pambros

There are many residential places in Accra that do not have storm drains and garbage facilities. Even where there are drains they are used as garbage repositories. In this case study I used photographs to explain garbage and drainage problems at Pambros in order to show how they contribute to flooding. Figure 7 below shows a road, which is being used as garbage dump at Pambros. Look at garbage having been dumped all over on the road by residents. One wonders whether the untarred road is constructed to serve as both vehicular and garbage use. Certainly not! There is a bill posted on the electric pole at the top left corner prohibiting dumping of garbage but this does not deter the residents. It is highly possible that during heavy rainfall the garbage on the road will be carried with runoff to block drains leading to flooding. An Unclean road as depicted in the photograph below is an example of a process indicator (Kolsky and Butler, 2002). According to Kolsky and Butler (2002) such conditions negatively affect the performance of drainage systems.

**Figure 7: Road as Garbage Dump in Pambros**

Source: Afeku (2003)
Figure 8: A Stagnant Open-Drain at Pambros

Figure 8 is an example of an open drain in Pambros that is not flowing because it is laden with garbage and silt. It is constructed next to a beautiful and high quality house (not visible) with a white wall. Garbage is strewn over the left bank of the drain. This is what the Hydraulic Engineer at the Hydrological Services Department said about drainage at Pambros:

*Pambros does not lend itself to drainage solutions. The place is like a flat bottom of a big bowl. It’s something like a depression and any attempt to construct drains would not only be ineffective to deal with the problem but would cause another environmental hazard because the drains would be filled perpetually with stagnant water and become death traps (Personal Interview, July 23).*

What the statement above means for the drains in Pambros is that even when they are clean of garbage and silt they will still not be able to flow because of the topography of Pambros.

Apart from the engineering limitations of Pambros for residential development it is also a wetland and not supposed to be settled. Department of Game and Wild Life Billboards that designate Pambros as a wetland exist on the site today. The instruction on the billboards requires the public to protect wetlands (Figure 9). The billboard shows that
Pambros is River Densu Delta. River deltas are flood prone areas that should not be settled. The billboard also shows the benefits of wetlands such as the provision of salt, fish and site for farming.

Despite these benefits and the warning, there were ongoing building projects when I visited, which indicated that the warning has not been heeded. According to the information I gathered from NADMO, during heavy rainfall they send their staff to Pambros to stand by. NADMO uses boats and canoes to rescue people from their homes during heavy rainfalls when their houses are flooded. This shows how serious flooding in Pambros can be.

**Figure 9: Encroached Wetland in Pambros**

Figure 10 shows continuing residential building at Pambros. There are no drains in this photograph. There is an ongoing building project, which is just above the foundation with black and white polybags scattered all over it. This is an indication that there are no garbage disposal facilities. To the front left of this photograph there is a pile of concrete blocks, which will probably be used for the ongoing building project. In the
distance and beyond the green pocket of bush and ponds of water (not visible) are some completed buildings but they are not high quality buildings. In the absence of good drainage and garbage facilities, those building will likely be inundated with floodwater when it rains heavily.

**Figure 10: Continuing Residential Building in Pambros**

Thus, beside the contribution of garbage and lack of good drains, settlement on flood plains makes residents of Pambros liable to flood hazards.

**4.4: Conclusion**

A major finding from this chapter is that land delivery and building permit issuance in Accra are deficient in many respects. As a result, many settlements develop without the necessary infrastructure such as storm drains that can reduce the incidence of flooding. In places where drains are provided, residents rather dump garbage in these drains, which clog and stop the flow of water. In some settlements, it has been noticed that there are no drainage and garbage disposal facilities. Large pools of water collect in peoples house due to lack of outlets for storm water to flow. Engineering problems resulting from
poorly constructed drains and sometimes-faulty ones have also contributed to the flooding of Accra.
CHAPTER FIVE
CONCLUSION

5.1: Introduction

The original intention of this thesis was to examine the nature of flooding in Accra. It sought to answer three specific questions that relate to flooding in Accra. These were:

1) What areas in Accra have flooded in the last ten years?
2) For the areas that flooded what rainfall attributes (quantity, duration and intensity) were associated with these floods?
3) What factors contributed to flooding?

