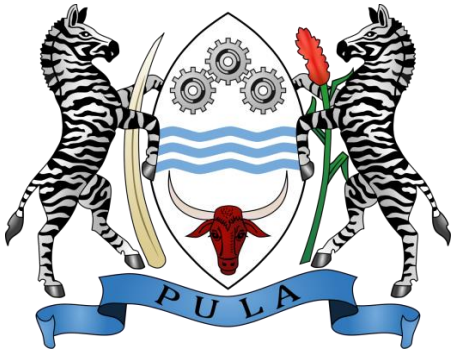

Republic of Botswana

Ministry of Land Management, Water and Sanitation Services

Department of Water and Sanitation

2017-19

Water Accounting Report

March 2021

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ABBREVIATIONS

BPC	Botswana Power Corporation
DWS	Department of Water and Sanitation
GoB	Government of Botswana
GDP	Gross Domestic Product
ISIC	International Standard Industrial Classification of All Economic Activities
MC	Management Centre
MCM	Million Cubic Meters
MFED	Ministry of Finance and Economic Development
MoA	Ministry of Agriculture Development and Food Security
MLWS	Ministry of Land Management, Water and Sanitation Services
NRW	None Revenue Water
SB	Statistics Botswana
SDG	Sustainable Development Goals
SEEA	System of Environmental Economic Accounting
SNA	System of National Accounts
WA	Water Accounts
WAB	Water Apportionment Board
WAU	Water Accounting Unit
WB	World Bank
WUC	Water Utilities Corporation
UN	United Nations
WAVES	Wealth Accounting and Valuation of Ecosystems Services

CHAPTER 1 INTRODUCTION

This is the sixth (6th) SEEA styled water accounting report for Botswana. The accounts cover the period 2017/18 to 2018/19 and in essence combine the 6th and 7th reports. The report provides highlights of the 2010/11 to 2018-19 trends. The country has so far published five (5) earlier reports, covering the years 2010/11 to 2016/17 (DWA and CAR, 2013, 2015, 2016) and (DWS 2017 and 2018).

The SEEA styled water accounts for Botswana started in March 2012 when the Government of Botswana (GoB) entered into a partnership with the World Bank (WB) to develop accounts for natural resources and to value ecosystem services under the Wealth Accounting and Valuation of Ecosystem Services (WAVES) Programme. The WAVES initiative has since become a continuous activity of the Department of Water and Sanitation (DWS)'s road map towards sustainability as per Sustainable Development Goal (SDG) number 6. The Water Accounts data directly addresses SDG 6.4 on indicators 6.4.1 and 6.4.2.

The Water Accounting (WA) activities are a credible approach to monitoring the scarce water resources in Botswana. Botswana is a semi-arid and water scarce country with high evapotranspiration loses exacerbating the problem. The country is located in the inland area of Southern Africa, with a tropical climate in the north and subtropical climate in the rest of the country. Botswana's annual precipitation is low, which is 450mm on average and varies by region and season. Rivers in Botswana flow 10~75 days a year and the flow is not continuous even in rainy season. There is no surface water runoff throughout the west and central region and the annual recharge in aquifers by rainfall reaches up to 40mm in Chobe, the northern part of the country, but it is almost zero in the south- western part of the country.

Current water accounting efforts in Botswana focus on physical flow accounts (use and supply). Monetary aspects have focused on the revenues and costs of water supply as well as the industry value added produced per cubic meter (m^3) of water used.

Major stakeholders in the production of water accounts are Water Utilities Corporation (WUC), Statistics Botswana (SB), Ministry of Agriculture Development and Food Security (MoA), Botswana Chamber of Mines and Ministry of Finance and Economic Development (MFED). The Botswana WA also provides information on the water abstraction and consumption of key industries (e.g. agriculture, mining, manufacturing and service industries) and households. Although not directly involved in the production of the WA, the MFED plays a significant role in the process as it provides overall coordination of the NCA Programme in the country and is one of the main users of the results together with the Ministry of Land Management, Water and Sanitation Services (MLWS).

This report has some improvements compared to the earlier reports. There have been further improvements on water abstraction and consumption of the irrigation sector following additional irrigation surveys and better irrigation data provided by the Ministry of Agriculture Development and Food Security. The waste water estimates have been maintained from improvements made in the last report. In addition, major strides have been made towards institutionalization of the Water Accounts at the Department of Water and Sanitation (DWS). DWS established a Water Accounting Unit (WAU) in 2015 and the focus and dedication has

improved significantly as the Unit has three (3) professionals focusing mainly on the water accounts and numerous technical contact persons within the DWS core divisions. The WAU has taken the lead on the overall production of the 2017/18 – 2018/19 accounts and the preparation of this report.

CHAPTER 2 MAIN FINDINGS

2.1 ABSTRACTION

As shown in the physical supply and use tables (table 2.1 and 2.2);

- There was a slight decrease of 1% in the volume of water abstracted (from water resources) from 204 MCM in 2017/18 to 202 MCM in 2018/19.
- WUC remains the major abstractor; 97.1 MCM and 99.2 MCM was abstracted in 2017/18 and 2018/19, respectively.
- Abstractions for major self abstractors were as follows;
    - Agriculture – Decreased from 79.6 MCM in 2017/18 to 74.6 MCM in 2018/19.
    - Mining – Increased from 26.9 MCM in 2017/18 to 27.8 MCM in 2018/19.
- Abstraction by the Electricity industry remained constant at 0.4 MCM.

2.2 CONSUMPTION

As shown in the physical supply and use tables (table 2.1 and 2.2);

- There was 8% increase in water consumption from 123.9 MCM in 2017/18 to 133.8 MCM in 2018/19.
- Agriculture continues to be the highest water consumer, though there was a decrease in consumption from 81.4 MCM in 2017/18 to 76.5 MCM in 2018/19.
- Consumptions for the years 2017/18 and 2018/19 by other sectors were as follows, respectively:
    - Mining – 27.3 MCM and 31 MCM.
    - Households – 12 MCM and 20.2 MCM.
    - Government – 3.2 MCM and 5.4 MCM.
    - Other industries – 3.7 MCM and 6.3 MCM.
    - Electricity – 1 MCM and 0.4 MCM.

Table 2.1: Physical supply and use table, 2017/18

Units (MCM)		Agriculture	Mining and Quarrying	Electricity	WUC	Sewage	Government	Other Industries	Total industries	Households	Imports	Total
I. Physical use table												
From the environment	**1. Total abstraction**	**79.6**	**26.9**	**0.4**	**97.1**	**0.0**	**0.0**	**0.0**	**203.9**	**0.0**		**203.9**
	1i.Surface water	23.7	2.7	0.0	56.3	0.0	0.0	0.0	**82.8**	0.0		**82.8**
	1ii.Ground water	55.9	24.2	0.4	40.8	0.0	0.0	0.0	**121.2**	0.0		**121.2**
Within the economy	2. Use of water from other economic sectors	2.0	8.6	0.8	7.1	40.1	9.0	10.5	**78.1**	33.7	0.0	**111.8**
	3. Total use of water (1+2)	**81.5**	**35.5**	**1.1**	**104.3**	**40.1**	**9.0**	**10.5**	**282.0**	**33.7**	**0.0**	**315.7**
II. Physical supply table												
Within the economy	4. Supply of water to other economic units	0.1	8.2	0.1	62.1	1.8	5.8	6.8	**85.0**	21.7	5.0	**111.8**
Into the environment	5. Total returns	0.0	0.0	0.0	41.7	38.3	0.0	0.0	**80.0**	0.0		**80.0**
	6.Total supply of water (4+5)	**0.1**	**8.2**	**0.1**	**103.8**	**40.1**	**5.8**	**6.8**	**165.0**	**21.7**	**5.0**	**191.8**
	7. Consumption (3-6)	**81.4**	**27.3**	**1.0**	**0.4**	**0.0**	**3.2**	**3.7**	**117.0**	**12.0**	**-5.0**	**123.9**

