Hydropolitical Situational Analysis: Water Resources and their Uses

Second Order Water Scarcity In Southern Africa: Zambia case study

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1 Situational Stage

This document compliments the mapping exercise for water access in Zambia. The situational map identifies the various actors in the water sector, while the positional map identifies the positions taken by the actors regarding discursive constructs shown in the situational map. Both the situational and positional maps are analytical tools that can be used to assess and understand activities related to water access in Zambia and evaluate the key outcomes of strategic development and planning processes.

This document elaborates on the metaphorical 'stage' upon which the actors are located or where they perform their roles. The stage includes all the assets that the actors have and possibly how they can be or are being utilised. The primary assets are mainly the available natural water resources, the so-called first order or physical resources. The actors and their capabilities are part of the second order assets, which enable the first order assets to be utilised or distributed appropriately. Second order assets such as financial resources, skilled manpower and social capacity are elaborated on in separate sections of the document. These assets are critical to the drive towards ensuring all the Zambian citizens are able to enjoy sustained access to reliable and sufficient supplies of water for their needs.

The first part of this document details the water resources in Zambia; including both the quantity and quality aspects of these resources. The second part of this document explores the water needs of the Zambian people, evaluates the extent to which these needs are being met by different actors in different locations and examines the typical approaches or methods that are applied to meet these needs.

1.1 Water Resources

Zambia lies partly on the Central African plateau between 1000 and 1600 metres above sea level. The topography is described as largely rolling to slightly undulating with infrequent hills and mountains especially along the Eastern border. The natural vegetation of Zambia is the savannah woodland which is mainly dominated by the Miombo, Mopane and Munga woodlands[1].

From a hydrological perspective, Zambia can be segmented into six major surface water drainage basins, namely: the Zambezi, Kafue, Luangwa, Chambeshi, Luapula and Tanganyika basins, see Table 1 and Figure 1[2]. Each of these basins contains extensive wetlands, lakes, rivers and streams. The country can also be sub-divided into three agro-ecological regions[3]. The first of these regions covers the semi-arid rift trough areas found in the Luangwa, Lunsemfwa and Zambezi valleys and the low altitude plateau areas of the south western region. This region has high temperatures,

[1] Mukanda, N. 1998. Zambia country paper: wetland classification for Agricultural development in Eastern and Southern Africa: the Zambian case.
[2] Queiroz. J., S., de. 1997. Environmental Threats Assessment: Zambia – Strategic Planning Document. USAID/REDSO/ESA
[3] Mukanda, N. 1998. Zambia country paper: wetland classification for Agricultural development in Eastern and Southern Africa: the Zambian case.

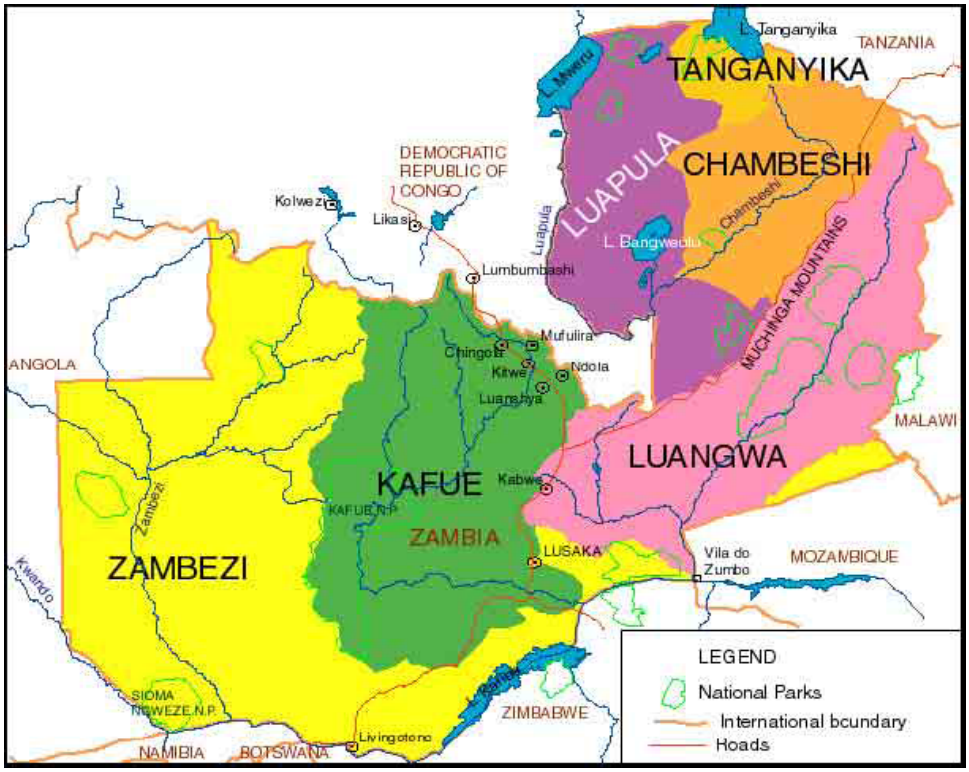
high evaporative losses and short crop growing seasons. The second region includes the central plateau which stretches from the east to the central part of the country. The region has rainfall ranges of 800 to 1000 mm. The third region covers mostly the Northern part of the country which is the high rainfall region.

Table 1 Surface water potential by Basin

River System	Basin Area in Zambia	Approx. Water Contribution (%)	Mean Daily Discharge (million m^3 /day)
Zambezi	268235	25	59.9
Kafue	156995	13	29.7
Luangwa	144358	24	57.1
Luapula	113323	28	54.1

Source: Annex 5 WRAP Documents

The term "mean daily discharge" is not very helpful in this case as it is not related to a specific point such as the outlet of a basin and is not explicitly shown on a map. However, it gives a approximation of the volumes of water discharged over the basin while indicating the quality of data that decisions in Zambian water management are based on. Quantities are important in the management of water but a focus on specific quantities in this case would limit the analysis to first order scarcity. This section of the document focuses on the first order scarcity. The research project focuses on second order scarcity, which does not necessarily require accurately specified quantities.



Source: http://www.riob.org/wwf/WDM-Initiative-Zambia.pdf (Accessed on 11/05/2005)

Figure 1 Catchment boundaries of different river basins

The country's tropical temperatures are moderated by altitude[4]. There are three annual seasons in Zambia known locally as the hot and wet season (December to March) cool and dry season (April to August) and the hot and dry season (September to November).

Rainfall in Zambia averages between 1100mm and 1400mm[5]. In the western half of the country, the rainfall increases from 700mm in the southern part to 1500mm in the northern part, Figure 2. In the northeast section of the country the rainfall gradient increases from east to west. Over 90% of the rainfall is received as convective storms during the hot and wet summer season. Periods of prolonged droughts are frequently experienced in the drier Southern, Western and Lusaka Provinces[6]. Table 2 shows the average rainfall in various provinces.

Table 2. **A long-term annual average Rainfall in each of Zambia's Provinces**

Province	Annual rainfall (mm)	Potential evapotranspiration (mm)	Rainfall (mm) minus evapotranspiration
Lusaka	857	1571	-714
Copperbelt	1231	1530	-299
Central	947	1621	-674
North Western	1173	1475	-302
Western	808	1705	-897
Southern	737	1669	-932
Luapula	1259	1508	-249
Northern	1138	1549	-411
Eastern	961	1531	-570
Total Average, Zambia	1001	1574	-573

Source: Environmental Threats Assessment: Zambia – Strategic Planning Background Document (USAID/REDSO/ESA)

[4] Ibid
[5] Queiroz. J., S., de. 1997. Environmental Threats Assessment: Zambia – Strategic Planning Background Document (USAID/REDSO/ESA)
[6] Ibid

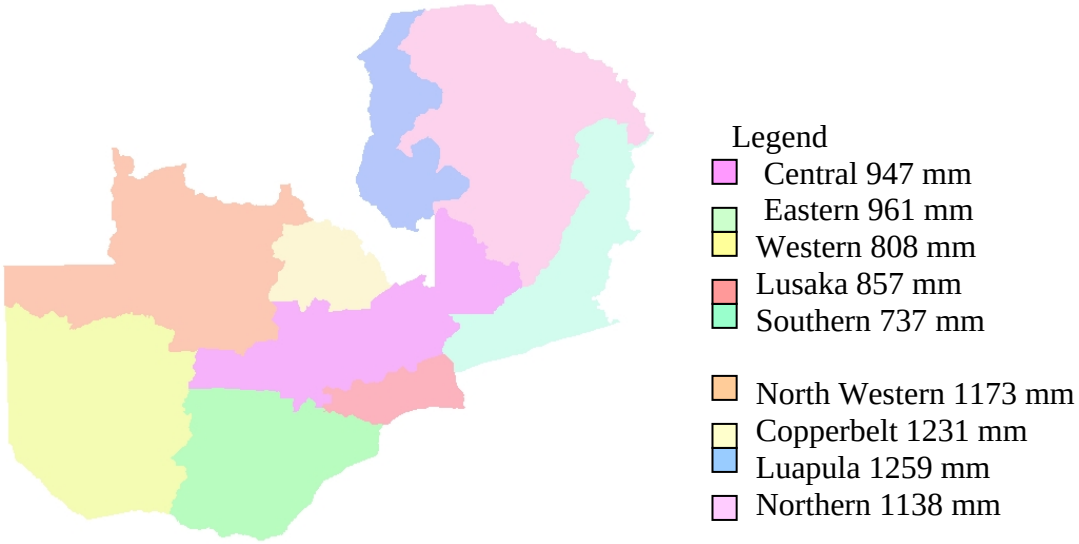


Figure 2 Annual Average Rainfall by Province

Water shortages are more frequent in the drought prone southern part of Zambia. Shortage is an absolute term directly related to the quantity of water available for different uses. Residents in the southern part of Zambia usually lack enough water for domestic use and to carry out daily activities like watering gardens and livestock, especially during the dry season and periods of drought. During the periods of water shortage the families have to walk longer distances to get water to meet their daily needs. Water points used during periods of water shortages are usually boreholes that are drilled at health centres or schools through community water projects.

