

STATISTICS BOTSWANA

BOTSWANA ENVIRONMENT STATISTICS WATER & CLIMATE DIGEST 2016

Copyrights © Statistics Botswana 2016

Statistics Botswana. Private Bag 0024 Botswana
Tel: (267) 367 1300. **Fax:** (267) 395 2201. **Email:** info@statsbots.org **Website:** www.cso.gov.bw

BOTSWANA ENVIRONMENT STATISTICS:
WATER & CLIMATE DIGEST 2016

Published by

Statistics Botswana
Private Bag 0024, Gaborone
Phone: 3671300
Email: info@statsbots.org.bw

Contact Unit:
Environment Statistics Unit
Phone: 3671395

Copyright Reserved © 2016

Extracts may be published if
Sources are duly acknowledged

ISBN:

PREFACE

This is the second bi-annual edition of the Botswana Environment Statistics: Water and Climate Digest. The purpose of the Digest is to provide data for use by decision-makers in water management as well as for monitoring trends related to climate.

The indicators in this report cover data on dam levels, water production, billed water consumption, water losses, water supplied to mines, rainfall, temperature and wind speed and direction. Billed water consumption, water losses, water supplied to mines and wind speed and direction are newly introduced indicators. Indicators will continue to be gradually expanded in subsequent editions as more data become available.

In compiling this report, international standards and guidelines were followed, particularly the United Nations Framework for the Development of Environment Statistics (UNFDES) and the United Nations International Recommendations for Water Statistics. Eventually, the data collected through these methodologies will feed into the UN System of Environmental Economic Accounting (SEEA) for water and hence facilitate an informed management of water resources.

I would like to extend my gratitude and appreciation to all stakeholders who assisted in the production of this digest, in particular the Water Utilities Corporation, the Department of Water Affairs and the Department of Meteorological Services for availing the water and climate data as required.

For more information and further enquiries, contact the Directorate of Stakeholder Relations at 3671300. All Statistics Botswana outputs/publications are available on the website at www.cso.gov.bw and at the Statistics Botswana Library (Head-Office, Gaborone).



A.N. Majelantle
Statistician General
May 2016

Contents

1. WATER	7
1.1. Dam Levels.....	7
1.2. Water production.....	9
1.2.1. Water production by settlements.....	10
1.2.2. Water production by Management Centers (MCs).....	12
1.3. Water consumption.....	14
1.4. Losses.....	17
1.5. Water to mines.....	18
2. CLIMATE	19
2.1. Rainfall.....	19
2.1.1. Monthly total rainfall.....	19
2.1.2. Total annual rainfall.....	22
2.2. Temperature.....	22
2.2.1. Mean monthly Minimum temperatures.....	23
2.2.2. Mean monthly maximum temperatures.....	23
2.3. Wind speed and direction.....	24
REFERENCES	25

List of Tables

Table 1.1: Dam Capacities.....	7
Table 1.2: Percentage dam levels in 2014-15.....	8
Table 1.3: List of water management centres (MCs).....	9
Table 1.4: Six months water production for selected settlements (2014/15).....	10
Table 1.5: Southern water production by management centres (kilolitres).....	12
Table 1.6: Northern water production by management centres (kilolitres).....	12
Table 1.7: Total water production (kilolitres).....	13
Table 1.8: Southern billed water consumption by MCs (kilolitres).....	14
Table 1.9: Northern billed water consumption by MC.....	15
Table 1.10: Total billed water consumption.....	16
Table 1.11: Water losses 2014/15.....	17
Table 1.12: Raw water supply to mines 2013/14 and 2014/15.....	18
Table 2.1: List of synoptic stations used.....	19
Table 2.2: List of rainfall stations used.....	19
Table 2.3a: Monthly total rainfall 2013/14 meteorological year.....	20
Table 2.4: Total annual rainfall by rainfall stations 2012/13 to 2014/15.....	22
Table 2.5: Mean monthly minimum temperatures (2015).....	23
Table 2.6: 2014 and 2015 April to September mean monthly minimum temperatures averaged.....	23
Table 2.7: Mean monthly maximum temperatures (April to September 2015).....	23
Table 2.8: 2014 and 2015 April to September mean monthly maximum temperatures averaged.....	24

List of Figures

Figure 1.1: Percentage change in dam capacities (April to Sept 2015).....	9
Figure 1.2: Six months average water production by settlements (October 2014 to March 2015).....	10
Figure 1.3: Water production for cities and towns (2013/14 and 2014/15).....	11

EXECUTIVE SUMMARY

This report looks at water and climate statistics, based on the indicators of dam levels, water production and billed water consumption, rainfall, temperatures, wind speed and wind direction. The report focuses mainly on the period from April to September 2015.

Botswana has nine dams from which surface water is sourced. Over the period reviewed all of the dams had falling levels.

Water Production

The cities of Gaborone and Francistown and their water management centres (MCs) continue to have the highest water production. Southern MCs have higher water production than the northern MCs. Both the southern and the northern MCs had higher water production in 2015 than in 2014.

Billed Water Consumption

Gaborone, Francistown and Selebi Phikwe management centres have the highest billed water consumption compared to the rest. Total billed water consumption between October and March was more in 2014/15 than in 2013/14 for the southern management centres but slightly lower for the northern management centres.

Water losses

Losses are mostly higher in the southern MCs than in the northern MCs for the 2013/14 and 2014/15 years, with losses reaching as high as 38 percent.

Water supplied to mines

For both the 2013/14 and the 2014/15 years, the highest quantity of water supplied was to the copper-nickel mines, Tati Nickel and BCL mines.

Rainfall

There are various rainfall stations around the country. Only those with full monthly data for 2014/15 are used for total annual rainfall. They are Francistown, Gaborone, Mahalapye, Shakawe, Rakops, Pandamatenga, Sowa Town, Lephephe, Goodhope, Lerala, Oliphant's Drift and Tshane meteorological stations, Maun, Ghanzi, Tsabong, and Sir Seretse Khama airports, and Mochudi and Molepolole police stations.

More total rainfall was recorded in 2013/14 than in 2014/15. The highest total rainfall recorded during the 2014/15 is that of Francistown, at 398.3 mm.

Temperatures

Data used for temperature in this report is of 8 stations across the country. The lowest mean monthly minimum temperature recorded during the period under review, April to September 2015, was 2.5°C for Tsabong in June 2015, while the highest mean monthly maximum temperature for the same period was 34.9°C for Shakawe in September 2015. 2015 had warmer mean minimum and mean maximum temperatures than 2014 during the period under review, for most of the stations.

Wind Speed and Direction

Wind speed and direction data covering the period July to November 2015 is available for fourteen (14) locations across the country. They are Ghanzi, Shakawe, Francistown, Mahalapye, Tshane, Jwaneng, Sir Seretse Khama Airport (SSKA), Sua Pan, Tsabong, Werda, Pandamatenga, Selibe Phikwe, Lephephe and Goodhope.

For all the stations considered the winds were predominantly from the south east. Average monthly wind speed ranged between a light air and a gentle breeze.

1. WATER

1.1. Dam Levels

Botswana has nine dams from which surface water is sourced. They are the Gaborone, Nnywane, Bokaa, Letsibogo, Shashe, Ntimbale, Thune, Lotsane and the Dikgathong dams. Botswana also imports water from Molatedi dam in the Republic of South Africa.

Table 1.1: Dam Capacities

Dam	Capacity (Mm ³)
Gaborone Dam	141.4
Bokaa Dam	18.5
Letsibogo	100.0
Nnywane	2.3
Shashe	85.0
Ntimbale	26.6
Lotsane	40.0
Thune	90.0
Dikgathong	400.0
Molatedi (Republic of South Africa)	201.0

Source: Statistics Botswana

Note: Molatedi dam is in South Africa and provides imported water to Botswana

The dam capacities are indicated above in Table 1.1. Dikgathong dam is the country's largest dam by capacity at 400 million cubic metres (Mm³) while Nnywane is the smallest at 2.3 million cubic meters.

Dam levels are determined by rainfall in the catchment areas as well as inflows and outflows of water into and out of the dams. Evaporation rates are also a determinant of the dam levels.

This report looks at dam level trends between April and September 2015. The data table however contains data for months beyond the period but they will not form part of the analysis.

Table 1.2: Percentage dam levels in 2014-15

Year		Gaborone	Nnywane	Bokaa	Letsibogo	Shashe	Nfimbale	Thune	Lotsane	Dikgatlhong	Molatedi
2014	17th February	13.2	74.7	38.5	100.9	98.3	100.0	41.6	99.1	101.0	20.2
	14th March	16.0	-	57.0	103.7	103.4	102.0	55.5	108.3	106.5	26.0
	14th April	15.1	73.0	56.2	97.7	97.3	98.4	55.7	96.4	98.9	35.3
	16th May	13.7	67.6	50.2	93.6	94.3	97.5	58.7	94.2	98.3	34.6
	June	12.5	61.5	46.0	90.1	91.1	95.8	58.7	89.4	97.0	32.8
	15th July	11.3	54.6	41.8	86.6	87.9	94.1	58.7	84.5	95.6	31.0
	29th August	9.8	54.1	36.3	77.5	83.4	90.5	52.0	82.9	95.4	28.4
	23rd September	8.5	51.1	30.5	78.7	80.6	88.7	51.2	80.7	92.3	26.8
	8th October	7.5	47.0	27.3	75.9	78.9	87.3	49.9	77.5	91.2	24.7
	14th November	6.1	40.2	22.0	72.3	75.1	84.1	48.1	75.2	88.2	21.7
	15th December	5.2	92.1	19.7	70.7	71.5	84.1	48.1	71.7	87.1	20.8
2015	*January	4.7	93.2	20.5	69.9	83.7	89.6	47.7	73.4	88.0	18.0
	17th February	4.2	94.2	21.2	69.0	95.8	95.0	47.2	75.0	88.8	15.2
	9th March	3.4	88.4	18.4	65.2	93.9	92.0	46.8	72.2	87.4	15.2
	15th April	2.7	85.6	15.5	58.3	92.6	97.9	45.5	70.0	85.6	13.4
	*May	2.2	79.5	11.9	55.7	93.9	95.9	44.3	67.4	84.1	12.5
	15th June	1.7	73.3	8.2	53.1	95.1	93.9	43.1	64.8	82.5	11.5
	17th July	1.6	66.7	2.4	49.2	91.5	89.8	41.5	61.3	80.9	10.2
	26th August	1.5	60.5	2.0	46.3	87.9	89.3	43.0	59.9	79.4	8.9
	22nd September	1.4	56.2	2.0	43.8	85.1	86.3	39.1	58.3	78.3	8.4
	6th October	1.4	53.4	2.0	43.3	83.2	85.3	39.1	57.4	77.6	7.6
	13th November	1.1	46.2	2.0	38.3	79.6	83.6	37.6	51.7	74.5	5.2