**Grey cells – Zero entries by definition*

Table 2.2: Physical supply and use table, 2018/19

Units (MCM)		Agriculture	Mining and Quarrying	Electricity	WUC	Sewage	Government	Other Industries	Total industries	Households	Imports	Total
I. Physical use table												
From the environment	**1. Total abstraction**	**74.6**	**27.8**	**0.4**	**99.2**	**0.0**	**0.0**	**0.0**	**202.0**	**0.0**		**202.0**
	1i.Surface water	22.1	2.2	0.0	71.3	0.0	0.0	0.0	**95.6**	0.0		**95.6**
	1ii.Ground water	52.5	25.6	0.4	27.9	0.0	0.0	0.0	**106.4**	0.0		**106.4**
Within the economy	2. Use of water from other economic sectors	2.0	10.8	0.1	8.5	40.1	11.2	13.1	**85.8**	41.9	0.0	**127.7**
	3. Total use of water (1+2)	**76.6**	**38.6**	**0.5**	**107.7**	**40.1**	**11.2**	**13.1**	**287.8**	**41.9**	**0.0**	**329.7**
II. Physical supply table												
Within the economy	4. Supply of water to other economic units	0.1	7.6	0.2	77.3	1.8	5.8	6.8	**99.5**	21.7	6.5	**127.7**
Into the environment	5. Total returns	0.0	0.0	0.0	29.8	38.3	0.0	0.0	**68.1**	0.0		**68.1**
	6.Total supply of water (4+5)	**0.1**	**7.6**	**0.2**	**107.1**	**40.1**	**5.8**	**6.8**	**167.6**	**21.7**	**6.5**	**195.8**
	7. Consumption (3-6)	**76.5**	**31.0**	**0.4**	**0.6**	**0.0**	**5.4**	**6.3**	**120.1**	**20.2**	**-6.5**	**133.8**

**Grey cells – Zero entries by definition*

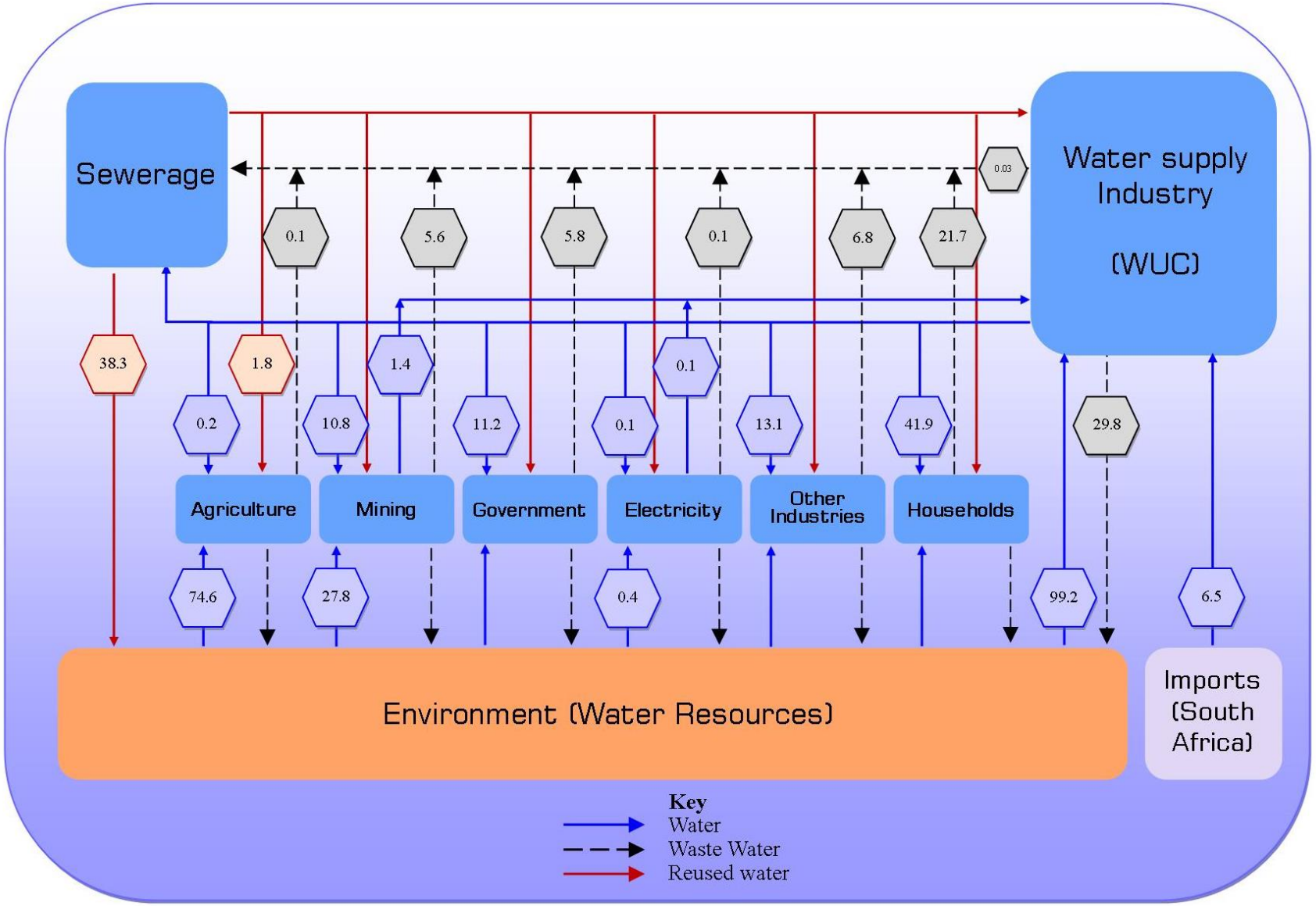

Figure 2.1: Physical supply and use diagram 2018/19 (MCM)

2.3 PHYSICAL SUPPLY AND USE

The summarized version of the supply and use table is presented in Table 2.1 and 2.2. The physical use tables show an increase in water use from 315.7 MCM in 2017/18 to 329.7 MCM in 2018/19. The water service provider (WUC) is the highest water user, accounting for 104.3 MCM and 107.7 MCM consecutively. Use and supply of water within the economy has increased from 111.8 MCM in 2017/18 to 127.7 MCM in 2018/19.

The physical supply table shows an increase in the total supply of water from 191.8 MCM in 2017/18 to 195.8 MCM in 2018/19. There was a decline on return flows from 80 MCM in 2017/18 to 68.1 MCM in 2018/19, this was mainly due to a decline in non-revenue water by the water service provider (From 41.7 MCM to 29.8 MCM).

Imports – There was an increase in water imported from South Africa from 5 MCM in 2017/18 to 6.5 MCM in 2018/19.

2.4 LONG TERM TREND IN WATER CONSUMPTION

The long term time series in water consumption in figure 2.2 shows a fluctuating trend in total water consumption. The highest consumption of 178 MCM was recorded in 2014 and the lowest (123.9 MCM) in 2018. A significant decline of 44 MCM was noted between 2016 and 2017, this was due to a significant decline in consumption by households and the agriculture industry.

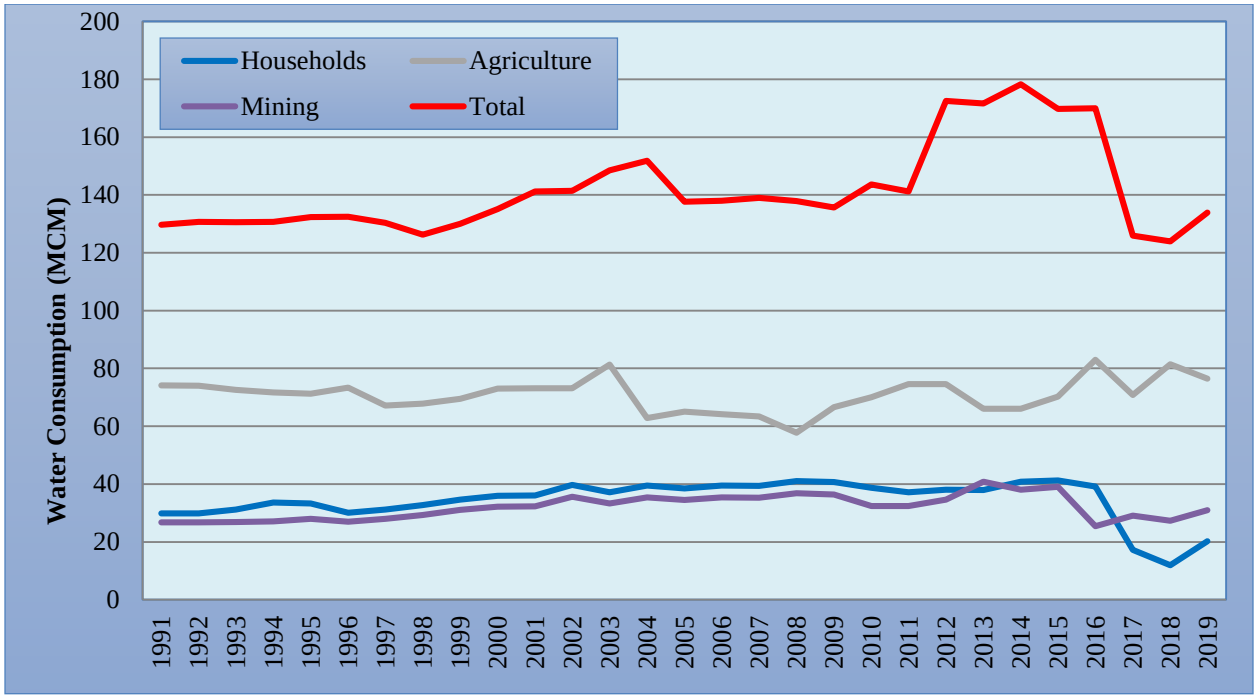

Figure 2.2: Long term time series for major water consuming sectors

Though there is an inconsistent trend in water consumption by agriculture, it remains the most water consuming industry in Botswana, with a peak of 83 MCM in 2016 and lowest consumption

of 58 MCM in 2008. There has been a marginal difference in water consumption between Households and Mining industry. Mining consumed more than Households for the first time in 2013 and that also reoccurred between 2017 and 2019.