1.1.1 Surface Water Resources

Water covers 11 890 sq km of the Zambian surface area with a total surface water potential estimated at 237 million m^3 /day[7]. This is the area of all lakes, dams, open rivers, streams and wetlands[8]. Figure 3 shows the main rivers of Zambia and their tributaries. The population of Zambia in the 2000 census stood at 10.3 million[9]. Using this population and the potential total surface water, the annual potential per capita amount of surface water is approximately 8404.3m^3. Using these figures in comparison with the quantitative definition of water scarcity that was given by Falkenmark defining it as occurring when the annual per capita water supply of a country is less than 1700m^3, Zambia can be seen as a country where water scarcity does not occur. The type of scarcity defined here refers to amounts of blue water or surface water and is scarcity of the first order i.e. lack of water as a resource. Seasonal problem areas are concentrated in the southern and western part of the country. These provinces receive the least average rainfall and depend on surface flows from the northern part of the country. When analysing the volumes of water per capita in the individual provinces, the figures in the southern and western provinces are significantly lower. These are the drought prone areas and places where first order

[7] Source: http://www.projectzambia.org/statistics.htm (Accessed on 01/02/03)
[8] Annex 5 WRAP Documents
[9] CSO 2000. Population and Household Census. Lusaka: CSO

water scarcity is likely to occur.

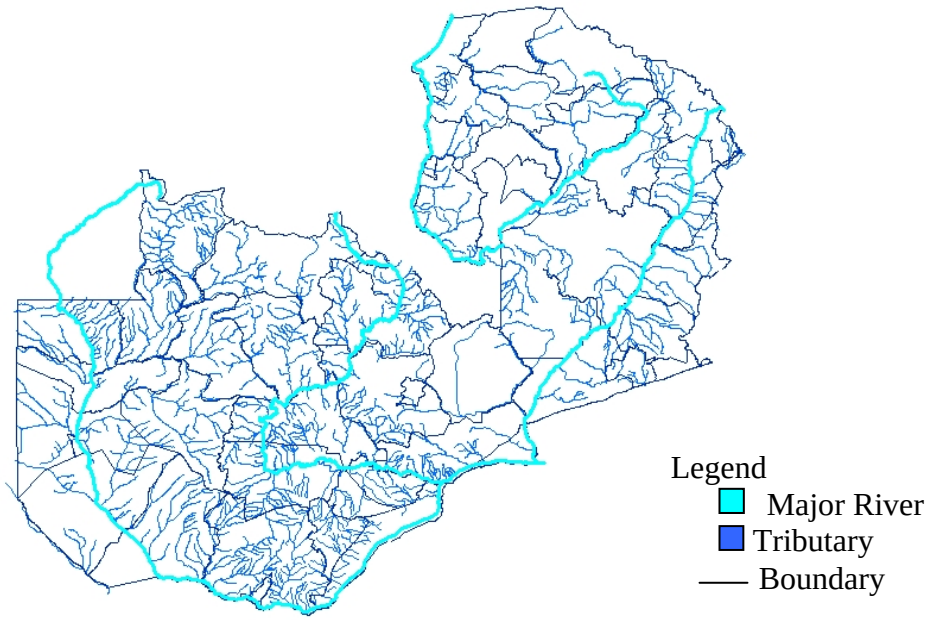


Figure 3 Main Rivers of Zambia and their tributaries

According to the National Water Resources Master Plan, current water consumption amounts to less than 2% of available water resources and less than 3% of the surface water resources[10]. Projected increases in water demand for 2015 indicate that total consumption will increase to 4% of available water resources and 7% of the surface water resources. These statements are rather confusing since no absolutes are used and the relative values cannot be compared easily. The study that produced the Master Plan notes that the water quality may be problematic in some areas such as the mineral rich Copperbelt and farming block in Central province, which include high copper concentrations and nutrient loads that approach unacceptable levels, Figure 4. Advocacy for Environmental Restoration have been investigating the quality of water in the Kafue river basin along side other stakeholders[11].

[10] Government of the Republic of Zambia. 1995. *National Water Resources Master Plan*. Lusaka: Ministry of Energy and Water Development.
[11] Kambole, M. S. 2002. Managing the Quality of the Kafue River. 3rd WaterNet/Warfsa Symposium 'Water Demand Management for Sustainable Development', Dar es Salaam, 30-31 October 2002

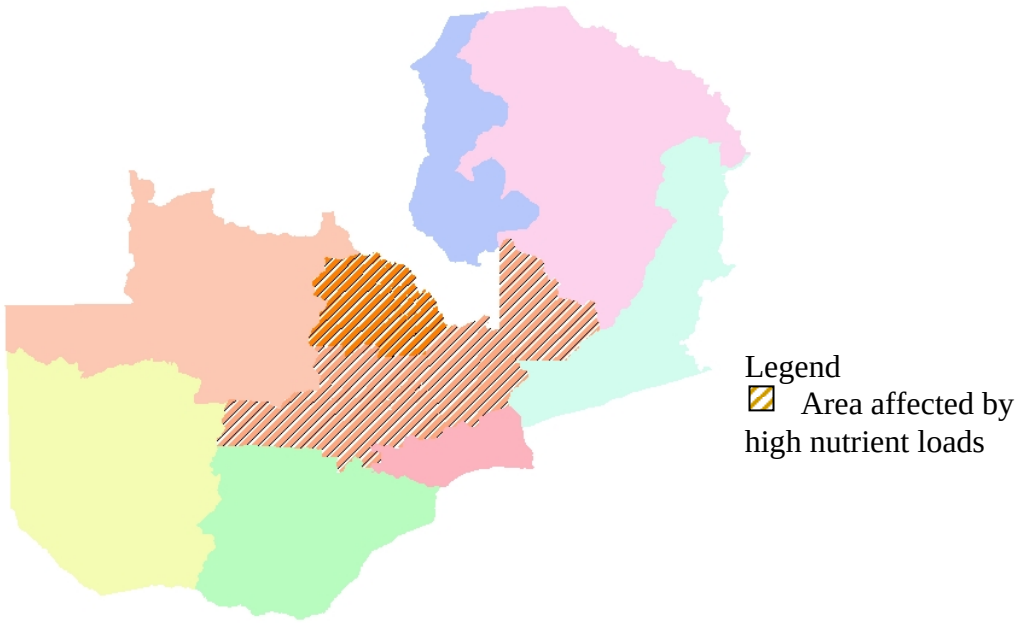


Figure 4 Provinces with high Nutrient Loads

Most economic activity in Zambia is located along the line of rail and the major road network which were primarily built on watersheds. The watersheds where economic activity is based usually have enough surface and ground water resources to support the economic activity apart from in consecutive drought years. Of the six basins that Zambia can be divided into, four are shared, Tanganyika, Zambezi, Luapula and Luangwa. Only two are completely within Zambia, Chambeshi and Kafue. The Zambezi basin has the largest area followed by the Kafue basin, see Table 1. The Kafue basin is also the basin with the most competition among water users in Zambia. It supports at least one third of the Zambian population and major industries[12].

1.1.2 Ground Water Resources

The groundwater resources of Zambia are yet to be fully quantified though rough estimates do exist. The total ground water storage was estimated at 1, 740x10^9 m^3, while the ground water recharge was estimated at 160x10^9 m^3/ year[13]. In more recent studies the total average groundwater recharge is estimated at 57.5x10^9 m^3/ year[14]. A significant discrepancy occurs in the total figures quoted by the separate studies as illustrated in Table 3 and Table 4. Both tables show figures from government agencies. The National Water Policy (NWP) was formulated under the Ministry of Energy and Water Development (MEWD) and the Water Resources Action Programme (WRAP) is also part of the MEWD as a project supporting the NWP.

[12] Chabwela and Mumba in Sherbivin, A, de., Dompka, V., (Eds). 1998. *Water and Population Dynamics: Case Studies and Implications Policy*. Washington Dc: IUCN, PRB, USAD, AAAS. Pp. 138 - 142
[13] National Water Policy, 1994
[14] Annex 5 WRAP Documents

Table 3 Ground Water Potential in Zambia

Drainage Basin	Luapula - Tanganyika	Luangwa	Kafue	Zambezi	Total
Basin Area Km^2	194,000	147,500	155,000	256,000	**752,000**
Total Mean Annual Rainfall (mm)	214.1	122.3	149.72	228.69	**714.85**
Groundwater through flow	0.83	1.634	0.96	0.22	**3.65**
Vertical Recharge	41.5	33.02	24.45	64.03	**160.08**
Ground water Storage	377.7	242.76	252.06	86.82	**1,740.4**

Source: Zambia National Water Policy

Table 4 Groundwater Potential by Province

Province	Groundwater (Estimated annual recharge rates) * 10^9 m^3/ year
Central	7.7
Copperbelt	2.6
Eastern	6.1
Luapula	3.9
Lusaka	1.5
Northern	11.5
North-Western	11.4
Southern	5.7
Western	7
Total	57.5

Source: Annex 5 WRAP Documents

According to a study carried out by Chipungu et al (1994), estimates showed that at least 200-400 litres/ day/person were accessible in urban areas and roughly 100- 200 litres/day/person was available in rural areas[15]. Accessibility in the urban areas refers to water that is readily obtainable for use. Availability on the other hand refers to potentially accessible resources. For example ground water may be present but not readily obtainable by some community members unless a borehole is installed or a river may be flowing past a community but if the water quality is poor then the water is not useful for domestic purposes. Availability of water resources does not always directly relate to accessibility of the water resources. It is however assumed by some members of the general public and officials in various government agencies that overall water shortages do not occur. The assumption is based on an overview of the water resources of Zambia and the amount of rainfall received in the country when drought years are excluded. Shortages occur on a localised scale and are linked to the proximity of the population to a natural water body or ground water source. Populations living close to a natural water body or areas where ground water is accessible rarely experience water shortages.

[15] Cited by Chabwela and Mumba in Sherbivin, A, de., Dompka, V., (Eds). 1998. *Water and Population Dynamics: Case Studies and Implications Policy*. Washington Dc: IUCN, PRB, USAD, AAAS. Pp. 138 - 142

In the urban areas most residents have access to a piped water supply. In the rural areas perennial water bodies and groundwater resources are more important for the populations to have access to water throughout the year. Close proximity to a water source, in rural and urban areas, does not always guarantee access to water of a suitable quality. The quality of water required for the different domestic uses also varies. Potable water cannot always be obtained from surface water bodies especially in the rural areas in the Kafue basin where water downstream of the mining, farming and industrial areas has high levels of minerals and nutrients like nitrates. In such areas a source of clean and safe potable water must be provided for the residents. This is usually done through community water projects that are usually funded by donor agencies and NGOs. Most rural residents assume clear water means good clean water especially ground water. This assumption is based on the taste of groundwater traditionally obtained from wells and the reportedly soft nature of the water. Groundwater is believed to be purified naturally as it drains into the ground giving it a pure taste. Most of the Zambian population relies on surface water resources while the rest make use of the ground water resources, Table 5.

