



# Promoting Green Urban Development in African Cities

DAR ES SALAAM, TANZANIA

Urban Environmental Profile





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April 2016

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## ACKNOWLEDGEMENTS

The *Promoting Green Urban Development in African Cities, Urban Environmental Profile for Dar es Salaam, Tanzania* was prepared by a core study team led by Roland White (Global Lead: City Management, Governance and Financing - Task Team Leader) and included Chyi-Yun Huang (Urban Specialist), Amy Faust (Consultant/Urban Environmental Management Specialist) and a consultant team from AECOM including John Bachmann, Diane Dale, Brian Goldberg, Maritza Pechin, and Dr. Jane Turpie (Anchor Environmental). Andre Bald (Program Leader), Dr. Jeffrey Wielgus Yanovich (Consultant/Environmental and Natural Resource Economist) and Dr. Timm Kroeger (Senior Environmental Economist, The Nature Conservancy) contributed critical review and guidance. Professor Alphonse Kyessi (Ardhi University) and Dr. Anesi Mahenge (Ardhi University) provided key insights and secondary data. Sonia Wheeler, Gloria Sindano and Leah Mukuta offered organizational and administrative support while Sarah Botta (AECOM) provided graphic design support.

The document was prepared under the overall guidance of Francisco Ferreira (Chief Economist), Sameh Wahba (Practice Manager), Mukami Kariuki (Practice Manager) and Philippe Dongier (Country Director).

This Urban Environmental Profile benefited immensely from close collaboration with representatives from the Government of Tanzania, including the Dar es Salaam City Council, Kinondoni Municipal Council, Ilala Municipal Council, Temeke Municipal Council, Prime Minister's Office - Regional Administration and Local Government (PMO-RALG), Ministry of Lands, Housing and Human Settlements Development, Ministry of Water, National Environment Management Council, Dar es Salaam Water and Sewerage Authority (DAWASA) and Dar es Salaam Water and Sewerage Corporation (DAWASCO). The team is also grateful for the inputs provided by representatives from the United Nations Environment Programme (UNEP), Tanzania Cities Network (TACINE), World Wildlife Fund, Ardhi University, University of Dar es Salaam, Open University of Tanzania and NIPE FAGIO. The team would like to express its gratitude especially to the Honorable Mayor Didas Massaburi for his guidance and support.

The study would not have been possible without the generous financial contribution of Korean Green Growth Partnership.



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## EXECUTIVE SUMMARY

The city of Dar es Salaam, Tanzania has undergone a period of unprecedented urbanization that has contributed to the degradation of the city's natural environment. With a growth rate above or near 5% for the past three decades, it is the fastest growing city in East Africa. The arrival of thousands of in-migrants year after year has overwhelmed the city's ability to deliver adequate public services, housing and jobs. Unplanned, densely populated informal settlements that lack basic water, sewer, and waste services now cover much of the city's land area.

At the same time, climate change is placing further strains on the city's ability to manage the urban environment. The projected rise in temperature, coupled with an increase in precipitation, could have wide-ranging impacts. A projected increase in the intensity of rainfall will result in storm runoff that exceeds the capacity of the city's infrastructure, causing flooding and the spread of pollution, of particular concern for low-lying informal settlements. Such conditions have degraded the quality of the city's natural environment and the vital ecosystem services that they provide.

An overall objective of this undertaking is to link the study of urban environmental issues with the advancement of more sustainable urban growth. The Urban Environmental Profile for Dar es Salaam has been prepared as the first component of the assignment "Promoting Green Urban Development in Africa: Enhancing the Relationship Between Urbanization, Environmental Assets and Ecosystem Services," a project being conducted under the leadership of the World Bank. The Profile summarizes the existing quality of the wetlands and other aquatic and terrestrial environmental assets, and identifies the key drivers of their environmental vulnerability, and the main institutional challenges and constraints.

This document is intended to be a resource for Dar es Salaam's municipal officials and stakeholders engaged in environmental resource management. Their informed decision making can lead to better safeguards of the environmental assets as the city continues to grow and develop as an important urban center of political, social, and economic activity. By consolidating into one document Dar es Salaam's drivers and challenges in environmental management, this document can inform and empower municipal officials, non-governmental entities, citizens, donors and other advocates to more effectively promote sustainable and inclusive development.

### The Impacts of Urbanization on Environmental Assets

***The pattern of urbanization has included intensive densification of existing settlement areas as well as development radiating outward along major arterial roads to the periphery. The fastest growing areas are the informal settlements in the peripheral area.*** A key driver of the outward growth has been the availability and affordability of land. This sprawling development pattern requires expensive extension of infrastructure for providing basic services. The radial road pattern contributes to high levels of traffic congestion.

***With limited urban planning and development controls to guide the rapid growth, the city is now characterized by large unplanned and informal settlements that occupy 70% to 80% of all residential land area.*** Urban planning has been severely limited without an update of the 1979 Master Plan. Between 1982 and 2002, more than 15,500 ha of formerly vacant agricultural lands were converted to urban development. The rapid growth is driving sand and stone extraction to meet the demand for new buildings and infrastructure. Poorly managed or regulated processes have resulted in large areas of disturbed land, soil erosion, and sedimentation that have contributed to environmental degradation.

***The provision of the water, sanitation, and drainage infrastructure capable of serving this rapidly urbanizing city is severely under provided and of poor quality.*** The Dar es Salaam sewerage system provides services to only 10% of the city's population. Eight independent waste water stabilization ponds provide primary treatment through the settlement of the raw sewage solids and the remaining liquids are discharged into streams, rivers, and the sea. The remaining approximately 90% of the population use on-site sanitation, including 73% relying on pit latrines that result in direct and indirect discharge to streams and rivers.

***The Msimbazi River, the most important water source for residents for drinking, bathing, and agriculture, is the most severely polluted and degraded of the four primary rivers in the city.*** It receives discharges from: treated and untreated industrial waste, waste water stabilization ponds, leachates from closed solid waste dumps, outfalls from storm water drainage systems, and effluent directly and indirectly from onsite sanitation systems. With the exception of the Mpiji, rivers have been degraded.

***There is very limited provision of formal storm water drainage systems and more than 50% of the existing system is rated in poor condition.*** The system only covers the central city, and the drains are insufficient to process increased rates of runoff due to the increased level of urbanization. There is frequent clogging due to poor maintenance, siltation, and disposal of solid waste. As a result, much of the storm water is equivalent to waste water effluent. However, the Community Infrastructure Upgrading Programme and Dar Metro Development Project are upgrading services in unplanned areas.

***Forest reserves have declined more than 30% over 30 years due to urban and peri-urban expansion and encroachment from nearby communities as well as due to the increasing use of charcoal for household fuel.*** The close proximity of the reserves to the city provides major markets for forest products, such as medicinal plants, fuel wood, building materials and food. The increase in use of charcoal reflects the lower cost option that it is easily available in forest lands compared to alternative fuels. There is little enforcement of forest law and limited restriction on access to forest products.

***Degradation of land, soil, and forest lands contributed directly to the decreasing quality and quantity of the city's water assets.*** The loss of land, soil and vegetation in the prime catchment areas reduces the water recharge and infiltration functions on the land. Destabilization and loss of soil causes erosion and sedimentation of the rivers downstream. The loss of vegetation also reduces vital habitat, diminution of biodiversity, and carbon sequestration capacity.

***Upstream land degradation and the growing demand for water is exceeding supply.*** The City relies on large-scale water transfers from the Ruvu River and the Kzinga River. Studies have shown an increase in sediment loading and water quality degradation, and reduced precipitation has heightened water scarcity concerns. The growing amount of water extraction from limited groundwater sources threatens the sustainability of water assets. Exploitation of aquifers is accelerating degradation of groundwater due to over consumption and saltwater intrusion.

***More than 60% of solid waste generated in the city is not collected.*** The causes of low collection include lack of equipment, low prioritization, inadequate financial resources, inaccessibility to some areas, and lack of waste transfer sites. Generation of waste is increasing and will continue to increase with population growth.

***The Pugu Dumpsite is the only functioning waste disposal site for the city as other sites have been closed.*** It is costly to transport waste from all three municipalities. The dump site is running out of area and it is not clear that a new site has been identified with feasibility studies conducted. Poor solid waste management has compounded problems of leachate discharge from Pugu dumpsite to watercourses.

***There has been extensive beach erosion, and the coastal and marine systems have suffered from the degradation of land and aquatic systems that have caused sedimentation and high turbidity.*** Most of the mangroves were harvested intensely between 1990-2000, resulting in severe fragmentation. However, a 2008 survey by NEMC revealed recovery of the density of coverage at Kinondoni due to conservation initiatives, and there is opportunity to take action to protect the remaining mangrove forests.



**Many air quality indicators exceed WHO-recommended limits.** While coastal areas of city benefits from dissipation of pollution by sea breezes, the inland areas suffer from high levels of air pollution. The majority of the population continues to travel by bicycling and walking, but the trend is shifting toward motor vehicles. The use of motor vehicles increased from 24,600 in 1979 to between 605,000 and 705,000 in 2011. The increase in emissions from motor vehicles is contributing to the degradation of air quality of the city, which has also been driven by the use of charcoal as a primary household fuel.

### **Key Findings**

**Institutional fragmentation restricts effective urban environmental management.** Many institutions are involved with aspects of environmental issues, including those of a local nature that are required to be addressed at the national level or vice versa. There is a multiplicity of legislation, with each institution having its own legal framework. Organizational capacity further challenges environmental management, with lack of effective systems and enforcement (i.e., development control), fiscal decentralization, and human resources.

**There are broader metropolitan-scaled environmental assets remaining that will require strategic action to conserve and protect.** These include the 2,000 ha of mangrove forest, the forest lands in the upland catchment areas that are degraded but remain open space and can be rehabilitated, and the Kigamboni (across the harbor bridge), which still has relatively healthy ecosystems that will soon come under much greater pressure.

**The city's aquatic ecosystems have been most burdened and degraded by the impacts of urbanization.** Poor land management, ineffective waste water treatment, and inadequate solid waste management are severely degrading the limited remaining resources. It is essential for the city to identify the environmental assets that can be reasonably saved and take the necessary actions to conserve and protect them so that previous mistakes are not repeated.

**Informal settlement is inevitable and is currently the single biggest driver of ecosystem loss.** The city needs to accelerate the necessary actions to provide affordable housing and basic services in order to make future urban settlement activities more environmentally sustainable.



## I. INTRODUCTION

The city of Dar es Salaam, Tanzania has undergone a period of unprecedented rapid urbanization that has contributed to the degradation of the city's natural environment. The arrival of thousands of in-migrants year after year has overwhelmed the city's ability to deliver adequate public services, housing and jobs. Unplanned, densely populated informal settlements that lack basic water, sewer, and waste services now cover much of the city's land area.

Climate change is placing further strains on the city's ability to manage the urban environment. Increasing levels of rainfall from climate change contribute to storm runoff levels that exceed the capacity of the city's infrastructure, causing flooding and the spread of pollution. Such conditions have degraded the quality of the city's natural environment and the vital ecosystem services that they provide.

The Urban Environmental Profile of Dar es Salaam has been prepared as the first component of the assignment "Promoting Green Urban Development in Africa: Enhancing the Relationship Between Urbanization, Environmental Assets and Ecosystem Services," a project being conducted under the leadership of the World Bank. An overall objective of the project is to link the study of urban environmental issues with the advancement of more sustainable urban growth. Profiling the city's environmental assets provides a reference and a platform on which cities can develop policies and procedures that will safeguard the natural assets as they continue as urban centers of political, social, and economic activity.

The Urban Environmental Profile summarizes the existing quality of the city's environmental assets, identifies the key drivers of environmental vulnerability, and describes the key institutional challenges and constraints. By consolidating into one document Dar es Salaam's drivers and challenges in environmental management, this document can inform and empower municipal officials, non-governmental entities, citizens, donors and other advocates to more effectively promote sustainable and inclusive development.

## A. Methodology

The Urban Environmental Profile was developed based on the collection of data using the Rapid Urban Environmental Assessment (RUEA) tool developed jointly by the United Nations Development Programme, United Nations Centre for Human Settlements (UNCHS – Habitat), and the World Bank (Leitmann, 1994). The purpose of the RUEA is to document available data and identify gaps in knowledge. A questionnaire was developed to guide the collection of data and to generate an existing baseline on a range of environmental Information.

The RUEA questionnaire seeks numerous charts to be populated with specific data on sanitation, solid waste, energy, and other urban systems and services. Identification of the key environmental assets and key drivers of environmental degradation within Dar es Salaam required a comprehensive review of reports on urban planning and infrastructure services. The required information was too complex to fit into the RUEA questionnaire format. Therefore, the process evolved to the definition and annotation of an outline for the profile that was then developed into this document.

There is considerable information available on the topic of urban planning, as this has been the subject of considerable academic research. However, the emphasis has been on spatial planning and the social and economic implications of informal settlements rather than the urban environment. Data on urban forestry, land and soil, and air quality was not widely available or does not appear to have been developed.

Recent environmental impact assessments for proposed sanitation and solid waste projects have been important sources of information. However, as the information is generated for projects rather than as part of a comprehensive planning initiative, the data is limited to specific areas of the city. There also has been little development of baseline inventory or analytics of the city's environment assets.

Consultation with key stakeholders informed the drafting of the profile. A kick-off workshop held in Dar es Salaam in September 2014 introduced relevant municipal officials and stakeholders to the objectives and intentions of the study. Participants provided overall direction on relevant secondary sources of environmental data, such as municipal development plans and strategic planning documents and reports prepared by national-level environmental ministries, the World Bank, and UN. Information was also gathered from interviews with municipal officials.

A PowerPoint presentation summarizing the intermediate findings was presented during a second workshop in December 2014. During the event, key stakeholders provided preliminary comments and feedback that guided the refinement of the Profile.

## B. Summary of Report

The Urban Environmental Profile report is organized as follows:

**Section II Dar es Salaam Context** provides an overview of the physical context background and of the impacts of rapid urbanization and climate change, and draws the link to the urban environment.

**Section III Quality of the Environmental Assets of Dar es Salaam** describes the state of the key environmental assets of the city: the terrestrial and aquatic ecosystems, marine and coastal ecology, and the air; and attempts to infer the associated historic and current trends.

**Section IV: Drivers of Environmental Vulnerability and Degradation** describes the key issues that drive degradation, and its impacts. Drivers include inefficient spatial development, informal settlements, effluents, storm water runoff, solid waste, and emissions.

**Section V: Institutional Issues and Challenges** describes the key factors that constrain the city of Dar es Salaam's ability to effectively address environmental management challenges.

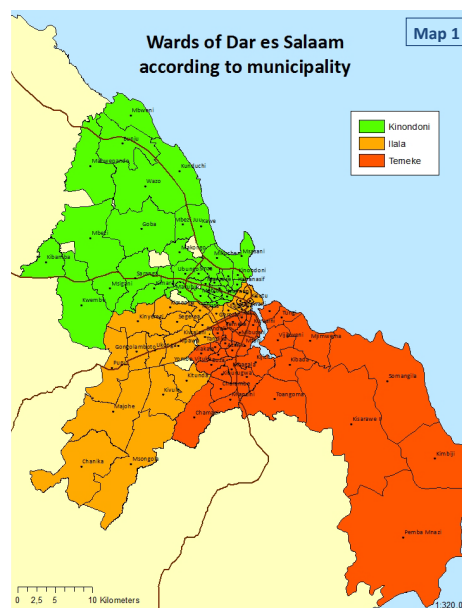
**Section VI: Summary** provides a synthesis of key findings of the study.

## II. DAR ES SALAAM CONTEXT

Dar es Salaam is bounded by the Indian Ocean to the east and the Coast (Pwani) region to the west (Figure 1). The city stretches 100km from the Mpiji River in the north to beyond the Mzinga River in the south, comprising a total land area of 1,630.7 km<sup>2</sup> (about 0.2% of the entire Tanzania mainland's area) (ILRI, 2007). It is the largest city in Tanzania.

Dar es Salaam was established as a port and trading center in 1862. It grew rapidly from the early 1890s when the colonial administrative headquarters of German East Africa (including Kenya and Uganda) was located there. The German colonial codes for the development of the city and local government system was largely continued by the British, who controlled the city from 1916 to 1961. The British established a Town Planning Department in 1947 and Town Planning Legislation and a Master Plan were created in 1948. Dar es Salaam was granted city status in 1961 and is divided politically and administratively into three districts - Kinondoni, Ilala and Temeke - that were declared municipalities of the city in 1999 (Kyessi, 2010).

***Dar es Salaam is the fastest growing city in Tanzania and in East Africa.*** By the late 1970s the city was established as the predominant urban center in the region and was approaching a population of 1 million. The city has grown at or above the rate of 5% for the past three decades, exceeding the national average rate of near 3% (Table 1) (URT 2002, 2012). The rapid growth in population has been due to both high rural-urban migration and natural birth rate of about 4.5 % per annum.



**Figure 1** City of Dar es Salaam Location  
Source: Andreason, 2013

The 2012 Census identified the population of Dar es Salaam at approximately 4.36 million people, at a density of 3,133 per km<sup>2</sup> (URT, 2013). Another study, on the density of urban spatial growth in Dar es Salaam, found a density of 2,688 people per km<sup>2</sup> (Andreassen, 2013). The future population projections for Dar es Salaam suggest continued absolute increases in population with the population anticipated to increase to more than 7 million people by 2025 (USSDM, 2013).

A consequence of rapid urbanization has been the decline in the quality of the urban natural environment. The impacts of climate change have exacerbated the rate and extent of environmental degradation and have made the city's efforts toward environmental management all the more challenging.

**Table 1** Population of Dar es Salaam by Municipality

Political Unit	2002 Count <sup>1</sup>	2012 Count <sup>2</sup>	2002 Count <sup>3</sup>	2012 Count <sup>3</sup>	Absolute Increase <sup>3</sup>	Share of Absolute Increase <sup>3</sup>	Average Annual Growth Rate <sup>3</sup>
Kinondoni	1,083,913	1,775,049	44%	41%	691,136	37%	5%
Ilala	634,924	1,220,611	26%	28%	571,359	30%	6.8%
Temeke	768,451	1,368,881	31%	31%	614,758	33%	5.9%
Dar es Salaam	2,487,288	4,364,541	100%	100%	1,877,253	100%	5.8%

<sup>1</sup> Source: 2002 ward level data acquired from the National Bureau of Statistics.

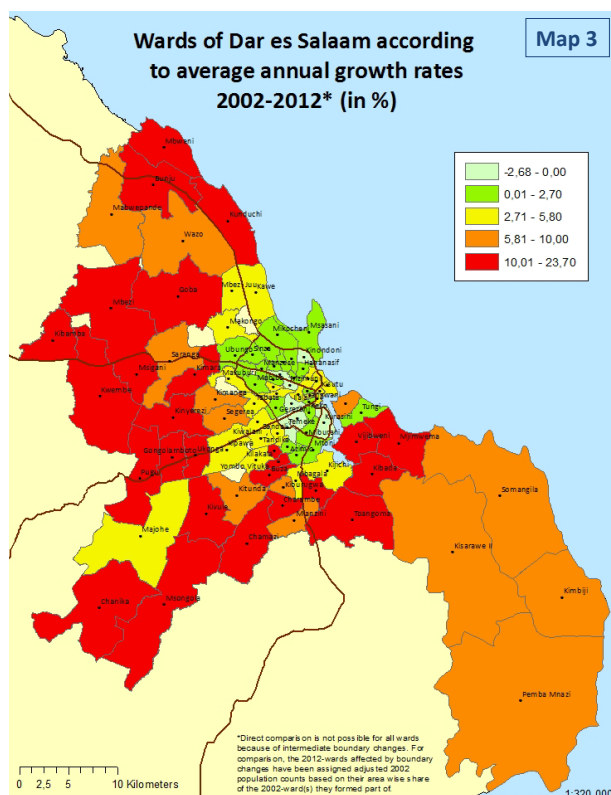
<sup>2</sup> Source: 2012 census (National Bureau of Statistics Tanzania et al., 2013).

<sup>3</sup> Source: Own calculations based on the above.

**Table 2** Population and Growth Trends in Dar es Salaam

Year	City Proper	Growth Rate (%)	Population Density (p/sq km)
1948	69,227		N/A
1957	128,742	2.4	N/A
1967	356,286	7.1	256
1978	843,090	7.8	605
1988	1,360,865	4.8	977
2002	2,487,288	4.3	1,786
2012	4,364,541	5.6	3,133

Source: Housing and Population Census Reports URT, 2002, 2012, Andresen, 2013

**Figure 2** Growth Rate of Dar es Salaam Wards

Source: Andreason, 2013

## A. Urbanization

***Without urban planning and development controls to guide its rapid growth, the city is now characterized by a vast area of unplanned and informal settlement areas.*** The colonial development model, with its low-density areas and open spaces, has not been updated to meet the demands of post-independence urbanization. Detached single story buildings at low development densities still predominate (Kyessi, 2010). The last Master Plan was prepared in 1979, when the population was 20% of the current population. As the adoption of a 2012 Master Plan has been delayed, the 1979 Master Plan is technically the guiding document. However, it is severely outdated and systematically ignored. Decades of rapid and unplanned urbanization have resulted in the proliferation of informal settlements and slums, a housing shortage, and inadequate infrastructure and services (Sutton 1970; Kironde 1995; URT 1997:10-11, Kyessi 2002) (Kjellen and Kyessi, 2013). It is estimated that approximately 80% of all buildings within Dar es Salaam are located in unplanned areas (Hill and Linder, 2010).

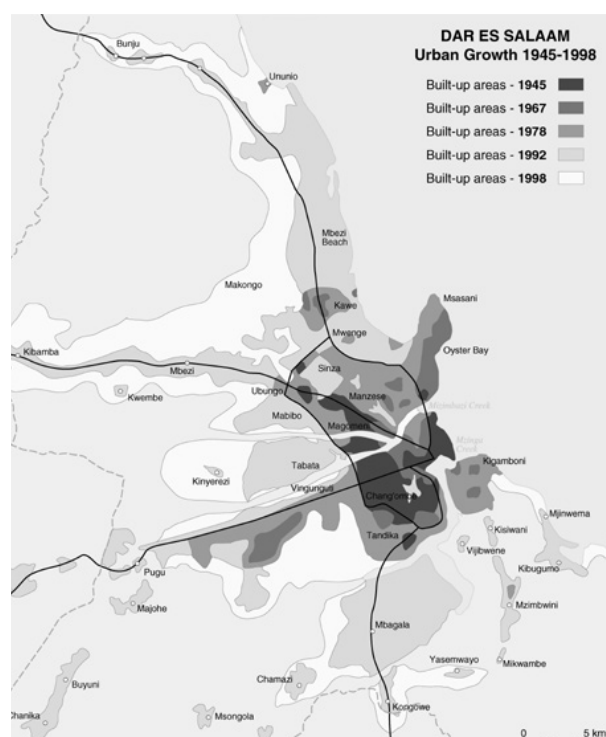
***Dar es Salaam has expanded from its center outward along major arterial roads, forming a radial development pattern; in addition, the fastest-growing areas of the city are the informal settlements in the city periphery, which lack infrastructure and transit services.*** There is an intensive densification and consolidation process occurring in existing settlement areas, and most of the urban population growth is on formerly vacant or agricultural land. Urban development has taken place significantly along the coast and the major arterial roads (including Ally Hassan Mwinyi (Bagamoyo), Morogoro, Nyerere and Kilwa Road) taking advantage of the better accessibility and availability of lower cost land, and reinforcing the mono-centric and radial development pattern (Kyessi, 2007). Radiating from the Central Business District (CBD), the immediate residential areas are Kinondoni Oyster Bay, Magomeni Regent Estate, Mikocheni, Kawe, Mwananyamala, Sinza, Manzese, Ilala, Kurasini, Chang'ombe, Buguruni, Kiwalani, Kigamboni, Mbezi Beach, Tegeta, Msasani, Kunduchi, and Bunju (Kyessi, 2007).

Dar es Salaam's fastest-growing areas by population are now those far from the city center (Figure 2). Peripheral wards have received 42% of the total population increase between 2002 and 2012. Medium-distance wards, 10-15 km west, south west, and south of the city center, have experienced 24% of the increase. To the north, rapid growth is found more than 15 km away from the city center. Population growth in the southern coastal areas that are not serviced by any major roads is less than the other areas (Andreassen, 2013).

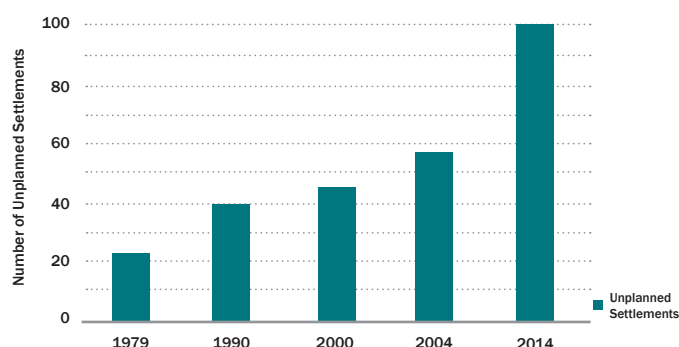
The city's rapid population growth and rural-urban migration, coupled with inadequate availability of affordable housing, has resulted in new developments concentrating on the periphery of the city (Figure 3) (Kyessi, 2013; Moss and Happold, 2013). A 2011 survey of roughly 6,000 households settled in Dar es Salaam's peri-urban areas (Ricci et al., 2012) shows that the majority (64%) moved from another municipality in the Dar es Salaam region to the peri-urban area, while 36% moved from other regions of Tanzania (rural to peri-urban) (Macchi et al, 2013). The public sector has not been able to keep up with the resulting demand for housing or provide a positive environment for housing development due to scarce resources, diminished capabilities to raise revenue, limited institutional capacity and the absence of a responsive policy framework (Moss and Happold, 2013).

**Most of the population growth in the previous decades has been absorbed by informally-developed settlements.** High population density and development intensity characterize many unplanned settlements, as well as: ease and low costs of entry, informal allocation of land but with efficient socially-regulated land delivery mechanisms, unregulated markets, and unserved land that is subdivided at will and sold (Kyessi, 2007). Many housing structures are in poor and dilapidated condition requiring major improvements or replacement.

Between 1982 and 2002, more than 15,500 ha of formerly vacant or agricultural land was converted into urban land uses. More than 75% of these new developments can be classified as informal settlements, while only roughly 15% were converted into planned residential areas. Only about 8% of these newly developed areas accommodate other uses, including industrial or commercial uses, transport or public services (Hill and Linder, 2010).



**Figure 3** Pattern of Urban Growth  
Source: Shand, n.d.a.



**Figure 4** Growth in the Number of Informal Settlement  
Source: Lupala, 2002, URT, 2005, Kyessi, 2014

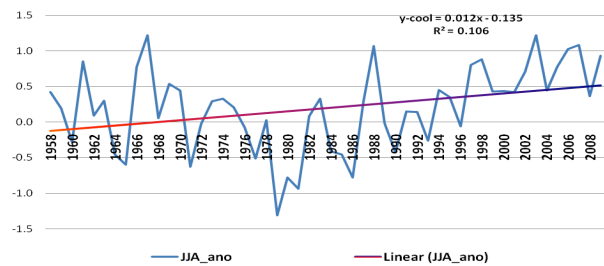


## B. Climate Change Impacts and Challenges

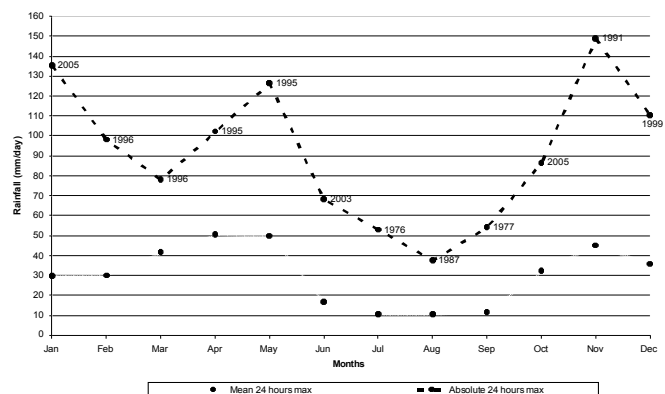
**Climate change is projected to affect precipitation variability, storm frequency and temperature, resulting in sea level rise and storm surges; coastal and beach erosion; submergence of some nearby islands; intrusion of salt water in fresh water bodies (wells and boreholes); and erosion and destruction of lifelines (i.e. roads, bridges and coastline).** The mean precipitation has been projected to increase during the long rainy season over coastal areas, including Dar es Salaam, by up to 6% by 2100 (Matari et al., 2008). While it is unclear whether overall rainfall in Tanzania will increase or decrease with climate change, it is expected that increasing variability will lead to both droughts and floods of increasing magnitude and frequency (Watkiss et al., 2011). There has been a general reduction of total annual rainfall per year in Dar es Salaam over the past five decades (Figure 5).