CHAPTER 3 WATER SUPPLY INDUSTRY

Following the water sector reforms, Water Utilities Corporation (WUC) remains the sole industry mandated with the supply of water in Botswana. This section addresses water abstraction, sales and non-revenue water by the 16 WUC management centers.

3.1 WATER ABSTRACTION

WUC water abstraction increased slightly by 2% from 97 MCM in 2017/18 to 99 MCM in 2018/19, as presented in table 3.1. The most populated Gaborone MC continues to abstract more water compared to other MCs, accounting for 26% and 23% of total abstraction in 2017/18 and 2018/19 respectively. Letlhakane, Tsabong, Ghanzi and Kasane MCs abstract less water, collectively accounting for less than 7% of total abstraction for both years.

Table 3.1 further shows water abstraction by source for the year 2018/19 and it indicate that 72% of water was abstracted from surface water resources and the rest from groundwater. Ten out 0f sixteen MCs abstract conjunctively from both surface and groundwater resources. MCs on the Southern and Western part of the country rely mostly on groundwater due to limited surface water resources.

Table 3.1: Water abstraction and source by WUC MCs

MC	Abstraction (000m3)		Water Source, 2018/19 (000m3)	
	2017/18	2018/19	Groundwater	Surface water
Gaborone	24725	22578	29	22549
Francistown	15072	14985	0	14985
Lobatse	9346	9792	1677	8115
Selebi-Phikwe	6191	6703	2633	4070
Kanye	4082	4142	4142	0
Molepolole	5455	5579	5579	0
Mahalapye	5264	5325	1647	3678
Palapye	4643	6329	1242	5086
Mochudi	4394	4613	447	4165
Masunga	3995	4483	1867	2616
Maun	3914	4541	2287	2255
Serowe	3603	3355	1238	2117
Letlhakane	2063	1790	1790	0
Tsabong	1539	1572	1572	0
Ghanzi	1460	1458	1458	0
Kasane	1392	1911	111	1800
TOTAL	**97138**	**99157**	**27721**	**71436**

To augment supply WUC also received water from Debswana mine (Jwaneng), BPC and Imports from South Africa as shown in table 3.2. Imports from South Africa include ground water to the Middlepits cluster and Molatedi dam supply to greater Gaborone.

Table 3.2: Water supply from other sectors (000m^3)

SECTOR	MC	2017/18	2018/19
Debswana	Kanye	1983	1442
BPC	Serowe	84	93
SA Imports	Gaborone and Tsabong	5047	6472
TOTAL		7115	8006

3.2 WATER SALES (BILLED CONSUMPTION)

Table 3.2, shows a 24% increase in billed consumption from 62 MCM in 2017/18 to 77 MCM in 2018/19. All MCs experienced an increase in billed consumption except for Palapye which decreased slightly. Gaborone and Francistown MCs accounted for 55% and 46% of total billed consumption for the two consecutive years while the less populated MCs consumed small volumes of water.

Table 3.2: Water sales (billed consumption) by WUC MCs

MC	2017/18		2018/19	
	Sales (000 m3)	**Sales contributions**	**Sales (000m3)**	**Sales contributions**
Gaborone	24977	40%	25185	33%
Francistown	9193	15%	10228	13%
Lobatse	3308	5%	5086	7%
Selebi-Phikwe	3266	5%	4478	6%
Kanye	2869	5%	4613	6%
Molepolole	2558	4%	3872	5%
Mahalapye	2468	4%	2767	4%
Palapye	2452	4%	4425	6%
Mochudi	2299	4%	3147	4%
Masunga	1828	3%	3054	4%
Maun	1786	3%	3043	4%
Serowe	1689	3%	2832	4%
Letlhakane	1046	2%	1279	2%
Tsabong	952	2%	1099	1%
Ghanzi	764	1%	1066	1%
Kasane	696	1%	1174	2%
TOTAL	62149		77347	

*Includes imports and water from other sectors

3.3 NON REVENUE WATER

Non-revenue water (NRW) is the difference between production and billed consumption and it consists of unbilled authorized consumption and water losses. Non-revenue water declined significantly from 42 MCM in 2017/18 to 30 MCM in 2018/19 at 40% and 28% for the consecutive years. As shown in figure 3.1, for all the years Lobatse, Francistown and Gaborone MCs had more NRW, with the least being Letlhakane, Tsabong, Ghanzi and Kasane. There was a substantial drop in NRW for Kanye MC from 3.2 MCM in 2017/18 to 1 MCM in 2018/19.

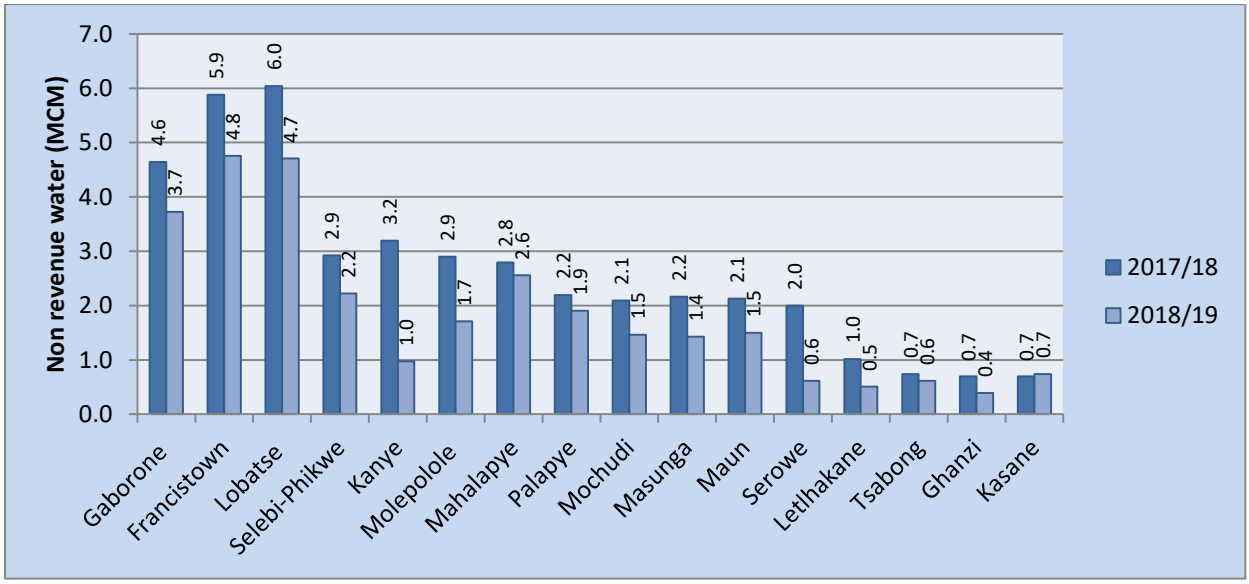

Figure 3.1: Non-revenue water by WUC MCs

3.4 WUC WATER SUPPLY TO INDUSTRIES AND HOUSEHOLDS

There was an increase in water supply to industries and households from 62 MCM in 2017/18 to 77 MCM in 2018/19, table 3.2. Figure 3.2; indicate that the bulk of the water is supplied to households and negligible amounts to the agriculture, water and electricity industry.