*June 2014, January and May 2015 data interpolated using average of two nearest neighbours

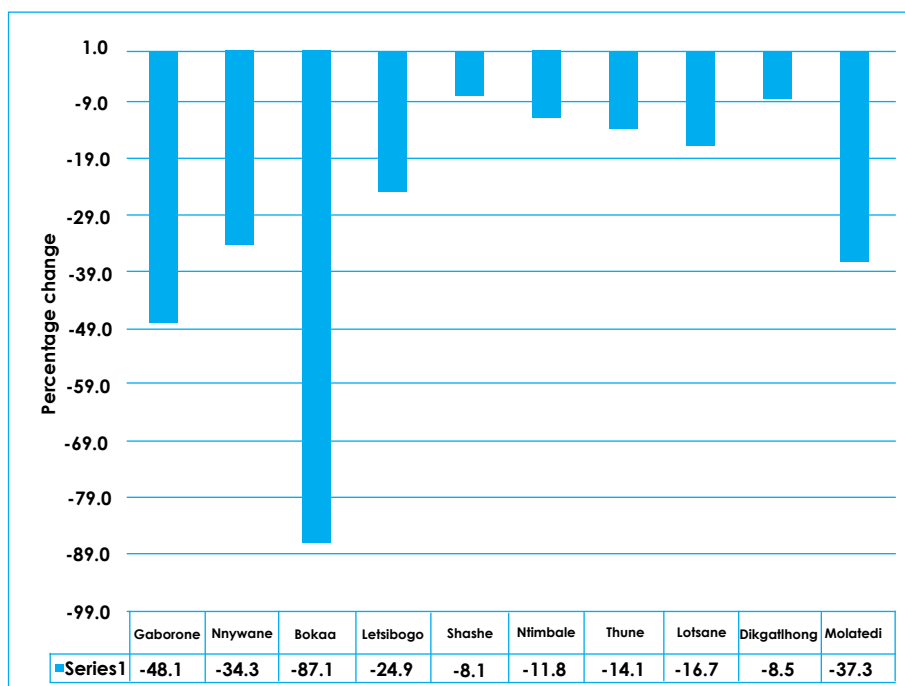
Dash (-) = no data

Source: Water Utilities Corporation

Table 1.2 above shows the percentage dam levels for the years 2014 and 2015. The period of analysis considered is April to September 2015. During this period, all of the dams showed losses in their levels, a trend that is expected in the dry season.

Figure 1.1 below shows the dry season percentage change in the dam levels between April 2015 and September 2015 for each of the dams.

Figure 1.1: Percentage change in dam capacities (April to September 2015)



During the dry period April to September 2015, Bokaa dam had the highest loss in the water that it held as at April 2015, with its level decreasing by 87.1 percent. This was followed by Gaborone dam at 48.1 percent loss, and then Molatedi dam (in South Africa) at 37.3 percent loss. The three dams serve the Gaborone water management centre.

1.2. Water production

Potable water production is carried out through sixteen (16) management centres throughout the country by Water Utilities Corporation (WUC). The management centres treat and provide water sourced from both surface and groundwater. The WUC management centres in the country are shown in Table 1.3.

Table 1.3: List of water management centres (MCs)

Region	Management Centre
Southern region	1 Gaborone
	2 Molepolole
	3 Lobatse
	4 Mochudi
	5 Kanye
	6 Tsabong
	7 Ghanzi
Northern region	8 Selibe Phikwe
	9 Palapye
	10 Serowe
	11 Letlhakane
	12 Mahalapye
	13 Kasane
	14 Masunga
	15 Francistown
	16 Maun

1.2.1. Water production by settlements

Table 1.4: Six months water production for selected settlements (2014/15) (Kilolitres)

Area	October	November	December	January	February	March	Average
Gaborone	1,525,716.00	1,429,847.00	978,135.00	1,105,740	963,979.00	998,196.00	1,166,936.00
Francistown	975,465.00	944,756.00	917,840.00	1,005,157	852,863.00	1,037,523.00	955,601.00
Phikwe	521,720.00	476,509.00	461,665.00	526,623	510,494.00	534,747.00	505,293.00
Lobatse	413,695.00	381,317.00	301,189.00	347,687	348,568.00	371,116.00	360,595.00
Tlokweng	127,400	257,640	189,650	206,130	231,680	171,290	298,797.00
Molepolole	317,113.00	287,460.00	305,964.00	288,440	263,074.00	283,462.00	290,919.00
Serowe	187,659.00	298,335.00	281,193.00	211,522	276,808.00	271,142.00	254,443.00
Kanye	250,012.00	201,300.00	217,437.00	222,523	213,476.00	224,324.00	221,512.00
Mogoditshane	296,404	279,800	364,270	276,145	310,703	265,459	197,298.00
Palapye	95,901	236,488	163,074	292,774	152,163	162,600	183,833.00
Jwaneng	167,658.00	199,720.00	196,740.00	188,034	221,837.00	122,288.00	182,713.00
Sowa	21,832.00	22,786.00	22,309.00	19,203	20,420.00	20,420.00	21,162.00

Table 1.4 above shows the six month (October 2014 to March 2015) trend in water production quantities for selected settlements. Gaborone and Francistown have high quantities of water supplied to them, compared to the other settlements, due to their population sizes and higher levels of industrial and economic activity.

Figure 1.2: Six months average water production by settlements (October 2014 to March 2015)

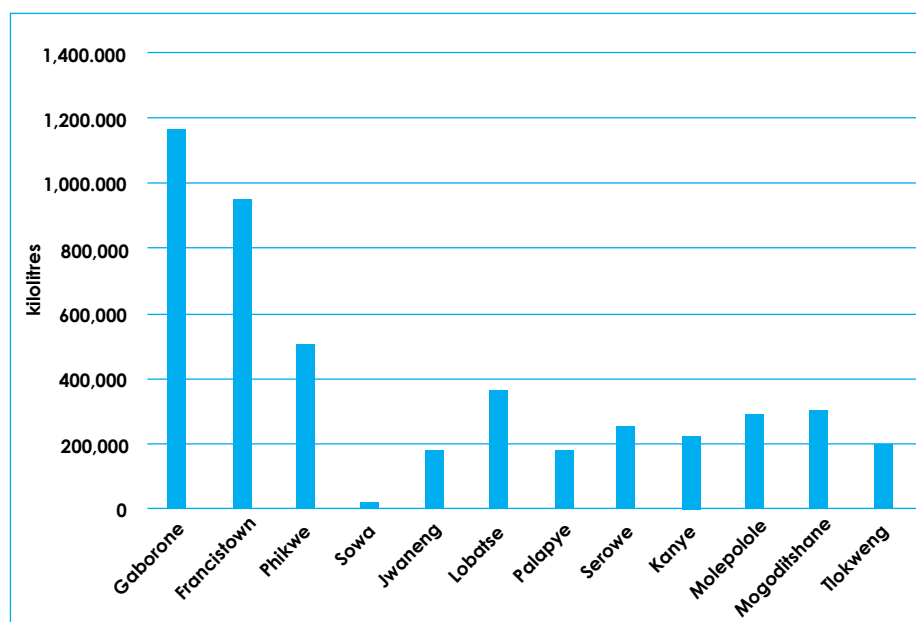


Figure 1.2 shows the average monthly water production for the selected settlements over the six month period of October 2014 to March 2015. Gaborone and Francistown continue to have the highest production of water.

Figure 1.3: Water production for cities and towns (2013/14 and 2014/15) (Kilolitres)

