DATA COLLECTION SURVEY ON THE URBAN WATER SUPPLY SECTOR IN THE REPUBLIC OF ZAMBIA

JANUARY 2014

GLOBAL ENVIRONMENT DEPARTMENT

JAPAN INTERNATIONAL COOPERATION AGENCY

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List of Abbreviations

AC	Asbestos Cement
AfDB	African Development Bank
AusAID	The Australian Agency for International Development
CP	Cooperating Partner
CU	Commercial Utility
DANIDA	Danish International Development Agency
DTF	Devolution Trust Fund
E/N	Exchange of Notes
EU	European Union
F/S	Feasibility Study
GRZ	Government of the Republic of Zambia
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)
GIS	Geographic Information System
HDP	High Density Polyethylene Pipe
KfW	Kreditanstalt für Wierderaufbau (German Development Bank)
LPWSC	Luapula Water and Sewerage Company
LWSC	Lusaka Water and Sewerage Company
MCA	Millennium Challenge Account
MCC	Millennium Challenge Corporation
MD	Managing Director
MEWD	Ministry of Energy and Water Development
MMEWD	Ministry of Mines, Energy and Water Development
MLGH	Ministry of Local Government and Housing
NRW	Non Revenue Water
NRWSSP	National Rural Water Supply and Sanitation Programme
NUWSSP	National Urban Water Supply and Sanitation Programme
NWASCO	National Water Supply and Sanitation Council
O&M	Operation and Maintenance
OJT	On-the-Job Training
PVC	Polyvinyl Chloride Pipe
SCADA	Supervisory Control and Data Acquisition
SIDA	Swedish International Development Agency
SNDP	Sixth National Development Plan
SOMAP	Sustainable Operation and Maintenance Project for Rural Water Supply
US$	United State Dollar
WASAZA	Water and Sanitation Association of Zambia
WB	World Bank
WSC	Water and Sanitation Company
WSPLP	Water Sector Performance Improvement Project
WWSC	Western Water and Sanitation Company
ZMK	Zambian Kwacha
ZESCO	Zambia Electricity Supply Corporation

Chapter 1 Outline of the Survey

1-1 Background and Objectives of the Survey

In the Republic of Zambia (hereinafter "Zambia"), the *National Urban Water Supply and Sanitation Programme* (NUWSSP) was announced by the Zambian government in October 2011, providing national guidelines for the urban water supply and sanitation sub-sector. The NUWSSP requires donors (cooperating partners (CPs)) to provide assistance effectively and efficiently while keeping aid coordination in mind. It is also planned that a Memorandum of Understanding (MoU) and Joint Financing Arrangement will be prepared before the end of 2013 between governments and CPs involved in the program assistance, and it is anticipated that they will sign a written agreement similar to one for the *National Rural Water Supply and Sanitation Programme* (NRWSSP) which was signed in 2007.

The Zambian government had planned to establish a basket fund as a new financial mechanism in 2011, but because it has taken time for the government, CPs and other relevant parties to form a consensus concerning the national guidelines, at present, no such mechanism has been established. However, in the rural water supply and sanitation sub-sector, Kreditanstalt für Wierderaufbau (German Development Bank, KfW) and the United Nations Children's Fund (UNICEF) have begun contributing to a basket fund. It is expected that a similar trend will also be seen in the urban water supply and sanitation sub-sector, and it is intended that a description of this matter will also be included in the MoU.

Furthermore, under the latest national guidelines, funds that do not flow via a perfect basket fund system, such as Japan's technical cooperation projects and grant aid, are also recognized as project-based assistance, and good project-based assistance needs to be maintained. JICA has already instigated operations aimed at transitioning to full-fledged cooperation programs for the water supply and sanitation sector. In terms of the rural water supply and sanitation sub-sector, since the 1980s, JICA has promoted the construction of boreholes fitted with handpumps with hand pumps funded by grant aid, and since 2005, it has promoted the construction of a maintenance model for boreholes (SOMAP O&M model) through technical cooperation projects. It has thus provided support aimed at achieving 70 percent accessibility to safe water by 2015, the target year of the NRWSSP.

On the other hand, in terms of the urban water supply and sanitation sub-sector, JICA's support in the past has been via grant aid targeted at two key cities in terms of the economy, industry and population, namely Zambia's capital city Lusaka and Ndola. JICA has also been recognized for having contributed to the building of community-led operation and maintenance systems as grant aid "soft" components. It is essential that future support be provided based on the NUWSSP and its target year of 2030. As for CPs, there has already been support to the Lusaka Water and Sewerage Company (LWSC) and Nkana Water and Sewerage Company (NWSC) via loan aid from the World Bank (WB) and the African Development Bank (AfDB), as well as support to commercial utilities (CUs) such as via grant aid from the Millennium Challenge Corporation (MCC), the EU, Germany (GIZ/KfW) and the Danish International Development Agency (DANIDA). Under such conditions, with respect to shifting toward the urban water supply and sanitation sector as a new potential target for aid, a strategic cooperation program with a central focus on loan aid and grant aid needs to be formulated, while ascertaining the economic and financial conditions of Zambia and of each CU, and while also bearing in mind Japan's predominance and the potential for Japanese companies to enter the market.

The aim of this survey is to collect and analyze necessary information on the current conditions of individual CUs for the purpose of examining an effective approach to providing aid for the urban water supply sub-sector given the context described above.

1-2 Mission Organization

(1) Mission leader

Juichiro Sahara, Water Resources Management Division II, Global Environment Department, JICA

(2) Technical consultant

Katsuhito Yoshida, Regional Project Formulation Advisor, JICA Kenya Office

(3) Urban water supply: organization management

Fumio Fukuda, Sowa Consultants Inc.

(4) Urban water supply: water supply facilities

Koji Yoshikawa, Individual consultant

1-3 Survey Schedule

Day #	Date	Day of week	Katsuhito Yoshida Technical consultant	Juichiro Sahara Mission leader	Fumio Fukuda Urban water supply: organization management	Koji Yoshikawa Urban water supply: water supply facilities	Overnight
1	10/23	Tue		Haneda-Hong Kong 23:50 Hong Kong →	16:55 Narita-20:40 Hong Kong		On board flight
2	10/24	Wed	Nairobi- Lusaka	→ 7:15 Johannesburg (SA287) 10:30 Johannesburg-12:30 Lusaka (SA062)			Lusaka
3	10/25	Thu	Meeting with JICA Zambia, AfDB, KfW, DANIDA				Lusaka
4	10/26	Fri	Meeting with MLGH, NWASCO, DTF, MCA Zambia				Lusaka
5	10/27	Sat	Internal meeting				Lusaka
6	10/28	Sun	Internal meeting				Lusaka
7	10/29	Mon	Meeting with Lusaka WSC, GIZ, WB, KfW				Lusaka
8	10/30	Tue	Site inspection (Ioland WTP, Kafue WTP, reservoirs and boreholes in Lusaka city)				Lusaka
9	10/31	Wed	Move to Luapula by car				Luapula
10	11/1	Thu	Courtesy call to Luapula Provincial Minister Meeting with Luapula WSC and site inspection (Mansa)				Luapula
11	11/2	Fri	Site inspection (Nchelenge/ Kashikishi, Mwense)				Luapula
12	11/3	Sat	Meeting with Luapula WSC and site inspection (Mansa)				Luapula
13	11/4	Sun	Move to Lusaka by car				Lusaka
14	11/5	Mon	Meeting with WASAZA Lusaka- Nairobi	Internal meeting			Lusaka
15	11/6	Tue		Lusaka-Johannesburg →	Move to Western by car		Western
16	11/7	Wed		→ HGK-Haneda	Courtesy call to Western Provincial Minister Meeting with Western WSC and site inspection (Mongu)		Western
17	11/8	Thu			Site inspection (Senanga)		Western

18	11/9	Fri			Meeting with Western WSC and site inspection (Sesheke)	Western
19	11/10	Sat			Move to Lusaka by car	Lusaka
20	11/11	Sun			Reporting	Lusaka
21	11/12	Mon			Meeting with Lusaka WSC and site inspection (Chongwe)	Lusaka
22	11/13	Tue			Site inspection (Kafue and Chilanga)	Lusaka
23	11/14	Wed			Meeting with Lusaka WSC regarding answer to questionnaire	Lusaka
24	11/15	Thu			Reporting	Lusaka
25	11/16	Fri			Report to JICA Zambia	Lusaka
26	11/17	Sat			Reporting	Lusaka
27	11/18	Sun			7:20 Lusaka- 9:25 Johannesburg 16:45 Johannesburg →	On board flight
28	11/19	Mon			→ 12:15 Hong Kong 14:25 Hong Kong- 19:15 Haneda	

1-4 Survey Policy

The specific survey policy is as follows.

(1) Lusaka Water and Sewerage Company

- According to *The Study on Comprehensive Urban Development Plan for the City of Lusaka in the Republic of Zambia*, which was conducted by JICA, the demand for water in Lusaka is expected to reach 615,000 m^3/day in 2030, whereas, as of 2007, its capacity to supply water was only 221,700 m^3/day. Hence, it is essential that the volume of water production and supply be strengthened. Furthermore, non-revenue water is 40-50 percent, putting additional stress on the water supply and financial situation.
- According to the *Water Supply Investment Master Plan, Lusaka, Zambia*, which was published by the MCC, in order to satisfy the water and sanitation demand in Lusaka, it is estimated that investments will be required of approximately US$2 billion in the long term (2035) and US$622 million in the short term (2015). Of the US$622 million, the MCC has itself committed US$350 million (grant aid), but on a basis of actual projects (water and sewerage), its investment has been limited to US$189 million. (In terms of water supply, its investment has been limited mainly to rehabilitation of existing facilities, measures dealing with non-revenue water, and the expansion of drainpipes.)
- The WB has provided assistance to the LWSC, issuing loans via the Ministry of Local Government and Housing (MLGH) worth a total of US$60 million between 2006 and 2009 (extended to 2013). Programs for 2013 and beyond are currently being formulated. In addition, the AfDB has also issued loans in the past via the MLGH worth approximately US$24 million, implementing and concluding projects supporting water supply in Lusaka.

Based on the above, in view of the need for strengthening the water supply facilities of the LWSC and of the performance of past loans, this study will outline the potential for collecting information and for providing cooperation to the LWSC as well as the need for that cooperation, with a mind to ODA loans, technical cooperation and so on.

(2) Other CUs

- Although there is no detailed information, it is presumed that CUs are unable to adequately cover their operational costs by means of their proper business operations (namely, the sale of water), and so, in general, most CUs are operating at a deficit. Consequently, the primary form of assistance from the majority of CPs is grant aid.
- At 40-60 percent, non-revenue water affects supply and financial conditions.
- Each CU is provided with assistance from a specific CP, but in the case of Luapula Province and Western Province, it has been confirmed that Denmark will pull out in 2013. Consequently, support from a new CP is required. In addition, among all the CUs, these two public corporations have the lowest coverage, at 15 percent and 52 percent respectively.

Based on the above, this study will use field surveys to outline the potential for collecting information and for providing cooperation to Luapula Province and Western Province as well as the need for that cooperation, with a mind to grant aid, technical cooperation and so on. The study will also seek to understand the current situation with regard to other public corporations, using existing materials and based on interviews with the MLGH and the National Water Supply and Sanitation Council (NWASCO).

Chapter 2 Outline of the Urban Water Supply Sector in Zambia

2-1 National Policy for the Urban Water Supply Sector

With aspirations of becoming a middle-income nation by 2030, in January 2011, the Zambian government formulated the *Sixth National Development Plan (SNDP, 2011-2015)* as a medium-term plan for attaining its long-term development policy, Vision 2030. Building on the gains of the *Fifth National Development Plan (FNDP, 2006-2010)*, the theme of the SNDP is "sustained economic growth and poverty reduction," and its objectives are to promote infrastructure development, economic growth and diversification, rural investment, and poverty reduction and human development.

As far as the water sector is concerned, the SNDP lists improving the provision of basic water supply and sanitation services as one of the issues for achieving economic growth and poverty reduction. With a goal of "all users have access to water and sanitation services by 2030 for the sake of health and improved livelihood," the SNDP also has a target of achieving 75 percent accessibility to safe water[1] and 60 percent accessibility to adequate sanitation services by 2015. As for policies related to water supply and sanitation, the SNDP lists "develop and provide sustainable and safe water supply services in urban and peri-urban areas" as one of the seven key strategies.

Another policy for the water supply and sanitation sector is the *National Rural Water Supply and Sanitation Programme (NRWSSP, 2006-2015)* which was launched in November 20007. One of its goals is to achieve accessibility to safe water in rural areas of 75 percent by 2015.

Furthermore, the *National Water Policy* was revised in 2010, and as part of the changes to water supply and sewerage, "assistance is to be given to provide adequate, safe and cost effective water supply and sanitation services with due regard to environmental issues." Moreover, in October 2011, the *National Urban Water Supply and Sanitation Programme (NUWSSP, 2009-2030)* was issued, and one issue to be addressed under this program between 2009 and 2015 is to "improve and maintain existing urban water supply facilities, and improve water supply coverage in urban areas."

(1) Sixth National Development Plan (SNDP)

The SNDP contains development strategies for 17 sectors.[2] Its goal in the water and sanitation sector is to achieve 75 percent (rural) and 80 percent (urban) accessibility to safe water, plus 60 percent accessibility to adequate sanitation services by 2015. Table 2-1-1 lists the associated strategies. Under the SNDP, year-by-year target values for accessibility to safe water and adequate sanitation services have also been set as shown in Table 2-1-2.

[1] In the summary for the water sector in the SNDP, this target is 75 percent, but the target for accessibility to safe water in urban areas is 80 percent (see Table 2-1-2).

[2] (1) Transport, (2) Energy, (3) Housing, (4) Health, (5) Education and skills development, (6) Water and sanitation, (7) Child, youth and sports development, (8) Agriculture, livestock and fisheries, (9) Mining, (10) Tourism, (11) Manufacturing, (12) Commerce and trade, (13) Science, technology and innovation, (14) Information and communication technology, (15) Natural resources, (16) Local government and decentralization, (17) Social protection

Table 2-1-1: SNDP strategies for the water supply and sanitation sector

Objectives	Key strategies	Programs
To provide adequate, safe and cost effective water supply and sanitation services with due regard to environmental issues	a) Enhance the implementation of the Water Sector Master Plan b) Develop infrastructure for sustainable rural water supply and sanitation service delivery and protect the environment c) Enhance capacity in effective planning, implementation and monitoring of programs for rural water supply and sanitation service delivery	NRWSSP
	d) Develop and provide sustainable and safe water supply services in urban and peri-urban areas e) Strengthen human, technical and financial capacity of institutions for improved water supply and sanitation service delivery in the urban and peri-urban areas f) Enhance solid waste management and institutional management systems g) Enhance institutional capacity of councils in the implementation of storm water drainage infrastructure development	NUWSSP

Source: SNDP 2011-2015, January 2011

Table 2-1-2: Annual accessibility targets under the SNDP

		Baseline	Annual targets (%)				
		2009	2011	2012	2013	2014	2015
Rural	Accessibility to safe water	53	61	65	69	73	75
	Accessibility to adequate sanitation services	33	43	48	53	58	60
Urban	Accessibility to safe water	74	75	76	77	79	80
	Accessibility to adequate sanitation services	37	44	48	52	56	60

Source: SNDP 2011-2015, January 2011

Shift in accessibility to safe water and adequate sanitation services

Table 2-1-3 shows the change in accessibility to safe water and adequate sanitation services in urban areas in Zambia between 2005/06 and 2011/12. Looking at the change in accessibility to safe water in urban areas, we can see that this reached 81.8 percent in 2011/12, meaning that the SNDP target for 2015, that is, 80 percent, has already been achieved. The definition of safe water is as follows:

- Piped water

- Public tap
- Borehole
- Protected spring
- Protected dug well
- Rainwater collection

Table 2-1-3: Shift in accessibility to safe water and adequate sanitation services in urban areas

	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Accessibility to safe water	67.0%	67.9%	68.6%	72.4%	73.9%	77.5%	81.8%
Accessibility to adequate sanitation services	32.0%	34.0%	29%	34.0%	36.6%	54.1%	56.7%

Source: Urban and Peri-Urban Water Supply and Sanitation Sector Report 2011/2012, NWASCO

(2) National Urban Water Supply and Sanitation Programme (NUWSSP)

The NUWSSP is a comprehensive program comprised of 14 chapters related to the development of water supply and sewerage, storm water drainage and waste disposal in urban areas. In Chapter 12 *Cost, Financing and Project Selection*, it has been tentatively calculated that US$40.810 billion of investment will be required up until 2030 for infrastructure development relating to urban water supply and sanitation. The amounts of investment required for each commercial utility (CU) and water and sewerage company (WSC) have also been similarly calculated.[3]

Chapter 1 Background
Chapter 2 Status of the urban water supply & sanitation sector
Chapter 3 Overall vision and strategic approach
Chapter 4 Water supply and development programme
Chapter 5 Sanitation development program
Chapter 6 Solid waste development programme
Chapter 7 Drainage development programme
Chapter 8 Policy development programme
Chapter 9 Capacity development programme
Chapter 10 Information management development programme
Chapter 11 Research and development programme
Chapter 12 Cost, financing and project selection
Chapter 13 Management and organization
Chapter 14 Financial management

2-2 Administrative Organization of the Urban Water Supply Sector

The supply of water in urban Zambia has been operated publicly since 2000,[4] with each CU adopting an independent profit system under the relevant local government. However, at present, most CUs operate at a

[3] For further details on the necessary amounts of investment under the NUWSSP, see *2-3 Current Situation and Issues for Initiatives in the Urban Water Supply Sector* below.
[4] Only the Lusaka Water and Sewerage Company was publicly incorporated in 1989.

loss, with their deficits in effect being covered by the MLGH. As of November 2012, there are 11 CUs across the country.[5]

In addition, the National Water Supply and Sanitation Council (NWASCO) has been established under the umbrella of the Ministry of Mines, Energy and Water Development (MMEWD, formerly the Ministry of Energy and Water Development (MEWD)) as the authority responsible for the regulation and supervision of water supply and sewerage services. Its operations include issuing operation licenses to CUs, deliberating and making decisions on increases in water and sewerage rates, and monitoring and evaluating the performance of CUs. Figure 2-2-1 shows the administrative organization of the urban water supply sector in Zambia.

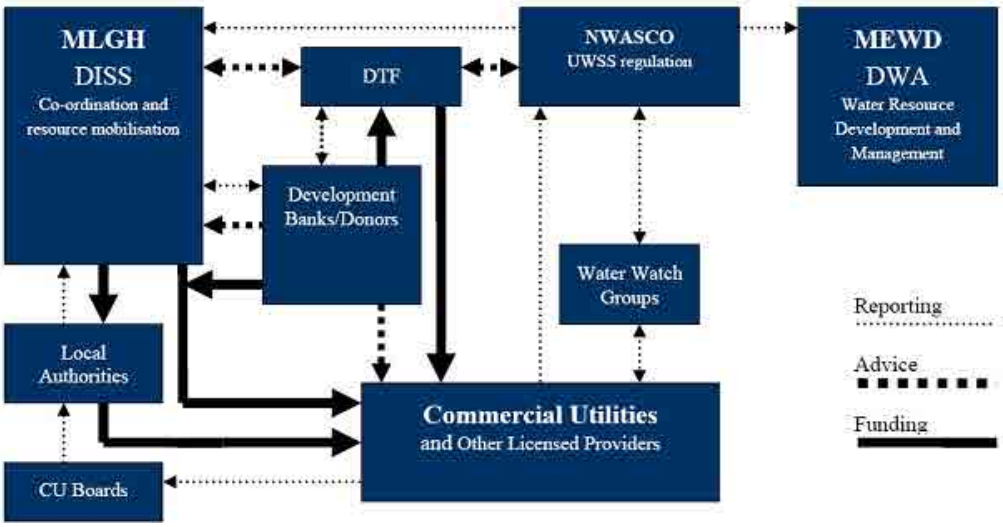

Figure 2-2-1: Administrative organization of the urban water supply sector in Zambia

Source: Water Supply Investment Master Plan Lusaka, Final Master Plan Report, MMC, 2011

(1) Ministry of Local Government and Housing (MLGH)

Zambia's urban water supply is governed by the Department of Housing and Infrastructure Development (DHID) within the MLGH. The department is headed by the Director of the DHID, under which there are three Assistant Directors in charge of: (1) water supply and waste management, (2) housing, and (3) roads, fire prevention, markets and bus stations. Urban water supply is the responsibility of the Assistant Director in charge of Water Supply & Sanitation & Waste Management. Figure 2-2-2 shows an organization chart of the DHID as of November 2012.

Under the Assistant Director in charge of Water Supply & Sanitation & Waste Management is the Principal Water Supply & Sanitation Officer – Urban, and under this position are two personnel: the Senior Water Supply & Sanitation Officer – Urban, and the Senior Water Supply & Sanitation Officer – Peri-Urban.

[5] For further details on CUs, see *2-5 Current Situation and Issues Facing Commercial Utilities* below.

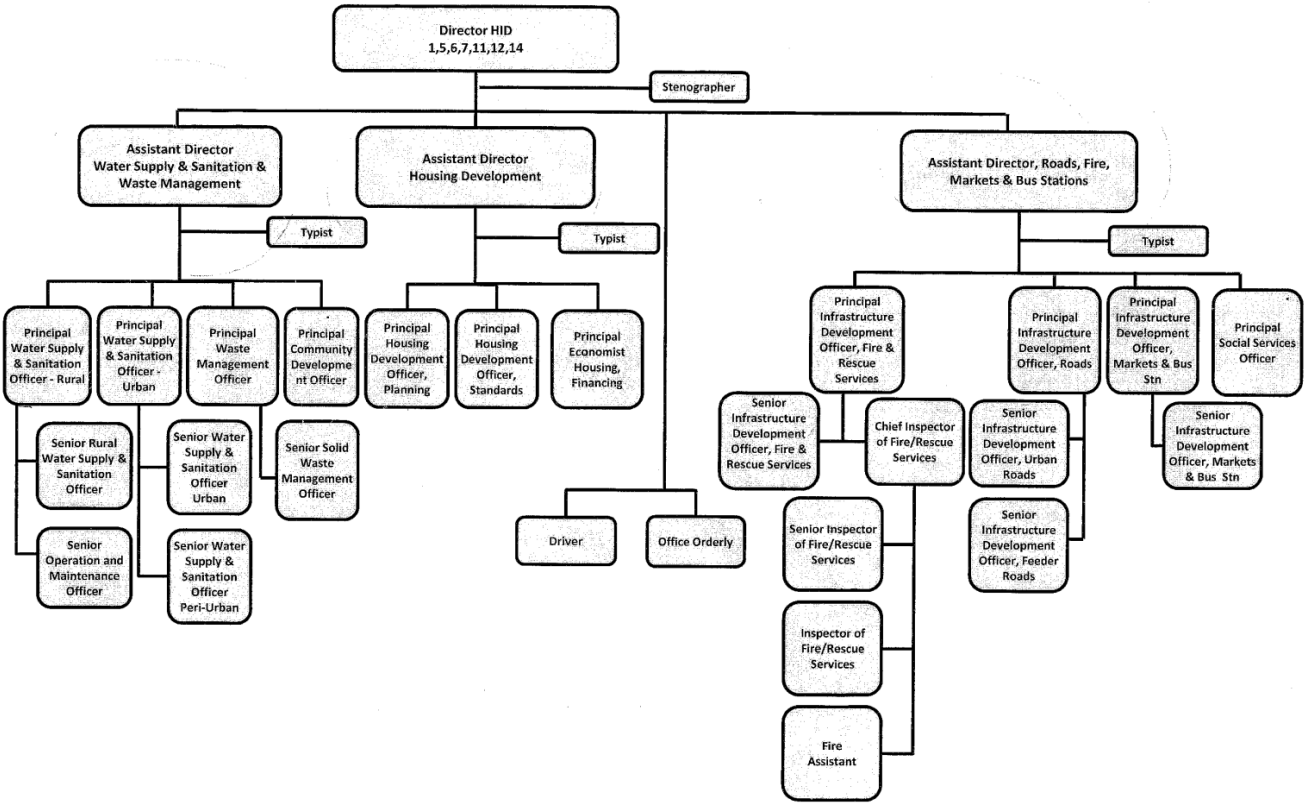

Figure 2-2-2: Organization chart of the Department of Housing and Infrastructure Development (Ministry of Local Government and Housing)

(2) Ministry of Mines, Energy and Water Development (MMEWD)

MMEWD is responsible for the development and management of mines, energy (including electricity) and water resources. NWASCO, the authority responsible for the regulation and supervision of water supply and sewerage services, comes under the umbrella of this ministry. Furthermore, under NWASCO comes the Devolution Trust Fund (DTF). DTF is a trust fund established by the Zambian government together with cooperating partners (CPs) used to improve water supply and sanitation facilities in peri-urban areas.[6]

(3) National Water Supply and Sanitation Council (NWASCO)

NWASCO was established in 2006 as the authority responsible for the regulation and supervision of water supply and sewerage services. Its operations include: (1) issuing operation licenses to CUs; (2) deliberating and making decisions on increases in water and sewerage rates; (3) setting and providing guidance on operating indicators in relation to water supply and sewerage services; (4) monitoring and evaluating the performance of CUs; (5) providing training and technical assistance to CU personnel; and (6) carrying out publicity activities. Although NWASCO was originally established in 2006 through assistance provided by GIZ and DANIDA, now it operates using the license revenue collected from CUs.

[6] For further details on the DTF, see *2-4 Trends of Other Donors in the Urban Water Supply Sector* below.

2-3 Current Situation and Issues for Initiatives in the Urban Water Supply Sector

(1) NUWSSP investment needs

The NUWSSP is a comprehensive program related to the development of water supply and sanitation in urban areas. According to this program, the amount of investment required for improving water supply and sanitation in urban areas between 2011 and 2030 has been tentatively calculated as shown in Table 2-3-1. Combining both new and replacement works, the urban water supply sector requires massive investment, totaling US$1,070 million by 2015, and US$3,310 million by 2030. The overall total investment required up to 2030 is US$4,081 million, with the urban water supply sector accounting for 81.1 percent (US$3,310 million), the urban sewerage and sanitation sector 15.7 percent (US$640 million), and other 3.2 percent (US$131 million). The amount of investment required by the urban water supply sector remains as large as ever.

Table 2-3-1: NUWSSP investment needs

	Investment needs (US$ million)								
Year	2011	2012	2013	2014	2015	2011-2015	2016-2020	2021-2030	2011-2030
Urban water supply (new)	73	95	110	93	68	438	288	932	1,659
Urban water supply (replaced)	88	109	135	151	148	631	444	576	1,652
Urban water supply, total	161	204	245	244	216	1,070	732	1,508	3,310
Sanitation (new)	13	15	17	14	11	70	59	216	345
Sanitation (replaced)	13	16	20	25	28	101	100	93	295
Sanitation, total	26	31	36	39	39	171	160	309	640
Other	6	8	5	5	8	32	29	70	131
Total	193	243	286	288	263	1,272	921	1,888	4,081

Source: National Urban Water Supply Sanitation Programme, 2011

Table 2-3-2 shows a breakdown of the investment needs of each CU in the urban water supply sector. Looking at investment needs up until 2030, the Lusaka Water and Sewerage Company (LWSC) accounts for US$1,264 million, or 31.0 percent of the total. The other CUs subject to this survey are the Western Water and Sanitation Company (WWSC), accounting for US$133 million (3.3 percent), and the Luapula Water and Sewerage Company (LPWSC) , accounting for US$64 million (1.6 percent).

Table 2-3-2: CU investment needs

	Investment needs (US$ million)								
Year	2011	2012	2013	2014	2015	2011-2015	2016-2020	2021-2030	2011-2030
Lusaka	55	63	72	80	81	351	267	646	1,264
Kafubu	34	48	59	52	35	227	126	256	609
Mulonga	25	29	35	41	43	174	145	263	581
Nkana	35	39	41	43	43	202	160	256	618
North Western	3	4	4	4	4	18	13	31	62
Lukanga	8	9	9	10	11	48	48	123	218
Southern	10	19	23	19	15	87	47	107	241
Western	4	6	9	9	8	35	35	63	133
Chambeshi	7	9	12	13	12	54	44	67	165
Eastern	6	7	8	8	8	37	30	58	125

Luapula	3	10	14	9	3	39	7	18	64
Total	193	243	286	288	263	1,272	921	1,888	4,081

Source: National Urban Water Supply Sanitation Programme, 2011

(2) Current state of investment in the urban water supply sector

As shown in Table 2-3-1, the amount of investment needed in the first year of the NUWSSP, 2011, is US$193 million. However, in terms of actual investment, the government budget is US$18.4 million, or only 9.5 percent of the required amount (US$193 million), and support from donors and the private sector amounts to US$30.5 million, or only 15.8 percent. Together, these represent US$48.9 million, or only 25.3 percent, meaning that securing funds has become a major issue (see Figure 2-3-1).

Such circumstances are not limited to merely Zambia. Similar situations can also be seen in the urban water supply sectors of other developing countries, and covering these shortfalls using domestic budgets and donor assistance alone is impossible. Consequently, in accordance with the basic principles of sector reform which, led by the WB, were promoted from the early 1990s, in order for CUs to recover their costs as quickly as possible and to enable them to procure their own funds from the financial market as a commercial-oriented enterprise, promoting the introduction of private finance by facilitating entry of the private sector (privatization, etc.) has become an integral element for future funding.

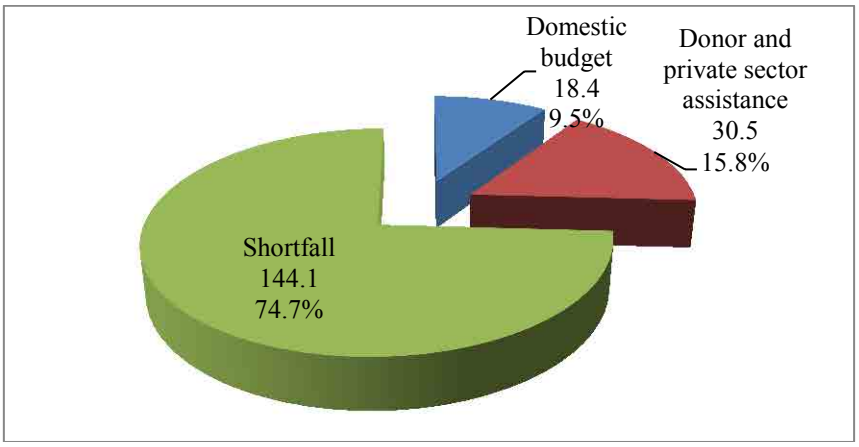

Figure 2-3-1: Actual investment under the NUWSSP (2011)

Table 2-3-3 shows a breakdown of assistance from CPs and the private sector which was invested in 2011.

Table 2-3-3: Breakdown of assistance from CPs and the private sector (2011)

Source	Project Name	Implementing Agency	Disbursement
Cooperating Partner – Grants			
AfDB	Central province 8 centres WSS	MLGH	US$0.40 mil
DANIDA	Water and sanitation	MLGH/MEDD/ DTF/NWASCO	US$7.61 mil
EU	Implementing of integrated water resource management in Zambia	GRZ	UD$0.24 mil
Germany	Devolution Trust Fund, phase III	MLGH	US$1.50 mil
	Urban water supply Eastern Province, Phase II		US$3.07 mil

	GRESP Groundwater management Lusaka		US$0.71 mil
	Study and expert fund VI	GRZ	US$0.28 mil
	Water sector reform program	MMEWD	US$2.73 mil
Japan	Improvement of water supply condition in Ndola city	MLGH	US$0.77 mil
Sub-total			US$17.31
Concessional Loans			
WB Group	ZM-Water sector performance improvement	MLGH	US$2.33 mil
AfDB Group	WSS project	Nkana WSS	US$1.09 mil
	Central province 8 centers water supply projects	MLGH	US$0.15 mil
	Water program	MLGH	US$1.56 mil
Sub-total			US$5.13 mil
Other-Private Sector (Loans and Grants)			
ZANACO Loan	Water supply-Farm 1971 and 1080 and Hillview in Lusaka	LWSC	ZMK14 bil
Mopanai Grant	Wusakile Sanitation Project in Kitwe	NWSC	ZMK21.7 bil
MOH Grant	Mupambe Sanitation Project in Mufulira	MWSC	ZMK5.6 bil
Sub-total			ZMK41.3 bil (US$8.10 mil)
TOTAL			US$30.5 mil

Source: Urban and Peri-Urban Water Supply and Sanitation Sector Report 2011/2012, NWASCO

2-4 Trends of Other Donors in the Urban Water Supply Sector

(1) Current state of basket funds

As with the NRWSSP, the MLGH is planning to establish a basket fund for the purpose of securing the massive investment funds necessary for implementing the NUWSSP and ensuring that the project is implemented swiftly. The idea of a basket fund originated with the KfW, being set as a policy of the German government in 2008 with an announcement of EU€8 million in aid. To present though, there have been delays in processes on the part of the Zambian government (approval for NUWSSP was given in 2011). KfW has achieved good results with basket funds in Tanzania, Uganda and Benin.

The current schedule is to complete draft guidelines (a detailed policy on how funds will be managed) by early 2013, to commence one or two pilot projects, to revise and finalize the guidelines during these pilot projects, and then to move to full-scale operation of the basket fund. In preparing the draft guidelines for the basket fund, two technical assistance advisors (one each from DANIDA and GIZ) have been dispatched to the MLGH, and are providing assistance for designing processes related to fund applications, detailed design, procurement, technology and auditing.

The plan for the basket fund is to initially start just with grant aid, to evaluate the pilot projects, and to gradually scale up the fund before expanding it nationwide. As the projects progress, the idea is to also introduce loans in five to ten years. As for running the basket fund, since the MLGH lacks human resources, it plans to outsource all management by contracting consultants. At present, in addition to KfW, AusAID and the AfDB have also indicated their intention to partner the basket fund, but it is unclear whether full-scale operation of the fund will eventuate.

(2) Trends in assistance provided by major donors

Table 2-4-1 illustrates the past assistance provided in the urban water supply sector by major CPs to the 11 CUs across Zambia.

Table 2-4-1: List of assistance provided by major donors to CUs

CU	Province	Major donor									
		WB	AfDB	KfW	GIZ*1	DANIDA	Aus AID	JICA	MCC	China	DTF*2
Lusaka	Lusaka	○	●			●		●*3	Δ	Δ	○
Kafubu	Copper-Belt					○		○*4		●*5	○
Mulonga							○				○
Nkana			○								○
North Western	North Western			●							○
Lukanga	Central		○								○
Southern	Southern	●	●	●							○
Western	Western					○					○
Chambeshi	Northern		○*6								○
Eastern	Eastern			○	○						○
Luapula	Luapula					○					○

Legend: ● Complete, ○ In progress, Δ Preparation stage

*1 Technical assistance (T/A) is provided to CUs nationwide through the MLGH.

*2 Kiosks (public taps) are constructed in peri-urban areas, with control of the facilities being transferred to CUs after completion.

*3 Project for the Improvement of Water Supply Facilities in Lusaka City (grant aid), 1986-1987.

*4 Improvement of Water Supply Condition in Ndola City (grant aid), 2012-2013.

*5 Improvement of Itawa Water Treatment Plant and Replacement of Aging Distribution Pipes in Ndola City (loan aid), 2007-2008.

*6 Support for the launch of a new CU in Muchinga Province as a consequence of the division of the Northern Province into two.

Source: Investigation by this mission

As shown in Table 2-4-1, assistance to CUs in the urban water supply sector has been provided based on coordination among donors (excluding China). A recent move has been AusAID's entry into the sector last year, providing assistance to the Mulonga Water and Sanitation Company (MWSC) with respect to infrastructure development close to the mines in Copperbelt Province.