Table 5 Developed Ground Water Supply

Population Ration (%)		**Proportion of the Population Served by Developed Water Supply (%)**			**Proportion of the Population Served by Developed Ground Water Supply (%)**		
Urban	Rural	Urban	Rural	Total	Urban	Rural	Total
43	57	85	58	70	20	52	38

Source: SADC Groundwater Monitoring Networks

The classification of urban and rural areas in Zambia depends on proximity to administrative centres and population density in an area. A rural area, according to the definition in the Local Government Act, is an area with an established council to run its affairs as provided for under the Act (1965)[16]. From a geographic stand point this area has a predominant agrarian economy. It has a clear pattern of a network of villages and towns based on agrarian pursuits, the hierarchy of functions and the various sizes in relation ascending scale of dimension. An urban area constitutes an area with a population of 5,000 and above. Ideally, an urban centre should be supported with a minimum of social facilities and services like piped water, electricity, banking facilities etc[17]. Other variables may be taken into account, such as the economic activity and other infrastructure in the area, as the definition above is from a population configuration stand point. There are some areas like Mkushi where commercial farming is the main economic activity but have more than the minimum social facilities. Such areas are termed as urban. For statistical purpose centres with less than 5,000 people but have a minimum of social facilities indicated above and in which the major economic activity is not agriculture will be termed urban.

The amounts of surface water used in both urban and rural areas are expected to more than double by 2015 according to the National Water Resources Master Plan

[16] Republic of Zambia. 1965. *The Local Government Act*. Lusaka: Government Printers.
[17] Ibid

(NWRMP)[18]. The amounts of ground water use are predicted to increase by a similar amount according to the NWRMP[19]. The predicted increase can be accounted for by increases in population, industrial activity and irrigation farming. There is also an increasing use of groundwater in urban areas especially by water utilities supplementing their surface water sources of raw water. Predicted increases in population are revised after the toll of HIV and AIDS. In the last census (2000) population remained almost stagnant from the previous census (1990). A growth rate of 2.3% was expected in the 2000 census. Water consumption as a result of the reduced increase in population will probably not increase up to the predicted levels in the NWRMP. Industrial activity and irrigation farming are less affected by HIV and AIDS when accounting for water consumption. The effect of HIV and AIDS weighs more on the productive workforce thus industrial productivity and agricultural productivity are adversely affected by HIV and AIDS.

Given that not all surface water bodies are perennial especially in the western and southern parts of Zambia and ground water is not always easily accessible in some parts of the country, see Table 6, the water providers and water users face challenges in storing enough water especially in consecutive drought years. Local farmers estimate droughts being every five years in minor form and major drought at least once every ten years. The meteorological department of Zambia has recorded a major drought roughly every ten years[20].

Table 6. **Minimum and Maximum Ground Water Levels**

Province	**Average Minimum Water Level (m)**	**Average Maximum Water Level (m)**
Lusaka	5	7
Copperbelt	5	8
Central	5	8
North Western	9	11
Western	3	6
Southern	8	11
Luapula	6	9
Northern	10	12
Eastern	5	8

Source: Environmental Threats Assessment: Zambia – Strategic Planning Background Document (USAID/REDSO/ESA

During the drought years the water storage becomes increasingly important especially in years of consecutive drought. Most urban areas have water reservoirs that are managed by the local water supplier. In the rural areas the storage mechanisms are large scale dams that are usually built for irrigation purposes but are used as multipurpose water points including fishing, domestic supply and irrigation. The dams are only found in villages with irrigation schemes which are concentrated in the

[18] Government of the Republic of Zambia. 1995. *National Water Resources Master Plan.* Lusaka: Ministry of Energy and Water Development.
[19] Ibid.
[20] Nkomoki J 1998 Drought Research and Drought-Related Activities in Zambia UNESCO, Paris 2-4 December

Eastern, Central, Northern and Southern provinces. These storage options are used as coping mechanisms, primarily by water suppliers and communities, for shortfalls in water quantity. Another coping mechanism is through other multipurpose water points such as boreholes. The boreholes are drilled by project teams to a depth where water is guaranteed even through the drought periods i.e. 50 to 100m. The project teams are often engineering firms, government departments or NGO teams. The Department for Water Affairs (DWA) has listed minimum borehole depths for all Provinces, see Table 6. The quality of water from boreholes is usually good and requires no further treatment before use. Communities using these water points are however advised to add chlorine to water before using it for drinking purposes. The advice is given as a precautionary measure to protect the community against water borne diseases like cholera.

1.2 Water Use

The four main water uses in Zambia are listed as; industry and mining, livestock, irrigation and domestic. The water use in each sector is shown in Table 7. As expected, most of the available water resources are used in irrigation. The second largest water consuming sector is the domestic supply. Figure 5 and Figure 6 show the sectoral water use in Zambia as percentages of the water resource use. The figures of water use in Zambia are relatively high compared to other countries in the SADC region. According to the SADC data base, the largest water user is South Africa which is expected given the industrial advancement and the population of the country. Water use figures in Zambia are approximately 12% of the South African figures. This is comparable to water use in Angola and Tanzania. Tanzania has a higher population than Zambia, three fold, and also uses larger amounts of water for irrigation. Domestic water use in Zambia is relatively higher per capita than other SADC countries.

Table 7 Distribution of Total Water Use

Distribution of Total Water Use (10^6 m^3/ yr)				
Domestic	**Mining and Industry**	**Livestock**	**Irrigation**	**Total**
271	170	90	1690	2221

Distribution of Groundwater Use (10^6 m^3/ yr)				
Domestic	**Mining and Industry**	**Livestock**	**Irrigation**	**Total**
75	13	42	59	189

Source: SADC Groundwater Monitoring Networks

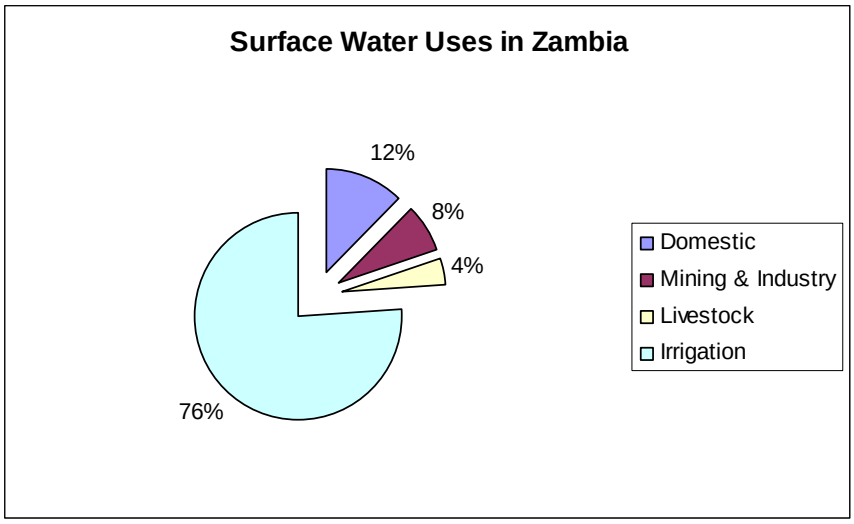


Figure 5 Surface Water uses in Zambia

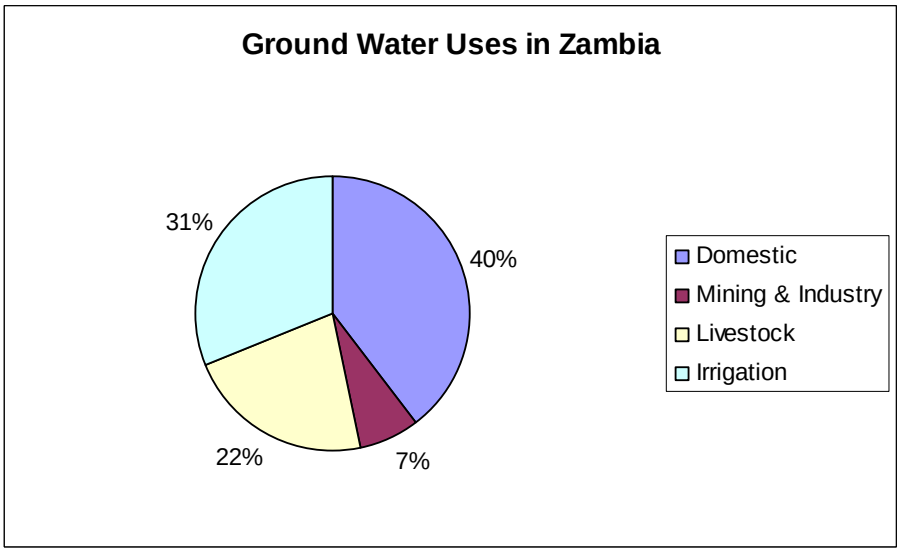


Figure 6 Ground water use in Zambia

The main four uses of water in Zambia give an indication of the type of needs to be met by different water suppliers and individuals. Water use is dependant on access to water for the different needs. The water access term is usually restricted to domestic water and in some cases, such as when looking at rural and peri-urban areas, may extend to water for livelihoods. In this research project water access covers all the main water uses. The research aims to include all actors in the water sector in order to dispel any connotations of power and develop a grass root level perspective of issues around water access. A wide range of stakeholders and actors were identified as potential participants in the research. To include a wide cross section of stakeholders and in an effort to sample the entire country, twelve towns were selected including the 9 provincial head quarters and 3 randomly selected towns, Table 8. The provincial head quarters have the potential of providing information about the water needs and uses in other towns in the same province. The information about other towns would potentially be found at the provincial water affairs department that is managed by the provincial water engineer. Each town was visited for a minimum period of 3 weeks. Initial contact in the towns was with the water engineers, water suppliers and Local

Authority personnel. The initial contact groups were the key gatekeepers in each town. Gatekeepers provide a link to the communities they work with and are able to introduce someone not known to the community. The relationship that the gatekeepers have with communities is used to introduce new people and goes towards ensuring acceptance of the individual by the community. These key gatekeepers then proposed local sites to visit and potential groups and individuals to interview.