Mean and absolute 24-hour maximum precipitation for the period 1971–2009 ranges from over 50 mm in April-May to 10mm for July-August (Figure 6). Rainfall intensity is likely to increase as climatic variability increases in coming years with the progression of climate change. Drainage designs are already accounting for a projected increase in the intensity, duration, and frequency (IDF) of rainfall resulting from an increase in longer and more concentrated rainfall (Figure 7). For example, the surface water drainage systems proposed in the Dar es Salaam Metropolitan Development Project are being designed to accommodate 15% increased precipitation intensity over current conditions (URT, 2014b TSCP). This increased intensity is anticipated to take effect approximately 12 years into the life of the project (URT, 2014b TSCP).

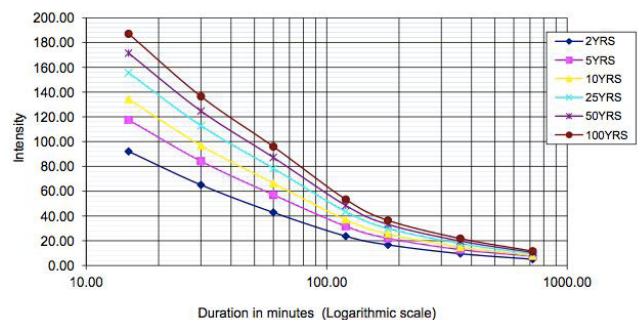
Heavy rainfall frequently causes flooding in the city, particularly in low-lying, flood-prone informal settlement areas, which positions the poor with heightened vulnerability to flooding. In addition to property loss and occasional loss of life, widespread health risks result from overflow of onsite sanitation, sewers and drains, contamination of wells and springs and the spread of diseases such as malaria, lymphatic filariasis, and diarrhea. The city's poor are challenged by current conditions and their situation is likely to worsen without interventions that address the impacts of climate change.



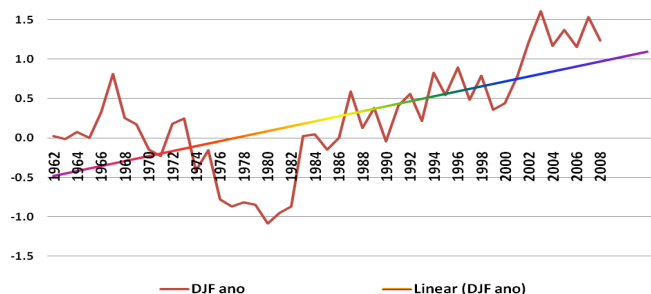
**Figure 5** Mean Annual Rainfall in Dar es Salaam 1961-2009  
Source: TMA, 2011



**Figure 6** Precipitation Intensity  
Source: Tanzania Meteorological Agency TMA, 2011



**Figure 7** Projected Intensity, Duration and Frequency of Rainfall Curves in Dar es Salaam  
Source: International Climate Fund, 2014 (reference of Proce1 and COWI, 2014 data)



**Figure 8** Trend for Mean Temperature over 5 Decades  
Source: Tanzania Meteorological Agency TMA, 2011

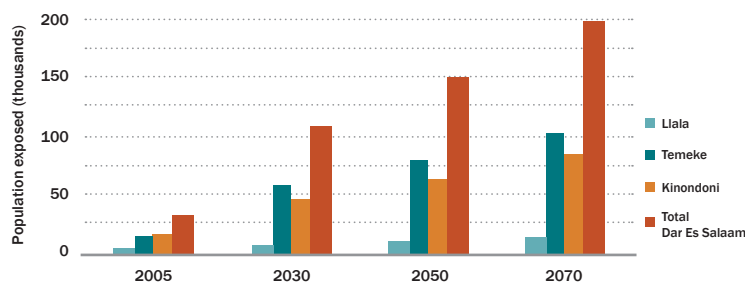


**A rise in temperature, coupled with an increase in precipitation, could have wide-ranging effects.** By 2100, mean annual temperature for Tanzania is expected to increase by 1.7°C, including areas around Dar es Salaam (Matari et al., 2008). This rise in temperature could also trigger an increase in the urban heat island effect, which would bring a gradient of higher temperatures where densities of people and the built environment are greatest. These higher temperatures could impact urban agriculture (evapotranspiration, heat stress), disease incidence (direct effects of extreme heat on humans, as well as on disease vectors, e.g., by increasing humidity), hydropower generation (increased evaporation in reservoirs), and household electricity requirements. Models also anticipate a projected increase in the number of days exceeding 32°C by 2050 (Watkiss et al., 2011).

Analysis over five decades, shows a significant increase in mean temperature (Figure 8). Increases in mean temperature, combined with reduced annual rainfall, could lengthen the dry seasons or intensify droughts. Recent extreme climatic events, for example, the droughts of 2006 and the floods of 2010, severely impacted the transport, energy and health sectors, with adverse socio-economic implications (Watkiss et al, 2011).

A 2011 study projected exposure of the city's population (more than 100,000 residents) to a 100 year storm event by 2030 in the absence of adaptation measures (Watkiss et al, 2011) (Figure 9). The 2011 study also noted that Temeke's coastal areas have the most people at risk from a 100 year storm, while significantly fewer people are at risk in Ilala.

Dar es Salaam has experienced a number of significant flood events over the past few decades due to rainfall that has been well above the average monthly mean, including four months with rainfall above 200% of mean (Table 3). The flood of December 2011 was caused by some of the heaviest rainfall in Tanzania since the 1960's (UPI, 2011). December 2011 flooding displaced approximately 10,000 people (2,000 families) and affected an estimated 50,000 people (10,000 families), particularly those residing around the Msimbazi River basin. Damage to property and infrastructure was massive (IFRC, 2012). Most recently, April 2014 floods displaced approximately 2,000 people with Msimbazi River floodwater entering 600 houses, washing away 13 houses and requiring 283 patients to be treated for waterborne diseases associated with contaminants from the flooded water (ReliefWeb, 2014; Hepworth and Joseph, 2014).



**Figure 9** Exposed Population to 100 Year Storm with Mid-Range Sea Level Rise and No Adaptation

Source: Watkiss et al., 2011

**Table 3** Significant Floods in Dar es Salaam, 1983 - 2006

Year	Months	Monthly Rainfall				Number of Affected People
		Long Term Mean (mm)	Actual (mm)	% of Long Term Mean		
1983	May	197.8	405.6	205		N/A
1989	Dec.	117.8	175.6	149		N/A
1995	May	197.8	374.2	189		N/A
1997	Oct.	69.3	250.8	361		19,170
	Nov.	125.9	152	121		
	Dec.	117.8	231	196		
1998	Jan.	76.3	107.3	141		N/A
	Feb.	54.9	123.7	225		
	March	138.1	155.2	112		
	April	254.2	319.9	126		
2002	April	254.2	569.4	224		N/A
2006	Nov.	125.9	240.4	191		10,758
	Dec.	117.8	230.4	196		
2011	Dec.	N/A	N/A	N/A		15,563
2014	Jan.-April	N/A	N/A	N/A		750,000

Source: Tanzania Meteorological Agency, 2011; Hambati and Gaston, 2014

**The most affected areas are the lowlands found along river valleys, areas occupied mainly by unplanned settlements, and areas already exposed to flooding events that will be exacerbated by climate change (World Bank, 2011; Hambati and Gaston, 2014).** Areas prone to floods include: Msasani bonde la mpunga (about 60ha mixed residential, commercial and institutional settlements), one of the fastest-growing settlements in Kinondoni municipality; Msimbazi valley; Jangwani (a slum area characterized by annual flooding during rainy season); Mikoncheni (already challenged by storm water drainage); and the city center (exacerbated by poor infiltration and outdated non-functioning storm water drainage system). Areas severely affected by flooding include: Kunduchi and Bahari beaches (Griffiths and Lwiza, 1988; Masalu, 2002). At the Kunduchi beach area, the coastline has retreated for about 200m over the last 50 years, destroying residential houses, public services, and other tourism facilities, as well as the historic fish market and a seawall constructed to protect the Ocean Road (Casmiri, 2008).

On behalf of a Mayor's Task Force, Ardhi University undertook a flood modeling exercise that provided an indication of the effects of climate change on flooding in different communities in Dar es Salaam. A hazard assessment using historical data indicated that a large part of Dar es Salaam will be subject to flooding. In terms of land area, the exercise found that Kinondoni Municipality is likely to be affected the most by floods in the future: 35% of the area in 5 years, 67% in 10 years and 70% in 50 years. In addition, Ilala is likely to be extensively affected by floods, 10% in 5 years, almost 22% in 10 years and 41% in 50 years. Temeke will have less flooding although some wards will be affected (World Bank, 2011) (see Table 4).

The study considered a worst-case scenario, assuming all natural and/or artificial defenses fail under the most extreme events, providing a detailed quantitative context of the potential exposure that could be used to assist coastal planners and policy makers. About 8% of Dar es Salaam lies within the low elevation coastal zone (below 10m elevation), estimated to be inhabited by more than 143,000 people and is an economic asset estimated to be worth at least US\$168 million in 2005. Over 30,000 people and US\$35 million in assets are located within the 100 year flood plain. The study considers alternative scenarios for 2013, mapping the population and asset values at risk with and without sea level rise (Kebede and Nicholls, 2010).

**Protection of environmental assets threatened by the impacts of climate change are directly tied to the protection of economic assets.** Infrastructure within Dar es Salaam worth US\$48 million is vulnerable to a 0.5 meter sea-level rise and another US\$82 million is vulnerable to a 1 meter sea-level rise. Other assets at risk are residential and commercial buildings, urban farms, coastal mangrove and other forests. The cost to build a seawall to protect vulnerable coastal homes and hotels against a 1 meter rise in sea level has been estimated at US\$337 million. The cumulative costs for repairing homes in Msasani Bonde la Mpunga, Hanna Nassif and Msimbazi valley informal housing areas have continued to climb due to the yearly impact of floods (Kebede and Nicholls, 2010).

It is predicted that on average about 400m of landward retreat would occur due to erosion in Dar es Salaam under a 1m sea-level rise (Mwaipopo, 2000). A total land loss estimated at 247 km<sup>2</sup> and 494 km<sup>2</sup> is expected for a 0.5 and 1 meter rise of sea level, respectively (URT2003).

A 2005 assessment estimated the total risk exposure in Dar es Salaam as 36,000 people and US\$130 million in assets. By the 2070s, this risk exposure grows dramatically due to a combination of urbanization, socio-economic change and sea-level rise. The 2070 estimate of risk anticipates that over 350,000 people and infrastructure assets worth approximately US\$5.3 billion could be exposed to a 100-year coastal flood (Nicholls et al., 2008). However, there is a general lack of information regarding the vulnerability of population and assets in low-lying areas to critical climate thresholds.

**Table 4** Projected Extent of Flooding Impacts throughout Municipality from 2011 Base Year

Municipality	5 years	10 years	50 years
Kinondoni	35%	67%	70%
Ilala	10%	22%	41%

Source: World Bank, 2011

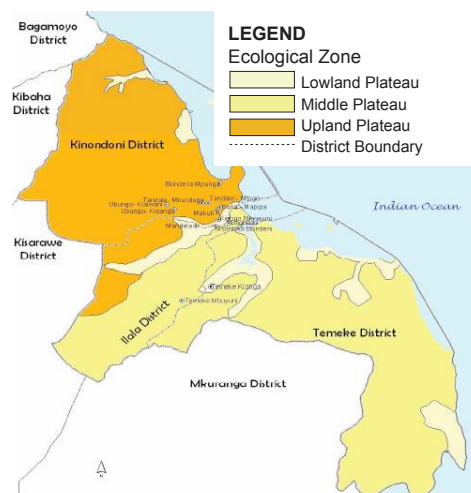
### III. QUALITY OF THE ENVIRONMENTAL ASSETS IN THE URBAN REGION

Dar es Salaam's terrestrial, aquatic and coastal ecosystems and the quality of the air have been degraded by the impacts of rapid and unplanned urbanization and climate change. The following section reviews the state of each of these assets, the trends in the condition of the asset, and the environmental problems that are being experienced in the city.

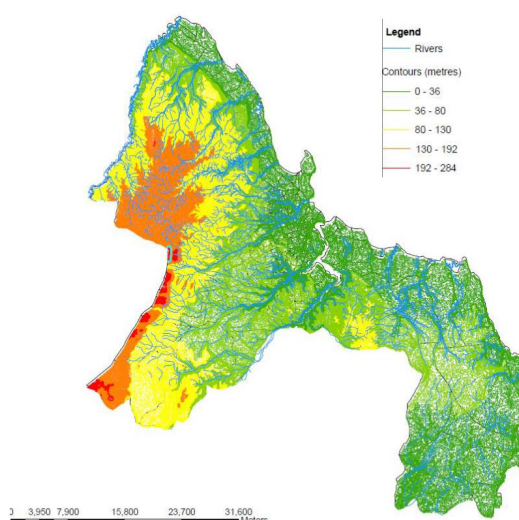
#### A. Terrestrial Ecosystems

Dar es Salaam City Region is characterized by four distinct landforms (Mutagaywa, n.d.a.) (Figure 10 and Figure 11):

- (1) **The shore land**, constituted by the land immediately abutting the Indian Ocean, comprising sand dunes, tidal swamps and cliffs.
- (2) **The limestone coastal plain** located west of the shore land extending to Pugu Hills, which is overlain with Pleistocene and sand with fairly uniform relief lying between 15 and 35 m above mean sea level and slopes of less than 3%. The width of the plain extends 8 to 10 km to the southeast and west, narrowing to 2 km at Kawe to the north. It is composed of poorly-graded white buff sand overlying sandy clay of varying permeability in highly variable sequences. The seaward fringe of the plain is generally formed by raised coral reef limestone.
- (3) **The inland alluvial plains**, flowing from the Pugu Hills to the east, dissect the Coastal plain in a series of steep sided U-shaped valleys, culminating in creeks and mangrove swamps before entering the Indian Ocean. The city's harbor, penetrating 10 km inland along the Kizinga and Mzinga Creeks, forms the principal topographical feature of the region. These valley soils are generally poorly drained silt clays enriched with organic matter.
- (4) **The deeply dissected hills** form the western boundary of the region with altitudes ranging from 100 to 200 m above mean sea level with some points reaching 330 m. It is characterized by steep, weathered slopes and well drained unconsolidated gravelly clay-bound sand. Occasional outcrops of raised coral limestone also occur around Wazo-Kunduchi.



**Figure 10** Geomorphological Zones of Dar es Salaam  
Source: URT, 2014a TSCP



**Figure 11** Dar es Salaam Topography  
Source: URT, 2014a

The following table (Table 5) describes the general extent of landform conditions at different elevations within the city from <5m to >150m. The diversity of elevations and landform types generally supports a diversity of wildlife and vegetation distributed throughout the different zones.

An aerial photo illustrates the general footprint of settlement while the darker colors represent areas of less developed, less disturbed land cover (Figure 12). As a consequence of both land area consumed by residential use and a need to cut the trees for building materials and energy supply, there is little remaining of the original coastal forest.



**Figure 12** Dar es Salaam  
Source: Google Earth, 2014

**Table 5** Dar es Salaam Local Topographical Conditions

Landform Type	Level	Condition
Lowland	<5 m	Areas in the bay area, river mouths and hinterland along the coast. Marsh and swampy areas widely spread; soft soil, thick and drains poorly.
Plain/ Terrace	5-20 m	Flat plains/terraces, extend along the coast and are generally a few kilometers wide. Geologically it belongs to the coastal plains.
Terrace/Hill	20-60 m	This makes up the dominant part of the residential terrain of Dar es Salaam, and are gently sloped areas, consisting of residential weathered limestone (Murr-earth material); many of these terraced areas of 500 m to 1,000 m are observed around the banks of Dar es Salaam City, and have been known to act as flood plains.
Hill	60-150 m	This zone extends to the Southwest of the study area, the geological origin of which is raised coral reefs, the undulation of which is dependent on the degree of weathering.
Mountain	> 150 m	In the Western region of Dar es Salaam, 30 km inland, composed of limestone associated with sandstone of the older geological area, steep and rigid slopes are formed.

Source: URT, 2014a

**The land and soil cover have been severely degraded by the large spatial footprint of informal settlements.** Between 1982 and 2002, more than 15,500 ha of formerly vacant agricultural lands had been converted to urban development. Seventy-five percent of new development has been classified as informal development; 15% converted into planned residential development; and 8 -10% developed for commercial and industrial, public and other uses (Hill and Linder, 2010). Both commercial development and informal settlements have resulted in areas of impervious or disturbed land area that prevent vegetation growth and inhibit infiltration of stormwater (URT, 2014c TSCP) (See photos).



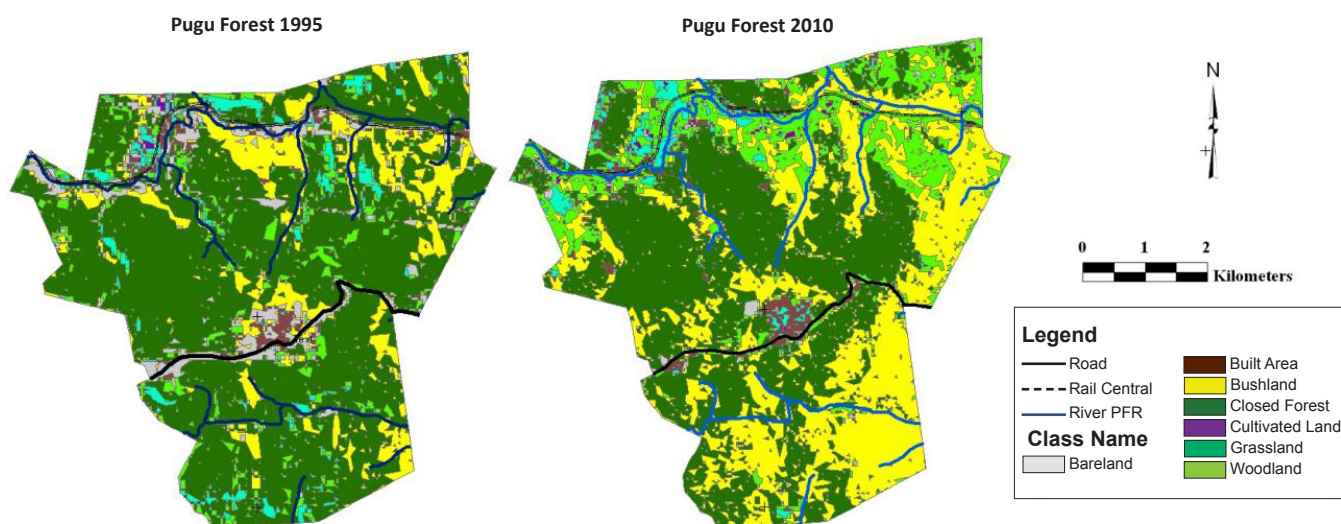
*Photo: Shows general landform type how the green forest canopy is partially displaced by buildings and road.*  
Source: AECOM



**Dar es Salaam contains approximately 2500 ha of protected forest reserves including the Pande and Dondwe Coastal Forest and the Pugu Forest.** Pande Game Reserve (1,226 ha) is on a low sandstone ridge 6 km north-west of the city and 16 km inland from the Indian Ocean. There are four distinct tree-species, with the remaining forest surrounded by fire-maintained grassland and secondary scrub, while three endemic plants and two near-endemics have been identified. Dondwe Forest, to the south of the city, has not been mapped. Parts of the forest flood seasonally. Both forests are managed by the Wildlife Division of the Ministry of Natural Resources and Tourism (Birdlife International, online, 2014). The Pugu Forest Reserve, a rainforest extending into Dar es Salaam, is protected and managed under District Authority control. It is the source of the Msimbazi River. One the largest kaolinite deposits in the world is located inside the reserve (protected planet. net, 2014). The forest reserves occupy a broader region beyond Dar es Salaam's boundary of approximately 70 sq km (CCIAM, 2013).

**The Pugu Hills Forest Reserve (2,180 ha), contains less than 400 ha in reasonable condition.** A 2010 study found Pugu and Kazimzumbwi forests declined more than 30% over 30 years due to urban and peri-urban expansion and encroachment from nearby communities (Figure 13). While this reserve and others offer non-extractive biodiversity benefits to the city, such as upstream water catchment purification services and habitat that supports the region's wildlife, they also serve as markets for forest products. Little enforcement of forest law and limited restriction to access has resulted in poaching of forest products (CCIAM, 2011). As the headwaters for the Msimbazi River, destruction of forest catchment can impact water quality and quantity downstream (NEMC and UNEP, 2014).

The coastal forests provide a wide range of goods, including medicinal plants, fuel wood, building materials and food that are vital for public and private use. However, the collection of these goods and other activities such as charcoal making, cattle grazing, fire ignition, pole and firewood collection, hunting and poaching, honey harvesting, and construction activities, have contributed to the degradation of the forest (Ilala Municipal Council, 2007) (See Section IV).



**Figure 13** Pugu Forest Cover Maps (1995 on left; 2010 on right): Pugu Forest experienced a decline in forest coverage (23% loss) from 1995 to 2010 due to settlement expansion and agricultural cultivation in peri-urban areas of Dar es Salaam.

Source: Lupala et al., 2014

The degradation of the forest lands contributes to a number of environmental problems, including the loss of flora and fauna, biodiversity, water recharge and infiltration, and carbon sequestration capacity as well as the sedimentation of rivers. The coastal forests are recognized Important Bird Areas (IBA), hosting numerous IBA species including a few that are globally endangered, as well as endemic and near-threatened species. This environmental habitat of rare coastal forest condition is essential for survival of these coastal forest birds.

An additional IBA designation runs from the open bay of Ras Kiramoni in the north, up to and including Ndege Beach, to Ras Ndege, east of Mbwamaji village—a total length of 40 km (Birdlife International, 2014). The city site on a natural harbor backed by low hills is an important feeding ground for several seabirds which rarely venture inshore of the coral reef. Within the IBA are tidal mudflats, river inlets, saltpans, extensive mangroves, coastal thicket and several offshore islands which create a remarkably diverse coastal environment. With a tidal range of nearly four meters, up to 25 km<sup>2</sup> of exposed sand and mud can be available to birds at low tide (BirdLife International, 2014).

The highly developed areas of Dar es Salaam, such as Ilala, contain non-bird species that are tolerant of humans such as house rats, common toads, crows and sparrows (URT, 2014a TSCP). Kinondoni and Temeke generally contain a broader diversity of wildlife due to less development compared to Ilala. In addition to the human-tolerant animals common to Ilala, Temeke also contains snakes (*Psammophis spp.*), skinks (*Mabuya varia*) and terrapins (*Pelusios sp.*), vervet monkeys (*Chlorocebus aethiops*), lesser galago (*Galago senegalensis*) and the banded mongoose (*Mungos mungo*) (URT, 2014c TSCP).

### Urban Tree Canopy

***Within the urbanized areas, street trees are heavily impacted by roadside conditions (see photos below).***

Tree and shrub species growing in Dar es Salaam include Mango tree (*Mangifera indica*), Neem tree (*Azadirachta indica*), Castor oil plant (*Ricinus communis*), *Hibiscus schizopetalus*, and Ashoka tree (*Polyalthia longifolia*) (URT, 2014a) (Prime Minister's Office, 2014a). While an urban tree canopy with diverse heights can provide microclimate control, promote infiltration of floodwaters, birdlife and biodiversity, the absence of

## Challenges for Dar es Salaam's Urban Street Trees and Tree Canopy



Photos: Dar es Salaam's street trees are heavily impacted by roadside conditions such as tires on a tree surrounded by compacted soil and rocks; and vehicle parts stacked against a tree with oil-soaked soil.

Source: AECOM



Photos: Roadside zones devoid of any trees or vegetation are found in both planned and unplanned areas. Maintaining healthy street trees is challenging when there is limited space allocated for tree growth.

Source: AECOM





urban canopy can facilitate suspension of road dust, higher temperatures and flooding (USDA, 2014). Given the absence of available studies on the quality of Dar es Salaam's street trees and tree canopy, the images on the prior page show how the city's trees have been impacted by settlements and roads.

The images below show healthy canopy coverage and practices, such as roadside nurseries, which provide some of the temporary environmental benefits otherwise provided by healthy street trees. Dense and contiguous urban tree plantings with diversified canopy heights can increase the amount of urban forest area while potentially forming ecological corridors for linking disconnected natural areas.

## Overview of Terrestrial Asset Trends

Dar es Salaam's landscape of woodland and coastal shrub lands has since become fragmented, deforested and settled following decades of development footprint expansion and infill. As a result, the areas of extensive, contiguous terrestrial habitats that remain are generally limited to the periphery of the city (Google Earth, 2014). However, most of these forested, undeveloped areas - with the exception of reserves such as Pande, Dondwe and Pugu - lack formal conservation protection and are thus threatened by encroachment. If development trends continue as modelled, these larger, contiguous habitats are likely to continue to become fragmented and reduced in size by encroachment at the margins, further straining overall catchment.

## Examples of Urban Street Trees, Tree Canopy and Temporary Vegetation Providing Environmental Benefits in Dar es Salaam



*Photos: In some areas, Dar's urban tree canopy provides shade, interception of road dust, micro-climate control and amenity values.  
Source: AECOM*



*Photos: Roadside markets of tree and plant material are frequent alongside Dar's roads. These nursery markets can provide some benefits of planted street trees by absorbing rainwaters, intercepting road dust and providing temporary wildlife habitat.  
Source: AECOM*

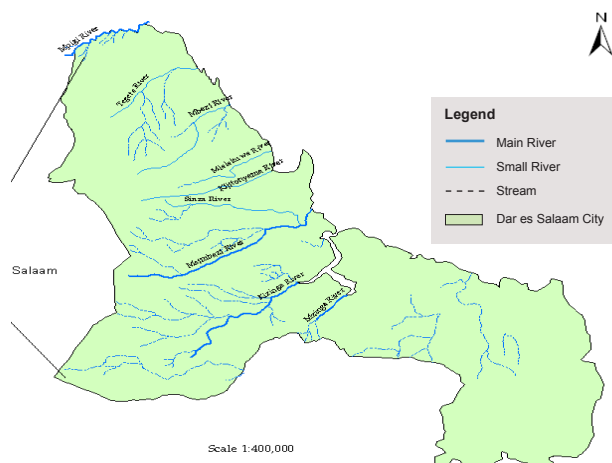
The lack of comprehensive, baseline data documenting an inventory of terrestrial assets in Dar es Salaam, such as an urban natural areas inventory or a tree canopy survey, makes it challenging to understand the current state of terrestrial assets and to identify locations of significant change. Similarly, baseline inventories of trees, forests, birds, etc. can enable prioritization of valuable assets or those most at risk, to inform allocation of limited fiscal and municipal resources for conservation, monitoring and restoration efforts. Data on vegetation and wildlife that is available has been generated for discrete projects, largely through environmental and social impact assessments covering specific areas. This segmented inventory data inhibits a broader, more comprehensive view of overall environmental health.