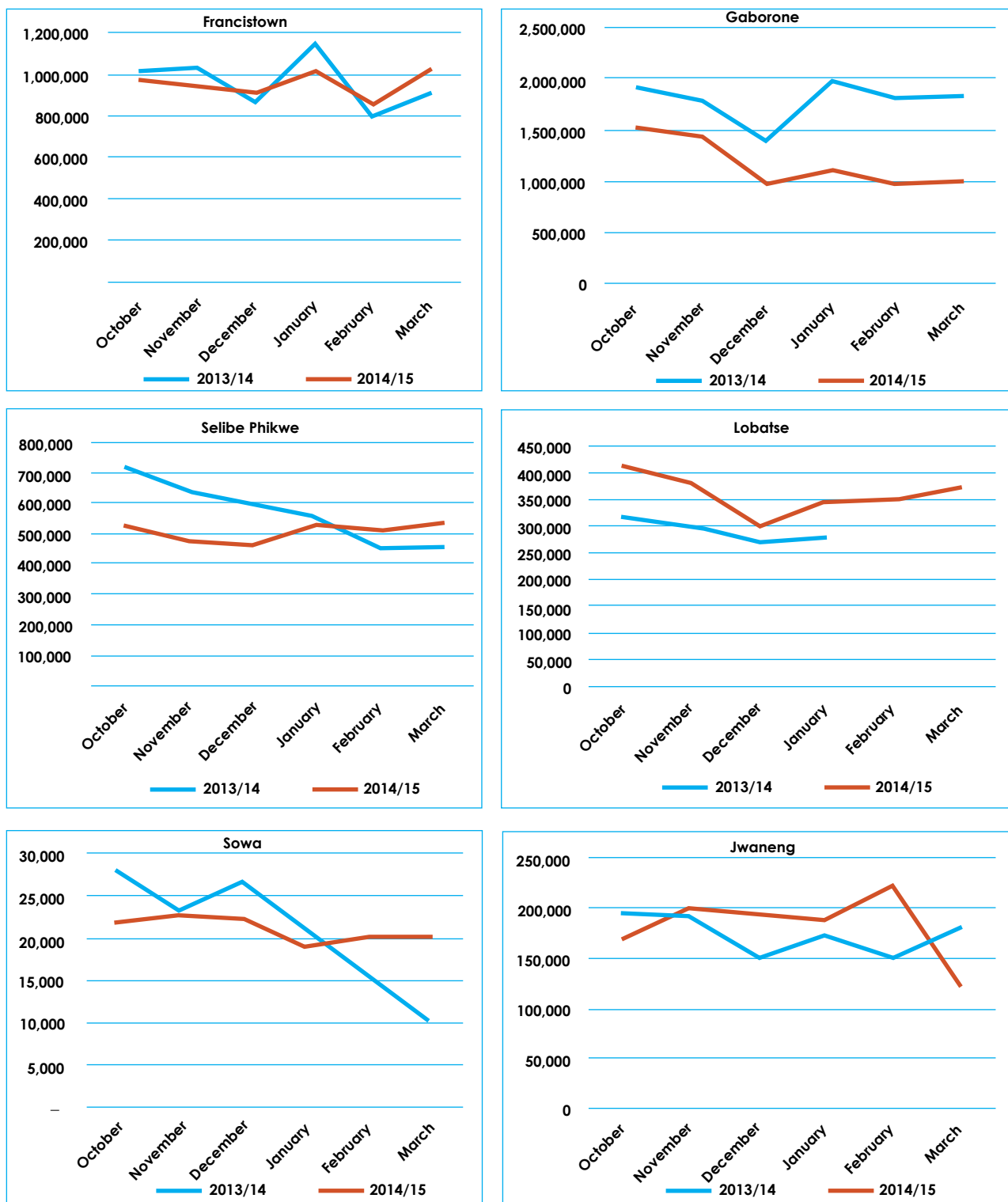


Figure 1.3 compares some selected urban settlements' (cities and towns) water production patterns for the six month period (October 2014 to March 2015) for the two successive periods 2013/14 and 2014/15. Indications are that Gaborone water production was less for the same period in 2014/15 than in 2013/14. This is likely due to water shortages and conservation measures as the management centre depends highly on water piped from the north through the North-South Carrier (NSC) pipeline. Water production is noticeably lower during the months of December in the cities and towns, which is possibly the result of lower demand as people travel to the rural areas and manufacturing and production processes close during the holiday break.

Gaborone dam remained in a failed state. Francistown and Selibe Phikwe produced marginally less water over the same period. Lobatse and Jwaneng show higher water production between October and March for 2014/15 than for the same period during the previous year, 2013/14.

1.2.2. Water production by Management Centers (MCs)

The sixteen (16) WUC Management Centres (MCs) are distributed between the northern MCs and the southern MCs. There are nine (9) MCs in the north and seven (7) in the south. The southern MCs serve a higher population, which is concentrated in the south-eastern parts of the country, where the capital city of Gaborone is situated. Most of the country's surface water resources are located in the northern parts of the country.

Table 1.5: Southern water production by management centres (kilolitres)

Year	Month	Gaborone	Molepolole	Lobatse	Mochudi	Kanye	Tsabong	Ghanzi	Total Southern Region
2014	Jan	2,635,700.0	444,326.0	653,449.0	301,593.0	504,174.0	135,035.0	110,765.0	4,785,042.0
	Feb	2,456,118.0	399,541.0	-	298,779.0	526,849.0	109,174.0	120,090.0	3,910,551.0
	Mar	2,513,053.0	347,610.0	-	248,796.0	481,199.0	115,432.0	104,557.0	3,810,647.0
	Apr	1,872,926.0	520,390.0	637,049.0	270,971.0	576,852.0	117,301.4	103,905.8	4,099,395.2
	May	2,533,323.0	516,621.0	820,395.0	314,514.0	551,130.0	118,405.8	102,633.3	4,957,022.1
	Jun	2,010,539.0	538,903.0	734,340.0	290,799.0	591,414.0	117,551.7	105,887.0	4,389,433.7
	Jul	2,073,870.0	554,028.0	800,895.0	264,400.0	612,539.0	116,718.6	105,672.0	4,528,122.6
	Aug	2,064,052.0	569,198.0	890,600.0	281,435.0	654,453.0	117,689.7	107,759.0	4,685,186.7
	Sep	2,156,692.0	593,401.0	705,828.0	285,322.0	670,303.0	112,275.6	108,648.0	4,632,469.6
	Oct	2,133,791.0	543,004.0	768,566.0	302,845.0	564,746.0	122,493.5	121,337.0	4,556,782.5
	Nov	2,136,719.0	504,631.0	757,319.0	298,106.0	545,762.0	128,276.8	109,981.0	4,480,794.8
	Dec	1,641,085.0	502,249.0	650,365.0	285,900.0	554,859.0	124,603.1	112,937.0	3,871,998.1
2015	January	1,764,028.0	487,149.0	722,284.0	319,914.0	543,210.0	110,408.5	131,011.0	4,078,004.5
	February	1,735,624.0	459,661.0	680,019.0	329,727.0	588,709.0	129,628.5	122,925.0	4,046,293.5
	Mar	1,623,934.0	482,148.3	749,286.0	283,151.0	479,042.0	130,574.5	123,967.0	3,872,102.8

Dash (-) = no data

Source: Water Utilities Corporation

Table 1.6: Northern water production by management centres (Kilolitres)

Year	Month	Selibe Phikwe	Palapye	Serowe	Lethakane	Mahalapye	Kasane	Masunga	Francistown	Maun	Total Northern Region
2014	Jan	712,949.0	267,310.0	242,698.0	110,891.0	379,359.0	101,400.0	497,695.0	1,409,800.0	383,890.0	3,722,102.0
	Feb	624,484.0	237,459.0	247,972.0	100,493.0	358,529.0	76,000.0	430,227.0	1,071,098.0	268,167.0	3,146,262.0
	Mar	632,418.0	162,333.0	216,986.0	129,292.0	368,667.0	108,000.0	336,824.0	1,215,041.0	278,435.0	3,169,561.0
	Apr	648,727.0	274,523.4	153,447.0	115,226.0	327,962.0	145,900.0	422,595.0	1,158,340.0	301,930.0	3,548,650.4
	May	737,743.0	186,354.0	225,985.0	109,766.0	349,428.0	135,440.0	357,987.0	1,227,951.0	329,257.0	3,659,911.0
	Jun	603,073.0	231,250.0	265,863.0	119,148.0	378,587.0	155,096.0	423,588.1	1,124,174.0	303,013.0	3,603,792.0
	Jul	591,856.0	181,292.0	215,258.0	92,797.0	369,839.0	127,100.0	351,870.1	1,143,794.0	308,992.0	3,382,798.1
	Aug	648,826.0	178,738.0	231,611.0	127,360.0	371,756.0	130,580.0	374,946.1	1,169,548.0	288,861.3	3,522,226.4
	Sep	623,245.0	209,261.0	322,619.0	122,656.0	341,994.0	162,569.0	334,528.9	1,203,994.0	288,669.0	3,609,535.9
	Oct	694,540.0	211,810.0	229,013.0	128,278.0	417,472.3	199,480.0	355,342.8	1,269,495.0	315,919.0	3,821,350.1
	Nov	663,743.0	322,475.0	337,384.0	131,310.0	383,140.0	138,920.0	439,834.4	1,232,306.0	311,948.0	3,961,060.4
	Dec	631,762.0	237,678.0	316,654.0	115,149.0	407,074.0	196,890.0	402,022.7	1,209,700.0	328,087.0	3,845,016.7
2015	Jan	718,888.0	369,220.0	244,228.0	129,360.0	404,546.0	171,188.0	359,967.4	1,327,017.0	285,416.0	4,009,830.4
	Feb	673,708.0	218,587.0	315,280.0	147,472.0	387,416.0	154,683.0	409,275.2	1,107,793.0	311,632.0	3,725,846.2
	Mar	738,700.0	246,365.0	318,604.0	140,539.0	419,981.0	148,585.0	341,298.9	1,294,483.0	339,186.0	3,987,741.9

Dash (-) = no data Source: Water Utilities Corporation

Tables 1.5 and 1.6 show the monthly water production trends by management centres in the northern and southern regions. Water demand remains higher in the southern than the northern regions due to the concentration of population in the southern regions, where the capital city Gaborone is located.

Gaborone Management centre continues to have the highest production of water in the southern management centres, while Francistown has the highest production in the northern centres.

Table 1.7: Total water production (Kilolitres)

SOUTHERN MCs	Total October 2013 to March 2014	Total October 2014 to March 2015
Gaborone	14,648,921.00	11,035,181.00
Molepolale	2,313,669.00	2,978,842.30
Lobatse	*2,557,866.00	4,327,839.00
Mochudi	1,669,752.00	1,819,643.00
Kanye	3,154,609.00	3,276,328.00
Tsabong	740,657.00	745,984.90
Ghanzi	665,121.00	722,158.00
Total	25,750,595.00	24,905,976.20
NORTHERN MCs		
Selibe Phikwe	4,465,623.00	4,121,341.00
Palapye	1,323,342.00	1,606,135.00
Serowe	1,444,588.00	1,761,163.00
Lethakane	665,233.00	792,108.00
Mahalapye	2,230,333.00	2,419,629.30
Kasane	623,400.00	1,009,746.00
Masunga	2,563,876.00	2,307,741.40
Francistown	7,500,036.00	7,440,794.00
Maun	1,706,305.00	1,892,188.00
Total	22,522,736.00	23,350,845.70

*Lobatse 2013/14 production figures low due to missing data for the months of February and March

Source: Water Utilities Corporation

Table 1.7 compares the October 2014 to March 2015 total water production for the management centres with that of the same period during the previous year 2013/14. For the southern management centres, Gaborone management centre water production was less between October 2014 and March 2015 than for the same period a year earlier. All the rest produced more water for the same period in 2014/15 than in 2013/14. The reduction in water production in Gaborone management centre is likely due to water restrictions and the failure of dams supplying Gaborone. Supply to some parts of the city has also been intermittent during the latter period.

For the northern management centres, Francistown, Selibe Phikwe and Masunga used less water between October 2014 and March 2015 during the 2014/15 year than for the same period in 2013/14. Water saving measures have been introduced in the city and town. Maun, Palapye, Serowe, Mahalapye, Kasane, and Lethakane on the other hand had higher water production in 2014/15 than in 2013/14, during the period under review.

Total water production between October and March was more in 2014/15 than in 2013/14 for the northern management centres, but less in 2014/15 than in 2013/14 for the Southern management centres.

1.3. Water consumption

Water consumption data is availed by Water Utilities Corporation (WUC). This is data based on water meter estimations and readings. The estimations and readings are then used for billing WUC customers. "Billed" water consumption is resultant from meter reading and estimates from customer billings. Billed water consumption data is available by management centre. WUC is responsible for metering and billing water consumption.