Table 8 Study sites in Zambia

Town	Admin Division	Pop. 2003 ('000)	Main Economic Activity	Main Water Source
Chipata	Eastern	92.1	Farming	Lutembwe Dams
Kabwe	Central	219.6	Former Mining, Farming, Fishing	Mulungushi River and Ground water
Kasama	Northern	72.4	Farming, Trading	Lukupa River and Milima Stream
Livingstone	Southern	111.2	Farming, Tourism	Zambezi River
Lusaka	Lusaka	1265.0	Industrial, Farming	Kafue River and Ground water
Mansa	Luapula	51.0	Fishing, Trading	Mansa River
Mbala	Northern	16.9	Farming, Trading	Lake Chila and Lucheche Stream
Mongu	Western	37.1	Farming, Fishing	Ground water
Kawambwa	Luapula	10.0	Farming	Natural Spring
Ndola	Copperbelt	349.3	Former Mining, Trading	Kafubu River, Old quarry (Ndola dam)
Solwezi	North-Western	4.0	Farming and Mining	Solwezi River
Lundazi	Eastern	12.0	Farming, Trading	Lundazi Dam

Source: Adapted from http://www.world-gazetteer.com/c/c_zm.htm (Accessed on 10/02/03)

1.3 Meeting Water Needs

1.3.1 Domestic Supply

The ability to meet water needs varies according to different water uses. Domestic water takes priority over other water uses. This prioritisation ensures access to clean and safe domestic water is a focus for all water suppliers. In the urban areas especially the larger towns, domestic water is provided to all townships with water distribution infrastructure. Many high-density townships, especially those consisting of low cost residential housing and some peri-urban areas do not receive any piped water because of the poor state of the infrastructure. Infrastructure here refers to water treatment plants, distribution pipes, valves and water taps.

The water supply to urban townships is usually metered in bulk and individually for some households. The number of hours of water supply varies because of the capacity of the water treatment plants, some of which are under-sized, or use outdated and ineffective technology. The more affluent, or so called high cost, townships get water for 24 hours in Lusaka and Chipata and most towns on the Copperbelt Province. The 24 hour water supply is usually only possible after water treatment plants have been rehabilitated or in areas where maintenance was consistent e.g. the mining towns on

the Copperbelt. Some of the less affluent townships with medium and low cost housing get water for at least 6 hours per day. Residents are accustomed to the daily number of water supply hours and collect enough water to meet their needs. The water is collected during the hours when supply is available and stored in drums or 20 litre containers. The residents in urban areas sometimes have back yard gardens that they are able to maintain as long as they are willing to pay the water bills that increase as a result of watering their crops. Crops grown in back yard gardens are restricted by the Local Authorities as directed by the Ministry of Health. Maize growing is discouraged as authorities view it as a potential breeding ground for mosquitoes. There is a debate as to how exactly maize growing impacts the breeding of mosquitoes just like the long grass. Researchers in urban agriculture have shown there is very limited possibility of maize growing providing a breeding ground for mosquitoes unless there are pools of water in the leaves that are stagnant for periods of over five days[21].

In rural areas the water supply infrastructure for safe and clean domestic water is usually a borehole or protected well. The water source is usually disinfected using granular chlorine when being handed over to the community. The communities are encouraged to add granular chlorine to their water source at regular intervals. Some water points are locked and access is controlled by an attendant. The residents in these areas agree on the most convenient times for the water to be available. In areas where no locking mechanism exists, the community has open access to the water point. Water for livelihoods that is not quality sensitive is obtained from more traditional water sources like hand dug wells, springs, streams and rivers where possible. This is usually water for cleaning and watering gardens where they exist. The traditional sources are sometimes perennial. If there are no accessible perennial sources the communities depend on the multipurpose water points. Perennial water sources are scarce in the western and southern parts of Zambia. The residents in these areas usually have few alternatives and rely on rain fed agriculture. Domestic water in the drought prone areas is obtained from multi-purpose water points constructed under community projects. Dams have to be a minimum depth of 3m to last through the dry season in the southern part of Zambia. Evaporation rates can be high so a dam of less than 3m is likely to dry up when the water is needed most[22].

Physical Features

Some areas in the northern part of Zambia like Mansa, Figure 7, have low yields for boreholes. The yields are as low as 5 litres per second as a result of the topography of the area. The low yields mean that even though Mansa may have a significant number of water points in the rural areas, most of the water points are not in use during the dry season. The low yields also deter NGO and donor agencies from working in the area as this may be considered to be an ineffective use of resources. The NGOs and donor agencies focus on accountability for resources injected into a project and the impact the water projects have in different areas. Shallow wells sometimes dry up during the dry season even in towns like Kawambwa which is in the north western part of Zambia like Mansa i.e. the part that receives high amounts of rainfall. When wells dry up, most people cope by deepening their wells or using a neighbouring well that is deeper. Ground water is available, just located at increased depth during the dry

[21] A.W. Drescher, R. Nugent & H. de Zeeuw 2000 Urban and Peri-urban Agriculture on the Policy Agenda FAO/ETC joint Electronic Conference August 21 - September 30.
[22] Personal interview with MACO official in Livingstone

months. Some residents look for a perennial water source which inevitably means walking longer distances than they are accustomed to, to get water.

Most towns are reportedly able to meet the domestic water needs of their urban clients, not according to the desires of the clients but more inclined towards keeping the minimum regulatory requirements. The minimum regulation covers the quality, quantity and supply hours for domestic water. The NWASCO, the national domestic water regulator, provides targets and guidelines for domestic water supply. Regulation targets include; the minimum number of hours for water supply, water testing procedures, complaints handling procedures etc. The official reports of suppliers meeting the needs of their clients according to minimum regulation imply the standard set by the regulator is low compared to the expectations of the clients. However, the NWASCO personnel admit the supplier were awarded a period during which they could improve their services gradually and not be penalised for missing targets; hence the lenient targets. Estimate figures for populations not being supplied with water can be obtained from the Central Statistics Office (CSO). The figures cover the district and not necessarily the urban centre. The district figures include some residents in the district that are not under the commercial water suppliers such as the CUs or the urban water supplier because of their relative distance from the administrative centre of the district. The size of the districts varies, Figure 7.

Figure 7 Districts of Zambia

Levels of access

According to the 2000 census the percentages for access to safe water by province range from 21 to 91, see Table 9[23]. From this Table it is possible to identify the

[23] Central Statistical Office, 2000 Census of Population and Housing

provinces with the least access figures notably, Luapula, Northern and Western Provinces. The CSO has definitions of what is meant by access to safe water usually following the UN definition of improved water sources at least 100m from the residence. Individuals continue to provide their own water sources in each province especially in rural and peri-urban areas. The water sources provided by individuals are usually hand dug wells located at a particular household. The figures for estimated coverage are provided by the water provider i.e. Commercial Utility or Local Authority. These are estimates of the population that is serviced with treated tap water in the different provinces. The estimated coverage is higher in some provinces because of the limitations in the jurisdiction of the water provider. The water providers are only responsible for the urban areas and not rural areas. Peri-urban areas are classified as part of the urban areas by the Ministry of Local Government and Housing (MLGH).

Table 9 Access to safe water by province

Residence	Population with Safe Water Access (%)	Water Provider(s)	Estimated Coverage (%)
Zambia	49.1		
Rural	29.5	Community water projects	
Urban	86.1	Commercial Utilities, Community schemes and Local Authorities	
Western Province	28.4	Western Water SC	29
Central Province	43.8	Local Authorities	<50
Copperbelt Province	70.9	Mulonga Water SC, Nkana Water SC, AHC and Kafubu Water SC	90
Eastern Province	43.6	Chipata Water SC and Local Authorities	70
Luapula Province	18.8	Local Authorities	10
Lusaka Province	91	Lusaka Water SC , Community water schemes	68
Northern Province	21	Chambeshi Water SC and Chila Water SC	<50
North-Western Province	31.6	North Western Water SC	31
Southern Province	58.6	Southern Water SC	54

Central Statistics Office, 2000

According to Nyumbu's 1996 study, 13% of Zambian households have access to in-house piped water while 25% of the households have access to piped water within 100 metres of their dwellings[24]. In the rural areas water is normally obtained from rivers, streams, communal wells or boreholes that are mostly provided with the help of the donor community funded projects. The rather low figures given in Nyumbu's study may be a result of the poor state of infrastructure in some urban parts of Zambia[25]. In some places where water taps exist; there is no running water at the taps because of the bad state of the pipe network. The increasing dilapidation of infrastructure was reported in the late 1980s and since then very little has been done to improve the state

[24] Cited in Environmental Threats Assessment: Zambia – Strategic Planning Background Document (USAID/REDSO/ESA)

[25] A critique of this study is limited due to the inaccessibility of the original documents from the study.

of the infrastructure in most parts of the country. The water distribution network in Kitwe was overhauled by the Local Authority water department using finance from a loan from Africa Development Bank. Similar projects have taken place in other urban areas like Lusaka. Smaller towns like Kabwe have allegedly received capital investment to replace blocked or burst pipes but no improvements are evident. Residents have reportedly had no running water from their taps since the late 1990s. In the smaller towns the urban residents resort to digging shallow wells at their premises in order to have a source of domestic water.

Water Suppliers

In some urban areas the water is distributed by the newly created Commercial Utility (CU) firms, Local Authorities or by a transitory firm known as Asset Holding Company (AHC). Figure 8 shows the districts that have local authorities managing the water supply. The AHC only existed in the Copperbelt province and was transitory in the sense that it took over the water distribution networks that were previously owned by the mining companies. All the CUs are monitored by the MLGH as they recently took over the operations previously run by local city councils in all large stand-alone districts of Zambia. The formation of the CUs is part of the commercialisation of the water sector. The CUs have taken over the work force from the council water departments. They have a commercial drive to provide an improved standard of service and improve revenue collection efficiencies. Revenue collection has improved in some towns and residents also report improved service delivery especially in Chipata.

Figure 8 Districts with Local Authority Managed Water Supply

After the privatisation of the mines (in 2000) all water supply and distribution services were handed over to the AHC, some of whose activities are funded by the World Bank through the Mine Townships Service Project which cost $37 million. The AHC is present in six towns on the Copperbelt. It was created in 2000 as a 4 years project. In 2004 an extension of one year was permitted by the World Bank. A debate ensued on the Copperbelt and in the MLGH to decide on the exit strategy for AHC. The Bank proposed the formation of one CU for the whole of the Copperbelt i.e. integrating all 4 CUs on the Copperbelt. The MLGH proposed the integration of AHC in the different towns into the CU in the various towns, which would mean having 3 CUs on the Copperbelt. The management in the Copperbelt CUs preferred the proposal from the MLGH. They considered the Copperbelt too large for one CU to manage. The reference was made to the number of clients, amount of infrastructure and operations in the province and not necessarily the physical space. The debate was fuelled by ideas on maximising economies of scale, synergies from the different CUs, egos and personalities of current CU management and recruiting effective management. In 2006 a decision was announced by the minister for Local Government and Housing that the assets held in trust by the AHC on behalf of the Local Authorities would be taken over by Nkana Water and Sewerage Company, (NWSC). The NWSC is one of the existing utilities on the Copperbelt and is seen as the most efficient utility according to the NWASCO records and the MLGH. The decision was supported by the national representative of the World Bank who acknowledged the residents' low willingness and ability to pay for water supply.