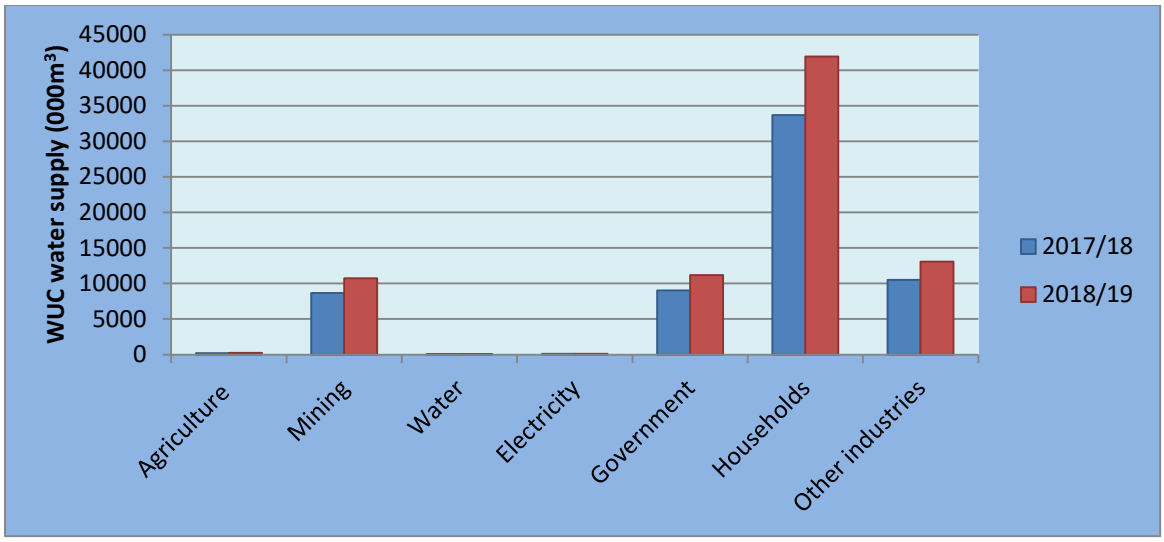

Figure 3.2: WUC water supply

CHAPTER 4 AGRICULTURE

The agriculture sector is one of the major self abstractors in Botswana with minimal reliance on water supply from other economic sectors. This publication and the previous ones have been focusing on water use by livestock and horticulture sub sectors, but efforts are ongoing to estimate water abstraction from soil water by the rain fed crop production. Water abstraction by this sector decreased from 79.6 MCM in 2017/18 to 74.6 MCM in 2018/19 and as illustrated in figure 4.1, consumption also declined from 81.4 MCM to 76.5 MCM respectively. Despite this decline in consumption, Agriculture continues to be the most water consuming industry as revealed in the long term trend in water consumption, figure 2.2.

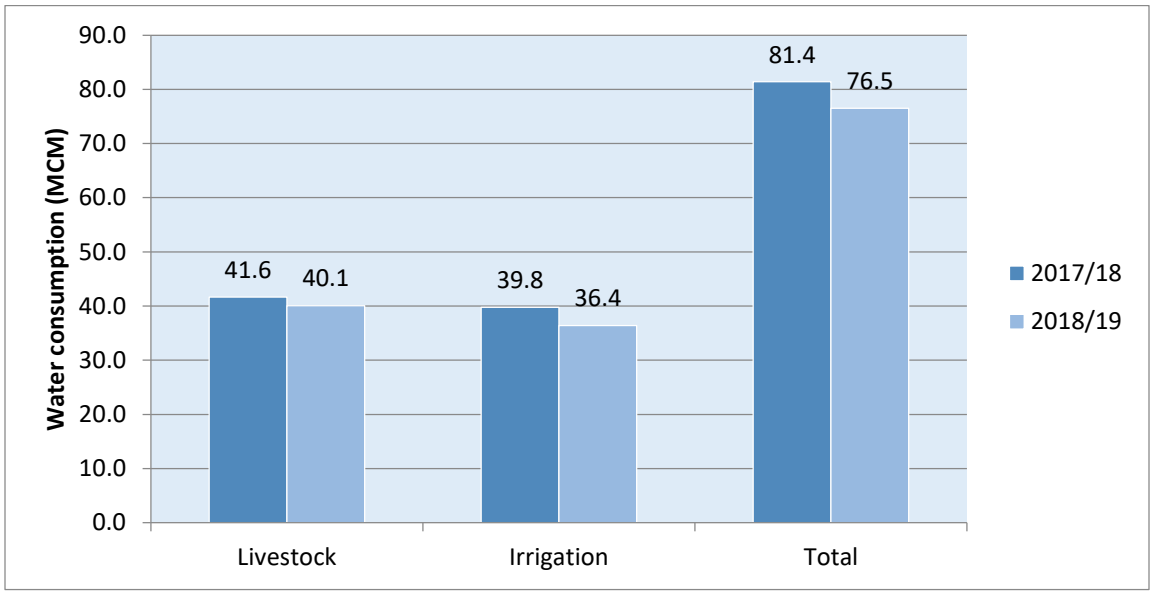

Figure 4.1: Water consumption by livestock and irrigation

4.1 LIVESTOCK

Over the years statistics indicates that livestock consume more water compared to horticulture. Due to a general decline in livestock numbers, water consumption also declined between the years 2017/18 and 2018/19. Figure 4.1, shows a slight decline in water consumption by livestock from 41.6 MCM in 2017/18 to 40.1 MCM in 2018/19.

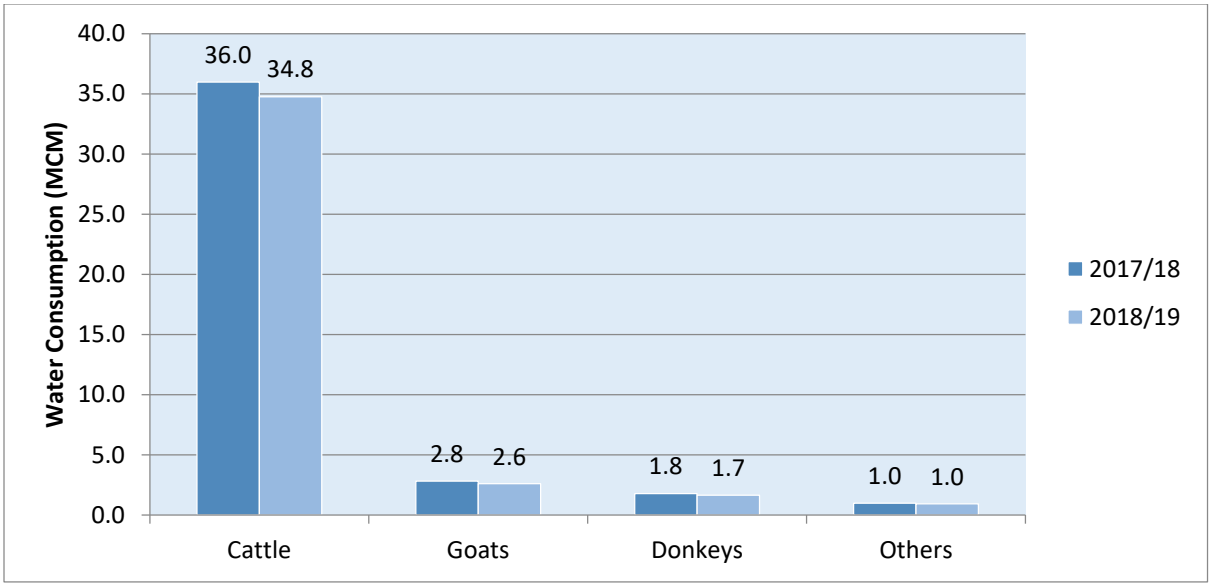

Figure 4.2: Water consumption by livestock

Water consumption by different livestock is displayed in figure 4.2, Cattle consumed more water compared to other livestock, 36 MCM and 34.8 MCM in 2017/18 and 2018/19 respectively. Goats, donkeys and other livestock, each consumed below 3 MCM for both accounting periods. Figure 4.3 shows long term trend in water consumption by livestock, there is uneven trend with the peak of 62.5 in 2002/03 and lowest of 38.9 MCM in 2007/08.