5.1.1: What Areas Flood in Accra

The aim was to identify areas that flood in Accra through the following:

1) Generate polygons for areas, which flood in Accra using GPS unit to record the coordinates of these polygons.
2) Use a DEM to determine the slope, aspect and elevation of areas which flood regularly.
3) Measure the depth, width and percentage blockage of drains in these flood areas.
4) Find out whether newly developing residential areas in these areas have building permits.
5) Find out whether more permits have been issued to people to build in old residential and commercial areas in the last 10 years.

Upon arriving in Accra in the summer of 2003, however, I obtained from NADMO a catalogue of names of broad communities that flood. There were no boundary maps associated with these communities so it was impossible to locate places that flood in order to obtain the coordinates I intended to generate with my GPS. I also did not have data on those communities on yearly basis. I also was unable to obtain the information on building permits records because AMA Record Department does not properly keep their permit records.
5.1.2: Rainfall Attributes

I sought to answer the following specific questions: what rainfall quantity, duration and intensity are associated with flood locations in Accra during each occurrence of floods? This would help to identify the pattern of flooding. The rainfall attributes would also be used to generate maps for locations, which flood. And the maps could be used to forewarn communities that flood to plan for flood disasters. They also could be used to alert prospective land and property owners of the level of flood risks.

However, my effort to collect rainfall data failed when I visited the field. This is because Ghana Meteorological Agency (GMA) does not have credible and reliable rainfall data. Examples include July 3, 1995 and June 27, 2000 flood. Unbelievable gaps exist in their data preventing me to use them for the intended purpose. Even more troubling was that rainfall data was not tied to specific flooding events. The Officer whom I contacted during my field study attributed the non-availability of reliable data to faulty equipment and breakdowns at many of their synoptic stations. The service has one synoptic station at the Kotoka International Airport but even that facility is plagued with similar problems despite the fact that its operation is crucial to the aviation industry since it provides weather information to guide the flight paths of aircrafts.

Having been unsuccessful in obtaining the data, which is crucial to my research, I then redirected my research interest to looking at the relationship between urbanization and flooding in Accra.

5.2: Findings of the Thesis

Huge spatial expansion in the built up area and population occurred in Accra particularly during the implementation of the Ghana Structural Adjustment Program. The growth occurred mostly in the peri-urban Accra, which Yeboah (2003) describes as Quality Residential Sprawl with Unicentric Tendencies. This particular residential development is haphazard and spontaneous and not accompanied by land management (Larbi, 1996).

It is believed that spatial planning of the government during this period was weak (Grant and Yankson, 2003). The building in the peri-urban Accra occurs on lands, which have been acquired informally whereas the building development takes place in the
absence of infrastructure such as drainage, water and electricity and garbage collection facilities. The owners of the building hope that government would some day extend those services to them. As a consequence, the environments of these buildings are very poor and are vulnerable to disasters such as flooding (Aryeetey-Attoh, 2001).

There is no proper record keeping of residential development in Accra. Building projects take place in the absence of planning permits. As a result of unnecessary delays and corruption by individual state officials who administer Accra lands, those who acquire their lands informally are discouraged to register their lands and obtain building permits. Lack of resources to monitor development activities in Accra has also contributed to the problem of unplanned residential development. I have seen in the AMA Record Department high stack of unorganized documents supposed to be building permit, which have been issued to residential developers in Accra over the years. Even though we are in the computer age, the Record Department does not have a single computer with which to organize their data.

The lack of good record keeping has contributed to the lack of planning and monitoring which has characterized the landscape of Accra. The continuous residential development with no planning permission or awareness of monitoring authorities has led to settlement developing in flood prone areas and areas with limited or no infrastructure such as drainage systems, roads and garbage disposal facilities.

