# The Challenge of urban flood control: The case of Accra's Korle Lagoon

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**Abstract**
In urban Sub-Saharan Africa there are three main problems related to water, namely drinking water supply, wastewater handling, and seasonal flooding. Mega Accra has a functional population of 2.7 million inhabitants with about 60 percent of the Metropolitan dwellers living in informal settlements or slums in the centre of the city while the middle and upper class move to its periphery. Like in all cities in the subregion, Ghana is experiencing a high level of pollution in its water bodies particularly where they are located near human settlements, industrial (including mining) estates and agricultural undertakings. About 60% of the Metropolis lives in the catchment of the Odaw River and Korle Lagoon and contribute to the environmental problems which result in flood situations. This is a major challenge to city authorities in instituting flood control measures. The aim of the study is to develop a planning framework to address the complex nexus between flood control and sanitation, which should include all key stakeholders and a multi-disciplinary approach based on a careful stakeholder analysis. Several key questions relating to pollution, hydrology, sociology and the local economy of the inhabitants of the Odaw River- Korle Lagoon catchment are addressed.

**Keywords**
Flood control, urban water quality, urban drainage, waste management, sanitation, urban agriculture

## INTRODUCTION

In urban Sub-Saharan Africa there are three main problems related to water, namely drinking water supply, wastewater handling, and seasonal flooding. In our context we will focus on the linkages between flood control and sanitation on the example of Accra, the administrative, political and commercial capital of Ghana located at the coast of the Gulf of Guinea.

Accra's population growth rate is about 3.4 % annually, which is constrained by the outdated boundary of the city. The actual population growth takes place behind this boundary where the Ga and Tema districts grew between 1984 and 2000 at a rate of 6.4 and 9.2%, respectively. Including both districts, we get the functional boundary of (Mega) Accra, as the urban dwellers perceive it, with 2.7 million inhabitants (Twum-Baah, 2002).

Accra covers an area of 229 $km^2$ . About 60 percent of the Metropolitan dwellers live in informal settlements or slums in the centre of the city while the middle and upper class moves to its periphery. The Accra Metropolitan Assembly (AMA) is struggling to provide basic services to its growing population and at the same time to create and maintain a healthy urban environment. It is facing a number of challenges, especially in its central slum areas:

- increasing coverage of safe water supply and sanitation facilities

- improve collection, transport and treatment of wastewater and solid waste and finding suitable ways for its disposal or reuse
- appropriate drainage of storm water

Like in all cities in the subregion, Ghana is experiencing a high level of pollution in its water bodies particularly where they are located near human settlements, industrial (including mining) estates and agricultural undertakings (MWH, 1998). Rivers flowing through cities, towns and villages serve not only as sources of water supply for the inhabitants but also as open sewers. The official sewer systems, even in the capital Accra, cover seldom more than 5% of the households. The aim of the PhD study is to develop a planning framework to address the complex nexus between flood control and sanitation.

## MATERIAL & METHODS

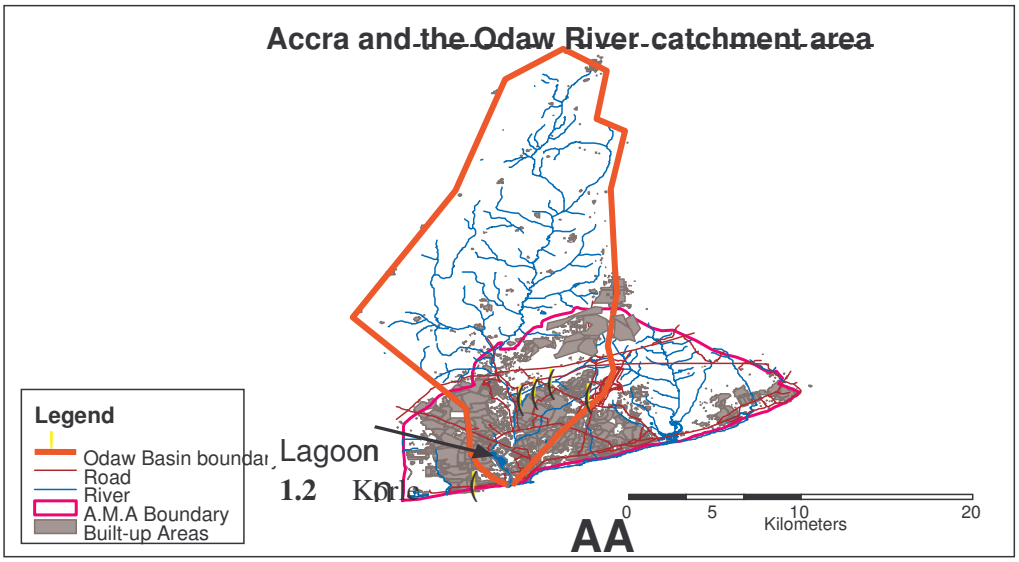
The study will involve all key stakeholders in a multi-disciplinary approach based on a careful stakeholder analysis. It will explore existing planning constraints and look for opportunities in terms of options for platform building, Learning Alliances and capacity building at different levels.