The mines operate fully on a commercial basis and are not involved in the provision of services like water. The private owners of the mines are not interested in providing social and public services at a subsidised rate as the Zambia Consolidated Copper Mines did. They focus on their core business; only maintain a core business workforce and aim to pay their workers enough to enable them pay their bills to the water supplier. The mines continue to pump water to the treatment plants they formerly owned. The AHC paid for the water received to fill the tanks at the treatment plants. The mining firms empty their treated effluent and excess water into surface waters bodies. Some employees of the mining companies argue they should be entitled to a discount from the Water Board in their payment for water rights as they actually contribute to volumes in the national surface water bodies. The quality of the water pumped into the surface water bodies is not consistently checked before discharge. The inconsistency results in several cases of surface water pollution.

The mines and the employment opportunities they offer continue to attract migrants from other parts of the country. These migrants usually end up living in shanty compounds surrounding the established townships. The compounds usually start off as illegal settlements but as populations grow the Local Authorities are lobbied by NGO teams, politicians or residents and in some cases forced to legalise them. The legalisation is usually timed close to election time and is promised by politicians wanting votes from the residents in the illegal townships. The authorities are in some cases convinced to legalise townships because of the pressure coming from different groups like the civil rights groups, NGOs and the residents of the townships. The residents continue to build permanent structures in the illegal townships making it difficult to relocate them in the long run. Once they are legalised, the satellite townships are eligible for service provision by the Local Authority. However, most Local Authorities are not able to provide services let alone clean water for some of the

residents. Some CUs have attempted to supply water to some satellite townships but laying new pipes requires high capital costs that they often cannot afford. Laying new pipes is often feasible as most CUs are not sure of the willingness and ability to pay for water in these satellite townships. The residents in satellite townships stand a better chance of getting stand alone water points from NGO or government projects. The CUs are also constrained by the water treatment capacity. Water kiosks are seen as the way forward by most CUs servicing the urban poor. The kiosks have been piloted in the Eastern and Southern Provinces.

In the peri-urban areas the communities either dig shallow wells within their premises or use communal wells or boreholes which will usually be funded by the donor community and NGOs. The water supply infrastructure in rural and peri-urban areas should ideally be financed using public funds but the financial resources of the government are limited. Water related projects are channels of donor aid especially in meeting MDGs. The wells and boreholes used as sources of water supply account for part of the percentage of the urban population using ground water resources. The other part of the population using ground water supply is accounted for through the CUs that use ground water sources and the industrial areas using boreholes. In some areas ground water may be easier to access than other areas and thus shallow wells may not always be possible, making deeper wells which are protected more desirable, Table 6

The water supply and the different actors involved vary according to location i.e. rural, urban and peri-urban. A summary of the organisation of the water supply, costs, actors and other related aspects is given in Table 10. The funding category refers to the actual funding for the sector in the location. In the rural and peri-urban areas there are semi-formalised structures that exist and channels available to secure funding for water projects. The main channel used is the District Water And Sanitation Health and hygiene Education (DWASHE) team. The community workers encourage residents in rural and peri-urban areas to write proposals for development projects that include water. These proposals are submitted to the Local Authorities who then seek funds from NGOs or Central Government. The latter source makes use of public funds to carry out development projects. Some Local Authorities manage to obtain public funds through the MLGH. In the urban areas the formalised structures ideally operate according to the market system. The formalised structures refer to the CUs that have customer service centres and various departments providing services to the urban clients. Public funds are sometimes used when the urban area lacks a commercial CU, which would ideally have access to money markets.

The urban water sector is also more individualistic i.e. most houses in affluent neighbourhoods have an individual connection that is metered. Most neighbours will not allow others to draw large volumes of water from their taps free of charge. The water sector in the rural and peri-urban areas is often organised according to communal ideas and informal relationships. The water points are communal and the community members play a role in maintaining the water points and preventing vandalism. The community is also expected to play a role in the sustainability of the water supply. The community contributes to the sustainability of the water supply through maintaining the water point and using the infrastructure appropriately. The traditional leaders in most rural areas also play a key role in the management of water resources. They are considered the legitimate voice of their subjects and elected

leaders and are custodians of the water resources on behalf of their subjects. However, they have been known to be swayed or influenced by large and extravagant gifts from foreign investors and influential members of the community or politicians[26]. Such stories have been circulated in land allocation in the Southern province especially along the Zambezi River.

Table 10 Organisation of water sector in different living classifications

Category	Rural	Peri-urban	Urban
Funding	Sourced by Local Authority. Donor and NGO project dependant	Sourced by Local Authority. Less dependant on NGOs and donors because of proximity to urban areas	Sourced by water supplier i.e. Local Authority or Commercial Utility
Groups Involved	Individuals, Water Committee, Traditional Leaders, Community Leaders, NGO staff, Line Ministry staff and Local Authority staff	Individuals, RDCs, Water Committee, NGO staff, Line Ministry staff and Local Authority staff	Individuals, Local Authority staff, Commercial Utility
Fees paid	K500 per month or payment in kind	K1000 – K5000 per month	Fixed clients K10, 000 to K50, 000 per month. Metered clients have variable monthly payments
Main uses	Domestic uses (washing, cleaning, drinking, bathing), small scale farming and livestock	Domestic uses, watering lawns back yard gardening,	Domestic uses, watering lawns, filling swimming pools, car washing and back yard gardening
Infrastructure	Usually boreholes, protected wells, furrows and springs	Usually taps, boreholes and protected wells	Taps
Determinants	Distance from point, type of use, quality and quantity of water, type of water point	Distance from point, type of water point, ability to pay, state of infrastructure, power supply	Ability to pay, state of infrastructure, power supply
Organisation	Community dependant making use of informal relationships and communal responsibility	Semi structured, fluctuates between urban and rural organisation	Structured with clear lines of responsibility set under Local Authority or Commercial Utility
Technology	Varies according to location and current promotions but usually wind lass or hand pump	Varies according to location and related to type of infrastructure but more urban oriented	Usually high level depending on population concentrations; includes water treatment plants, motorised pumps, and automated systems in treatment and water delivery.
Expectations	Rather low, populations want a clean source of domestic water and a source of water for livelihoods. The water	Varies depending on proximity to an urban centre. If proximity is close then residents expect a similar standard of service to that in the urban area	Residents expect a high standard of service. Water should be supplied 24 hours a day with individual

[26] Personal account of residents and government agency officials

	points are communal points	connections.

Public Service Attitudes

Generally residents in urban and peri-urban areas understand the need to pay for treated water. They however do not accept the amounts the CUs propose as the cost of supplying them with treated water. According to the CUs management, only users using above 30 cubic metres of water per month, pay the actual cost of supplying their water. This would mean that the cost for the majority of the users is covered by the company. In effect the companies make less profit than they expect showing that water is still regarded widely as a social good rather than an economic good. Private / public partnerships have not been fully explored in the Zambian water sector. Even though the CUs are meant to be registered under the companies act, they are still wholly owned by the Local Authorities. The ownership limits their chances of access to financial markets which stipulate 51% private ownership in companies. Cross subsidisation would have to be effectively maximised to ensure the private companies are able to cater for the poor who require low cost water. Otherwise the private firms would have to find ways of supplying the water cheaply.

Attitudes to charging for public services are polarised according to the social economic status or affluence in some areas. The more affluent and elite members of the Zambian society understand the need to pay for service delivery mechanisms and for the assurance of good (safe) quality. This group is also easier to penalise in the event of non payment for services; they have individual taps that can be disconnected. The status of the individual implies the social standing would be adversely affected by the penalty of say disconnection of electricity or water supply. The less affluent members of society usually feel public services should be subsidised especially clean and safe water, which is vital for health. Most poor people believe water is an entitlement especially in the rural areas where water can be obtained from natural water bodies or from the ground. They also acknowledge that water is actually a free gift from God. Their location entitles the rural residents to the resources around them. So unless the water is being treated, most rural residents believe there should be no charge for water and government should subsidise other public services. The less affluent usually have limited financial resources to pay for services and have different priorities when compared to their more affluent neighbours.

Long Term Strategy

The long term strategy for rural water supply is still being worked out by a team assembled under the rural water sector project. Various feasibility studies have been conducted to provide a platform for the project team to work from. In the past most rural water strategies have been drawn up mainly through trial and error and experience from past projects by the MLGH and the MEWD. The progression of the rural water sector strategy has lagged behind the urban water sector strategy. Focus was initially placed on resolving the issues around poor service delivery in the urban areas with the drive to commercialise the water sector. Commercialisation is not feasible in the rural water sector. The lack of commercial viability and the scanty nature of the population distribution in these areas are just some of the factors that the

project team needs to deal with. The delay in forming a long term strategy and implementing it means the populations with no access to clean and safe drinking water that are concentrated in the rural and peri-urban areas continue to use water sources that health officials consider unsafe.

The rural water sector is externally driven by donor aid and NGO projects. This external influence affects the long term viability of the sector. The long term viability is affected in terms of continuity and availability of resources. Financial resources for projects are often released in stages. If a project is not going according to plan or the local environment changes, the next stage of resources may not be released. Disasters that occur in other parts of the world or the country may also cause funds to be diverted to projects that are considered more of a priority. The sector needs to remain a priority locally for donor funds to be allocated to the sector. This requires political commitment locally. It has been recognised that what works in one community does not necessarily work in another community. Finding out what particular attributes of a project or programme make it work in a particular location is considered, by the project facilitators, rather time consuming and some times ignored by the project implementers. An increasing number of project teams carry out evaluation exercises periodically after the project has been completed. It is unfortunate that reports written from such evaluation exercises sometimes remain on desks gathering dusts and no lessons are learnt especially across organisations. Information flow between organisations would help avoid some pitfalls in new projects or current projects. Information sharing is also a way of highlighting best practice in projects and approaches that work in particular environments. New projects stand a higher chance of getting funding than review exercises of projects or fact finding missions. The lack of emphasis on evaluation and the learning curve such exercises should produce has implications on the long term strategy and the likelihood of its success. The long term strategy is hindered if the same mistakes continue to be made and no real progress is made or impact is not recorded at the grass roots.