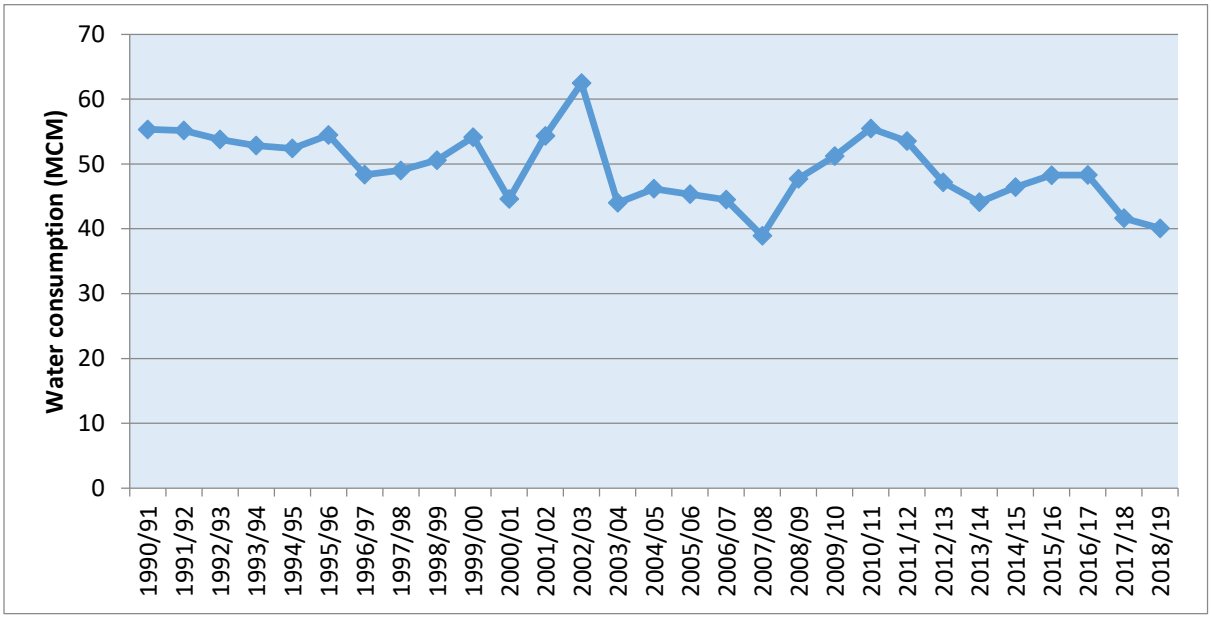

Figure 4.3: Trend in livestock consumption (1990-2019)

4.2 HORTICULTURE

The data provided by Department of Crop Production shows a decline in the horticulture area irrigated from 3652 Ha in 2017/18 to 3205 Ha in 2018/19. Because of a decline in the area irrigated, there was a drop in water consumption from 39.8 MCM in 2017/18 to 36.4 MCM in 2018/19 as reflected in figure 4.1.

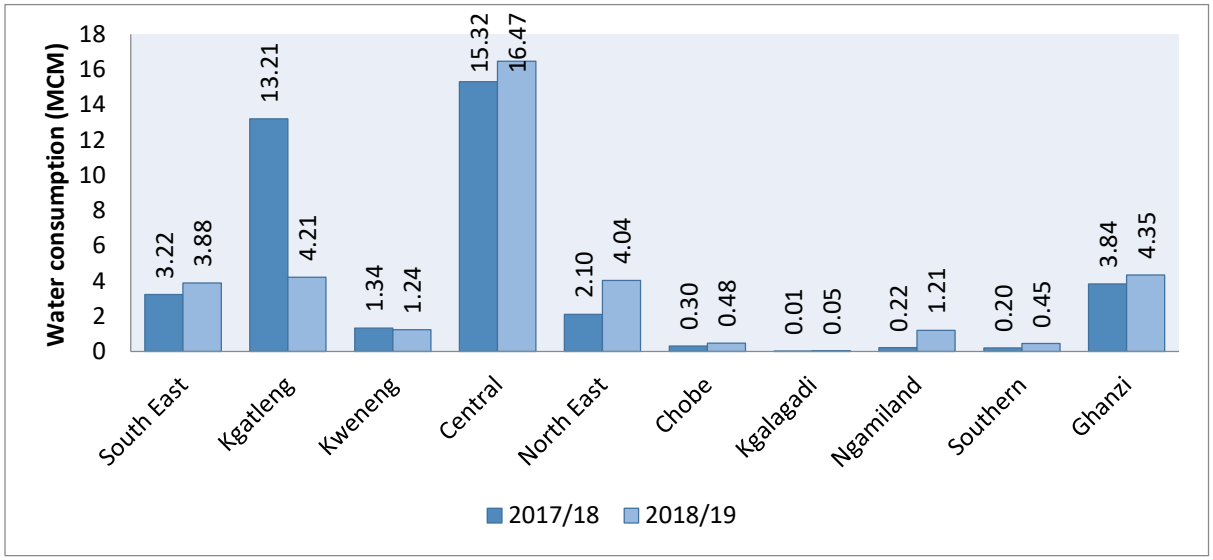

Figure 4.2 Irrigation water consumption by districts

Figure 4.2 displays irrigation water consumption by districts, central district consumes more water compared to other districts, this is because there is more irrigated area than in other districts. A substantial decrease of 68% was observed for Kgatleng district from 13.2 MCM in 2017/18 to 4.2 MCM in 2018/19, as a result of a decline in the area irrigated. There is negligible irrigation activity in Chobe, Kgalagadi, Ngamiland and Southern districts.

CHAPTER 5 MINING

Mining sector plays a key role in Botswana's economic growth; the sector has been the dominant contributor to the country's economy for many years. For its daily operations the sector self-abstracts and in some cases receive water from WUC for its various activities. This sector also supplies water to other economic sectors. A total of seven operational mines have provided data on their water usage for 2017/18 and 2018/19.

5.1 WATER ABSTRACTION AND CONSUMPTION

The mining sector self-abstract most of the water it uses, for the two years under review water abstraction was 25.7 MCM and 27.8 MCM respectively. Mining is the third most water abstracting industry after the water service provider and Agriculture. Diamond mining as a substantial driver of Botswana's economy remained the dominant water abstractor; the sub-sector has abstracted 25.2 MCM and 27.3 MCM in 2017/18 and 2018/19 in order, refer to figure 5.1. Soda ash and coal abstracted negligible amounts and Copper-nickel in 2017/18. Gold did not have any abstractions but rather rely on water supply from other economic sectors.

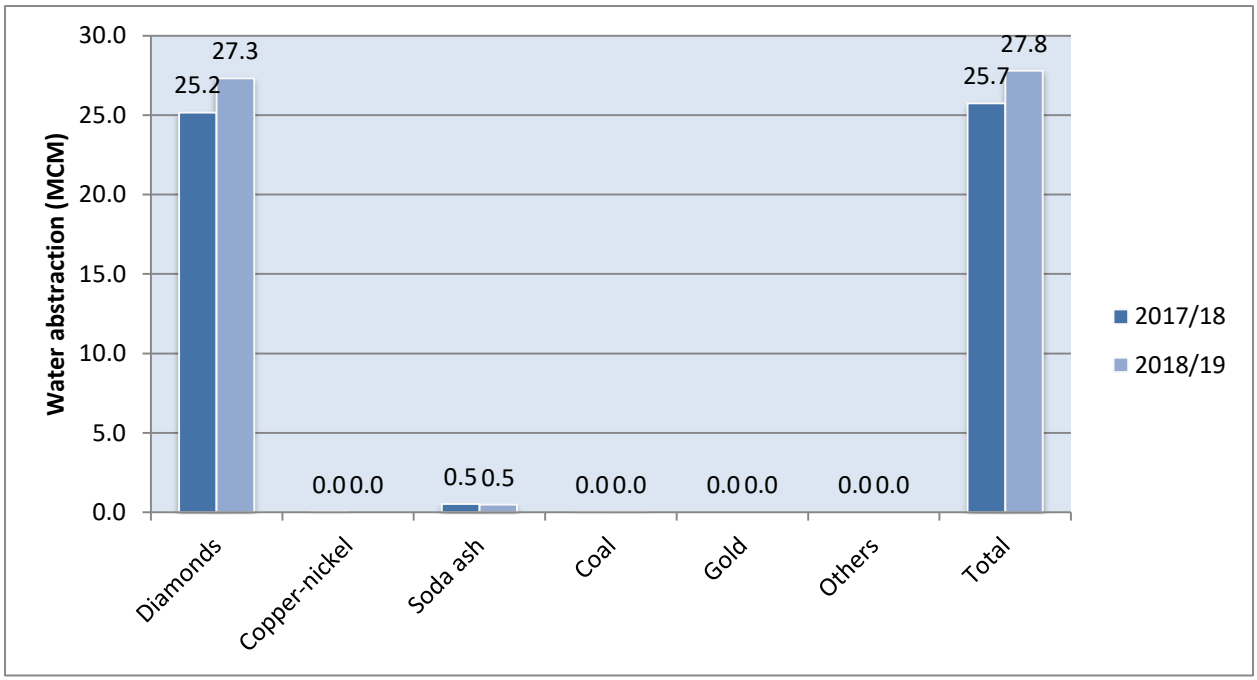

Figure 5.1: Water abstraction by mining

Water consumption increased by 18% from 24.1 MCM in 2017/18 to 28.4 MCM in 2018/19. As presented by figure 5.2, diamond mining consumes significantly great amount of water at a total of 22.9 MCM and 25.7 MCM for the two years consecutively. Soda ash, Coal and Gold consume less water with a combined consumption of 1.1 MCM and 2.7 MCM for the two successive years.