## B. Aquatic Ecosystems

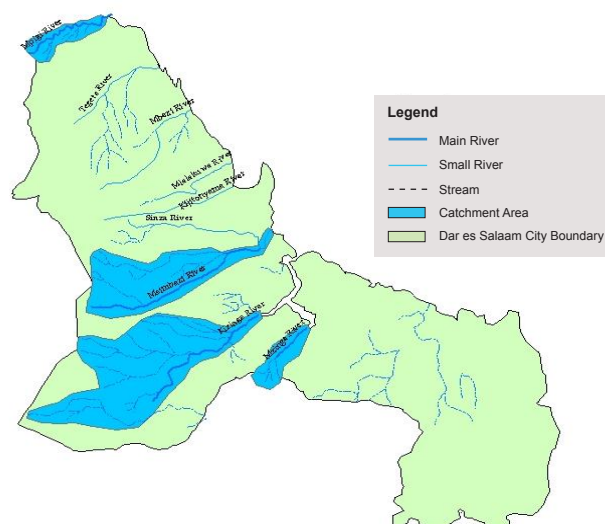
The freshwater ecosystems of Dar es Salaam include both surface waters (1,123.087 ha of rivers and streams) and groundwater resources (Dar es Salaam MP, 2013). The main rivers within the city include: Msimbazi, the largest river in the city; Mpigi; Kizinga, with the largest catchment area; and Mzingo (Figure 14 and Figure 15). Three of Dar es Salaam's four major rivers are heavily degraded. While the predominant aquatic assets of Dar es Salaam are rivers, small wetland areas are designated as protected in Ilala, such as the wetlands of Kata ya Chanika (180 ha) and Kata ya Kinyerezi (67 ha) (URT, 2014a TSCP).

The rivers have been degraded due to the impacts of encroachment, erosion and sedimentation, effluents from waste water and runoff, and solid waste. The following is a summary state of conditions of each river (Table 6).

Encroachment of settlements into riverine corridors and catchment areas, the discharge of sewage and solid waste, sediment, sand mining, river bank erosion, deforestation and the impervious footprint of development have reduced the quantity and quality of water and the ecosystem as a whole. Recent studies have shown that several locations along the Msimbazi River are highly contaminated, making the river water unsuitable for potable water and the soil unsuitable for urban agricultural cultivation.



**Figure 14** Dar es Salaam Rivers and Streams  
Source: NEMC, 2009



**Figure 15** Dar es Salaam River Catchments  
Source: NEMC and UNEP, 2014



**Table 6** Dar es Salaam Rivers and General Character of Pollution

River	Character/Source of Pollution	Quality
Kizinga	Pugu catchment area. Only one used for surface water supply as has stable mean annual flow rate throughout the year. Exceeds Tanzania national standards for chemical oxygen demand and biological oxygen demand concentrations posing threat to drinking water quality.	Some parameters exceed Tanzania National Standards for drinking water quality.
Mzinga	Pugu catchment area. Unstable flow rate; higher in rainy season/lower in dry season. Sand mining is common. The Mbezi, a tributary, has been degraded by sand mining.	Meets the standard for domestic use.
Mpiji	Runs through less developed areas, less vulnerable to pollution. Sand mining is common.	Data on water quality is not available
Msimbazi	<p>Pugu Catchment and shallow groundwater are important water source for residents for drinking, bathing, agriculture.</p> <ul style="list-style-type: none"> <li>Industrial discharge of treated and untreated waste water, especially in Ilala.</li> <li>Ubungo, Vingunguti and Buguruni Waste Water Stabilization Ponds discharge their effluents directly to tributaries.</li> <li>Leachates discharge from closed solid waste dumps of Vingunguti and Tabata.</li> <li>Outfalls for storm water drainage systems that collect from industrial, residential, commercial, institutional areas, and informal sector activity premises.</li> <li>Effluents from on-site sanitation systems, mainly in residential areas, flow overland, through groundwater by seepage, and by outcropping on hillsides.</li> <li>Heavy metals in soil and water were determined at four points along river valley, indicating potential for pollution transfer to food chain as is popular for vegetable cultivation.</li> <li>Solid waste dumping from settlement areas.</li> </ul>	<p>Unsuitable for potable water. Coliform 1000 times safe swim levels at mouth of river.</p> <p>Concentrations of lead in the water exceed Tanzania Bureau of Standards and World Health Organization standards.</p> <p>pH as high as 12 compared to the legal standard of 8.5, a level which causes severe burns to skin.</p> <p>Chromium (VI) at 75 times the legal limit for waste water discharges, which can cause cancer and birth defects</p> <p>Indicators of disease causing faecal contamination which exceed the World Health Organization limits for safe use of waste-water in agriculture.</p>
Yombo	A small river with a basin area of 24.9km. Heavily polluted by industrial wastewater.	Lead contamination of waters due to high soil lead levels attributed to local vehicle emissions.

Source: NEMC and UNEP, 2014; URT, 2014a; URT, 2014b; Mwegoha, 2010; URT, 2014f; Hepworth and Joseph, 2014

- At the entry point to Dar es Salaam (at Kisarawe) the E.coli count is 75 to 100 per 100 mL of water, a relatively low amount indicating good quality water. However, at Selander Bridge, the coliform count is more than 1,000 times the level considered safe for swimming (coliform count between 250,000 and 400,000 per 100 mL of water) (UNEP NEMC, 2014). Fecal coliform indicates water contamination with human and animal excreta. High levels indicate serious health risks for diarrhoeal diseases which can be a particular threat to healthy childhood development (UN, n.d.a.).
- Settlements, such as those adjacent to the Morogoro Road crossing of the Msimbazi, have degraded river vegetation, filled portions of the river edge with sand and gravel, eroded soil and contributed significant sediment and effluent loads that degrade the river's habitat and water quality.
- The Msimbazi also has high concentrations of heavy metals in the water, such as lead, that exceeds WHO drinking water standards. Furthermore, the presence of heavy metals in soil and water indicates the potential for pollution transfer into the food chain, especially since portions of the Msimbazi river valley are popular for vegetable cultivation (Mwegoha, 2010).
- High values of chemical oxygen demand (COD) concentrations (range between 487 and 654 mg/l) have been observed indicating strong organic pollution. The Tanzania Bureau of Standards notes that maximum COD concentration should be 60 mg/l (Mwegoha, 2010).
- High levels of pollution in the rivers is evident from biochemical oxygen demand (BOD)<sub>2</sub> and dissolved oxygen (DO)<sub>3</sub> data. In some sections of the river, DO levels are lower than 5 mg/L, the minimum concentration required to support a diverse population of fish (NEMC and UNEP, 2014).

The city's rivers and streams receive waste water from sanitary facilities and from septic tanks of adjacent industrial and residential use. It is common to see tributaries of rivers including Mlalakuwa, Mbezi, Msimbazi and others flowing with sewage during the dry season. During rainy periods, sewerage from pit latrines or septic tanks is released into storm water and into the streams and rivers. The rivers are also used as illegal dumping sites for solid waste, a situation common in areas of high population density that lack solid waste management systems (NEMC and UNEP, 2014).



*Photos: Settlement encroachment of Msimbazi River, at Morogoro Rd. Crossing.*

*Source: AECOM*

## Overview of Aquatic Asset Trends

While the headwaters of Dar es Salaam's rivers are generally in good condition, the quality and ecological function becomes increasingly poor as they flow from the city's periphery through more populated and built-up settlements and areas of industrial activities. Threats to the overall health of the river will increase as development progresses towards the city's periphery and catchments become more populated.

Pollution data indicating significant impacts of wastewater and industrial and drainage effluents within two of the city's major rivers (Msimbazi and Kizinga) combined with unabated sand mining of river beds and the decline in forest coverage suggests that overall water quality parameters will continue to show deterioration. Furthermore, deteriorating water quality may likely become more common in river locations farther upstream.

Comprehensive baseline efforts such as the proposed Dar es Salaam Rivers Rehabilitation and Management Project are essential for documenting current ecological health, identifying threats and prioritizing actions which can prevent further degradation while promoting restoration of ecological functions. While the Dar es Salaam Rivers Project is focused on the Msimbazi, perhaps the study can serve as a model for data collection and analysis of the city's other major rivers and tributaries.

## C. Coastal and Marine Ecosystems

Dar es Salaam's coastline is approximately 100 km long, reaching from the Mpiji River in the north to Mpakani village in the south, and includes sandy beaches; rocks, cliffs and platforms; coral reefs, mangrove forests, estuaries, and seagrass-covered lagoons (Hartnoll, 1975; Kairu and Nyandwi, 2000) (UNEP, 2011).

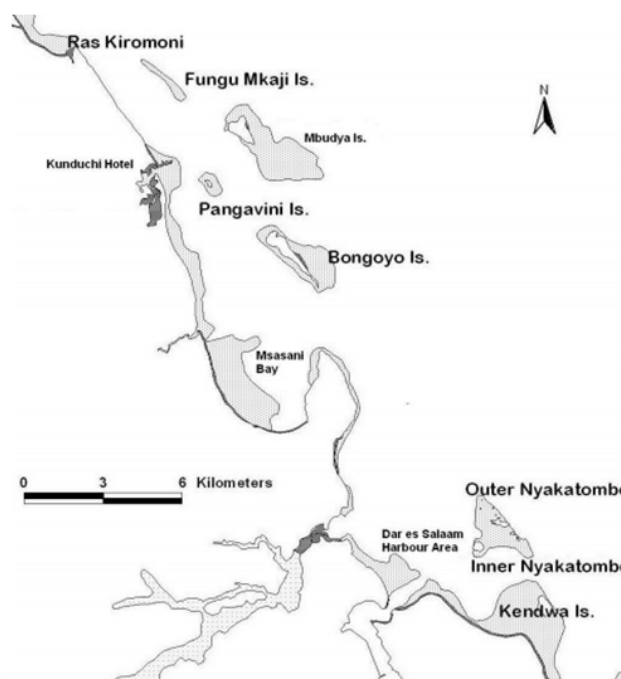
The coral reefs within Dar es Salaam's island and bay areas, established within the broader 26km<sup>2</sup> Marine Protected Areas designation in 1975, were found to have high diversity in the 1960s and 1970s. However, surveys in the 1980s and 1990s described general degradation due to destructive fishing techniques and tourism (Muhando, n.d.a). Studies in 1999 and 2000 noted that while live hard coral cover increased in most locations, the species composition changed (Muhando, n.d.a).

Furthermore, the city's marine system provides habitat for endangered species including marine turtles, hawksbill (*Eretmochely imbricata*) and green turtle (*Chelonia mydas*), sea turtle, dolphins, humpback whales and whale sharks (URT, 2011 as referenced in URT, 2014d).

**Surges of beach erosion have been recorded at numerous locations along Dar es Salaam's coast since the 1970's (Figure 16).** Areas that are known to be severely affected by beach erosion include the Kunduchi (north of Dar es Salaam) and Bahari beaches (Figure 16) (Griffiths and Lwiza, 1988; Masalu, 2002) (Kebede and Nicchols, 2010). Beach erosion has also been identified as a severe threat to Dar es Salaam's coastal areas at Ununio, Mbweni, Kimbiji, Kigamboni, and Vijibweni coastal areas (Samaki, 2015). At the Kunduchi beach area, the coastline has retreated about 200m over the last 50 years (Casmiri, 2008), while the average rate of erosion for the city area has been estimated about 3 – 5 m/year (Fay, 1992) (Kebede and Nicchols, 2010).

**Mangrove forests exist throughout coastal areas of Dar es Salaam, but are considered highly threatened, particularly in Temeke District.** Kinondoni District supports 314 ha of mangroves (Kunduchi Creek with 68.7 ha; Ras Kiromoni 20.2 ha; and Mbweni area 100.6 ha) while Ilala sustains 39ha of mangrove forest with the majority located in one stand at the mouth of the Msimbazi river (Samaki, 2015).

Temeke District has the most extensive coverage of mangrove forest (see Table 7) with 7 distinct forests covering more than 2,000 km<sup>2</sup>. However, mangrove forests in Dar es Salaam face considerable threats to forest decline due to exploitation and uncontrolled use (Samaki, 2015).



**Figure 16** Locations of Reported Beach Erosion (areas of erosion in lighter shading and sand accretion the darker shading)  
Source: Nyandwi, 2010

**Table 7** Mangrove Forests within Temeke

Forest Number	District	Area (in hectares)
1	Mbezi River	570.3
2	Mbuyuni	476.7
3	Shugu/ Mtandika	270.8
4	Ras Dege	245.0
5	Mbwa Maji	29.6
6	Mji Mwewma	80.9
7	Mtoni	378.4

Source: URT, 2014c TSCP  
(reference to Dar es Salaam Marine Ecology Conservation Project)

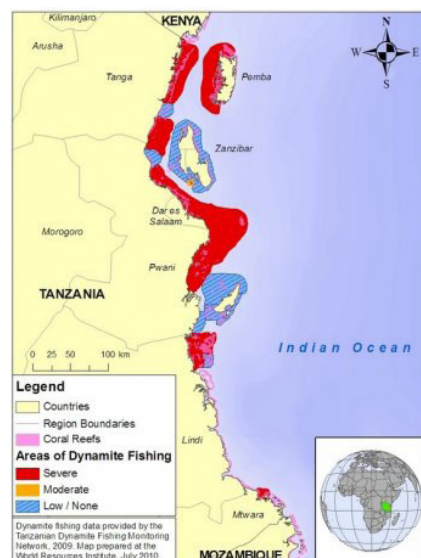
Most mangrove forests, including Kunduchi, Mbweni and Mtoni, were harvested intensely in the 1990s and 2000s, resulting in severe fragmentation. The area of mangrove forest decreased from 2,516 hectares (Semesi, 1991) to 2,170 hectares (TCMP, 2001), along with a considerable decrease in density, height and canopy cover. In addition, Dar es Salaam has been losing coastal beach habitat due to coastal storms (City Links, 2014).

**Opportunity exists to restore mangrove forests at Kinondoni.** A 2008 survey by NEMC revealed some recovery of the density of mangrove trees at Kinondoni after government and stakeholder conservation initiatives (UNEP, 2011).

The coastal and marine systems have suffered from the degradation of land and aquatic systems that have caused sedimentation and high turbidity. The deteriorating aquatic system has had a major impact on the fishing industry, a significant source of livelihood in the city. Aquatic resources have been polluted from the discharge of urban sewage and effluents, subject to invasive flora and fauna, and depleted and/or exploited by dynamite fishing methods (Figure 17)(UNEP, 2011).

**Pollution of beaches and coastal waters is a growing concern due to upstream solid waste disposal and discharge of heavy metals, oil and industrial wastes that flow untreated from city rivers and stormwater (Samaki, 2015).** Large amounts of sediment, nutrients and other pollutants are deposited throughout the year by Dar es Salaam's rivers into near-shore waters, polluting the city's coastal beaches and inter-tidal mud flats. Areas experiencing beach and nearshore pollution include Selander Bridge Beach, Ocean Road Beach, Mbagala Kuu and Mjimwema (Samaki, 2015).

Locally, Ilala's coastal waters face considerable sewage pollution from Aga Khan Hospital; coastal effluents in Temeke are from KTM Textile industry, Dar es Salaam port and Kigamboni refinery plant; while Kinondoni's coastal assets are degraded by wastes from tourist hotels (Samaki, 2015). Periods of heavy rainfall (March to May) bring the largest volume of pollution into Dar es Salaam's coastal waters, and resources from oil, heavy metals, industrial and sewage pollution have been ranked among the most severe threat according to the 2015 Coastal Rapid Impact Assessment (Samaki, 2015).



**Figure 17** Areas of Dynamite Fishing  
Source: World Resources Institute, 2010

## Overview of Coastal Asset Trends

Dar es Salaam is unique among cities globally as one of the few cities that contain a marine reserve system of islands, coral reefs and bays. While studies of coral reef health suggest that trends of coral reef growth are improving, mangrove destruction and surges of beach erosion reflect a depletion of coastal and marine assets. Dynamite fishing and increasing water temperatures associated with climate change might likely reverse any recent coral reef recovery due to reef destruction and coral bleaching. Furthermore, the continued release of effluents from Dar es Salaam's wastewater collection system and the steady input from polluted rivers draining the city suggest future trends of further coastal asset degradation.

Comprehensive inventories and assessments of the coastal and marine assets can strengthen the baseline understanding of existing conditions, such as the Kinondoni Integrated Coastal Area Management Project and projects from the World Wildlife Fund. Also, continued investment in these coastal area studies can enable identification of opportunities for resource enhancement, such as banning sand mining and restoring mangrove forests, along with the capacity and resources for long-term implementation and environmental management.



## D. Air Quality

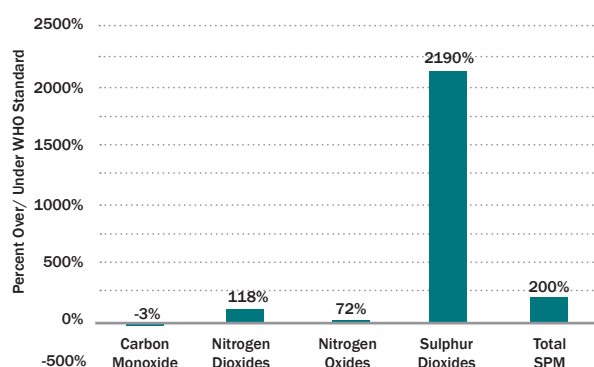
The local air quality of Dar es Salaam is driven by coastal and inland air circulation zones. Coastal area air patterns help to mix air and dissipate most pollution concentrations (ICF, 2009). Inland areas can retain concentrations of air pollutants that can impact ecosystem and human health. Cars and gasoline-burning engines are a large source of volatile organic compounds (VOCs) and nitrogen oxides (NOx) from the fossil fuels.

Based on limited available data, most recent measures of air quality indicators are exceeding WHO recommended limits.

The quality of urban ambient air quality was assessed in a 2010 study by measuring the levels of the atmospheric pollutants sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), carbon monoxide (CO), nitrous oxide (NO) and suspended particulate matter (SPM) at different localities within the city. The sites were selected to cover industrial, commercial, residential, and tourist-beach areas. The study confirmed that persons working or just walking along the Gerezani area, Uhuru Street and Askari Monument Road junction were being exposed to high levels of NO<sub>2</sub>, SO<sub>2</sub>, CO and SPM (Figure 18). Most of these exceedances are attributable to transportation emissions. The concentrations of particulates were consistently high at Gerezani, Kariakoo, and at Askari Monument and Muhimbili (MMC) (Table 8) (Othman, 2010).

When Dar es Salaam air quality study results were compared to results from earlier studies, the pollutant levels showed an increasing of pollutant exposure to Dar es Salaam City residents. (Othman, 2010). A review of prior air quality studies at discrete locations in Dar es Salaam shows levels of Nitrogen Dioxides and Sulphur Dioxides that have consistently exceeded WHO standards, particularly at inland and industrial locations such as Kariakoo and Gerezani. However, coastal location such as Kunduchi Beach Hotel have generally had less air quality degradation due to coastal breezes.

The Urban Air Quality Monitoring Capacity Building Project (ARMCBP), initiated in Dar Es Salaam with UNEP support, monitored five locations in the city in 2007 for particulate matter 10 (PM<sub>10</sub>), NO<sub>2</sub>, SO<sub>2</sub>, and O<sub>3</sub>. Unlike the studies in Table 9, the UNEP study found that only PM<sub>10</sub> levels exceeded Tanzania and World Health Organization standards (URT, 2014a TSCP). The UNEP study also attributed the high PM<sub>10</sub> levels to increased traffic volume, industrial activities and suspended roadway dust from unpaved surfaces (URT, 2014 a, b).



**Figure 18** Roadside Ambient Air Pollution Levels

Source: O.C. Othman, 2012

The degradation of air quality promotes formation of ground-level ozone that can be harmful to people, animals, crops, and other materials by inhibiting respiratory systems and altering cellular formation (US EPA ground level, 2014). Ground-level ozone also interferes with the ability of sensitive plants to produce and store food; visibly damages the leaves of trees and other plants, harming the appearance of vegetation in urban areas, national parks, and recreation; leads to increased susceptibility of sensitive plant species to disease, damage from insects, effects of other pollutants, competition, and harm from severe weather; and causes adverse impacts on ecosystems, including loss of species diversity and changes to habitat quality and water and nutrient cycles.

### Overview of Air Quality

Based on the limited available data, it is clear that some indicators of air quality in Dar es Salaam are exceeding national and WHO standards. Since exceedences such as suspended particulate matter, SO<sub>2</sub> and NO<sub>2</sub> are largely attributed to transportation emissions, roadside air quality is likely to continue to degrade as the vehicle population continues to increase on unpaved roads (See Drivers Section on Emissions). Furthermore, the combination of industrial production within areas of high vehicle presence seems to yield considerable exceedences of standards, such as at Kariakoo and Gerezani.

Dar es Salaam's coastal areas appear to provide a moderating effect on air quality parameters; however, further study over time across a full range of air quality parameters will confirm the accuracy of locational findings.

**Table 8** Air Pollutant Levels in Dar es Salaam as Reported in Literature

Site	NO <sub>2</sub> (ug m <sup>-3</sup> )	SO <sub>2</sub> (ug m <sup>-3</sup> )	SMP (ug m <sup>-3</sup> )	CO (mg m <sup>-3</sup> )	Reference
Askari monument	298	872	414	---	Othman (1996)
	250	3290	187	---	NEMC (1992)
	---	3968	---	---	Mwakibete (1991)
	43.7				Henricson (1999)
	44.8			7.4	Musabila et al. (2003)
	1000	9867	762	9.7	This study (2010)
Gerezani	497	1886	723	---	Othman (1996)
	428	3352	692	---	NEMC (1992)
	5110	1687	---	---	Othman (1991)
	59.8			9.6	Musabila et al. (2003)
	567	9833	1175	15.3	This study (2010)
Kariakoo	288	1520	782	---	Othman (1996)
	249	3323	757		NEMC (1992)
	733	10533	1134	18.0	This study (2010)
MMC	290	1662	136	---	Othman (1996)
	200	3319	609		NEMC (1992)
	42	4757	187	1.8	This study (2010)
Kunduchi B Hotel	75	309	78	---	Othman (1996)
	187	1230	85		NEMC (1992)
	20	235	77	0	This study (2010)
Several sites	<53	<1385	<1161	---	Jackson (2005)
WHO guide value	200	350	230	10	

Source: O.C. Othman, 2012

The ARMCBP's initial inventory of air quality data is a key step in helping to establish a baseline understanding of urban development impacts on air quality. Regular monitoring that builds upon this project and other earlier studies can help the city develop a more comprehensive understanding of how air quality changes over time in light of development and environment changes in the city.

Dar es Salaam has developed an accounting of greenhouse gas emissions for January 2012 through April 2014, however, this information has not yet been made available (CDP, 2014). A greenhouse gas inventory is essential for assessing Dar es Salaam's contributions to global climate change. Furthermore, a baseline GHG inventory will enable the City to identify opportunities for improved energy-efficiency that can reduce operating costs and enhance adaptation and resilience to climate change impacts.

## IV. DRIVERS OF ENVIRONMENTAL VULNERABILITY AND DEGRADATION

Drivers of environmental degradation are identified and described in this section. While environmental degradation in Dar es Salaam is the result of numerous drivers, the drivers described below have emerged from discussions with key stakeholders and review of existing literature as having direct actions which impact the quality and condition of the environmental assets described in Section III. The key drivers of degradation in Dar es Salaam include informal settlement, the extraction of natural resources, solid waste management, effluent, the extraction of water, and emissions.

### A. Informal Settlements

***The majority of urban spatial expansion of Dar es Salaam has occurred without guidance and has manifested as informal settlements throughout the city. Approximately 70%-80% of the population now resides in the dense, unplanned areas that are typically located in environmentally vulnerable areas such as those prone to flooding (Prime Minister's Office, 2013a; Kyessi, 2010).*** Informal developments are characterized by rapid, unstructured, unplanned and unserviced growth (Kyessi, 2010). They are usually located in areas intended for recreational purposes; relocated from designated areas; or result from other exploitative strategies by developers. This increase in haphazard patterns of urban growth has caused economic inefficiency, environmental degradation and negative impacts to human quality of life. Large numbers of households live without access to safe water and quality sanitation and infrastructure; secure property tenure; or adequate opportunity to participate in government decision-making processes (*ibid*).

Dar es Salaam has over 100 unplanned housing areas covering an area of at least 5,197 hectares (Kyessi, 2010). The settlement pattern includes small planned areas within the large unplanned urban landscape. Landowners informally subdivide and sell their land to small-scale developers. Detached (single story) buildings have predominated, very low population densities although existing unplanned areas continue to densify, and some of the more accessible areas are undergoing gentrification (Kyessi, 2010).



*Photos: Environmental degradation in informal urban peripheral expansion areas due to a lack of infrastructure services.  
Source: AECOM*

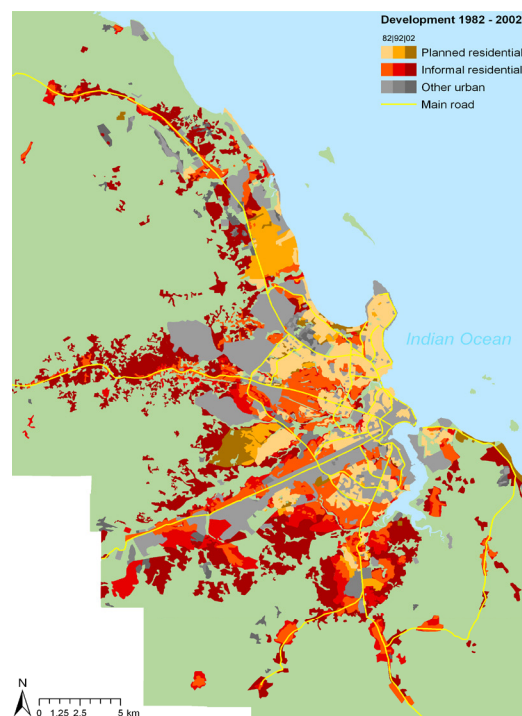
Growth in Dar es Salaam's periphery is expected to continue in a similar pattern of development, bringing further degradation to the existing vegetation, land and aquatic resources (Figure 19 and Figure 20). A closer look at projected growth reveals considerable densification of river valley catchments, threatening the future ecological health of the city's waterways. Residential development is by far the largest land use in the city, occupying 167,772 hectares (URT, 2013). The informal residential areas occupy 75% of the total residential area, including informal regularized (15,506 ha), informal consolidated (31,750 ha), and informal scattered (71,355 ha). Planned residential occupies 49,160 hectares (Moss and Happold, 2013).

Unplanned areas have shown a continuous growth trend since 1979, when there were 25 areas, increasing to 40 in 1990, 50 in 2000, 54 in 2004, and more than 100 areas by 2014 (Lupala, 2002; URT, 2005; Kyessi, 2010). Informal settlements are anticipated to continue to expand spatially along the city's radial growth pattern (Figure 20) (Prime Minister's Office, 2013) (Hill and Linder, 2010).

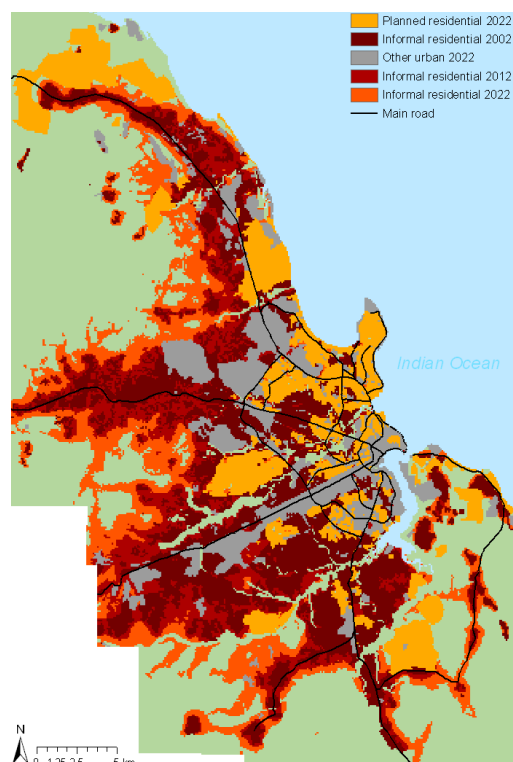
The characteristics of unplanned and un-serviced areas in Dar es Salaam vary significantly. They are classified as: (i) high density, mostly found in central and strategic locations; (ii) medium density, usually located in the immediate periphery of the city center and in the process of ongoing densification; and (iii) low density, mainly in the outer rings of the city. The land in low-density areas is still partly used for agriculture. This leads to frequent flooding, soil erosion, ground water and air pollution, public safety issues, high cost of services such as potable water, long walking distances to water points, and lack of health services, schools, and playgrounds for children.