Another development worthy of special mention is a report in a local press release dated October 31, 2012 of the signing of a contract between the MLGH and China Civil Engineering Construction Corporation (CCECC), totaling US$150 million in concessionary loans from the Export-Import Bank of China (China Exim Bank) for the expansion of the Iolanda Water Treatment Plant and construction of transmission pipes as a new water source for Lusaka.

The following describes the current state and future trends of assistance provided by each of the major donors in the urban water supply sector.

<u>WB</u>

The WB has been running the Water Sector Performance Improvement Project (WSPIP) since 2006. Under Component A of the project, improvements have been made to the existing water treatment plant in Lusaka, as well as to water supply facilities in four surrounding districts. Under Component B, support has been provided to the MLGH for the sector financing policy process: *How can CUs be better managed?* The project is scheduled to conclude in June 2013.

As for future assistance, a new Country Strategy Partnership Plan (CSP) is currently being prepared. The focus of this plan is urban sanitation, which is an area that has not received priority assistance for the past 30 years. Particular attention will be paid to improving sewerage and sanitation in Lusaka.

AfDB

The AfDB is currently preparing a new Country Strategy Paper to take effect in 2013. It plans to finalize the assistance program in November 2012 in negotiation with the Zambian government. In terms of urban areas, the program covers the cities of Muchinga and Lusaka. Regarding Muchinga, at the request of the Zambian government, assistance will be provided for the establishment of a CU in Muchinga Province (a new province created as a consequence of the division of the Northern Province into two).

Regarding Lusaka, consideration is being given to the cofinancing of two large-scale sewage treatment plants (oxidation ponds or stabilization ponds) by four international financial institutions, namely AfDB, KfW, WB and the European Investment Bank (EIB). Given that there have been delays in disbursements for the projects currently underway, it is expected that the sewerage project will be implemented from 2015.

KfW (Germany)

Following is the actual assistance provided by KfW to the urban water supply sector. All assistance has been in the form of grant aid.

Eastern Province:	Phase-1 (EU€7.5 million) concluded in 2008. Phase-2 (EU€4 million) and Phase-3 (EU€6 million) commenced in 2009 and are still in operation.
Southern Province:	EU€30 million, concluded in 2009. Rehabilitation of water treatment plant, rehabilitation of water distribution network, and expansion of water distribution network.
Northwestern Province:	EU€15 million, concluded in 2008. Details of assistance are the same as above.

KfW is currently endeavoring to launch a basket fund. As for future assistance, although the current project in Eastern Province is ongoing, if the basket fund can commence full-scale operation, KfW's policy would be to promote subsequent assistance by way of the basket fund.

GIZ (Germany)

GIZ is a lead donor for technical assistance in the urban water supply sector in Zambia. For instance, it has provided assistance for the establishment and operation of NWASCO, launched and contributed funds for the DTF, dispatched experts to the MLGH, established the Water and Sanitation Association of Zambia (WASAZA), and conducted training programs through WASAZA. In terms of improving water supply facilities through financial assistance, GIZ has provided assistance to the Eastern Water and Sewerage Company (EWSC).

DANIDA (Denmark)

DANIDA is a lead donor for technical assistance in the urban water supply sector in Zambia. For instance, in cooperation with GIZ, it has provided assistance for the establishment and operation of NWASCO, launched and contributed funds for the DTF, and dispatched experts to the MLGH.

However, with closure of the Embassy of Denmark in Lusaka at the end of 2013 in line with the Danish national policy, all projects currently underway are to be concluded by the end of 2013. Previously, DANIDA has provided support to the Luapula Water and Sewerage Company (LPWSC) and the Western Water and Sanitation Company (WWSC).

AusAID (Australia)

Since last year, AusAID has provided assistance to the Mulonga Water and Sanitation Company (MWSC) with respect to infrastructure development close to the mines in Copperbelt Province. It has also contributed funds to the DFT since last year. Furthermore, it also intends to participate in the basket fund in cooperation with KfW.

MCC (United States)

The MCC is a grant aid program run by the United States which targets high-performing countries in Africa that are selected based on US appraisal standards. In Zambia, US$355 million has been committed for the improvement for water supply, sanitation and drainage infrastructure managed by the Lusaka Water and Sewerage Company.

In Zambia, the program started in 2006, and in 2011, master plans (short-term: 2015, medium-term: 2020, long-term: 2035) were drafted for three sub-sectors in Lusaka: (1) water supply, (2) sewerage, and (3) storm water drainage. At present, the Compact Projects contained in the short-term plan are at the implementation design phase. From mid-2013, construction works will be sequentially implemented for each phase after going through a bidding process, with completion scheduled for 2018. Of the Compact Projects funded through the US$355 million commitment, US$104 million is slated for the urban water supply sector.[7]

China

A contract has been signed between the MLGH and CCECC totaling US$150 million in concessionary loans from the China Exim Bank for the expansion of the Iolanda Water Treatment Plant and construction of transmission pipes as a new water source for Lusaka (press release dated October 31, 2012). Construction will take 24 months.

DTF

The DTF was established by NWASCO in 2006. It is operated using a trust fund managed by KfW, GIZ, DANIDA, EU, AusAID and the Zambian government. AusAID has contributed funds since last year. DANIDA and the EU will continue to raise their contributions in the future.

The DTF targets the improvement of water supply and sanitation in peri-urban areas. The control of any water supply facilities constructed through the fund transfers to CUs. Projects for the construction of kiosk-style public taps in peri-urban areas involve a series of activities, from construction to the formation of resident associations and the raising of awareness for sanitation. Furthermore, the construction and management methods for facilities are standardized. Going forward, if the NUWSSP basket fund can be operated at full-scale, (according to the MLGH and KfW) it would be preferable that the DTF be absorbed into the basket fund and its organization dissolved.

[7] For further details on Compact Projects, see *3-1 Current Urban Water Supply Situation at the Lusaka Water and Sewerage Company and Candidate Projects for Assistance* below.

2-5 Current Situation and Issues Facing Commercial Utilities

(1) General business conditions of commercial utilities

Apart from the LWSC (which was established in 1989), all 11 nationwide CUs are new entities which were established after 2000 as a consequence of the national policy for decentralization. In particular, the Luapula Water and Sewerage Company (LPWSC), which had the lowest overall rating, and the Western Water and Sanitation Company (WWSC), which had the third lowest rating, are new startup entities established in 2009. Table 2-5-1 shows the performance evaluations of CUs during 2011/2012, as evaluated by NWASCO.

Table 2-5-1: Performance evaluation of CUs

CU	Start of operations	Number of connections	Evaluation item								Overall rating
			Non-revenue water (%)	Water quality pass rate (%)	Metering ratio (%)	Water supply ratio (%)	Hours of supply (hr/d)	Staff per 1,000 water connections (persons)	Collection efficiency (%)	Rate of cost recovery* (%)	
Lusaka	1989	78,394	44	90	67	82	20	11	84	108	1
Nkana	2000	47,203	46	97	48	93	14	7	73	93	2
Kafubu	2000	52,251	44	96	54	87	14	6	58	93	3
Mulonga	2000	44,612	41	95	61	93	17	7	92	120	4
Lukanga	2007	17,050	53	96	75	68	22	12	79	75	5
Southern	2000	32,945	53	91	72	94	17	9	99	115	6
Chambeshi	2003	15,269	41	91	48	78	14	12	85	87	7
North Western	2000	8,313	30	98	100	72	23	11	88	106	8
Western	2000	12,240	43	86	17	52	9	10	66	63	9
Eastern	2009	10,335	41	94	99	75	20	10	83	76	10
Luapula	2009	3,583	63	96	4	15	9	14	91	46	11

* Rate of cost recovery takes collection efficiency into account (Amount of rates collected / Operation and maintenance costs)
Source: Urban and Peri-Urban Water Supply and Sanitation Sector Report 2011/2012, NWASCO

(2) Issues facing commercial utilities

The key important issues facing CUs in Zambia are common issues faced by many water utilities in developing countries, and can be summarized into the two areas of: (1) reduction of non-revenue water, and (2) cost recovery.

Reduction of non-revenue water

The percentage of non-revenue water is 30 percent for North Western, and for the other ten CUs, it is even higher at between 41 percent and 63 percent. This ineffectual water needs to be curbed by replacing aging water transmission and distribution networks and by introducing rate structures based on a measured rate system using installed water meters. A high percentage of non-revenue water also affects cost recovery, and so reducing non-revenue water is an essential element in building a sustainable financial structure for water utilities.

Rate of cost recovery

As commercial-oriented enterprises, CUs are by nature required to be business entities that are financially sustainable. Looking at the rates of cost recovery in Table 2-5-1, we can see that four CUs have achieved cost recovery: Lusaka (108%), Mulonga (120%), Southern (115%) and North Western (106%). However, at present, development funds are reliant upon government budgets and grant aid from donors. Therefore, in order for CUs to procure and repay their own development funds as business entities, their financial structures will need to be improved further.

On the other hand, the disparity among CUs is wide, and the remaining seven CUs have not achieved cost recovery. The rates of cost recovery at the Luapula CU and the Western CU, which are subject to this survey, are particularly low, at 46 percent and 63 percent respectively. There is a long way to go before these two CUs achieve cost recovery. The Luapula and Western CUs also have a fragile facilities maintenance and management structure needed to provide water supply service as water utilities. This is reflected in their hours of supply, which are both short at an average of nine hours,[8] and their water service coverage, which is extremely low at 15 percent and 52 percent respectively.

The first requirement for CUs ranked at the bottom of this performance evaluation is to build the foundations upon which they can provide a water supply service as a water utility. To this end, it is essential that assistance be provided from both "hard" aspects (facilities improvement) and "soft" aspects (human resources development and training). With respect to the Luapula CU in particular, replacing the aging water supply facilities, and thereby improving the water supply service and increasing the customer base, is essential for it achieving cost recovery and building a sustainable financial basis.

(3) Current state of human resources development

The MLGH currently has neither training facilities nor training programs. The training of CU personnel is reliant upon assistance from donors such as GIZ and DANIA. Training is delivered using universities and research institutions in Zambia, training facilities owned by private enterprises and manufacturers, as well as existing training organizations such as WASAZA.

In the case of assistance provided by DANIDA, DANIDA covers 90 percent of training costs (accommodation, transport, training), and the MLGH covers the remaining 10 percent. This means CUs do not bear any cost. The withdrawal of DANIDA following closure of the Embassy of Denmark in Lusaka at the end of 2013 means that the MLGH will lose one of its major providers of training-related technical and financial support, and as a consequence, the MLGH is calling on JICA for support.[9]

Overview of training provided by WASAZA

WASAZA plays a central role in the training of CU personnel. It is a local non-governmental organization (NGO) established in 1999, and provides tailor-made training programs in relation to the water supply and sanitation sector. It has 13 staff members, and 320 companies and individuals registered with it, including government agencies, private enterprises, private individuals, NGOs and

[8] The unstable power supply by the Zambia Electricity Supply Corporation Limited (ZESCO) also makes it difficult for water utilities to maintain their water supply for many hours.

[9] A written request for training-related technical cooperation (*Training in Operation and Maintenance of Urban Water Supply and Sanitation Infrastructure*) has been submitted by the MLGH to the Japanese government, dated August 2012.

CUs. The association selects instructors and designs training content according to their training needs, and in the past it has provided more than 300 training courses on such topics as measures to counter non-revenue water, rates collection and customer management. Because WASAZA does not own any dedicated training facilities, each time it conducts a training session, it borrows the facilities of a hotel, conference center or CU according to conditions. Furthermore, based on a multiyear contract with GIZ, WASAZA also facilitates capacity development training which is funded by GIZ under the WAVEPlus program.

Chapter 3 Current Situation of the Urban Water Supply in Target Cities and Candidate Projects for Assistance

3-1 Current Urban Water Supply Situation at the Lusaka Water and Sewerage Company and Candidate Projects for Assistance

3-1-1 Outline of the Lusaka Water and Sewerage Company

Established in 1989, the Lusaka Water and Sewerage Company (LWSC) is the largest and oldest water and sewerage company in all of Zambia. In 2009, control of water supply facilities in the four surrounding districts (Kafue, Chilanga, Chongwe, Luangwa) was transferred to the LWSC, and as a consequence, the loan period for loans issued under the World Bank's WSPIP was extended to June 2013 for urgently needed repair and improvement work, some of which has already been completed.

(1) Business summary

Table 3-1-1 shows the key performance indicators for the LWSC. According to the performance evaluation ranking by NWASCO, the LWSC was ranked first among 11 corporations for both 2010/2011 and 2011/2012.

Table 3-1-1: Key performance indicators for the LWSC

Year	Number of connections	Evaluation item								Overall rating
		Non-revenue water (%)	Water quality pass rate (%)	Metering ratio (%)	Water supply ratio (%)	Hours of supply (hr/d)	Staff per 1,000 water connections (persons)	Collection efficiency (%)	Rate of cost recovery* (%)	
2010/2011	76,749	43	89	62	75	18	11	75	102	11
2011/2012	78,394	44	90	67	82	20	11	84	108	1

* Rate of cost recovery takes collection efficiency into account (Amount of rates collected / Operation and maintenance costs)

Source: Urban and Peri-Urban Water Supply and Sanitation Sector Report 2010/1011, 2011/2012, NWASCO

1) Non-revenue water: This remains high, at a level of 43 percent and 44 percent, and therefore it is essential that the water distribution network be rehabilitated and upgraded.

2) Water quality pass rate, metering ratio, water service coverage, hours of supply, collection efficiency: All indicators are showing a trend toward improvement. However, with close to 60% of the water supply being sourced from groundwater, and with the amount of drawn groundwater already reaching the limit of well capacity, in order to improve water service coverage by further expanding the water service area and in order to accomplish a 24-hour water supply, it is essential that surface water sources be developed as new sources of water supply. Currently, a plan to develop surface water sources is being pursued in accordance with the MCC Water Supply Investment Master Plan mentioned below.

3) Rate of cost recovery: The LWSC has already attained 100 percent cost recovery. It has entered a stage of developing into a financially sustainable commercial-oriented water utility, and has embarked on a stage of self-financing facilities maintenance on a commercial basis.

(2) Organization

The LWSC is comprised of a Managing Director (MD) and the following eight divisions organized under a Board of Directors. Figure 3-1-1 shows an organization chart of the entire LWSC. As of March 2012, staff numbered 826.[10]

(a) Engineering Division
(b) Commercial Division
(c) Financial Division
(d) HR (Human Resource) & Administration Division
(e) IT (Information Technology) Division
(f) Audit Services
(g) Purchasing Supply
(h) Corporate Affairs

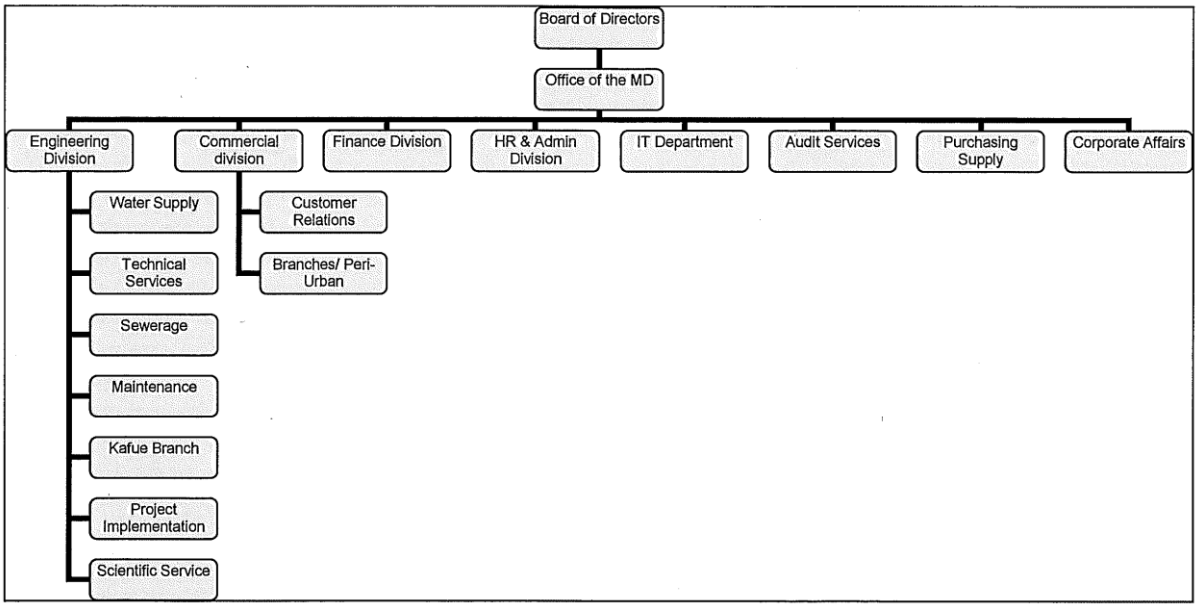

Figure 3-1-1: Organization chart of the entire LWSC

Source: Water Supply Investment Master Plan Lusaka, Final Report, MCC, 2011

The Engineering Division's Water Supply Section and Kafue Branch are responsible for the operation and maintenance of water supply facilities at the LWSC. The Water Supply Section is responsible for facilities in Lusaka and in the two districts of Chongwe and Luangwa. Staffing at the two districts is currently being reorganized. Figure 3-1-2 shows an organization chart of the Engineering Division's Water Supply Section. The Engineering Division's Technical Services Section is responsible for GIS mapping of the water distribution network, leak detection work and measures for the reduction of non-revenue water. Figure 3-1-3 shows an organization chart of the Engineering Division's Technical

[10] Urban and Peri-Urban Water Supply and Sanitation Report 2011/2012

Services Section. The Commercial Division is responsible for invoicing and collecting water supply and sewerage rates.

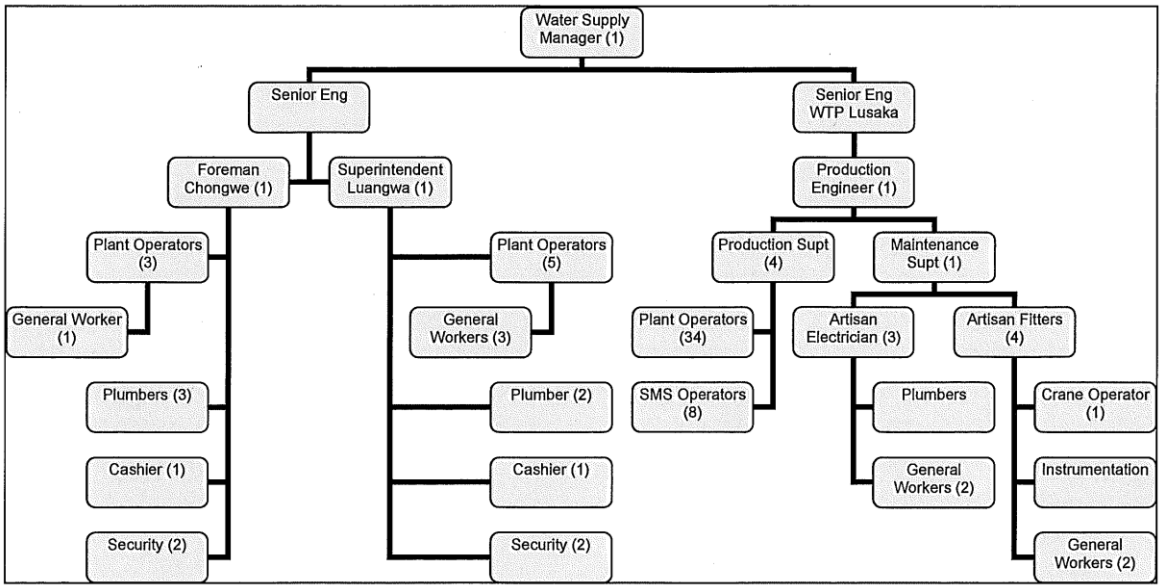

Figure 3-1-2: Organization chart of the Water Supply Section, Engineering Division at the LWSC

Note: The figures in parentheses ( ) indicate the number of staff.
Source: Water Supply Investment Master Plan Lusaka, Final Report, MCC, 2011

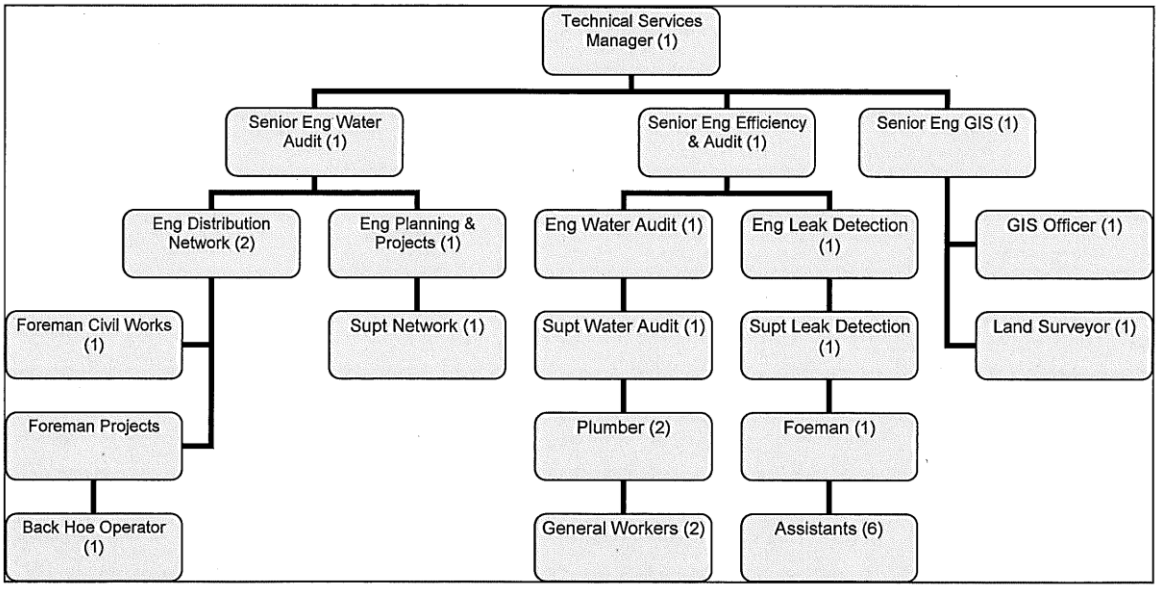

Figure 3-1-3: Organization chart of the Technical Services Section, Engineering Division at the LWSC

Note: The figures in parentheses ( ) indicate the number of staff.
Source: Water Supply Investment Master Plan Lusaka, Final Report, MCC, 2011

3-1-2 Water Supply Plan and Forecast Water Demand in Lusaka

Figure 3-1-4 shows the forecast water demand and water supply plan for Lusaka according to the MCC Master Plan (Water Supply Investment Master Plan Lusaka, Final Report, MCC, 2011). Table 3-1-2 shows the water supply plan for each type of water source.

Three measures have been adopted under the water supply plan: (1) construction of new boreholes; (2) expansion of the existing Iolanda Water Treatment Plant with water sourced from Kafue River; and (3) construction of new water treatment plants annexed to the Iolanda Water Treatment Plant. The timing, planned water supply capacity and plan for increasing water supply capacity for each measure are as follows.

(1) Construction of new boreholes

Year	Planned water supply capacity	Plan for increasing water supply capacity
2010	130,000 m^3/day	
2011	145,000 m^3/day	Construction of 10 new boreholes (15,000 m^3/day). Implemented under World Bank's WSPIP.
2015	180,000 m^3/day	Construction of 25 new boreholes (35,000 m^3/day)
2015 and beyond	as above	No plan

(2) Expansion of the existing Iolanda Water Treatment Plant

Year	Planned water supply capacity	Plan for increasing water supply capacity
2010	95,000 m^3/day	
2011	110,000 m^3/day (currently 97,000 m^3/day)	Water treatment capacity had fallen to 95,000 m^3/day. Under the WB's WSPIP, the plan had been to undertake repair and improvement work to restore capacity to original 110,000 m^3/day. But budgetary deficits have meant that capacity is currently limited to 97,000 m^3/day.
2015	160,000 m^3/day	The plan is for an increase of 50,000 m^3/day, but given that the current water treatment capacity is only 97,000 m^3/day, an increase of 63,000 m^3/day is required.
2015 and beyond	as above	No plan

(3) Construction of new water treatment plants annexed to the Iolanda Water Treatment Plant

Year	Planned water supply capacity	Plan for increasing water supply capacity
2015	320,000 m^3/day	Construction of new water treatment plant with water supply capacity of 320,000 m^3/day.
2020	540,000 m^3/day	Construction of new water treatment plant with water supply capacity of 220,000 m^3/day.
2025	760,000 m^3/day	Construction of new water treatment plant with water supply capacity of 220,000 m^3/day.

Items (1) construction of new boreholes and (2) expansion of the existing Iolanda Water Treatment Plant are strategies for increasing water supply capacity until 2015. Beyond that, the plan is to meet the increasing demand for water through (3) construction of new water treatment plants annexed to the Iolanda Water Treatment Plant. In terms of increasing water supply capacity through the construction of new water treatment plants, the plan is to construct a water treatment plant every five years so as to enhance capacity by an extra 320,000 m^3/day by 2015, an extra 220,000 m^3/day by 2020, and an extra 220,000 m^3/day by 2025. In total, this entails a large-scale plan to construct new water treatment plants providing an extra capacity of 760,000 m^3/day.

Table 3-1-2: Lusaka water supply plan, by water source (2010-2035)

	Water Production (m3/day)			
	Total	Groundwater	Kafue River	Remarks
2010	225,000	130,000	95,000	existing
2011	255,000	145,000	110,000	10 boreholes (15,000 m3/d) - drilled under WB
2015	255,000	145,000	110,000	
2015	290,000	180,000	110,000	+ 25 boreholes (35,000 m3/d)
2015	660,000	180,000	480,000	upgrade existing to 160,000, add 320,000 Mld
2020	660,000	180,000	480,000	
2020	880,000	180,000	700,000	add 220,000 Mld
2025	880,000	180,000	700,000	
2025	1,100,000	180,000	920,000	add 220,000 Mld
2030	1,100,000	180,000	920,000	
2030	1,100,000	180,000	920,000	
2035	1,100,000	180,000	920,000	

Source: Water Supply Investment Master Plan Lusaka, Zambia, Final Report, MCC, 2011

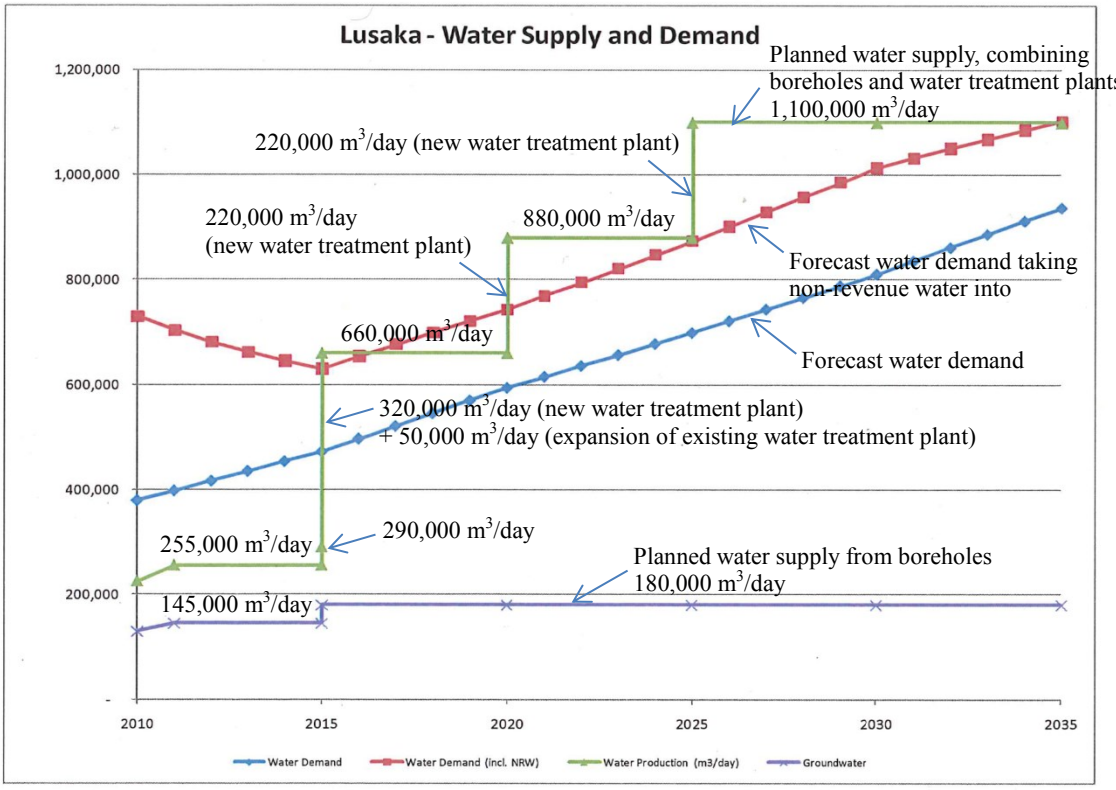

Figure 3-1-4: Forecast water demand and water supply plan for Lusaka (2010-2035)

Source: Water Supply Investment Master Plan Lusaka, Zambia, Final Report, MCC, 2011

3-1-3 Investment Program under the MCC Master Plan

Table 3-1-3 shows the investments needed until 2035 to improve urban water supply under the MCC Master Plan, encompassing Lusaka and its four neighboring districts (Kafue, Chilanga, Chongwe, Luangwa). Investment needs total US$1.345 billion, comprised of US$1.278 billion for Lusaka and US$67 million for the four neighboring districts (the investment for Kafue includes Chilanga).

Table 3-1-3: Investment program under the MCC Master Plan

	Invetmemnt Sub-Project	Year					
		2015		2020	2025	2030	2035
		Rehabilitation Costs (US$)	Expansion Costs (US$)	Expansion Costs (US$)	Expansion Costs (US$)	Expansion Costs (US$)	Expansion Costs (US$)
	LUSAKA						
①	Iolanda raw water pumping station and rising main Iolanda取水ポンプ場と導水管の改修	220,050					
②	Rehabilittation of existing Ioland water treatment works 既存Iolanda浄水場の改修	3,606,930					
③	Chilanga treated water pumping station and rising mains Chilanga中継ポンプ場と送水管の改修	878,175					
④	Rehabilitation works at distribution centres 配水センターの改修	3,997,661					
⑤	NRW reduction 無収水削減対策	25,438,010					
⑥	Primary Distribution mains 配水本管の改修	33,243,750					
⑦	Distribution system and connections 配水管網の拡張と給水接続管の設置		135,257,513				
⑧	Uprating existing Ioland treatment works 既存Iolanda浄水場の拡張		4,179,600				
⑨	New treatment plant 新規浄水場の建設		148,953,708	102,405,674	102,405,674		
⑩	Treated water pumping station and rising mains 送水ポンプ施設と送水管の建設		154,845,000	154,845,000	154,845,000		
⑪	New storage reservoirs and distribution centres メイン貯水タンクと配水センターの建設		9,652,500	12,251,250	18,933,750	19,490,625	17,820,000
⑫	Distribution system and connections 配水管網の拡張と給水接続管の設置			24,583,500	50,236,875	50,236,875	50,338,125
	Sub-Totals	67,384,575	452,888,321	294,085,424	326,421,299	69,727,500	68,158,125
	Sub-Total Lusaka	520,272,896		294,085,424	326,421,299	69,727,500	68,158,125
	Sub-Total Lusaka	1,278,665,244					
	KAFUE						
	Intake, treatment plant, rising main, reservoirs, boreholes 取水施設、浄水場、送水管、貯水タンク、井戸の改修・建設	10,750,050		5,805,000	1,215,000		2,463,750
	Distribution system and connections 配水管網の拡張と給水接続管の設置		6,559,785	2,075,625	121,500		2,595,915
	Sub-Totals	10,750,050	6,559,785	7,880,625	1,336,500	0	5,059,665
	CHONGWE						
	Intake, treatment plant, rising main, reservoirs 取水施設、浄水場、送水管、貯水タンクの改修・建設	607,500	1,782,000	7,668,000		8,174,250	
	Distribution system and connections 配水管網の拡張と給水接続管の設置		3,174,998	1,275,750		1,308,420	
	Sub-Totals	607,500	4,956,998	8,943,750	0	9,482,670	0
	LUANGWA						
	Intake, treatment plant, rising main, reservoirs 取水施設、浄水場、送水管、貯水タンクの改修・建設	291,600	3,165,750		3,936,600		
	Distribution system and connections 配水管網の拡張と給水接続管の設置		1,710,113		1,939,613		399,600
	Sub-Totals	291,600	4,875,863	0	5,876,213	0	399,600
	Sub-Total Kafue, Chongwe & Luangwa	67,020,819					
	Total Inestment Cost	79,033,725	469,280,966	310,909,799	333,634,012	79,210,170	73,617,390
	Total Inestment Cost	548,314,691		310,909,799	333,634,012	79,210,170	73,617,390
	Total Inestment Cost	1,345,686,062					

US$ 202,000,000

US$ 896,000,000

Source: Water Supply Investment Master Plan Lusaka, Zambia, Final Report, MCC, 2011

The most important components under the above investment program relate to development of new water sources for Lusaka, namely, expansion and new construction of the Iolanda Water Treatment Plant and construction of distribution and transmission facilities. The associated required investments (items ⑧ through ⑪ in Table 3-1-3) amount to US$896 million, or two thirds of the total investment (US$1.345 billion). It should be noted that the work listed at item ⑩ in Table 3-1-3 for construction of a treated water pumping station and rising mains comprises construction of three new transmission pipes of approximately 50km in length from the Iolanda Water Treatment Plant to within the Lusaka precinct (1 × ϕ1,400 mm + 2 × ϕ1,200 mm) and construction of the Chilanga Booster Pumping Station along that route.

Figure 3-1-5 shows the location of the water intake facility along the Kafue River, the source of water supply, as well as the location of the Iolanda Water Treatment Plant. Figure 3-1-6 shows the location of the transmission pipes from the Iolanda Water Treatment Plant to the main storage tanks within Lusaka.

Figure 3-1-5: Location of water intake facility and water treatment plant

Figure 3-1-6: Location of transmission pipes

3-1-4 Outline of MCC Compact Projects and the China-Funded Project

The compact projects, which are being implemented using the US$355 million already committed by the MCC as grant aid, cover the three sectors of water supply, sewerage and storm water drainage. US$103.9 million of this has been slated for the water supply sector budget. Table 3-1-4 shows a breakdown of the planned compact projects in the water supply sector.

The compact projects in the water supply sector are aimed at rehabilitation of the existing Iolanda Water Treatment Plant, rehabilitation of transmission and distribution pipes and measures for the reduction of non-revenue water (items ① through ⑦ in Table 3-1-3), and exclude those components related to the development of new water sources required in Lusaka by 2015 (items ⑧ through ⑪ in Table 3-1-3). However, whereas the amount of investment required until 2015 for items ① through ⑦ in the investment program in Table 3-1-3 is US$202 million, the budget for compact projects in the water supply sector is only US$103.9 million. As a consequence, items ⑥ rehabilitation of primary distribution mains and ⑦ rehabilitation and expansion of the water distribution network and installation of water-supply connection pipes have only been implemented to a partial extent.

The planned scope of partial implementation covers the service areas of only two of the five districts in Lusaka shown in Figure 3-1-11, namely, Central and Chelstone. Furthermore, details concerning the scope of expansion will be planned and determined only as far as the budget permits at the time of detailed design.