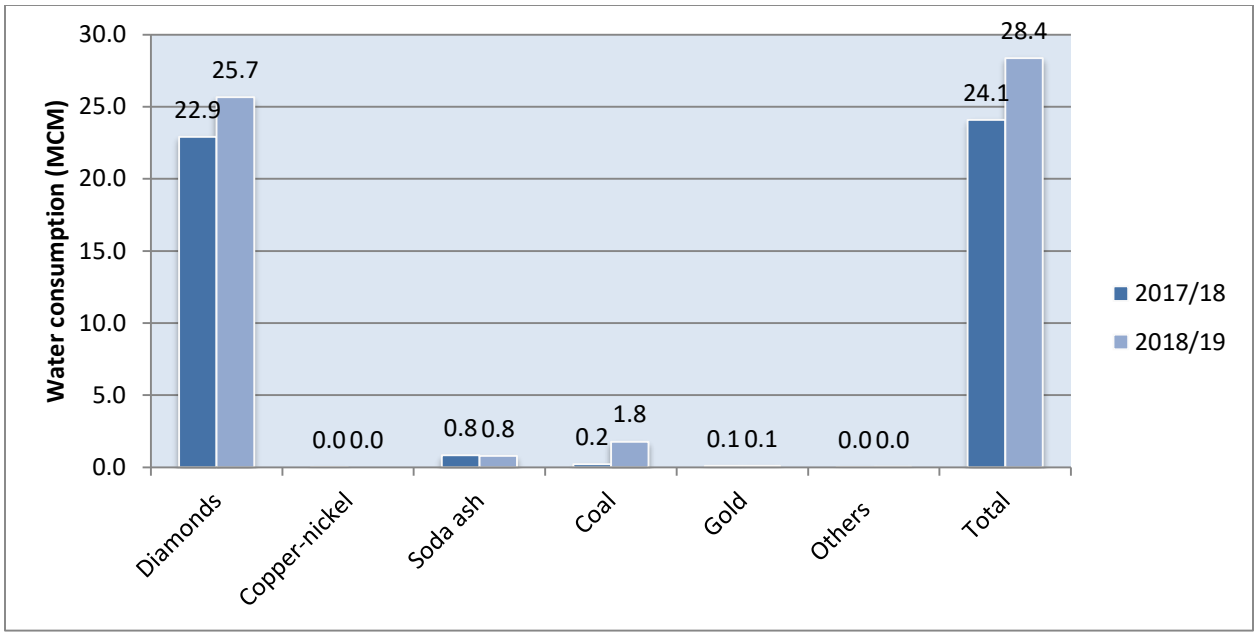

Figure 5.2: Water consumption by the mining sector

5.2 TREND IN WATER ABSTRACTION AND CONSUMPTION

There is a fluctuating trend in both water abstraction and consumption by the mining sector. Generally figure 5.3 shows an increasing trend in consumption from 32.3 MCM in 2010/11 to 39 MCM in 2014/15 then a decline from there to 24.1 in 2017/18. Abstraction increased from 25.2 MCM in 2010/11 to 31.1 MCM in 2014/15. There is also an increasing trend in abstraction between 2015/16 and 2018/19 from 23.2 MCM to 27.8 MCM respectively.

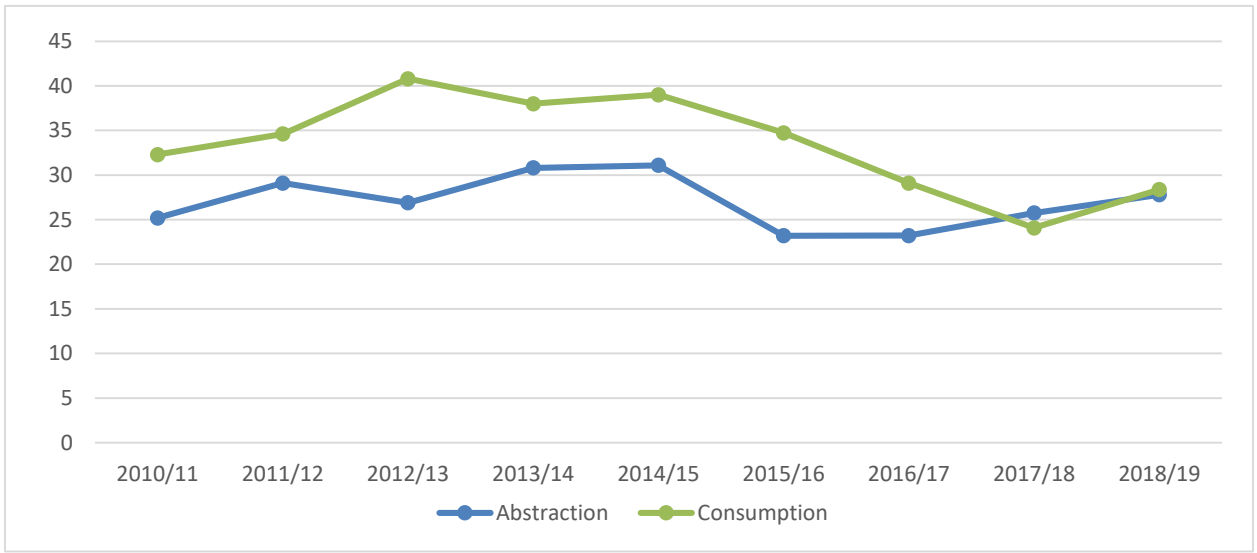

Figure 5.3: Trend in water abstraction and consumption by mining (MCM)

CHAPTER 6 GOVERNMENT

This sector covers both the Central and Local Government. Government largely depends on WUC for water supply and accounting for water abstraction by this sector remains a challenge due to lack of data. Some of the self-abstracting entities of this sector are immigration offices in some border posts, anti-poaching army camps, wildlife and national parks offices, etc.

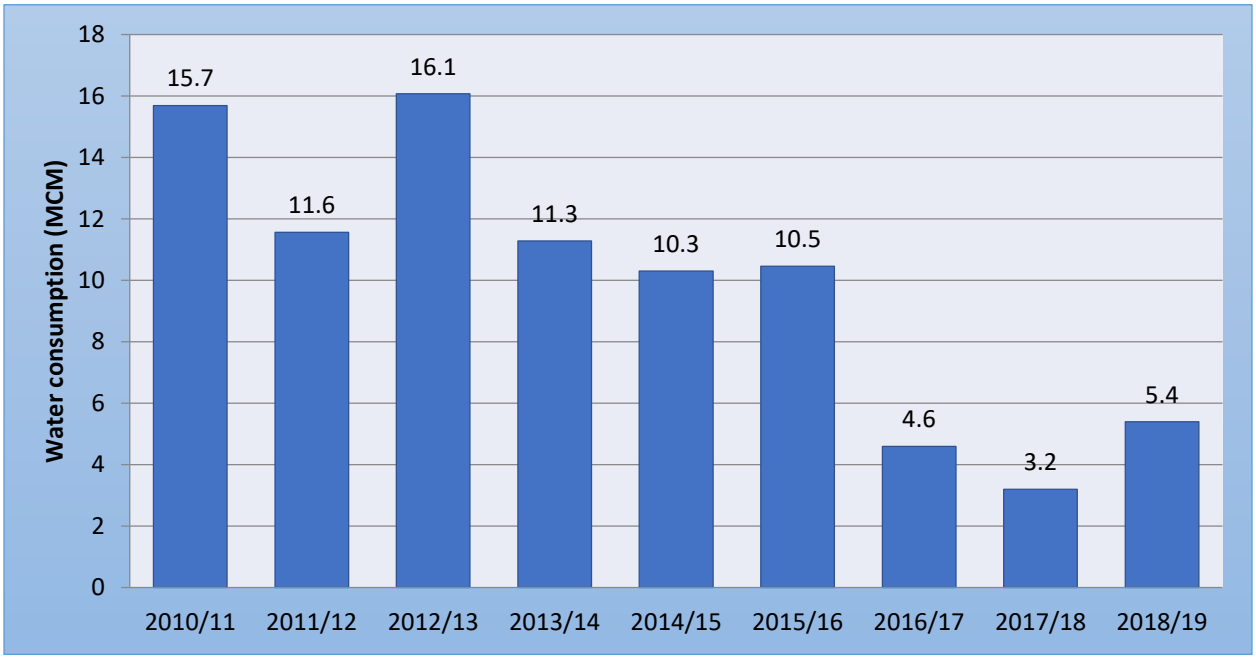

Figure 6.1: Trend in water consumption by Government (2010/11 to 2018/19)

Figure 6.1 gives a general overview of water consumption trend from 2010/11 to 2018/19. It is evident that there has been a decreasing trend in water consumption from 16.1 MCM in 2012/13 to 3.2 MCM in 2017/18. Since 2016/17 water consumption declined drastically due to factoring of wastewater supplied to sewage by this sector. The availability of first estimates of waste water supplied to sewage caused a 56% decline in water consumption from 10.5 MCM in 2015/16 to 4.6 MCM in 2016/17.