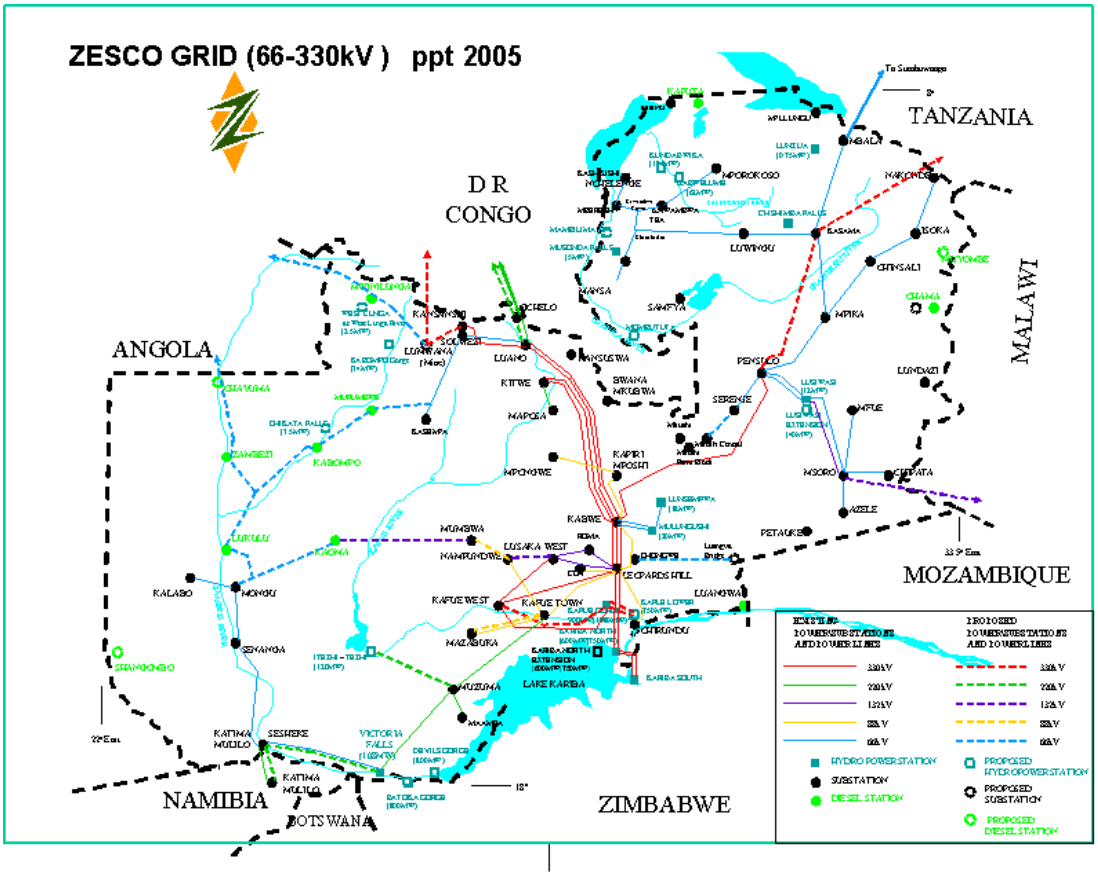
The long term strategy in the urban areas has a higher chance of survival than the rural water supply strategy. The strategy in the urban areas is based on commercialisation and the user pay principle. The introduction of commercialisation has reportedly benefited both the consumer and the supplier. The CUs feel they are free to make decisions and provide a good standard of service with minimum interference compared to the council or Local Authority controlling days. The consumer has benefited in seeing an improved service in some areas even though it has been with increased water tariffs. Some areas have also benefited from increased information coming from the supplier and a more professional approach to providing services. The continuity and further development of positive attributes of commercialisation depend on the financial viability of the CUs and their sustainability. The financial viability and investment potential is affected by the ownership of the CUs, which are effectively still owned by the MLGH through Local Authorities who own 100% shares in the companies. This structure of ownership limits the access of finances available from financial markets. Some CUs also have the problem of a carry over of the staff seconded from the Local Authorities. The staff carry-over results in over staffed utilities just like the former Council water departments. Unfortunately a large number of the staff are also not adequately trained or qualified for their jobs. The staff needs to be given their redundancy packages before they can be laid off. The packages were supposed to be provided by the MLGH

through the financial kick start to the CUs. Howver, the kick start never materialised. The lack of a kick start was reportedly due to lack of financial resources that the government hoped to secure from international financial institutions through the MLGH.

1.3.2 Mining and Industry

Water and energy development are the responsibility of the MEWD, showing their strong link and ties. Hydroelectric power is crucial to the Zambian economy. Most of the industrial and domestic power is supplied using hydroelectric power. The ZESCO is the largest power utility in Zambia followed by Copperbelt Energy Corporation, (CEC). The CEC supplies power to the mining companies on the Copperbelt province. There are currently 8 hydroelectric power stations spread all over the country, the three largest being in Kariba, Itezhi tezhi and Kafue, Figure 9. At least 10 proposed sites exist for hydroelectric power under ZESCO's expansion strategy. Hydroelectric power is listed as a tertiary water use in the Water Act (1949). Primary use of water is defined as the use of water for domestic purposes and the support of animal life[27]. Secondary use of water means the use of water for the irrigation of land and pisciculture. Tertiary use means the use of water for mechanical and industrial purposes for the generation of power. As such, any dispute between community water supply and ZESCO water volumes would rule in favour of domestic water supply. There are no disputes or tension situations that are publicised. The use of water in hydroelectric power generation is also non consumptive apart from the increased evaporation loss. The ZESCO draws its water from the same sources that some water providers use. The use of same source is only problematic in drought years when water levels are below average levels. Negotiations have to be carried out during drought years when levels of water are usually lower than expected. During the years of severe drought water has to be rationed among the different water users. The large water users like industry, hydroelectric power stations and water providers have to negotiate the water allocations according to the available resources. In years of severe or consecutive drought power cuts are imposed on most of the citizens. Strategic industries, hospitals, schools and government departments are usually exempt from the power cuts or use generators.

[27] Republic of Zambia. 1949. *The Water Act*. Lusaka: Government Printers.



Source: ZESCO website (www.zesco.co.zm Accessed on 06/04/2005)

Figure 9 ZESCO grid and Hydro electric power stations

Industries like the mining companies are self sufficient when it comes to water. They apply for water abstraction licences from the Water Board and also pump out ground water as a product of their mining activities. Mines cannot function unless they de-water their areas of operation. This water is always contaminated in some way and needs to be treated with care. Water on the mineral processing plants is obtained from water treatment plants that were managed by the AHC. This is water used in mineral processing and the employees changing rooms and tea rooms. In Lusaka the light industrial areas have numerous boreholes that companies use for their water source. This scenario is also present on the Copperbelt. Some of the smaller companies e.g. food and beverage companies, use water from the local water supplier. These are some of the large volume water consumers and pay a higher water rate since they are commercial clients. Most large companies e.g. manufacturing companies and breweries prefer to be independent of the local water supplier. This is probably because of the historically poor standard of service delivery in the water sector. The companies that drill their own boreholes require permission from the Water Board. Capital costs for drilling a borehole vary according to the province but range between K8 million to K 20 Million. This is a capital investment the companies are willing to spend. Reportedly, the initial investment is worth it in the long run as the company ends up saving money in water bills and ensuring they have a constant supply of water. The revision of the water act will result in an abstraction charge for groundwater. Groundwater will be controlled and regulated like the surface water resources. The revised act still needs to be debated in parliament and is not likely to come into effect for another couple of years.

1.3.3 Agriculture

Most small scale farmers depend on rain fed agriculture. The levels of irrigation farming in Zambia are rather low compared to neighbouring countries like Zimbabwe and Tanzania. In Zambia, some of the cultivating fields using irrigation are located several kilometres from the residential areas and near natural water bodies. Rain fed farming is prominent in almost all rural areas. Irrigation is widely practiced by commercial farmers especially those with access to the electricity grid. The small scale irrigation farming is usually practised close to natural water bodies according to observations in the Eastern, Northern and Western Province irrigation schemes. Most farmers that are part of irrigation schemes use surface irrigation where the water flows by gravity. Some small scale farmers use ground water on their cultivated land. They use bucket irrigation or treadle pumps. Some farmers purchase diesel pumps that pump water into their fields. The amounts of water used are relatively minimal compared to the groundwater amounts abstracted by commercial farmers. The small scale farmers dig shallow wells while the commercial farmers drill boreholes for irrigation purposes. Commercial farmers using irrigation are concentrated in the Central Province. This region was allocated as farming land during the colonial period. It was favoured by the climatic conditions, lack of tsetse flies, soil types and the availability of the line of rail. The farmers mainly use centre pivots, drip irrigation and overhead irrigation systems.

Some commercial farmers have dams on their premises for water storage. Damming of rivers and streams affects the availability of water for users downstream. Permits are required from the Water Board to prevent any adverse effects of damming on users downstream. The dams are built by several different bodies depending on the height of the dam wall. Any dam with a wall below 3 metres can be built by the Ministry of Agriculture, technical services branch. A wall above this height can be built by the Department for Water Affairs (DWA) within the MEWD. Private firms are also eligible to build dams. The dams have to be certified as safe with inspections carried out by the MEWD. In view of the revised water laws, commercial farmers will also have to obtain licences and declare the amounts of ground water they use. The revised water act will probably take another couple of years before coming into effect. A declaration on the amounts of surface water used is an existing requirement.

Using the provincial rainfall data (Table 1), the northern region of Zambia gets relatively high amounts of rainfall on average. These regions have sufficient rainfall even in drought years though some localised areas may get low levels of rainfall. The key provinces are Northern, North Western, Luapula, Eastern, Copperbelt and the upper part of Central Province. The Western and Southern Provinces are drier and experience more frequent droughts and years of below-average rainfall i.e. have more potential for droughts. In the Southern Province where part of the agricultural stronghold is, more dams are being built and multi-purpose water points. During drought years the water level in the dams is very low. The drought years are also separated by years of more than average rainfall, resulting in floods. The dams in southern province have to be at least 3 metres deep to provide water throughout the dry months. This is because of the high rates of evapotranspiration. The rates can be as high as 1.5 metres. The water resources are available in some parts of southern province, the challenge is to get them to the people usually by using these multi-

purpose water points but this needs resources and maintenance of any infrastructure that is installed. The northern part of Zambia does not have the most suitable soils for farming and livestock numbers are limited because of the existence of tsetse flies. Related to the physical amount of water available for domestic uses is the actual quality of water that is available. Even though water is available in an area it may not be of a suitable quality to use for domestic or industrial purposes.