Table 3-1-4: Breakdown of MCC compact projects in the water supply sector

	Invetmemnt Sub-Project	Year					
		2015		2020	2025	2030	2035
		Rehabilitation Costs (US$)	Expansion Costs (US$)	Expansion Costs (US$)	Expansion Costs (US$)	Expansion Costs (US$)	Expansion Costs (US$)
	Possible Compact						
	緊急プロジェクト候補案件						
	Iolanda raw water pumping station and rising main	220,050					
①	Iolanda取水ポンプ場と導水管の改修						
	Rehabilittation of existing Ioland water treatment works	3,607,000					
②	既存Iolanda浄水場の改修						
	Chilanga treated water pumping station and rising mains	878,000					
③	Chilanga中継ポンプ場と送水管の改修						
	Rehabilitation works at distribution centres	3,998,000					
④	配水センターの改修						
	NRW reduction	25,438,000					
⑤	無収水削減対策						
	Primary Distribution mains	16,943,000					
⑥	配水本管の改修						
	Distribution system and connections	23,601,000	29,283,000				
⑦	配水管網の改修・拡張と給水接続管の設置						
	Sub-Totals	74,685,050	29,283,000				
	Sub-Total Lusaka	103,968,050					

Source: LWSC documents

The above compact projects are currently at the detailed design stage, which should be completed in about April or May 2013. Then, after going through a tender process, work will be gradually undertaken for each package, with completion due by 2018. However, as shown in Table 3-1-3, the required investment in Lusaka up until 2015, including the components related to development of new water sources, is US$520 million, whereas, as mentioned earlier, only US$103.9 million has been invested under the MCC compact projects. Procuring the remaining investment funds of over US$400 million is a key challenge.

Chinese concessionary loans

A local press release dated October 31, 2012 was issued stating that a contract between the MLGH and the China Civil Engineering Construction Corporation (CCECC) has been signed, totaling US$150 million in concessionary loans from the Export-Import Bank of China (China Exim Bank) for the expansion of the Iolanda Water Treatment Plant and construction of transmission pipes as a development of new water sources for Lusaka. According to an interview with the LWSC, the work covered by the Chinese concessionary loans is as follows.

1) New water treatment plant with a capacity of 50,000 m^3/day (annexed to the existing Iolanda Water Treatment Plant)
2) New water intake facility with a capacity of 150,000 m^3/day, and conveyance piping to the water treatment plant
3) Water pump facilities and transmission pipe from the new water treatment plant to the main storage tanks within Lusaka (1 × 50 km × ϕ 800 mm)

The concessionary loans with China are a contract between the MLGH and CCECC/China Exim Bank. Under the loans, detailed design and construction work is undertaken by the CCECC without going through any tender process. Construction will take 24 months.

These concessionary loans surfaced suddenly and were announced without liaison with other donors, including JICA. They are at variance with the content of the MCC Master Plan. There have also been reports that, because there are deficiencies in the statements contained in the contract, the MLGH has not yet decided to

settle and the contract has not officially taken effect. These developments will need to be watched carefully in the future.

3-1-5 Current Situation of Urban Water Supply Facilities in Lusaka and Four Surrounding Districts

Figure 3-1-7 shows the location of Lusaka and its four surrounding districts, and Table 3-1-5 lists an overview of urban water supply facilities here (population, population served, hours of supply, number of connections, current state of urban water supply facilities, proposed facility improvements, approximate estimate for construction work, LWSC's priority order, etc.).

Table 3-1-5: Overview of urban water supply facilities in Lusaka and four surrounding districts

Name of city/district	Lusaka	Kafue District		Chongwe District	Luangwa District
		Kafue	Chilanga	Chongwe	Luangwa
Population (2012)	1,917,976	88,712	10,000	28,655	6,205
Number of households (2012)	159,831	13,471	1,520	5,892	1,342
Population served (2012)	1,591,920	73,630	8,300	23,780	5,150
Hours of supply	19 hours	19 hours	19 hours	19 hours	19 hours
Volume of water supply (2012)	130,000 m^3/day (boreholes) 95,000 m^3/day (maximum treatment capacity:110,000 m^3/day)	22,000 m^3/day	1,100 m^3/day	7,200 m^3/day	1,250 m^3/day
Revenue water (2012)	120,000 m^3/day	12,000 m^3/day	600 m^3/day	4,000 m^3/day	680 m^3/day
Water demand (2012)	416,776 m^3/day	14,345 m^3/day	1,500 m^3/day	5,041 m^3/day	830 m^3/day
Organization (personnel)	Headquarters (302),branches under city jurisdiction (24), 5 zone offices (14)	Kafue Branch (78)	Chilanga Branch (18)	Facilities currently managed by the Engineering Division's Water Supply Section at headquarters, but preparations underway to establish Chongwe Branch.	Facilities currently managed by the Engineering Division's Water Supply Section at headquarters, but preparations underway to establish Luangwa Branch.
Current state of water supply services, and demand for new water service connections	Number of connected households: 132,658	Number of connected households: 11,180	Number of connected households: 1,260	Number of connected households: 4,890	Number of connected households: 1,113
	Number of necessary connections: 27,173	Number of necessary connections: 2,291	Number of necessary connections: 260	Number of necessary connections: 1,002	Number of necessary connections: 229
	Number of households with meters installed: 98,166	Number of households with meters installed: 9,968	Number of households with meters installed: 932	Number of households with meters installed: 3,618	Number of households with meters installed: 823
Current state of water supply facilities	Water source: Kafue River + boreholes in Lusaka Water intake: 110,000 m^3/day + 130,000 m^3/day	Water source: Kafue River Water intake: 1,000 m^3/hour	Water source: borehole Water intake: 28 m^3/hour (East), 28 m^3/hour (West)	Water source: Chongwe River Water intake: 300 m^3/hour	Water source: Zambezi River Water intake: 1250 m^3/day
	4 pumps from intake tower, including one standby. New pumps have been installed funded by WB.	Intake channel from river. Water abstracted from 3 vertical mixed flow pumps (500 m^3/hour) in upper building of intake well. 1 standby pump. However, 2 pumps have stopped functioning. Only 1 pump is operating. In preparation for the dry season, 1 standby centrifugal pump (500 m^3/hour) has been installed in a building on the side of intake channel, and is operational.	There are two facilities in the East and West Zones, bordering national road (T2).	Water abstracted from weir in river. 2 centrifugal pumps (300 m^3/hour) pump water to modular water treatment facility on the same site. 1 of 2 pumps is standby.	Water abstracted using submersible pumps by installing overhanging girder over river. 1 of 2 pumps is standby.
	Conveyance pipes (iron pipe) of ϕ600 mm have been laid to the water treatment plant approximately 1.5 km away.	Conveyance pipes (iron pipe) of ϕ600 mm have been laid to the water treatment plant approximately 1.7 km away. Of this, approximately 300 m is exposed piping.	East Zone Water conveyed from borehole to clean water reservoir (concrete, 200 m^3), and to elevated steel panel tank (130 m^3) using multi-stage pump. No chlorination. Elevated tank leaks and so is not used at present.	Flocculant and lime are injected via inlet pipe at modular water treatment facility. Passes through 4 flocculation and sedimentation basins and 4 pressure filters, before going to clean water reservoir.	Rapid filtration capacity (1,000 m^3/day). In operation for 20 years. Flocculant injected at receiving well. Passes through 2 rapid flocculation and sedimentation basins and 2 rapid filter beds, before going to clean water reservoir.
	Rapid filtration capacity (110,000 m^3/day) Flocculant injected in receiving well and mixed. Passes through 30 sedimentation basins and 20 rapid filter beds, lime and chlorine gas are injected, and passes through a chlorination basin, before going to clean water reservoir.	Rapid filtration capacity (24,000 m^3/day) Flocculant injected via inlet pipe. Passes through flocculation and sedimentation basin and 6 rapid filter beds, before going to underground clean water reservoir. Chlorine gas injected at clean water reservoir.	West Zone East Zone Water conveyed from borehole to 2 concrete tanks (2 × 60 m^3). No chlorination. Facilities have become noticeably deteriorated.	Concrete clean water reservoir (380 m^3) is roofed with galvanized sheet iron.	Concrete clean water reservoir is roofed with galvanized sheet iron. Lime and chlorine injected.
	1 of 4 centrifugal pumps (1,389 m^3/hour) is standby. Water conveyed through pipes of ϕ900 mm to Chilanga Booster Pump Station approximately 25 km away.	3 pumps for backwashing (1 standby) 2 vacuum pumps. 2 air blow pumps			
	1 of 4 centrifugal pumps (1,361 m^3/hour) is standby. Water conveyed through pipes of ϕ900 mm to Stuart Park/Lusaka Water Works/Lumumba distribution reservoir approximately 25 km away.	1 of 3 centrifugal pumps (94 kW, 500 m^3/hour) is standby. Water conveyed through pipes of ϕ600 mm to a distribution reservoir approximately 500 m away.		1 of 2 centrifugal pumps (132 kw, 300 m^3/hour) is standby. Chlorine gas injected into outlet pipe. Water conveyed through pipes of ϕ250 mm to elevated tanks approximately 1.5 km and 2.5 km away.	1 of 3 centrifugal pumps (80 m^3/hour) is standby. Water conveyed to elevated tank inside water treatment plant and to 2 elevated tanks 500 m away.
	Stuart Park has storage capacity of approximately 90,000 m^3. There are 26 tanks within Lusaka with a capacity of approximately 156,000 m^3, and there are 12 booster pump stations.	There are 1 circular and 2 rectangular concrete tanks with capacity of 7,600 m^3.		Elevated tank (steel panel tank 500 m^3) leaks. Elevated tank (steel panel tank 450 m^3) leaks and so is not used.	Elevated tanks inside water treatment plant (steel tank 90 m^3) leaks. Elevated tanks (steel tanks) of 120 m^3 and 50 m^3.
	Almost all distribution piping in city is AC pipes.	Distribution piping is AC, GI and steel pipes of ϕ50-150 mm.	Distribution piping is AC, GI and steel pipes of ϕ50-150 mm.	Distribution piping is AC, GI and steel pipes of ϕ50-250 mm.	Distribution piping is AC, GI and steel pipes of ϕ50-200 mm.
		During dry season, water intake is insufficient because water level falls.		Shortage of water intake during the dry season.	
Current evaluation of water supply facilities	Demand for water is 680,000 m^3/day, but supply capacity is only 240,000 m^3/day. More water intake facilities need to be constructed. Also, non-revenue water is 47%, and so distribution pipes and service pipes need to be replaced. Meters also need to be installed.	2 intake pumps need to be installed. Control units and valves, etc. need to be replaced. Conveyance pipes need to be reinforced. Existing distribution pipes need to be repaired.	Due to marked deterioration, all facilities in both zones need to be rebuilt.	Existing distribution pipes need to be repaired.	Due to marked deterioration, all facilities need to be rebuilt.
Facility drawings	Yes	No	No	No	No
Piping diagram	Water service plan (GIS)	Water service plan (GIS)	No	Water service plan (GIS)	Water service plan (GIS)

Notes: The term "population served" refers to the number of inhabitants that are receiving a water service from water supply facilities.
The term "hours of supply" refers to the number of hours per day that recipients of a water service are able to receive that service.

Name of city/district	Lusaka	Kafue District		Chongwe District	Luangwa District
		Kafue	Chilanga	Chongwe	Luangwa
Facilities improvement plan (2020) (Reference: MCC Master Plan)	Rebuild intake tower (2015). Install new intake pump (2015). Install new intake pump (2020).	Dredge existing intake channel.	Water intake (boreholes), conveyance and distribution reservoir currently under construction, funded by WB. Because details of construction work funded by WB are unclear, future plans will need to be reexamined after construction.	Due to the limited river flow, compensate for the shortfall with 2-4 boreholes.	Repair/improve water intake facility.
	Lay 1.5km of new conveyance pipe of ϕ1,400 mm (2015). Lay 1.5km of new conveyance pipe of ϕ1,200 mm (2020).	Build 4-6 new boreholes.			
	Construct new water treatment plant (320 mld) (2015). Construct new water treatment plant (220 mld) (2020).	Repair/improve intake pumps.			
	Lay 50 km of new transmission pipe of ϕ1,400 mm (2015). Lay 50 km of new transmission pipe of ϕ1,200 mm (2020).	Repair conveyance pipes.			
	Construct new booster pump station (2015). Construct new booster pump station (2020).	Repair/improve water treatment plant.		Repair/improve water treatment plant.	Construct new water treatment plant.
	Construct new tanks in Lusaka (29,000 m^3).	Replace + lay new transmission pipes (for boreholes).		Lay new transmission pipes (for boreholes).	Lay new transmission pipes.
	Repair/improve booster pump station in Lusaka.	Install additional elevated tanks.		Construct new elevated tank.	Construct new elevated tank.
	Replace main distribution pipes.	Replace water distribution network.	Replace water distribution network.	Replace water distribution network.	Replace water distribution network.
	Replace the water distribution network in the Lumumba/Kabwata/Kabulonga zones.	Expand water distribution network.	Expand water distribution network.	Expand water distribution network.	Expand water distribution network.
	Expand the water distribution network in the Lumumba/Kabwata/Kabulonga zones.	Install generators.	Install generators.	Install generators.	Install generators.
	Install water meters.	Install water meters.	Install water meters.	Install water meters.	Install water meters.
Facilities improvement plan (2020): Summary (Reference: MCC Master Plan)	Intake tower (new) + intake pump (new) + 1.5 km of conveyance pipe ϕ1,400 mm, ϕ 1,200 mm (new) + water treatment plant (320 mld + 220 mld) (new) + 50 km of transmission pipe ϕ1,400 mm, ϕ1,200 mm (new) + booster pump station (new) + tank in Lusaka (29,000 m^3) (additional) + booster pump station in Lusaka (improvement) + main distribution pipes (improvement).	Existing river + borehole water sources. Use boreholes to compensate for the shortfall in river flow. River intake (improvement) + boreholes (new) + conveyance pipes (improvement) + rapid filtration facility (improvement) + clean water reservoir (new construction for water from boreholes) + transmission pipes (improvement + new construction) + elevated tank (additional) + distribution pipes (existing + expansion).	Given that construction is in progress funded by WB, and that the LWSC has insufficient data, exploring future considerations is difficult at this stage.	Existing river + borehole water sources. Use boreholes to compensate for the shortfall in river flow. Boreholes (new) + transmission pipes (new) + rapid filtration facility (improvement) + clean water reservoir (new construction for water from boreholes) + transmission pipes (improvement) + elevated tank (additional) + distribution pipes (existing + expansion).	River intake (improvement) + conveyance pipes (improvement) + rapid filtration facility (new) + transmission pipes (new) + elevated tank (new) + distribution pipes (existing + expansion).
Planned water demand in 2015 (m^3/day) (given non-revenue water of 25%)	472,500 m^3/day (630,000 m^3/day)	16,300 m^3/day (21,700 m^3/day)	—	5,700 m^3/day (7,600 m^3/day)	900 m^3/day (1,200 m^3/day)
Planned water demand in 2020 (m^3/day) (given non-revenue water of 25%)	594,200 m^3/day (742,700 m^3/day)	20,000 m^3/day (25,100 m^3/day)	—	7,100 m^3/day (8,800 m^3/day)	1,100 m^3/day (1,400 m^3/day)
Expected population served (2020)	2,812,000	124,239	—	40,131	8,492
Donor support / domestic budget	10 boreholes under construction, funded by WB (15,000 m^3/day).	Repairs/improvements to water treatment plant underway, funded by WB.	East Zone New boreholes under construction, funded by WB. Plans for repairs/improvements to tanks.	Repairs/improvements to water treatment plant and transmission pipes underway, funded by WB.	Modular water treatment facility under construction, funded by WB.
	Piping expansion work in progress in the Kabwata area, funded by ZNCB (Zambia National Commercial Bank).		West Zone Plans for repairs/improvements to boreholes and tanks, funded by WB.	Repair/improvement work on intake pumps and buildings complete, funded by DANIDA/Zambian government.	
	Current MCC plan is for improvement of the water treatment plant, improvement of transmission pipe accessories, construction of 3 or 4 tanks in Lusaka, improvement of 10 booster pump stations, improvement of 4 main distribution pipe systems, expansion and replacement in the Centre and Chelston areas, and if required, construction of boreholes, capacity development.				
Amount requested (US$) (2035 target year)	896,000,000	31,600,000		24,000,000	11,400,000
Approximate estimate (JPY billion) (2020 target year)	56.0	2.0-2.5	—	1.0-1.5	1.0-1.5
MLGH priority	○				
LWSC order of priority	1	2	2	3	4
JICA evaluated order	1	2		3	

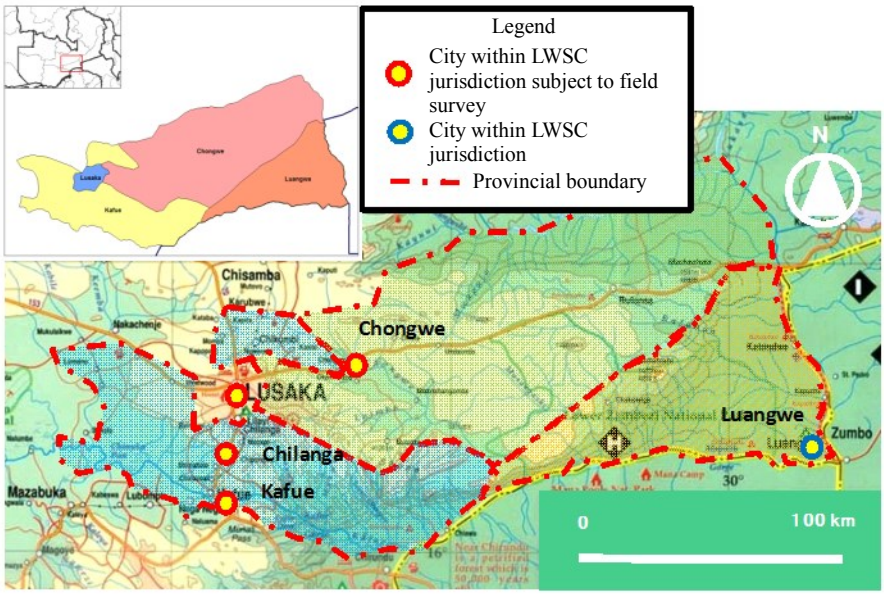

Figure 3-1-7: Location of Lusaka and four surrounding districts

In this study, field surveys were conducted on the urban water supply facilities in three areas prioritized by the LWSC, namely, Lusaka, Kafue District and Chongwe District. Following is a detailed account of the results of the field surveys.

(1) Current state of urban water supply facilities in Lusaka

According to the 2011 MCC Master Plan, the population of Lusaka is 1,917,976, its water supply coverage is 83 percent, and its population served is approximately 1,591,920. Its average volume of water supply is 225,000 m^3/day, and its non-revenue water is high at 47 percent. Residents not connected to the water supply use kiosks or shallow wells. Water meters have been installed at 98,166 of the 132,658 households connected to the water supply. Figure 3-1-8 shows a schematic diagram of the water supply facilities in Lusaka.

There is an intake tower on Kafue River, and from there, four vertical mixed flow pumps (including one standby) and two conveyance pipes 675 mm in diameter are used to convey water to the Iolanda Water Treatment Plant approximately 1.5 km away. Flocculant is injected at the receiving wells, and after passing through 30 flocculation and sedimentation basins and 20 rapid sand-filter beds, the water enters a chlorination basin. Chlorine gas and a pH adjuster are injected before the water enters a clean water reservoir, from where four centrifugal pumps (including one standby) and a transmission pipe 900 mm in diameter are used to convey the water to the Chilanga Booster Pump Station approximately 26 km away. From there, four centrifugal pumps (including one standby) at a booster pump station and a transmission pipe 900 mm in diameter are used to convey water approximately 24 km away to the Stuart Park Tank (approximately 90,000 m^3), which is the largest distribution reservoir in Lusaka. Water is also conveyed from the same booster pump station to the Lusaka Water Works Tanks (approximately 5,420 m^3) and to the Lumumba Tanks (approximately 9,090 m^3).

Within Lusaka, water is distributed from nine relay tank bases. Water is also drawn from 105 boreholes scattered around the city, from where it is distributed directly or conveyed to relay tanks. Water

distribution is divided into five service areas (see Figure 3-1-11), where the maintenance and management of boreholes, distribution pipes, service pipes and water meters is undertaken.

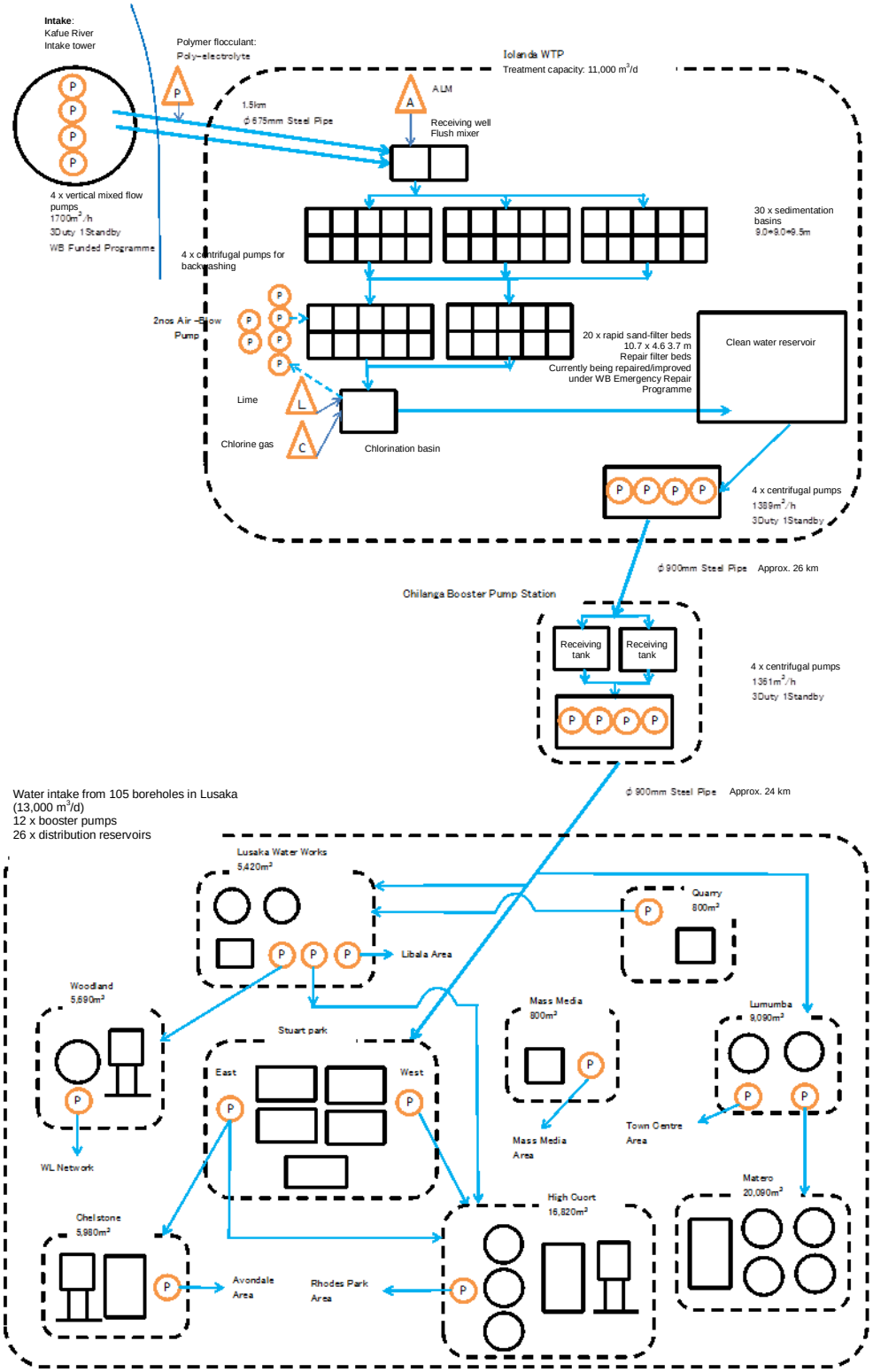

Figure 3-1-8: Schematic diagram of water supply facilities in Lusaka

Current water demand is 416,776 m^3/day (not taking account of non-revenue water), whereas the volume of water supply is only 225,000 m^3/day, or about 50 percent of demand. As a consequence, at times, water pressure is inadequate, water quality is poor and water supply is cut off, although the conditions are different in each area. The LWSC has taken urgent action in these areas, sinking new boreholes and connecting them directly to distribution pipes. Furthermore, the rapid growth in population and development of urban areas mean that, in 2015, water demand is forecast to reach 660,000 m^3/day (including non-revenue water of 25 percent), and so a pressing need is the development of water sources. Based on the survey result that the remaining available groundwater that could be pumped is approximately 50,000 m^3/day, water intake from the Kafue River will be the main source of water.[11]

Non-revenue water is 47 percent. About half of this is accounted for by leaks from distribution pipes (AC pipe, etc.), leaks from service pipes (poor connections, etc.) and leaks on residential sites. The other half is comprised of water thefts, uncollected water rates and so on. Water meters need to be installed, distribution pipes replaced, and service pipes improved. With respect to distribution pipes, although there is a GIS piping diagram, most of the distribution pipes are still AC pipes that have passed their useful life.[12]

(2) Current state of urban water supply facilities in Kafue

The population of Kafue is 88,712, its water supply coverage is 83 percent, and its population served is approximately 73,630. Its average volume of water supply is 22,000 m^3/day, and its non-revenue water is high at 47 percent. Residents not connected to the water supply use river water or shallow wells. Water meters have been installed at 9,968 of the 11,180 households connected to the water supply. Figure 3-1-9 shows a schematic diagram of the water supply facilities in Kafue.

A diversion canal has been excavated at right angles to the Kafue River, and an intake tower installed, approximately 10 km downstream from the Iolanda water intake facility. Within the intake tower, three vertical mixed flow pumps have been installed (two of them have stopped functioning), and one centrifugal pump has been installed in a building next to the base of the intake tower. Iron pipes 600 mm in diameter are used to convey water to the Kafue water treatment plant approximately 1.7 km away. Flocculant is injected at the inlet pipe of the water treatment plant, and the water passes through six flocculation and sedimentation basins and six rapid sand-filter beds before entering the clean water reservoir. Once chlorine gas has been injected into the clean water reservoir, three centrifugal pumps (including one standby) are used to convey water to three elevated distribution reservoirs (7,600 m^3) approximately 0.5 km away. Water is distributed within the city by gravity.

During the dry season, the river level falls, and so too does the water level of the diversion canal, meaning that water cannot be drawn in excess of the designed intake capacity of 24,000 m^3/day. Waterweeds and mud accumulate in the diversion canal, requiring dredging work to be carried out. Also,

[11] Source: Water Supply Investment Master Plan Lusaka, Final Report, MCC, 2011

[12] An asbestos-cement (AC) pipe refers to a pipe made from asbestos fiber and cement. Its useful life is short (25 years), and compared to pipes made from other materials, its strength is noticeably poorer when it deteriorates. For this reason, it is a major cause of leaks. Based on points raised in the WHO Guidelines for Drinking-Water Quality, etc., the official opinion on using AC in water supply pipes is that “it is not hazardous to health.” Nevertheless, if the asbestos pipe is broken or cut up, there is a chance of dust being produced which contains asbestos, which poses a carcinogenic risk (mesothelioma) if that dust is inhaled.

two vertical mixed flow pumps, which have currently stopped working, need to be installed. The WB has undertaken various repair/improvement work, such as replacement of the filter media inside the water treatment facilities, repairs of leaks in the pipework and valves, and repairs of leaks in buildings. Treatment capacity is 24,000 m^3/day, meaning that the demand for water in Kafue should be adequately met until 2015.

With respect to the water distribution network, GIS-based digital mapping is already in place, but because most of the distribution pipes are still AC pipes, the water distribution network needs to be replaced.

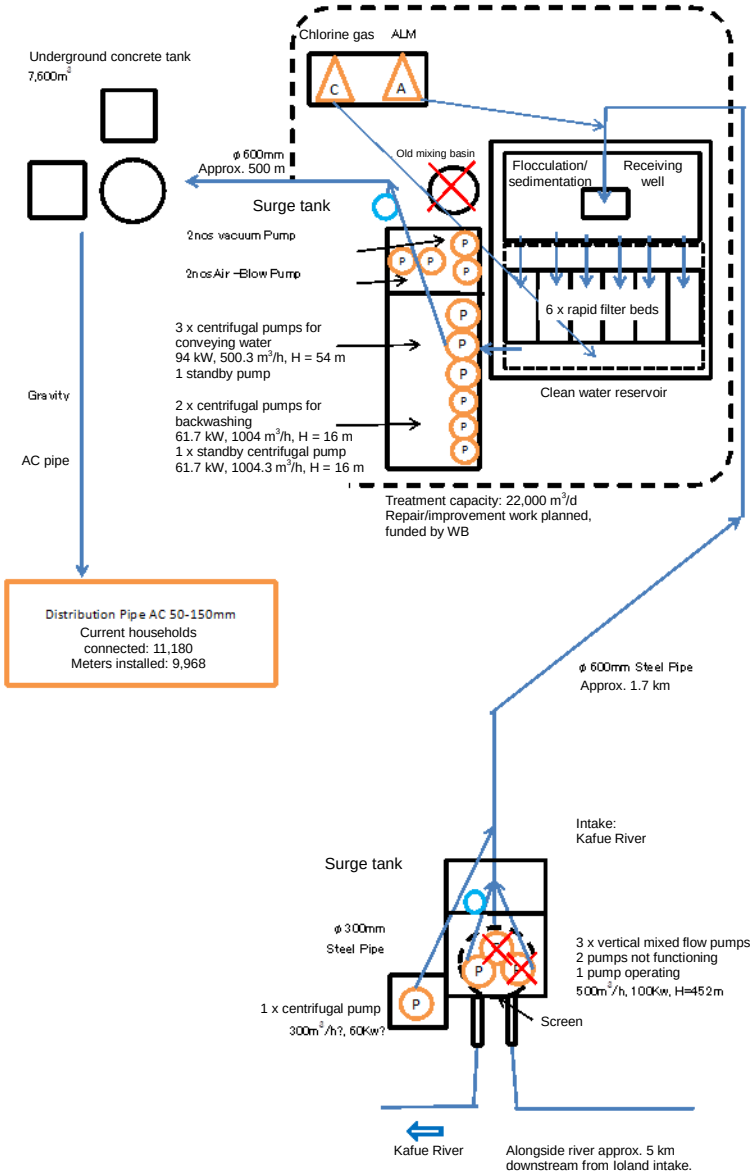

Figure 3-1-9: Schematic diagram of water supply facilities in Kafue

(3) Current state of urban water supply facilities in Chongwe

According to the 2011 MCC Master Plan, the population of the Chongwe District is 28,655, its water supply coverage is 83 percent, and its population served is approximately 23,780. Its average volume of

water supply is 7,200 m^3/day, and its non-revenue water is high at 47 percent. Residents not connected to the water supply use river water or shallow wells. Water meters have been installed at 3,618 of the 4,890 households connected to the water supply. Figure 3-1-10 shows a schematic diagram of the water supply facilities in Chongwe.

Water is drawn from a weir on the Chongwe River, and using two centrifugal pumps (including one standby), the water is conveyed to a modular, compact water treatment facility. At this facility, flocculant and a pH adjuster are injected into an inlet pipe, and after passing through four flocculation and sedimentation basins and four pressure tanks, the treated water is stored in a clean water reservoir. Chlorine gas is injected into a pipe coming from the clean water reservoir, and using a centrifugal pump, the water is either conveyed to an individual distribution reservoir or is distributed directly. Two elevated tanks have been installed, but both of them leak due to deterioration, and one of them is currently not used. During the dry season, the river level falls and the volume of water decreases, meaning that water cannot be drawn in excess of the current facility capacity. Apparently, the LWSC has considered drawing water from an existing weir upstream on the Chongwe River as a future source of water as the population increases, but given that the river flow and the size of the weir are about the same, any increase in water intake cannot be expected. Future consideration needs to be given to the possibility of using groundwater. Work funded by DANIDA and the Zambian government for improving the intake pump and building was completed in 2011. Work funded by the WB is currently being carried out to repair/improve the water treatment facility, transmission pipes and elevated tank.

With respect to distribution pipes, as with Kafue, GIS-based digital mapping is already in place, but because most of the water distribution network is still laid with AC pipes, the distribution pipes need to be replaced.

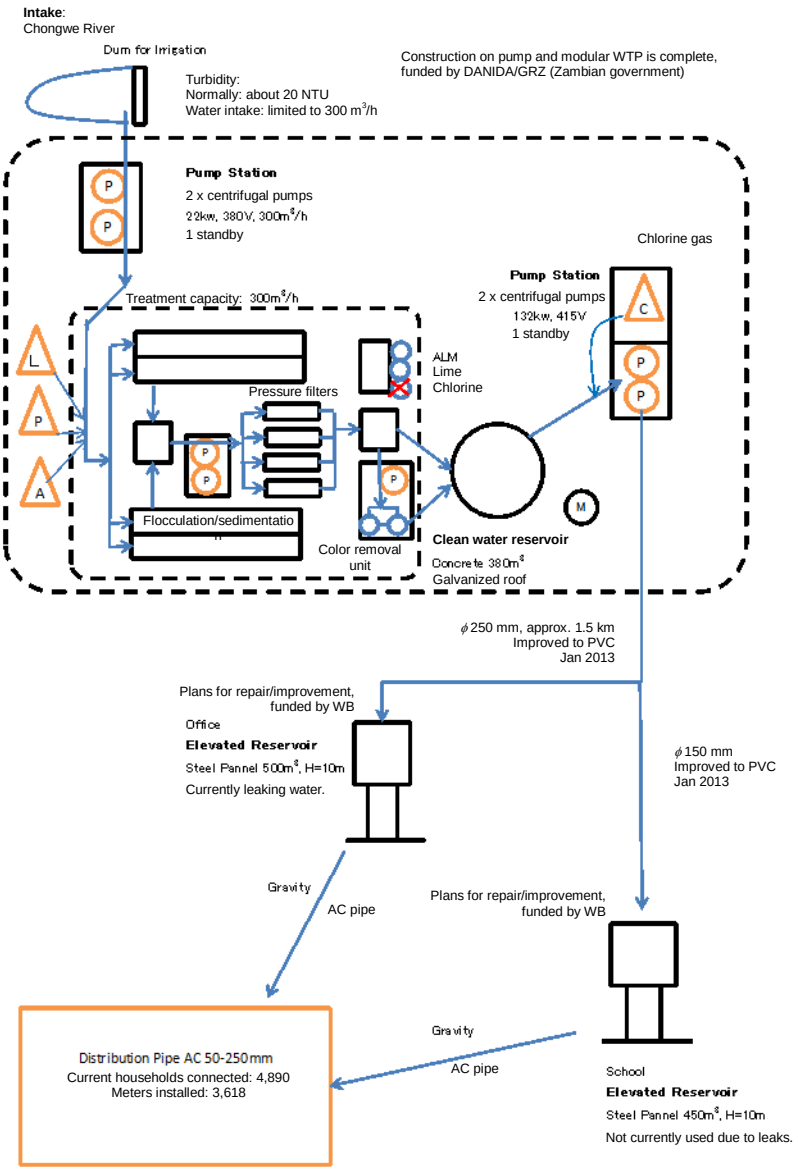

Figure 3-1-10: Schematic diagram of water supply facilities in Chongwe

3-1-6 Candidate Projects for Assistance

The LWSC's order of priority for improving its urban water supply following the MCC compact projects is: (1) Development of new water sources by constructing new water treatment plants; (2) Improvement and expansion of water supply facilities in neighboring four districts; and (3) Expansion of the water distribution network in two service areas (Lumumba, Kabulonga) within Lusaka, and establishment of an automated remote monitoring system. Table 3-1-6 provides an overview of each of the construction works plus the approximate estimates under the MCC Master Plan.