## RESULTS AND DISCUSSION

As the project did not start yet, only a first overview on the problem is provided:

### Stormwater management

Accra experiences a bimodal rainfall regime, which occurs from March to July (major rainy season) and from September to November (minor rainy season). Average annual rainfall is about 810mm. Rainfall is usually intensive with short storms, giving rise to annual local flooding where drainage channels are missing or obstructed.




1.1 ACCRA

Figure 1 Map of Accra showing the Odaw catchment and the Korle Lagoon

Some of Accra's slum areas are the most affected. Of special focus in this study is the Odaw River which flows into the ocean through the Korle Lagoon, one of the "world's dirtiest places" (IDRC, 1996) (Figure 1). The Lagoon is the principal outlet to the sea for the city of Accra, and about 60% of the Metropolis lives in the catchment of the Odaw stream and Korle Lagoon. Prior to the explosion of the city's population and the onset of the severe pollution of the Korle Lagoon in Accra, i.e. in the early 1950s, the lagoon supported a thriving fishery of both fin and shellfish, which served as a source of income for people in the nearby shantytowns. The fisheries have now been lost (Biney and Amuzu, 1995). The lagoon receives water from a total catchment area of 400km$^2$. It receives discharges from three main sources– the Odaw River and two major drains in its western and eastern sections. As these drains are open, they collect all kinds of debris and silt into the lagoon (Mensah, 1976). It has been estimated that a biochemical demand (BOD) load of 10,500 kg day$^{-1}$ is generated within the slums and shantytowns near the Korle Lagoon, with appreciable quantities of this reaching the Lagoon due to the inadequacy of waste disposal sites (Biney and Amuzu, 1995). This, however, is probably only a small part of the inflow through the Odaw. It is therefore important that measures are put in place to manage stormwater and wastewater influx so as to minimize the amount of pollutants entering important water bodies like the Odaw River and the Korle Lagoon. Presently, there is not any comprehensive plan by the city regarding stormwater management via streams and constructed drains in view of their dependency on an appropriate waste management. This obviously must change if urban water would be managed and the resources harnessed to ensure healthy living of city dwellers especially within the Odaw-Korle catchment.

**Drainage in Accra**

Drainage in Accra usually consists of natural drains and a few major stormwater drains. There is also a network of small drains known as gutters to serve a dual purpose as storm water drain and as well convey domestic effluent. In the case of the Korle lagoon, its auxiliary function as a central drainage system emptying its content into the sea, has resulted in it becoming shallow over time due to excess siltation and waste finding their way into the water body with runoff (Biney, 1982). As the Lagoon is heavily silted, the outlet is often blocked, and the water fails to flow into the sea fast enough to avoid becoming stagnant. This leads to periods of flood when it rains (Boadi and Kuitunene, 2002). Due to Accra's limited sanitation infrastructure, the lagoon receives a huge amount of wastewater as well as solid waste through the Odaw River (Boadi and Kuitunen, 2002). Figure 2 shows Agbogbloshie drain entering the Korle Lagoon with all kinds of debris.

Fig. 2: Korle Lagoon (right) and the Agbogbloshie drain (below)

**The social dimension**

A particular problem with high socio-political significance is Accra's major slum known as Old Fadama or Sodom & Gomorrah. The slum is located directly at the Korle Lagoon, near the suburb of Agbogbloshie. Old Fadama occupies about 31 ha with a squatter community of estimated 30,000 people. In view of the precarious situation of the highly polluted Lagoon, the slum is believed to constitute its primary source of pollution, especially since the landfill opposite to Old Fadama was closed down and rehabilitated. However, alternative assessments say that only a few percent of the total pollution load entering the lagoon comes from the slum area (COHRE, 2004). Still, the waste flows coming out of the slum through the Agbogbloshie drain and Odaw River are uncontrolled and ultimately end in the Korle lagoon.