5.3: What the Government of Ghana is Doing to Curb Accra Floods

The Government of Ghana through the Hydrological Services Department and AMA uses two main approaches to reduce the impact of flooding on the residents of Accra. One approach is the dredging and desilting of drains. The second approach is rebuilding of the drains to increase their sizes and to fortify them to accommodate large stormwaters (Ghanaweb, 2005). For example, under the ongoing Accra Drainage Improvement work, 24 secondary drains of approximately 60 km stretch were designed with a 15-year flood flow. Currently 7 km drain of the Odaw Channel stretching from the Motorway to Abosey Okai Bridge, near Kaneshie in Accra is being desilted and reconstructed. Contractors of these projects are using reinforced concrete rectangles and
the trapezoidal channels in order to reduce resettlement, acquisition of land, and partial demolition of permanent structures (Spacefm, 2005).

Thus the government of Ghana is making some efforts to reduce Accra floods. Despite the government’s solution, my research shows that there are engineering issues, record keeping and data generation issues, physical planning issues, and garbage collection issues. Since government is only tackling Engineering issues the rest will still lead to flooding unless addressed.

5.4: Institutional Capacity: Good Record Keeping and Data Generation Issues

In order to deal with the impact of flooding Andjelkovic (2001) suggested the use of accurate pre- and posturbanization data. The need to control the spatial expansion of Accra can only be achieved if there is accurate record of all development activities in the city. Since residential development is what is mostly responsible for the expansion in Accra (Yeboah, 2000), accurate record of building developments in the city must be kept, particularly building permits. This is because it is important for effective monitoring. If we do not know the rate at which the city is growing and where this growth is occurring then how can we provide the right number of drains and the sizes of those drains? Since the size of the impervious layer determines the runoff rate, it should be considered when the drains are being designed.

However, record keeping in the state institutions in Accra leaves much to be desired. For example, there are no accurate records of building permits issued to builders in Accra. Although Accra has expanded so much the AMA Record Department does not keep accurate record of the building permits it has issues for building projects in Accra. In the absence of this important information, how can AMA plan and budget very well? How can AMA control Accra’s growth and prevent building without permits if accurate records are not kept? And how can people be prevented from building along drainage systems and areas that are prone to flooding when AMA does not take record keeping seriously? How can the AMA properly account for the revenue it generates from building permits when it does not know how many permits it issues? Does this not leave loopholes for corruption at AMA and for stealing of its revenue? So apart from ensuring that proper
Building permits are issued to prevent unauthorized buildings and flooding in Accra, AMA stands to improve its revenue generation by engaging in good record keeping.

Another department where good record keeping and data generation is hampered is the GMA. The inaccuracies in their data generation particularly rainfall data does not augur well for flood analysis. Rainfall attributes in terms of quantity, intensity and duration can be used together with runoff data and topographic data, particularly a DEM, to map out areas that flood in Accra. Therefore the accuracy with which they are collected cannot be overstressed. And the GMA must be resourced to provide this data in the most accurate form as possible.

My observation of GMA shows that it is under resourced. For example, there were only a few computers in their offices. However it is an important institution that needs to be adequately funded so that it can perform its duties without any hindrance. It is therefore welcome news that the agency last week was both granted permission and provided with equipment by the European Union to directly download information from its Meteosat Second Generation (MSG) satellite which would be used to provide better and timely information in the field of water development and management, food security, flood damage assessment and agriculture (Ghanaweb, 2005).

It is also welcome news that beginning from next academic year, University of Ghana would establish a new Department to run programs in Meteorology. According to Mr. Franklin P. Mote, Director-General of GMA, these new developments would help to solve some of their problems and enable the Agency to improve and expand its services to meet challenges such as flood planning (Ghanaweb, 2005). It is hoped that this new department would be well resourced so it would, besides training of experts for GMA, would team up with GMA to do, for example, data compilation and analysis in order to speed up GMA’s work.