The outward expansion of development into peri-urban and peripheral areas requires expansion of infrastructure services such as drainage, sewage and roads in order to service new settlements. However, infrastructure development is not keeping pace with settlement, resulting in the degradation of environmental assets through unplanned activities such as road construction, which erodes fragile coastal forest edge, contributes sediment to rivers and conveys solid wastes and untreated effluent.

**Informal settlement has negative impacts on human health.** Cholera was found to have a high incidence of transmission in informal settlement areas due to population density which promotes direct transmission from person to person (Figure 21) (Penrose et al, 2010).



**Figure 19** Development 1982-2002  
Source: Hill and Linder, 2010



**Figure 20** Planned and Informal Residential 2012-2022  
Source: Hill and Linder, 2010



Hospital and dispensary health statistics indicate the prevalence of water borne disease, vector borne disease and parasites, infections, and malnutrition in informal settlements. The high incidence of diarrhea, intestinal worms and gastroenteritis are indicators of poor sanitation conditions and contamination of food and soil with human excrement. Poor personal hygiene is also evident from the fact that water-washed diseases (e.g., infectious skin and eye diseases) are widespread, as are fecal-oral diseases such as diarrhea and dysentery.

## B. Extraction of Natural Resources

***The dependence of urban-based livelihoods on extraction of the city's natural resource base continues to drive both decline and depletion of the environmental assets.***

Extractive activities include fishing, harvesting of trees, sand mining, quarrying, and, to a lesser extent, the harvesting of medicinal plants. Dynamite fishing, coral and sand mining, mangrove cutting, and seaweed farming have a marked effect on degradation of the coastal environment (URT, 2009). The major pressure causing coral reef degradation in Dar es Salaam coast is dragging of seine nets and dynamite fishing (UNEP, 2011).

Fishing has been a major economic activity in the city of Dar es Salaam, contributing about 29 per cent of the city GDP (BOT, 2007). Each municipality has several landing sites along coastal villages to support the fishing industry, including: Kunduchi, Msasani, Mbweni and Ununio in Kinondoni municipality and Kigamboni, Buyuni and Mtoni Kijichi in Temeke municipality. A ferry fish market in Ilala municipality also serves as a landing site during peak catches (UNEP, 2011).

The average annual catch is approximately 7,855,134 kilograms of fish worth Tsh 2,386,198,400 (Table 9). Countrywide, the number of fresh and marine fishermen has more than doubled between 1993 and 2006, placing further pressure on marine resources (URT, 2007a). (UNEP, 2011)

***A driver of deforestation has been the increasing use and preference for using charcoal and household fuel.*** From 1991-92, 51% of households used charcoal as the primary fuel; usage increased to 69% in 2000-2001 and 78% in 2007 (Malimbwi and Zahabu, 2008). Usage levels in 2009 included 200,000-300,000 bags (avg. 50 kgs) of charcoal per month (URT, 2009). More recently, in 2012, 94% of households relied on firewood and charcoal as primary fuel. The increase in charcoal use reflects lower costs than alternative fuels and is easily available in forests (Household Budget Survey, 2012).

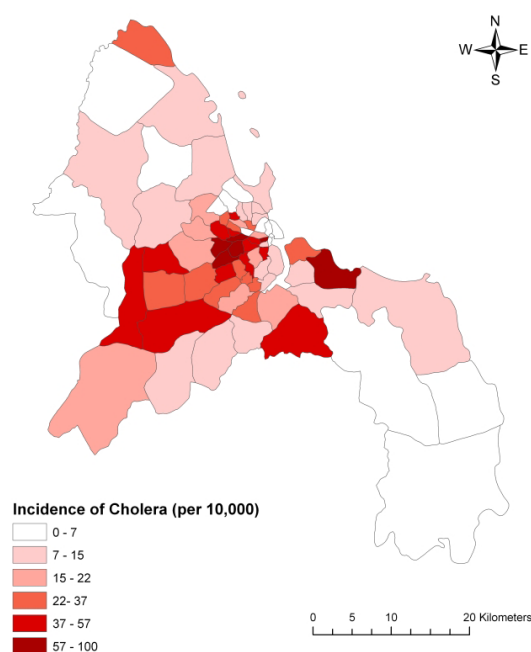


Photo: Charcoal Making in the Forest  
Source: CCIAM, 2013

**Table 9** Fish Catch in Dar es Salaam

Year	Quantity (Kg)	Value (Tsh)
2006	6,224,786	1,873,436,000
2007	8,410,336	2,102,584,000
2008	8,395,185	2,269,096,000
2009	7,847,897	2,746,764,000
2010	8,397,463	2,939,112,000
Total	39,275,668	11,930,992,000
Average	7,855,134	2,386,198,400

Source: UNEP, 2011



**Figure 21** Cholera-prone Areas in Dar es Salaam  
Source: Ardhi University, 2011

Charcoal is also the major source of energy for hotels, bars and small-scale food vendors (Table 10) (World Bank, 2011). This has resulted in deforestation, woodland degradation, habitat destruction, loss of biodiversity, environmental pollution, all having significant impact on catchment areas and the loss of carbon sequestration potential (URT, 2014b TSCP). Collectively, this is equivalent to a loss equal to at least 2 percent of Tanzania's gross domestic product. Use of charcoal creates indoor air pollution, due to crowding and poor ventilation in the informal settlements, which impacts the respiratory health of residents of these neighborhoods. It also contributes to greenhouse gas emissions (World Bank, 2011).

While mangroves in Kinondoni are threatened by salt mining activities, the Kinondoni Integrated Coastal Area Management Project (KICAMP) has formulated a comprehensive plan for the coastal area, resulting in a ban on sand excavation in critical areas (World Bank, 2014).

***Mangroves are also harvested for firewood and charcoal-making, salt and lime production, building poles, and clearing for building sites for urban expansion and agriculture, road construction and hotel construction, as is evident at Kunduchi, Mbweni and Ununio areas (UNEP, 2011). Various types of pollution such as municipal sewage, garbage and oil pollution are also a threat. (URT, 2009d).***

The rapid growth of the population and economic activities in Dar es Salaam city are driving the demand for new buildings and infrastructure construction requiring sand, limestone, and clay. Due to the scarcity of sand, there has been an expansion of illegal sand mining. While mining activities are regulated by the Government, including government-designation of mining areas and issuance of licenses, enforcement is inadequate (UNEP, 2011). Data on the extent of mining and quarrying is limited, but it is common to see people mining sand for sale (Malele, 2009). Sand mining occurs along the coast at Kunduchi Beach. Exploitation activities are also undertaken along major river valleys, which lead to erosion of riverbanks and land degradation. Inland areas of rivers along the Msimbazi, Tabata, and Malalakuwa are also freely mined.

Mining at the Kunduchi quarry site for aggregates and stone for building construction purposes, Kunduchi Stone, and in Kibugumo, Boko-Magereza and Bunju ended when the site was closed in 2008. Limestone is quarried from Wazo/Kunduchi outcrops for the local cement factory (see photos). Clay is extracted from the upper Msimbazi River valley for the manufacturing of bricks. Salt is mined at the shore of the Indian Ocean for domestic consumption.

**Table 10** Household Fuel Preferences

Type of Fuel	Fuel Preference (%)		
	1991-1992	2000-2001	2007
Charcoal	51	69	78
Kerosene	28	25	13
Electricity	15	4	5
Firewood	1	2	4

Source: CHAPOS, 2002, in Malimbwi and Zahabu, 2008



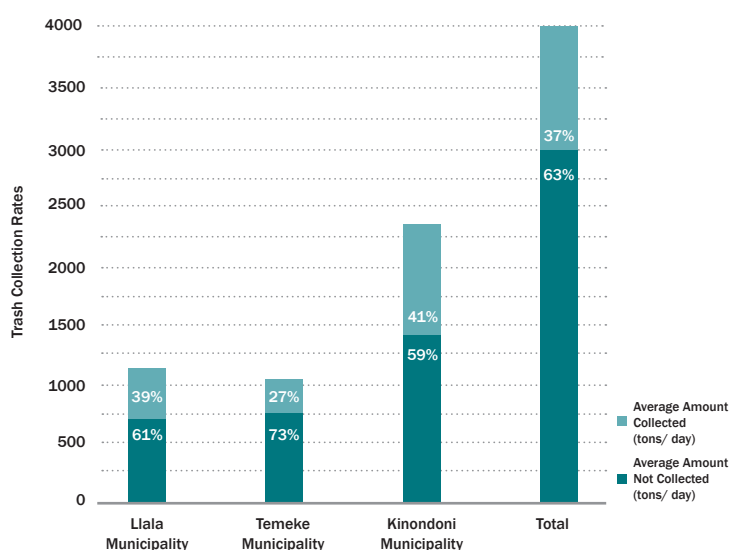
Photos: Informal settlements, established on closed quarry site, without proper stabilization.

Source: Professor Kyessi, 2014

## C. Solid Waste

**About 60% of waste generated in Dar es Salaam remains uncollected and may end up in storm water drains, contributing to pollution of runoff water, rivers and coastal waters and exacerbating annual flooding events and the spread of disease.** While implementation of Sustainable Dar es Salaam's solid waste management reforms increased waste collection from 21% in 2001 to 40% in 2007, solid waste management services are still basic in most unplanned areas.

The rate of collection within each municipality varies (Temeke (27%), Ilala (39%) and Kinondoni (41%)) with the city-wide total average rate of collection at approximately 37% (Figure 22). While the data in Figure 22 is more current than the data below from 2010 (Table 11), both data sets generally correlate to an average rate of collection of approximately 40% across the City. (Ilala Municipal Council, 2012) (URT, 2014a. TSCP b. TSCP, c.TSCP). In more affluent areas of the city, waste is generally collected curbside by local authorities or private operators and transported to the city's only landfill at Pugu. In less affluent areas the waste is picked up by handcart for delivery to neighborhood collection sites where local authorities or private sector services pick up the waste and transport it to Pugu (Breeze, 2012).

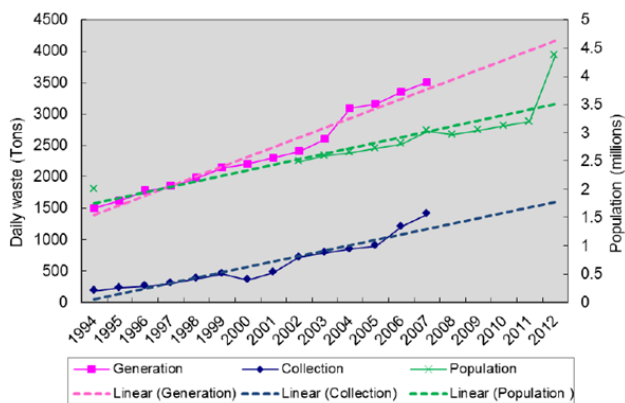


**Figure 22** Solid Waste Generation and Collection Rates by Municipality  
Source: Ilala Municipal Council, 2012; URT, 2014a TSCP, bTSCP, cTSCP; AECOM

**Table 11** Disposal of Municipal Solid Wastes by Municipality

	Ilala		Kinondoni		Temeke		Totals	
Method of Disposal	Average (tons/ day)	% of Total Volume	Average (tons/ day)	% of Total Volume	Average (tons/ day)	% of Total Volume	Citywide Total Waste Per Day (tons)	% of City Wide Total
Amount of Solid Waste Transported and Disposed to the Pugu Kinyamwezi Sanitary Landfill	430	39	458	23	280	27	1,168	28%
Amount Recycled or Reused	176	16	365	18	5	0.5	546	13%
Amount Controlled with On-Site Disposal	250	23	507	25	10	10	767	18%
Amount Remaining Without Control	244	22	696	34	737	71.5	1,677	40%
Disposal of Incinerate	-	-	-	-	-	-	-	-
Total	1,100	100	2,026	100	1,036	100	4,158	100%* Rounded

Source: Dar es Salaam Infrastructure Development Programme, DCC, 2010  
Only one operating landfill at Pugu serves as the disposal source for the city's collected waste.



**Figure 23** Trends in Population with Volumes of Waste Generated and Collected 1994-2012

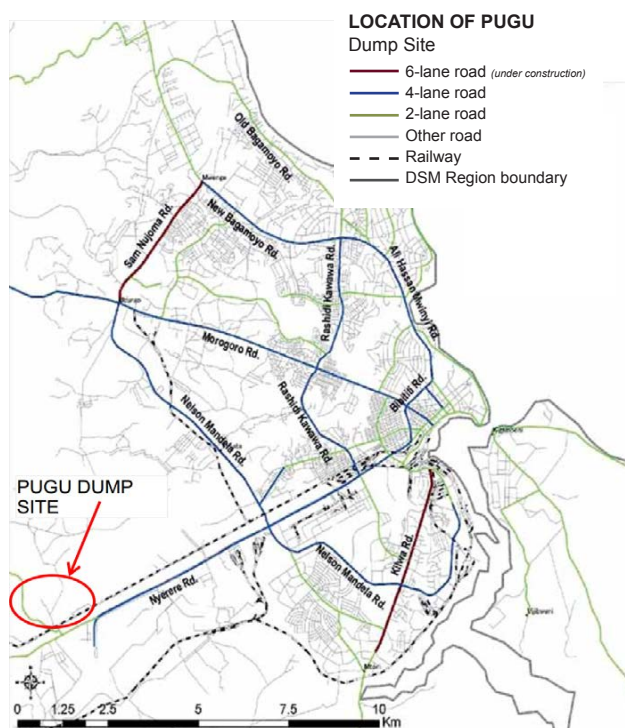
Source: Jones, 2013

Data from each municipality shows that 40% of uncollected waste remains uncontrolled while 18% or approximately 767 tons per day is controlled on site by burying or burning (Table 11). Approximately 13% or 546 tons of waste per day is recycled or reused.

The lack of services, such as a comprehensive network for waste collection, transfer stations, and transport and disposal systems leads to waste being dumped in riverbanks, drainage canals and open spaces. Ambiguous governance that results in unclear bylaws related to short-term contracts and waste collection charges are further reasons why collection rates remain low (Jones, 2013).

**Waste generation is likely to continue to grow with the population and even exceed the rate of collection projected through 2012 (Figure 23).** It is estimated that Dar es Salaam could generate more than 12,000 tons per day by 2025, representing a tripling of the waste generated in just 14 years. Of further concern is the significant cost per ton among municipalities within the city for collecting only 40% of waste generated (Breeze, 2012).

**The main reasons for the failure to collect solid waste are lack of equipment, low priority given to solid waste services by municipalities, inadequate financial resources, inaccessibility of areas, lack of space for transfer stations in informal areas, lack of small-scale industrial sector economy/market for processing wastes (recycling) and lack of national policy and legislation on recycling (URT Rio+20, 2012).** Local municipal entities have authority under the proposed Environmental Management Act to plan, design, build, establish standards, manage, monitor, evaluate and report on municipal solid waste operations and have drafted a plan based on capacity and available resources. Dar local authorities note that there are upwards of 50 to 60 neighborhood collection sites across the city. Twenty-six planned Wards, 64 unplanned Wards and several hundred sub-Wards are responsible for the collection of solid wastes and related fee collection through formation of community-based organizations (CBOs) to establish and operate community or private waste collection systems at the neighborhood level. However, building reasonable capacity for collection and handling of waste at the Ward and sub-Ward level has been challenging (Breeze, 2012).



**Figure 24** Location of Pugu Dump Site

Source: Ardhi University, 2010



The 65 hectare landfill is located on the city's periphery (near the headwaters of the Msimbazi River and Pugu Forest Reserve) requiring considerable transport costs from Kinondoni, the CBD, and Temeke (Figure 24). The open dumpsite is not lined and does not meet basic environmental controls as waste are scattered across the surface without application of daily or monthly cover material to keep wastes from spreading by wind and birds (Prime Minister's Office, 2013). Open fires are burning across the site while compaction efforts are limited as bulldozers spread waste after it has been searched through by waste pickers (Breeze, 2012).

**Inadequate facility management at Pugu Landfill has compounded environmental problems as the leachates from the existing dumpsites discharge directly into the existing watercourses (Table 12).** All parameters of groundwater quality measured at Pugu (per Table 12) indicate high levels of pollution in groundwater and impacts on surface waters (Mato, 2002; Prime Minister's Office, 2013).

Four of the city's closed landfills still contribute to degradation of environmental assets through leachate and illegal dumping. The Tabata Ward site in Ilala currently has a residential community settled on top of the closed landfill and there is evidence of groundwater leachate flows to nearby watercourses (Prime Minister's Office, 2013). Also, illegal dumping has been observed at Kigogo (Breeze, 2012).

Methane gas, a high intensity greenhouse gas, is generated and released by landfills. Mtoni landfill has a gas capture facility that has mitigated some release of greenhouse gasses by capturing gasses for generating approximately 2.5 MW of electricity (URT Rio+20, 2012). However, this facility ceased operations in 2012 (Chacha, 2015).

Landfill closure processes can take years for full settlement and release of methane gasses from decomposition. Prior to full closure, gas leaks and structural concerns of landfill settlement remain risks to environmental and community resources (US EPA, 2007).

**The high organic composition of Dar es Salaam's solid waste is a driver of water quality degradation.** Studies confirm that about 40-45% of the wastes are organics from kitchens and 10% are yard wastes, while the rest of the wastes are less organic materials such as plastics (2%), metals (1.7%) and ceramics / stone (.3%) (Table 13) (Breeze, 2012; Ilala Municipality Study, 2012).

**Table 12** Estimation of Pollution Loads to Groundwater at Dumpsites in Dar es Salaam

Dump-Site	Area (ha)	Pollution Loads (x 100, tons/year)			
		COD	BOD <sub>5</sub>	TOC	NH <sub>3</sub> -N
Pugu Kajiungeni dumpsite	50	450	42	240	156
Kunduchi (New MECCO) (closed 2010)	32	268.8	26.9	153.6	99.8
Vingunguti (closed in 2001)	10	84	8.4	48	31.2
Tabata (closed in 1992)	6	50.4	5	28.8	18.7

Source: Groundwater Pollution in Urban Dar es Salaam, Tanzania by Mato, 2002

**Table 13** Composition of Waste in Dar es Salaam

Waste Components	Wet Weight (%)
Kitchen Waste	45
Grass/wood	25.1
Papers	4.1
Ceramic and stones	0.3
Metals	1.7
Plastics	2.0
Glass	2.9
Leather and rubber	1.0
Textiles	1.1
Others	17.1
Total	100

Source: Prime Minister's Office, 2013

The high composition of organic solid waste in a city where 40% of the waste generated remains uncontrolled, can cause considerable nutrient loading of drainage channels and rivers, once the waste is transported into Dar es Salaam's water bodies. The resultant nutrient concentrations contribute to high nutrient levels observed in rivers throughout the city (NEMC and UNEP, 2014). Though the city does not have a large-scale compost facility, this high organic composition of waste suggests considerable opportunity for managing waste and nutrient loads through large-scale compost collection and processing (Jones, 2013).



On-site uses include: pit latrines (73%), septic tanks (19%) with soak pits system and constructed wetlands to treat wastewater and the remaining 0.4% have no toilet or use bush/field (National Bureau of Statistics, 2013) (Mahenge, 2014). Many residents in informal areas discharge waste water directly into streams as they cannot afford the cost of pit latrines. Also, pit latrine leachate contaminates surface and ground waters via leaks and overflows of latrine systems during flooding. Wastewater has been found to impact Dar es Salaam's groundwater reserves, compromising this secondary drinking water resource (URT, 2014a).

A 2010 study of 45 wards found that the percentage of informal residents lacking improved sanitation ranged from 71.7 to 97.3%, with a mean of 92.4% (World Bank, 2011). In heavy rains the pit latrines tend to overflow and human excreta spreads into settlement areas, and waterways, and seeps into the ground. Due to the high water table and poor drainage system, this polluted water can remain un-drained in the settlement for a long period of time, a major factor in disease prevalence in the settlements (World Bank, 2011).

## Stormwater

**Where drainage infrastructure does exist, more than 50% is in poor condition (Table 15).** The existing drainage network covers central Dar es Salaam and has outfalls onto the estuary and Msimbazi River. This network is being extended inland with new connections, but the central Dar es Salaam existing drains are not being sufficiently upgraded to deal with the increasing overland flow due to rapid urbanization. The Dar es Salaam City Council indicate that of the 825 km of installed drains, only 422 km are in good condition. There is frequent clogging of drains due to poor maintenance and insufficient protection from silt, solid waste and/or construction debris (Dar es Salaam Masterplan, 2012-2032).

**Drainage corridors used for waste dumping further deteriorate drainage functions.** Clogging of drainage corridors causes inefficient stormwater drainage. This condition is prevalent in the informal areas where there is no solid waste collection or sewerage (URT, 2014b). The Community Infrastructure Upgrading Programme (CIUP) is one of the most recent initiatives aimed at improving infrastructure in unplanned settlements. Dar es Salaam was a pilot case study undertaken through the Local Government Support Project. The program focused on upgrading basic infrastructure and services in low-income settlements while increasing participation in planning and development to improve sustainability, foster accountability, and strengthen capacities of local authorities (Kyessi, 2010).



Photo: Solid waste collected in drainage channel  
Source: AECOM

**Table 15** Existing Surface Water Drainage System

Municipality	Total # Drains	% Poor Conditions
Kinondoni	443	38%
Ilala	157	58%
Temeke	225	53%

Source: Moss and Happold, 2013; AECOM

Lack of regular maintenance, illegal construction of additional structures, and the practice by residents of dumping refuse into the drains has led to deterioration of drain function (Prime Minister's Office, 2013). In informal settlements, alleyways are often too narrow to enable waste collection trucks to enter; thus, waste disposal is a major problem and waste is often dumped into ditches and drains, or alongside drainage channels, obstructing flow. Even though per capita water use in Dar es Salaam is fairly low, waste water and fecal disposal remain problematic. Moreover, with rains concentrated during a few months of the year, stormwater drainage is particularly precarious. During these months, overflowing rivers, roads, and latrines create transport and mobility problems, and contribute to the spread of fecal pollution (Kyessi, 2013).





Photo: Drainage ditches collect sediment, solid waste and animal wastes, concentrating these pollutants and conveying them through flood events downstream.

Source: AECOM

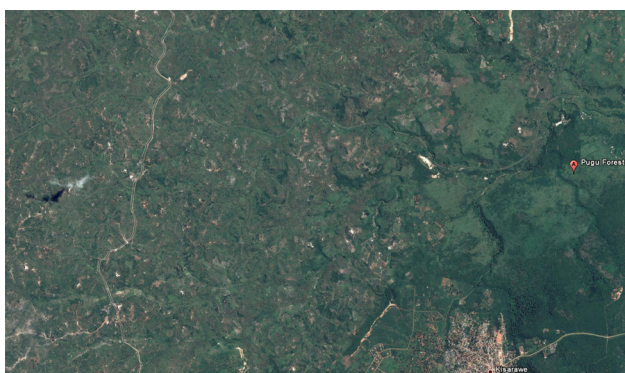


Photo: The catchment for the headwaters of the Msimbazi, located in the Pugu Forest, has low fecal coliform counts due to the limited amount of development in the area. Source: Google Earth, 2014

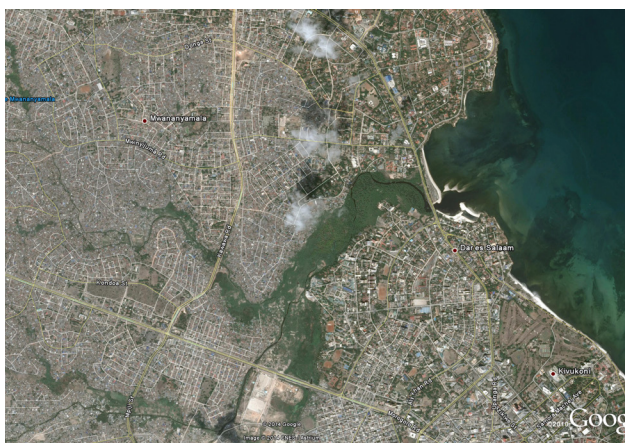


Photo: Msimbazi River outlet at Indian Ocean where fecal coliform counts, due to effluents from upstream areas, register more than 1,000 times safe swimming levels.

Source: Google Earth, 2014; NEMC and UNEP, 2014

## Effluent Case Study: Msimbazi River

The extensively built environment within the Msimbazi catchment and along its edges (see photos on right) has contributed to flooding and flows of wastewater and storm water effluent into the Msimbazi River (Hepworth and Joseph, 2014). These pollution impacts have been severe and the level of pollution and degradation of the riverine corridor is well established (see Table 6). These flooding impacts are also anticipated to be exacerbated by climate change.

The following is a case study analysis of the cumulative impact of urban development on the river, from when it enters Dar es Salaam near Pugu landfill on the far left, to when it exits Dar at the Ocean, highlighting the need for an integrated approach to urban and infrastructure planning. The graphics are diagrammatic to illustrate the concepts and do not represent technical analysis of the topography, drainage, or infrastructure systems.

The Msimbazi River extends from headwaters in the Pugu Forest catchment area to the Indian Ocean and has three tributaries that connect with the main river, with an overall basin area of 240km<sup>2</sup> (URT, 2014a TSCP) (Figure 26).

Figure 27: Development encroachment, primarily of informal settlements within the lower catchment area along the Msimbazi and its tributaries, has degraded the overall land area, causing erosion and sedimentation of the river and streams.

Figure 28: The informal settlements lack sewerage and drainage infrastructure. They rely primarily on on-site sanitation that results in untreated wastewater flowing directly and/or indirectly into the rivers. The storm water effluent is contaminated by the lack of sewerage. Poorly functioning municipal waste stabilization ponds at Vingunguti also contribute high levels of pathogens and industrial contaminants (Hepworth and Joseph, 2014).

Figure 29: These areas also lack solid waste collection. As a result, solid waste flows into the rivers during storm events and pollutes and obstructs flow.

Figure 30: Untreated wastewater from industrial land uses is a problem in highlighted areas of the city, adding levels of toxicity to the waste water effluent. Textile industries, particularly some facilities on Nelson Mandela Road, are a major source of chromium VI and high pH pollution found in the water (Hepworth and Joseph, 2014).

Figure 31: The cumulative impact of the encroachment and the flows of untreated effluent, stormwater, and solid waste into the Msimbazi and its tributaries negatively impacts riverine habitats, and water quality and quantity.