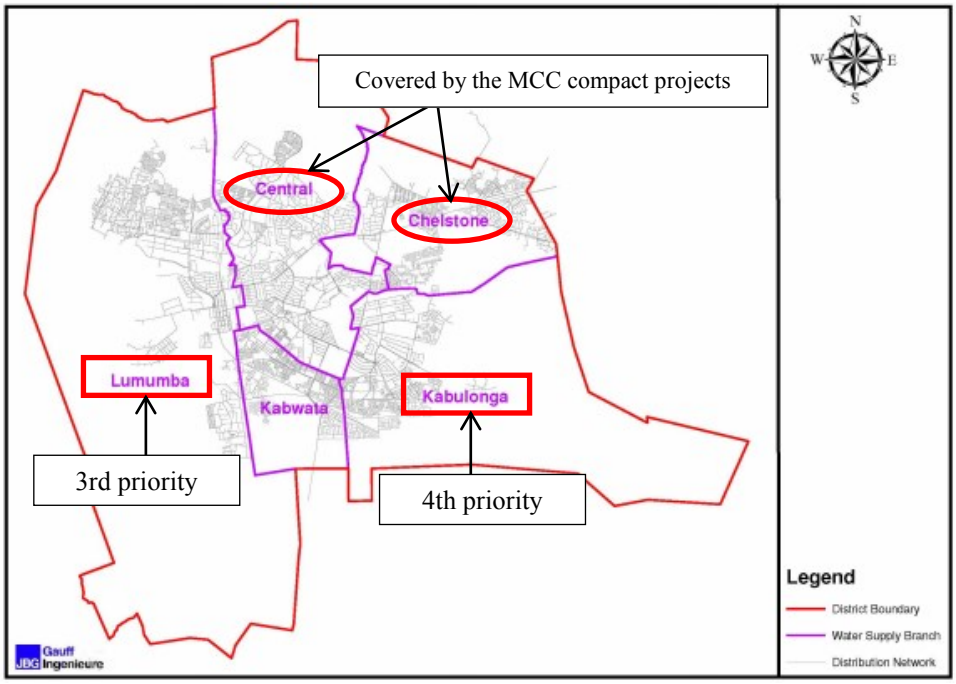

Figure 3-1-11: Map of service areas within Lusaka

Table 3-1-6: LWSC's order of priority for urban water supply improvement projects

Priority	Project	MCC approximate estimate (US$)
	(1) Development of new water sources by constructing new water treatment plants	
1	Construction of new water treatment plant with a capacity of 320,000 m^3/day, 45 km × DN1,400 mm transmission pipes, and related facilities (main storage tanks, district distribution center)	313,000,000
	(2) Improvement and expansion of water supply facilities in neighboring four districts	
2	Kafue/Chilanga Repair/improvement of existing water intake facilities, water treatment plants, transmission pipes, water storage tanks, water distribution network (main / secondary / tertiary), and expansion work	31,000,000
2	Chongwe Construction of new water intake facility, water treatment plant, transmission pipes, water storage tank and boreholes, repair/improvement of existing water distribution network (main / secondary / tertiary), and expansion work	24,000,000
2	Luangwa Repair/improvement of new water intake facility, water treatment plant, transmission pipes, water storage tank and existing water distribution network (main / secondary / tertiary), and expansion work	11,000,000

	(3) Expansion of the water distribution network in service areas within Lusaka, and establishment of an automated remote monitoring system	
3	Lumumba service area Expansion of water distribution network (secondary / tertiary) within DMAs[13] (water distribution blocks), installation of flow meters and individual household meters, and establishment of automated remote monitoring system based on telemeters or SCADA[14] (remote control and data collection system).	40,000,000
4	Kabulonga service area Expansion of water distribution network (secondary / tertiary) within DMAs, installation of flow meters and individual household meters, and establishment of automated remote monitoring system based on telemeters or SCADA	15,000,000

Source: LWSC documents

Examination of candidate projects for support

As a result of confirming the above order of priority with the LWSC, and based on the results of the field survey as well as of a detailed examination of the MCC Master Plan, it became clear that a key important issue for Lusaka is the development of new water sources through the construction of new water treatment plants which can accommodate the increase in water demand attributable to the rapid increase in population. Therefore, in terms of the candidate projects for support for the LWSC, the first candidate project to be proposed for support is the plan for construction of new water treatment plants in Lusaka in relation to development of new water sources, which is the biggest need for the city (tentative name: Project for Improving the Urban Water Supply in Lusaka City). As shown in Table 3-1-6, since the project involves a large-scale investment of more than US$300 million, implementing it will require both medium-term and long-term management and financial planning by the LWSC as well as the collaborative cofinancing with organizations such as the AfDB and the WB.

Next, the second candidate project to be proposed for support is the improvement and expansion of urban water supply facilities in Kafue District, a place where drastic development has been achieved (tentative name: Project for Improving the Urban Water Supply in Kafue District).

Detailed summaries of both candidate projects for support are contained in Chapter 4 *Outline of the Candidate Projects for Assistance in Target Cities*.

3-2 Current Urban Water Supply Situation at the Luapula Water and Sewerage Company and Candidate Projects for Assistance

3-2-1 Outline of the Luapula Water and Sewerage Company

The Luapula Water and Sewerage Company (LPWSC) is one of the most recent water and sewerage companies in Zambia, established in 2009. Six of the eight districts in Luapula Province (namely: Mansa, Samfya, Mwense, Nchelenge, Kashikishi and Kawambwa) have water supply facilities, and the LPWSC develops, operates and maintains those facilities.

[13] DMAs: District Metered Areas
[14] SCADA: Supervisory Control and Data Acquisition

(1) Business summary

Table 3-2-1 shows the key performance indicators for the LPWSC. According to the performance evaluation ranking by NWASCO, the LPWSC was ranked lowest among 11 corporations for both 2010/2011 and 2011/2012.

Table 3-2-1: Key performance indicators for the LPWSC

Year	Number of connections	Evaluation item								Overall rating
		Non-revenue water (%)	Water quality pass rate (%)	Metering ratio (%)	Water supply ratio (%)	Hours of supply (hr/d)	Staff per 1,000 water connections (persons)	Collection efficiency (%)	Rate of cost recovery* (%)	
2010/2011	2,929	67	79	0	15	6	17	90	48	11
2011/2012	3,583	63	96	4	15	9	14	91	46	11

* Rate of cost recovery takes collection efficiency into account (Amount of rates collected / Operation and maintenance costs)

Source: Urban and Peri-Urban Water Supply and Sanitation Sector Report 2010/1011, 2011/2012, NWASCO

1) Number of connections: The number of connections in 2011/2012 was 3,583, but the number of serviced connections (invoiced connections) as of September 31, 2012 was 2,411, or about two thirds of the total connections. About one third of customers who are connected to the water supply (1,172 connections) repeatedly default on payments, are disconnected, and/or cancel their contracts because of the poor water supply service (low water pressure, small volume of water supply, shortened hours of water supply). The LPWSC urgently needs to improve its water supply facilities as a water utility. Moreover, the North Western Water and Sewerage Company has the second least number of connections among water and sewerage companies nationwide, but even this has 8,313 connections, meaning that the 3,583 connections of the LPWSC is a conspicuously small number.
2) Non-revenue water: Although there has been a slight improvement from 67 percent to 63 percent, given that the metering ratio is low at only 4 percent, actual water consumption cannot be measured. Therefore, these figures are nothing more than mere estimates, and are extremely unreliable. Even supposing that non-revenue water was 63 percent, this is noticeably lower than the other ten companies (30-53%), and so it is essential that the LPWSC's water distribution network be repaired and upgraded.
3) Water quality pass rate: This has increased significantly from 79 percent to 96 percent. NWASCO analyzes two items when testing water quality: residual chlorine and bacteria (coliform bacteria). If there is residual chlorine, it means there is no bacteria, and so the LPWSC conducts chlorination faithfully at its water treatment plant and pumping stations.
4) Metering ratio: As a result of water meters being provided by DANIDA, the metering ratio increased from 0 percent to 4 percent, but compared to the other ten water and sewerage companies (48-100%), the rate is conspicuously low. Of the 1,325 water meters provided by DANIDA, only 478 had been installed as of September 30, 2012. 100 percent of meters also need to be installed in order to reduce non-revenue water.

5) Water service coverage: This remains low at 15 percent. Because the small budget has been allocated to the rehabilitation of existing facilities, the LPWSC is not in a position to undertake new construction or expansion work.
6) Hours of supply: Although this has been lengthened from an average of six hours to nine hours, the impact of power failures means it is difficult to extend the hours of water supply.
7) Staff per 1,000 water connections: The decrease in the number of staff per 1,000 water connections corresponds to the increase in the number of connections.
8) Collection efficiency: This is at a relatively high level of between 90 and 91 percent.
9) Rate of cost recovery: This is extremely low, at 48 percent in 2010/2011 and 46 percent in 2011/2012. Even compared to the other ten water and sewerage companies (63-120%), it is conspicuously low. In order to achieve cost recovery, it is essential that water supply services be improved by repairing and upgrading the existing water distribution network.

Supposing that non-revenue water could be reduced to 21 percent, or one third of its current level of 63 percent, if the current volume of water taken from water sources and the current capacity of water treatment plants are maintained, it would be possible to supply 2.1 times the current volume of water. As a consequence, the customer base would also increase by a factor of 2.1, and cost recovery would become feasible. Particularly in the case of the provincial capital, Mansa, here, there are approximately 7,000 households in the existing water service area, but the current number of serviced connections is only 1,271. If the volume of water supply (that actually reaches customers) can be increased, then it should also be easy for the LPWSC to achieve increases in its customer base.

As mentioned above, when the LPWSC was publicly incorporated in 2009, it inherited aging water supply facilities from the MLGH with no notable capital investment, and to this day, it has been unable to establish foundations as a water utility. Furthermore, although a business plan (2010-2013) has been prepared using the MLGH/DANIDA budget, it contains no details on the investment program. Compounded by the withdrawal of DANIDA, MLGH and LPWSC have made strong pleas to JICA for assistance.[15]

(2) Organization

The LPWSC is a new water and sewerage company, having been established in 2009. Consequently, its Managing Director (MD) and other key positions of Director of Engineering and Finance and Commercial Manager have only been filled through a public recruitment process between last year and the year before. Moreover, its Manager of HRA (Human Resource and Administration) was only appointed four months ago. Figure 3-2-1 shows an organization chart of the LPWSC.

[15] A written request for grant aid (*Luapula Water Supply and Sanitation Project*) has been submitted by the MLGH to the Japanese government, dated June 2011.

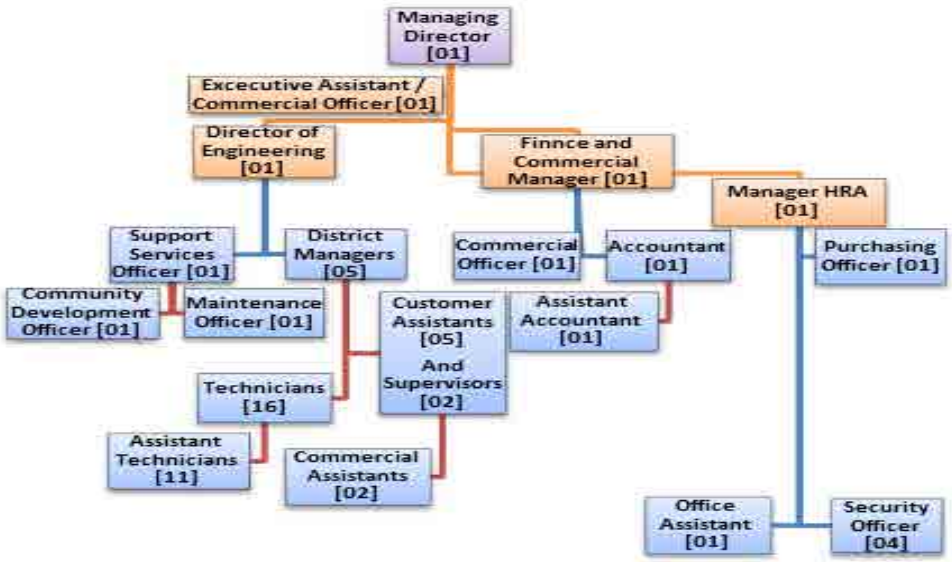

Figure 3-2-1: Organization chart of the Luapula Water and Sewerage Company (LPWSC)

The LPWSC has its headquarters in Mansa, and has branch offices in the five districts where it provides water supply services. Under the leadership of a District Manager, each branch carries out the operation and maintenance of its own water supply facilities as well as the invoicing and collection of water rates. Table 3-2-2 shows the number of staff at headquarters and at each branch. As of September 2012, staff numbered 56.

Table 3-2-2: Headquarters/branch staff numbers at the LPWSC (as of September 2012)

Headquarters (Mansa)	Branch offices					Total
	Mansa	Samfya	Mwense	Nchelenge/Kashikishi	Kawambwa	
11	12	7	7	12	7	56

Source: LPWSC documents

(3) Current state of human resources development

Training of LPWSC staff has so far been conducted with assistance provided by DANIDA. DANIDA covers 90 percent of training costs (accommodation, transport, training), and the MLGH covers 10 percent. Different training topics have been hosted by different local universities and private enterprises. Only the MD attends a three-week course in Sweden (Sustainable Urban Water and Sanitation - Integrated Processes).

Table 3-2-3 lists the actual training conducted between 2010 and September 30, 2012. There were five staff members who attended training in 2010, two in 2011, and 21 in 2012, making a total of 28, or only about half of all personnel. Ongoing training is needed on operation and maintenance and on management as a water utility.

Table 3-2-3: Actual training attended by LPWSC staff (2010 - September 30, 2012)

Year	Position	Total attendees	Training course	Training organization	Duration	Location
2010	Engineering Director	1	Project management	Olympus B.S Consulting	4 days	Lusaka
	District Manager	3	Non-revenue water	WASAZA	3-4 days	Lusaka
	District Manager	1	Commercial & customer orientation	WASAZA	5 days	Lusaka
2011	Managing Director	1	Sustainable urban water & sanitation - integrated processes	Lund University	3 weeks	Sweden
	Engineering Director	1		WASAZA		
2012	Customer service assistant	12	Customer care	Luanshya Business College	2 weeks	Luanshya, Copperbelt
	Maintenance officer	2	Electric motor control system	Luanshya Business College	2 weeks	Luanshya, Copperbelt
	Water treatment plant operator	2	Electric motor control system	Luanshya Business College	2 weeks	Luanshya, Copperbelt
	District Manager	1	Water Engineering	National Resources Development College (NRDC)	6 weeks	Lusaka
	District supervisor	1	Water Engineering	NRDC	6 weeks	Lusaka
	Plant operator	3	Water Engineering	NRDC	6 weeks	Lusaka
Total		28				

Source: LPWSC documents

(4) Current support provided by DANIDA

Water distribution network mapping

Digital water distribution network maps are the most important requirement for the operation and maintenance of water supply facilities, and yet at the LPWSC, there is not even a single paper-based water distribution network map. Therefore, it has been decided to use the assistance provided by DANIDA to create these maps. The maps will cover the water distribution network of all five districts where the LPWSC has water supply facilities. At present, tenders are being accepted from local consultants. Work is scheduled to begin next month, and will finish at the end January 2013. After that, there are also plans to provide training on GIS digital mapping.

Survey of available groundwater

As part of investigations into the amount of available groundwater, test drilling is planned for Mansa and the Mwense District. Drilling will commence gradually from about the end of November 2012, and results are expected in about February 2013. In Mansa, test drilling will be carried out near the shores of the upper reaches of the Luapula River, from where the water supply is currently sourced. Depending on the results, consideration will be given to the potential of this groundwater as a future source of water supply.

3-2-2 Current Situation of Urban Water Supply Facilities Managed by LPWSC

Table 3-2-4 lists an overview of the population, population served, hours of supply, number of connections, current state of urban water supply facilities and proposed facility improvements in each district in Luapula Province, as well as the amount requested and the approximate estimates for construction work. Furthermore, Figure 3-2-2 shows the administrative divisions of Luapula Province, as well as the location of the urban water supply facilities in each district.

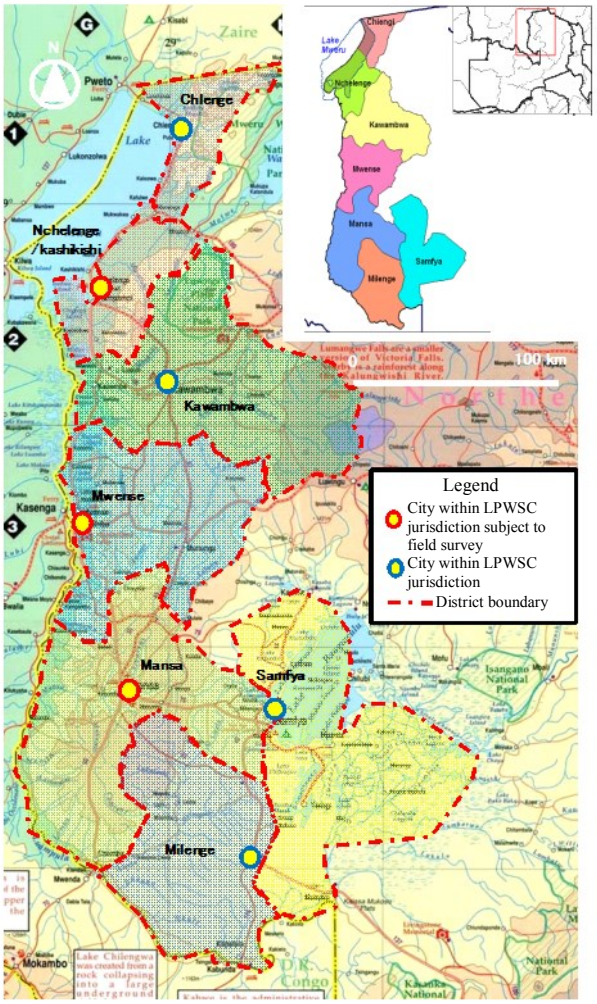

Figure 3-2-2: Administrative divisions of Luapula Province, and the location of urban water supply facilities

In this study, field surveys were conducted on the urban water supply facilities in four areas that were given high priority after confirming with the MLGH/LPWSC, namely: the provincial capital, Mansa, Nchelenge and Kashikishi in the Nchelenge District, and the Mwense District. Following is a detailed account of the results of the field surveys.

Table 3-2-4: Overview of urban water supply facilities in Luapula Province

Name of city/district	Mansa District	Mwense District	Nchelenge District		Samfya District	Kawambwa District	Chiengi District	Milenge District
	Mansa	Mwense	Nchelenge	Kashikishi	Samfya	Kawambwa	Chiengi	Milenge
Population (2011)	95,269	13,738	29,798		39,062	20,846	9,944	9,532
Number of households (2011)	7,513	1,044	2,483		3,555	1,855		
Population served (2011)	19,054	2,748	5,960		7,812	4,169	—	—
Hours of supply	8 hours	8 hours	5 hours		7 hours	5 hours	—	—
Volume of water supply (2011)	6,390 m^3/day	460 m^3/day	960 m^3/day		1,700 m^3/day	350 m^3/day	—	—
Revenue water (2011)	2,240 m^3/day	160 m^3/day	340 m^3/day		600 m^3/day	120 m^3/day	—	—
Water demand in current water service areas (original unit: 150 liters/person/day)	5,910 m^3/day	770 m^3/day	1,700 m^3/day		—	—	—	—
Organization (personnel)	Headquarters (11) Mansa Branch (12)	Mwense Branch (7)	Nchelenge Branch (12)		Samfya Branch (7)	Kawambwa Branch (7)	—	—
Current state of water supply services, and demand for new water service connections	Number of connected households: 1,734	Number of connected households: 291	Number of connected households: 233	Number of connected households: 250	Number of connected households: 711	Number of connected households: 371	No water supply services.	No water supply services.
	Number of unconnected households in serviced area: 1,851	Number of unconnected households in serviced area: 250	Number of unconnected households in serviced area: 207	Number of unconnected households in serviced area: 223	—	—		
	Approximately 3,920 households in 8 unserviced areas.	Approximately 500 households in 4 unserviced areas.	Approximately 1,600 households in 5 unserviced areas.		Unserviced areas: 350 houses in Chiblya; 10,000 people in Chilumba area; 20,000 people in Mwense area.			
	Number of necessary connections: 5,779	Number of necessary connections: 753	Number of necessary connections: approximately 2,000		Number of necessary connections: 2,844	Number of necessary connections: 1,484		
	620 households on measured rate system; others on flat rate system.	Flat rate system because of lack of water meters.	Flat rate system because of lack of water meters.		Flat rate system because of lack of water meters.	Flat rate system because of lack of water meters.		
	Hours of supply are not constant because of power failures and voltage drops.	Hours of supply are not constant because of power failures and voltage drops.	Hours of supply are not constant because of power failures and voltage drops.		Hours of supply are not constant because of power failures and voltage drops.	Hours of supply are not constant because of power failures and voltage drops.		
Current state of water supply facilities	Water source: Mansa River Water intake: 400 m^3/hour (dry season)	Water source: Mwense River Water intake: 70 m^3/hour (dry season)	Water source: Lake Mweru Water intake: ∞		Water source: Lake Banguweulu Water intake: ∞	Water source: Spring that feeds upper reaches of north-south flowing river. Water intake: 900 m^3/day	No water supply facilities.	No water supply facilities.
	2 floating submersible pumps (37kw) are installed (estimate: 400 m^3/hour). 1 standby submersible pump for the dry season (under repair).	Water stored using a simple weir. Water abstracted from 2 water intake wells on the riverside. 1 submersible pump installed directly on the river in preparation for the dry season.	Screen-type intake well installed in lake.	Screen-type intake well installed in lake.	Screen-type intake well installed in lake.	Water abstracted by laying collecting pipes at the site of the spring. Water is conveyed by gravity to clean water reservoir in city. (Replacement of AC pipes with PVC pipes is complete. Approximately 8 km.)		
	80% of water drawn from river goes to the clean water reservoir untreated. 20% of water goes to the clean water reservoir via a slow sand filter (250 m^3).	Water conveyed to water treatment plant using 2 centrifugal pumps (70 m^3/hour). 2 pumps not operating due to malfunction. Standby submersible pump (70 m^3/hour) is operating.	Chlorine injected using simple equipment prior to pump.	Rapid filtration facility is compact, but with marked deterioration. Water is conveyed to receiving well using 1 centrifugal pump (18.5kw) in basement of facility building.	2 centrifugal pumps (20 m^3/hour) are used to covey water to a slow sand filter. 1 standby pump (20 m^3/hour).	Chlorine and neutralizer are injected using simple equipment at the clean water reservoir (concrete, 420 m^3).		
	Of the 4 slow sand-filter beds (constructed in 1970s, 1,000 m^3/day/bed), 2 beds are not operating due to replacement of collecting pipes.	Rapid filtration capacity (1,000 m^3/day) Flocculant injected using simple equipment at 1 receiving well. Passes through 2 rapid flocculation and sedimentation basins and 2 rapid sand filter beds, before going to clean water reservoir. Backwashing system has broken down. Looks like filter medium has been replaced.	Water is distributed directly using 1 pump (122 m^3/hour, 39 kw, H = 89 m). No standby pumps, only frame.	Small receiving well located on 2F of facility building. Flocculant injected using simple equipment.	1 of 8 slow sand-filter beds (constructed around 1987; 12 m^3/hour/bed) is standby.	Approximately 40% of water is conveyed to aboveground concrete tank (800 m^3) using 2 centrifugal pumps adjacent to clean water reservoir. No standby pumps. Approximately 60% of water is distributed by gravity.		
	Chlorine injected using simple equipment at clean water reservoir (250 m^3).	Chlorine injected using simple equipment at clean water reservoir (570 m^3, roofed with galvanized sheet iron).	Water is distributed after chlorination only.	1 circular rapid flocculation and sedimentation basin, 2 rapid filtration facilities annexed to building, 1 clean water reservoir on 1F/basement of building.	Chlorine injected using simple equipment at clean water reservoir (120 m^3).	1 of 2 pumping stations (vertical) located near the aboveground concrete tank (800 m^3) conveys water to onsite elevated tank (steel panel, 50 m^3). 1 pump distributes water to elevated residential areas.		
	Of the 3 centrifugal pumps housed in the clean water reservoir building (110 kW, 370 m^3/hour), only 1 is operating. 2 duty + 1 standby. 1 pump is scheduled to have its motor replaced (4 million ZMK). 1 standby pump is under repair.	Water is distributed by gravity from clean water reservoir. Some water is distributed to elevated residential areas (around the water treatment plant) using 2 pumps (29.1 m^3/hour, 7.5 kW; 9 m^3/hour, 2.2 kW).		Chlorine injected into clean water reservoir using simple equipment from 2F of building.	3 centrifugal pumps (55 m^3/hour) in pumping station. 2 duty + 1 standby.			
	40% of water is distributed to elevated tank (circular, concrete tank of 900 m^3) in Mansa. 60% is distributed directly.			Water conveyed using 1 centrifugal pump housed in separate pump shed. No standby pumps. About 40% of water is conveyed to elevated tank (steel panel tank, 90 m^3), and about 60% is distributed directly.	In one elevated area, 2 elevated tanks (steel panel tanks 50 m^3, 32 m^3) are used to distribute approximately 20% of water by gravity to the elevated area. Also, 2 concrete tanks (circular 1,140 m^3, rectangular 850 m^3) to distribute approximately 80% of water by gravity.	Pressure pumps are used to convey water under pressure to elevated tanks and high-elevation zones.		
	Almost all distribution piping in city is AC pipes.							
	Shortage of water intake during the dry season.	Shortage of water intake during the dry season.		Existing elevated tank (steel panel tank, 90 m^3) has weak foundations and is leaning slightly. Therefore, although it is currently being used, it will become unusable in the future. Tank has conspicuous leaks.				
	Pump motors fail due to frequent power failures, voltage drops and/or excess voltage.							
	Water supply is inadequate due to power failures and voltage drops.							

Name of district	Mansa District	Mwense District	Nchelenge District		Samfya District	Kawambwa District	Chiengi District	Milenge District
	Mansa	Mwense	Nchelenge	Kashikishi	Samfya	Kawambwa	Chiengi	Milenge
Current evaluation of water supply facilities	Facilities are markedly deteriorated and are not functioning to supply water. All facilities need to be rebuilt.	Rapid filtration facility could continue to be used in future if backwash function, etc. improved. All water intake, conveyance and distribution facilities need to be replaced.	Not water supply facilities. All facilities need to be rebuilt.	Facilities are markedly deteriorated and are not functioning to supply water. All facilities need to be rebuilt.	All water conveyance facilities need to be replaced.	All water conveyance facilities need to be replaced.	Water supply facilities need to be rebuilt.	Water supply facilities need to be rebuilt.
Facility drawings	No	No	No	No	No	No	—	—
Piping diagram	No	No	No	No	No	No	—	—
Facilities improvement plan (proposed by mission coordinator for water supply facilities)	4 options.	4 options.	2 options.		2 options.		2 options.	2 options.
	1. Meet all demand by constructing boreholes.	1. Meet all demand by constructing boreholes.	1. Lake Mweru rapid filtration facility as a water source		1. Lake Banguweulu rapid sand filter as a water source	Construct water intake well at the site of new spring + lay additional conveyance pipes	1. Lake Mweru rapid sand filter as a water source	1. Luapula River rapid sand-filter as a water source
	2. Meet demand by constructing new boreholes + rapid sand filters, 8,000 m^3/day.	2. Construct new boreholes + 1,000 m^3/day existing river water sources	2. Boreholes on the shores of Lake Mweru as a water source		2. Boreholes on the shores of Lake Banguweulu as a water source		2. Boreholes on the shores of Lake Mweru as a water source	2. Boreholes in the vicinity of the Luapula River as a water source
	3. Cover current supply area by constructing new rapid sand filters, 8,000 m^3/day.	3. Construct new river water source with estimated 2,000 m^3/day (river close to secondary school, see attachment for planned site) + existing river water sources						
	4. Construct a weir at a point upstream from the existing intake location (see attachment for planned site), thereby avoiding the a water shortage for about the last two weeks of the dry season and expanding the water service area to some extent.	4. Construction of new river water sources + existing river water sources + boreholes						
	Construct new water treatment plant.	Construct additional water treatment plant.	Construct new small water treatment plant or new water treatment plant.		Construct new small water treatment plant	Construct new small water treatment plant	Construct new small water treatment plant	Construct new small water treatment plant
	Replace transmission pipes.	Replace transmission pipes.	Lay new transmission pipes.		Lay new transmission pipes.	Lay new transmission pipes.	Lay new transmission pipes.	Lay new transmission pipes.
	Construct new elevated tanks (adjacent to existing elevated tanks)	Construct new elevated tank (in existing water treatment plant)	Construct new elevated tank Construct new distribution reservoir (1,000-1,200 m^3)		Construct new elevated tank	Construct new elevated tank	Construct new elevated tank	Construct new elevated tank
	Replace water distribution network	Replace water distribution network	Replace water distribution network		Replace water distribution network	Replace water distribution network		
	Expand water distribution network	Expand water distribution network	Expand water distribution network		Expand water distribution network	Expand water distribution network	Construct new water distribution network	Construct new water distribution network
	Install generators	Install generators	Install generators		Install generators	Install generators	Install generators	Install generators
	Install water meters	Install water meters	Install water meters		Install water meters	Install water meters	Install water meters	Install water meters
Summary of facilities improvement plan (proposed by mission coordinator for water supply facilities)	Meet demand by constructing new rapid sand filters for boreholes + river intake, 8,000 m^3/day. If it cannot be expected that the volume of water will be met from boreholes, construct water supply facilities for existing area. River intake (or boreholes) + conveyance pipes + rapid filtration facility + clean water reservoir (including for water from boreholes) + chlorine + pumps + transmission pipes + elevated tanks (additional) + distribution pipes (existing + expansion)	Construction of new river water sources + existing river water sources + boreholes. If it cannot be expected that the volume of water will be met from boreholes, construct new river water sources + construct new water supply facilities at existing river water source. Note, the existing rapid filtration facility can still be used, but construct additional filtration facility for the shortfall. River intake (or boreholes) + conveyance pipes + rapid filtration facility (shortfall) + clean water reservoir (including for water from boreholes) + chlorine + pumps + transmission pipes + elevated tank (additional) + distribution pipes (existing + expansion)	Boreholes on the shores of Lake Mweru as a water source + conveyance pipes + clean water reservoir + chlorine + pumps + transmission pipes + elevated tank (new) + distribution pipes (existing + expansion)		Boreholes on the shores of Lake Banguweulu as a water source + conveyance pipes + clean water reservoir + chlorine + pumps + transmission pipes + elevated tank (additional) + distribution pipes (existing + expansion)	Water intake well at the site of new spring + conveyance pipes + clean water reservoir + chlorine + pumps + transmission pipes + elevated tank (additional) + distribution pipes (existing + expansion)	Boreholes on the shores of Lake Mweru as a water source + conveyance pipes + clean water reservoir + chlorine + pumps + transmission pipes + elevated tank + distribution pipe	Boreholes in the vicinity of the Luapula River as a water source + conveyance pipes + clean water reservoir + chlorine + pumps + transmission pipes + elevated tank + distribution pipe
Amount of water demand including piping expansion (m^3/day) (original unit: 150 liters/person/day)	12,390	1,490	4,610		5,860	3,130	1,490	1,430
Donor support / domestic budget	GIS mapping system will be completed by DANIDA by the end of Jan 2013. GIS training is also scheduled.	GIS mapping system will be completed by DANIDA by the end of Jan 2013.					Nil	Nil
	1,325 water meters have been provided by DANIDA. Of this, 478 have been connected.		JICA (grant aid) rural water supply mission is conducting survey. Need to avoid duplication.			Work to replace 8 km of conveyance pipes (ϕ300 mm PVC) completed (2011 government budget: 3,200 million ZMK)		
	Work undertaken to improve water supply system, funded by BADEA; No activity since 2002.					Work currently underway to improve water supply system, funded by BADEA; No activity since 2002.		
	Trial digging of boreholes on planned site, funded by DANIDA and the Zambian government. Planned for about Nov 2012. Results in about Jan 2013. See attachment for planned site.	Trial digging of boreholes on planned site, funded by DANIDA and the Zambian government. Planned for about Dec 2012. Results in about Feb 2013. See attachment for planned site.						
Amount requested (US$)	2,500,000	3,000,000	3,000,000		4,000,000	1,600,000	4,000,000	3,500,000
Approximate estimate (JPY billion)	1.5-2.6	1.0-1.5	1.0-1.5		1.0-1.5	1.0	1.0	1.0
MLGH priority	○		○					
LPWSC order of priority	1, 2, 3	1, 2, 3	1, 2, 3		4, 5	4, 5	6, 7	6, 7
JICA evaluated order	1	3	2					

(1) Current state of urban water supply facilities in Mansa

According to 2011 data from the LPWSC, the population of Mansa is 95,269, its water supply coverage is 20 percent, and its population served is approximately 19,054. Its average volume of water supply is 6,390 m^3/day, but its non-revenue water is high at 65 percent. Residents not connected to the water supply use shallow wells. Water meters have been installed at 620 of the 1,734 households connected to the water supply, and with provision of an extra 1,325 meters from DANIDA, more are currently being installed. Figure 3-2-3 shows a schematic diagram of the water supply facilities in Mansa.

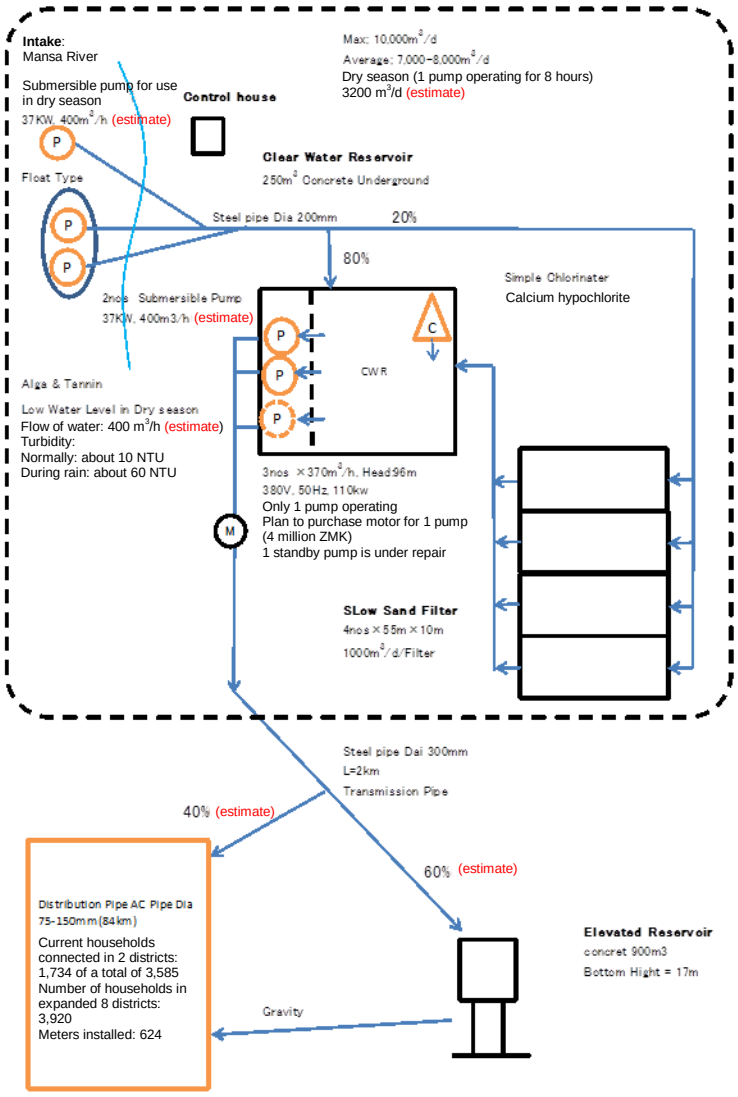

Figure 3-2-3: Schematic diagram of water supply facilities in Mansa

Water is drawn using a submersible pump from a float on a natural weir on the Mansa River, and approximately 80 percent of the intake enters the clean water reservoir as raw water. The remaining 20 percent or so is treated using the slow sand filtration method before entering the clean water reservoir. Chlorine is injected at the clean water reservoir, and the water is either conveyed to elevated tanks within the city or is distributed directly. Raw water that has been merely chlorinated accounts for approximately 80 percent, and so the system could not be described as a water supply facility. The

treatment capacity of the slow sand filters is estimated at more than 4,000 m^3/day, but two of the four filters are under repair.