Table 1.8: Southern billed water consumption by management centres (kilolitres)

Year	Month	Gaborone	Mochudi	Molepolole	Lobatse	Kanye	Tsabong	Ghanzi	Total
2013/14	Apr	2,381,880.0	285,480.0	168,901.0	559,035.0	296,876.0	58,003.0	77,511.0	3,827,686.0
	May	2,064,749.0	211,460.0	170,565.0	388,399.0	309,078.0	66,940.0	70,306.0	3,281,497.0
	Jun	2,127,780.0	329,575.0	189,135.0	336,914.0	299,653.0	45,217.0	67,482.0	3,395,756.0
	Jul	1,871,794.0	234,836.0	176,409.0	367,574.0	306,118.0	41,148.0	66,590.0	3,064,469.0
	Aug	1,782,489.0	366,916.0	167,868.0	363,669.0	323,234.0	47,758.0	66,253.0	3,118,187.0
	Sep	1,927,084.0	119,853.0	179,752.0	419,588.0	304,997.0	33,719.0	86,709.0	3,071,702.0
	Oct	1,725,882.0	128,269.0	147,264.0	336,741.0	297,118.0	31,627.0	73,750.0	2,740,651.0
	Nov	1,645,401.0	195,797.0	183,396.0	305,570.0	270,138.0	15,529.0	64,378.0	2,680,209.0
	Dec	1,944,628.0	251,147.0	175,378.0	351,037.0	317,234.0	71,040.0	72,059.0	3,182,523.0
	Jan	1,869,288.0	154,979.0	159,613.0	365,764.0	269,696.0	36,771.0	61,726.0	2,917,837.0
	Feb	1,817,597.0	85,382.0	116,731.0	241,631.0	216,936.0	74,080.0	59,878.0	2,612,235.0
	Mar	1,757,696.0	310,764.0	464,440.0	452,574.0	260,804.0	88,191.0	84,438.0	3,418,907.0
2014/15	Apr	1,476,809.0	105,563.0	272,575.0	520,460.0	256,500.0	70,000.0	73,095.0	2,775,002.0
	May	1,962,598.0	255,890.0	350,753.0	449,105.0	440,627.0	79,638.0	77,669.0	3,616,280.0
	Jun	1,766,112.0	203,068.0	295,836.0	331,377.0	136,253.0	62,262.0	94,168.0	2,889,076.0
	Jul	1,866,053.0	300,734.0	191,956.0	344,422.0	392,717.0	69,590.0	66,302.0	3,231,774.0
	Aug	1,570,685.0	221,692.0	339,264.0	365,581.0	260,105.0	71,574.0	64,059.0	2,892,960.0
	Sep	2,252,159.0	263,808.0	235,990.0	363,842.0	352,560.0	49,522.0	95,429.0	3,613,310.0
	Oct	2,011,572.0	262,078.0	234,109.0	489,647.0	277,740.0	103,409.0	73,483.0	3,452,038.0
	Nov	1,896,299.0	268,172.0	189,955.0	402,194.0	394,455.0	79,712.0	90,449.0	3,321,236.0
	Dec	1,953,936.0	271,215.0	160,528.0	243,928.0	257,718.0	52,828.0	64,413.0	3,004,566.0
	Jan	1,566,272.0	243,538.0	205,836.0	364,935.0	234,927.0	67,220.0	88,987.0	2,771,715.0
	Feb	1,528,043.0	210,598.0	214,793.0	371,764.0	436,312.0	107,903.0	113,604.0	2,983,017.0
	Mar	1,422,633.0	221,015.0	211,553.0	397,121.0	353,194.0	90,831.0	96,103.0	2,792,450.0

Source: Water Utilities Corporation

Table 1.9: Northern billed water consumption by management centre (Kilolitres)

Year	Month	Francistown	Selibe Phikwe	Palapye	Serowe	Mahalapye	Kasane	Masunga	Lethakane	Total
2013/14	Apr	1,244,863.0	845,171.0	258,846.0	224,081.0	261,186.0	70,962.0	260,590.0	62,444.0	3,228,143.0
	May	1,053,128.0	526,238.0	238,408.0	172,154.0	164,817.0	102,942.0	222,457.0	60,615.0	2,540,759.0
	Jun	1,083,700.0	656,866.0	206,379.0	1,442,390.0	162,342.0	96,360.0	196,305.0	138,774.0	3,983,116.0
	Jul	1,008,006.0	716,526.0	190,788.0	146,032.0	158,919.0	91,131.0	192,657.0	60,920.0	2,564,979.0
	Aug	791,440.0	632,221.0	197,903.0	150,662.0	165,273.0	98,083.0	235,679.0	72,234.0	2,343,495.0
	Sep	1,064,834.0	746,223.0	163,042.0	172,062.0	173,246.0	79,931.0	197,866.0	72,475.0	2,669,679.0
	Oct	1,046,435.0	618,629.0	229,199.0	165,929.0	196,597.0	90,068.0	121,184.0	71,774.0	2,539,815.0
	Nov	1,026,246.0	716,363.0	237,667.0	157,552.0	161,266.0	65,969.0	86,200.0	75,967.0	2,527,230.0
	Dec	1,986,762.0	590,183.0	208,275.0	161,797.0	138,747.0	66,642.0	88,343.0	89,598.0	3,330,347.0
	Jan	1,024,060.0	782,623.0	178,079.0	122,098.0	261,178.0	49,471.0	54,119.0	52,593.0	2,524,221.0
	Feb	991,839.0	533,879.0	158,294.0	173,642.0	232,425.0	53,186.0	32,904.0	173,857.0	2,350,026.0
	Mar	1,111,287.0	796,658.0	152,886.0	120,593.0	176,074.0	93,351.0	671,566.0	212,742.0	3,335,157.0
2014/15	Apr	852,802.0	681,861.0	146,512.0	260,839.0	245,874.0	63,186.0	108,929.0	69,070.0	2,429,073.0
	May	967,096.0	599,191.0	159,518.0	173,599.0	146,407.0	66,427.0	308,176.0	95,771.0	2,516,185.0
	Jun	999,477.0	620,807.0	201,588.0	167,387.0	167,757.0	79,286.0	273,045.0	94,936.0	2,604,283.0
	Jul	877,668.0	683,482.0	169,898.0	247,460.0	145,637.0	83,902.0	91,439.0	87,528.0	2,387,014.0
	Aug	1,234,445.0	619,899.0	301,440.0	176,640.0	175,981.0	93,308.0	469,655.0	89,645.0	3,161,013.0
	Sep	1,098,313.0	642,379.0	233,729.0	251,434.0	198,737.0	114,833.0	227,163.0	99,000.0	2,865,588.0
	Oct	1,344,011.0	682,506.0	277,463.0	188,691.0	298,475.0	106,872.0	156,562.0	86,910.0	3,141,490.0
	Nov	1,003,556.0	716,145.0	263,292.0	193,883.0	175,568.0	98,978.0	227,282.0	92,355.0	2,771,059.0
	Dec	634,471.0	535,222.0	270,833.0	157,508.0	242,332.0	79,530.0	237,146.0	99,586.0	2,256,628.0
	Jan	1,144,163.0	631,935.0	262,419.0	192,087.0	316,579.0	104,374.0	258,428.0	105,138.0	3,015,123.0
	Feb	952,563.0	600,200.0	207,292.0	230,930.0	165,242.0	87,813.0	175,561.0	98,237.0	2,517,838.0
	Mar	808,997.0	635,444.0	203,118.0	201,330.0	288,627.0	93,843.0	202,111.0	95,006.0	2,528,476.0

No data available for Maun MC
Source: Water Utilities Corporation

Tables 1.8 and 1.9 show the monthly billed water consumption for the southern and the northern management centres for the 2013/14 and 2014/15 years. Gaborone, Francistown and Selebi Phikwe management centres have the highest water consumption compared to the rest in both years.

Table 1.10: Total billed water consumption (kilolitres)

SOUTHERN MCs	Total October 2013 to March 2014	Total October 2014 to March 2015
Gaborone MC	10,760,492.0	10,378,755.0
Lobatse MC	2,053,317.0	2,269,589.0
Kanye MC	1,631,926.0	1,954,346.0
Mochudi MC	1,126,338.0	1,476,616.0
Molepolole MC	1,246,822.0	1,216,774.0
Ghanzi MC	416,229.0	527,039.0
Tsabong MC	317,238.0	501,903.0
Total	17,552,362.0	18,325,022.0
NORTHERN MCs		
Francistown MC	7,186,629.0	5,887,761.0
Selibe Phikwe MC	4,038,335.0	3,801,452.0
Mahalapye MC	1,166,287.0	1,486,823.0
Palapye MC	1,164,400.0	1,484,417.0
Masunga MC	1,054,316.0	1,257,090.0
Serowe MC	901,611.0	1,164,429.0
Letlhakane MC	676,531.0	577,232.0
Kasane MC	418,687.0	571,410.0
Maun MC	-	-
Total	16,606,796.0	16,230,614.0

Dash (-) = no data

Source: Water Utilities Corporation

Table 1.10 compares the October 2014 to March 2015 total billed water consumption for the management centres with that of the same period during the previous year 2013/14. For the southern management centres, Gaborone and Molepolole management centres billed water consumption was less between October 2014 and March 2015 than for the same period the previous year. All the rest had higher billed water consumption for the same period in 2014/15 than in 2013/14.

For the northern management centres, Francistown, Selibe Phikwe and Letlhakane had less billed water consumption between October and March during the 2014/15 year than for the same period in 2013/14. Palapye, Serowe, Mahalapye, Kasane and Masunga on the other hand had higher billed water consumption in 2014/15 than in 2013/14, during the period under review.

Total billed water consumption between October and March was higher in 2014/15 than in 2013/14 for the southern management centres but slightly lower for the northern management centres.

1.4. Losses

Water losses are the calculated difference between water production and water consumption and expressed as a percentage of the water production, by management centre. It should be noted that water consumption is based on meter readings and estimations for billings and sales and thus will vary.

Table 1.11: Water losses 2014/15 (percent)

Month	Southern MCs	*Northern MCs
Apr	32%	25%
May	27%	24%
Jun	34%	21%
Jul	29%	22%
Aug	38%	2%
Sep	22%	14%
Oct	24%	10%
Nov	26%	24%
Dec	22%	36%
Jan	32%	19%
Feb	26%	26%
Mar	28%	31%

*Northern MCs losses based on total production and consumption excluding Maun

Source: Calculated from WUC supplied water production and consumption data

Table 1.11 shows the percentage water losses for the year 2014/15. Southern management centres water losses were highest in August 2014 at 38 percent, while for northern management centres the highest was for December 2014 at 36 percent. Losses are mostly higher in the southern management centres than in the northern management centres.