CHAPTER 7 OTHER INDUSTRIES AND ELECTRICITY GENERATION

7.1 OTHER INDUSTRIES

These comprise of manufacturing, construction, trade, hotels and restaurants, transport, finance and business, social and personal services and international organisations. These industries relatively consume smaller volumes of water and mainly get their water supply from WUC. In 2017/18 and 2018/19 other industries consumed 3% (3.7 MCM) and 4.4% (6.3 MCM), consecutively of total water consumption.

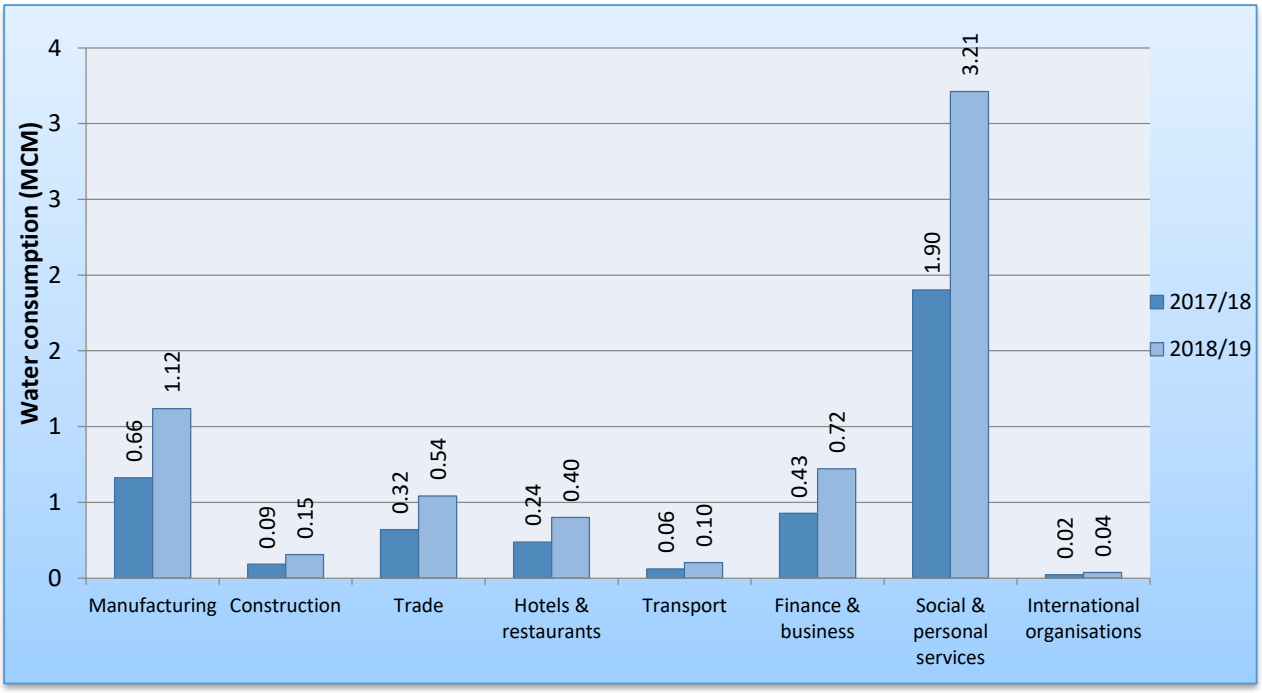

Figure 7.1: Water consumption by other industries

As illustrated in figure 7.1 social and personal services remains the dominating water consumer among these industries with its consumption climbing considerably from 1.9 MCM in 2017/18 to 3.21 MCM in 2018/19. International organizations remained the lowest water consumer at an amount of 0.02 MCM and 0.04 MCM for 2017/18 and 2018/19 respectively.

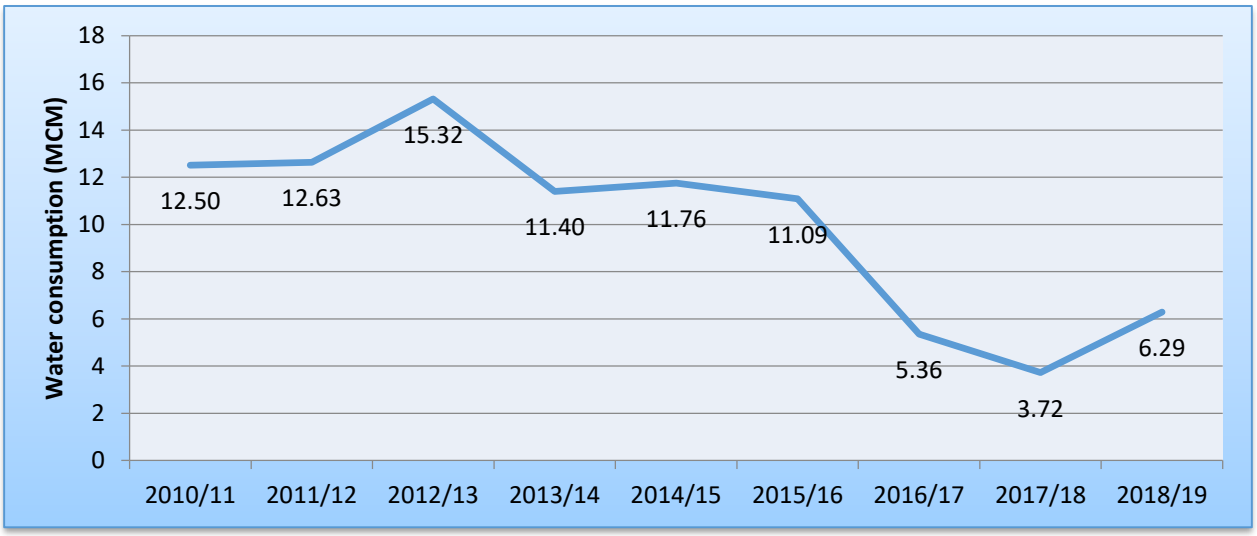

Figure 7.2: Trend in water consumption by other industries (MCM)

Figure 7.2 illustrates a fluctuating declining trend in water consumption over a period of nine years. Consumption was high in 2012/13 at 15.3 MCM and reached the lowest in 2017/18 with 3.7 MCM. Just like other sectors water consumption by other industries declined in 2016/17 as a result of the availability of estimates on return flows to sewerage. In 2012/13 there was a significant increase from 12.6 MCM to 15.3 MCM and also from 3.72 MCM to 6.29 MCM in 2018/19.

7.2 ELECTRICITY

Botswana Power Corporation is the principal power supplier in Botswana, BPC has two (2) coal powered plants in Palapye and these are Morupule A and Morupule B. In addition, BPC operates two small diesel-fueled power stations.

Table 7.1: Use of water within the electricity sector from 2011/12 to 2018/19

Units (MCM)	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**
Abstraction	-	-	-	0.7	0.8	0.2	0.4	0.4
Supply from other economic sectors	0.1	0.2	0.1	0.1	0.3	0.1	0.8	0.1
Total water use (a)	**0.1**	**0.2**	**0.1**	**0.8**	**1.1**	**0.3**	**1.1**	**0.5**
Supply to other economic sectors (b)	-	0.01	0.02	0.1	0.1	0.2	0.2	0.2
Consumption (a-b)	**0.1**	**0.2**	**0.1**	**0.8**	**1.1**	**0.2**	**0.9**	**0.4**

- denotes data is not available

As presented in table 7.1, water abstraction from the environment for electricity generation is relatively low, since 2014/15 water abstraction range between 0.2 MCM to 0.8 MCM. Water consumption between 2011/12 and 2018/19 range between 0.1 MCM and 1.1 MCM, this makes this industry one of the least consuming industry in Botswana.