For the last two or three weeks of the dry season (from late September to late October), the flow of the Mansa River decreases. The spillway of the natural weir is dammed with small stones and pebbles, and water is drawn using a submersible pump. As a consequence, based on the intake capacity of the submersible pump, the river flow during the dry season is estimated at about 400 m^3/hour. Furthermore, turbidity is normally less than 10 NTU, and so is suited to slow sand filtration, but when it rains, turbidity increases to more than 50 NTU, and the intake of water must be stopped.

With no blueprints mapping the distribution pipes, the pipe network is unclear. But as most distribution pipes are AC pipes, they need to be replaced. With the assistance of DANIDA, a GIS mapping system will be utilized to develop a pipe network diagram which is scheduled for completion before the end of January 2013. Furthermore, given the problem of the decreased river flow during the dry season and the view to reducing treatment costs, with an aim of drawing water from boreholes, a study will be undertaken (funded by DANIDA and the Zambian government) to survey the capacity of raising groundwater by sinking a trial borehole on the western Mansa River upstream from the water treatment plant. The results from this study are also due in about January 2013.

In Luapula Province, obtaining a stable supply of power is not possible. As a consequence of power failures and voltage drops, operating hours are constrained, with pumps operating on average about 10 hours per day. In addition, excess voltages lead to motors seizing and repeated breakdowns, which result in mounting repair costs.

(2) Current state of urban water supply facilities in Nchelenge and Kashikishi

Nchelenge and Kashikishi each have a simple water supply facility. However, because they are adjacent to each other by a distance of about 3 km, there is a plan to combine these into one facility. According to 2011 data from the LPWSC, the population of Nchelenge and Kashikishi is 29,798, their water supply coverage is 20 percent, and their population served is approximately 5,960. Its average volume of water supply is 960 m^3/day, and its non-revenue water is high at 65 percent. Residents not connected to the water supply use shallow wells. No water meters have been installed, and so a flat rate is charged per household.

In Nchelenge, water is drawn from Lake Mweru and chlorine is added before being distributed to individual households. With the raw water merely being chlorinated, the system could not be described as a water supply facility. Figure 3-2-4 shows a schematic diagram of the water supply facility in Nchelenge.

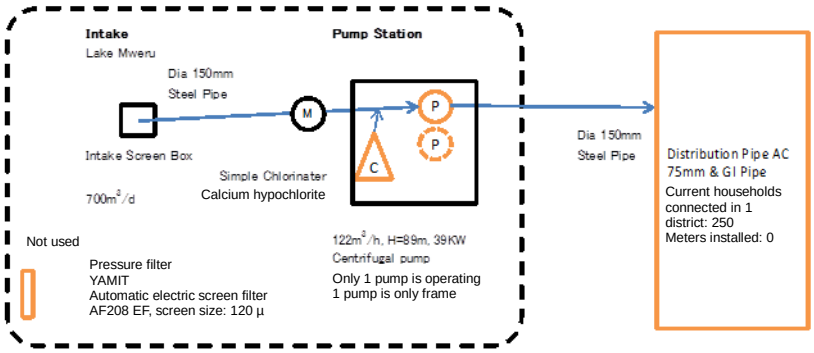

Figure 3-2-4: Schematic diagram of water supply facilities in Nchelenge

In Kashikishi, water is drawn from Lake Mweru and flocculant is added, before passing through a rapid flocculation and sedimentation basin and rapid sand-filter bed, and onto a clean water reservoir. Chlorine is added, and then water pumps are used to either convey the water to an elevated tank within the city or to distribute it directly. Although it is unclear when the water treatment facility was built, its deterioration is noticeable. Furthermore, the foundations of the elevated tank in the city are weak. The tank is leaning somewhat, and leaks are conspicuous. Figure 3-2-5 shows a schematic diagram of the water supply facility in Kashikishi.

As with Mansa, neither of these cities have a blueprint mapping the distribution pipes, and so the pipe network is unclear. But as most distribution pipes are AC pipes, they need to be replaced. With the assistance of DANIDA, a GIS mapping system will be utilized to develop a pipe network diagram which is scheduled for completion before the end of January.

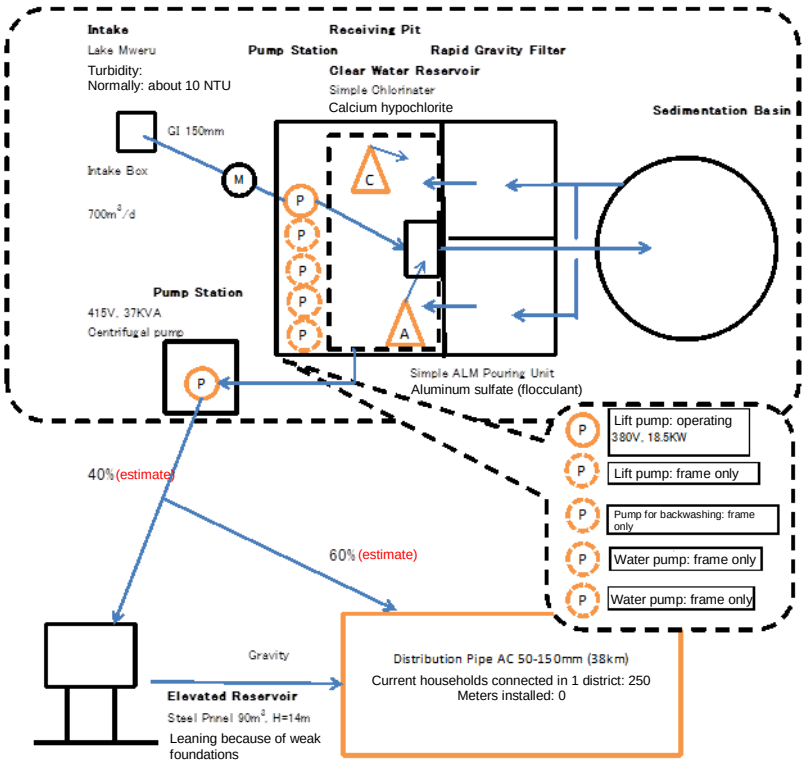

Figure 3-2-5: Schematic diagram of water supply facilities in Kashikishi

(3) Current state of urban water supply facilities in Mwense

According to 2011 data from the LPWSC, the population of Mwense is 13,738, its water supply coverage is 20 percent, and its population served is approximately 2,748. Its average volume of water supply is 460 m^3/day, and its non-revenue water is high at 65 percent. Residents not connected to the water supply use shallow wells or river water. No water meters have been installed, and so a flat rate is charged per household. Figure 3-2-6 shows a schematic diagram of the water supply facilities in Mwense.

A water intake well has been installed next to a weir on the Mwense River, and using two centrifugal pumps (both have stopped working), water is conveyed to a water treatment plant. Water is also conveyed directly to a reservoir by means of a standby submersible pump. At the water treatment plant, there is a package-type, paired rapid sand-filter facility, and treatment capacity is estimated at 1,000 m^3/day. Flocculant is injected at the receiving well, and after being treated at the rapid flocculation and sedimentation basins and the rapid sand-filter beds, chlorine is added at the clean water reservoir, before the water is distributed within the city by gravity. Pumps are also used to distribute water directly to elevated areas.

During the dry season, the water level of the water intake well falls, making it impossible to draw water. For this reason, a submersible pump is installed directly onto the dam impoundment to draw water from the Mwense River. As a consequence, based on the intake capacity of the submersible pump, the river flow during the dry season is estimated at about 70 m^3/hour. Since an adequate supply cannot be ensured with this volume of water, consideration is being given to alternate water sources: (1) drawing

water from a river north of the water treatment plant; and (2) drawing water from boreholes. In terms of drawing water from a river north of the water treatment plant, currently, there is a water intake facility for the exclusive use by a secondary school, but given that it has no treatment facility and for the purpose of reducing costs, consideration is being given to transferring this facility to the LPWSC and supplying water to the secondary school in return. Furthermore, given the problem of the decreased river flow during the dry season and the view to reducing treatment costs, a study will be undertaken (funded by DANIDA and the Zambian government) to survey the capacity of raising groundwater by sinking a trial borehole in the vicinity of the current river intake point. The results from this study are due in about January 2013.

As with other cities, there are no blueprints mapping the distribution pipes, and so with the assistance of DANIDA, a GIS mapping system will be utilized to develop a pipe network diagram which is scheduled for completion before the end of January 2013.

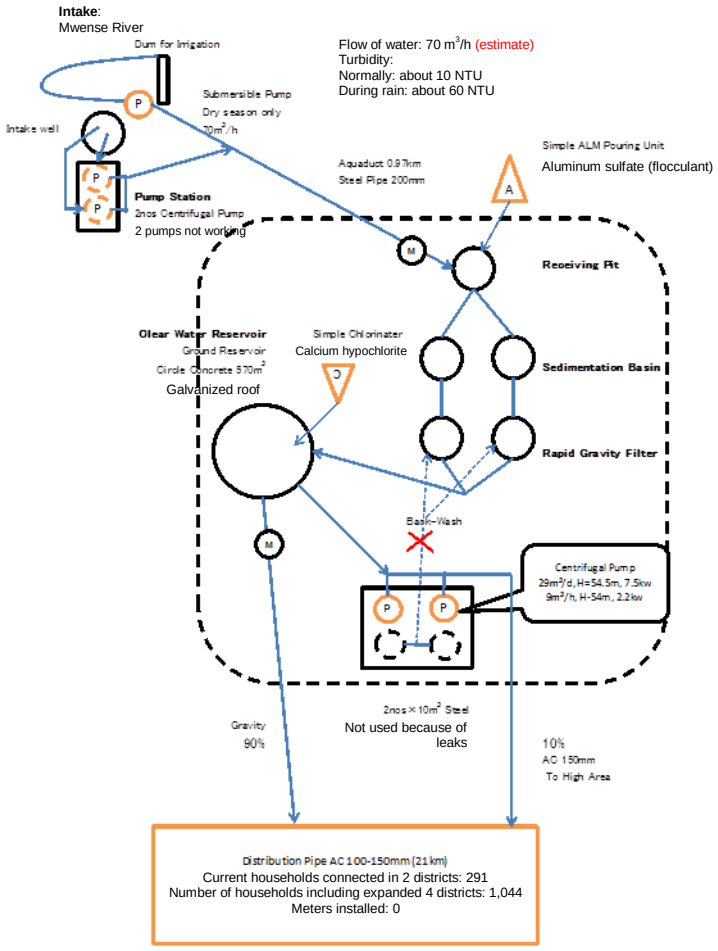

Figure 3-2-6: Schematic diagram of water supply facilities in Mwense

3-2-3 Candidate Projects for Assistance

In the written request for grant aid, which has already been submitted, requests have been made for the improvement and expansion of water supply facilities in five districts that have such urban facilities, as well as for the construction of new water supply facilities in two districts that lack them. However, given certain

geographical conditions and the costs of construction work, covering all of these would be difficult. Therefore, as a result of confirming the order of priority with the MLGH/LPWSC, and based on the results of the field survey, the first candidate project to be proposed for support is the replacement of urban water supply facilities in the provincial capital, Mansa (tentative name: Project for Improving the Urban Water Supply in Mansa City). It was determined that this project would have the largest number of beneficiaries and would have the most impact. Next, the second and third candidate projects to be proposed for support are the improvement and expansion of urban water supply facilities in Nchelenge/Kashikishi and Mwense.

A detailed summary of the first candidate project for support (tentative name: Project for Improving the Urban Water Supply in Mansa City) is contained in Chapter 4 *Outline of the Candidate Projects for Assistance in Target Cities*.

3-3 Current Urban Water Supply Situation at the Western Water and Sanitation Company and Candidate Projects for Assistance

3-3-1 Outline of the Western Water and Sanitation Company

The Western Water and Sanitation Company (WWSC) was established in 2000, but until 2009, poor management meant that no progress was made in improving its water supply service. As a consequence, the management team was completely replaced in September 2009, and it has since been engaged in making improvements. The WWSC provides water supply services in seven districts in Western Province (see Figure 3-3-1).

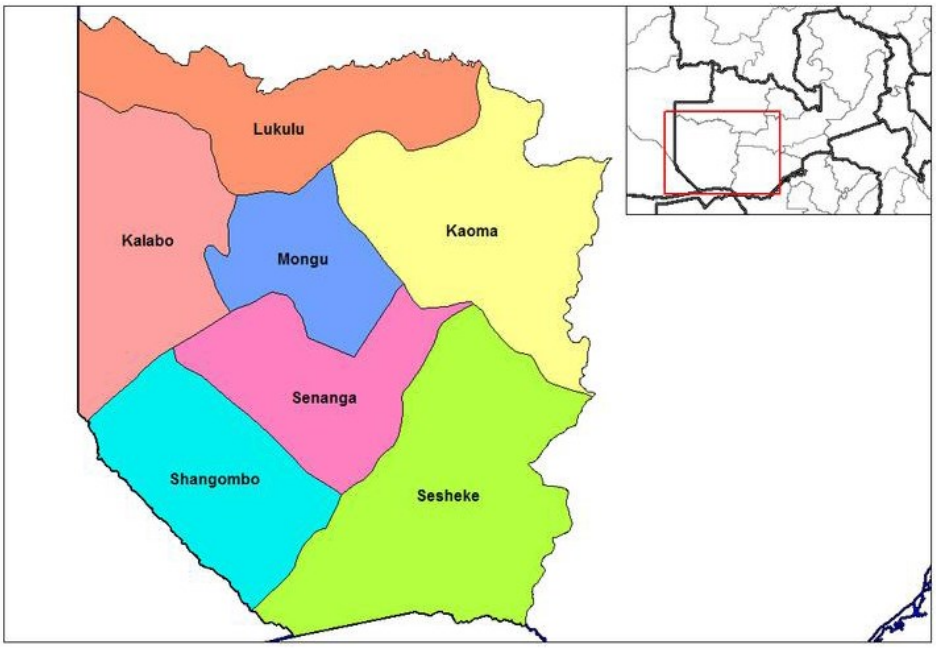

Figure 3-3-1: Administrative divisions (districts) of the Western Province

(1) Business summary

Table 3-3-1 shows the key performance indicators for the WWSC. According to the performance evaluation ranking by NWASCO, the WWSC was ranked ninth among 11 corporations for both 2010/2011 and 2011/2012.

Table 3-3-1: Key performance indicators for the WWSC

Year	Number of connections	Evaluation item								Overall rating
		Non-revenue water (%)	Water quality pass rate (%)	Metering ratio (%)	Water service coverage (%)	Hours of supply (hr/d)	Staff per 1,000 water connections (persons)	Collection efficiency (%)	Rate of cost recovery* (%)	
2010/2011	9,257	45	89	14	51	10	11	75	73	9
2011/2012	10,335	43	86	17	52	9	10	66	63	9

* Rate of cost recovery takes collection efficiency into account (Amount of rates collected / Operation and maintenance costs)

Source: Urban and Peri-Urban Water Supply and Sanitation Sector Report 2010/1011, 2011/2012, NWASCO

1) Number of connections: In one year, the number of connection increased by 1,078 (12%) from 9,257 in 2010/2011 to 10,335. In order to achieve cost recovery, the rate at which connections are increasing needs to be further accelerated.
2) Non-revenue water: Although there has been a slight improvement from 45 percent to 43 percent, non-revenue water remains at a high level. Therefore, it is essential that the water distribution network be repaired and upgraded.
3) Water quality pass rate: The WWSC had the lowest pass rate of all 11 companies, decreasing from 89 percent to 86 percent. The chlorination process at wells, water treatment plants and pumping stations needs to be rechecked, and substandard areas need to be improved in order to raise the pass rate.
4) Metering ratio: The percentage of households with water meters installed increased from 14 percent to 17 percent due to the provision of meters from DANIDA. Under DANIDA's project for the reduction of non-revenue water, water meters have been installed in all households in Kaoma. Given that 100 percent of water meters need to be installed in order to reduce non-revenue water, the WWSC has highlighted the installation of meters in all households as a top-priority project.
5) Water service coverage: This increased by a mere 1 percent, from 51 percent to 52 percent. DANIDA's assistance will conclude, and because the small domestic budget has been allocated to the rehabilitation of existing facilities, the WWSC is not in a position to deal with new construction or expansion work.
6) Hours of supply: This has shortened from an average of ten hours to nine hours. The impact of power failures and voltage drops is considerable, and if the situation remains unchanged, it will be difficult to lengthen the hours of water supply. Therefore, measures are needed such as enhancing the capacity of water storage tanks and installing generators.
7) Staff per 1,000 water connections: The decrease in the number of staff per 1,000 water connections corresponds to the increase in the number of connections.

8) Collection efficiency: This has decreased from 75 percent to 66 percent. At present, the Director of Finance and the Manager of Commercial Services have taken a central role at the WWSC in ensuring that water rates are collected, and there have been signs of improvement. In the second quarter of 2012, the WWSC had achieved a collection efficiency of more than 90 percent.
9) Rate of cost recovery: This has decreased from 73 percent to 63 percent. This is attributable to the aforementioned decrease in collection efficiency, and it remains at a low level, second only to the Luapula Water and Sewerage Company (LPWSC). In order to achieve cost recovery, the collection efficiency needs to be improved, and the existing water distribution network needs to be rehabilitated and upgraded.

Supposing that non-revenue water could be reduced to 21 percent, or half of its current level of 43 percent, if the current capacity of water supply is maintained, it would be possible to supply 1.4 times the current volume of water (that is, the volume of water supply that reaches customers). As a consequence, the customer base would also increase by a factor of 1.4, and cost recovery would become feasible. Particularly in the case of the provincial capital, Mongu, here, work under a DANIDA project is nearing completion to replace the system for conveying water from well water sources, via transmission pipes, to water storage tanks. As long as this water distribution network can be upgraded, then the WWSC should be in a position to expect considerable improvements in non-revenue water.

(2) Organization

The new management team of the WWSC has been actively making improvements under the leadership of its young, 46-year-old Managing Director (MD). Figure 3-3-2 shows an organization chart of the WWSC's management team, and Figure 3-3-3 shows an organization chart of the Technical Services Division. Each district has a branch office, with the District Managers positioned under the Technical Services Division. Table 3-3-2 shows the number of staff at headquarters and at each branch. As of September 2012, staff numbered 105.

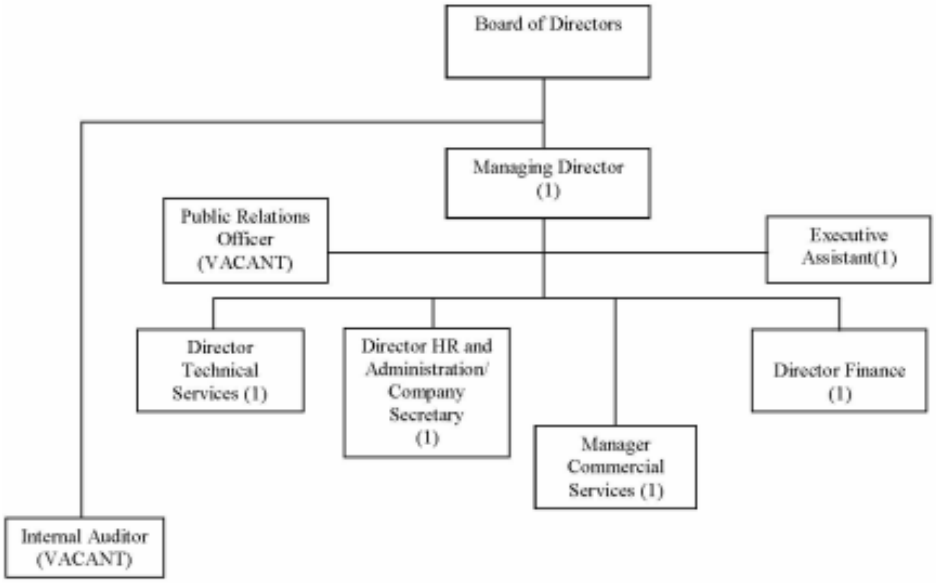

Figure 3-3-2: Organization chart of the WWSC management team

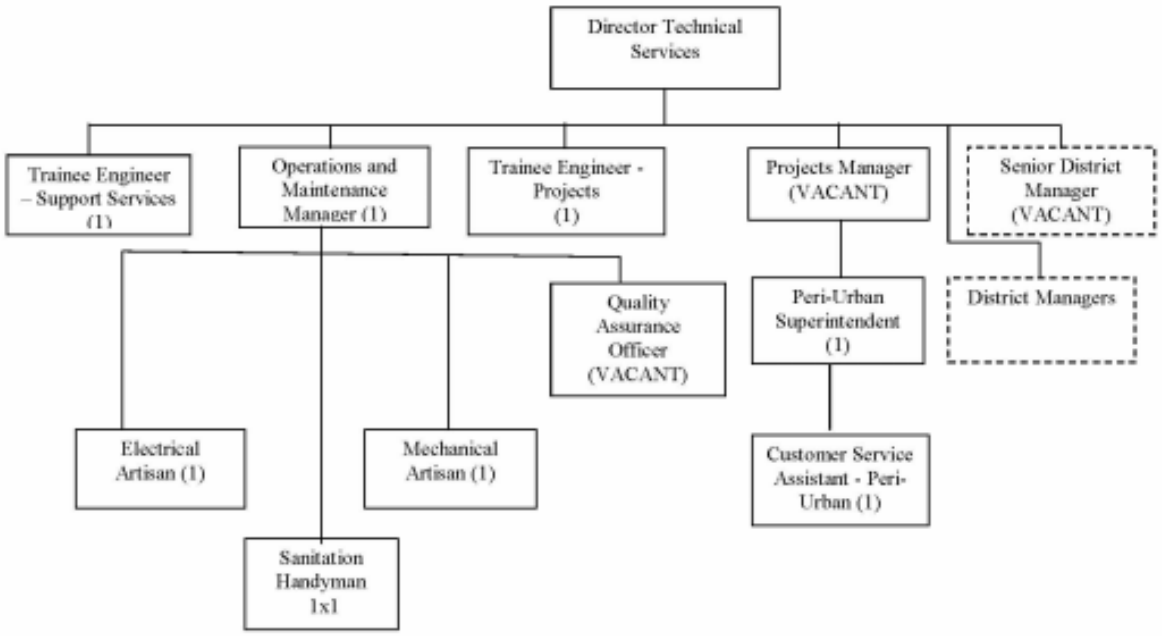

Figure 3-3-3: Organization chart of the WWSC Technical Services Division

Table 3-3-2: Headquarters/branch staff numbers at the WWSC (as of September 2012)

Headquarters (Mongu)	Branch offices							Total
	Mongu	Kaoma	Senanga	Sesheke	Lukulu	Kalabo	Shango-mbo	
31	30	7	7	12	6	6	2	101

Source: WWSC documents

(3) Current state of human resources development

Training of WWSC staff has been conducted out of the WWSC budget and with assistance from DANIDA, GIZ, NWASCO, WASAZA, SIDA[16] and JICA. In 2012, 200 million ZMK (approximately 3 million yen) had been recorded in the WWSC training budget. Overseas training is also provided, with the MD attending training in Denmark (aided by DANIDA) and Sweden (aided by SIDA), and with the Director of Technical Services attending a training course on "Sustainable Urban Water & Sanitation – Integrated Process" in Sri Lanka (aided by SIDA). In addition, the Kaoma District Manager attended a training course on "Leakage Control and the Reduction of Non-Revenue Water" at the Nagoya City Waterworks & Sewerage Bureau for one and a half months from November 2011, as part of JICA's Training and Dialogue Programs.

Table 3-3-3 lists the actual training conducted between 2010 and October 31, 2012. Different training topics have been hosted by different universities, research institutions and manufacturers in Zambia. There were 104 staff members who attended training in 2010, 54 in 2011, and 49 in 2012, making a gross total of 207. All 101 staff members have already attended two training sessions, and thus have acquired a certain degree of required basic knowledge and basic technologies. In terms of current

[16] SIDA: Swedish International Development Agency

priority topics, the WWSC views the acquisition of technology related to maintenance management as essential, and as such, an engineer has already been dispatched from GIZ as discussed below.

Table 3-3-3: Actual training conducted for WWSC staff (2010 - October 31, 2012) (1/2)

Training course	Position (number)	Training location	Duration	Organizer	Funded by
2010					
Water Demand Management	Managing Director Technical Director	Lusaka - Zambia	2 days	WASAZA	WWSC
Non Revenue Water	Senior District Manager District Manager Commercial Manager Customer Services Officer Billing Officer Peri-Urban Superintendent	Lusaka - Zambia	5 days	WASAZA	WWSC
Water Leakage	Technical Director	South Africa	3 days	Global Prospectus Training	DANIDA
ACCA Skills Stage	Financial Accountant	Lusaka - Zambia	12months	ZCAS*	DANIDA
Commercial & Customer Orientation	Assistant Accountant Accounts Assistant District Manager	Lusaka - Zambia	5 days	WASAZA	WASAZA
Total Quality Management & Customer Care	All Employees (91)	Mongu - Zambia	1 Day	Career Prospects	DANIDA
Sub-total (2010)	Total: 104				
2011					
NWASCO Information	Billing Officer	Lusaka - Zambia	1 days	NWASCO	NWASCO
System (NIS)	O& M Manager Ass Accountant Peri Urban Foreman	Lusaka - Zambia	1 days	NWASCO	NWASCO
Piano Billing	Billing Officer Cashier Billing Assistant (2)	Mongu - Zambia	5 days	Software Developer	WWSC
Basic Fire Fighting	Senior District Manager District Manager (5) Plant Operator (7)	Mongu - Zambia	1 day	Circuit Technologies	WWSC
Basic First Aid	Senior District Manager District Manager (5) Plant Operator (8)	Mongu - Zambia	1 day	Zambia Red Cross	WWSC
Organizational Change MGT	Managing Director	Copenhagen - Denmark	18 days		DANIDA
Procurement Course	Procurement Officer	Kampala - Uganda	14 days	Uganda Management Institute	DANIDA
Water quality testing & use of testing kits	Senior District Manager District Manager (5) Plant Operator (8)	Mongu - Zambia	1 day	SWSC**	WWSC
Conflict	Director Human Resource & Admin	Copenhagen - Denmark	24 days	Danish Institute for Human Relations	DANIDA
Leakage Control and the Reduction of Non-Revenue Water	District Manager	Nagoya, Japan	46 days	Training Center, Nagoya City Waterworks & Sewerage Bureau	JICA
Sustainable Urban Water & Sanitation-Intergrated Process	Director Technical Service	Sweden	18 days	LUCE***	SIDA
Sub-total (2011)	Total: 54				

Table 3-3-3: Actual training conducted for WWSC staff (2010 - October 31, 2012) (2/2)

Training course	Position (number)	Training location	Duration	Organizer	Funded by
2012					
Sustainable Urban Water & Sanitation-Intergrated Process	Director Technical Service	Sri- Lanka	14 days	LUCE	SIDA
Certified Ethical Hacker	Billing/ICT Officer	Lusaka - Zambia	5 days	Computer Center - UNZA	WWSC
Public Public Cooperation	Managing Director	Copenhagen - Denmark	25 days	Socialbility	DANIDA
Grundfos Borehole	Senior District Manager	Johannesburg - South Africa	3 days	Grundfos Training	DANIDA
Submersible & Highlift	Mecahnical Artisan	Johannesburg - South Africa	3 days	Academy	DANIDA
Pumps Maintenance	Electrical Artisan	Johannesburg - South Africa	3 days	Academy	DANIDA
Basic GIS Training	Trainee Engineer (2)	Livingstone - Zambia	5 days	Provincial Centre for Geopgaphical	DANIDA
	GIS Technician	Livingstone - Zambia	5 Days	Information Systems	DANIDA
Non Revenue Water	Trainee Engineer (2) Distribution Superintendent	Siavonga - Zambia	5 days	WASAZA	WASAZA
Promoting Governance Integrity & Anti Corruption	Acting Director - Finance	Kampala - Uganda	14 days	International Law Institute	DANIDA
Waveplus Training of Trainers Course on Design of Effective Facilitation	Billing/ICT Officer	Nairobi - Kenya	8 days	Steven Mukibi & Alexander	GIZ
		Lusaka - Zambia	11 days	Nancy Barnes	GIZ
Trade Test 3 Certificate	All Unskilled Plumbers (8)	Mongu - Zambia	6months	Mongu Trades Training Insitute	WWSC
Basic Supervisory Skill	All Supervisory Staffs (7)	Mongu	1 day	Mongu Trades	DANIDA
Customer Service Exellence	All Supervisory Staffs with Front Staff (14)	Mongu	1 day	Career Prospects	DANIDA
HR Skills for Non HR Managers	Director Technical Services Acting Director Finance Commercial Services Manager Trainee Engineer (O & M) Trainee Engineer GIS & Proj Senior District Manager	Mongu	3 days	Career Prospects	DANIDA
Sub-total (2011)	Total: 54				

* ZCAS: Zambia Center for Accountancy Studies
** SWSC: Southern Water and Sewerage Company
*** LUCE: Lund University Commissioned Education

(4) Assistance provided by donors

Assistance provided by DANIDA

Through DANIDA projects, work has been undertaken in the provincial capital, Mongu, to upgrade existing water source wells and conveyance facilities, from transmission pipes to elevated tanks. However, no work has yet been started on the water distribution network beyond that, and so non-revenue water has remained at a high level of 43 percent (2011/2012). As for measures aimed at reducing non-revenue water, a pilot project is being conducted in Kaoma to install meters in all households, develop a system for measuring non-revenue water, and conduct on-the-job training (OJT) in techniques for managing non-revenue water.

Assistance provided by GIZ

At present, the electrical engineer dispatched from GIZ (a development worker with the former Deutscher Entwicklungsdienst (DED, German Development Service)) is permanently stationed in a private office within the Technical Services Division. The terms of reference (TOR) are maintenance management, providing guidance on the maintenance of pumps and electrical equipment. The tenure is for two years, and there is one year remaining.

3-3-2 Current Situation of Urban Water Supply Facilities Managed by WWSC

Table 3-3-4 lists an overview of the population, population served, hours of supply, number of connections and current state of urban water supply facilities in each district in Western Province, as well as the approximate estimates for construction work. Furthermore, Figure 3-3-4 shows the administrative divisions of Western Province, as well as the location of the urban water supply facilities in each district.