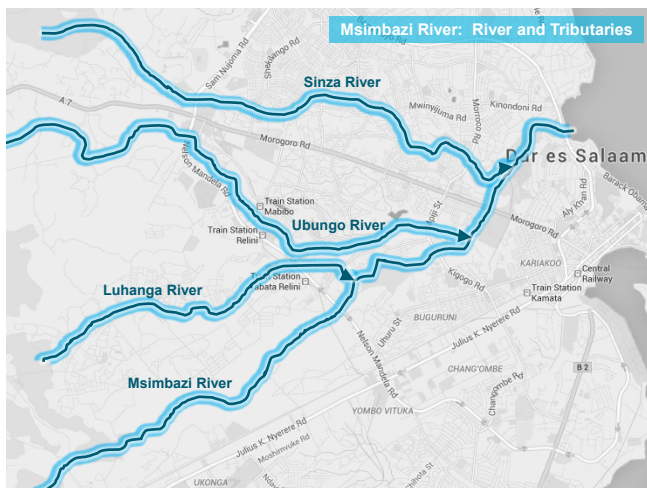


Figure 26 Msimbazi River and Tributaries

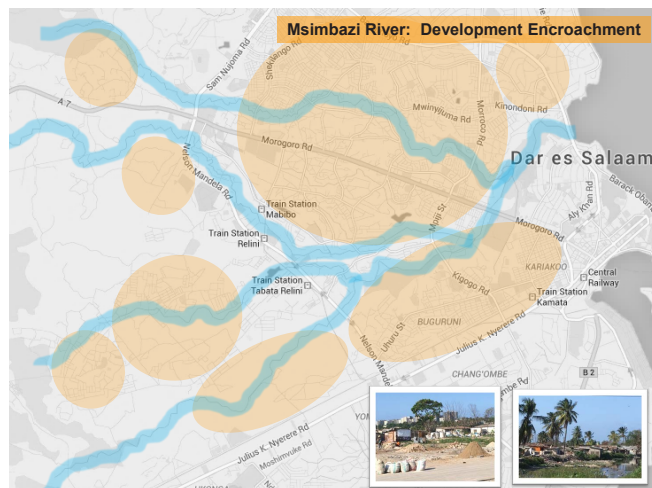


Figure 29 Development Encroachment

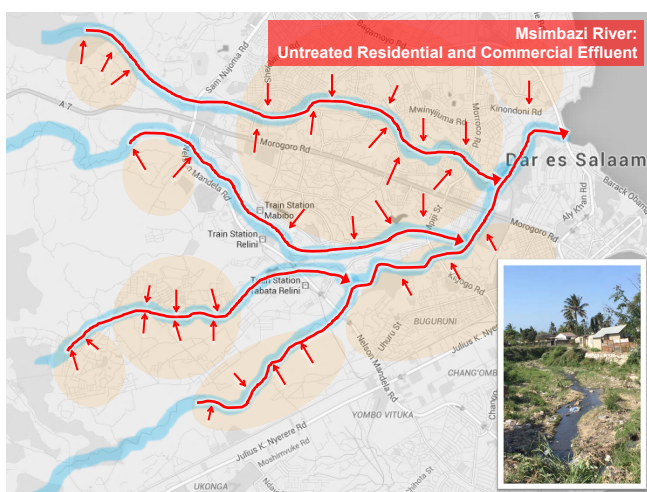


Figure 27 Untreated Effluent from Development

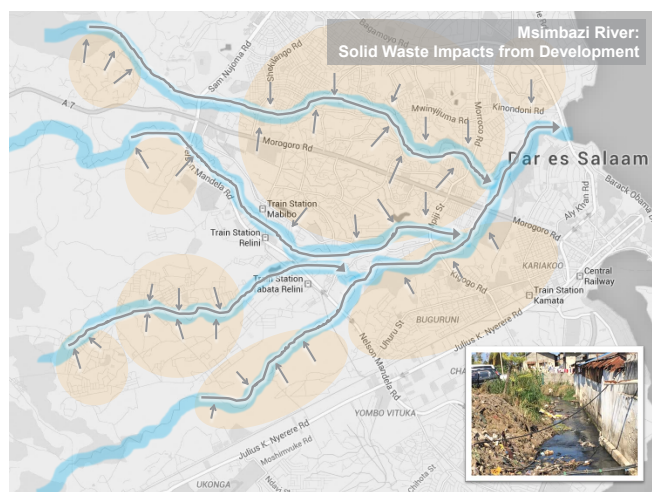


Figure 30 Waste from Development

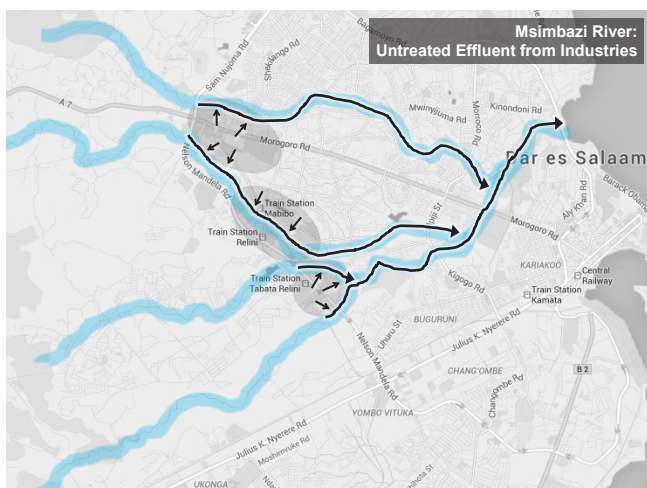


Figure 28 Untreated Effluent from Industries

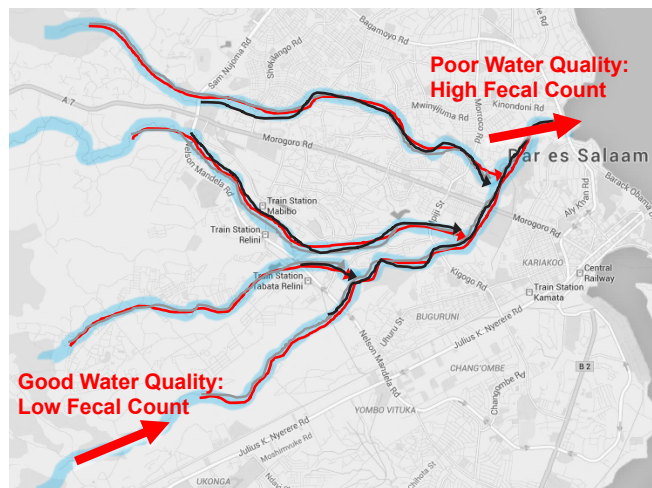


Figure 31 Combined Impacts on the Msimbazi River after river enters city

Note: Arrows are notional and do not follow topography, Bubbles represent general location of settlements and industries  
Source: AECOM, 2014; Google Earth, 2014; NEMC & UNEP, 2014; Hepworth and Joseph, 2014

## E. Extraction of Water

**Upstream land degradation in the Ruvu River Basin, growing water demand of the present-day city region far exceeding supply, and the growing amount of water extraction from limited groundwater sources threatens the sustainability of Dar es Salaam's water assets.** Since the 1950s, Dar es Salaam has relied on large-scale water transfers from the Ruvu River. However, the extraction of 264 million liters each day from the Ruvu River and an additional 6 million liters extracted per day from the Kizinga River are likely contributing to downstream degradation of Dar es Salaam's aquatic resources by reducing the quantity and quality of river flows (DAWASCO, 2012).

The city has two major extraction points along the Upper Ruvu and Lower Ruvu River, called the Ruvu Water Works. Water from the rivers is captured, extracted, treated and transferred to reservoirs. Studies of the upstream catchments of the Ruvu River show extensive evidence of increased sediment loading and water quality degradation (Yanda, 2007) (Table 16).

**The growing amount of water extraction from limited groundwater sources threatens the sustainability of Dar es Salaam's water asset.** The exploitation of aquifers and boreholes threatens to accelerate degradation of groundwater through salinization due to coastal intrusion and consumption that exceeds aquifer recharge capacity (Municipal officials, project workshop, Sept. 2014). From 1997 until the present, borehole drilling has increased tremendously and the trend is expected to increase even more. Assessment indicates that the coastal aquifers are vulnerable to saline intrusion, causing irreversible salinization. Over pumping of the groundwater has resulted in encroachment of sea water into the coastal aquifers (Mitoni, 2010). Water samples from Mikocheni, Oyster Bay, Msasani, Masaki and city center areas show elevated chloride, sulphate and sodium concentrations, and over 50 percent of the samples were brackish (Mitoni, 2010). In addition, partly due to the degradation of the river, the impacts of climate change (including flooding and ground water salinization) may be exacerbated (Dar Rivers Program, 2014).

The results of a 2009 household survey capture the importance of borehole for households: there has been an increase of people accessing water from boreholes (37.3 percent) compared to 26.2 percent recorded during the 2006 Baseline Survey (World Bank, 2010). Based on the current surface water supply, only 31.9% of the demand will be met in 2015, and use of groundwater boreholes will increase to cover this gap between demand and supply (Mato, 2002, Ghent, 2012).

**Table 16** Current Water Source and Production Per Day

Water Source	Water Production Per Day in m <sup>3</sup>
Lower Ruvu	182,000
Upper Ruvu	82,000
Mtoni	5,000
Boreholes	3,000
Total	272,000

Source: DAWASA, 2006

Water quality and reliability is low in unplanned settlement areas, and water is frequently purchased at exorbitant prices from vendors, kiosks and neighbors. A study of 45 of Dar es Salaam's wards, containing 84% of the city's population, found that the percentage of residents in each ward without access to improved drinking water ranged from 37.8% to 90%, with a mean of 71.8% (Penrose et al., 2010). Subsistent urban agriculture is also heavily impacted by water shortages and at times it becomes limited to rainy season cultivation (World Bank, 2011).

An environmental impact assessment reveals that the increased extraction of water from the Ruvu River reduces flows and quality of water, and may affect the mangrove communities in the lower Ruvu estuary. It may also increase sea water intrusion into the river, increasing water salinity at the estuary and mangrove forest, affecting the habitat of fish, prawns, crocodiles and the marine environment in general. Increased water extraction will also have effects on the quantity of water reaching the downstream users. The prisons and SEKAB Bio-Energy Tanzania depend entirely on water from Ruvu River for irrigation (NEMC, 2010).

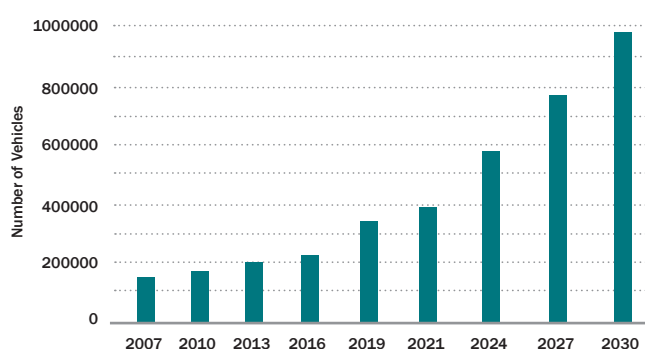
A decrease in flows can exacerbate the natural decrease in dry weather flow of the river, reducing the river's ability to dilute pollutants discharged into it as well as achieve effective self-purification (Dar Rivers program, 2014). Additionally, inefficient distribution systems exacerbate impacts from overall water loss, requiring more supply of water to be captured for reaching end users, due to the large volume of water lost en route due to poor infrastructure (e.g., broken pipes) and unauthorized use. Broken pipes also serve as entry points for bacteria, which may result in disease (World Bank, 2011).

## F. Air Emissions

While the majority of the population of Dar es Salaam travels by non-motorized modes, such as by bicycle and by walking, the trend is shifting toward motor vehicles. The increase in emissions from motor vehicles is degrading the air quality of the city. The number of cars in the city has increased from 24,600 in 1979 to 605,000 - 705,000 in 2011. (Marshall and (Macklin Monaghan Ltd., 1979; Elinaza, 2012). The increase in the number of vehicles has compounded traffic congestion problems in the city. The situation is made worse by the increase of motorcycles and tricycles in Dar es Salaam using city roads (Kiunsi, 2013).

The increasing use of vehicles (Figure 32) has been driven by the rapid increase in population and urban sprawl. The mono-centric CBD structure with the arterial roads originating from Centre has resulted in many City services and institutions located at one major point and with traffic flow from residential areas to the CBD during rush hours. (Kiunsi et al., 2006; Lupala & Kiunsi, 2011) (Kiunsi, 2013).

Inadequate roadway infrastructure has led to inadequate capacity of roads to cope with increased number of cars due to three main factors: 1) low spatial road coverage of only 2.5% of land in the city compared to Tanzania physical planning guidelines of 15 to 20% coverage; 2) poor road conditions due to lack of regular maintenance; 3) lack of overpasses or underpasses at main intersections to facilitate smooth flow of traffic and limited parking, especially in the CBD, that results in road side parking that further reduces road capacity (Kiunsi, 2013).



**Figure 32** Projection of Vehicles in Dar es Salaam, TZ  
Source: UNEP, 2011

Charcoal, a primary source of cooking fuel in the city, is also a contributor of local air quality degradation (URT, 2014a TSCP). Charcoal combustion emits carbon monoxide and nitrogen oxides, and the smoke also includes particulates, formaldehyde and carcinogens, exposure to which can cause acute lower respiratory infections in children, chronic bronchitis or chronic obstructive pulmonary disease in women, and other adverse health conditions (World Bank, 2011). The high usage of charcoal in areas of intense road traffic can create pockets of degraded local air quality (URT, 2014a TSCP).

Industrial emissions are estimated to be the primary driver of Dar es Salaam's PM<sub>10</sub> and PM<sub>2.5</sub> emissions with domestic and vehicle sources also contributing to PM pollution (ICF, 2009). The majority of Dar es Salaam's local air quality degradation from emissions of SO<sub>x</sub> and Benzene are generated from domestic sources and transportation activities, including open air burning of household wastes, wood, and charcoal (ICF, 2009).





## V. INSTITUTIONAL CHALLENGES

### A. Overview

In discussing the key drivers and causes of environmental vulnerability and the promotion, or lack thereof, of green urban development, the threads converge at governance and institutional issues. This section, therefore, seeks to first characterize the prevailing institutional landscape around promoting green urban development in Dar es Salaam, thereby highlighting key institutional factors or challenges that may foster or hinder green urban development, and finally offer some possible suggestions for improvements. To provide more tangible examples, for Dar es Salaam, we focused on the environmental assets of land and water and on the broader issues of urban planning and development, environmental management and service provision (especially water and sanitation).

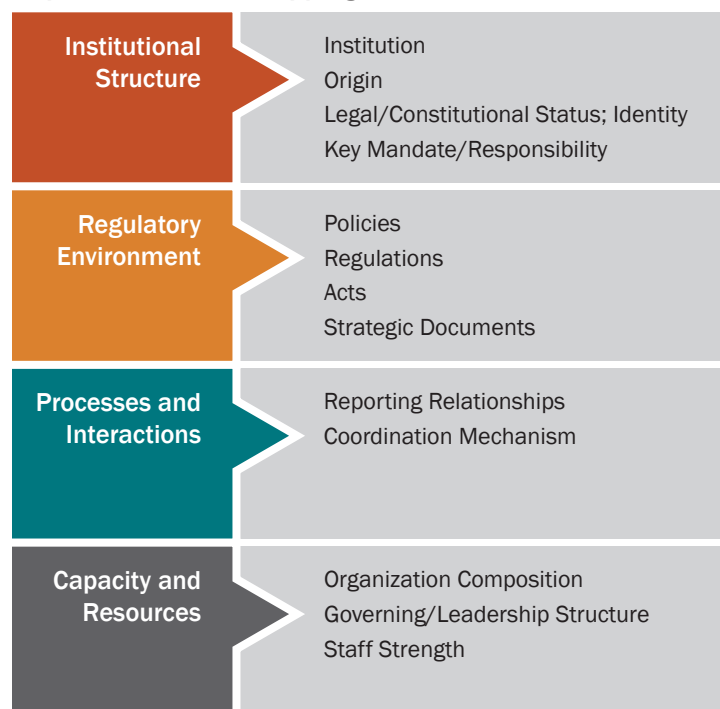
The first half of the section will present an overview of the prevailing institutional landscape through a rapid institutional mapping organized around four main areas: (i) institutional structure, (ii) relevant regulatory environment, (iii) typical processes and interactions and (iv) capacity and resources as shown in Figure 33. The selected key agencies or institutions involved in the planning, execution and management related to the environmental assets of land and water are introduced.

With the overall understanding established in the first part, the second half of the section explores the key institutional challenges and issues related to these four areas. Finally, the section concludes by offering some suggestions and recommendations for improvements to decision makers and practitioners.

The methodology undertaken comprised mainly: (i) data collection through desk research on the background of the selected agencies/institutions for the institutional mapping and conducting face-to-face interviews with senior technical staff in some of the agencies/institutions; and (ii) institutional context analysis using information mainly drawn from the interviews and supplementary documents or data collected.

The discussion here does not seek to be comprehensive and does not cover all relevant stakeholders, given significant data and time constraints. Instead, through the qualitative and anecdotal evidence provided by focused discussions, it serves to highlight and reveal some of the main institutional obstacles, to candidly express issues being faced and reflect honest opinions, in the hopes of feeding into larger ongoing debates, assisting with tackling the challenges of green urban development and identifying areas for deeper analysis.

#### Rapid Institutional Mapping



**Figure 33** Rapid Institutional Mapping  
Source: World Bank Staff



## B. Prevailing Institutional Landscape

### Institutional Structure, Capacity and Resources

For Dar es Salaam, the key institutional actors include both central and city-level agencies, and at times regional agencies as well. These actors can be broadly considered under three functional areas: (i) urban planning and development, (ii) service provision (especially water and sewerage) and (iii) environmental management. The central government retains multiple controls over local authorities. For example, the central government appoints senior personnel to run the urban authorities, and the Minister for Local Government approves the urban authorities' by-laws, budgets and proposals for own source revenue generation (most of the LGAs are still largely dependent on central fund transfers). Several central-level government agencies or national parastatals play crucial roles in areas under the jurisdiction of the LGAs, for example in services provision (roads, water, electricity, drainage), land-use regulations (especially land-use planning and land allocation) and environmental management (Kironde 2009). (Please see Appendix B for organograms and figures related to this section on Institutional Challenges).

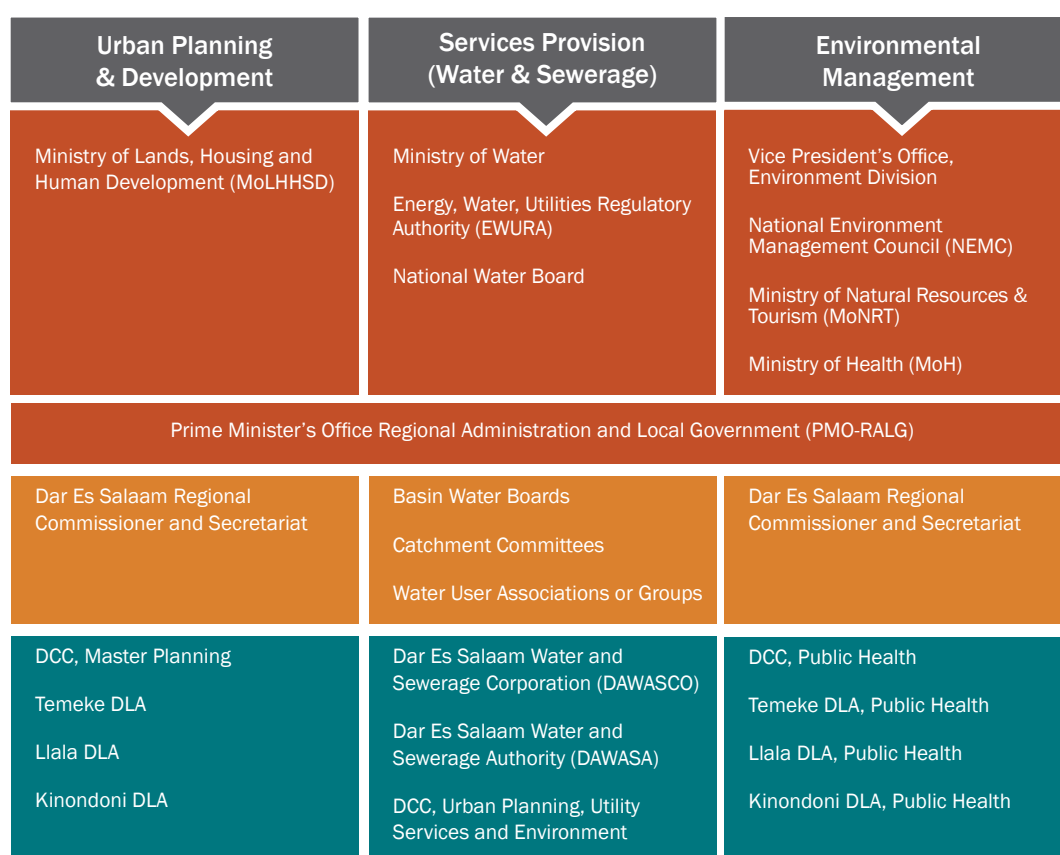
### Central/ Regional Level

At the central level, the Prime Minister's Office Regional Administration and Local Government (PMO-RALG) is a key player with functions straddling across all three areas, as it is the main central agency overseeing all local government authorities. In addition, there are several ministries and central-level entities as well as various subsidiary or autonomous regional entities directly involved, as elaborated below.

- a. **Prime Minister's Office Regional Administration and Local Government (PMO-RALG)** – committed to empower Regional Administration and Local Government Authorities to improve the provision of quality life and services to the community.

The broad functions of PMO-RALG include:

- Facilitating Local Government Authorities to provide quality services;
- Managing the critical interfaces with Ministries and Development Partners and Local Government Authorities and formulating policies;
- Monitoring support provided to Local Government Authorities by Regional Secretariats as well as regional affairs;



**Figure 34** Key Actors Involved

Source: World Bank Staff

- Providing quality and timely information;
- Providing sound advice to Local Government Authorities on policies, approaches, systems and planning methodologies;
- Facilitating capacity building;
- Providing legal support and advice to the Ministry itself and to LGAs;

Currently, it has 9 Divisions, 6 Units and 5 affiliate institutions. The more relevant departments include: Division of Local Government, Division of Urban Development, Unit of Sector Coordination and Unit of Infrastructure Development.

- b. **Ministry of Lands, Housing and Human Settlements Development (MoLHHSD)** – to facilitate an effective management of land and human settlements development services for the betterment of social and economic well-being of the Tanzanian society, providing various land related services to individuals and institutions in the country. The core sector Departments within the Ministry are: Land Administration, Survey and Mapping, Physical Planning and Housing, and some core sector units are: Registration of Titles, Property Valuation, and District Land and Housing Tribunal. In addition, the ministry has an agency dealing with Housing and Building materials research, a commission dealing with Land Use Planning and also the National Housing Corporation.
- c. **Ministry of Water (MoW)** - to ensure that water resources are developed and managed sustainably in collaboration with all stakeholders.

The Ministry has the following main functions:

- i. Formulating and revising the National Water Policy, policy implementation strategies, legislation and regulations;
- ii. Promoting the development, management and use of the nation's water resources, providing commercial water and sewerage services, and providing community water supply and sanitation services in accordance with the national water policy and strategies;
- iii. Monitoring the implementation and performance of rural water supply and sanitation as well as urban water supply and sewerage development programmes;

- iv. Providing technical and financial support to the urban Water Supply and Sanitation Authorities (WSSAs) and Local Government Authorities (LGAs);
- v. Coordinating the Ministry's participation in national and international dialogue initiatives on projects pertaining to the management and development of water resources;
- vi. Providing strategic guidance, and technical and operational support to Basin Water Offices to enable them carry out their mandated functions, including water resources assessment, monitoring and regulation;
- vii. Collecting information and providing such information and associated services to other government institutions and to the public;
- viii. Providing sector-related information and guidance to stakeholders;
- ix. Mainstreaming cross-cutting and cross-sectoral issues such as gender, HIV/AIDS, environment, health and land; and
- x. Promoting the use of ICT in the water sector.

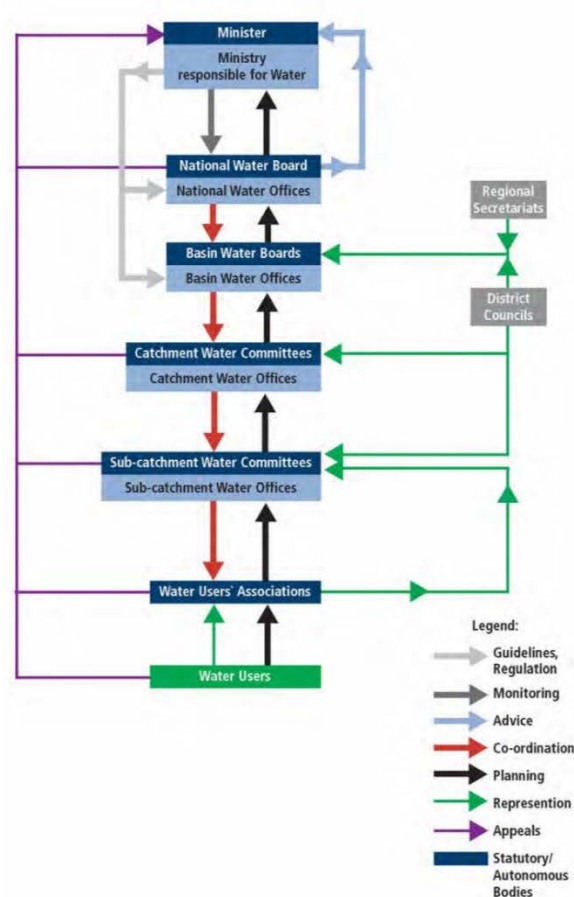
In particular, the Urban Water Supply and Sanitation Division under the MoW holds the key functions of:

- i. Advising on the formulation and revision of the national water policy and policy implementation strategies, particularly aspects of the policy and strategies that pertain to urban water supply and sewerage services.
- ii. Promoting the development and provision of commercial water and sewerage services in accordance with the national water policy and strategies.
- iii. Monitoring the implementation of commercial water supply and sewerage development programs.
- iv. Providing technical and financial support to the operations of commercial water supply and sewerage authorities.
- v. Monitoring the performance of commercial water supply and sewerage authorities.

## Water Resources Management

There has been a policy direction change in the role of the MoW towards that of coordination, policy and guideline formulation and regulation, instead of a service provider. As such, water resources management is the responsibility of the National Water Board, Basin Water Boards (divided into nine basins in the country), Catchment Committees, and Water User Associations or Groups. Representatives from district councils and local government authorities sit on the Basin Boards and Catchment Committees:

- a. *National Water Board* - a financially and administratively autonomous organization, financed by the Basin Boards; oversees, coordinates and facilitates the activities of Basin Boards.
- b. *Basin Boards* - financially and administratively autonomous, and financed through water user charges; water users are represented on the Boards.
- c. *Catchment and Sub-catchment Committees* - autonomous bodies financed from user charges, and will carry out such functions as are delegated by the Basin Water Board; they may employ staff necessary to carry out these functions, or may be supported by Basin Water Board staff.
- d. *Water User Associations* - legally constituted bodies drawing their membership from water users in a particular locality; costs of the Association will be borne from charges levied on its members.



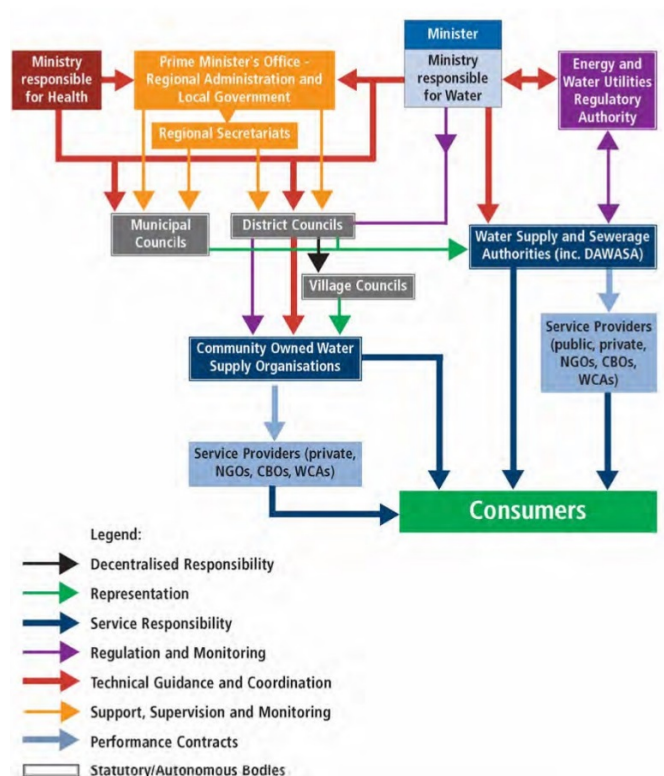
**Figure 35** Institutional Framework for Water Resources Management  
Source: National Water Sector Development Strategy, 2006-2015

## Water Supply, Sewerage and Sanitation

Similarly, in the area of water supply, sewerage and sanitation, MoW is moving away from being a service provider to being a regulator. Thus, such service provision is now based on the local government structures but delegated to “clustered” Water Supply and Sewerage Authorities (DAWASAA and DAWASCO in this case); however, sanitation remains the responsibility of local government authorities (discussed in later sections).