The sanitary situation within the slum at Korle Lagoon is disastrous. In general, any larger storm water gutters are lacking, and smaller ones around individual houses/shelter are not connected, or blocked by solid waste and stagnant rain and wastewater poses serious health risks. In most other parts of Accra, much emphasis is put on a network of gutters which function as open sewers-cum-storm water drains discharging their load into the ocean or natural waterways, like the Odaw River. As the Korle Lagoon also functions as a buffer against flooding, there are a number of self-constructed and locally managed communal toilets but people also defecate free-range along the Lagoon. As there is no safe dumping site for content of buckets and pans, dumping into the Korle Lagoon is likely. There is a local waste dump close to the river, managed by the community without public support. Small-scale entrepreneurs provide independent sanitation services (public bath houses, sachet water supply, waste transport) and obtain a livelihood out of providing these services, but are possibly also polluting the lagoon. The community shows commitment and is self-organizing cleaning campaigns, supported by the NGO "Peoples Dialogue" and local Federations.

Three limitations in the drainage system in Accra are - institutional limitation, infrastructural/financial limitation, and behaviour of the citizens. The lack of adequate institutions with the capacity to plan and ensure proper management of stormwater and drainage is implicated in the current environmental challenges which confront the city today. The insufficiency of stormwater drains in the city, or under capacity drains have not helped in addressing challenges of seasonal flooding in the city during rainy seasons. The additional inability of the Waste Management Departments to collect all solid waste generated in the city leads to illegal dumping, preferably into streams and drains. People normally clean just their immediate environment but remain careless about what happens in the river or lagoon next to them. With this mentality, individuals within the city, and especially in the low income areas have the general propensity of dumping refuse and other waste into the river or the lagoon as occurs along the whole Odaw River, not only near Old Fadama. The impact of urban sanitation for a successful storm water management can thus not be over-emphasized.

**Addressing the challenges of drainage and stormwater management**

*The need for inter-sectoral approaches*

So far, sectoral approaches were not able to achieve any breakthrough in addressing the challenges of urban flood control. An example of such an approach is the Korle Lagoon Environmental Restoration Project (KLERP), which started in the year 2000. This Project is

the largest of its kind addressing Accra's natural resources problems. It was carried out in two phases so far. The objective of the project is to restore the Korle Lagoon, as far as possible, to its former state in which marine life was abundant and offered substantial improvements to the drainage systems in Accra by way of ensuring efficient floodwater conveyance to the sea. The project, however, focused on the lagoon itself and a related sewage system but was not extended to the incoming waste load via the Odaw River from the heart of Accra. Facing its inability to succeed, the KLERP asked for the removal of the Old Fadama community as most "obvious" obstacle. This echoes Accra's efforts to restore the Lagoon as a wetland. Since May 2002, the residents are under the official threat of eviction.

The KLERP included sanitation control measures, the construction of a sewage treatment plant with a total capacity of 1300 $m^3day^{-1}$. As well as 3100 m network of drains for the diversion of the dry weather flows, as well as the construction of a new sea outfall pipe from the treatment plant of 1.5 km in length (Boadi and Kuitunen, 2002).

A larger, intersectoral approach to the KLERP would have indicated that it is not enough trying to restore a disturbed natural ecosystem **at the end of the pipe** without any measure to deal with the challenge at the upstream and midstream sections of the Odaw River, the main river draining into the Korle Lagoon. In addition, the discussion about the neighboring slum showed clearly that drainage is not only a technical issue but requires a sensitive approach and **social impact assessments** to analyze feasible options for the people concerned.

The institutions indicated in Figure 2 below must necessarily all be involved in such an important project of addressing challenges of stormwater management and drainage systems in Accra to ensure improved life of the city dwellers. For instance the linkages shown on figure 2 indicate that the Ministry of Environment, Science and Technology works together with the Ministry of Works and Housing in addressing the drainage and stormwater management issues in Accra whereas the Environmental Protection Agency offers the main support in terms of SEA technical advise and enforcement of regulations.

In the process of intersectoral management of stormwater and drainage one aspect that emerges is integrated (urban) water resources management (IWRM) where water bodies, wetlands and streams within an urban context are crucial for various (sometimes competing) uses, while at the same time they are the receivers of many different waste flows, creating externalities between uses and users, calls for management at the lowest appropriate level and taking a catchment approach to capture the hydrological dependencies. In an urban context, the type of intervention envisaged influences the choice of the unit of work. Neighbourhoods are for example the typical unit at which to organise sanitation or solid waste services. A hydrological catchment would be most relevant for applying pollution control and monitoring measures. Integrated Water Resources Management in an urban context will need to straddle both catchment and administrative or social boundaries and will need specific adaptations to the urban planning context.