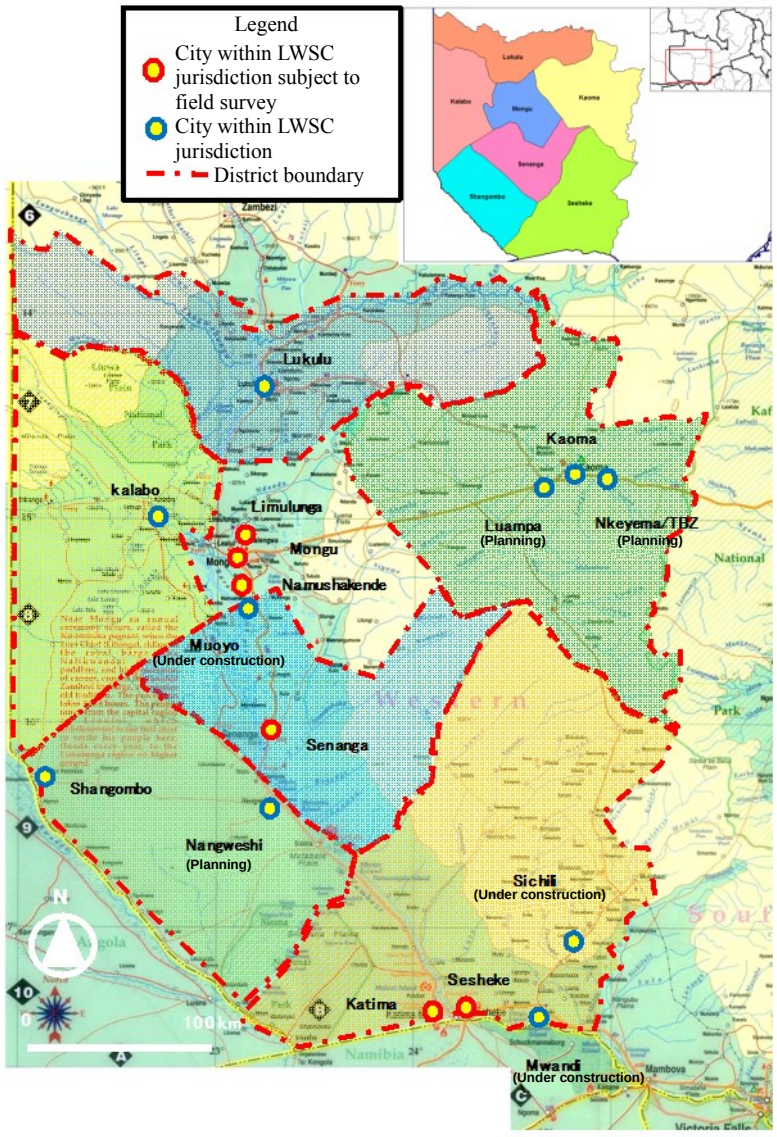

Figure 3-3-4: Administrative divisions of Western Province, and the location of urban water supply facilities

Table 3-3-4: Overview of urban water supply facilities in Western Province

Name of city/district	Mongu District			Senanga District		Sesheke District				Kaoma District	Kalabo District	Lukulu District	Shangombo District
	Mongu	Namushakende	Limulunga	Senanga	Muoyo	Sesheke	Katima	Mwandi	Sichili	Kaoma	Kalabo	Lukulu	Shangombo
Population (2011)	79,794	3,175	8,154	20,287		27,010	5,000			25,110	18,976	14,043	5,204
Number of households (2011)	5,730	208	544	1,460		1,630	301			1,855	1,462	1,128	418
Population served (2011)	61,165	2,858	7,339	16,548		21,133	4,000			15,568	10,437	8,145	-
Hours of supply	10 hours	20 hours	6 hours	11 hours	New water service area (2012/11; Tender Condition)	12 hours	1.25 hours	New water service area (under construction)	New water service area (under construction)	4 hours	18 hours	10 hours	- hours
Volume of water supply (2011)	7,150 m^3/day	230 m^3/day	1,420 m^3/day	2,680 m^3/day		2,800 m^3/day	80 m^3/day			1,4640 m^3/day	1,4570 m^3/day	1,320 m^3/day	-
Revenue water (2011)	5,980 m^3/day	200 m^3/day	480 m^3/day	1,900 m^3/day		1,360 m^3/day	-			1,120 m^3/day	770 m^3/day	850 m^3/day	-
Water demand in current areas (m^3/day) (original unit: 150 liters/person/day)	9,170 m^3/day	430 m^3/day	1,100 m^3/day	2,480 m^3/day		3,170 m^3/day	750 m^3/day			2,340 m^3/day	1,570 m^3/day	1,220 m^3/day	780 m^3/day
Hours of intake pump operation per day	19 hours	13 hours	16 hours	17 hours		18 hours	2 hours			16 hours	21 hours	20 hours	- hours
Organization (personnel)	Headquarters (31), branches under city jurisdiction (27)	Namushakende Branch (2)	Limulunga Branch (6)	Senanga Branch (7)		Sesheke Branch (12)				Kaoma Branch (7)	Kalabo Branch (6)	Lukulu Branch (6)	Shangombo Branch (2)
Current state of water supply services, and demand for new water service connections	Number of connected households: 4,392	Number of connected households: 187	Number of connected households: 490	Number of connected households: 1,191	New water service area (2012/11; Tender Condition)	Number of connected households: 1,275	Number of connected households: 380	New water service area (under construction)	New water service area (under construction)	Number of connected households: 1,150	Number of connected households: 804	Number of connected households: 654	Number of connected households: 33
	Installation of water meters: 5%	Installation of water meters: 30%	Installation of water meters: 5%	Installation of water meters: 10%		Installation of water meters: 17 %	Installation of water meters: 5%			Installation of water meters: 4%	Installation of water meters: 12%	Installation of water meters: 13 %	Installation of water meters: 0%
	Approximately 18,633 people in unserviced areas.	Approximately 317 people in unserviced areas.	Approximately 815 people in unserviced areas.	Approximately 3,739 people in unserviced areas.		Approximately 5,877 people in unserviced areas.	Approximately 1,000 people in unserviced areas.			Approximately 9,542 people in unserviced areas.	Approximately 8,539 people in unserviced areas.	Approximately 5,898 people in unserviced areas.	-
	Number of necessary connections: 1,338	Number of necessary connections: 21	Number of necessary connections: 54	Number of necessary connections: 269		Number of necessary connections: 355	Number of necessary connections: 80			Number of necessary connections: 705	Number of necessary connections: 658	Number of necessary connections: 474	-
	220 households on measured rate system; others on flat rate system.	56 households on measured rate system; others on flat rate system.	25 households on measured rate system; others on flat rate system.	119 households on measured rate system; others on flat rate system.		217 households on measured rate system; others on flat rate system.	20 households on measured rate system; others on flat rate system.			46 households on measured rate system; others on flat rate system.	96 households on measured rate system; others on flat rate system.	85 households on measured rate system; others on flat rate system.	Flat rate system because of lack of water meters.
	Hours of supply are not constant because of power failures and voltage drops.					Hours of supply are not constant because of power failures and voltage drops.				Hours of supply are not constant because of power failures and voltage drops.			
Current state of water supply facilities	Water source: boreholes (14)	Water source: boreholes (2)	Water source: boreholes (3)	Water source: Zambezi River	Water source: borehole	Water source: Zambezi River	Water source: Zambezi River	Water source: borehole	Water source: borehole	Water source: boreholes (3)	Water source: Luanginba River	Water source: boreholes (2)	Water source: boreholes (1)
	Water intake: 806 m^3/hour	Water intake: 57 m^3/hour	Water intake: 172 m^3/hour	Water intake: ∞	New water service area (2012/11; Tender Condition) Plan: Muoyo (4,427 million ZMK by Zambian government) Construction of 3 boreholes, transmission pipes, 2 elevated galvanized panel tanks (254 m^3), 2 kiosks.	Water intake: ∞	Water intake: ∞	New water service area (under construction): 2012/11 Mwandi (28 million ZMK by Zambian government /DANIDA) floating intake, filtration, transmission pipes, distribution pipes, 254 m^3 elevated galvanized panel tank, office, 2 kiosks (under construction); 2013/02 Mwendi (3.10 million ZMK by Zambian government /DANIDA) distribution pipe extension	New water service area (under construction): Sichili (3,900 million ZMK by Zambian government) 2 boreholes, transmission pipes, distribution pipes, 254 m^3 elevated galvanized panel tank, office, 2 kiosks.	Water intake: 172 m^3/hour	Water intake: ∞	Water intake: 115 m^3/hour	Water intake: 57 m^3/hour
	Of the 12 boreholes in the wellfield zone (shores of the Zambezi River), 9 boreholes are operating; within the WTP, 2 boreholes are operating. The water from these wells is conveyed to the WTP clean water reservoir. 1 borehole is operating in St Johon, 1 borehole is operating in Wenela (1 borehole contains a lot of iron, and so is currently not being used), and 1 borehole is operating in Malengwa. At present, 14 boreholes are operational in the city (average 16 Lit/s/well). In the dry season, the groundwater level goes down.	2 of the 3 boreholes on the shores of the Zambezi River are operating (average 16 Lit/s/well). Recently transferred to the WWSC. Equipment is inadequate and deterioration noticeable.	3 of the 7 boreholes are operating. (average 16 Lit/s/well).	Centrifugal pumps (37 kW, 100 m^3/hour; and 45 kW, 150 m^3/hour) have been installed on 2 floating platforms on the Zambezi River.		Centrifugal pump (45 kW, 200 m^3/hour) has been installed on 1 floating platform on the Zambezi River. Zambian government plans to replace pumps.	Centrifugal pump (45 kW, 65 m^3/hour) has been installed on 1 floating platform on the Zambezi River.			3 boreholes are operating.	1 float-type centrifugal pump has been installed on the Luanginba River. Pump capacity is insufficient.	2 boreholes are operating.	1 of 2 boreholes has collapsed.
	The conveyance pipes from the boreholes have not been replaced.		The conveyance pipes from the boreholes (AC pipes) have not been replaced.	Conveyance pipes from water intake to pressure filter (iron pipe ϕ200 mm).		Conveyance pipes from water intake to pressure filter (iron pipe ϕ150 mm).	Conveyance pipes from water intake to pressure filter (iron pipe ϕ200 mm). Has leaks.				Conveyance pipes from water intake to pressure filter.		
	Chlorine is manually injected at the 2 concrete clean water reservoirs (1,000 m^3) within the WTP. At each borehole in St Johon, Wenela and Malengwa, after water is drawn from the well, chlorine is injected using a flow-type chlorinator.	Chlorine is not added.	Chlorine is manually injected in the clean water reservoir (38 m^3) inside the WTP building.	WTP has 4 pressure filter (1989). The piping and valves around the equipment have leaks. 30% loss due to drainpipe valves not shutting. There is a fault in the pressure filter nozzles.		WTP has 4 pressure filter (1989). The piping and valves around the equipment have leaks.	WTP has 4 pressure filter (1986). The piping and valves around the equipment have leaks.			After water is drawn from borehole, chlorine is injected using flow-type chlorinator.	WTP has 4 pressure filter. There is a fault in the pressure filter nozzles.	After water is drawn from the well, chlorine is injected using a flow-type chlorinator. The flow-type chlorinator has stopped working.	After water is drawn from the well, chlorine is injected using a flow-type chlorinator. The flow-type chlorinator has stopped working.
	Of the 7 centrifugal pumps housed in the WTP clean water reservoir building (55 kW, 180 m^3/hour), 3 are standby. Of the 2 Imwiko (booster pump) centrifugal pumps (30 kW, 106 m^3/hour), 1 is standby. Of the 2 Wenela (booster pump) centrifugal pumps (37 kW, 84 m^3/hour), 1 is standby. All pumps installed in DANIDA Phase-1 (2011).		Of the 2 centrifugal pumps housed in the WTP clean water reservoir building (60HP, 200 m^3/hour), 1 + 1. Standby pump needs repairing.	Chlorine injected at exit of pressure filter. No bulk meters.		Chlorine injected at exit of pressure filter. Bulk meter at exit has stopped functioning.	Chlorine injected at exit of pressure filter. No bulk meters.				Chlorine injected at exit of pressure filter. No bulk meters.		

Name of city/district	Mongu District			Senanga District		Sesheke District				Kaoma District	Kalabo District	Lukulu District	Shangombo District
	Mongu	Namushakende	Limulunga	Senanga	Muoyo	Sesheke	Katima	Mwandi	Sichili	Kaoma	Kalabo	Lukulu	Shangombo
Current state of water supply facilities	All transmission pipes have been replaced with ductile cast iron pipe under DANIDA Phase-1 (2011).	Transmission pipes (AC pipe ϕ100 mm) from boreholes have not been replaced, and leaks are conspicuous.	The transmission pipes from the clean water reservoir (AC pipes ϕ200 mm) have not been replaced.	Transmission pipes (AC pipe ϕ100 mm, and AC pipe ϕ200 mm) from the pressure filter have not been replaced.	New water service area (2012/11; Tender Condition)	Transmission pipes (iron pipe 200 mm) from the pressure filter to the 2 elevated tanks in the WTP have not been replaced. Transmission pipes (iron pipe ϕ150 mm) from the pressure filter through the booster pump station to the steel tanks have also not been replaced. No bulk meters.	Transmission pipes (AC pipe ϕ150 mm) from the pressure filter to the elevated tank have not been replaced. No bulk meters.	New water service area (under construction)	New water service area (under construction)	Transmission pipes (PVC pipe) from the boreholes are currently being replaced.	Transmission pipes (AC pipe) from the pressure filter to the elevated tank transmission pipes have not been replaced. No bulk meters.	Transmission pipes (AC pipe) from the boreholes have not been replaced.	There are no problems with the transmission pipes (PVC pipe) from the boreholes.
	Boma: Of the 4 GRP elevated tanks (250 m^3), 1 is deteriorated and so is not used. 1 GRP elevated tank (381 m^3) is scheduled for repair due to leaks. 1 underground concrete tank (900 m^3). With no float valve or level switch, cannot shutdown automatically.	1 GRP elevated tank (186 m^3, H = 8 m) has noticeable leaks due to deterioration. No bulk meters.	1 of the 2 GRP elevated tanks (381 m^3, H = 15 m) is unusable due to deterioration. 1 tank (1989) is currently being used. No bulk meters.	Repairs on 1 of the 2 GRP elevated tanks (Mwananmainji, 441 m^3, H = 15 m) were completed in 2008, and is currently being used. The other tank (Boma) is also currently being used. With no float valve or level switch, cannot shutdown automatically.		There are 2 GRP elevated tanks (381 m^3, H = 15 m) within the WTP. 1 of the tanks (1989) has leaks, and is scheduled for repair by the Zambian government. The other tank (1991) is also currently being used. There are no water level gauges.	There is 1 elevated tank (30 m^3, H = 12 m) which utilizes 3 × 10 m^3 polyethylene tanks. A 100 m^3 GRP elevated tank is under construction next to the existing tank, funded by DTF.			2 GRP elevated tanks (441 m^3, H = 18 m) are currently being repaired.	3 elevated tanks (229 m^3 × 3). With no float valve or level switch, cannot shutdown automatically.	1 GRP elevated tank (441 m^3, H = 12 m) has leaks. No bulk meters. There are no water level gauges.	1 GRP elevated tank. No bulk meters.
	Imwiko: 2 GRP elevated tanks (381 m^3) are scheduled for repair due to leaks. St Johon: 1 GRP elevated tank (441 m^3) is scheduled for repair due to leaks. Wenela: 1 GRP elevated tank (381 m^3). 1 underground concrete tank (900 m^3). Malengwa: 1 GRP elevated tank (250 m^3).					1 centrifugal pump (37 kW, 188 m^3/hour) installed in booster pump station. No standby pumps. Operates 4 hours/day. Rainwater has penetrated the base of the aboveground steel tank (100 m^3). There are plans to construct a 100 m^3 elevated tank, funded by DANIDA.	There is 1 elevated tank (10 m^3, H = 3 m) which utilizes 1 × 10 m^3 polyethylene tank, but this is unusable due to deterioration.						
	Insufficient bulk meters have been installed in the main distribution pipes from each distribution reservoir. Almost all distribution piping in city is AC pipes. Service pipes have been connected haphazardly. Connections are weak.	Bulk meters have not been installed in the main distribution pipes from each distribution reservoir. Almost all distribution piping in city is AC pipes. Service pipes have been connected haphazardly. Connections are weak.	Bulk meters have not been installed in the main distribution pipes from each distribution reservoir. Almost all distribution piping in city is AC pipes. Service pipes have been connected haphazardly. Connections are weak.	Bulk meters have not been installed in the main distribution pipes from each distribution reservoir. Almost all distribution piping in city is AC pipes. Service pipes have been connected haphazardly. Connections are weak.		Bulk meters have not been installed in the main distribution pipes from each distribution reservoir. Almost all distribution piping in city is AC pipes. Service pipes have been connected haphazardly. Connections are weak.	Bulk meters have not been installed in the main distribution pipes from the distribution reservoir. Almost all distribution piping in city is AC pipes. Service pipes have been connected haphazardly. Connections are weak.			Bulk meters have not been installed in the main distribution pipes from each distribution reservoir. Almost all distribution piping in city is AC pipes. Service pipes have been connected haphazardly. Connections are weak.	Bulk meters have not been installed in the main distribution pipes from each distribution reservoir. Almost all distribution piping in city is AC pipes. Service pipes have been connected haphazardly. Connections are weak.	Bulk meters have not been installed in the main distribution pipes from each distribution reservoir. Almost all distribution piping in city is AC pipes. Service pipes have been connected haphazardly. Connections are weak.	Almost all distribution piping in city is PVC pipes.
	Pump motors fail due to frequent power failures, voltage drops and/or excess voltage.					Pump motors fail due to frequent power failures, voltage drops and/or excess voltage.				Pump motors fail due to frequent power failures, voltage drops and/or excess voltage.			
	Water supply is inadequate due to power failures and voltage drops.					Water supply is inadequate due to power failures and voltage drops.				Water supply is inadequate due to power failures and voltage drops.			
Current evaluation of water supply facilities	Boreholes need to be repaired regularly due to collapses caused by deterioration, excessive drawing of water, silt, etc. The DANIDA Phase-1 improvement from the clean water reservoir to each relay reservoir is complete. Distribution pipes from each relay reservoir need to be replaced (from AC pipes to PVC pipes). Service pipes need to be replaced and water meters installed.	Boreholes need to be repaired regularly due to collapses caused by deterioration, excessive drawing of water, silt, etc. Boreholes need to be repaired, and all water conveyance, distribution and supply facilities need to be urgently replaced.	Boreholes need to be repaired regularly due to collapses caused by deterioration, excessive drawing of water, silt, etc. Boreholes need to be repaired, and all water conveyance, treatment, distribution and supply facilities need to be replaced.	Piping and valves, etc. around the pressure filter need to be replaced. Transmission pipes need to be repaired. Distribution pipes need to be replaced (from AC pipes to PVC pipes). Service pipes need to be replaced and water meters installed.		Piping and valves, etc. around the pressure filter need to be replaced. Transmission pipes need to be repaired. Distribution pipes need to be replaced (from AC pipes to PVC pipes). Service pipes need to be replaced and water meters installed.	Piping and valves, etc. around the pressure filter need to be replaced. Transmission pipes need to be repaired. Distribution pipes need to be replaced (from AC pipes to PVC pipes). Service pipes need to be replaced and water meters installed.			Boreholes need to be repaired regularly due to collapses caused by deterioration, excessive drawing of water (in the dry season), silt, etc. Boreholes need to be repaired, and all water distribution and supply facilities need to be replaced.	Capacity of intake pumps needs to be increased. Pressure filters need to be repaired. Transmission pipes need to be repaired. Elevated tanks need to be repaired. Distribution pipes need to be replaced (from AC pipes to PVC pipes). Service pipes need to be replaced and water meters installed.	Boreholes need to be rehabilitated regularly due to collapses caused by deterioration, excessive drawing of water, silt, etc. Boreholes need to be repaired, and all water conveyance, distribution and supply facilities need to be replaced.	1 borehole needs to be constructed.
Facility drawings	No	No	No	No		No	No			No	No	No	No
Piping diagram	Water service plan (GIS)	Water service plan (GIS)	Water service plan (GIS)	Water service plan (GIS)		Water service plan (GIS)	No			Water service plan (GIS)	Water service plan (GIS)	Water service plan (GIS)	Not acquired.

Name of city/district	Mongu District			Senanga District		Sesheke District				Kaoma District	Kalabo District	Lukulu District	Shangombo District
	Mongu	Namushakende	Limulunga	Senanga	Muoyo	Sesheke	Katima	Mwandi	Sichili	Kaoma	Kalabo	Lukulu	Shangombo
Facilities improvement plan (proposed by mission coordinator for water supply facilities)	1. Meet all demand by constructing boreholes. There is an abundant supply of groundwater in the wellfield zone on the east side of Imwiko (16-18 Lit/s).	Repair/improve boreholes. Sink additional boreholes.	Repair/improve boreholes. Sink additional boreholes.	Given the WWSC forecast for population growth, build an additional floating water intake facility (float, centrifugal pump) sourcing water from the Zambezi River.	New water service area (2012/11; Tender Condition)	Build an additional floating water intake facility (float, centrifugal pump) sourcing water from the Zambezi River.	Repair/improve the floating water intake facility (float, centrifugal pump) sourcing water from the Zambezi River.	New water service area (under construction)	New water service area (under construction)	Currently, plans in progress by the donors below.	Increase the capacity of the centrifugal pumps drawing water from the Luanginba River.	Rehabilitate boreholes. Sink additional boreholes.	Sink 1 new borehole.
	2. Water is abstracted from the Zambezi River close to a ferry landing located approximately 25 km upstream. (The Zambezi River is wide, and in the rainy season, approximately 23 km of the river becomes a flood zone. Therefore, the optimal location is a ferry landing on elevated ground close to the main course of the river.)			Repair/improve and lay additional conveyance pipes.		Repair/improve and lay additional conveyance pipes.	Repair/improve conveyance pipes.				Repair/improve conveyance pipes.		
	Repair/improve conveyance pipes (pipes from the boreholes to the clean water reservoir).		Repair/improve small water treatment plant. (pumps, chlorinator, etc.)	Repair/improve and build additional small water treatment plant (pressure filters, chlorinator, piping, valves, etc.).		Repair/improve and build additional small water treatment plant (pressure filters, chlorinator, piping, valves, etc.).	Repair/improve small water treatment plant (pressure filters, chlorinator, piping, valves, etc.).				Repair/improve pressure filter.		
	Lay new transmission pipes.	Replace transmission pipes.	Lay new transmission pipes.	Repair/improve transmission pipes, and lay new transmission pipes (for new tanks).		Repair/improve transmission pipes, and lay new transmission pipes (for new tanks).	Repair/improve transmission pipes.				Repair/improve transmission pipes.	Replace transmission pipes.	
	Install additional elevated tanks.	Construct new elevated tank.	Repair/improve and build additional elevated tanks.	Construct new elevated tank.		Construct new elevated tank.					Repair/improve elevated tanks.	Repair/improve elevated tanks.	
	Replace water distribution network.	Replace water distribution network.	Replace water distribution network.	Replace water distribution network.		Replace water distribution network.	Replace water distribution network.			Replace water distribution network.	Replace water distribution network.	Replace water distribution network.	Replace water distribution network.
	Expand water distribution network.	Expand water distribution network.	Expand water distribution network.	Expand water distribution network.		Expand water distribution network.	Expand water distribution network.			Expand water distribution network.	Expand water distribution network.	Expand water distribution network.	Expand water distribution network.
	Install generators.	Install generators.	Install generators.	Install generators.		Install generators.	Install generators.			Install generators.	Install generators.	Install generators.	Install generators.
	Install water meters.	Install water meters.	Install water meters.	Install water meters.		Install water meters.	Install water meters.			Install water meters.	Install water meters.	Install water meters.	Install water meters.
Summary of facilities improvement plan (proposed by mission coordinator for water supply facilities)	There is an abundant supply of groundwater. Therefore, use boreholes to meet demand for expanded area. Boreholes, transmission pipes, chlorine (expanded area) + elevated tank (expanded area) + distribution pipes (repair/improve existing pipes + extend new pipes).	Boreholes sourcing water from the shores of Zambezi River (repair/improve existing boreholes, or sink new boreholes) + transmission pipes (improvement) + chlorine + elevated tank (new) + distribution pipes (repair/improve existing pipes + extend new pipes).	Boreholes (rehabilitate existing boreholes, or sink new boreholes) + conveyance pipes (improvement) + simple clean water reservoir (improvement) + transmission pipes (improvement) + elevated tank (new) + distribution pipes (repair/improve existing pipes + extend new pipes).	Construct new floating water intake facility on the Zambezi River + repair/improve and lay new conveyance pipes/pressure filters/chlorinator/transmission pipes + construct new elevated tank + distribution pipes (repair/improve existing pipes + extend new pipes).		Construct new floating water intake facility on the Zambezi River + repair/improve and lay new conveyance pipes/pressure filters/chlorinator/transmission pipes + construct new elevated tank + distribution pipes (repair/improve existing pipes + extend new pipes).	Repair/improve floating water intake facility on the Zambezi River + repair/improve conveyance pipes/pressure filters/chlorinator/transmission pipes + distribution pipes (repair/improve existing pipes + extend new pipes).			Distribution pipes (repair/improve existing pipes + extend new pipes).	Repair/improve floating water intake facility on the Luanginba River + repair/improve conveyance pipes/pressure filters/chlorinator/transmission pipes + repair/improve elevated tank + distribution pipes (repair/improve existing pipes + extend new pipes).	Boreholes (repair/improve existing boreholes, or sink new boreholes) + transmission pipes (improvement) + chlorine + elevated tank (improvement) + distribution pipes (repair/improve existing pipes + extend new pipes).	Boreholes (sink new boreholes) + distribution pipes (repair/improve existing pipes + extend new pipes).
Amount of water demand including piping expansion (m^3/day) (original unit: 150 liters/person/day)	12,000 m^3/day	480 m^3/day	1,230 m^3/day	3,050 m^3/day		4,050 m^3/day	750 m^3/day			—	—	—	—
Donor support / domestic budget	Planning stage: remaining work from DANIDA Phase-1 Mongu (2,281 million ZMK by Zambian government) 1 borehole + transmission pipes (Imwiko), repair/improve 4 elevated tanks (2 in Imwiko, 1 in Boma, 1 in St Johon) Provide 1,000 saddle ferrules					Implementation stage: 2012/11 Sesheke (736 million ZMK by Zambian government) Repair/improve elevated tank Construct floating water intake, 100 m^3 elevated galvanized panel tank				(2012/11; Tender Condition) Kaoma (5,527 million ZMK by Zambian government) Construct 2 boreholes, transmission pipes, 2 × 254 m^3 elevated galvanized panel tanks, 1 kiosk			
	Implementation stage: 2012/11 Mandanga area (1,600 million ZMK by DTF) 2 boreholes, transmission pipes, distribution pipes, 100 m^3 elevated galvanized panel tank, office, 4 kiosks									Implementation stage: 2012/12 Kaoma (3,400 million ZMK by Zambian government /DANIDA) Repair/improve 2 boreholes, transmission pipes, distribution pipes, water pump, 2 elevated tanks Construct 2 boreholes, transmission pipes, 254 m^3 elevated galvanized panel tank			
	Implementation stage: 2012/01 Mongu (2,100 million ZMK by Zambian government /DANIDA) Install 3,150 water meters							Implementation stage: 2013/02 Mwandi (210 million ZMK by Zambian government /DANIDA) Install 150 water meters		Implementation stage: 2013/02 Kaoma (940 million ZMK by Zambian government /DANIDA) Install 1,200 water meters			
Amount requested (billion ZMK)	38.15 (570 million yen)	1.84 (30 million yen)	4.69 (70 million yen)	12.71 (190 million yen)		12.04 (180 million yen)				10.05 (150 million yen)	11.03 (170 million yen)	4.92 (50 million yen)	1.14 (20 million yen)
Approximate estimate (JPY billion)	2.0-2.5	0.5	0.5	1.0-1.5		1.0-1.5	0.5			—	—	—	—
MLGH priority	○												
WWSC order of priority	1			2		3							
JICA evaluated order	1			2		3							

In this study, field surveys were conducted on the urban water supply facilities in three areas that were given high priority at the request of the WWSC, namely: the provincial capital, Mongu, the Senanga District, and the Sesheke District. Following is a detailed account of the results of the field surveys.

(1) Current state of urban water supply facilities in Mongu

According to 2011 data from the WWSC, the population of Mongu is 79,794, its water supply coverage is 77 percent, and its population served is approximately 61,165. Its average volume of water supply is 7,150 m^3/day, and its non-revenue water is relatively low at 16 percent. Residents not connected to the water supply use shallow wells. Water meters have been installed at 220 of the 4,392 households connected to the water supply, and with provision of an extra 3,150 meters from DANIDA, more are currently being installed. Figure 3-3-5 shows a schematic diagram of the water supply facilities in Mongu.

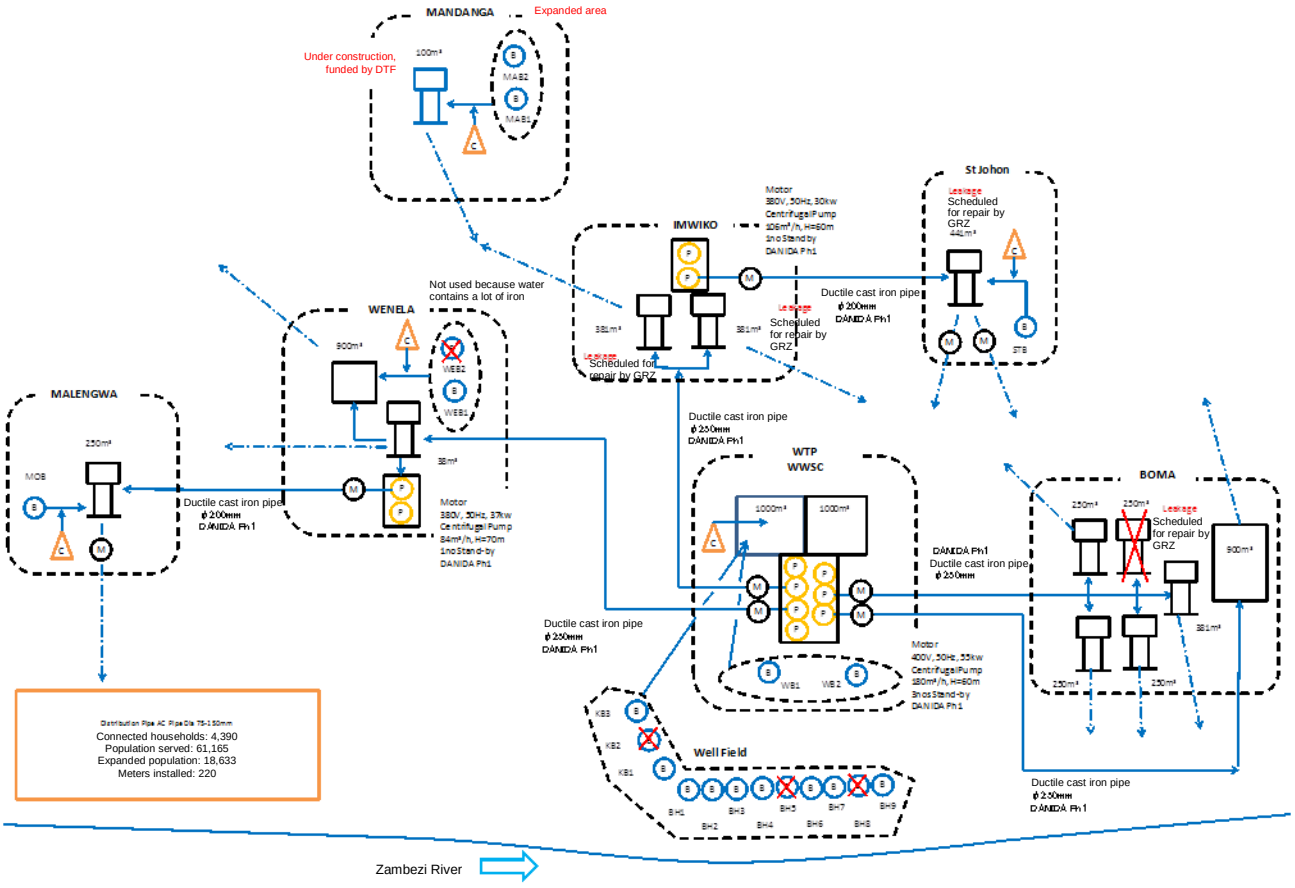

Figure 3-3-5: Schematic diagram of water supply facilities in Mongu

In Mongu, there is a wellfield (length: approximately 2 km, width: approximately 500 m) located on the shores of the Zambezi River, approximately 200 m to the west of the WWSC office. There is an abundant supply of groundwater here, with 11 boreholes in operation, each with a potential unit pumpage of 58-65 m^3/hour/well (average depth of borehole: 100 m). Water drawn from boreholes is also conveyed to tanks in three areas within the city where there are relay tanks. Water is conveyed from

the wellfield to a clean water reservoir where chlorine is added, before water pumps are used to convey the water to distribution reservoirs in Boma, Imwiko and Wenela.

From Boma, water is distributed within the city by gravity. In Imwiko, water is distributed within the city by gravity, and is conveyed to the distribution reservoir in St. Johon. In St. Johon, water conveyed from Imwiko and water drawn from boreholes passes through an elevated tank, and is distributed within the city by gravity. In Wenela, water conveyed from a clean water reservoir and water drawn from boreholes passes through a distribution reservoir, and is distributed within the city by gravity. Some of the water is conveyed to Malengwa. In Malengwa, water conveyed from Wenela and water drawn from boreholes passes through an elevated tank, and is distributed within the city by gravity. Furthermore, in Mandanga, a package of water supply facilities, including boreholes, an elevated tank and distribution pipes, are under construction, funded by the DTF.

The quality of water drawn from boreholes is essentially good, and there is an abundant volume available. It should be noted that one of the two boreholes in Wenela has a lot of iron, and so is currently not being used. Also, leaks have been seen in four places on the elevated tank, and there are plans to repair them from within the budget of the Zambian government. As for the water pumps and transmission pipes to each relay location, repair and improvement work was undertaken as part of the DANIDA Phase-1 projects, and no problems have been observed.

Although there is a pipe network diagram for distribution pipes which was developed using a GIS mapping system and with assistance from DANIDA, according to the WWSC, the diagram is not very reliable. Moreover, most distribution pipes are AC pipes, and they need to be replaced. Furthermore, obtaining a stable supply of power is not possible, and as a consequence of power failures and voltage drops, operating hours are constrained. In addition, excess voltages lead to motors seizing and repeated breakdowns, which result in mounting repair costs.

(2) Current state of urban water supply facilities in Senanga

According to 2011 data from the WWSC, the population of Senanga is 20,287, its water supply coverage is 82 percent, and its population served is approximately 16,548. Its average volume of water supply is 2,800 m^3/day, and its non-revenue water is relatively low at 29 percent. Residents not connected to the water supply use shallow wells. Water meters have been installed at 119 of the 1,191 households connected to the water supply. Figure 3-3-6 shows a schematic diagram of the water supply facilities in Senanga.

In Senanga, water is drawn from the Zambezi River via a floating intake equipped with a centrifugal pump. After being filtered through pressure filters, chlorine is added, and the water is conveyed to individual distribution reservoirs. From the reservoirs, water is distributed within the city by gravity. As for the water drawn from the Zambezi River, during the rainy season, the river level rises about 5 m, but the turbidity of the water remains relatively low (normal times: 10 NTU, during rain: 20 NTU). The pressure filters were installed in 1989 and are in good condition, but faults in the surrounding valves have been observed. Given that turbidity is relatively low, and given the economic efficiency of being able to convey water to the elevated tank using one pump, the situation is suited to treatment via pressure filters. One drawback, however, is that it is difficult to inspect the filter media, and so replacing

them is neglected. Even though backwashing is done every month, the filter media have only been replaced once two years ago.

As with Mongu, although there is a pipe network diagram for distribution pipes which was developed using a GIS mapping system and with assistance from DANIDA, according to the WWSC, the diagram is not very reliable. Moreover, most distribution pipes are AC pipes, and they need to be replaced. Again, as with Mongu, obtaining a stable supply of power is not possible, and as a consequence of power failures and voltage drops, operating hours are constrained. In addition, excess voltages lead to motors seizing and repeated breakdowns, which result in mounting repair costs.

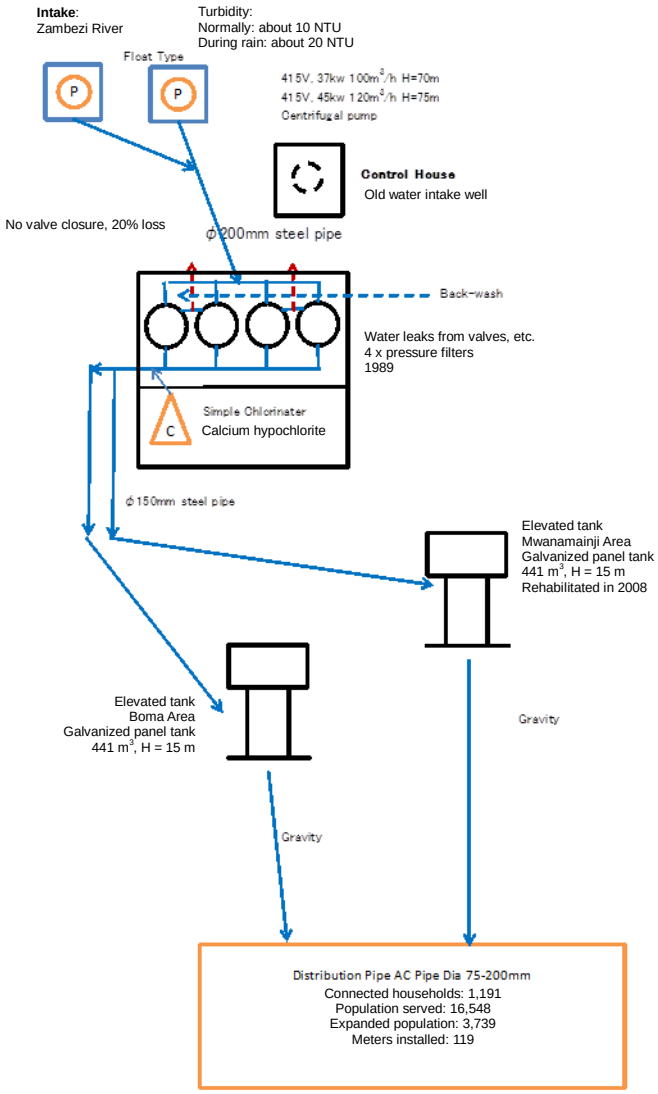

Figure 3-3-6: Schematic diagram of water supply facilities in Senanga

(3) Current state of urban water supply facilities in Sesheke

According to 2011 data from the WWSC, the population of Sesheke is 27,010, its water supply coverage is 78 percent, and its population served is approximately 21,133. Its average volume of water supply is 2,800 m^3/day, but its non-revenue water is high at 51 percent. Residents not connected to the water supply use

shallow wells. Water meters have been installed at only 217 of the 1,275 households connected to the water supply. Figure 3-3-7 shows a schematic diagram of the water supply facilities in Sesheke.

In Sesheke, water is drawn from the Zambezi River via a floating intake equipped with a centrifugal pump. After being filtered through pressure filters, chlorine is added, and the water is conveyed to individual distribution reservoirs. From the reservoirs, water is distributed within the city by gravity. Some water is also conveyed to the distribution reservoirs via a booster pump. The condition of the distribution pipes and the power supply situation is similar to Senanga mentioned above.