Table 1.12: Raw water supply to mines 2013/14 and 2014/15 (Kilolitres)

2013/14	Botash	Morupule Colliery Mine	BCL	Tati Nickel	Mupane
Apr-13	25,479.0	100,830.0	172,190.0	256,121.0	195,700.0
May-13	27,267.0	105,760.0	193,420.0	263,780.0	93,000.0
Jun-13	22,811.0	30,660.0	174,000.0	190,638.0	64,830.0
Jul-13	19,993.0	24,780.0	183,590.0	324,459.0	90,710.0
Aug-13	29,359.0	-	209,990.0	269,209.0	63,041.0
Sep-13	25,486.0	-	139,790.0	253,924.0	63,489.0
Oct-13	15,949.0	-	192,610.0	248,052.0	7,981.0
Nov-13	26,446.0	-	162,510.0	207,313.0	7,343.0
Dec-13	33,581.0	-	185,220.0	-	-
Jan-14	26,248.0	-	102,390.0	212,981.0	60,530.0
Feb-14	31,169.0	-	211,780.0	207,530.0	64,330.0
Mar-14	19,290.0	-	218,020.0	266,849.0	77,520.0
	303,078.0	262,030.0	2,145,510.0	2,700,856.0	788,474.0
2014/15					
Apr-14	30,250.0	95.0	315,810.0	213,104.0	73,020.0
May-14	24,880.0	43,765.0	185,490.0	217,922.0	70,190.0
Jun-14	29,722.0	45,224.0	219,490.0	206,117.0	65,800.0
Jul-14	25,411.0	43,765.0	167,040.0	247,521.0	67,710.0
Aug-14	24,500.0	40,875.0	153,780.0	274,476.0	68,840.0
Sep-14	24,786.0	43,189.0	158,330.0	282,738.0	82,940.0
Oct-14	26,140.0	84,064.0	95,220.0	269,155.0	90,850.0
Nov-14	30,110.0	81,262.0	66,950.0	298,898.0	68,910.0
Dec-14	28,125.0	89,668.0	317,460.0	303,117.0	76,840.0
Jan-15	19,203.0	86,866.0	225,300.0	305,805.0	72,940.0
Feb-15	25,989.0	-	219,000.0	207,284.0	63,170.0
Mar-15	16,224.0	-	209,060.0	182,141.0	68,190.0
	305,340.0	558,773.0	2,332,930.0	3,008,278.0	869,400.0

Dash (-) means no water supply recorded
Source: Water Utilities Corporation

Table 1.12 shows the raw water quantities supplied to the mines between April 2013 and March 2015. For both the 2013/14 and the 2014/15 years, the highest quantity of water supplied to a mine was to Tati Nickel mine, while BCL mine received the second highest quantity of water from WUC. Both mines are copper nickel mines.

2. CLIMATE

2.1. Rainfall

Rainfall is measured by the Department of Meteorological Services (DMS) at various rainfall stations and seventeen (17) synoptic stations around the country. The synoptic stations are those manned by meteorologists, while rainfall stations are monitored by other members of the society such as police and schools.

Table 2.1: List of synoptic stations used

1	Ghanzi
2	Mahalapye
3	Tsabong
4	Francistown
5	Maun
6	Sir Seretse Khama Airport
7	Tshane
8	Shakawe
9	Selibe Phikwe
10	Letlhakane
11	Good Hope
12	Sua Pan
13	Jwaneng
14	Werda
15	Pandamatenga
16	Kasane
17	Lephephe

Table 2.2: List of rainfall stations used

1	Francistown Airport
2	Gaborone Met H/Q
3	Ghanzi Airport
4	Kanye Seepapitso SSS
5	Lobatse Police Station
6	Mahalapye Met. Station
7	Maun Airport
8	Mochudi Police Station
9	Molepolole Police Station
10	Palapye Police Station
11	Serowe Police Station
12	Shakawe Met. Station
13	Tsabong Airport
14	Tshane Met. Station
15	Kasane Airport
16	Good Hope
17	Moshupa Police Station
18	Sowa Town
19	Lephephe
20	Lerala
21	Rakops
22	Oliphant's Drift
23	Jwaneng Met. Station
24	Selebi Phikwe Met. Station
25	Werda Met. Station
26	Letlhakane Met. station
27	Pandamatenga

The synoptic stations used are listed in Table 2.1 while the rainfall stations used are listed in Table 2.2. Only those stations with some data available have been used in this Digest.

2.1.1. Monthly total rainfall

The meteorological year starts in July and ends in June of the subsequent year. The main rain season covers the period beginning in October and ending in March. (Statistics Botswana: 2005) This report looks at the monthly total rainfall for the wet seasons of the two meteorological years 2013/14 and 2014/15. Data for months outside of the wet season are however included in the data tables.

Table 2.3a: Monthly total rainfall 2013/14 meteorological year (millimetres)

Month	Francistown Airport	Gaborone Met H/Q	Mahalapye Met. Station	Maun Airport	Mochudi Police Station	Molepolole Police Station	Shakawe Met. Station	Tsabong Airport	Tshane Met. Station	Bobonong Police Station	Bokspits Agromet Station	Gumare	Kang
Jul	0.0	20.6	0.0	0.0	0.0	16.1	0.0	4.2	0.0	0.0	0.7	0.0	0.7
Aug	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sep	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oct	24.9	10.0	14.5	7.0	7.0	0.0	9.4	1.5	25.0	0.0	18.1	0.0	18.1
Nov	31.8	33.3	57.7	20.8	82.0	29.5	0.8	14.0	11.2	29.0	1.5	30.2	1.5
Dec	133.3	174.1	152.6	142.9	103.1	61.6	124.1	48.8	121.8	93.0	88.9	95.3	88.9
Jan	193.6	35.7	107.8	143.4	37.0	59.5	196.0	47.8	19.6	76.5	151.6	192.7	151.6
Feb	94.4	43.3	0.0	0.0	73.3	43.5	83.4	246.1	275.7	80.0	273.2	176.9	273.2
Mar	221.5	128.5	156.1	0.0	167.5	174.0	282.4	45.9	23.2	160.0	96.1	78.2	96.1
Apr	17.4	15.9	23.7	27.2	9.0	0.0	49.2	8.4	0.4	0.0	4.3	14.7	4.3
May	0.0	0.1	0.0	0.0	0.0	0.0	0.0	19.1	21.6	0.0	18.2	0.0	18.2
Jun	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	716.9	464.8	512.4	341.3	478.9	384.2	745.3	435.8	498.5	438.5	652.6	588.0	652.6

Source: Department of Meteorological Services

Table 2.3b: Monthly total rainfall 2014/15 meteorological year (Millimetres)

Month	Francistown Met. Station	Gaborone Met H/Q	Sir Seretse Khama Airport	Gantsi	Goodhope	Mahalapye Met. Station	Maun Airport	Mochudi Police Station	Molepolole Police Station	Shakawe Met. Station
Jul	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aug	0.0	0.0	0.0	0.0	14.0	0.0	0.0	0.0	0.0	0.0
Sep	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0
Oct	1.5	0.3	1.8	1.4	0.0	18.1	1.3	7.0	5.8	0.0
Nov	111.3	52.6	48.7	46.0	38.8	26.0	33.0	92.5	148.0	77.3
Dec	167.1	90.6	35.0	7.5	104.5	134.9	78.5	72.0	101.6	49.6
Jan	0.0	80.6	60.3	0.0	75.4	51.4	0.0	71.0	22.0	114.1
Feb	41.9	41.1	10.9	0.0	20.5	18.6	0.0	22.0	31.5	6.1
Mar	38.3	19.9	9.5	0.0	31.5	48.3	0.0	33.0	6.5	5.2
Apr	37.6	25.5	13.3	0.0	17.6	1.8	0.0	3.0	0.0	134.1
May	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jun	0.0	0.9	0.8	0.0	5.4	0.0	0.0	0.0	0.0	0.0
Total	398.3	311.5	180.3	54.9	307.7	299.1	114.2	300.5	315.4	386.4

Source: Department of Meteorological Services

Table 2.3b: Monthly total rainfall 2014/15 meteorological year (Millimetres) continued

Month	Tsabong Airport	Tshane Met. Station	Moshupa Police Station	Sowa Town	Lephephe	Lerala	Pan-damatenga	Rakops	Oliphant's drift
Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aug	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sep	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oct	1.1	3.1	0.0	10.5	10.6	0.0	0.0	0.0	0.0
Nov	94.5	24.1	0.0	16.4	57.3	38.5	26.7	24.0	0.0
Dec	17.3	42.2	0.0	106.3	36.5	125.7	102.9	70.7	134.6
Jan	8.8	75.9	0.0	63.6	136.6	51.7	35.8	116.3	26.2
Feb	24.1	30.1	0.0	5.4	4.7	39.4	136.8	12.9	0.0
Mar	19.5	71.9	87.9	92.8	40.7	21.9	24.0	96.7	6.5
Apr	1.4	32.6	0.0	28.4	21.3	10.0	0.0	32.4	0.0
May	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jun	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
Total	167.3	279.9	87.9	323.4	307.7	287.2	326.9	353.0	167.3

Source: Department of Meteorological Services

Tables 2.3a and 2.3b show the monthly total rainfall for selected rainfall stations for the two meteorological years 2013/14 and 2015/16.

Monthly rainfall trends are in consonance with Botswana's seasonal variations. The highest recorded monthly rainfall for the 2013/14 meteorological year was 282.4 mm recorded for the month of March at Shakawe meteorological station. The highest monthly rainfall for the meteorological year 2014/15 was recorded at 167.1 mm at Francistown meteorological station, for the month of December.

2.1.2. Total annual rainfall

For analysis of total annual rainfall only those stations with data for all the months of the meteorological year are used.