Finally, when all the aspects of the data on flooding are generated, all the institutions that deal with flooding must be coordinated. NADMO as the first responder to flood disasters must be given the responsibility of delineating all the areas that flood using for example GPS units. Fortunately, the price of this technology has come down and should be affordable by NADMO.
With the data on all aspect of flooding acquired, the Geological Services Department can use its expertise in map-making to generate maps for all the areas which flood in Accra on a yearly basis. The Geological Services Department must also produce good Digital Elevation Models because its usefulness in flood analysis.

5.5: Human: Garbage Disposal and Collection Issues

The Waste Management Department lacks the expertise to carry out its responsibilities (Boadi, 2003). Even though it has privatized part of its services, approximately 40% of the waste generated in Accra is not collected and disposed (Boadi, 2003). In providing for this very important department government should put a certain percentage of tax on fuel purposely for the collection of waste in the country as a whole. It would seem unfair for people living in rural Ghana to be made to pay tax for the collection of waste in the cities. But waste collection is very important and the implications of uncollected waste can lead to outbreak of diseases that can spread to the rural areas as well.

Poor management in the Waste Management Department must be tackled seriously. Retraining of staff of this department to carry out their responsibilities well is paramount for the success of the service. The residents of Accra need to be educated on the need to keep the city clean. The practice where people dump garbage or human excreta in drains must stop. But for this to take place the residents of Accra need to be educated that water drains are made for the purpose of carrying excess water away and not for toilet or garbage disposal. Garbage disposal facilities must be placed at vantage points for residents to dispose their waste without having to walk unbearably long distances to the nearest garbage disposal facility.

The lack of toilet facilities in many houses is what is causing some residents to use the drains as the dumping grounds for human excreta. If there are spaces in the houses, that have already been built, owners of such houses must be given loans to erect toilet facilities in their houses. For houses where there are no spaces for such developments should have the option of visiting community toilet facilities. The government of Ghana must provide more community toilets in areas where individual provision of such a facility is impossible because of lack of space.
5.6: Good Physical Planning

The unplanned growth of Accra is attributed to the neglect of land management and weak spatial planning when government of Ghana was implementing various economic development projects. Prior to 1983 land use planning and development control were non-existent in the cities of Ghana, especially Accra (Larbi, 1996). During the colonial period land-use planning was concentrated only in newly developing areas occupied by Europeans and on state lands to the neglect of customary lands although the latter is the dominant type of land in Accra (Acquaye, 1989; Larbi, 1996) After independence, planning and development of Accra continued in the colonial pattern (Larbi, 1996).

When the government of Ghana started implementing SAP in 1983, land use planning was seriously tackled but land management has not received enough attention (Larbi, 1996; Grant and Yankson, 2003). However, the management of land is fundamental to the improvement in the quality of an urban environment (Larbi, Aryeetey-Attoh, 2001) and has a lasting deleterious effects on the environment if it is poorly managed (Larbi, 1996; Aryeetey-Attoh, 2001). Both formal and informal land ownership systems exist in Accra but the latter has not been made part of spatial planning although it is the dominant form of land ownership (Larbi, 1996). The exclusion of the informal lands from spatial planning accounts for the haphazard development in Accra.

Since haphazard development contributes to flooding in Accra it is being suggested that Accra as a region takes spatial planning and land management seriously. The planners should evolve a planning framework that takes account of both types of lands and not exclude the informal land, as has been the practice. In preparing this planning framework the planners should ensure active participation of informal landowners. The coordination of activities between the landowners and the state agencies that administer lands should be an integral part of this planning framework. This will ensure that all respect the outcomes of any future plans for Accra. When these suggestions are implemented we can avoid uncoordinated development of Accra and its accompanied environmental disasters including flooding.
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