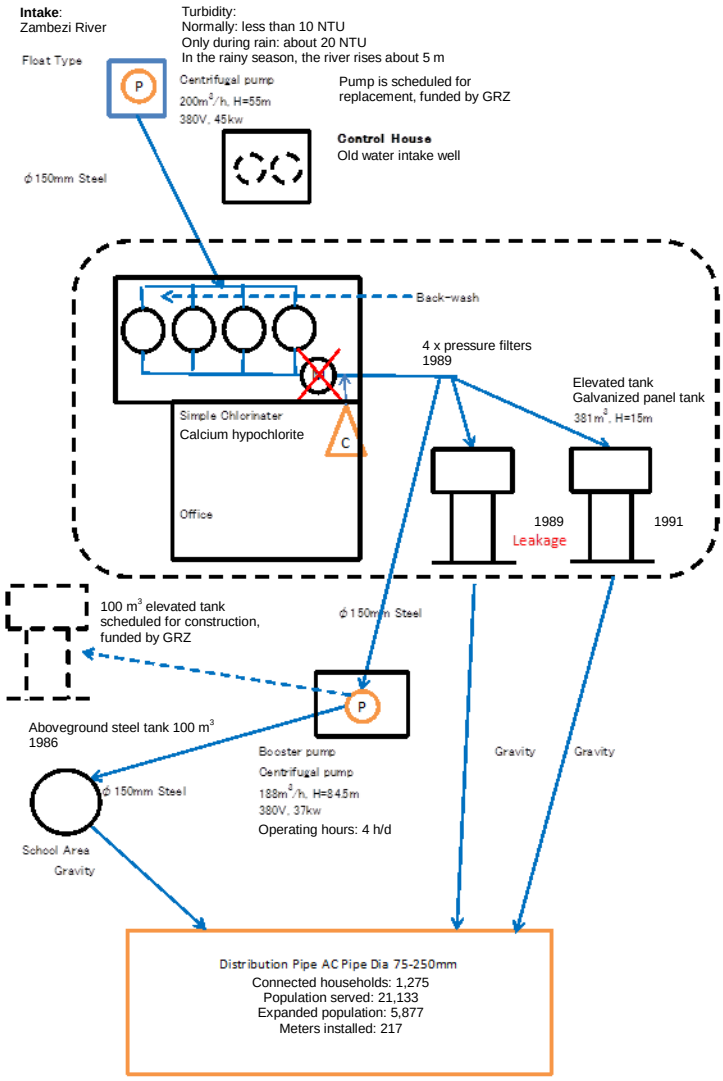

Figure 3-3-7: Schematic diagram of water supply facilities in Sesheke

3-3-3 Candidate Projects for Assistance

In April 2012, the WWSC drafted the *Business Plan 2012-2015* which contained a list of necessary projects. During the visit made by the mission, the WWSC produced a list of projects plus their order of priority in the form of a request to JICA. This is shown in Table 3-3-5.

Table 3-3-5: List of projects and order of priority

Priority	Project	Overview of construction works	Counterparty estimate (ZMK)	Outcome / benefit
1	100% installation of water meters	Provision and installation of 12,103 water meters	10,529,610,000 (approximately 160 million yen)	• 100% installation of water meters • Improvement in rates collection • Improvement in distribution management
2	**Improvement and expansion of water supply facilities in Senanga**	Construction of small water treatment facility, elevated tank with capacity of 551 m^3, improvement and new expansion of existing water distribution network	11,550,000,000 (approximately 170 million yen)	• Improvement in water supply services • Expansion of water supply service area
3	**Replacement and expansion of the water distribution network in Mongu (Kasima area)**	Construction of 4 boreholes, 2 elevated tanks with capacity of 551 m^3, replacement and new expansion of existing water distribution network	36,270,000,000 (approximately 540 million yen)	• Improvement in water supply services • Expansion of water supply service area
4	**Improvement and expansion of water supply facilities in Sesheke**	Construction of small water treatment facility, improvement and new expansion of existing water distribution network	10,630,000,000 (approximately 160 million yen)	• Improvement in water supply services • Expansion of water supply service area
5	Installation of generators	Installation of 110kW generators (Mongu, Kaoma, Senanga, Sesheke, Kalabo)	1,575,000,000 (approximately 26 million yen)	• Guarantee of power source during power failures • Stable water supply service
6	Improvement and expansion of water supply facilities in Lukulu, Kalabo, Kaoma, Mwandi, Sichili, Limulunga, Namushakende and Shangombo	Improvement and new expansion of existing water distribution network, construction of small water treatment facility in Kalabo, construction of 8 boreholes (Shangombo, Lukulu)	33,524,000,000 (approximately 500 million yen)	• Improvement in water supply services • Expansion of water supply service area
7	Construction of new water supply facilities in Nkeyema, Luampa, Nangweshi and Mulobezi	Construction of water distribution network and water storage tanks, construction of small water treatment facility in Nangweshi, construction of 10 boreholes (Nkeyema, Luampa, Mulobezi)	22,015,000,000 (approximately 330 million yen)	• Improvement in water supply services • Expansion of water supply service area
8	Construction of rate collection offices in branches	Construction of offices (Senanga, Sesheke, Kalabo, Lukulu, Limulunga, Manushakende and Shangombo)	4,800,000,000 (approximately 72 million yen)	• Improvement in customer service
9	Telemeters	Installation of telemeters at all water treatment plants	4,440,000,000 (approximately 66 million yen)	• Improvement in the management of water production

Source: WWSC, JICA Data Collection Visit 2012

Examination of candidate projects for support

As a result of confirming the above order of priority with the WWSC, and based on the results of the field survey, the first candidate project to be proposed for support is the replacement and expansion of the water distribution network in the provincial capital, Mongu (tentative name: Project for Improving the Urban Water Supply in Mongu City). It was determined that this project would have the largest number of beneficiaries, and because work to replace water source wells and conveyance facilities is already being performed by DANIDA, the project would also have an extensive effect on achieving improvements in water supply services, and so would have the most impact.

Next, the second and third candidate projects to be proposed for support are the improvement and expansion of water supply facilities in Senanga and Sesheke, which accords with the WWSC's order of priority. As for installation of water meters in all households in all districts, which is the first priority of the WWSC, it would appear that the most realistic approach would be to provide water meters for all households that are located in the districts actually targeted by the projects.

The WWSC's counterparty estimates listed in Table 3-3-5 assume a minimum amount of construction work. As a result of this survey, replacing the existing aging asbestos pipes, etc. requires a complete overhaul, and if this was to be conducted using grant aid, an allowance would need to be made equivalent to two or three times this estimate.

A detailed summary of the first candidate project for support (tentative name: Project for Improving the Urban Water Supply in Mongu City) is contained in Chapter 4 *Outline of the Candidate Projects for Assistance in Target Cities*.

Chapter 4 Outline of the Candidate Projects for Assistance in Target Cities

Following is a detailed summary of the candidate projects for support which were listed in Chapter 3 *Current Situation of the Urban Water Supply in Target Cities and Candidate Projects for Assistance*.

4-1 Outline of the Project for Improving the Urban Water Supply in Lusaka

The *Project for Improving the Urban Water Supply in Lusaka City* (tentative name) is the top-priority project for the LWSC. The project has the greatest impact, but it also requires an investment of US$314 million. Since it would constitute a large-scale ODA loan project, it is envisaged that it would be divided into phases and cofinanced with other donors.

(1) Expected results

1) Water supply services will improve as a consequence of improving urban water supply facilities in the Zambian capital city of Lusaka.
2) Providing a stable supply of safe drinking water will lead to a decrease in the use of shallow wells, which are a cause of water-borne diseases, and will help improve the living conditions and sanitation of residents.
3) Increasing the customer base and reducing non-revenue water will lead to better cost recovery.

(2) Plan parameters

Target year	2015
Source of water	River water from the Kafue River and groundwater from boreholes in Lusaka
Expected population served	1,740,000
Original unit (average)	Lusaka design standard (H-Cost 280 liters/person/day, M-Cost 150 liters/person/day, L-Cost 100 liters/person/day, etc.)[17]
Design water supply	660,000 m^3/day (including non-revenue water of 25%)
Water supply in 2015	325,0000 m^3/day Kafue River: Iolanda Water Treatment Plant: 110,000 m^3/day (scheduled for improvement by the MCC) New Iolanda Water Treatment Plant: 50,000 m^3/day (scheduled for construction by China) City boreholes: 130,000 m^3/day (existing boreholes) 15,000 m^3/day (10 boreholes under construction by the WB)[18] 20,000 m^3/day (16 subsidiary boreholes scheduled for construction by the LWSC)
Water supply shortfall in 2015	335,000 m^3/day (660,000 m^3/day - 325,0000 m^3/day) Kafue River: New Iolanda Water Treatment Plant: 320,000 m^3/day (unprovided) City boreholes: 15,000 m^3/day (unprovided)

[17] H-cost (High Coat Houses) basically indicates a house with a floor space of at least 120 m^2. M-Cost (Medium Cost Houses) indicates a standard house with a floor space of 90-100 m^2, and L-Cost (Low Cost Houses) indicates a house with a floor space of no more than 60 m^2.

[18] The "remaining available groundwater that could be pumped is approximately 50,000 m^3/day" stated in Chapter 3 near the top of page 3-14 represents the following figures contained in the table above: 15,000 m^3/day (10 boreholes under construction by the WB), 20,000 m^3/day (16 subsidiary boreholes scheduled for construction by the LWSC), and 15,000 m^3/day (unprovided).

(3) Outline of proposed facilities

a) Intake tower (new): intake tower, intake pump (near existing facilities)

b) Conveyance pipes (new): ϕ1,400 mm ductile cast iron pipe, approximately 1.5 km (alongside existing pipes)

c) Water treatment plant (new): 320,000 m^3/day (near existing facilities)

d) Transmission pipes (new): ϕ1,400 mm ductile cast iron pipe, approximately 50 km (alongside existing pipes)

e) Booster pump station (new): (near existing facilities)

f) Receiving tank in city (new): approximately 13,000 m^3, near the Stuart Park distribution reservoir

Compared to the volume of water drawn from the river outlined above, the volume of water drawn from the boreholes below is relatively small and the cost of construction is also small. Since this work could be carried out by the LWSC, it is excluded from this plan.

g) Boreholes (new): 10 boreholes (15,000 m^3/day)

Since the following would be carried out after the construction work listed in a) to f) above, they are excluded from this plan.

h) Booster pump station (new): From the receiving tank to each relay tanks, between relay tanks

i) Transmission pipes in city (extension): From the receiving tank to each relay tanks, between relay tanks

j) Relay tanks in city (additional)

Since the replacement and expansion of distribution pipes in the following areas are low in the order of priority, they are excluded from this plan.

k) Replacement and expansion of distribution pipes in the Lumumba area

l) Replacement and expansion of distribution pipes in the Kabulonga area

m) Replacement and expansion of distribution pipes in the Kabwata area

Since the replacement and expansion of distribution pipes in the following areas will be conducted as part of the MCC compact projects, they are excluded from this plan.

n) Replacement and expansion of distribution pipes in the Chelston area

o) Replacement and expansion of distribution pipes in the Central area

(4) Estimated construction costs

Estimated construction costs: 314 million US$

Breakdown of construction work:

Itemized work	Amount (million US$)	
Construction in a)	49.7	149
Construction in b)	9.3	
Construction in c)	90.0	
Construction in d)	138.6	155
Construction in e)	16.4	
Construction in f)	10.0	10
Total		314.0

Source: Water Supply Investment Master Plan Lusaka, Zambia, Final Report, MCC (2011)

(5) Proposals for project implementation

The construction plans a) through e) above relate to the construction of a series of facilities for supplying water in Lusaka (water intake, water treatment and water conveyance). If even part of any of these construction works was absent, supplying water would no longer be possible. Given the high

construction costs, it would be difficult for a single donor to implement them all single handedly. But, assuming that donors cooperate in implementing the series of construction work, as long as the scope of work can be divided and coordinated, the plan should be adequately feasible.

If carrying out the construction work in sections, then in terms of workability, processes, safety and quality, it seems that it would be better to implement it separately in each construction zone. From the water intake facilities in a), b) and c), to the water treatment plant, and transmission-related facilities and the receiving tank in Lusaka in d), e) and f). On the other hand, if meetings can be held frequently for coordinating among contractors and donors, and if duplication of construction sites and materials delivery dates, etc. can be avoided, then implementing a), b), c), d), e) and f) separately for each facility is also possible.

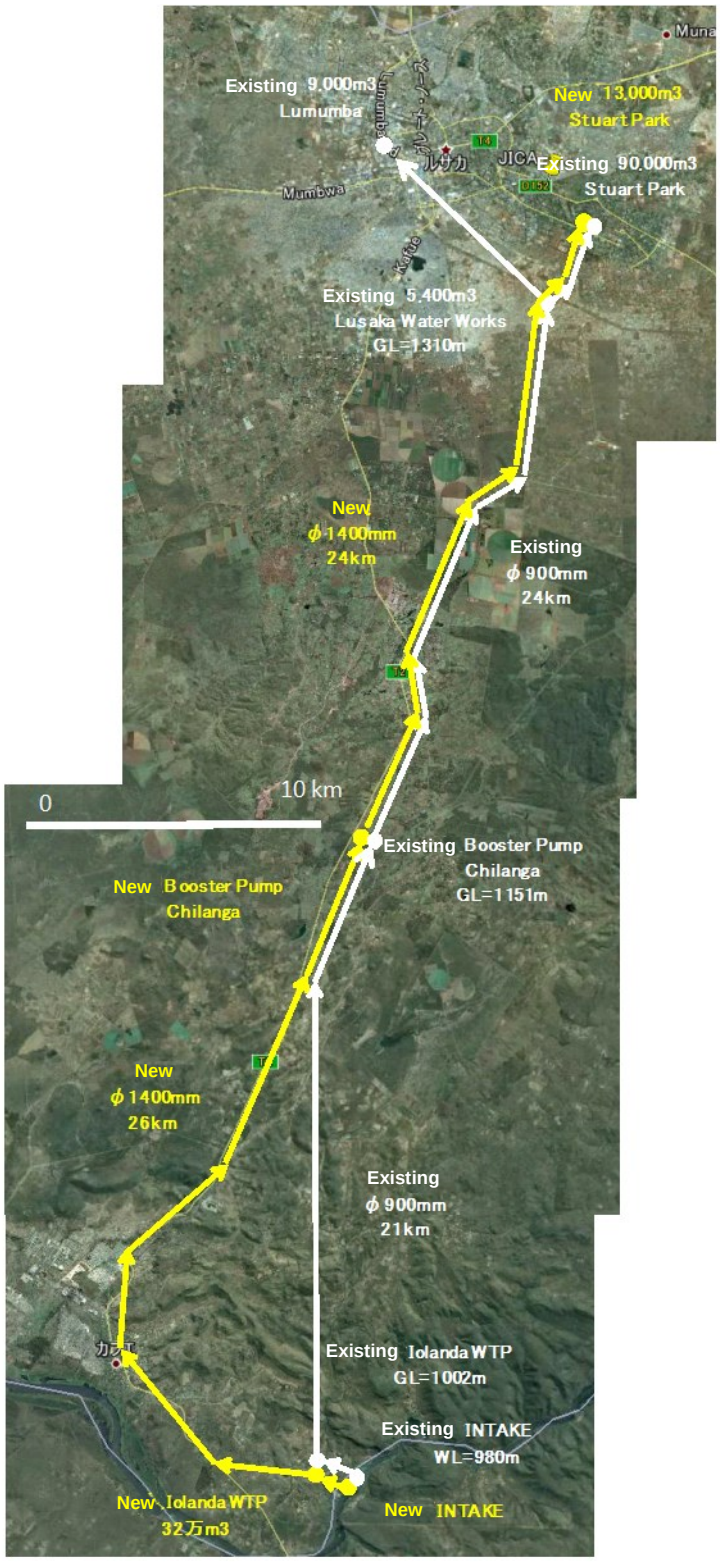

Figure 4-1-1: Locations of the intakes and Iolanda Water Treatment Plant to the receiving tank in Lusaka

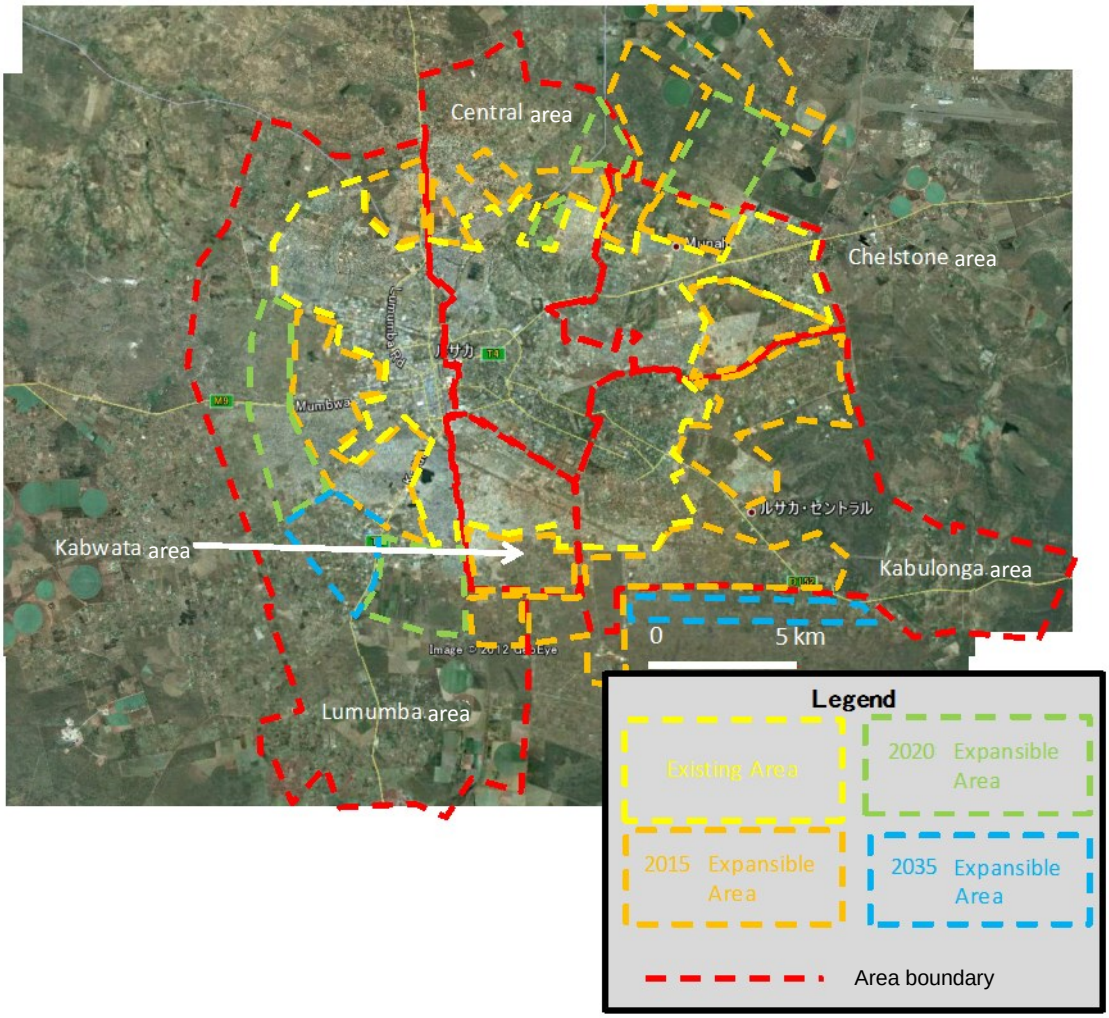

Figure 4-1-2: Map of the planned expansion of water service areas in Lusaka, by year

4-2 Outline of the Project for Improving the Urban Water Supply in Kafue

The *Project for Improving the Urban Water Supply in Kafue City* (tentative name) is the second project according to the LWSC's order of priority. Its estimated construction costs until 2020 are approximately 2,300 million yen. The LWSC has already achieved cost recovery, and has embarked on a stage of self-financing facilities maintenance as a commercial-oriented enterprise, and so it is envisaged that this project would be funded by ODA loans.

(1) Expected results

1) Water supply services will improve as a consequence of improving urban water supply facilities in Kafue, a place in Lusaka Province where rapid development has been achieved.
2) Providing a stable supply of safe drinking water will lead to a decrease in the use of shallow wells, which are a cause of water-borne diseases, and will help improve the living conditions and sanitation of residents.
3) Increasing the customer base and reducing non-revenue water will lead to better cost recovery.

(2) Plan parameters

Target year	2020
Source of water	River water from the Kafue River and groundwater from boreholes along the shores of the Kafue River
Expected population served	124,200 (9,600 taps) Existing water service area: 73,600 (5,600 taps) Expansible water service area: 15,100 (1,200 taps) Population increase: 35,500 (2,800 taps)
Original unit (average)	Lusaka design standard (H-Cost 280 liters/person/day, M-Cost 150 liters/person/day, L-Cost 100 liters/person/day, etc.)
Operating hours	19 hours on average
Design water intake	25,100 m^3/day Kafue River: 22,000 m^3/day, and boreholes: 3,100 m^3/day
Design water supply	25,100 m^3/day Existing water service area: 18,300 m^3/day Expansible water service area: 3,900 m^3/day Population increase: 2,900 m^3/day
Number of beneficiaries	50,600
Number of quasi-beneficiaries	73,600 (existing beneficiaries)

(3) Outline of proposed facilities

a) Intake tower (improvement): 2 × intake pumps, dredging of waterways, etc.
b) Transmission pipes (improvement): Repair of ϕ600 mm steel pipes
c) Boreholes (new): 4 × boreholes (depth: 100 m, diameter: 150 mm), submersible pump
d) Control room/chlorinator for boreholes (new): 2 sets, 4 × generators
e) Transmission pipes for boreholes: As far as the clean water reservoirs of existing water treatment plants.
f) Elevated tank (new): 2 × elevated tank (400 m^3)
g) Water distribution network (improvement + new construction): ϕ400 mm - 75 mm PVC pipes, existing supply area (approximately 15 km^2) + expansible area (approximately 21 km^2)
h) Generators (new): 7 (4 × intake pumps, 3 × booster pumps)

Work for connecting service pipes and installing water meters is to be undertaken by the counterparty. Only materials are to be provided.

i) Service pipes (provision): For 9,600 taps, ϕ25 mm - 50 mm HDP, saddle, sluice valve, etc.
j) Water meters (provision): 5,500 (existing area: 1,500, expanded area: 1,200, population increase: 2,800)

Improvement work is currently being undertaken on the existing water treatment plant, funded by WB. It would appear that there are no particular problems.

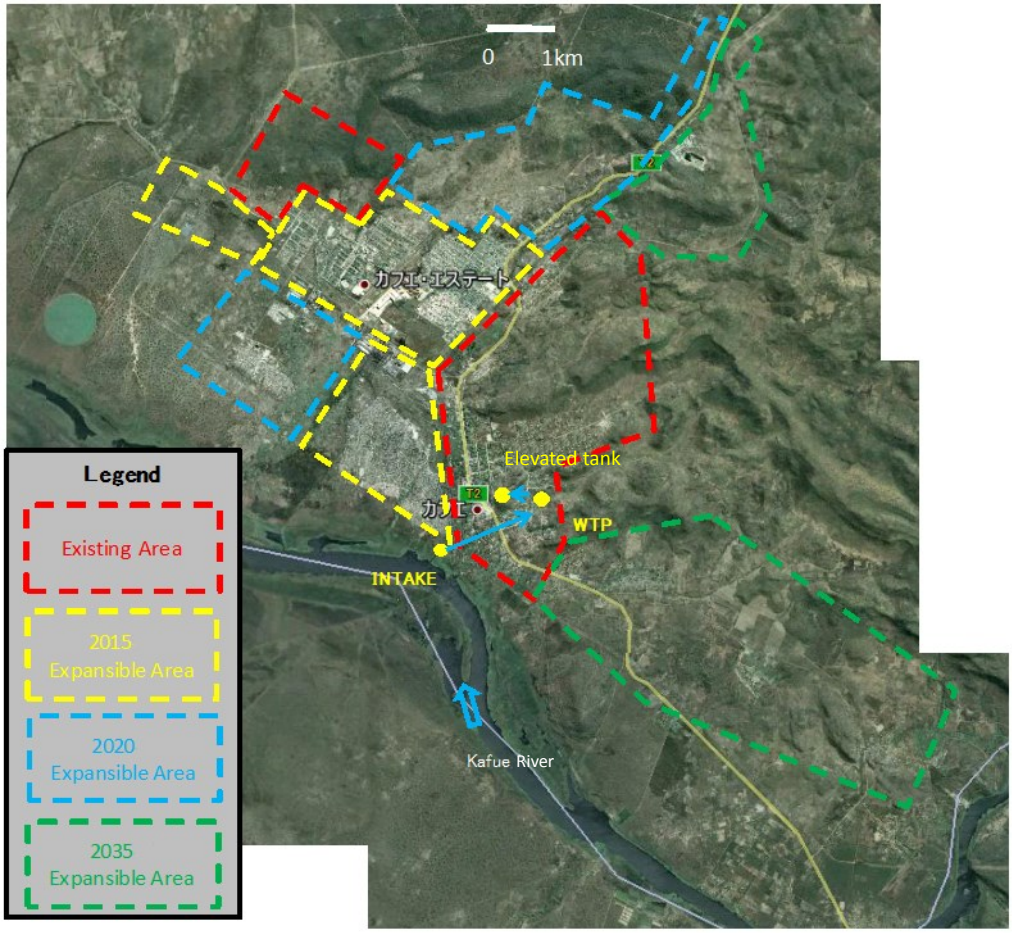

Figure 4-2-1: Map of the planned expansion of water service areas in Kafue, by year

Table 4-2-1: Estimated piping lengths in Kafue

Description	Unit	2015	2020
Distribution Mains PVC Pipes			
160mmdia.	m	3,800	15,100
110mmdia.	m	20,300	3,700
90mmdia.	m	36,800	13,500
Distribution Mains Ferrous(IRON) Pipes			
400mmdia.	m	6,850	0
Total	**m**	**67,750**	**32,300**

Source: Water Supply Investment Master Plan Lusaka, Zambia, Final Report, MCC (2011)

(4) Estimated construction costs

Estimated construction costs: 2,300 million yen (including temporary construction works, common costs, and general and administrative expenses)

Construction period: 2 years

Breakdown of construction work:

Itemized work	Amount (million JPY)
Construction in a) and b)	150
Construction in c) - f)	150
Construction in g)	1,750
Construction in h)	100
Construction in i) and h)	150
Total	2,300

4-3 Outline of the Project for Improving the Urban Water Supply in Mansa

The *Project for Improving the Urban Water Supply in Mansa City* (tentative name) is the top-priority project of the LPWSC, and it is assumed it would be implemented using grant aid.

(1) Expected results

1) Water supply services will improve as a consequence of improving urban water supply facilities in the provincial capital, Mansa.
2) Providing a stable supply of safe drinking water will lead to a decrease in the use of shallow wells, which are a cause of water-borne diseases, and will help improve the living conditions and sanitation of residents.
3) Increasing the customer base and reducing non-revenue water will lead to better cost recovery.

(2) Plan parameters

Source of water	River water from the Mansa River and groundwater from boreholes
Expected population served	82,600
Design connections	7,500 taps (households) Existing water service area: Water supplied: 19,100 (1,730 taps) Not connected: 20,300 (1,850 taps) Expansible water service area: 43,200 (3,920 taps)
Original unit (average)	150 liters/person/day
Design water intake	Mansa River: 8,000 m^3/day + Boreholes: 4,400 m^3/day
Design water supply	12,400 m^3/day
Number of beneficiaries	63,500 (20,300 + 43,200)
Number of quasi-beneficiaries	19,100 (people currently benefiting from water supply)

Table 4-3-1: Population served and number of households in Mansa

No.	Supply Area	Service Level	Household			Population	
			Connected	Not Connected	Total	Population served	Population (Presumption)
①	Main Supply Area	Part supply	1,668	1,200	2,868	18,328	31,514
②	Musenga	Part supply	66	651	717	725	7,878
③	Sumbu / Chitamba	No Supply		437	437		4,802
④	New Mufulira	No Supply		425	425		4,670
⑤	Luka Kapasha	No Supply		285	285		3,132
⑥	Senama	No Supply		642	642		7,054
⑦	Namwandwe	No Supply		518	518		5,692
⑧	Chabala Muwe	No Supply		647	647		7,109
⑨	Spark Extension	No Supply		359	359		3,945
⑩	Kapesha	No Supply		615	615		6,758
	Total		1,734	5,779	7,513	19,053	82,554

Source: Report from LPWSC (2012)

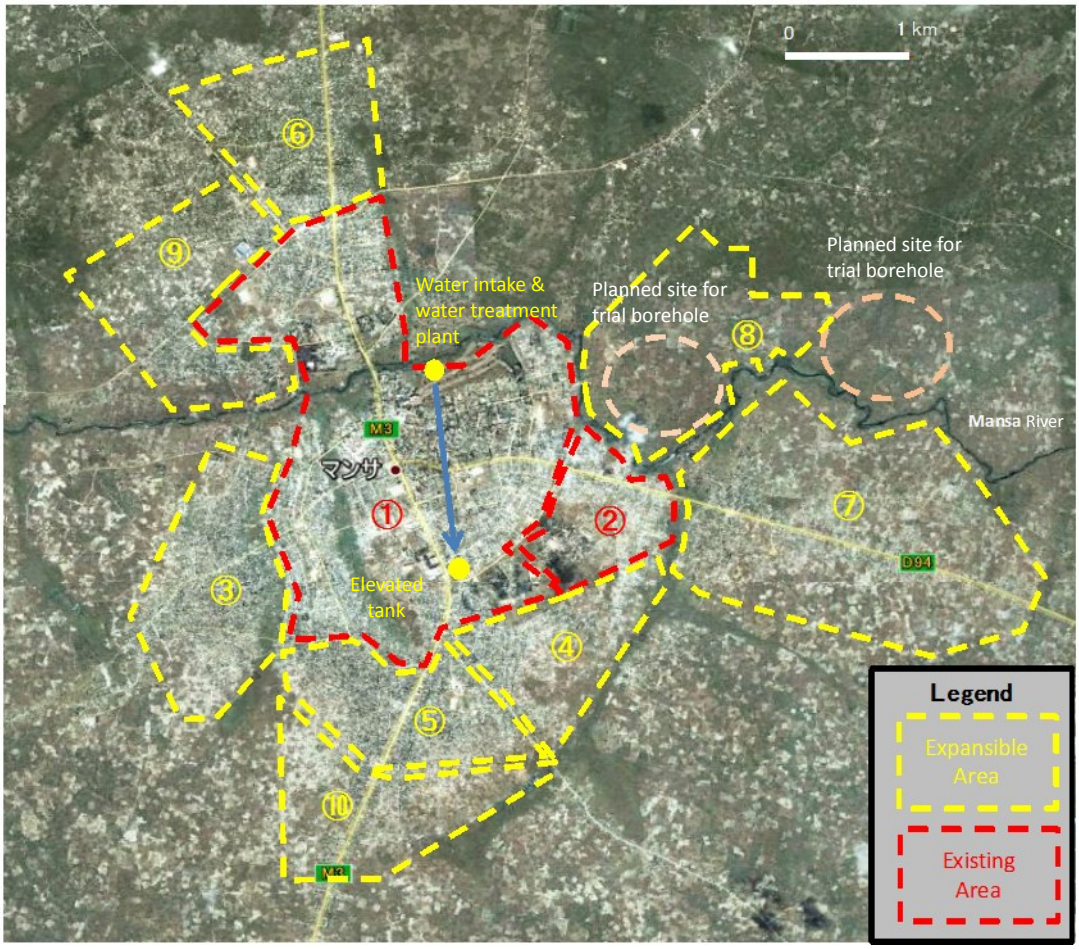

Figure 4-3-1: Map of water service areas in Mansa

(3) Overview of plan

The Mansa River, which is the existing water source, is the main source of water. However, due to a lack of flow data on the Mansa River, the flow is estimated based on interviews with the LPWSC. During the two or three weeks around when the dry season moves into the rainy season (from late September to late October), the river flow decreases, and a submersible pump for the dry season is used.

Given that water is drawn by damming the spillway of the natural weir with small stones and pebbles, the river flow is estimated at about 400 m^3/hour. In terms of operating hours, due to frequent voltage drops and power failures, it is speculated that the service operates for about ten hours a day, although this is not certain. Accordingly, the volume of water intake at the end of the dry season is thought to be 4,000 m^3/day. The installation of new generators, however, should enable a daily power supply of at least 20 hours, and given this, there is potential for water intake of at least 8,000 m^3/day. At other times, two submersible pumps would operate, meaning that an average of at least 8,000 m^3 of water could be drawn each day even if the pumps are only operating for ten hours.

Given that there are limits to the volume of river flow, the LPWSC is planning to draw groundwater. Trial boreholes will be dug near the Mansa River to the northeast of Mansa (trial boring scheduled for before the end of November 2012; report on findings concerning the amount of available groundwater due in early January 2013; funded by the Zambian government and DANIDA). If the volume of groundwater able to be drawn shows enough promise (50-70 m^3/hour/borehole, operating for 10 hours/day = 500-700 m^3/day), the water supply plan could combine water drawn from boreholes with water drawn from rivers.

The following three plans are proposed.

A. Plan to cover part of the existing water service areas and expansible water service areas by means of water drawn from the river (8,000 m^3/day, 52,000 people).
B. Plan to cover all existing water service areas and expansible water service areas by means of water drawn from the river (8,000 m^3/day, 52,000 people) + water drawn from (approximately 7) boreholes (4,400 m^3/day, 30,000 people; amount of available groundwater is uncertain).
C. Plan to cover all existing water service areas and expansible water service areas by means of water drawn from 18 boreholes (12,400 m^3/day; amount of available groundwater is uncertain) (Judging from data contained in the *Groundwater Development in Luapula Province* on the excavation of boreholes fitted with handpumps, feasibility of this plan appears to be low).

At present, given that the amount of available groundwater is uncertain, it would seem that Plan A (to supply water produced only through river intake) is the most convincing proposal. An outline of Plan A is provided below. In addition, an outline of Plan B is also described later for reference.