Table 2.4: Total annual rainfall (mm) by rainfall stations

Station	2013/14	2014/15
Francistown Met. Station	716.9	398.3
Shakawe Met. Station	745.3	386.4
Rakops	-	353.0
Pandamatenga	-	326.9
Sowa Town	-	323.4
Molepolole Police Station	384.2	315.4
Gaborone Met H/Q	464.8	311.5
Goodhope	-	307.7
Lephephe	-	307.7
Mochudi Police Station	478.9	300.5
Mahalapye Met. Station	512.4	299.1
Lerala	-	287.2
Tshane Met. Station	498.5	279.9
Sir Seretse Khama Airport	-	180.3
Tsabong Airport	435.8	167.3
Oliphant's drift	-	167.3
Maun Airport	341.3	114.2
Moshupa Police Station	-	87.9
Gantsi	-	54.9

Note - figures based on meteorological year (July to June)

Dash (-) = no data

Source: Department of Meteorological Services

In Table 2.4, analysis of the total annual rainfall, for the meteorological year July 2014 to June 2015 shows that the wettest area was Francistown's meteorological station, where a total of 398.3 mm of rainfall was recorded during the year. Shakawe follows with a total of 386.4 mm of rainfall, followed by Rakops with 353.7 mm of rainfall. For all the stations with data, indications are that more total rainfall was recorded in 2013/14 than in 2014/15.

2.2. Temperature

Data for temperature trends monitoring is available from eight (8) stations across the country. These are, Ghanzi airport, Mahalapye meteorological station, Tsabong airport, Francistown airport, Maun airport, Tshane meteorological station, Shakawe meteorological station and Sir Seretse Khama airport (SSKA).

2.2.1. Mean monthly minimum temperatures

Table 2.5: Mean monthly minimum temperatures (°C) (April to September 2015)

Station	April	May	Jun	Jul	Aug	Sep
Gantsi	14.7	9.2	4.5	6.2	9.1	14.1
Shakawe	15.7	8.5	5.3	6.0	7.3	14.1
Maun	16.8	12.4	9.3	12.5	10.9	17.3
Francistown	13.5	6.3	3.7	7.6	4.9	-
SSKA	14.6	8.4	4.4	5.7	8.2	-
Mahalapye	14.9	11.0	6.5	7.3	9.6	15.0
Tsabong	12.8	6.7	2.5	3.3	6.5	12.6
Tshane	15.0	9.0	4.0	6.2	9.3	13.0

Dash (-) = no data

Source: Department of Meteorological Services

Table 2.5 shows the stations' mean monthly minimum temperatures for the period under review, April to September 2015. The lowest mean monthly minimum temperature recorded during the period under review was 2.5°C for Tsabong in June 2015. The highest mean monthly minimum temperature for the same period was 17.3°C for Maun in September 2015.

Table 2.6: Average of mean monthly minimum temperature (April to September 2014 and 2015)

Station	2014 Average	2015 Average
Maun	12.9	13.2
Mahalapye	7.7	10.7
Gantsi	9.2	9.6
Shakawe	10.8	9.5
Tshane	8.6	9.4
SSKA	7.8	8.3
Tsabong	6.2	7.4
Francistown	7.9	7.2

Table 2.6 compares the 2014 and 2015 six-month averages, which are calculated using the mean monthly minimum temperatures for the period April to September. Only Shakawe and Francistown recorded cooler mean monthly minimum temperatures for the period under review in 2015, than in the previous year 2014. The rest recorded warmer mean monthly minimum temperatures.

2.2.2. Mean monthly maximum temperatures

Table 2.7: Mean monthly maximum temperatures (°C) (April to September 2015)

Station	Apr	May	Jun	Jul	Aug	Sep
Gantsi	27.2	28.1	23.8	25.0	29.3	32.5
Shakawe	29.2	29.7	26.7	27.8	31.2	34.9
Maun	28.8	29.6	25.7	27.0	30.8	33.4
Francistown	28.3	29.2	25.0	26.2	28.8	29.4
SSKA	27.9	27.9	21.9	22.8	27.8	-
Mahalapye	28.1	28.8	22.2	24.1	27.9	29.2
Tsabong	28.2	29.2	21.2	22.8	28.0	29.4
Tshane	27.2	28.4	22.3	23.4	28.4	31.2

Dash (-) = no data

Source: Department of Meteorological Services

Table 2.7 shows the stations' mean monthly maximum temperatures for the period under review, April to September 2015. The highest mean monthly maximum temperature of the period under review was 34.9°C for Shakawe in September 2015, while the lowest was 21.2 °C for Tsabong in June 2015.

Table 2.8: Average of mean monthly maximum temperature (April to September 2014 and 2015)

Station	2014 Average	2015 Average
Shakawe	28.4	29.9
Maun	28.5	29.2
Francistown	26.9	27.8
Gantsi	26.3	27.7
Tshane	25.8	26.8
Mahalapye	26.1	26.7
Tsabong	25.6	26.5
SSKA	25.5	-

Dash (-) = no data

Source: Department of Meteorological Services

To compare the 2014 and the 2015 mean monthly maximum temperatures for the same period (April to September), Table 2.8 shows the averages calculated from the mean monthly maximum temperatures for the six (6) months period for each of the meteorological years. All the stations recorded warmer maximum temperatures for the period under review in 2015 than in the previous year 2014.

2.3. Wind speed and direction

The Department of Meteorological Services (DMS) monitors wind speed and direction at its meteorological stations and provides the data herein. Wind speed is measured in metres per second (m/s) while wind direction is expressed in degrees. Wind direction is expressed in terms of the direction that the wind is blowing from. For example, northerly winds blow from the north to the south. Annex 5 in this report provides the wind speed scale. Annex 6 provides an illustration of the directions of the winds.

Wind speed and direction data covering the period July to November 2015 is available for fourteen (14) locations across the country. They are Ghanzi, Shakawe, Francistown, Mahalapye, Tshane, Jwaneng, Sir Seretse Khama Airport (SSKA), Sua Pan, Tsabong, Werda, Pandamatenga, Selibe Phikwe, Lephephe and Goodhope.

Table 2.9: Wind speed (m/s) and direction (degrees) – 2015

Station	July		August		September		October		November	
	Speed	Degrees	Speed	Degrees	Speed	Degrees	Speed	Degrees	Speed	Degrees
Ghanzi	2.5	105.7	2.4	102.8	2.6	142.9	2.5	121.4	2.6	161.6
Shakawe	1.4	126	1.3	134.1	1.6	129.1	1.5	136.6	1.8	131.6
Francistown	-	-	-	-	-	-	-	18.8	-	24.2
Mahalapye	2.3	131.9	2.3	88.3	3.2	88.6	3.1	76.4	3	101.1
Tshane	2.1	119.2	2.3	115.4	2.5	153.3	2	128.2	2.6	163.2
Jwaneng	-	-	-	-	3.2	88.6	-	21.3	-	-
SSKA	-	-	-	-	-	-	-	15.9	-	17.2
Sua Pan	2	103.1	2.1	105.3	2.7	101.2	2.9	99.6	2.7	118.5
Tsabong	1.9	129.3	2.2	107.5	2.7	167.4	2.2	150	3	166.2
Werda	2.3	106	2.3	111.4	2.6	156.2	2.1	122.5	2.6	143.4
Pan-damatenga	2	88.5	2.3	80.9	2.8	75.8	2.7	92.6	2.4	146.4
Selibe Phikwe	-	-	-	-	-	-	-	35.5	-	39.9
Lephephe	2.2	153.9	2.2	119.8	3.3	121.3	3.2	103	3.3	125.6
Goodhope	3.4	99.8	3.3	72.1	3.9	106.8	3.7	70.9	3.8	150

Dash (-) = no data

Source: Department of Meteorological Services

Table 2.9 shows wind speed and direction data for July to November 2015. For all the stations considered the winds were predominantly from the south east.

Average monthly wind speed ranged between a light air of 1.3 metres per second (m/s) at Shakawe in August, and 3.9 m/s, a gentle breeze for Goodhope in September. (See Annex 5 for wind scale).

REFERENCES

Central Statistics Office, 2005, '2001 Population Census Atlas: Botswana' Government of Botswana, Gaborone.

Central Statistics Office, 2006, 'Environment Statistics' Department of Printing and Publishing Services, Gaborone.

Statistics Botswana 2013, 'Botswana Environment statistics 2012,' Statistics Botswana, Gaborone.

Statistics Botswana 2014, 'Botswana Environment Statistics: Human Settlements Report 2013', Statistics Botswana, Gaborone.

United Nations Statistics Division, 2012, 'International Recommendations for Water Statistics: Series M No. 91,' Department of Economic and Social affairs, United Nations, New York.

United Nations Statistics Division, 2013, 'Framework for the Development of Environment Statistics 2013 final draft,' Department of Economic and Social affairs, United Nations, New York.

United Nations Statistics Division, 2014, 'System of Environmental-Economic accounting 2012', United Nations, New York.

Water Utilities Corporation, 2014, online: www.wuc.bw

Met Office online www.metoffice.gov.uk

Annex 1: Water production in towns and cities (kilolitres)

Year	Gaborone	Lobatse	Jwaneng	Selibe-Phikwe	Francistown	Sowa
2003	23,977,709.0	2,589,689.0	1,594,425.0	9,054,474.0	6,759,856.0	536,518.0
2004	24,529,020.0	2,607,674.0	1,686,921.0	8,681,348.0	7,185,879.0	463,493.0
2005	19,643,169.0	505,326.0	505,326.0	9,305,079.0	7,715,038.0	501,959.0
2006	20,669,603.0	2,282,253.0	1,543,636.0	8,594,176.0	8,419,012.0	517,717.0
2007	23,973,239.0	2,656,014.0	1,736,555.0	8,906,098.0	8,566,130.0	441,988.0
2006 Q1	4,706,577.0	503,632.0	364,865.0	2,034,483.0	1,945,758.0	113,840.0
Q2	4,848,705.0	562,527.0	382,175.0	2,175,378.0	2,037,438.0	154,352.0
Q3	5,200,148.0	588,340.0	373,851.0	2,053,131.0	2,187,229.0	120,814.0
Q4	5,914,173.0	627,754.0	422,745.0	2,331,184.0	2,248,587.0	128,711.0
2007 Q1	6,128,022.0	664,125.0	446,651.0	2,341,251.0	1,973,254.0	109,111.0
Q2	6,109,970.0	697,300.0	463,525.0	2,412,454.0	2,194,094.0	119,979.0
Q3	5,710,645.0	620,014.0	400,689.0	2,019,773.0	2,353,476.0	96,390.0
Q4	6,024,602.0	674,575.0	425,690.0	2,132,620.0	2,045,306.0	116,508.0
2008 Q1	6,109,627.0	628,172.0	481,920.0	2,152,639.0	2,336,645.0	127,764.0
Q2	6,291,264.0	766,555.0	268,133.0	2,520,308.0	2,294,401.0	123,374.0
Q3	6,313,052.0	758,330.0	388,979.0	2,260,705.0	2,368,583.0	125,146.0
Q4	6,943,420.0	815,662.0	439,575.0	2,414,659.0	2,269,867.0	125,611.0
2009 Q1	6,845,188.0	819,656.0	381,132.0	2,228,727.0	2,220,849.0	116,972.0
Q2	7,236,338.0	849,652.0	403,243.0	2,208,227.0	2,544,499.0	109,833.0
Q3	6,267,847.0	752,176.0	410,579.0	2,203,269.0	3,086,926.0	124,251.0
Q4	6,978,014.0	788,037.0	440,874.0	2,183,455.0	3,354,395.0	144,570.0