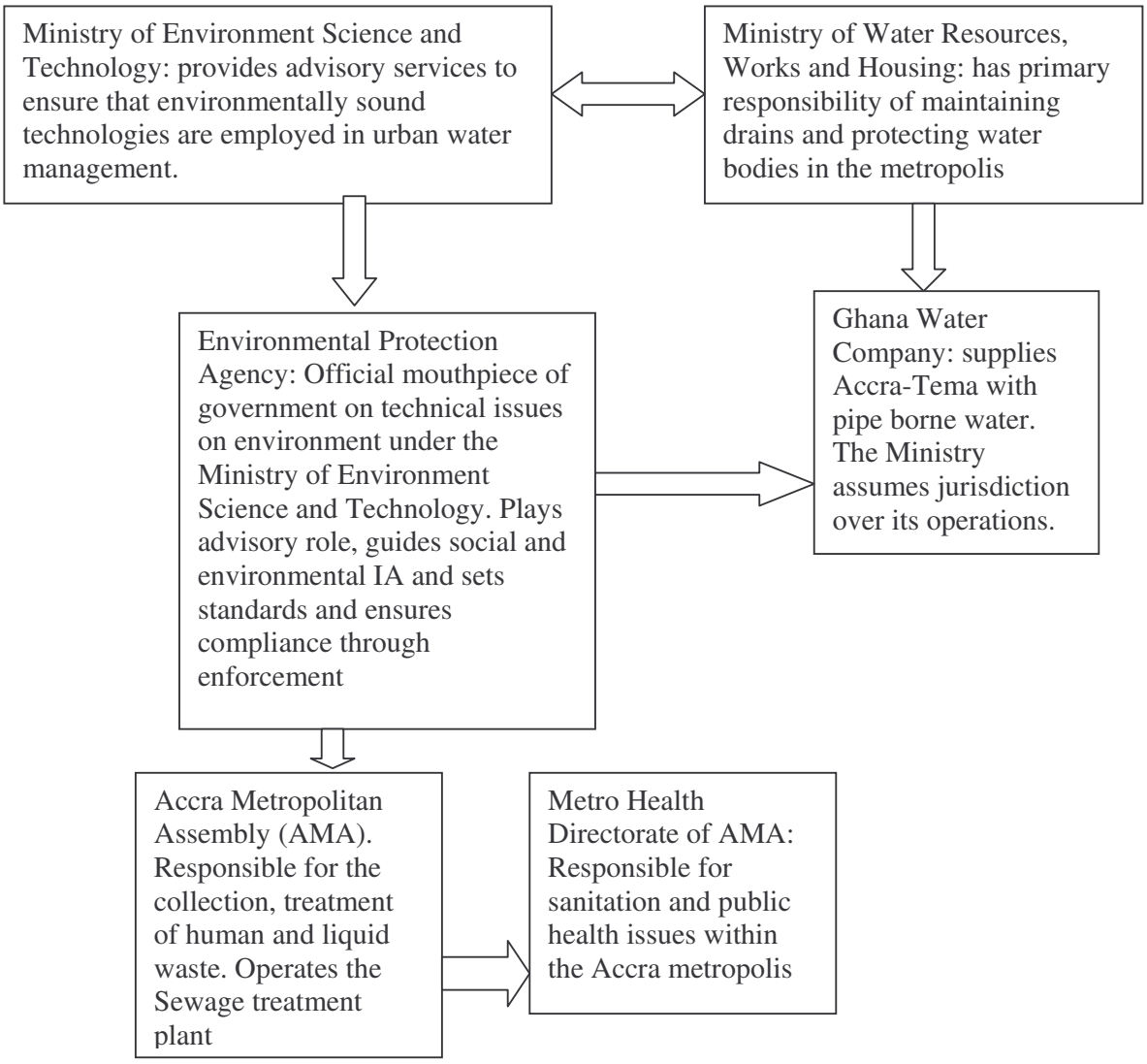



Figure 2: Key stakeholders in urban water management

*Urban agriculture, sanitation and flood control*

The Odaw/ korle catchment used to support fishing and vegetable cultivation along its border. However following the formation of the slum and the subsequent restoration project, farmers were compelled to abandon the catchment since conditions, including access to land and (safe) water were no more favourably. Inspection of urban agriculture sites within the city indicate that such sites are generally clean because farmers would not allow any one to dump refuse at such sites. These farms are located mostly along open drains, streams, and other water bodies to facilitate easy access to water for irrigation. The water is carried in watering cans or in some cases a motorized pump is used to pump the water to the farm site. Streams used are usually blocked or diverted for use in irrigation. Not only does urban agriculture keep the sites tidy and free from waste but ensures that the soils are receptive for rain while avoiding erosion. This supports flood control. The farmers occupying such lands also maintain a constant urban