1.3.4 Water Quality

Water quality is a problem for some domestic users during the dry periods as competition for water increases in some localities. Increased competition occurs in Kawambwa, Mansa, Kabwe and other towns where a significant number of residents depend on ground water. At this time the water level in the wells drops and water appears cloudy, which results in residents having to wait long periods before being able to use the water. The cloudiness is due to particles from the unlined well. When the water appears clear, the residents assume it is clean. This assumption results in increased incidences of waterborne diseases such as diarrhoea. In most areas visited, the water quality had actually not been tested in hand dug wells. Neighbourhood health campaigns have been held especially in peri-urban areas, encouraging the community to boil water for drinking or add domestic chlorine. These campaigns increase after a disease outbreak e.g. cholera. The domestic treatment of water is expected to get rid of bacteria that cause diarrhoeal diseases. Water quality is also a problem in some boreholes which have stagnant water. The water appears clear but has a rusty smell and taste. The water from these boreholes reportedly becomes unsuitable for domestic use. The boreholes are presumably located in lateritic soils with high natural levels of iron. In parts of Western province like Senanga, there are reports of highly saline water being drawn from some boreholes. This water is also considered unsuitable for domestic use. In Ndola the water supplier is concerned about high risks of contamination of the water source because of the close proximity of sewage effluent discharge points. The threat is increased by the lack of efficient effluent treatment. The water users are vulnerable in this particular situation especially if there is any breakdown in the water treatment process.

The water quality in the Kafue River and its tributaries is affected adversely by the concentration of industrial activity, farming and population density in the upper Kafue basin. Studies have been conducted on the wetlands in the basin and the nutrient and mineral loads that can be dealt with through natural processes of purification. These wetlands, like the Lukanga Swamps, only temporarily 'clean' the water. The minerals and metals remain in the plant material and sediments in the swamps and can be released later. This is, in effect, an ecological "time bomb". There is currently a project funded by the WWF looking especially at the effect of relatively high nutrient and mineral loads on wild life, aquatic life and conservation related activities in the Kafue basin.

A wide variety of technical, institutional, financial, economic, political, and social challenges would have to be overcome to meet the water needs expressed by different users and water uses, Table 11. The challenges faced by the different suppliers also vary in intensity and significance according to the location of the user. The summary shown in Table 11 is based on data obtained from interviews with different water users and suppliers and also field observations. These challenges, and the reasons

underpinning the challenges, comprise the basis of the second order assets of the water sector.

Table 11 Summary of Problems and Assets in different areas

Location	Use	Challenge	Reasons	Groups Affected	Assets
Rural	Domestic	• Infrastructure • Maintenance • Sustainability • Ability to Pay • Non- monetarised economy	• Inappropriate infrastructure • Highly limited resources • Low commitment from committee • Non moneterized economy • Non ownership of projects • Lack of idea internalisation	Poor residents Low density areas Low political clout Remote residents	Water projects Water Committees Community contribution User fees
	Small Scale farming	• Access • Land tenure • Maintenance • Sustainability • Crop variety • Labour	• Water points are secluded, far apart • Prime land limitations • Limited community resources • Low commitment from community • Low prices and accessibility of market • Family and resource dependant	Poor residents Low political clout Remote residents	Irrigation Projects Water User Groups Extension workers Agric. Support Programs Input subsidy
	Commercial Farming	• Access • Capital expenditure • Crop variety	• Prime land limitations • Boreholes are capital intensive • Dependant on soil, season and water requirements	Start up ventures	Individual resources Feeder roads
	Livestock	• Access • Infrastructure	• Water points are secluded • Not always appropriate and multipurpose	Remote residents Low political clout Poor residents	Water projects Corridor creation
Peri Urban	Domestic	• Supply • Infrastructure • Ability to pay • Population density • Plot sizes • Sustainability • Ownership (tenancy)	• Very limited hours of supply • Not always appropriate • Limited community resources • High demand for water • Pit latrines close to water points • Limited community resources • Limited investment in community services and infrastructure	Poor residents Low political clout Vulnerable groups	Water projects Water schemes Community based enterprises Water Committees Community contribution User fees Commercial Utilities

			• Lack of idea internalisation		
	Small Scale Farming	• Supply • Crop variety • Land Tenure	• Water points not multipurpose • Limited by space, prices and market access • Limits community investment • Customary tenure considered limiting	Poor residents Low political clout Vulnerable groups	Rain fed dependant
	Livestock	• Access • Infrastructure	• Water points not multi-purpose • Not always appropriate	Poor residents Low political clout Vulnerable groups	Soak-aways
Urban	Domestic	• Cost • Responsibility	• Perceived to be high, commercial • Shifted to client abruptly	Poor residents Vulnerable groups	Water Watch Groups Commercial Utilities
	Industrial	• Cost	• Perceived to be high, commercial	Company expenditure	Extended licences

1.4 External Influence

The role played by NGOs is closely linked with the donor agencies especially because the donors sometimes fund the community projects that are implemented by NGOs. The donors have conditions attached to funding that are relayed to the implementer of the project. Some donors restrict their relations to government level especially when negotiating donor support e.g. JICA. The JICA projects are secured as government to government aid. The JICA concentrates on intergovernmental partnerships and so in effect say they do not give the community any conditions. It selects projects from those proposed by the government of Zambia. It has a strong bias towards technical advancement in their projects. This usually means the personnel carry out the project with little involvement from the community. Lack of community involvement usually results in lack of project ownership and the community feeling they are not responsible for maintaining the project even after the donor agency has handed it over to them. The community sensitisation and capacity building is usually contracted out to an NGO like CARE International. Donors like the DfID, the NORAD and Irish Aid provide both project support and government to government support. The DfID has moved its focus from project support to governance in the last couple of years. The governance focus includes improving accountability and effectiveness of the government agencies. Other donors moving along these lines are the NORAD and the International Financial Institutions like the World Bank. However, each donor is involved in projects they fund often by tagging on consultants. The funds spent on consultants that are hand picked by the donors are a considerable part of the project costs. This almost always results in a degree of donor fund ineffectiveness. The consultants are essential to give guidance and fill gaps in skills and capabilities. Incidentally the same consultants are very likely to be used as scapegoats if the projects fail. The risk is higher for foreign consultants who may not mix with the community. It would be more ideal to make use of local consultants or increase the local participation in projects so that communities understand the role of consultants in the projects.

Most (but not all) donor funded projects are viewed as avenues for capacity building in communities and offering assistance to the Zambian government to reach remote areas. Real capacity is difficult to measure mainly because projects have different factors that affect their success and sustainability. The factors include; the technology, infrastructure, community attitudes, type of projects, funding availability and continuity, location of project, etc. A debate continues on harmonising the entry points for donor funds. This is a move towards budget support and not project support. The distinction between project support and budget support is rather vague especially when dealing with government projects as opposed to NGO and donor projects. Budget support instruments channel relatively large volumes of funds directly to a partner government, using its own allocation, procurement and accounting systems. This system of fund channelling marks a radical departure from previous aid instruments, which have relied either on project - based aid or on forms of programme aid linked directly to the achievement of *ex ante* conditionalities[28]. Traditional project, programme and sector driven programmes have not resulted in the overall improvement of economic conditions or the improvement of poverty related

[28] Oxford Policy Management 2003. Poverty Oriented Budget Support Project Report.

indicators. Thus donor agencies and local government sought to find a new approach to the provision of support.

External influence sometimes attempts to target funds to the remote areas and less visible parts of the country. It does however mean that national plans are not always followed because the projects done by NGOs are more locally focused with little national direction. The roll out of the national plan is disrupted by the sometimes ad hoc NGO projects. The NGO projects could fit into the national strategy but their priority areas are likely to differ. Further checks would be required to ensure the NGO projects make a significant contribution or compliment the national strategy. The NGO projects also affect the standing of central government and elected leaders in different communities. The projects introduced in communities from donors appear to promote the belief that government does not consider the rural areas to be of benefit apart from in staple food production. Development appears to be limited to the urban areas where government resources are directed. It may be beneficial for NGOs to involve not only traditional leaders but also local MPs in the remote areas when carrying out a project. The involvement of MPs in different locations would keep a direct link with central government and the planning structures that exist. In effect the presence of the MP on the project team would strengthen the central government role in the development projects in these areas.

Poverty reduction strategies are a way of strengthening central government and the role of elected leaders in development programmes. However, donors choose which projects and programmes they are willing to fund. This choice in effect still allows the donors to influence the priorities of the local government. The consequences of a donor driven agenda can be linked back to the non performance of project support and the lack of impact locally. If decisions are made by donor agencies that are in effect external agencies, local initiatives are not promoted and project implementers still feel the projects are imposed on them. The external decision making also contributes to government presenting plans for projects that they know they will not under take but know the donors will choose to support. This practice results in inefficiencies in the system as funds are redirected once they are released and long term strategies produce no benefits.

1.5 Government Responsibilities

In 1994 the National Water Policy was drawn up after the end of the UN International Decade for Water and Sanitation (1981-1990) [29]. The NWP was part of the operationalisation of the Brazzaville Declaration where African Governments agreed to take up the responsibility of providing clean water and sanitation to their populations. It also coincided with the restructuring of the public sector in Zambia. The objective of the NWP is to promote sustainable water resources development with a view to facilitate an equitable provision of adequate quantity and quality of water for all competing groups of users at acceptable costs and ensuring security of water supply under varying conditions. The policy has been implemented by the MEWD.

[29] Government of the Republic of Zambia. 1994. *National Water Policy*. Lusaka: Ministry of Energy and Water Development.

The proposed institutions from the Coopers and Lybrand study, carried out for the commercialisation of the water sector, have taken the form of a National Water and Sanitation Council (NWASCO) which is a statutory body with all the functions recommended in the study. The NWASCO has been functioning since 2001. The proposed Zambia Water and Sewerage Company has been replaced with CUs in the different provinces. The study recommended a national firm after considering aspects of coordination that would be involved if provincial companies were set up. The CUs are monitored by the NWASCO and the Local Authorities. Local authority control of equity limits the investment that the CUs can make to improve service delivery. Lending institutions require 51% private ownership of a company before they can lend the company any money. Investment limitations are particularly important in the extension of services to newly developed residential areas in the urban centres.

The next phases of the water sector reform are the legal and institutional reforms. These have been investigated through the Water Resources Action Programme (WRAP). This programme was started in 1999 and had a main goal of: "ensuring Zambia's water resources being managed and utilised for maximum economic benefit in an equitable and sustainable manner with strong stakeholder participation". The participation aspects of the programme are probably drawn from the key funding bodies of the programme which include NORAD, Irish Aid, GTZ (German Technical Cooperation) and the World Bank[30]. The WRAP also has a focus of integrated water management and the incorporation of groundwater resource legislation in the amended Water Act. The WRAP project is complete and results from the team should be promulgated shortly[31]. The promulgation will be through the revision of the water act and various documents targeting different sections of the water sector such as demand management. The recommendations made by the multi disciplinary team that formed the WRAP will go towards creating long term instruments, tools and strategies for effective operation of the water sector. Some of the expected results are the revision of the Water Act (1949), inclusion of ground water regulation and control and strengthening the operations of the organisation that has been proposed to replace the current Water Board. Table 12 gives a summary of the different roles of government agencies in the water sector. This summary is followed by a summary of the main NGOs working in the Zambian water sector, Table 13.