Annex 1: Water production in towns and cities (kilolitres) continued

Year	Gaborone	Lobatse	Jwaneng	Selibe-Phikwe	Francistown	Sowa
Q2	5,536,241.0	814,777.0	394,718.0	2,367,839.0	2,730,707.0	122,573.0
Q3	5,073,786.0	848,805.0	466,125.0	2,407,279.0	3,076,847.0	128,335.0
Q4	4,995,433.0	883,491.0	483,072.0	2,363,041.0	2,385,715.0	125,966.0
2011 Q1	4,721,472.0	876,672.0	461,423.0	1,999,938.0	1,989,304.0	124,627.0
Q2	4,752,822.0	812,314.0	476,749.0	2,297,013.0	1,942,824.0	134,441.0
Q3	4,549,912.0	827,165.0	429,377.0	1,654,294.0	1,967,235.0	127,722.0
Q4	5,153,892.0	836,107.0	507,915.0	2,961,830.0	2,154,069.0	131,053.0
2012 Jan	-	-	-	-	-	-
Feb	-	-	-	-	-	-
Mar	-	-	-	-	-	-
Apr	2,605,694.0	818,043.9	138,315.0	736,244.0	1,213,404.8	-
May	2,590,836.0	813,524.6	175,999.0	711,800.5	1,243,636.8	-
Jun	2,234,208.0	826,530.1	144,920.0	659,507.0	1,157,673.6	-
July	2,451,412.0	804,721.2	129,687.0	708,702.0	1,260,338.4	-
Aug	2,505,470.0	745,471.4	171,316.0	720,952.0	1,091,474.0	-
Sep	2,547,216.0	773,732.6	162,625.0	701,876.0	1,082,584.0	-
Oct	2,625,707.0	803,496.7	195,027.0	709,239.0	1,178,627.2	-
Nov	2,470,925.0	782,900.0	191,170.0	661,403.0	1,058,340.9	-
Dec	2,298,238.0	784,045.1	98,517.0	628,739.3	1,098,230.7	-
2013 Jan	2,458,374.0	826,833.0	187,990.0	649,734.7	1,243,500.0	22,590.0
Feb	2,445,300.0	645,293.0	116,134.0	644,921.8	1,234,420.0	21,260.0
Apr	2,941,956.0	687,568.0	222,665.0	671,254.0	1,178,641.0	31,990.0
May	2,580,440.0	757,968.0	240,320.0	681,496.0	1,208,080.0	30,030.0

Annex 1: Water production in towns and cities (kilolitres) continued

Year	Gaborone	Lobatse	Jwaneng	Selibe-Phikwe	Francistown	Sowa
2013 Jun	2,082,503.0	310,163.0	230,926.0	459,335.0	608,535.0	30,810.0
July	1,957,659.0	303,164.0	223,978.0	471,460.0	1,082,734.0	26,970.0
Aug	1,839,951.0	364,290.0	179,787.0	479,186.0	847,354.0	26,720.0
Sep	1,882,752.0	358,394.0	142,671.0	500,057.0	642,300.0	38,990.0
Oct	1,916,656.0	318,359.0	195,082.0	717,211.0	1,010,370.0	28,060.0
Nov	1,778,930.0	297,561.0	194,401.0	640,806.0	1,028,106.0	23,260.0
Dec	1,381,756.0	268,228.0	152,228.0	595,141.0	866,032.0	26,730.0
2014 Jan	1,974,584.0	279,763.0	173,549.0	552,518.0	1,140,030.0	21,040.0
Feb	1,812,195.0	-	151,602.0	455,309.0	797,179.0	15,680.0
Mar	1,830,223.0	-	182,543.0	452,569.0	912,397.0	10,080.0
Apr	1,046,296.0	345,512.0	173,030.0	449,957.0	905,940.0	29,080.0
May	1,884,506.0	380,177.0	194,639.0	541,375.0	954,071.0	24,400.0
Jun	1,359,261.0	359,168.0	153,696.0	372,026.0	859,154.0	25,500.0
July	1,431,729.0	392,007.0	167,795.0	413,654.0	878,874.0	21,042.0
Aug	1,426,843.0	428,493.0	189,194.0	477,532.0	890,118.0	23,000.0
Sep	1,602,529.0	384,796.0	220,061.0	462,568.0	919,174.0	19,940.0
Oct	1,525,716.0	413,695.0	167,658.0	521,720.0	975,465.0	21,832.0
Nov	1,429,847.0	381,317.0	199,720.0	476,509.0	944,756.0	22,786.0
Dec	978,135.0	301,189.0	196,740.0	461,665.0	917,840.0	22,309.0
2015 Jan	1,105,74.0	347,68.0	188,03.0	526,62.0	1,005,15.0	19,203.0
Feb	963,979.0	348,568.0	221,837.0	510,494.0	852,863.0	20,420.0
Mar	998,196.0	371,116.0	122,288.0	534,747.0	1,037,523.0	20,420.0

Dash (-) = no data

Source: Water Utilities Corporation

Annex 2: Dam levels in million cubic metres (1990-2011)

Year	Gaborone	Nnywane	Bokaa	Letsibogo	Shashe	Ntimbale	Thune	Lotsane	Dikgatlhong	Molatedi
1994	90.1	2.0	10.5	n/a	66.6	-	-	-	-	-
1995	109.1	2.0	13.6	n/a	77.3	-	-	-	-	-
1996	130.0	2.0	12.4	n/a	67.5	-	-	-	-	-
1997	126.6	2.0	11.3	7.5	67.4	-	-	-	-	-
1998	97.2	1.1	3.3	10.6	66.9	-	-	-	-	-
1999	95.8	1.4	9.6	37.2	72.4	-	-	-	-	-
2000	121.8	2.1	17.0	85.1	72.5	-	-	-	-	-
2001	135.6	1.9	18.5	68.0	76.6	-	-	-	-	-
2002	99.1	1.0	9.0	38.0	39.2	-	-	-	-	-
2003	65.0	0.6	3.5	49.0	23.5	-	-	-	-	-
2004	36.8	1.6	10.4	93.0	63.5	-	-	-	-	-
2005	24.0	2.2	3.7	95.0	88.7	-	-	-	-	-
2006	91.9	1.1	10.4	76.0	45.2	-	-	-	-	-
2007	80.6	2.2	18.4	70.0	86.1	-	-	-	-	-
2008	73.5	1.3	9.3	66.0	53.1	-	-	-	-	-
2009	83.4	1.6	12.7	83.0	63.5	-	-	-	-	-
2010	52.3	1.1	11.0	82.0	68.7	-	-	-	-	-
2011	96.2	1.4	4.8	60.0	87.0	-	-	-	-	-
2012	-	-	-	-	-	-	-	-	-	-
2013	-	-	-	-	-	-	-	-	-	-
2014	7.4	2.1	3.6	70.7	60.8	22.4	43.3	28.7	348.4	41.8

Source: Water Utilities Corporation

Annex 3: Monthly total rainfall (millimetres)

Year	Month	1	2	3	4	5	6	7	8	9	10	11	12
		Francistown Airport	Gaborone Met H/Q	Ghanzi Airport	Kanye Seepiso SSS	Lobatse Police Station	Mahalapye Met. Station	Maun Airport	Mochudi Police Station	Malepolole Police Station	Palapye Police Station	Serowe Police Station	Shakawe Met. Station
2010/11	Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Aug	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sep	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Oct	32.3	13.7	3.5	0.0	2.1	100.1	0.2	0.0	5.5	61.2	12.0	0.0
	Nov	92.3	44.2	91.0	14.4	65.8	38.7	45.3	54.7	49.0	146.0	110.8	51.3
	Dec	117.4	95.6	89.7	110.2	103.8	28.7	84.3	144.6	86.5	56.5	35.0	98.3
	Jan	198.5	140.8	204.6	268.1	391.5	81.5	213.3	177.4	163.0	156.8	70.0	142.7
	Feb	25.8	26.4	32.8	60.6	41.0	76.0	46.3	0.0	34.0	27.0	0.0	78.6
	Mar	14.3	88.0	79.1	34.5	2.4	3.8	182.8	96.0	66.0	4.8	65.0	66.4
	Apr	60.0	105.0	90.8	37.1	118	35.8	54.1	42.0	44.5	19.0	27.5	44.4
	May	3.1	5.5	4.5	0.0	9.0	0.0	1.6	0.0	0.0	0.0	0.0	11.3
	Jun	0.0	12.4	0.0	33.7	46.0	1.6	0.0	0.0	0.0	2.0	48.7	0.0
2011/12	Jul	0.0	0.6	0.0	1.8	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0
	Aug	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sep	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Oct	5.2	2.3	0.0	0.0	0.0	10.7	0.0	22.0	0.0	40.0	0.0	0.7
	Nov	115.9	17.7	8.3	28.7	80.2	76.4	86.5	28.2	22.0	88.0	0.0	86.5
	Dec	125.3	108.0	72.0	56.0	48.7	67.7	171	86.0	15.0	68.0	31.8	78.9
	Jan	-	82.9	39.3	89.0	76.6	31.0	70.5	98.5	-	-	34.5	141.7
	Feb	15.8	43.1	73.4	0.0	43.0	9.3	62.9	31.6	-	-	0.0	127.4
	Mar	31.1	24.7	37.6	50.7	59.4	16.7	15.4	51.0	29.0	37.5	34.2	50.6
	Apr	0.0	1.4	4.5	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0
	May	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Jun	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Annex 3: Monthly total rainfall (Millimetres) continued