greening and the cultivated lands serve as sinks to floodwater and reduce pressure on stormwater drains. Illegal occupants such as squatters are also prevented since it is the incipient stage of slum creation with its concomitant environmental and health problems. This has been termed as the control function of urban agriculture in ensuring good sanitary conditions within the city. Urban agriculture is significant in Accra there are presently about 1000 farmers on 7 large sites, along streams and drains in Accra. Of this number, 600 farmers cultivate exotic vegetables throughout the year while 400 farmers located in one site cultivate indigenous vegetables like okro, tomatoes, garden eggs in the rainy season and occasionally depend on polluted streams and drains like the exotic farmers.

*Capacity building in addressing these challenges*

Participatory research and capacity building e.g. in Geographic Information Systems (GIS), **M**ultistakeholder **P**rocesses for **A**ction **P**lanning and Policy Formulation (MPAP), Strategic Environmental Assessment (SEA) including costs and benefits of externalities, and other tools, applied in the context of this study are also important. Training will ensure that the stakeholders involved in the restoration project for instance are at a common leverage regarding knowledge base, perception, orientations and general understanding of the core issues which will influence decision making in the project execution. In the restoration of the lagoon it was observed that the success of the project depended heavily on the capacity of the Environmental Protection Agency to effectively monitor and regulate industrial activities in the Odaw-Korle Lagoon complex. This is quite important in addressing the main challenges of drainage and stormwater management.

*Local action and provision of alternatives*

This will involve the active participation of the people who are directly affected by the restoration of the lagoon. There is need for them to also understand and appreciate the implications of their activities on the Odaw/Korle catchment. Within such communities the opinion leaders, which in this case will include the Assembly man for the area and a few people with some form of education could mobilize themselves and institute strategies to help address the drainage, sanitation and seasonal flooding within the catchment. One important component in finding solutions to water problems of such magnitudes is the provision of alternatives. For instance, one way of reducing the dumping of refuse into Odaw River upstream is to make sure that sufficient waste collection points have been designated and that waste is not allowed to accumulate but are collected by trucks on time. Once the waste is collected on time the issue of waste being washed into the River to induce siltation, which could lead to flood situation, is also avoided. Availability of well constructed drains and sanitation facilities will address haphazard discharges of domestic effluent and human waste onto the environment.

*Key research questions*

- How severe is the contribution of Old Fadama to the pollution and flooding of the Lagoon and what could be done to reduce it?
- How unsuitable is the area of Old Fadama for human settlements, also in comparison with other parts of the capital?
- How many people live in this informal settlement, under what kind of conditions and with which livelihood support?
- Which low-cost temporary sanitation improvements are possible to provide the local population with the dignity the law requires, with or without “upgrading” the slum?
- How would any action influence the restoration of the wetland?

- How could Accra address the basin-wide water pollution challenge to sustain fishing in the lagoon, aquaculture and urban farming?
- What are the key issues relating to flood control within the Odaw River/Korle Lagoon catchment
- What are the key hydrological data to be collected for decision support?

## CONCLUSIONS

Mega Accra has a current population of about 3 million. It is the most populated and the fast growing metropolis in Ghana with an annual growth rate of 3.4%. The Accra Metropolitan Assembly (AMA) is struggling to provide basic services to its growing population and at the same time to create and maintain a healthy urban environment. The paper thus seeks to ascertain innovative ways of addressing the challenges of storm water and drainage management, flood control and provision of sanitation facilities for city dwellers. This is necessary as the Odaw/Korle catchment receives about 60% of the storm water in Accra. Secondly the catchment is home to a major slum known for its unhealthy living conditions which gives the whole a strong social component. The most appropriate approach to address this complex situation is an intersectoral one tapping expertise from different disciplines. The involvement of key institutions is important for the success of any attempt to address the above stated challenges.

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