Most government agencies are centrally controlled in Lusaka. The central control has an adverse effect on the ability to reach the grass roots especially on a national level. On paper channels and procedures to be followed for activities such as obtaining water rights from the Water Board are laid down. Practice however differs from written down procedures. Government agencies are also affected by the level of skills that the employees have. The job description and qualifications are not always met mainly because of the low pay offered by the government compared to the private sector. The pay also affects the morale of the employees. Some government employees working at the grass root opt to get involved in projects that are usually higher paying and neglect their daily duties. Some positions at district level in the government agencies remain vacant for long periods of time affecting continuity in projects and addressing the needs of people at the grass roots. One of the promising

[30] Funding for the programme was linked to wide consultation of the various stakeholders.
[31] Personal account from interview with Publicity Officer for WRAP project.

district level agencies is the DWASHE team. This team is headed by the Local Authority head i.e. either a Town Clerk or some one appointed by him. The DWASHE teams have the ability to reach out to the grass roots through the line ministry staff especially from health and education. Unfortunately only limited channels exist for the district teams to feed back to the national level given the weakness or non existence of the Provincial WASHE teams. The lack of a provincial team prevents district teams from learning from each other's experiences and also drawing up a long term strategy that distributes resources across the province instead of just a district. It is an unfortunate trend that some good practices and concepts like the WASHE appear to fall to the way side once another concept is introduced since the same group of people i.e. grass root line ministry staff, are expected to champion the causes.

The ministry line staff also works with NGOs on various projects in their locations. NGOs play a key role in filling gaps and assisting local communities that are unlikely to benefit from the limited public funds and government resources. The work of NGOs is acknowledged by government though in some cases NGOs are accused of meddling in political affairs and inciting communities. Some politicians also feel the NGOs weaken central government by painting the picture that government concentrates on some areas and not others.

1.6 International Agreements

Some noticeable differences occur in the way shared water resources are dealt with especially since some shared resources have international agreements. Zambia is a signatory to most agreements apart from the newly created Zambezi River Commission. The impact of the international agreements seems to be restricted to a rather high level among the government employees or project teams that deal with and are aware of the agreements. In effect, international agreements have little or no effect on water management at the community level, apart from the principle of reasonable and equitable utilization and not causing significant harm. So even though the Kafue River is wholly in Zambia any degradation of the integrity of the quality of the water will eventually be passed downstream to a shared transboundary resource, the Zambezi River. One effective way of instilling awareness of these links in the communities may be through line ministry staff that work at the grass roots but in the water sector the grass roots usually end with the district water engineer who more often than not deals with rural water supply as opposed to water resource management. Some villages in Southern Province, especially in Senior Chief Mukuni's area are working with some NGOs to promote sustainable development and conservation in the use of natural resources. External actors have an influence in supporting such activities and working with local communities.

IWRM is championed mainly in transboundary basins. This may push IWRM into the local debate and agenda within the Zambian water sector. This is part of the positive influence from shared water resources and external actors. Some NGOs working in the Zambian water sector and some government officials acknowledge that IWRM has been left out of most debates but that is usually because Zambia is accustomed to playing catch up on most issues especially regarding water management. The

institutions and organisations in the water sector seem to take more time to internalise ideas compared to institutions and organisations in the neighbouring countries.

Table 12 Government Agencies in Water Sector

Body	Governing Act and Level	Roles and responsibility	Comments
Water Development Board (WDB) under MEWD	Water Act of 1948 National level	To control the use of all surface water resources in the country by allocating water rights to different users	Under staffed and has central control. Lacks resources as revenues are placed in central government coffers. Limited monitoring activities and weak at enforcing
Department of Water Affairs (DWA) under MEWD	Water Act of 1948 National level, Provincial level and District level	Provide technical support to the Water Development Board Monitoring development of water structures in the country Monitoring of water levels in national rivers Conducting Geophysical surveys Hydrological and meteorological data collection and analysis for public use Physical implementation of the National Water Policy	Undergoing restructuring and responsibility refocusing. Some posts at district level not filled. Machinery usually lies idle because of lack of contracts and funding for projects. Personnel not sure of full duties and responsibilities. Internal struggles with MLGH. Well placed to cover national concerns.
Environmental Council of Zambia (ECZ)	Environment Protection and Pollution Control Act of 1990 National and one Provincial level	Control of pollution in national water ways Issuing licences for effluent discharges Identifying areas that require Environmental Impact Assessments Setting standards for effluent before discharge Enforcing effluent discharge standards Policy formulation	Effectiveness affected by central control structure and lack of consistent funding. Revenues from licensing not sufficient. Potential overlap with NWASCO on effluent licensing
National Water and Sanitation Council (NWASCO)	Water Supply and Sanitation Act of 1997 National level	Regulate Water Supply and Sanitation Supervise the operations of newly formed Commercial Utilities Enforcement of water quality standards Regulating the levels of capital expenditure associated with meeting water quality standards Evaluating efficiency levels Giving incentives for improved performance	Effectiveness affected by central control structure and lack of resources for efficient monitoring of standards. Rely on feed back from water providers. Monitoring and inspection activities not efficient. Potential over lap in drinking water quality monitoring with MoH. Potential overlap with ECZ on effluent treatment for sewerage companies.

		Penalizing defaulters for negligence.	
Water Resources Action Programme	National Water Policy	Institutional and legal reform of water sector	Conducted national consultation with all major stake holders but have remit to focus on economic exploitation of water resources thus the general public are not consulted on water resource management
Ministry of Health (MoH)	Public Health Act of 1978 National, Provincial and District Level	Enforcement of water quality standards Random checks on drinking water quality	Potential overlap in water quality monitoring with NWASCO. Erratic water quality monitoring unless disease outbreak. Record keeping not harmonised. Well placed to cover national concerns
Ministry of Local Government and Housing (MLGH)	Local Government Act of 1980 National, Provincial and District level	Service Provider in areas where Commercial Utilities have not been created Domestic water supply in rural and urban areas	Well placed to cover national concerns. Lacks human and capital resources to provide clean and safe drinking water to all citizens. In house squabbling with MEWD.

Table 13 NGOs in the water sector

NGO	Location	Project Areas	Aims	Comments
World Vision International	Over 20 Area Development Programs (ADPs) across the country in partnership with communities and local government	Food and agriculture security Water and sanitation Education Income generation Primary and curative health care	Promote quality programming that responds to the needs and aspirations of all community members Facilitate continued learning across ADPs: sharing of best practices, new monitoring tools Respond to emergency and immediate humanitarian needs Embrace policies in decision making, communication and human resource management that are participatory and affirming Demonstrate servant leadership	WVI is a Christian based organisation with a child focus. The work of the organisation reflects the focus of bettering a child's life. Water is recognised as one of the main elements in a child's life so access to clean and safe water is vital for good health. The funding for local WVI projects comes from overseas partners. The local teams carry out a needs assessment with the communities they work in to decide what projects to undertake in the communities. The communities prioritise their needs but these needs must meet the criteria set by WVI.
CARE International	The poor in urban and rural communities	Multiple aspects of poverty including the following: Renovations of water systems for access to sufficient and safe water supply Operations and maintenance of water & sanitation systems Solid waste management Surface water drainage Improving surface drainage Hygiene education	Promote the empowerment of individuals and organisations/partners by assisting them in enhancing their capacity to secure their livelihood and to improve their environments Link relief to longer term sustainable development activities intending to foster a capability for self-reliance Improve the accessibility to agri-	CARE is a livelihood and sustainable development focused NGO. They take a holistic view to life including the importance of access to safe and clean drinking water. The projects undertaken by CARE are funded through international funding mechanisms especially donor agencies. The work of the organisation is centred around the poor and vulnerable especially in the urban areas and surrounding peri-urban

			inputs and other products in rural areas while reducing the real and opportunity costs of agri-inputs for farmers in remote rural areas	areas. The organisation carries out a needs assessment involving the community where a potential project will be undertaken. CARE also sets criterion that the community and proposed project must meet. The organisation usually makes use of line Ministry staff in their project areas.
Lutheran Worldwide Foundation	Eastern province	Improving water supply Promoting income generating activities	Implementing an integrated development programme. Looking at agriculture, health, HIV and AIDS, income generating activities etc. Interacting with the communities in these fields promotes awareness of the organisation and enables communities to approach the organisation when they need help in water supply and water related activities.	A Christian based organisation which has an integrated development approach through its rural development and motivational programme. The organisation mainly works with communities that use shallow wells and helps them in lining and re-deepening of wells. There is criterion set by the organisation which the projects and communities need to meet. Funding for projects is controlled centrally from Geneva where the organisation head quarters are located.
Irish Aid or DCI	Northern province and projects near the capital Lusaka, in the city of Kitwe on the Copperbelt, and in the south of the country in the town of Mazabuka. In partnership with the Zambian people at all levels, national, regional and community	Improving water supply and sanitation Health care Primary education Urban/community development.	To help address poverty and basic needs by supporting essential sectors such as health, education, water, sanitation and income generation, To build up the capacity of the Zambian people - at community, local and national level - and to maximise their involvement in their own development, thus	Inter governmental aid agency with a strong hold in the Northern Province. The strong hold can be traced back to the white fathers who came to the region as missionaries. DCI has a development focus. Specifically regarding water the organisation offers financial and technical support in IWRM under the umbrella of meeting MDGs. DCI has a mandate which includes capacity

			helping to ensure that progress made can be sustained and further improved	building in communities and using a bottom up approach in development.
Water Aid	Urban and rural poor .	Dedicated exclusively to the provision of safe domestic water, sanitation and hygiene education to the world's poorest people	Works by helping local organisations set up low cost, sustainable projects using appropriate technology that can be managed by the community itself. Water Aid also seeks to influence the policies of other key organisations, such as governments, to secure and protect the right of poor people to safe, affordable water and sanitation services	Water Aid focuses on capacity building in government institutions and in improving community water supply especially in rural areas. They aim to influence policy in the Zambian water sector acting as both a facilitator and a coordinator for donor activities. The funding for water aid projects is mainly provided by well wishers in the form of donations and good will. Water Aid is in effect a British charity organisation. .