**Energy and Water Utilities Regulatory Authority (EWURA)** – an autonomous multi-sectoral regulatory authority established under the Energy and Water Utilities Regulatory Authority Act, 2001. It is responsible for technical and economic regulation of the electricity, petroleum, natural gas and water sectors in Tanzania. In the areas of water and sewerage services, EWURA is responsible for issuing licenses to WSSAs based on the submission of business plans and for monitoring and regulating performance of the WSSAs against these business plans. This includes the approval of tariffs for water and sewerage services based on the performance of the WSSAs in delivering services to consumers. As the business plans of the WSSAs are required to include performance-related contractual arrangements with their Service Providers, the WSSAs have responsibility for the management of these contracts, and EWURA is not required to separately regulate the Service Providers.

- e. **Vice President’s Office (VPO), Environment Division** – the mandate of the VPO has been articulated in the Constitution of the United Republic of Tanzania (1977) Article 47 and its functions are stated in the Government Instrument made under Article 55 of February, 2008. The major roles and functions of this Office are to assist the President on all matters concerning the United Republic of Tanzania, particularly under the Environment Division:
  - i. Formulate Environmental Policy and ensure its implementation;
  - ii. Monitor and coordinate National Environmental Management Council (NEMC) activities.



**Figure 36** Institutional Framework for Water Supply, Sewerage and Sanitation

Source: National Water Sector Development Strategy, 2006-2015

- f. **National Environment Management Council (NEMC)** – to undertake enforcement, compliance, review and monitoring of environmental impacts assessments (EIAs) of development policies, plans and activities, research, and to facilitate public participation in environmental decision-making, raise environmental awareness and collect and disseminate environmental information. Its functions include advising and coordinating environmental management issues. In addition, NEMC has the power to set standards and issue permits for the discharge of effluents into the environment, including into water resources, and to levy penalties for non-compliance. The NEMC sits directly under the VPO, and parallel to the Division of Environment (the NEMC is more operational- and enforcement-oriented while the Division of Environment handles the policy and legislative issues and international conventions.)

NEMC is headed by a Director General (DG) under guidance of the Board of Directors of the Council. The DG is assisted by Directors of directorates, Heads of units, Heads of zonal offices, technical and supporting staff. Currently the Council has four technical Directorates (Environmental Compliance and Enforcement, Environmental Impact Assessment, Environmental Research and Planning, Environmental Information, Communication and Outreach), one supporting Directorate, four supporting Units and three Zonal Offices (Northern Zone based in Arusha, Southern Zone based in Mbeya and Lake Zone based in Mwanza), with plans to expand to seven. By year 2010, NEMC had 91 technical staff and 53 supporting staff. In addition to available technical manpower, NEMC out-sources additional support in the implementation of its planned activities.

- f. **Regional Commissioner and Secretariat** – to provide advisory and supervisory services to the LGAs and act as a facilitator for the transfer of power and authority from the central to local level. For example, the RS could provide physical planning, land development and engineering services through support for and regulation of technical designs, surveys, contracting and tendering. Dar es Salaam region is led by the Regional Commissioner (RC) who is assisted by the Regional Administrative Secretary (RAS) and District Commissioners (DCs) who are assisted by the District Administrative Secretary and Divisional Secretaries. RAS is assisted by Assistant Administrative Secretaries and professional staff.

## Local Level

- a. **Dar es Salaam Local Authorities (DLAs).** Dar es Salaam Region<sup>1</sup> is one of 30 administrative regions in Tanzania with its regional capital as the city of Dar es Salaam. The city consists of three districts – Ilala, Kinondoni and Temeke. Each district is governed by its own Municipal Council: Kinondoni (KMC), Ilala (IMC), and Temeke (TMC), in addition to a coordinating Dar es Salaam City Council (DCC) – collectively known as the Dar Local Authorities (DLAs). Also, each district is represented by a Council headed by the District Commissioner, and the districts are sub-divided into divisions, and each division into wards. Each DLA has its own set of technical and administrative departments. The Local Government Authorities are ultimately accountable to PMO-RALG (as such the Municipal Councils (MCs) do not report to the DCC but directly to the PMO-RALG). In terms of service provision, such as water supply and sewerage, the Local Government Acts of 1982 for both District and Urban Authorities give the respective authorities the powers to establish, maintain, operate and control public water supplies drainage and sewerage works.

*Dar es Salaam City Council (DCC).* DCC does not have an associated geographic jurisdiction and is largely mandated to have a coordinating role and attends to cross-jurisdictional issues. In addition, it currently provides some services for the city including: issuing permits for motorbikes, taxi and car parking in the city, levy for banks and solid waste management (such as the management of Pugu dump site, the only one in the city). It also manages certain city projects and programs such as Community Infrastructure Upgrading Program (CIUP - a low-income communities upgrading program, closed in 2012), the Bus Rapid Transit (BRT) project, and special initiatives on environmental issues such as working with ICLEI (Local Governments for Sustainability) on carbon emission for climate change. It also has the mandate to oversee the updating of the physical master plan for Dar es Salaam (however, the latest round has been coordinated mainly by MoLHHSD instead – as discussed later). The DCC has around 200-300 staff.

<sup>1</sup>The region has a regional administration, headed by the Regional Commissioner, in addition to a city administration, headed by the City Council and the Mayor of Dar es Salaam.



*Kinondoni Municipal Council (KMC)*. Kinondoni is located in the northern part of Dar es Salaam City. It has an area of 531 sqkm with a population of around 2.5 million people. KMC is an autonomous body with four divisions - Magomeni, Kinondoni, Kibamba and Kawe - and sub- divided into 34 wards and 171 sub-wards. The Municipality has three electoral constituencies: Ubungo, Kawe and Kinondoni. The Municipal is governed by a full council with 56 councilors. KMC has a staff strength of around 6000 people in all. The Municipal Councils are basically responsible for the provision of basic infrastructure and socio-economic services such as district roads, solid waste management, water, health, education and management of development activities.

- b. Dar es Salaam Water and Sewerage Authority (DAWASA) and Dar es Salaam Water and Sewerage Corporation (DAWASCO) – DAWASA and DAWASCO are the two main entities responsible for water and sanitation within Dar es Salaam. DAWASA owns the assets and has the responsibility to invest in expanding the pipe network and water production, while DAWASCO operates the pipe systems, bills customers, and collects and treats wastewater. DAWASA is an autonomous public utility established in 1997, and DAWASCO is a public parastatal company financed by the state.

## Regulatory Environment

### Overall

Generally, a basic array of legal tools such as policies and regulations to guide urban development and protect the urban environment are available at the national level, but to a much lesser extent at the regional and local levels. While there are fundamental regulatory frameworks at the national level, translation into relevant regional and local level regulations to allow for implementation is often insufficient.

The key national level documents currently in place include: National Land Policy, National Human Settlement Development Policy 2000, Land Act, Land Acquisition Act, Building Acquisition Act, Urban Act, Planning Act, Local Government Reform Policy, Local Government Act, Regional Administration Act, National Environment Policy 1997, Environmental Management Act 2004, National Health Policy 1990, Water Policy 2002, National Water Sector Development Strategy, and the related Forestry Act and Mining Act etc.

At the local level in Dar es Salaam, regulations, guidelines and by-laws are greatly lacking in all the relevant areas (urban planning, development and environmental protection), and government actions take place largely through specific projects, but are not guided by a holistic regulatory framework.

## Physical Planning and Development

*Planning Act*. The Planning Act is the key regulatory document behind physical planning and development. It spells out the responsibilities and roles at each level of government. For example:

1. At the national level, the Director of Urban Planning shall be the principal adviser to the Minister on land use planning and shall: (i) issue guidelines to planning authorities on proposals for declaration of planning areas, preparation of general planning schemes, land use plans and detailed planning schemes, (ii) issue guidelines on planning standards and norms, (iii) approve all planning schemes, and monitor and evaluate their implementation; (iv) approve applications for change of use of land in planning areas; and (v) approve applications made by developers for subdivision of land or plots in planning areas, amongst other functions.
2. At the local level, the Planning Act provided that every city council, municipal council, town council and township authority shall each become a planning authority in respect of its area of jurisdiction. Such local planning authorities shall: (i) prepare general planning schemes, as well as detailed planning schemes for implementation in its area of jurisdiction; (ii) grant planning consent; (iii) recommend approval of building schemes and subdivision applications made by developers; (iv) secure the co-operation of all agencies, utility bodies, land holders and other bodies and institutions involved in preparation and implementation of the planning process, (v) control the use of land, and development of land and buildings in the interests of proper and orderly development of the planning area; (vi) formulate by-laws to regulate zoning with respect to use and density of development; (vii) consider and approve all applications for consent to develop land and grant the same, amongst other functions.

*Master Plan.* Dar es Salaam has had three master plans - the first was prepared in 1948, a second, revised in 1968, and the latest was approved and adopted for implementation in 1979. The Town and Country Planning Act, which is the principal legislation for urban and rural planning in Tanzania, provides for review of such General Planning Schemes (the term used in the Act to refer to a Master Plan or interim land use plan) every five years.

In the 1990s, the Government, through the predecessor of MoLHSSD, requested the United Nations Development Programme (UNDP) technical assistance from to review the Dar es Salaam Master Plan. The UN Centre for Human Settlements (UN-HABITAT) initiated the Environmental Planning and Management (EPM) process under the Sustainable Dar es Salaam Project to develop a Strategic Urban Development Plan (SUDP) for Dar es Salaam including identification of priority actions. The SUDP was an overall dynamic framework which, among other things, provided for land use, city expansion and sector investment strategies, as well as investment in infrastructure and utilities. The SUDP was drawn up through broad consensus and by working groups consisting of a wide variety of stakeholders including representatives from the Dar es Salaam City Councilors, government technical staff, utility agencies, the private sector, NGOs, central government departments and donors. Outputs of the working groups formed the basis for the SUDP, in addition to further technical inputs from land suitability analysis and environmental sensitivity analysis. However, the SUDP was never officially adopted and gazetted as a master plan due to multiple reasons. One key reason could be that the SUDP was “essentially an environmental management framework built on environmental management strategies and action plans” and “has taken a form of something less than what should have been expected of an integrated strategic urban development plan,” especially lacking in addressing urban economy issues and thus “rendering it a deficient tool for guiding urban growth and development” (NNKYA, 1999). The EPM process itself focuses on the analysis of interactions between development and environmental/natural resources with an environmental management system as the essential output but not necessarily a strategic development plan, although the analysis could certainly form an integral part of such a plan.

Currently, a draft Dar es Salaam Master Plan for 2012-2032 is in a protracted approval process so the version from 1979 (when the population was 900,000) is still valid. Effectively, there has not been a master plan guiding the city’s development for decades. Further, it complicates the tenure system, as the master plan is an enabling instrument for local development plans, which are a precursor for issuance of land titles. To date, the city remains a collage of patches of planned neighborhoods amongst largely unplanned areas.

## Environmental Regulations

There are two key national environmental legislations that provide the framework for the regulation of the environment:

- *The National Environmental Policy, 1997* provides a set of principles and objectives for addressing all aspects of the environment. While the objective of the policy was to integrate a multi-sectoral approach to environmental strategies, for the most part environmental issues have been addressed under sectoral ministries.
- *The Environmental Management Act, 2004* (which repealed the National Environment Management Council Act, 1983) established a framework for the governing of environmental issues and recognizes the existence of other sector laws. It includes provisions for impact and risk assessments, prevention and control of pollution, environmental quality standards, public participation, and compliance and enforcement (Pallangyo, 2007). The Act stipulated roles and responsibilities for each level of government.

These are supplemented by national level regulations and standards such as EIA & Audit regulations 2005, Registration of Environment Experts regulations 2005, Solid Waste Management Regulations 2009, Water Quality Standards regulations 2007 etc. In addition, the Vice President’s Office has published the “Strategy for Urgent Actions on Land Degradation and Water Catchments” in March 2006, and has subsequently prepared the “Urgent Action for Protection of Marine, Lakes, Rivers and Dams Environment” to address pressing environmental challenges. These strategic actions define immediate measures to be taken to improve the environmental situation, related to the conservation and protection of water sources. The two urgent strategic action papers provide important guidance for the implementation of comprehensive and prioritized water conservation and environmental protection measures.

Local regulations, guidelines and by-laws are greatly lacking, although DLAs are making an effort to establish them, along with help from NEMC. (For example, Kinondoni has had environmental by-laws on environment since 2003.) Instead, currently, environmental protection at the local level is carried out largely on a project basis. One good example is the Kinondoni Integrated Coastal Area Management Project (KICAMP) which yielded good results at the local level.<sup>2</sup> However, sustainability of such project-based approaches could be an issue.

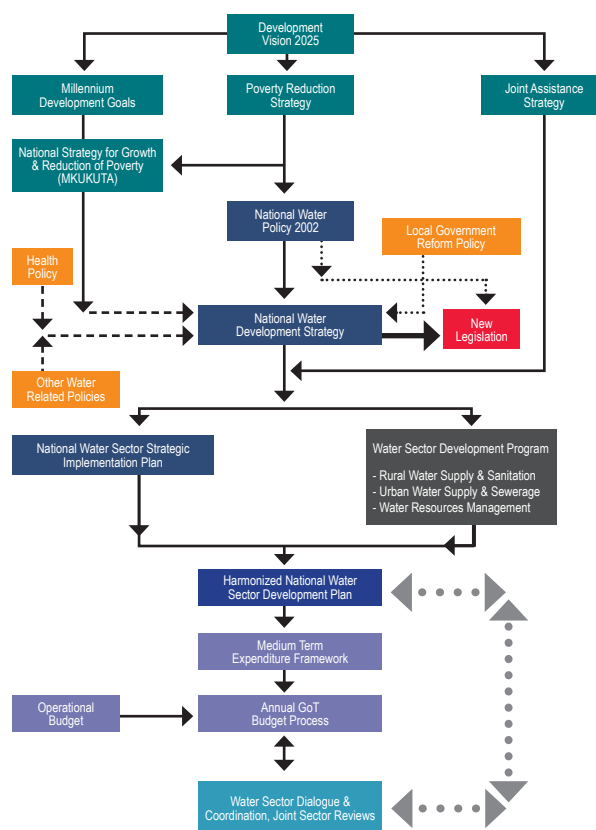
<sup>2</sup>This project resulted in banning excavation of sands in critical areas as a way to prevent further beach erosion from occurring along the coastal area. Households are also made aware of the value of mangroves and were involved in their protection, and combined with heavy protection from KICAMP, this has led to increase in mangroves. Complementing this, the government has also invested in a number of sea walls on highlight susceptible areas to sea level rise storm surges and coastal erosion such as Kunduchi Beach and Bahari Beach

## Water Regulations

The water sector has been included among priority sectors in the National Strategy for Growth and Reduction of Poverty (NSGRP/MKUKUTA). Pertaining to the water sector, two key documents lay the foundation for the regulatory framework:

- The Water Policy of 2002* (amendment of 1991 policy) – the main objective is to develop a comprehensive framework for sustainable development and management of the National water resources, in which an effective legal and institutional framework for its implementation will be put in place. The policy aims at ensuring that beneficiaries participate fully in planning, construction, operation, maintenance and management of community-based domestic water supply schemes. This policy seeks to address cross-sectoral interests in water, watershed management and integrated and participatory approaches for water resources planning, development and management. Also, the policy lays a foundation for sustainable development and management of water resources in the changing roles of the Government from service provider to that of coordination, policy and guidelines formulation, and regulation.
- The National Water Sector Development Strategy* - The main objective of the NWSDS is to develop a coherent, holistic and integrated strategy for the Water Sector in order to implement the National Water Policy. This will then allow the on-going sub-sectoral initiatives and projects to be set within the overall strategic and planning framework for the Sector. Furthermore, this strategy has been developed to support re-alignment of other water related key sectoral policies of energy, irrigation, industry, mining, and environment. The institutional framework underscores separation of service delivery and regulation to ensure fair play among the various actors and sectors.

The relationship of these two main documents with other relevant national policies and financial planning framework is shown in Figure 38.



**Figure 37** Relationship of Water Policy and Strategy with Others  
Source: National Water Sector Development Strategy, 2006-2015

## Processes and Interactions

### Physical Planning and Development

Formally, local governments' planning authorities are recognized as the preparatory authorities in charge of the planning, preparation and implementation of physical plans. After a draft General Planning Scheme (GPS) is completed, this will be submitted to the Regional Secretariat, which either rejects or submits it to the MoLHSSD Director of Urban Planning with recommendations and comments. Public consultations are undertaken at both the local and national levels. The Director may make alterations or modifications to the GPS after taking into account the public hearings and views of the Regional Secretariat. Upon satisfaction, the GPS is submitted to the Minister for approval.

In practice, however, the formal procedures are not always followed, especially since the drafting of GPS used to be under the Ministry. In Dar es Salaam, the latest Master Plan revisions were driven largely by the MoLHSSD and not the local government (rightfully coordinated by DCC). This led to issues of insufficient local buy-in and thus inability to complete the Master Plan.<sup>3</sup> Without the Master Plan, Dar es Salaam is in a difficult position to develop any detailed planning schemes to properly guide developments. As such, planning regulations are largely still done on a piecemeal basis.

### Environment

In terms of environmental coordination and interactions, officially, both top-down and bottom-up approaches are designed. From the central level, there is the National Environment Advisory Committee (NEAC) which is chaired by the Permanent Secretary of VPO, Ministry of Environment. This is a non-permanent committee with members as statutory posts, drawn from many agencies involved with environment (e.g., directors of Forestry, Water Resources, Mining etc.) Recommendations by committee are taken to the Cabinet Environment Working Group (Ministers as members) and then tabled to cabinet. The NEAC convenes only when there are issues, which could be once or twice a year.

<sup>3</sup> MoLHSSD realizes the issue and is taking corrective measures such as forming a Task Force involving all stakeholders, especially local ones. However, the original resources dedicated for the master plan formulation has largely been exhausted, and the upcoming election also causes uncertainty.

At the national level, there are 13 Sector Ministries, and each establishes an Environmental Section with a Sector Environmental Coordinator (SEC) (usually a single person) who is the main channel for coordination and ensures that all implementations observe environmental issues. In addition, there are Regional Secretariat and Regional Environmental Management Expert (REME) responsible for coordinating the higher offices with local government. In the local governments (city/municipal/district), each local council has a City Environment Management Committee and Environment Management Coordinator.

In practice, especially at the local level, Dar es Salaam does not have an effectively working structure for environmental coordination. DCC has the main coordinating role; however, as it does not have formal authority, the DLAs meet only "voluntarily" and thus depend on personal good relations to achieve holding routine meetings once a month among the DLA environmental coordinators. Within the other three DLAs, the environmental coordinators are usually not full time but doubled up by public health officials.

### Water

The provision of water services provides a good example of the multitude of processes and actors involved in its implementation. The overall responsibility for all water issues, including water service provision, is the mandate of the MoW. It supplies water in Dar es Salaam through the DAWASCO, with the DAWASA as a smaller holding authority, and EWURA also involved in regulations, in addition to local authorities. Given the limited reach of the water services provided by DAWASCO, only a minority of the city population can rely exclusively on piped water, and water distribution is mainly a private activity. While DAWASCO and SAWASA focus on bringing water to the settlements (Kyessi, 2013), an increasing part of Dar es Salaam's peri-urban water supply is developed through Mtaa leadership and voluntary organizations in the water sector (Kyessi, 2010). This complex process and relationships are illustrated in Figure 39.

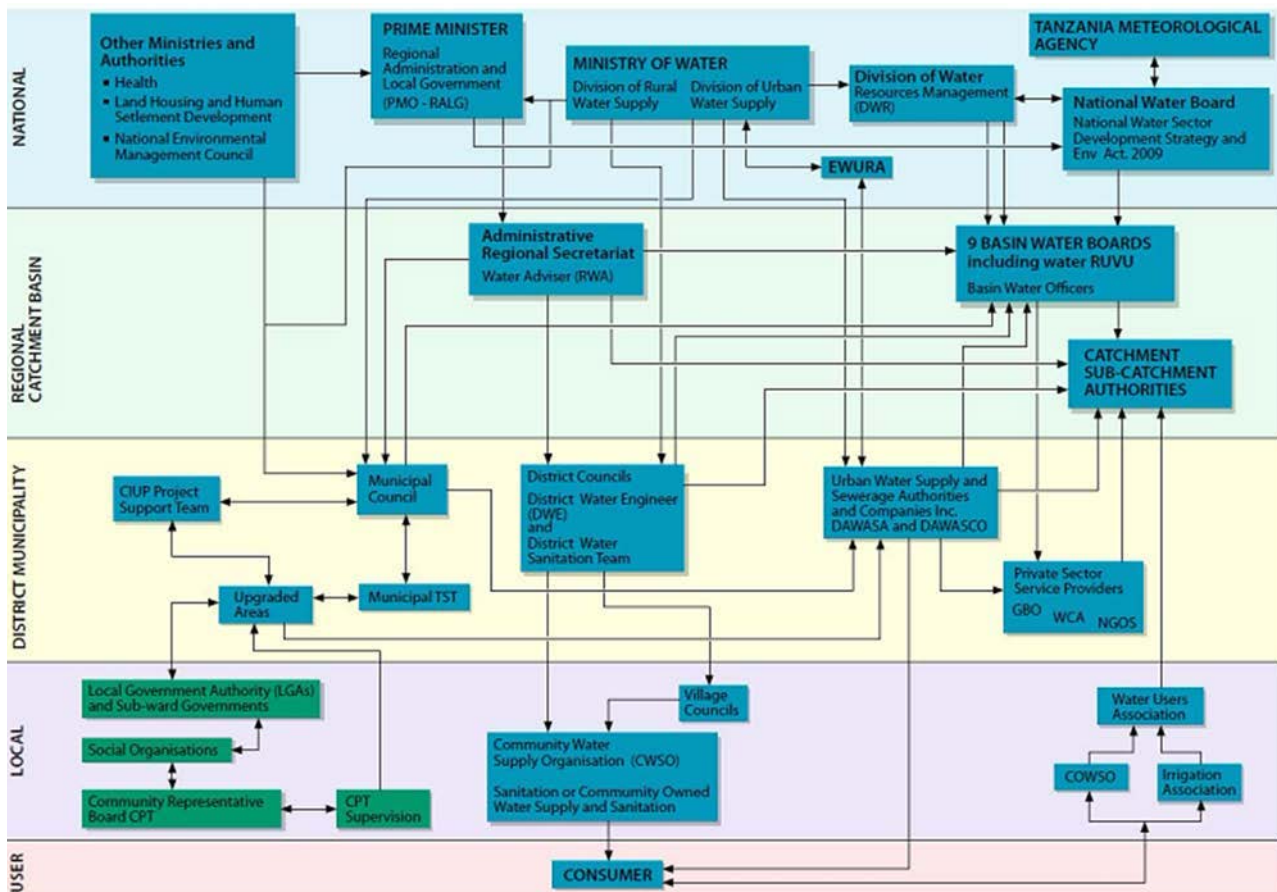


Figure 38 Water Stakeholder Map

Source: Kyessi, 2014

## C. Institutional Key Findings

### Institutional Challenges

1. **Institutional fragmentation within each government level and across levels** – overlapping mandates, weak integration and coordination. Tackling environmental degradation issues involves multiple sectors, such as environment, urban planning, infrastructure and services provision, as well as requires clear lines of responsibility and accountability. Currently, the city's basic services - water, sanitation, and drainage infrastructure - are severely underprovided and of poor quality. Environmental protection and enforcement efforts are also largely inadequate. Institutional dysfunction is a key contributing factor, as institutional fragmentation occurs both horizontally at all levels of governments, and vertically across levels, as exemplified in the following areas:
  - a. On environmental issues, there are multiple agencies and departments intimately involved at the national level, especially the VPO's Environment Division and NEMC. Locally, the fragmented and ineffectively coordinated four local governments pose challenges on all fronts from overall urban development and service provision to environment protection (eg. drains may literally stop at the boundary of a DLA). DCC, the designated coordinating body is ineffective and not empowered to do so. Rather, in reality, it is functioning as a "special projects office". Without proper coordination, especially at the local Dar es Salaam metropolitan level, it is difficult to address cross-jurisdictional issues, phasing or set priorities to achieve more efficient use of resources and produce positive impacts.



- b. Vertical coordination is also a challenge. The division in roles and mandates between levels of governments are often ineffective and unclear. For example, the Planning Act states that the local authorities shall “prepare general planning schemes, and detailed planning schemes for implementation in its area of jurisdiction” and “control the use of land, development of land and buildings in the interests of proper and orderly development of the planning area”. Yet, the Director of Urban Planning in MoLHSSD is required to “approve applications for change of use of land in planning areas” and “approve applications made by developers for subdivision of land or plots in planning areas.” In fact, until recently, the issuance of building permits in Dar es Salaam has been centrally done by MoLHSSD (and not the DLAs). This is not only a huge mismatch in terms of government-level responsibilities but has also created bottle-necks in formal approvals, leading to the growth of informality, as the centrally-controlled process tends to be very slow.
- c. In addition to the sometimes unclear and overlapping roles across levels, coordination between national and local-level agencies are weak, and agencies often act on their own without sufficient involvement of the other relevant parties. A good example is on the enforcement of environmental regulations. Both NEMC and the local governments are empowered by the Environmental Management Act to regulate environmental violations. While this allows flexibility on one hand, the lack of clear jurisdictional demarcation results in accountability issues and the no-one-is-in-charge phenomenon on the other. Further, on the coordination side, VPO or NEMC may enforce environment measures with little involvement of DLAs or other ministerial agencies; or DLAs would work on their own upon occurrence of floods without coordinating with higher-level authorities. A further complication occurs within the local level where power plays may exist between the mtaa, ward and municipality.

## 2. ***Weak regulatory guidance, and lack of regulatory frameworks and tools, especially at the local level.***

Facing the unprecedented rapid urbanization rate in Dar es Salaam (around 5% for the past three decades and the fastest growing city in East Africa), the city is ill-equipped with the necessary regulatory guidance and tools to direct growth and to provide affordable housing and basic services. As such, the majority of the city’s residential area – 70% to 80% - is considered unplanned and informal settlements. Further, the fastest-growing areas continue to occur in the informal areas, especially on the periphery of the city. The rapid urbanization without strategic guidance also resulted in the loss of urban ecosystems such as forest reserves, increased disturbance to land and aquatic systems, and unregulated stone and sand extraction for building material – all contributing to environmental degradation. The woeful lack in regulatory guidance, frameworks and tools at the city level are most apparent in the following areas:

- a. Dar es Salaam is still relying on a 1979 Master Plan and the current draft is stuck in a protracted process. Without a Master Plan (and also largely absent detailed physical plans), the local governments do not have a guiding decision-making tool or a basis for coordinating infrastructure and overall urban development. Formal planning is carried out on an ad-hoc basis and covers only 20%-30% of the city.
- b. The overall legal tools and mechanisms (e.g., local policies, guidelines, by-laws etc.) to guide urban development and environmental protection actions are largely missing, and, if present, apply only to specific Districts within the city or are outdated and thus impractical. Urban development regulation and environmental protection efforts are largely carried out through projects, on a case-by-case basis. Thus, enforcement and sustainability is a huge challenge.
- c. Further, especially at the local level, the DLAs do not have an integrated information database to serve different agencies and for different sectors; economic and social data are also not supported spatially. A proper inventory of river and aquatic systems is lacking, and archives for the river and swamps are not properly kept by the responsible authorities. Furthermore, they are not shared among themselves, not even upon succession from one authority to another when re-organization occurs.

3. ***Loose adherence to prescribed regulatory processes.***

Besides the lack in regulatory guidance and tools, the ability of both national and local-level agencies to carry out their necessary mandates according to procedures is largely lacking in practice. Often, national level Acts would lay down the coordination and execution processes, from the national-level to the local levels. However, these formal procedures may not be followed in practice. For example, MoLHSSD was the main driver of the Master Plan revision for Dar es Salaam, although the local governments should have been the responsible party. Or, due to many factors, agencies' actions are not aligned with the safeguarding of the urban environment and the larger public interest. (For example, government agencies or service providers may build/provide services to or provide title deeds/allocate land for development on environmentally sensitive areas unsuitable for development (e.g., wetlands, river basins) or site their infrastructure on haphazardly developed land.)