(4) Plan A

1) Parameters of Plan A

Source of water	River water from the Mansa River
Expected population served	52,000 (4,730 taps) Existing water service areas: Water supplied: 19,100 (1,730 taps) Not connected: 20,300 (1,850 taps) Expansible water service areas: 12,600 (1,150 taps)
Original unit (average)	150 liters/person/day
Operating hours	20 hours minimum
Existing water service areas	1) Main Supply Area, 2) Musenga
Expansible water service areas	3) Sumbu / Chitamba, 4) New Mufulira, 5) Luka Kapasha

Design water intake	7,900 m^3/day (however, generators need to be installed)
Design water supply	7,900 m^3/day Existing water service areas: Water supplied: 2,900 m^3/day Not connected: 3,100 m^3/day Expansible water service areas: 1,900 m^3/day
Number of beneficiaries	32,900 (20,300 + 12,600)
Number of quasi-beneficiaries	19,100 (people currently benefiting from water supply)

2) Outline of Plan A facilities

a) Floating intake (new): Floating platform, 3 × submersible pumps (400 m^3/hour)

b) Rapid sand-filter water treatment plant (new): Modular water treatment facility[19] (8,000 m^3/day), clean water reservoir (800 m^3), 3 × generators

c) Water pump facilities (new): 3 × centrifugal pumps (400 m^3/hour), 3 × generators

d) Elevated tank (additional): 1 × elevated tank (900 m^3)

e) Transmission pipes (new): ϕ300 mm PVC pipes, approximately 1.7 km

f) Water distribution network (improvement + new construction): ϕ400 mm - 75 mm PVC pipes, existing supply area (approximately 7 km^2) + expansible area (approximately 4 km^2)

Work for connecting service pipes and installing water meters is to be undertaken by the counterparty. Only materials are to be provided.

g) Service pipes (provision): For 4,730 taps, ϕ25 mm - 50 mm HDPE, saddle, sluice valve, etc.

h) Water meters (provision): 3,000 (existing meters: approximately 1, 730)

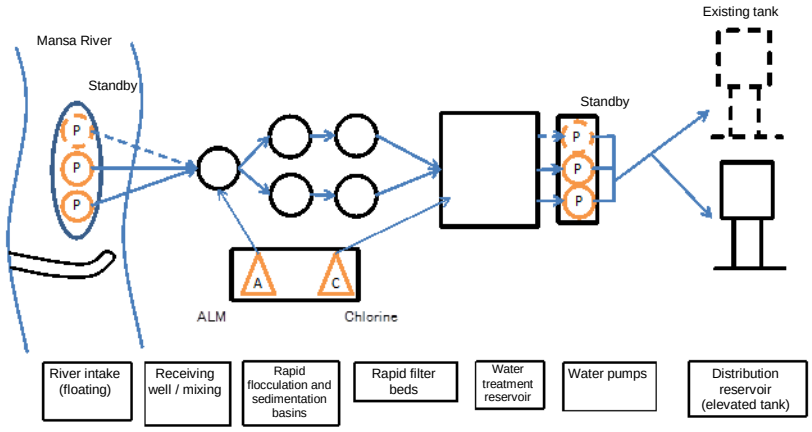

Figure 4-3-2: Schematic diagram of water supply facilities in Plan A

[19] The modular water treatment facility is frequently used when treating 10,000 m^3/day or less. A feature of this style is that the entire set of facilities is compact as a result of production assembly in a factory or onsite assembly, and so has the potential to improve quality and shorten the construction period.

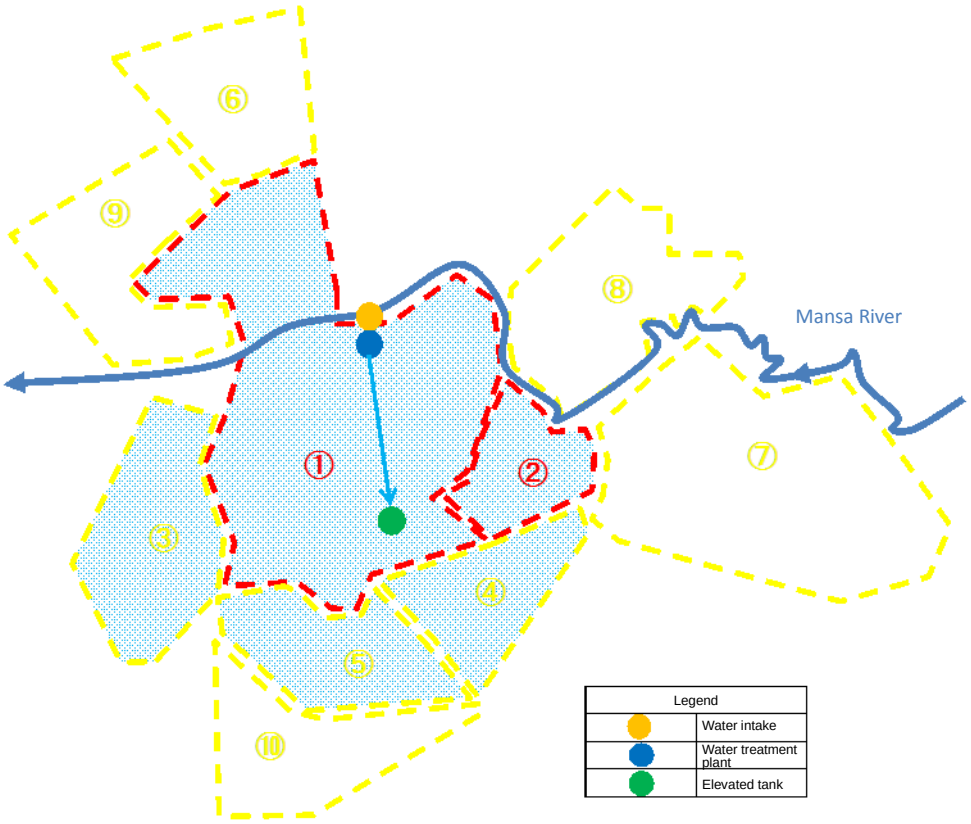

Figure 4-3-3: Map of water service areas under Plan A

3) Estimated construction costs

Estimated construction costs: 1,500 million yen (including temporary construction works, common costs, and general and administrative expenses)

Construction period: 2 years

Breakdown of construction work:

Itemized work	Amount (million JPY)
Construction in a) - e)	540
Construction in f)	900
Construction in g) and h)	60
Total	1,500

(5) Plan B

1) Parameters of Plan B

Source of water	River water from the Mansa River and groundwater from (approximately 7) boreholes
Expected population served	82,600 (7,500 households) Existing water service areas: Water supplied: 19,100 (1,730 households) Not connected: 20,300 (1,850 households) Expansible water service areas: 43,200 (3,920 households)
Original unit (average)	150 liters/person/day
Operating hours	20 hours minimum for water drawn from river 10 hours for water drawn from boreholes

Existing water service areas	1) Main Supply Area, 2) Musenga
Expansible water service areas	3) Sumbu / Chitamba, 4) New Mufulira, 5) Luka Kapasha, 6) Senam 7) Namwandwe, 8) Chabala Muwe, 9) Spark Extension, 10) Kapesha
Design water intake	12,400 m^3/day (Mansa River: 8,000 m^3/day + borehole: 4,400 m^3/day)
Design water supply	12,400 m^3/day Existing water service areas: Water supplied: 2,900 m^3/day Not connected: 3,100 m^3/day Expansible water service areas: 6,400 m^3/day
Number of beneficiaries	63,500 (20,300 + 43,200)
Number of quasi-beneficiaries	19,100 (people currently benefiting from water supply)

2) Outline of Plan B facilities

Areas 1), 2), 3), 4), 5), 6), 9), 10):

a) Floating intake (new): Floating platform, 3 × submersible pumps (400 m^3/hour)
b) Rapid sand-filter water treatment plant (new): Modular water treatment facility (8,000 m^3/day), clean water reservoir (1,000 m^3), 3 × generators
c) Water pump facilities (new): 5 × centrifugal pumps (400 m^3/hour), 5 × generators
d) Elevated tank (additional + new): 2 × elevated tanks (900 m^3, 900 m^3)
e) Transmission pipes (new): ϕ300 mm PVC pipes, approximately 1.7 km; ϕ200 mm PVC pipes, approximately 1.7 km
f) Boreholes (new): 5 × boreholes (50 m^3/hour/borehole), 5 × control buildings, 5 × generators
g) Conveyance pipes (new): ϕ100, 200 mm PVC pipes, approximately 1.5, 3.0 km

Areas 7), 8):

h) Boreholes (new): 2 boreholes (90 m^3/hour/borehole), 2 × control/chemical buildings, 2 × generators
i) Transmission pipes (new): ϕ100 mm PVC pipes, approximately 0.5, 1.5 km
j) Elevated tank (new): 2 × elevated tanks (250 m^3, 250 m^3)

Water distribution network:

k) Water distribution network (improvement + new construction): ϕ500 mm - 75 mm PVC pipes, existing water service areas (approximately 7 km^2) + expansible water service areas (approximately 17 km^2)

Work for connecting service pipes and installing water meters is to be undertaken by the counterparty. Only materials are to be provided.

l) Service pipes (provision): For 7,500 taps, ϕ25 mm - 50 mm HDP, saddle, sluice valve, etc.
m) Water meters (provision): 5,770 (existing meters: approximately 1, 730)

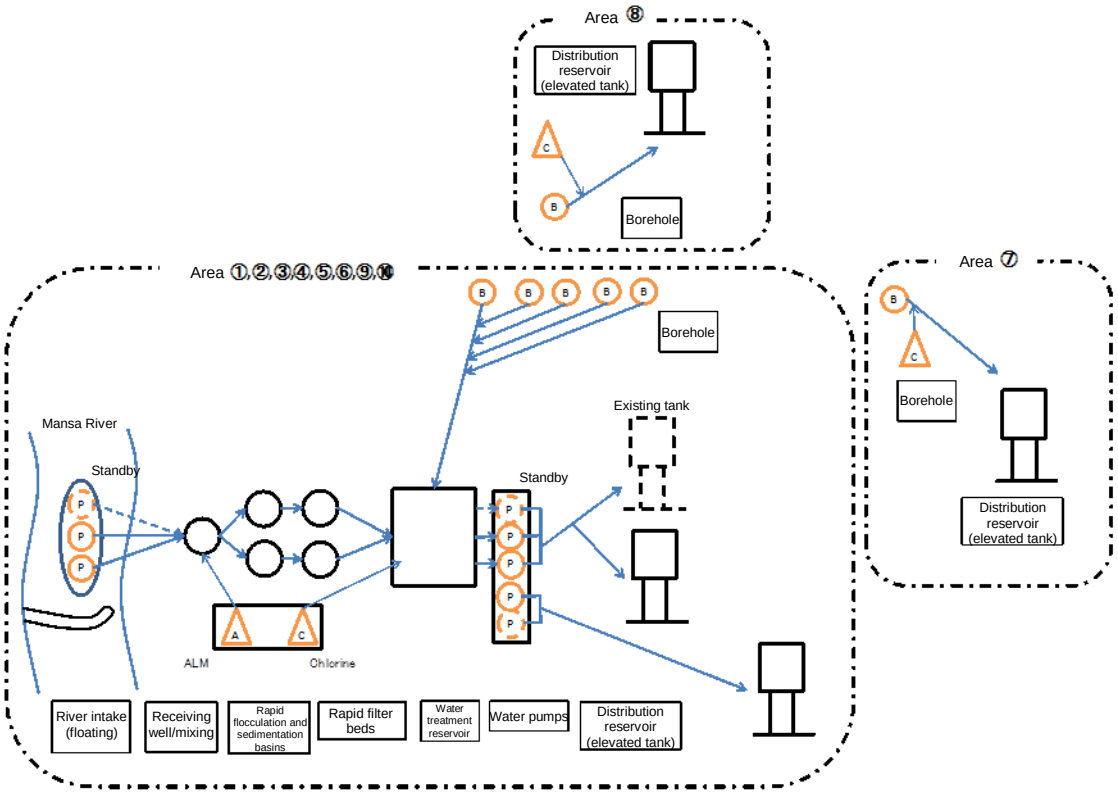

Figure 4-3-4: Schematic diagram of water supply facilities in Plan B

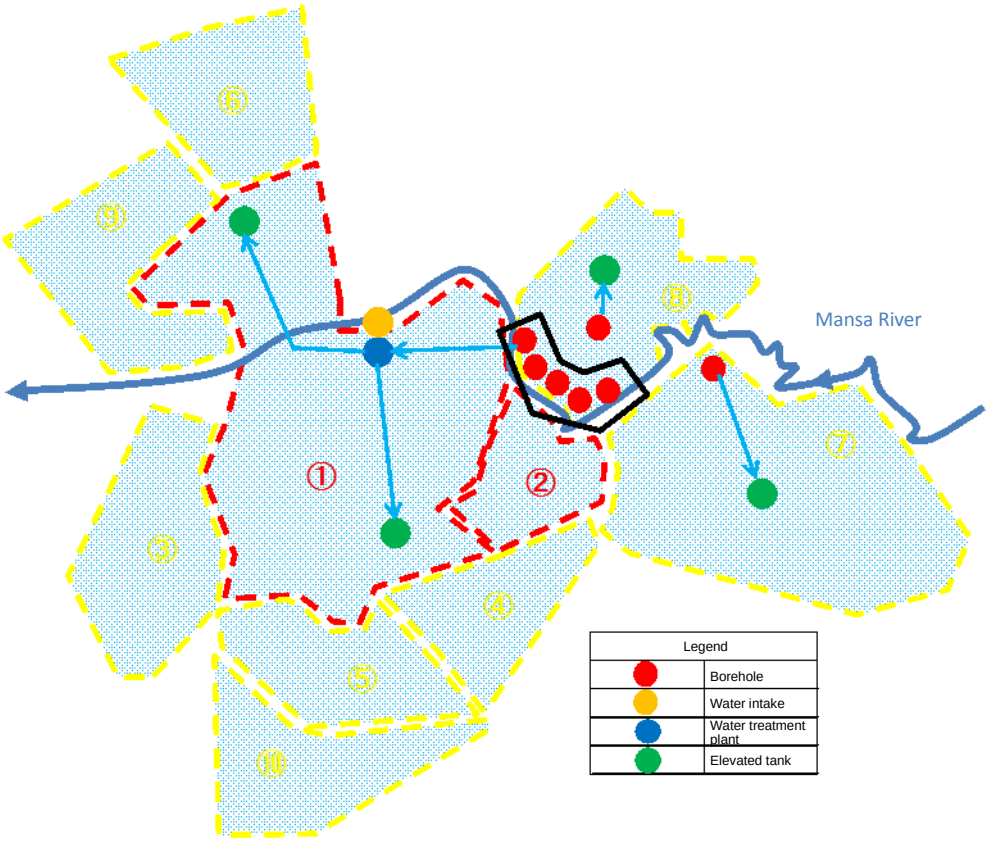

Figure 4-3-5: Map of water service areas under Plan B

3) Estimated construction costs

Estimated construction costs: 2,600 million yen (including temporary construction works, common costs, and general and administrative expenses)

Construction period: 3 years

Breakdown of construction work:

Itemized work	Amount (million JPY)
Construction in a) - e)	650
Construction in f) and g)	100
Construction in h) - j)	150
Construction in k)	1,550
Construction in l) and m)	150
Total	2,600

(6) Proposals for project implementation

Since there are no documents on the flow rate of the Mansa River, flow measurements and hydrologic studies need to be undertaken for at least one hydrological year. Furthermore, based on data concerning the trial boring undertaken by the LPWSC, groundwater productivity should be re-surveyed and adopted as supporting data for sources of water supply.

4-4 Outline of the Project for Improving the Urban Water Supply in Mongu

The *Project for Improving the Urban Water Supply in Mongu City* (tentative name) is the top-priority project of the WWSC, and it is assumed it would be implemented using grant aid.

(1) Expected results

1) Water supply services will improve as a consequence of improving urban water supply facilities in the provincial capital, Mongu.
2) Providing a stable supply of safe drinking water will lead to a decrease in the use of shallow wells, which are a cause of water-borne diseases, and will help improve the living conditions and sanitation of residents.
3) Increasing the customer base and reducing non-revenue water will lead to better cost recovery.

(2) Plan parameters

Source of water	Groundwater drawn from boreholes on the shores of the Zambezi River and from boreholes in Mongu
Expected population served	80,000 (6,000 taps) Existing water service areas: 61,000 (4,600 taps) Expansible water service areas: 19,000 (1,400 taps)
Original unit (average)	150 liters/person/day
Operating hours	10 hours on average
Design water intake	12,000 m^3/day (current water intake: 7,150 m^3/day)
Design water supply	12,000 m^3/day Existing water service areas: 9,200 m^3/day Expansible water service areas: 2,800 m^3/day
Number of beneficiaries	19,000
Number of quasi-beneficiaries	61,000 (people currently benefiting from water supply)

(3) Outline of proposed facilities

a) Boreholes (new): 4 × boreholes (depth: 100 m, diameter: 150 mm), submersible pumps
b) Control room/chlorinator (new): 2 × control/chemical buildings, 4 × generators
c) Transmission pipes (new): ϕ 100 mm GI pipes
d) Elevated tank (new): 2 × elevated tanks (550 m^3)
e) Water distribution network (improvement + new construction): ϕ 400 mm - 75 mm PVC pipes, existing supply area (approximately 15 km^2) + expansible area (approximately 14 km^2)
f) Generators (new): 20 (14 × existing submersible pumps, 6 × booster pumps)

Work for connecting service pipes and installing water meters is to be undertaken by the counterparty. Only materials are to be provided.

g) Service pipes (provision): For 6,000 taps, ϕ 25 mm - 50 mm HDP, saddle, sluice valve, etc.
h) Water meters (provision): 2,400 (existing area: 1,050, expanded area: 1,350)

Work to improve water pumps, transmission pipes and elevated tanks has been completed as part of a DANIDA Phase-1 project. Furthermore, the unfinished work from the project, namely, work to repair leaks in the elevated tanks, is scheduled to be undertaken from within the budget of the Zambian government. Given this, the primary components of this project will be work to improve existing distribution projects and work to expand new distribution pipes.

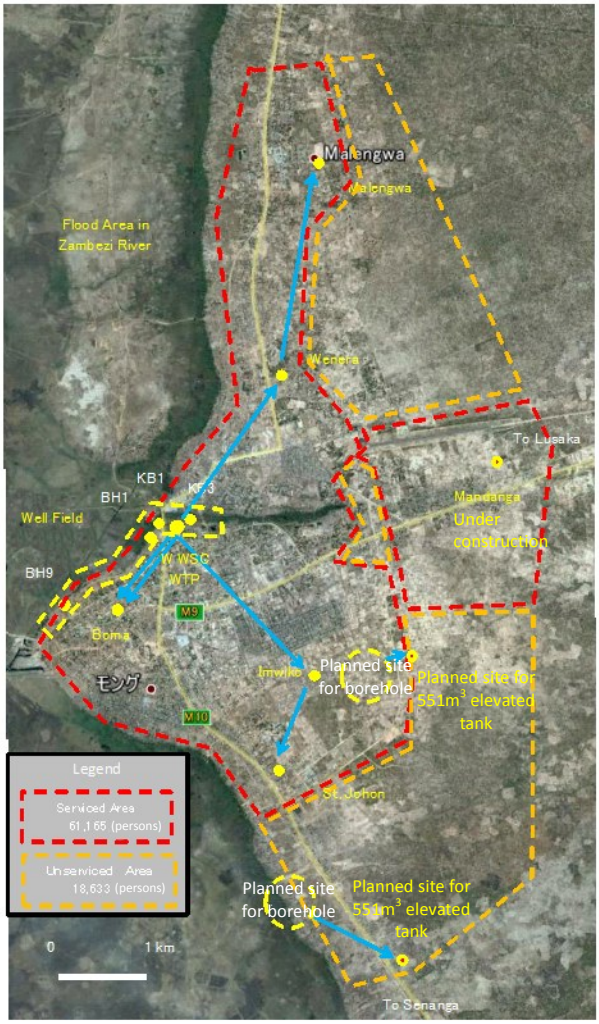

Figure 4-4-1: Map of water service areas in Mongu

(4) Estimated construction costs

Estimated construction costs: 2,000 million yen (including temporary construction works, common costs, and general and administrative expenses)

Construction period: 2 years

Breakdown of construction work:

Itemized work	Amount (million JPY)
Construction in (a) - (d)	200
Construction in (e)	1,620
Construction in (f)	100
Construction in (g) and (h)	80
Total	2,000

Chapter 5 Direction of Japan's Cooperation for the Urban Water Supply Sector

5-1 Japan's Past Cooperation

Table 5-1-1 shows Japan's past cooperation for the water supply sector in Zambia. Looking at the urban water supply sector, and from the late 1980s, development studies and grant aid were intermittently implemented, targeting the improvement of water supply in Lusaka. At present, the *Improvement of Water Supply Condition in Ndola City* (grant aid) is being carried out in the Copperbelt Province.

In Lusaka, work funded by grant aid was undertaken, particularly in 1986-1987, to improve the Iolanda Water Treatment Plant and Chilanga Booster Pump Station, which, even today, are two of the main urban water supply facilities in Lusaka. The Lusaka Water and Sewerage Company (LWSC) still has great expectations for support from JICA.

Table 5-1-1: Japan's past cooperation for Zambia's water sector

Project	Schedule	Scheme	Project outline
Rural water supply			
Project for Groundwater Development, Phase 1	1985	Grant aid	(E/N amount: 626 million yen, number of beneficiaries: approximately 50,000) Construction of 95 boreholes fitted with handpumps in five districts in Southern Province
Project for Groundwater Development in Southern Province	1988	Grant aid	(E/N amount: 541 million yen, number of beneficiaries: approximately 90,000) Construction of 174 boreholes fitted with handpumps in Southern Province
Rural Water Supply Project	1991-1994	Grant aid	(E/N amount: 2,777 million yen, number of beneficiaries: approximately 160,000) Construction of 524 boreholes fitted with handpumps in Lusaka Province, Central Province and Copperbelt Province
Project for Rural Water Supply in Southern Zambia	1996-1997	Grant aid	(E/N amount: 1,364 million yen, number of beneficiaries: approximately 59,000) Construction of 220 boreholes fitted with handpumps in Livingstone and eight districts in Southern Province
Project for Groundwater Development and Sanitation Project in Drought Prone Rural Areas	2001-2004	Grant aid	(E/N amount: 1,640 million yen, number of beneficiaries: approximately 75,000) Construction of 298 boreholes fitted with handpumps in Western Province, Central Province and Southern Province

Follow-up Cooperation for Ground Water Development and Water Supply Projects	2004	Follow-up survey	Survey on the operation rate of more than 600 boreholes fitted with handpumps constructed up until 2004. An operation rate of more than 80% was verified. It was also confirmed that the operation and maintenance system is weak, and that it needs to be strengthened for the sustainable use of facilities.
Project for Groundwater Development and Sanitation Improvement in the Northern Province	2004-2007	Grant aid	(E/N amount: 641 million yen, number of beneficiaries: approximately 112,000) Construction of 175 boreholes fitted with handpumps in Northern Province
Groundwater Development in Luapula Province	2008-2010	Grant aid	(E/N amount: 541 million yen) Construction of approximately 200 boreholes fitted with handpumps in seven districts in Luapula Province
Groundwater Development in Luapula Province Phase 2 (in progress)	2011-2013	Grant aid	(E/N amount: 712 million yen) Construction of approximately 216 boreholes fitted with handpumps in four districts in Luapula Province
Sustainable Operation and Maintenance Project for Rural Water Supply (SOMAP)	2005-2007	Technical cooperation project	Based on the follow-up survey mentioned above, a technical cooperation project to strengthen the operation and maintenance of rural water supply facilities was requested by the Zambian government and commenced. The pilot model built in two districts in this project was adopted as a national model in the O&M component under the NRWSSP.
Sustainable Operation and Maintenance Project for Rural Water Supply Phase 2 (SOMAP-2)	2007-2010	Technical cooperation project	The pilot model was refined further, and a Phase 2 project to expand the model nationwide was requested by the Zambian government and commenced.
Support in National Roll-out of Sustainable Operation and Maintenance Programme (SOMAP-3) (in progress)	2011-2015	Technical cooperation project	Supports the O&M component of the NRWSSP, which aspires to extend nationally the SOMAP O&M built up to SOMAP-2, and aims to achieve a 70%-80% operation rate for boreholes fitted with handpumps by 2015.
Urban water supply			
Project for the Improvement of Water Supply Facilities in Lusaka City	1986-1987	Grant aid	(E/N amount: 1,753 million yen) Improvement of the Iolanda Water Treatment Plant and Chilanga Booster Pump Station, which are main sources of water supply in Lusaka
Water Supply Project in Satellite Area of Lusaka	1993-1999	Grant aid	(E/N amount: 2,612 million yen) Excavation of boreholes and construction of elevated tanks and public taps in the unplanned urban settlement of George in Lusaka
Development Study: Lusaka Unplanned Urban Settlements Living Environment Improvement Plan	1999-2001	Development study	A study on the formulation of plans for improving living conditions in unplanned urban settlements in Lusaka; formulation of an action plan for eight unplanned urban settlements

Lusaka Unplanned Urban Settlements Living Environment Improvement Plan	2004-2006	Grant aid	(E/N amount: 461 million yen) Construction of water supply facilities and development of centers run by residents for the operation and management of facilities in three unplanned urban settlements contained in short-term plans under the above action plan
The Study on Comprehensive Urban Development Plan for the City of Lusaka	2007-2009	Development study	The same study makes recommendations for the water supply sector, regarding the building of a hydraulic analysis model for the LWSC's existing water transmission and distribution network and the reduction of non-revenue water.
Improvement of Water Supply Condition in Ndola City (in progress)	2012-2013	Grant aid	(E/N amount: 2,116 million yen) Repair of the Kafubu water treatment plant in Ndola, and establishment of public taps in peri-urban areas
Water resources management			
Study on National Water Resources Master Plan	1993-1995	Development study	A plan was created to formulate a National Water Resources Master Plan, aimed at improving the stable supply of safe water through improvement of the rural water supply and sanitation environment. As part of the plan, the Project for Groundwater Development and Sanitation Project in Drought Prone Rural Areas (grant aid) was implemented.

5-2 Direction of Future Assistance

(1) Country Assistance Policy for the Republic of Zambia

Table 5-2-1 shows Japan's *Country Assistance Policy for the Republic of Zambia* (April 2012). According to the country assistance policy in Table 5-2-1, the urban water supply sector is positioned within the development issue (objective) "Improving basic environment for human resource development for the next generation" of priority area 3 (target) "Improvement of social infrastructure for sustainable economic growth." Japan's strategy for the development issue is to "promote the development of healthy and high-quality human resources and support sustainable economic growth, by securing access to health services and safe water supply and sanitation."

The candidate projects for support in the target cities examined in this survey are aimed at improving access to the stable supply of safe water through improvement of water supply facilities and capacity enhancement in maintenance,[20] and hence are in accord with Japan's country assistance policy.

[20] Development of systems for the management of non-revenue water based on the provision and installation of bulk meters and water meters ("hard" components); training for personnel in water and sewerage companies and practical guidance (on-the-job training) for operation and maintenance ("soft" components), etc.

Table 5-2-1: Japan's Country Assistance Policy for the Republic of Zambia (April 2012)

Priority Area 3 (Target)	Improvement of social infrastructure for sustainable economic growth												
Development issue (objective) Improving basic environment for human resource development for the next generation	Current situation and issues A healthy population of those under the age of 15 is desirable and essential for sustainable economic growth as this age group accounts for almost half of the 13 million Zambian population. However, the living conditions of these children are deteriorating and there is a need to improve their quality of basic education and health condition. Securing safe water and sanitation is also necessary since diarrhea, one of the top three diseases affecting children in Zambia, is caused by the lack of access to safe water and sanitation. Furthermore, Zambia has a weak social infrastructure arising from limitations in health systems and insufficient human resources to address issues such as a high maternal mortality rate and a high prevalence of HIV/AIDS and other infectious diseases.			Strategy on issues Promote the development of healthy and high-quality human resources and support sustainable economic growth, by improving the quality of basic education which is necessary during the early stages of developing human resources for industry, and by securing access to health services and safe water supply and sanitation. In the education sector, undertake efforts which align with the New Education Policy 2011-2015. In the health sector, support the training of the health workforce, and support strengthening of the overall health system, such as the improvement of medical equipment and capacity enhancement in maintenance.									
	Program	Program summary	Project	Scheme	Schedule						Assistance amount (million yen)	Notes
					2010 and earlier	2011	2012	2013	2014	2015		
	Improving the quality of basic education through enhancement of teachers' performance and skills	Improve the quality of basic education through enhancement of teachers' performance and skills by the practice of School Based Continuing Professional Development (SBCPD) through lesson studies.	Grant Aid for Poverty Reduction Strategy (Education)	Grant aid			―				300	
			SMASTE School Based Continuing Professional Development Project Phase II	Technical cooperation project	―							
			Strengthening Teachers' Performance and Skills through School-based Continuing Professional Development Project	Technical cooperation project		―	―	―	―	―	420	
			Education Policy Advisor	Expert			―	―	―		30	
			Japan Overseas Cooperation Volunteers in Education Sector (33 volunteers)	JOCV	―	―	―	―	―	―		
			Grant Aid for Grassroots Human Security Projects in Education Sector (6 projects)	Grassroots grant assistance	―	―						
			Training Programme in Education Sector (4 persons)	Thematic Training Course, etc.	―	―						
	Improving maternal, newborn and child health (MNCH) through strengthening primary health care with sustainable physical health infrastructure development and medical facilities maintenance service	With a focus on primary health care centered on community health workers, improve child health by improving healthcare facilities, equipment and materials (including vaccines) and by building systems to sustainably manage and maintain these.	The Project for Strengthening Community-Based Child Health Promotion System in Urban Areas	Technical cooperation project		―	―	―			390	
			Medical Equipment Supply Program (BCG Vaccine)	Equipment	―							
			Project for Safer Pregnancy/Delivery Sustained by the Local Community in Chibombo District	JICA partnership program	―	―	―					
			Health Capital Investment Support Project	Technical cooperation project	―	―	―				320	
			Preparatory survey on Upgrading of Lusaka Health Centres to District Hospitals	Preparatory survey	―							
			Training Programme in Health Sector (6 persons)	Thematic Training Course, etc.	―	―						
			Project for the Improvement of the Medical Equipment of the University Teaching Hospital	Grant aid	―	―					480	
	Improving access to safe water and sanitation through construction of water supply and sanitation facilities as well as capacity development for operation, maintenance and management.	Improve access to safe water through construction of water supply and sanitation facilities as well as capacity development for operation, maintenance and management in order to mitigate water-borne diseases such as diarrhea.	Sustainable Operation and Maintenance Project for Rural Water Supply (SOMAP) Phase 2	Technical cooperation project	―						220	
			Groundwater Development in Luapula Province	Grant aid	―	―					640	
			Support in National Roll-out of Sustainable Operation and Maintenance Programme (SOMAP-3)	Technical cooperation project		―	―	―	―	―	470	
			Groundwater Development in Luapula Province Phase 2	Grant aid		―	―				710	
			Improvement of Water Supply Condition in Ndola City	Grant aid		―	―	―			2,120	
			Training Programme in Water and Sanitation Sector (1 person)	Thematic Training Course, etc.	―	―						

(2) Direction of future assistance

Future assistance needs

Looking at the urban water supply sector in Zambia, in the wake of the privatization of state-owned enterprises, structurally, the public incorporation of water and sewerage enterprises based on independent profit systems has already been completed. Financially, however, the sector is still in the process of reform, and as discussed in detail in this report in 2-5 *Current Situation and Issues Facing Commercial Utilities*, seven of the 11 water and sewerage companies have not yet achieved cost recovery.

On the other hand, four companies (Lusaka (LWSC), Mulonga (MWSC), Southern (SWSC) and North Western (NWWSC)) have achieved cost recovery. Nevertheless, development funds have thus far primarily relied on the budget of the Zambian government and on grant aid from donors, and so in order to secure large-scale development funds required for the NUWSSP, the companies will need to procure funds from financial markets and to repay these funds themselves as commercial-oriented enterprises.

As the business conditions of water and sewerage companies in Zambia have become polarized in this way, there also needs to be two forms of assistance for the urban water supply sector which are suited to those respective business conditions and needs.

1) Assistance for water and sewerage companies that have not achieved cost recovery (LPWSC, WWSC)

Assistance provided from both “hard” aspects (facilities improvement) and “soft” aspects (human resources development and training) for building the foundations upon which the company can provide a water supply service as a water utility (grant aid / technical cooperation).

Particularly in the case of the LPWSC—which is one of the public corporations subject to this survey, and which was ranked lowest in the performance evaluation conducted by NWASCO—at the time of its public incorporation, it inherited unimproved aging facilities from the Ministry of Local Government and Housing (MLGH) with no notable capital investment, and to this day, it has been unable to establish foundations as a water utility. Consequently, improving cost recovery by encouraging self-reliance through both “hard” and “soft” forms of assistance is essential for further improving the company’s water supply service to residents and expanding its water service areas (improving water service coverage), which would afterward be brought about by its subsequent self-help efforts.

2) Assistance for water and sewerage companies that have achieved cost recovery (LWSC)

Assistance

Assistance provided for the purpose of procuring development funds required for the NUWSSP (ODA loans / technical cooperation).

The LWSC and other water and sewerage companies in Zambia have hardly any experience in taking out and repaying long-term loans. Neither do they have experience in long-term management and financial planning when it comes to running water supply and sewerage services. Therefore, assistance from “soft” aspects is needed (dispatch of financial planning experts, feasibility studies).

In Zambia, the MLGH is the implementing agency for long-term AfDB and WB loans for urban water supply. In the case of the LWSC, following the transfer of jurisdiction for four neighboring

districts in 2009, responsibility for the debt was also transferred. Consequently, as a debt relief measure, the LWSC was released from obligation for the long-term AfDB loan, and the amount to be repaid was put into the capital account. As a result, the repayment obligation to the MLGH has been eliminated. In addition, funds under the WB's WSPIP are currently being disbursed. Repayments have not yet started, and there is not even any record of the repayment of long-term loans in the LWSC's audit report of December 2010. There is, however, the issue of repaying the Chinese concessionary loans, and so in order to proceed with plans for the construction of a large-scale water treatment plant necessary for the development of new water sources, it is imperative that long-term management and financial plans be formulated for the borrowing and repayment of long-term loans.

List of candidate projects for support

Table 5-2-2 shows a list of candidate projects for support in the urban water supply sector in Zambia, which has been compiled based on the results of the field survey and on the future assistance needs outlined above.

Table 5-2-2: List of candidate projects for assistance in the urban water supply sector

Assistance needs	Water and sewerage company in target city	Scheme	Candidate projects for support[21]	Estimated construction costs
Assistance for water and sewerage companies that have not achieved cost recovery	LPWSC	Grant aid	Project for Improving the Urban Water Supply in Mansa City	1,500 million yen
	WWSC	Grant aid	Project for Improving the Urban Water Supply in Mongu City	2,000 million yen
	LPWSC & WWSC	Technical cooperation	Operation and maintenance dispatch of experts	-
Assistance for water and sewerage companies that have achieved cost recovery	LWSC	ODA loan	Project for Improving the Urban Water Supply in Lusaka City	US$314 million (approximately 27.0 billion yen)
		ODA loan	Project for Improving the Urban Water Supply in Kafue District	2,300 million yen
		Technical cooperation	Dispatch of financial planning experts, feasibility studies	-

<Assistance for LPWSC & WWSC>

In the case of the LPWSC and the WWSC, it seems the most effective way to improve water supply services would be to first improve those water supply facilities which have impaired function due to deterioration, and then to strengthen the capacity of the companies to properly operate and maintain those improved facilities.

With the grant aid mentioned above, more than just the improvement of water supply facilities, this approach also envisages support for the development of non-revenue water management systems based on the provision and installation of bulk meters and water meters, training for personnel in water and sewerage companies and practical guidance (on-the-job training) for operation and maintenance ("soft"

[21] For an outline of the candidate projects for support, see Chapter 4 *Outline of the Candidate Projects for Assistance in Target Cities*.

components), followed by the dispatch of operation and maintenance experts or senior volunteers, as well as ongoing support for capacity building.

<Assistance for LWSC>

With estimated construction costs upward of US$300 million, the *Project for Improving the Urban Water Supply in Lusaka City* mentioned above involves large loans, and so cofinancing with the AfDB, WB and other donors is envisaged. In addition, since the LWSC lacks any long-term financial plan related to implementation of the project, the following procedure is envisaged: financial planning experts would be dispatched, the financial conditions and local conditions would be ascertained in detail, and the details of the assistance and its rough feasibility would be confirmed. Only then would a feasibility study be undertaken, which would subsequently lead to conclusion of the ODA loan.