CHAPTER 8 HOUSEHOLDS

This chapter discuss water use and consumption by Households (HH). Households rely mostly on water supplied by the Water service provider (WUC). Though there is self-abstraction by HH, it is still a challenge to account for it due to unavailability of data.

Water use by HH in 2017/18 and 2018/19 (respectively) was as follows;

- Water supplied by WUC was 33.7 MCM and 41.9 MCM.
- Return flows to sewage was constant at 21.7 MCM for the two years.
- Consumption increase from 12 MCM to 20.2 MCM.

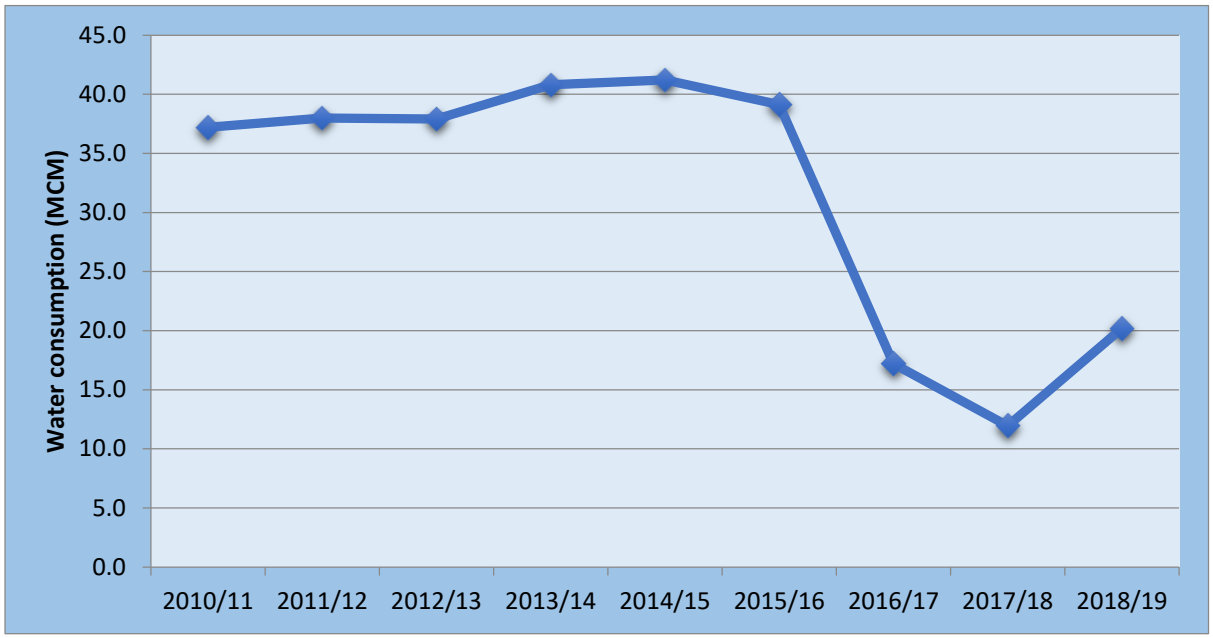

Figure 8.1: Water consumption trend by households (2010-2019)

Households remain the third highest water consumer after Agriculture and Mining industry. Figure 8.1 shows a trend in water consumption by HH; there is an increasing trend in water consumption between 2010/11 and 2014/15. Since 2016/17 there has been a drastic decrease in water consumption due to availability of data on return flows to sewage. In the absence of wastewater estimates (between 2010/11 and 2015/16, consumption was equivalent to water use, from 2016/17 consumption was calculated as the difference between water use and return flows to sewage.

CHAPTER 9 DATA SOURCES AND METHODS

Compilation of water accounts relies of data from various organisations. Major data sources include; WUC, Mining Companies, Statistics Botswana and Ministry of Agricultural Development and Food Security.

9.1 WUC DATA

9.1.1 Customer data

The water sales (volume and value) provided was not disaggregated by ISIC sector classification. WUC uses ten client categories comprising domestic, business and industries, some mines and government. The 2017/18 and 2018/19 data sorting and assigning economic codes was a challenge, so percentages from the previous report were applied to estimate how much water each industry has used.

9.1.2 WUC water abstraction and use

Comprehensive and up to-date WUC water abstraction data was provided by MC.

9.2 MINING DATA

A total of 7 mines provided data for 2017/18 and 6 mines for 2018/19. A water balance was created for each mine and an overall water balance for the mining sector was produced. The overall balance for the mining sector groups the mines into similar sectors e.g. diamond, gold, coal. The water abstraction was categorized to indicate the source of water (groundwater, surface or waste water). The mining companies also indicated how much water they receive from WUC (where applicable). Mines and WUC have differing data on water provided to mines. To be consistent, WUC sales data was used for all mines that receive (some) water from WUC.

9.3 AGRICULTURE

9.3.1 LIVESTOCK

Water abstraction by livestock was estimated by multiplying livestock numbers by daily water requirements per type of livestock (Cattle, goats, sheep, donkeys, chickens, pigs and horses). A moving average was applied on the previous livestock data to estimate livestock numbers for 2017/18 and 2018/19. Daily water requirements by livestock types were obtained from the Ministry of Local Government and Rural Development design manual for rural water supply.

Table 9.1: Livestock standard daily water consumption

Animal	Consumption
Cattle	50 L/day/animal
Goat and sheep	5 L/day/animal
Donkey	20 L/day/animal
Horse	30 L/day/animal
Pigs	12.5 L/day/animal
Chickens	0.25 L/day/animal

Source: rural water supply guidelines.

9.3.2 IRRIGATION

In an effort to improve water use estimates by the horticulture subsector survey was carried out in Ghanzi District by the Water Accounting Unit in collaboration with the District Agriculture Office. Survey results were merged with the previous survey (South East, North east and Tuli Block) results to obtain the average water use estimate. MOA also provided data on production and the total irrigated area for the year 2017/18 and 2018/19. Average water use estimates were increased by total irrigated area to obtain the total water used for irrigation.

9.4 SEEA- WATER SUPPLY AND USE TABLE

The supply and use table displays the flows between the economy and the environment; the flow of water from the environment into the economy (inputs), flows within the economy (products) and flows from the economy to the environment (residuals).

Water imported from South Africa (Molatedi dam) is captured in the supply table as the water supplied to other economic units. It has been deducted from WUC's abstraction for distribution, as well as from water supplied by WUC to other economic units.

Water received by WUC under the water use table includes water from the mining sector (Debswana Jwaneng). Therefore, this figure is also captured under the diamond sector as water abstracted for distribution, and also water supply to other economic units (WUC) in the supply table.

The SEEA table also contains estimates of return flows to sewage by different sectors. Wastewater was estimated using capacity of the sewage treatment plants and the percentages were applied to estimate how much water each industry return to sewage.

Table 9.2: SEEA terminology

Terms	SEEA description	Comment
Water abstraction	The amount of water that is removed from any source, either permanently or temporarily, in a given period of time for consumption and production activities. Water can be abstracted for distribution or for own use (once it is used it can be delivered to another user for treatment or re-use).	Rainfall that is not captured is not abstraction. For example, rain-fed crop production uses rainfall but this is not recorded in the WA; in contrast, irrigation water is usually abstracted and stored and therefore accounted for in the WA
Water use	Water intake of an economic unit. It is the sum of water: a. provided to that economic unit by a water service provider or another economic sector; and b. water abstraction from the environment by that economic unit.	
Water consumption	That part of water use which is not distributed to other economic units and does not return to the environment because during use it has been incorporated into products, or consumed by households or livestock.	When return flows are unknown consumption becomes similar to water use. Water consumption is not equal to water sales but consumption relates to the hydrological water cycle.
Return flows	Water that is returned into the environment or another economic unit by an economic unit. Returns can be classified according to the receiving body and to the type of water, such as treated water.	Return flows can potentially be used again within the economy.
Water losses	The volume of water lost during transport through leakages and evaporation between a point of abstraction and a point of use, and between points of use and re-use.	Water losses from water infrastructure become return flows into the environment.

Source: United Nations, 2012

CHAPTER 10 REFERENCES

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