4. ***Lack of current capacity, resources and technical expertise; and competing priorities for resource allocation.*** The lack in both financial and staff capacity and resources is a common challenge highlighted by all institutions. For example on water basin management, each river basin officer has to cover (including manage and enforce) a very large geographic area, which is practically impossible. In the DLAs, while the total staff strength is large, the issue seems to lie with a mismatch in necessary expertise and priority areas. For example, environmental issues are typically not a priority area for the DLA (each DLA only has one or two environmental officers and usually doubled up by public health officials to carry out the environment-related work). Ineffective enforcement of environmental protection actions is a key challenge, and this occurs due to lack in capacity, dedicated resources and also insufficient regulatory backing or protracted judicial procedures. Further, with the central government having played (and in various aspects, still playing) the main role for many years, in most cases Local Government Authorities lack the experience, skills and resources to undertake their new roles.

For example in the provision of water supply and sanitation services, the absence of adequate capacity and expertise to implement water resources management activities has led to ineffective water resources assessment, inefficient water allocation, and inadequate follow-up on water use and enforcement of water law. Skilled professionals in these sectors often have limited incentives and poor remuneration, which leads to them leaving the sector. The provision of water, sewerage and sanitation services has also suffered due to bureaucratic procedures, lack of autonomy, and lack of resources and facilities.

## Suggestions and Recommendations

1. ***Consolidate, align and rationalize institutional structure and mandates.*** Further consolidation and/or realignment of mandates, roles and functions of the agencies is needed – first within each level of government, and also vertically across the levels. (For example, the roles and responsibilities need to be clarified between: (i) VPO Division of Environment and NEMC; (ii) EWURA and MoW; (iii) DCC, the Regional Secretariat and PMO-RALG in terms of coordinating the Dar es Salaam local districts; and (iv) local governments and service providers such as DAWASCO.) Further, the regulatory roles of various entities need to be rationalized in accordance with hierarchical functions. For example, the local authority, DLAs, should carry out the day-to-day functions and be the first line of initiation and response, while central-level ministries should largely serve regulatory and policy-setting roles and provide back-stopping support, rather than detailed approval functions at the local level (such as planning approvals of individual parcels for land use changes). It is imperative to clarify institutional roles, functions and mandates to empower the various agencies with the necessary authority and power to plan, implement and enforce their regulatory functions. Enabling this may require amendment of existing laws or a commitment to enforce them and establishing new ones.
2. ***Greatly improve, update and put in place necessary local regulatory framework and tools.*** Projects at the local level are good initiatives and could serve as pilot experiments. However, these need to be backed by strong legal tools to allow systematic treatment to tackle the many urban development and environment challenges. The legal tools are necessary to translate national-level framework and guidance into implementable and enforceable measures which are contextual and endorsed locally. (For example, local governments should supplement their regulatory tools by developing or updating the necessary environmental by-laws, detailed local development plans etc.) In addition, better data collection, management, setting up an integrated database and allowing smooth information exchange and flow between relevant agencies would greatly enhance regulatory functions and effectiveness.

3. ***Reinforce prescribed mandates and processes and improve inter-agency integration and coordination aligning across the chain of processes for urban development, basic service provision and environmental management.*** Further to consolidating and rationalizing the institutional structure, where the mandates and responsibilities are clear, better adherence to prescribed mandates and processes by each entity needs to be reinforced in practice. For example, where joint actions or consultations are required, the necessary actions and coordination should be undertaken; also, national-level agencies should not cite the reason for lack of capacity at the local level to take over or interfere directly with local responsibilities. Rather, a better way is to provide the necessary capacity building or technical assistance to build up local capacity. Coordination between all relevant agencies at various steps of urban development, service provision and environmental management process should be strengthened, potentially through reinforcing standard operating procedures, or setting up of regular forums or specific task forces.
4. ***Institute accountability and track performance.*** Within each agency, it would be useful to devise monitoring and evaluation indicators and systems to track development cases, permits/licenses issued and conditions attached to them, in addition to an associated follow-up plan. This would allow better monitoring and enforcement of the necessary requirements and procedures. Audit mechanisms could also be considered to assess the performance of both national level and local governments on aspects such as environmental regulation enforcement, together with built-in incentives or disincentives related to performance as determined by the audits.
5. ***Conduct public education and communication initiatives.*** Creating public awareness and even enabling community/self-policing would be another good way to strengthen the enforcement of relevant environmental regulations. The objectives of conducting public education and communication initiatives could be multi-fold. The first objective is to demonstrate and publicize the benefits of green urban environment and the direct positive impacts to communities (e.g., improvements to public health, increase in property values etc.). Secondly, the responsibilities of various government agencies should be clarified to create transparency and build trust with the public. The public should be able to direct queries and report any misconduct to the relevant authority and hold it accountable, and see that appropriate actions are taken. Conversely, the relevant authority would have the power to enforce its mandate without unnecessary interference. Therefore, each agency could embark on a communication campaign to outline its mandate, responsibilities, assessment methods (e.g., for licensing or permits) and publish public guideline documents through means (illustrations, pamphlets, websites etc.) easily accessible and understandable (in plain language free of jargon) by the general public. In addition to the public at large, the management team in each agency and the local leaders should be the first target group to obtain alignment in thinking. Once these leaders are on board, it would be easier to rely on them to disseminate the correct messages and communicate directly with their own reports/constituents to strengthen the cause.
6. ***Strengthen capacity and boost resources.*** In addition to macro-level improvements such as increasing Dar es Salaam's own source revenue or increasing education and skills training, other steps could be taken to strengthen capacity and boost resources. Capacity could be improved, especially in the DLAs focusing on urban planning and development and environmental management, especially to: (i) implement the new Master Plan, (ii) develop strategic local area development plans, (iii) utilize GIS data for evidence-based decision making, (iv) enforce and monitor, and (v) plan and coordinate across DLAs and departments. In addition, consolidating institutional functions and structure, better planning to align staff numbers and skills with development priorities, or smart use of technology could help to increase efficiency for carrying out the necessary tasks. Each agency, especially the local governments, should also have control over its own budget and staffing plan and decisions, in line with their functions and obligations.

## VII. KEY FINDINGS

***Informal settlement is inevitable and is currently the single biggest driver of ecosystem loss across the city of Dar es Salaam.*** Dar es Salaam is an important economic engine of the country. It will continue to grow and attract new residents, many of whom cannot afford housing and are without the means to participate in the formal economy. The impacts of informal settlement that have been described in the Profile will only worsen if the city does not take an active role in developing spatial plans that designate where informal settlements will be located and how they will be provided basic services. Without intentional urban planning intervention, the informal settlements will continue to be one of the primary sources of environmental degradation.

***Dar es Salaam's aquatic ecosystems have been most burdened and degraded by the impacts of urbanization.*** The systems are under acute pressure and action is urgent if their deterioration is to be arrested. The rivers and streams within the developed urban area have been severely polluted by encroachment and heavily impacted by solid waste and poor quality waste water treatment services. The Msimbazi River, the most important water source for residents for drinking, bathing, and agriculture, is the most severely polluted and degraded of the four primary rivers in the city. However, as is common with other cities in Tanzania and Sub-Saharan Africa, there are limited resources available to invest in the large-scaled grey infrastructure projects that will be required to mitigate the impacts of inadequate services such as sanitation.

Given these constraints, leadership and institutional action to develop and advance feasible programs, plans and policies capable of addressing key problems are particularly important. It will be important to establish a regulatory and planning framework that promotes integration across the sectors to support more sustainable approaches.

***Institutional fragmentation problems are particularly challenging in Dar es Salaam and restrict effective urban environmental management.*** Many institutions are involved with aspects of environmental issues, including issues of a local nature that are required to be addressed at a national level or vice versa. There is multiplicity of legislation, with each institution having its own legal framework. Environmental management and regulation at the city level, as well as administration of services such as sanitation and drainage that

directly impact management of the environment, involve numerous levels of government regulation and coordination that limit the capacity of municipal departments to act in a timely and effective manner. A number of initiatives are currently underway (e.g. the EcoPoor project, or UNDP - funded "Implementation of concrete measures to reduce vulnerability of livelihood and economy of coastal and lakeshore communities in Tanzania") but any effective interventions will require serious action to address the institutional weaknesses that prevent effective response.

***Urban development has not been guided by a strategic planning framework that identifies the most critical natural assets and prioritizes their conservation.***

There is no planning structure or tools to assist town planners and environmental regulators with balancing development with environmental conservation and to mitigate the loss of environmental assets. The lack of an updated master plan in the past 35 years has had severe consequences on all aspects of urban spatial planning and the provision of basic urban services. The city lacks effective spatial development plans and urban design standards to guide growth and development. There is little integration of planning across sectors. This significant institutional failing has prevented the city from creating an effective framework to identify and protect natural assets, to establish the means to evaluate development proposals, and to create a balance in tradeoffs between the interests of development and the environment.

***There are broader metropolitan-scale environmental assets remaining within the city that will require strategic action to conserve and protect.*** The continued development of the city and its environmental impacts need to be considered at the metropolitan scale. Spatial and infrastructure planning should consider critical environmental assets to be protected and conserved as the city expands. These environmental assets include the 2,000 ha of Mangrove Forest along the coast; the forest lands in the upland water catchment areas that are degraded but remain open bush land where forest can be regenerated; and the Kigamboni (across the harbor bridge), which still has relatively healthy ecosystems that will soon face the pressure of urbanization. It is essential for the city to identify the environmental assets that are still worth saving and take the necessary actions to conserve and protect them so that past mistakes are not repeated.





## VIII. BIBLIOGRAPHY

- Abebe, Fikreselaissie K., 2011. *Modelling Informal Settlement Growth in Dar es Salaam, Tanzania*. March, 2011.
- Andreasen, Manja Hoppe. 2013. *Population Growth and Spatial Expansion of Dar es Salaam. An analysis of the rate and spatial distribution of recent population growth in Dar es Salaam Rurban Africa African Rural-City Connections*. 2013.
- Ardhi University, 2010. *Department of Urban Planning*.
- Breeze, Robert, 2012. *Municipal Solid Waste Management in Dar Es Salaam. Draft Baseline Analysis*. Prepared for World Bank. October, 2012.
- Bingham, Rachel, 2014. *Capacity Building in Dar es Salaam*. Prepared for Notes from CityLinks. November 7, 2014.
- BirdLife International, 2014. Important Bird Areas factsheet: Pande Game Reserve and Dondwe Coastal Forests. Downloaded from <http://www.birdlife.org> on November 6, 2014.
- Bubegwa, Samweli, 2012. *An Overview of Solid Waste Management in City of Dar es Salaam, Ilala Muncipal Council-Dar es Salaam*.
- Buchta, Katja, 2013. *Urban Spatial Scenario Design Modelling (USSDM) in Dar es Salaam: Background Information Modelling urban settlement dynamics in Dar es Salaam*. Prepared as part of Climate change and Urban Vulnerability in Africa (CLUVA). July 2013.
- Casmiri, D., 2008. *Vulnerability of Dar es Salaam City to Impacts of Climate Change*. EPMS.
- CCIAM, 2013. *Analysis of the impacts of urban land use and climate change on coastal forest ecosystem and management*. Written by Sylvester Chaisamba and Pamela Levira. Tanzania Meteorological Agency. June 2013.
- CDP, 2014. *City Responses to Carbon Disclosure Project Survey*. Prepared by Dar es Salaam, TZ for the CDP, a project of the C40 Cities.
- Chacha, Mr. 2015. Temeke Municipality. Personal communication between Mr. Chacha and Dr. Anesi Mahenge. February 19, 2015.
- CLUVA, 2011. *Ardhi University Climate Change Studies. Climate change and Urban Vulnerability in Africa (CLUVA)*.
- Dar es Salaam City Council, 2004. *Dar es Salaam City Profile*. Prepared with advice from Cities and Health Programme, WHO Centre for Development, Kobe, Japan. November 2004.
- DAWASA, 2013. *Water Utilities and Performance Review Report 2012-2013*. Dar es Salaam, Tanzania.
- De Risi et al., 2013. *Flood Risk Assessment for Informal Settlements. Natural Hazards*. June 2013.
- De Witte, Ine. 2012. *Characterization of the status of Dar es Salaam aquifer in view of salt-water intrusion and nitrate contamination*. Prepared for Universiteit Gent.
- Kabisch Nadja, 2014. *Ecosystem service implementation and governance challenges in urban green space planning—The case of Berlin, Germany*. 2014.
- Kironde, J. M. Lusugga. Onibokun, Adepoju G., 1999. *Managing the Monster – Urban Waste and Governance in Africa*. International Development Research Centre. 1999.
- Hepworth N. and Jane Joseph, 2014. *Water Witness International: Dar es Salaam's Urban Rivers: pollution and flood impacts of the Msimbazi, Ubungu, Luhanga and Tenge Rivers*. September 2014.
- Hill, Alexander and Christian Linder, 2010. *Modelling Informal Urban Growth Under Rapid Urbanization*. Prepared for the TU Dortmund University. June 2010.
- Halla, Francos, 2006. *A SWOT analysis of strategic urban development planning: The case of Dar es Salaam city in Tanzania*. Habitat International. 2007.

- ICF International, 2014. *Inputs to Design and Appraisal for Business Case for Building Urban Resilience to Climate Change in Tanzania. Inception Report*. Prepared for UK Department for International Development. November 28, 2014.
- ICF International, 2009. *Final Report Sub Saharan Africa Refinery Project Health Study: Volume I-A Health Study Final Report*. Prepared for World Bank. September 2009.
- ICMA, n.d.a. *Durban-Dar es Salaam Climate Change Partnership*.
- IFRC, 2012. *DREF Final Report, Tanzania: Floods*. June 28, 2012. [www.ifc.org](http://www.ifc.org).
- Ilala Municipal Council, 2012. *Overview of Solid Waste Management in the City of Dar es Salaam. Paper presented at the Coast East Africa Solid Waste Management and Gas to Energy Best Practices Workshop*. September 10-13, 2012.
- International Climate Fund, 2014. *Building urban resilience to climate change in Tanzania*. Proposal submitted to DFID Tanzania, May 2014.
- Jones, Thomas Edward and Rahel Nasoni Mkoma. 2013. *Reflections on 20 Years of Solid Waste Management Reforms in Tanzania: The Case Study of the Sustainable Dar es Salaam Project. The Macrotheme Review* 2(4). Summer 2013.
- Kebede, A. and Robert Nicholls, 2010. *Population and Assets Exposure to Coastal Flooding in Dar es Salaam (Tanzania): Vulnerability to Climate Extremes*. Report Submitted to Global Climate Adaptation Partnership. January 2011.
- Kiunsi et al., 2006. Unpublished Conception Plan for the decongestion of Dar es Salaam. An unpublished paper exhibited during the 2006 Saba Saba Trade Fair, University College of Lands and Architectural Studies.
- Kiunsi, 2013. *Constraints on Climate Change Adaptation in a city with Large Development Deficit, the case of Dar es Salaam*. 2013.
- Kiunsi, 2013. *A Review of Traffic Congestion in Dar es Salaam City from the Physical Planning Perspective*. Journal of Sustainable Development; Vol. 6, No. 2. 2013.
- Kjellen Marianne and A. Kyessi, 2013. *Dar es Salaam: The Development of Water Supply and Sewage Systems. Water Urban Pt*. 2012.
- Kyessi, A., 2007. *Capacity Building Needs Assessment and Capacity Building Plan for Upgrading of Unplanned and Unserved Settlements in the City of Dar-es-Salaam*. Prepared for Dar es Salaam City Council. March 2007.
- Kyessi, A. 2010. *Formalisation of Unplanned Settlements and its Implications on Poverty Reduction: The Case of Dar es Salaam City*. Tanzanian Journal of Development Studies, University of Dar es Salaam, 2010, Vol. 8, No. 2, pp. 1-22. 2010.
- Lupala, J. 2002. *Urban types in rapidly urbanizing cities - Analysis of formal and informal settlements in Dar es Salaam, Tanzania*. Doctoral Thesis submitted to the Department of Infrastructure, Royal Institute of Technology, Stockholm.
- Lupala, J., & Kiunsi, R., 2011. *Dar es Salaam city, 50 years to come: Conceptual considerations*. Unpublished working workshop paper presented during the 50 years anniversary of the University of Dar es Salaam.
- Lupala et al., 2014. *Effects of Peri-Urban Land Use Changes on Forest Ecosystem Services: The Case of Settlements Surrounding Pugu and Kazimzumbwi Forest Reserves in Tanzania*. Journal of Geography and Geology; Vol. 6, No. 4, 2014.
- Macchi et al. *Adapting to Climate Change in Coastal Dar es Salaam*. AESOP-ACSP Joint Congress. July 2013. Dublin.
- Majura, n.d.a. *Current and Future Groundwater Resources Management Strategies in Dar es Salaam, Tanzania, Department of Geology, University of Dar es Salaam*.
- Mato, 2002. *Groundwater Pollution in Urban Dar es Salaam, Tanzania*.
- McKenzie, M., 2014. *Durban and Dar es Salaam: Sharing lessons on coastal problems*. CityLinks.

- Mitoni, Yohana. 2010. *Saltwater Intrusion in the Quaternary Aquifer of the Dar es Salaam Region, Tanzania*. SWIM21-21st Salt Water Intrusion Meeting. June 21-26, 2010. Azores, Portugal.
- Moss and Happold, 2013. *Draft Dar es Salaam Master Plan 2013*. Presentation Prepared for the Ministry of Lands, Housing and Human Settlements Development. April 22, 2013.
- Muhando, Christopher and J. Francis, n.d.a. *The Status of Coral Reefs in the Dar-es-Salaam Marine Reserves System and the State of Reefs in Other Marine Protected Areas of Tanzania*.
- Mutagaywa, Rweyemamu, n.d.a. Dar es Salaam Marine Ecology Conservation Project. World Care-Tanzania.
- Mwegoha, W.J.S and and C. Kihampa., 2010. *Heavy metal contamination in agricultural soils and water in Dar es Salaam city*, African Journal of Environmental Science and Technology Vol. 4(11), pp. 763-769, November, 2010. Tanzania.
- National Audit Office, 2009. *Performance Audit on Management of Solid Waste in Big Cities and Regions in Tanzania*. 2009.
- National Environment Management Council, 2010. *Environmental and Social Impact Assessment of the Proposed Expansion of the Lowere Ruvu Water Treatment Plant, Bagamoyo, Tanzania*.
- National Environmental Management Council (NEMC) and United Nations Environment Program (UNEP), 2014. *Dar es Salaam Rivers Rehabilitation and Management Programme (DRMP). Project Design Document*. March, 2014.
- National Settlements Report, 2013. *Household Budget Survey. 2006-2007*; settlements section last modified 2013.
- NEMC, 2009. *Dar es Salaam River Basin Management Project. Draft Project Concept*.
- NEMC and UNEP, 2014. *Dar es Salaam Rivers Rehabilitation and Management Programme (DRMP). Project Design Document*. March 2014.
- Norconsult, 2008. *The United Republic of Tanzania. Dar es Salaam Water and Sewerage Authority. Environmental Impact Assessment (EIA) Statement for Kidunda Dam. Executive Summary. Final*. March, 2008.
- Nyandwi, 2010. *The Major Cause of Observed Erosion Surge on the Beaches North of Dar es Salaam City*. *Tanzania Journal of Science* Vol 36. 2010.
- Nnkya, Tumsifu Jonas, 1999. *Towards Strategic Planning in Tanzania – The case of Sustainable Dar es Salaam Project*. May 1999.
- Othman, O.C, 2010. *Roadside Levels of Ambient Air Pollutants: SO<sub>2</sub>, NO<sub>2</sub>, NO, CO and SPM in Dar es Salaam City*, Tanzania Journal of Natural and ISSN 1821-7249 Applied Sciences (TaJONAS), University of Dar es Salaam, Dar es Salaam.
- Pallangyo, Daniel Mirisho. 2007. *Environmental Law in Tanzania; How Far Have We Gone? Law, Environment and Development Journal*, (LEAD). 2007.
- Penrose et al, 2010. *Informal Urban Settlements and Cholera Risk in Dar es Salaam, Tanzania*. PLoS Neglected Tropical Diseases. Mar 2010; 4(3): e631
- Prime Minister's Office, 2013. *Consultancy Services for Improvement of Solid Waste Management in Dar es Salaam Local Authorities in Support of Preparation of the Proposed DMDP. Appendix 2. Draft Final Environmental and Social Impact Assessment (ESIA) Report*. September 2013.
- Shand, n.d.a. As located in: Universitat Dortmund IPRUD, n.d.a. Dar es Salaam MEGA : Cities. Website download March 23, 2016, <http://www.raumplanung.tu-dortmund.de/irpud/megacities/>.
- Taljaard, Susan and Dr. Sixtus Kayombo, 2007. *DRAFT UNEP- GEF WIO-LaB Project Addressing Land Based Activities in the Western Indian Ocean Preliminary Transboundary Diagnostic Analysis on Land-based Activities: Marine Pollution. Prepared for UNEP and GEF*. June 2007.

- Tanzania - Environmental Management Act, 2004, 3/3 Law, Environment and Development Journal (2007), p. 290, <http://www.lead-journal.org/content/07290.pdf>.
- Tanzania Meteorological Agency et al., 2011. *Urban Poverty & Climate Change in Dar es Salaam, Tanzania: A Case Study*. March 10, 2011.
- The United Republic of Tanzania Ministry of Water and Irrigation. *National Water Sector Development Strategy 2006 to 2015*. September 2008.
- The United Republic of Tanzania Prime Minister's Office Regional Administration and Local Government, and Regional Commissioner's Office, 2010. *Strategic Plan for 2010/11-2012/2013*. 2010.
- The United Republic of Tanzania President's Office Public Service Management, 2011. *The Functions and Organization Structure of the Regional Secretariats*. June 2011.
- The United Republic of Tanzania Prime Minister's Office Regional Administration and Local Government, 2012. *Strategic Plan – 2011/12 – 2015/16*. September 2012.
- The United Republic of Tanzania, 2004. *The Environmental Management Act, 2004*. 2004.
- The United Republic of Tanzania. *National Water Policy*. July 2002.
- Tietz, Peter, n.d.a. *Trunk Infrastructure and Urban Growth – Managing Rapid Urbanization in Poverty in Dar es Salaam, Tanzania*. Prepared for German Federal Ministry of Education and Research.
- United Nations, n.d.a. *Factsheet on Presence of Faecal Coliforms in Freshwater*. Available from [http://www.un.org/esa/sustdev/natlinfo/indicators/methodology\\_sheets/freshwater/faecal\\_coliforms.pdf](http://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/freshwater/faecal_coliforms.pdf)
- UNEP, 2006. *Challenges to International Waters – Regional Assessments in a Global Perspective*. United Nations Environment Programme, Nairobi, Kenya.
- UNEP, 2011. *Dar Es Salaam City Environmental Outlook 2011*. Prepared for the Vice-Presidents' Office. 2011.
- UN-Habitat, 2004. *The Sustainable Dar es Salaam Project 1992-2003*. The SCP Documentation Series, Volume 3. October 2004.
- URT, 2003. Vice President's Office. *Initial National Communication Under the United Nations Framework Convention on Climate Change*. March, 2003.
- UPI, 2011. *Rain brings deadly flooding in Tanzania*. December 23, 2011.
- URT, Ministry of Finance and Economic Affairs. June, 2010. *Environmental and Social Impact Assessment of the Proposed Expansion of the Lower Ruvu Water Treatment Plant, Bagamoyo, Tanzania*. Prepared by DAWASA for NEMC. Prepared for DAWASA by SMEC International (PTY) Ltd. June 2010.
- URT, 2009. Vice President's Office. *Division of Environment. Fourth National Report on Implementation of Convention on Biological Diversity*. July, 2009.
- URT, 2010. *Environmental and Social Impact Assessment of the Proposed Expansion of the Lower Ruvu Water Treatment Plant, Bagamoyo, Tanzania*.
- URT, 2012. Vice President's Office. *National Report for the United Nations Conference on Sustainable Development, Rio+20*. Prepared 2012.
- URT, 2013. *Basic Facts and Figures on Human Settlements, 2012*. National Bureau of Statistics, Ministry of Finance. Dar es Salaam. December, 2013.

- URT, 2014a. *Environmental and Social Impact Assessment Report for the Proposed Infrastructure Upgrading in Unplanned Settlements in Ilala Municipality, Dar Es Salaam, Region*. December 2014.
- URT, 2014b. *Environmental and Social Impact Assessment Report for the Proposed Infrastructure Upgrading in Unplanned Settlements in Kinondoni Municipality, Dar Es Salaam, Region*. December 2014.
- URT, 2014c. *Environmental and Social Impact Assessment Report for the Proposed Infrastructure Upgrading in Unplanned Settlements in Temeke Municipality, Dar Es Salaam, Region*. December 2014.
- URT, 2014a TSCP. *Tanzania Strategic Cities Project (TSCP) Environmental Impact Statement of the Proposed Rehabilitation/Improvement of Surface Water Drainage System in Ilala Municipality, Dar Es Salaam Region*. Prepared by COWI in association with PROCESL. November 11, 2014.
- URT, 2014b TSCP. *Tanzania Strategic Cities Project (TSCP) Environmental Impact Statement of the Proposed Rehabilitation/Improvement of Surface Water Drainage System in Kinondoni Municipality, Dar Es Salaam Region*. Prepared by COWI in association with PROCESL. November 12, 2014.
- URT, 2014c TSCP. *Tanzania Strategic Cities Project (TSCP) Environmental Impact Statement of the Proposed Rehabilitation/Improvement of Surface Water Drainage System in Temeke Municipality, Dar Es Salaam Region*. Prepared by COWI in association with PROCESL. November 12, 2014.
- US AID, 2008. *A Profile of the Wami River Sub-Basin*. Prepared by the Anzania Coastal Management Partnership for Sustainable Coastal Communities and Ecosystems in Tanzania. June 2008.
- USDA, 2014. *Values of Urban Trees*. Downloaded from USDA on December 7, 2014.  
<http://www.na.fs.fed.us/spfo/pubs/uf/techguide/values.htm> U.S. Department of Agriculture.
- US EPA, n.d.a. *Ground-level Ozone Ecosystem Effects*. <http://www.epa.gov/groundlevelozone/ecosystem.html>.
- US EPA, 2007. *Closing Small Tribal Landfills and Open Dumps*. U.S. Environmental Protection Agency. EPA 909 R-11-007.
- US EPA, 2013. *The Ozone Problem*. [http://www.epa.gov/region1/airquality/oz\\_prob.htm](http://www.epa.gov/region1/airquality/oz_prob.htm).
- US EPA, 2014. *Asthma Triggers: Gain Control. Outdoor Air Pollution*. <http://www.epa.gov/asthma/outdoorair.html>.
- Van Stigt, R., Driessen, P.P.J., Spit, T.J.M., 2014. *A user perspective on the gap between science and decision-making. Local administrators' views on expert knowledge in urban planning*. 2014.
- Victor Deo, 2009. *The District Land and Housing Tribunals in Tanzania Mainland: An Examination of the Execution Stage of Judicial Process*. Mzumbe University. 2009.
- Watkiss, P. Downing, T., Dyszynski, J., Pye, S. et al (2011). *The Economics of Climate Change in the United Republic of Tanzania. Report to Development Partners Group and the UK Department for International Development*. Published January 2011.
- World Bank, n.d.a, *Dar Es Salaam Case Study. Climate Change, Disaster Risk and the Urban Poor: Cities Building Resilience for a Changing World*. Prepared by World Bank, Institute of Resource Assessment at University of dar es Salaam, Ardhi University, Tanzania Meteorological Agency, International START Secretariat and the Dar es Salaam City Council.
- World Bank, 2010. *Implementation Completion and Results Report. (IDA-37710 and IDA 3771A). On a Credit in the Amount of SDR 45 Million (\$61.5 Million) To the United Republic of Tanzania for a Dar es Salaam Water Supply and Sanitation Project. Report No: ICR00001361*. Prepared by Water and Urban Unit, Africa Regional Office. May 31, 2011.



World Bank, 2011. *Mayor's Task Force: Urban Poverty & Climate Change in Dar es Salaam, Tanzania: A Case Study. Final Report*. May 31, 2011.

World Bank. 2014. *Environmental and social management framework and environmental codes of practice. Tanzania: Crown, TECH-Consult Ltd.*

World Resources Institute, 2010. As located in: *Tanzania National Resource Forum: Tanzania Dynamite Fishing Monitoring Network*. Website download March 23, 2016, <http://www.tnrf.org/en/dynamitefishing>.

Yanda, P.Z., 2007. *Hydrologic and Land Use Cover/Change Analysis for the Ruvu River (Uluguru) and Sigi River (East Usambara) Watersheds. Prepared for WWF/CARE. Dar es Salaam, TZ. March, 2007.*

Yhdego, Michael. *Urban environmental degradation in Tanzania. Environment and Urbanization*. 1991 3:147.

## IX. APPENDIX

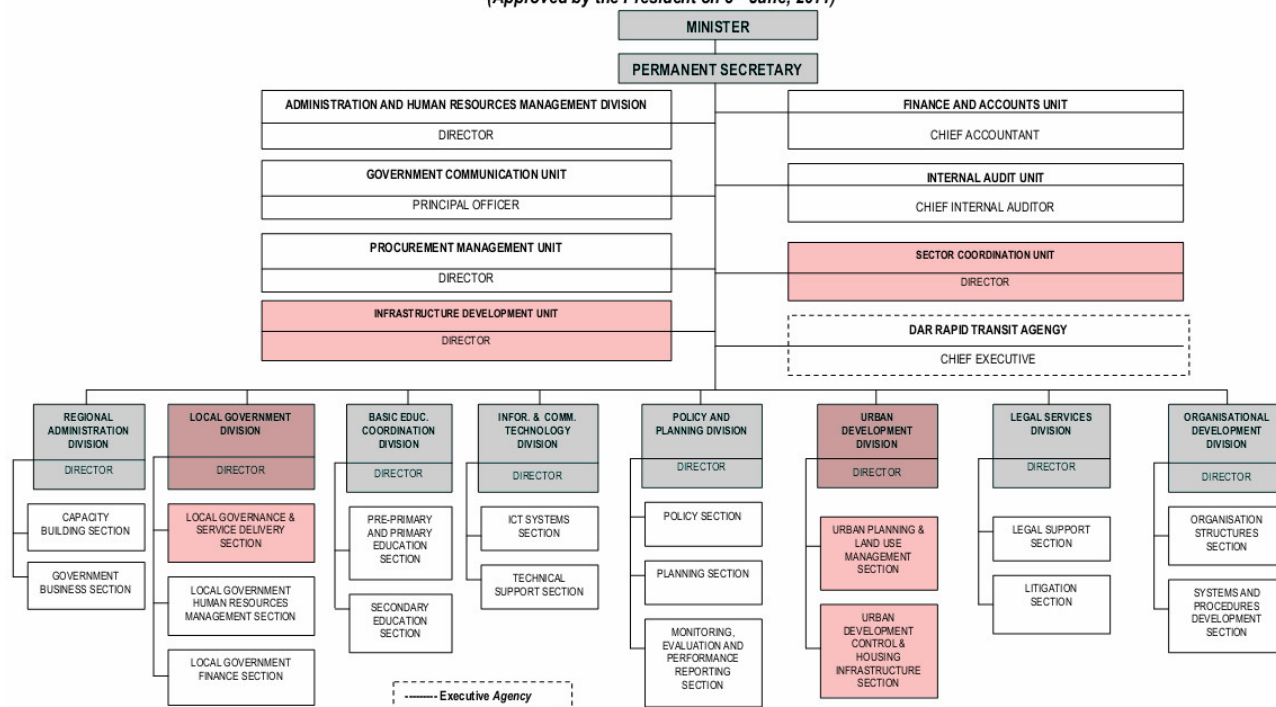
### Appendix A: Summary of Institutional Analysis

	Prevailing Institutional Landscape	Institutional Challenges	Suggestions and Recommendations
Institutional Structure	<ul style="list-style-type: none"> <li>Both central and city level agencies, and at times regional agencies are directly involved in aspects of urban/land and urban environment management.</li> <li>Multiple agencies at each government level are directly involved (eg. centrally: PMO-RALG, MoLHSSD, MoW, VPO, NEMCI; locally, the four DLAs plus service provider and private companies).</li> </ul>	<ul style="list-style-type: none"> <li>Institutional fragmentation within each government level and across levels – overlapping mandates, weak integration and coordination</li> </ul>	<ul style="list-style-type: none"> <li>Consolidate, align and rationalize institutional structure and mandates</li> </ul>
Regulatory Environment	<ul style="list-style-type: none"> <li>Basic array of legal tools such as policies and regulations to guide urban development and the protection of urban environment are available at the national, but to a lesser extent at the regional and local levels.</li> <li>At the local level, government actions take place largely through specific projects, but lacks overall regulatory guidance and framework.</li> </ul>	<ul style="list-style-type: none"> <li>Weak regulatory guidance, lack in regulatory frameworks and tools especially at the local level</li> </ul>	<ul style="list-style-type: none"> <li>Greatly improve, update and put in place necessary local regulatory framework and tools</li> </ul>
Processes and Interactions	<ul style="list-style-type: none"> <li>Formal structures and processes have been set down through regulation. However in practice, these may not be followed, or are not adequately capacitated. (For example physical planning is formally decentralized, but in practice the draft Dar Master Plan has been mainly coordinated by MoLHSSD. Or, at the local level, Dar is not equipped with effective environmental management coordination mechanisms/people).</li> </ul>	<ul style="list-style-type: none"> <li>Loose adherence to prescribed regulatory processes</li> </ul>	<ul style="list-style-type: none"> <li>Reinforce prescribed mandates and processes; Improve inter-agency integration and coordination aligning across the chain of processes for urban development, basic service provision and</li> </ul>

			environmental management <ul style="list-style-type: none"> <li>• Institute accountability and track performance</li> </ul>
Capacity and Resources	<ul style="list-style-type: none"> <li>• Large staff numbers in DLAs, however not sufficiently skilled or appropriately deployed.</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of current capacity, resources and technical expertise; and competing priorities for resource allocation</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct public education and communication initiatives</li> <li>• Strengthen capacity and boost resources</li> </ul>

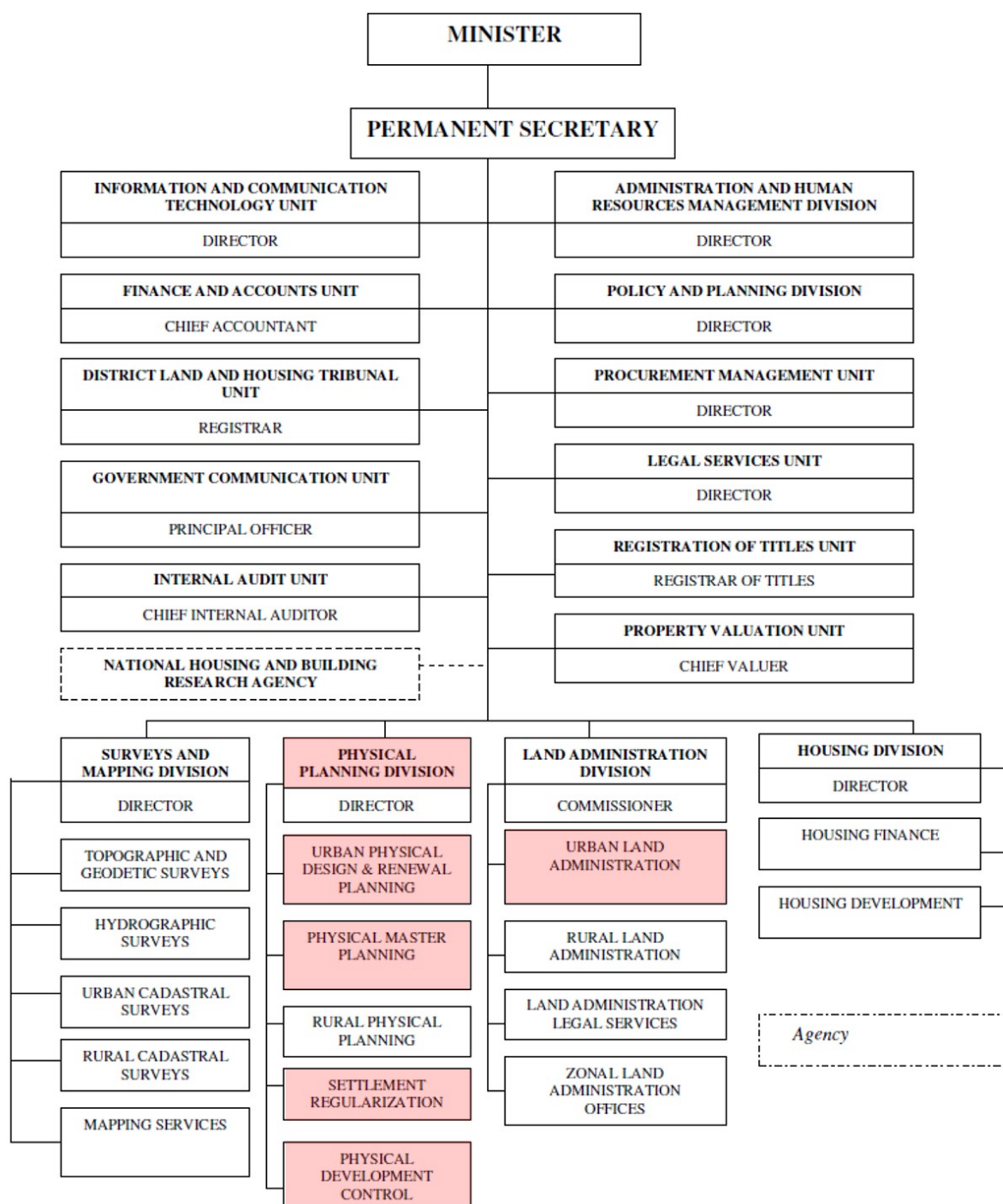
## Appendix B: Institutional Figures

### THE ORGANISATION STRUCTURE OF PRIME MINISTER'S OFFICE – REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT (Approved by the President on 3<sup>rd</sup> June, 2011)



**THE ORGANISATION STRUCTURE OF THE MINISTRY OF LANDS, HOUSING AND  
HUMAN SETTLEMENTS DEVELOPMENT**

***(Approved by the President on 3<sup>rd</sup> June, 2011)***

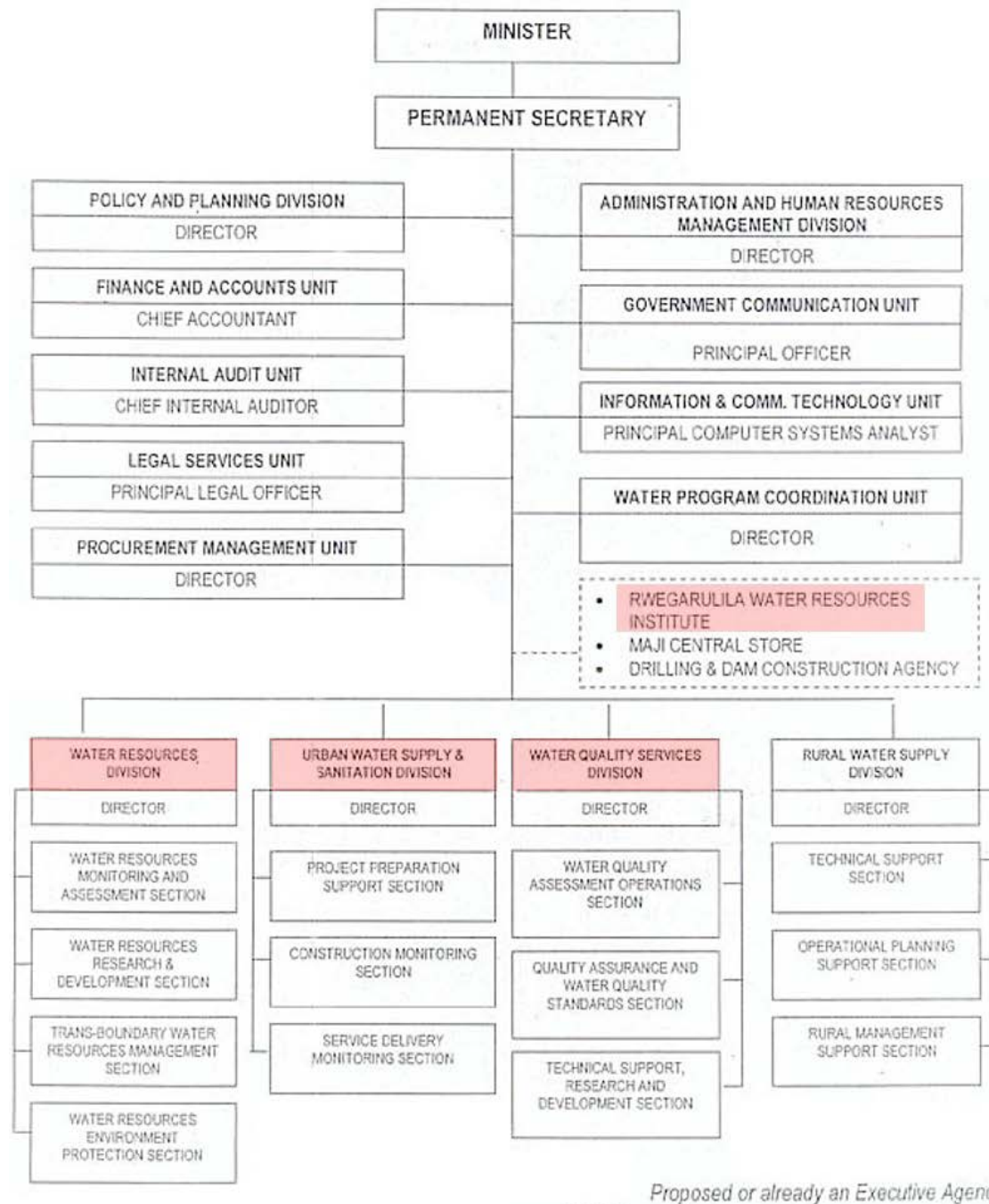


*Figure: Organogram of Ministry of Lands, Housing and Human Settlements Development  
(with most relevant departments and agencies highlighted)*

*Source: MoLHHSD website*



**THE ORGANISATION STRUCTURE OF THE MINISTRY OF WATER**  
(Approved by the President on 3<sup>rd</sup> June, 2011)



*Figure: Organogram of Ministry of Water (with most relevant departments and agencies highlighted)*  
*Source: MoW website*

Organisation	Functions and Responsibilities
Minister responsible for Water	<p>Presents national policy and strategy to the Government.</p> <p>Ensures policies and strategies are implemented.</p> <p>Appoints Chairperson and members of National Water Board and Basin Water Boards.</p> <p><b>Determines a mechanism for appeals from all levels of framework.</b></p>
Ministry responsible for Water	<p>Provides for sectoral co-ordination, monitoring and evaluation.</p> <p>Develops and reviews policies, strategies, including legislation and financing.</p> <p>Formulates technical standards and WRM guidelines.</p> <p>Ensures dam safety.</p> <p>Monitors Water Quality.</p> <p>Deals with trans-boundary issues of national interest.</p> <p>Develops water resources of national interest.</p> <p>Maintains national WRM sub-sector information</p> <p>Monitors the National Water Board and the Basin Boards.</p> <p>Supervises the Water Resources Institute. (Agency).</p> <p>Supervises the Drilling and Dam Construction Agency.</p>
National Water Board	<p>Co-ordinates and harmonises strategic actions of Water Basin Boards.</p> <p>Co-ordinates and endorses basin plans (e.g. sectoral and inter-sectoral, investment priorities and financing patterns, inter-basin water transfer).</p> <p>Co-ordinates technical trans-boundary water resources management issues of national interest.</p> <p>Resolves inter-sectoral / inter-basin conflicts.</p> <p>Co-ordinates information management and assessment of water resources (e.g. hydrological, hydrogeological information, water and discharge permit registers, registers of water user associations etc).</p> <p>Supports basin water boards in the formation of water users associations/catchment organisations.</p> <p>Serves as a communication channel between the water basin boards and the Government</p> <p>Co-ordinates and facilitates the conduct of water audits and provides technical support</p>
Basin Water Boards	<p>Data collection, processing and analysis for WRM monitoring and resource assessment.</p> <p>Co-ordinates technical aspects of trans-boundary issues in the basin.</p> <p>Co-ordinate and approve basin WRM planning / budgets.</p> <p>Approve issue and revoke water use and discharge permits.</p> <p>Enforce water use permits and pollution control measures.</p> <p>Co-operate between sectors at the local level.</p> <p>Resolve conflicts between water users.</p> <p>Co-ordinate stakeholders.</p> <p>Integrate district plans into WRM plans</p>
Catchment / Sub-catchment Water Committees	<p>Co-ordinate and harmonise catchment/sub-catchment integrated water resources management plans.</p> <p>Resolve water resources conflicts in the catchment/sub-catchment, and other delegated responsibilities from Basin Water Board.</p>
Water User Associations	<p>Manage allocation of water resources at local level.</p> <p>Manage equitable allocation of water resources during drought.</p> <p>Mediate in local disputes.</p>
Regional Secretariat	Representation on Basin Water Boards.
District Councils	<p>Representation on Basin Water Boards.</p> <p>Representation on Catchment Committees.</p> <p>Formulate and enforce bylaws</p> <p>Promote efficient water utilisation</p> <p>Prepare district plans</p>

Figure: Institutional Framework for Water Resources Management  
Source: National Water Sector Development Strategy, 2006-2015

<b>Organisation</b>	<b>Functions and Responsibilities</b>
Minister responsible for Water	Presents national sector policy and strategy to Government. Ensures policies and strategies are implemented.
Ministry responsible for Water	Develops policies and strategies. Advises EWURA in formulation of technical guidelines/standards. Co-ordinates planning for projects of national importance. Secures finance for infrastructure and capacity development projects. Monitors performance and regulates COWSOs. Provides technical guidance to Councils. Provides technical guidance and co-ordination for Water Supply and Sewerage Authorities (WSSA), including DAWASA. Provides technical support and monitoring for major capital works. Co-ordinates and monitors WSSA strategies and plans Supervises the Water Resources Institute. Supervises the Drilling and Dam Construction Agency.
Water Supply and Sewerage Authorities	Own, manage and develop water supply and sewerage assets. Prepare business plans to provide water supply and sewerage services, including capital investment plans. Secure finance for capital investment, and relevant subsidies. Contract and manage Service Providers. Provide services not contracted out. Formulate by-laws for service provision.
Service Providers	Provide water supply and sewerage services in accordance with contractual requirements. Collect revenues for services. Construction of water sector infrastructures; Provide Consultancy services; Supply goods; and Train communities in water related aspects
Community Owned Water Supply Organisations	Own and manage water supply assets. Operate and maintain water supply assets. Determine consumer tariffs. Collect revenue for the provision of services. Contract and manage Service Providers.
Energy and Water Utilities Regulatory Authority	Approves business plans of WSSAs. Issues operating licences to WSSAs.
	Approves service tariffs. Publishes technical guidelines and standards. Monitors water quality and performance of WSSAs. Collects and publishes comparative performance data. Advises Ministry on impact of major capital works on customer tariffs
Prime Minister's Office - Regional Administration and Local Government	Co-ordinates planning of projects from local government authorities. Co-ordinates local government authority budgets. Co-ordinates capacity building for local government authorities.
Regional Secretariat	Representation on WSSA Boards. Provides technical advice and support to local government authorities. Supervises and monitors local government authorities.
Municipal and District Councils	Representation on WSSA Boards. Co-ordinate WSSA budgets within Council Budgets. Disburse block grant funds to WSSAs. Co-ordinate physical planning with WSSAs. Delegated performance monitoring and regulation of COWSOs. Provide and/or promote on-site sanitation. Formulate by-laws concerning water supply and sanitation.
Village Councils	Promote establishment of COWSOs. Representation on COWSO management body. Co-ordinate COWSO budgets within Council Budgets. Resolve conflicts within and between communities. Formulate by-laws concerning water supply and sanitation.
Ministry responsible for Health	Develops policy, guidelines and strategies for sanitation. Provides technical assistance to councils for sanitation. Prepares Acts, Regulations and Standards for sanitation. Monitors, regulates and provides support and advice to councils and other stakeholders on sanitation issues.

*Figure: Institutional Framework for Water Supply, Sewerage and Sanitation*

*Source: National Water Sector Development Strategy, 2006-2015*

## ORGANISATION STRUCTURE OF THE VICE PRESIDENT'S OFFICE

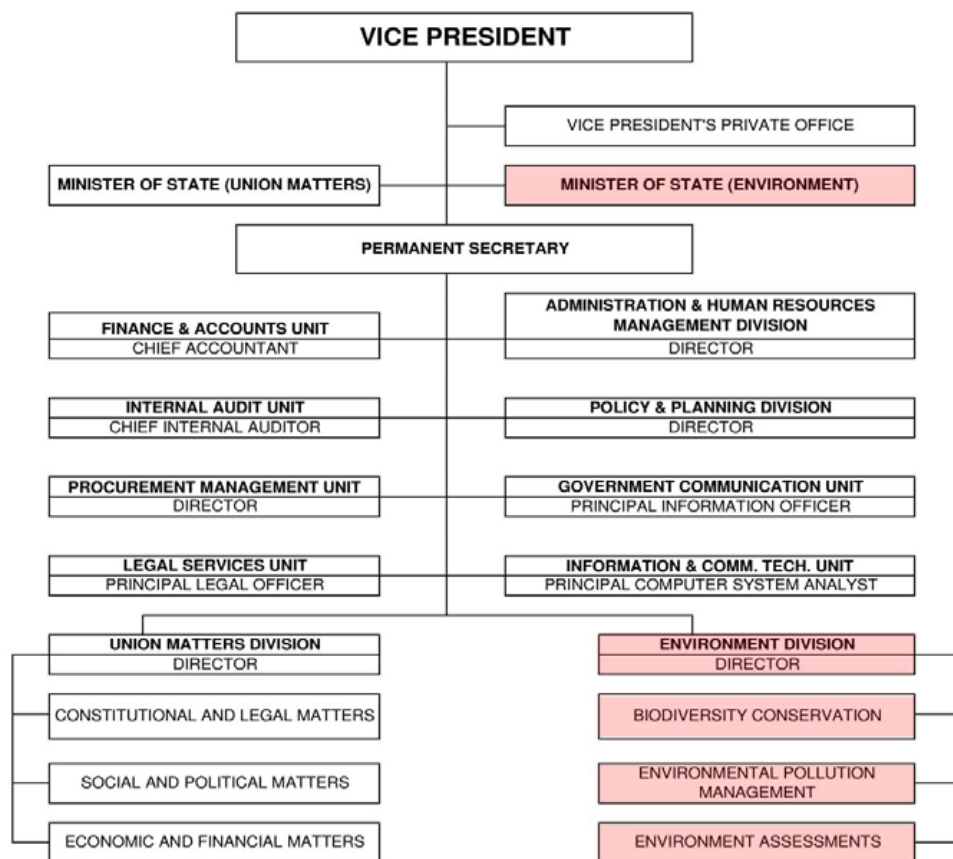
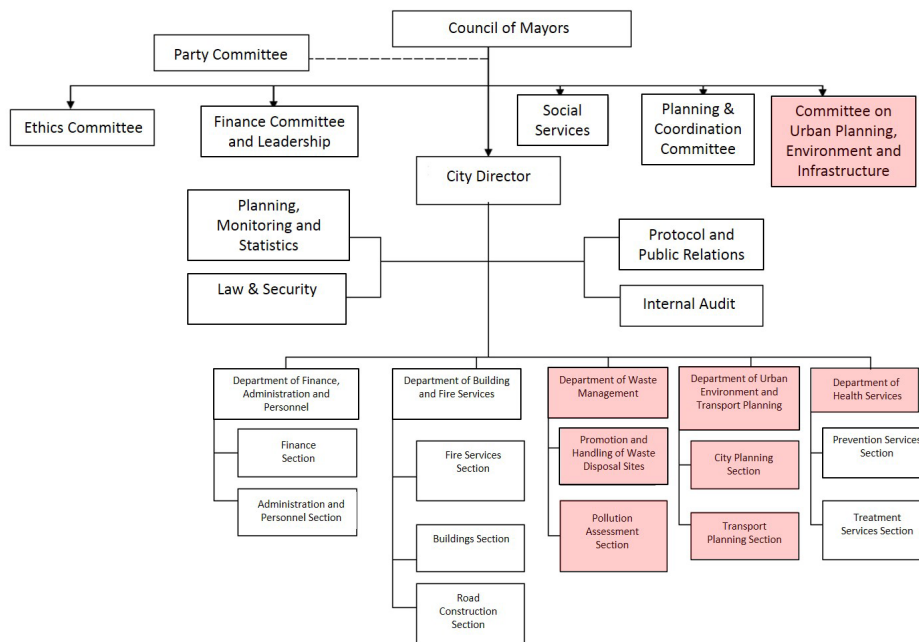


Figure: Organogram of Vice President's Office (with relevant departments and agencies highlighted)

Source: VPO website

## DCC Organization Structure



## KINONDONI MUNICIPAL ADMINISTRATIVE STRUCTURE

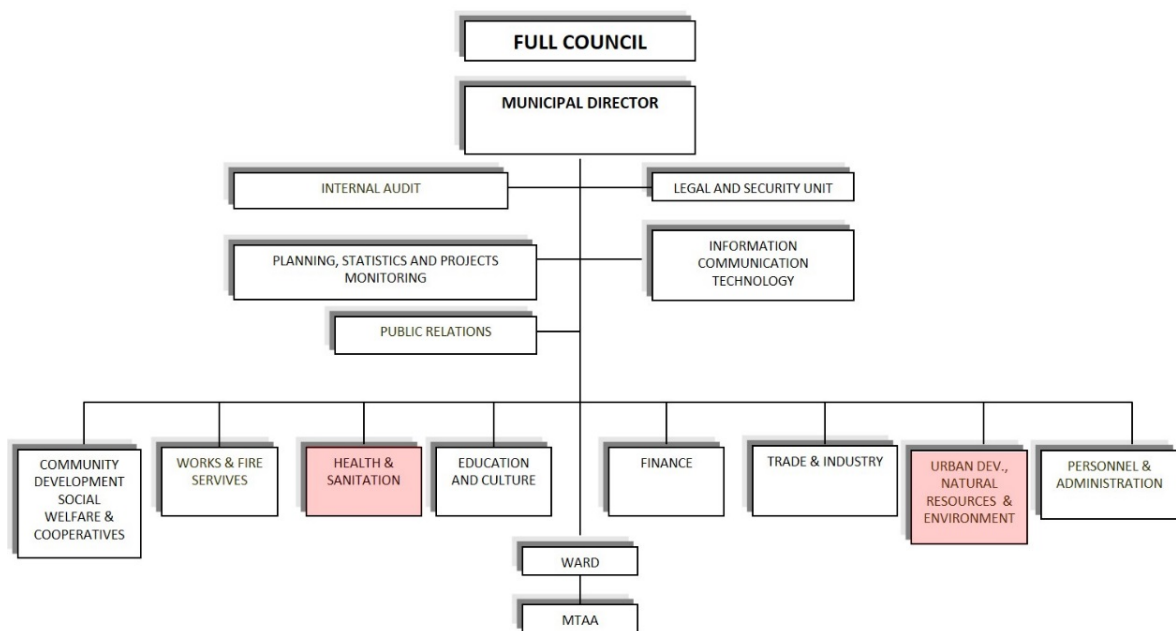


Figure: Organogram of Kinondoni Municipal Council (with relevant departments and agencies highlighted)

Source: KMC website