		1	2	3	4	5	6	7	8	9	10	11	12
Year	Month	Francistown Airport	Gaborone Met H/Q	Ghanzi Airport	Kanye Seepa-pitso SSS	Lobatse Police Station	Mahalapye Met. Station	Maun Airport	Mochudi Police Station	Molepolole Police Station	Palapye Police Station	Serowe Police Station	Shakawe Met. Station
2012/13	Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Aug	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sep	0.0	0.9	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
	Oct	29.5	68.7	15.7	36.1	33.8	80.0	11.0	41.5	103.2	28.0	0.0	26.2
	Nov	78.3	51.1	16.9	5.1	12.7	61.4	28.6	44.5	35.5	0.0	106.3	31.3
	Dec	54.4	118.7	71.0	129.2	75.3	95.6	99.0	20.6	81.0	147.6	133.8	96.1
	Jan	208	34.8	65.4	60.9	53.3	69.0	207.9	37.0	52.1	104.0	145.9	147
	Feb	4.2	37.8	3.5	1.5	41.7	0.7	3.1	8.6	15.2	34.0	1.0	30.0
	Mar	6.5	18.3	0.0	48.3	10.5	12.7	5.4	9.7	22.0	0.0	0.0	57.7
	Apr	6.6	33.3	0.0	8.7	12.8	28.5	0.0	31.0	0.0	37.5	9.3	16.0
	May	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Jun	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2013/14	Jul	0.0	20.6	0.0	4.8	2.0	0.0	0.0	0.0	16.1	0.0	0.0	0.0
	Aug	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sep	0.0	2.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0
	Oct	24.9	10.0	16.8	30.2	21.6	14.5	7.0	7.0	0.0	0.0	13.5	9.4
	Nov	31.8	33.3	39.7	13.1	23.4	57.7	20.8	82.0	29.5	28.0	51.6	0.8
	Dec	133.3	174.1	89.5	84.8	71.1	152.6	142.9	103.1	61.6	124	96.7	124.1
	Jan	193.6	35.7	86.0	-	-	107.8	143.4	37.0	59.5	-	-	196.0
	Feb	94.4	43.3	239.9	-	-	0.0	0.0	73.3	43.5	-	-	83.4
	Mar	221.5	128.5	97.3	-	-	156.1	0.0	167.5	174.0	-	-	282.4
	Apr	17.4	15.9	28	-	-	23.7	27.2	9.0	0.0	-	-	49.2
	May	0.0	0.1	7.4	-	-	0.0	0.0	0.0	0.0	-	-	0.0
	Jun	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0
2014/15	Jul	-	0	0	-	-	0	0	0	0	-	-	0
	Aug	-	0	0	-	-	0	0	0	0	-	-	0
	Sep	-	0	0	-	-	0	1.4	0	0	-	-	0
	Oct	-	0.3	1.4	-	-	18.1	1.3	7	5.8	-	-	0
	Nov	-	52.6	46	-	-	26	33	92.5	148	-	-	77.3
	Dec	-	90.6	7.5	-	-	134.9	78.5	72	101.6	-	-	49.6
	Jan	-	80.6	5.0	-	-	51.4	0.0	71.0	22.0	-	-	114.1
	Feb	-	41.1	29.2	-	-	18.6	0.0	22.0	31.5	-	-	6.1
	Mar	-	19.9	55.6	-	-	48.3	0.0	33.0	6.5	-	-	5.2

Annex 3: Monthly total rainfall (Millimetres) continued

		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Year	Month	Tsabong Airport	Tshane Met. Station	Kasane Airport	Good Hope	Moshupa Police Station	Sowa Town	Lephephe	Lerala	Rakops	Oliphant's Drift	Jwaneng Met. Station	Selebi Phikwe Met. Station	Werda Met. Station	Letlhakane Met. station	Panda-matenga
2010/11	Jul	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	Aug	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	Sep	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	Oct	0.0	23.7	10.7	-	-	-	-	-	-	-	-	-	-	-	-
	Nov	78.6	83.2	112.0	-	-	-	-	-	-	-	-	-	-	-	-
	Dec	80.4	142.9	42.8	-	-	-	-	-	-	-	-	-	-	-	-
	Jan	153.2	40.4	129.6	-	-	-	-	-	-	-	-	-	-	-	-
	Feb	18.1	26.2	55.7	-	-	-	-	-	-	-	-	-	-	-	-
	Mar	3.2	34.7	56.5	-	-	-	-	-	-	-	-	-	-	-	-
	Apr	54.0	40.9	7.4	-	-	-	-	-	-	-	-	-	-	-	-
	May	11.0	22.3	0.0	-	-	-	-	-	-	-	-	-	-	-	-
Jun	14.5	1.6	1.6	-	-	-	-	-	-	-	-	-	-	-	-	
2011/12	Jul	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	Aug	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	Sep	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	Oct	0.0	0.0	7.4	-	-	-	-	-	-	-	-	-	-	-	-
	Nov	6.9	0.2	52.5	-	-	-	-	-	-	-	-	-	-	-	-
	Dec	46.7	47.9	170.0	-	-	-	-	-	-	-	-	-	-	-	-
	Jan	27.2	37.9	126.4	-	-	-	-	-	-	-	-	-	-	-	-
	Feb	65.6	69.3	164.5	-	-	-	-	-	-	-	-	-	-	-	-
	Mar	43.4	52.2	49.1	-	-	-	-	-	-	-	-	-	-	-	-
	Apr	13.7	4.4	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	May	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
Jun	9.9	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	

Dash (-) = no data

Source: Department of Meteorological Services

Annex 3: Monthly total rainfall (Millimetres) continued

Year	Month	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
		Tsabong Airport	Tshane Met. Station	Kasane Airport	Good Hope	Moshupa Police Station	Sowa Town	Lephephe	Lerala	Rakops	Oliphant's Drift	Jwaneng Met. Station	Selebi Phikwe Met. Station	Werda Met. Station	Leithakane Met. station	Panda-matenga
2012/13	Jul	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	Aug	0.0	0.0	0.2	-	-	-	-	-	-	-	-	-	-	-	-
	Sep	0.4	0.0	0.6	-	-	-	-	-	-	-	-	-	-	-	-
	Oct	3.7	0.7	6.8	-	-	-	-	-	-	-	-	-	-	-	-
	Nov	1.0	15.0	80.8	-	-	-	-	-	-	-	-	-	-	-	-
	Dec	77.1	65.3	56.4	-	-	-	-	-	-	-	-	-	-	-	-
	Jan	35.9	49.6	161.3	-	-	-	-	-	-	-	-	-	-	-	-
	Feb	5.3	6.5	95.1	-	-	-	-	-	-	-	-	-	-	-	-
	Mar	36.9	2.6	5.2	-	-	-	-	-	-	-	-	-	-	-	-
	Apr	0.0	9.7	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	May	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	Jun	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
2013/14	Jul	4.2	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	Aug	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	Sep	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
	Oct	1.5	25.0	17.5	-	-	-	-	-	-	-	-	-	-	-	-
	Nov	14.0	11.2	81.7	-	-	-	-	-	-	-	-	-	-	-	-
	Dec	48.8	121.8	262.1	-	-	-	-	-	-	-	-	-	-	-	-
	Jan	47.8	19.6	-	67.8	0.0	70.7	47.2	87.5	137.3	117.7	-	-	-	-	137.9
	Feb	246.1	275.7	-	83.2	0.0	28.5	89.9	51	103.1	40.3	-	-	-	-	37.3
	Mar	45.9	23.2	-	54.8	0.0	64.1	0	151.5	131.6	127.4	-	-	-	-	34
	Apr	8.4	0.4	-	17.4	0.0	36	3.4	29	17	0	-	-	-	-	3.8
	May	19.1	21.6	-	0.0	0.0	1.8	0.9	0	0	0	-	-	-	-	0
	Jun	0.0	0.0	-	0.0	0.0	0	0	0	0	0	-	-	-	-	0
2014/15	Jul	0	0	-	0	0.0	0	0	0	0	0	-	-	-	-	0
	Aug	0	0	-	14	0.0	0	0	0	0	0	-	-	-	-	0
	Sep	0.6	0	-	0	0.0	0	0	0	0	0	-	-	-	-	0
	Oct	1.1	3.1	-	0	0.0	10.5	10.6	0	0	0	-	-	-	-	0
	Nov	94.5	24.1	-	38.8	0.0	16.4	57.3	38.5	24	0	-	-	-	-	26.7
	Dec	17.3	42.2	-	104.5	0.0	106.3	36.5	125.7	70.7	134.6	-	-	-	-	102.9
	Jan	8.8	75.9	-	75.4	0.0	63.6	136.6	51.7	116.3	26.2	19.5	5.4	27.7	52.1	35.8
	Feb	24.1	30.1	-	20.5	0.0	5.4	4.7	39.4	12.9	0	17.4	35.6	43.7	2.2	136.8
	Mar	19.5	71.9	-	31.5	87.9	92.8	40.7	21.9	96.7	6.5	27.7	38.0	29.0	59.4	24.0

Dash (-) = no data Source: Department of Meteorological Services

Annex 4: Dam levels by percentage of full capacity (1990-2014)

Year	Gaborone	Nnywane	Bokaa	Letsibogo	Shashe	Ntimbale	Thune	Lotsane	Dikgatlhong	Molatedi
1990	80.0	17.4	-	-	99.8					-
1991	60.5	4.3	-	-	84.4					-
1992	76.7	56.5	38.9	-	74.6					-
1993	72.3	73.9	56.2	-	84.0					-
1994	63.7	87.0	56.8	-	78.4					-
1995	77.2	87.0	73.5	-	90.9					-
1996	91.9	87.0	67.0	-	79.4					-
1997	89.5	87.0	61.1	7.5	79.3					-
1998	68.7	47.8	17.8	10.6	78.7					-
1999	67.8	60.9	51.9	37.2	85.2					-
2000	86.1	91.3	91.9	85.1	85.3					-
2001	95.9	82.6	100.0	68.0	90.1					-
2002	70.1	43.5	48.6	38.0	46.1					-
2003	46.0	26.1	18.9	49.0	27.6					-
2004	26.0	69.6	56.2	93.0	74.7					-
2005	17.0	95.7	20.0	95.0	104.4					-
2006	65.0	47.8	56.2	76.0	53.2					-
2007	57.0	95.7	99.5	70.0	101.3					-
2008	52.0	56.5	50.3	66.0	62.5					-
2009	59.0	69.6	68.6	83.0	74.7	-				-
2010	37.0	47.8	59.5	82.0	80.8	-				-
2011	68.0	60.9	25.9	60.0	102.4	-				-
2012	-	-	-	-	-	-				-
2013	12.6	17.5	7.5	58.0	67.6	95.1	-	11.0	38.3	14.9
2014	5.2	92.1	19.7	70.7	71.5	84.1	48.1	71.7	87.1	20.8

Dash (-) = no data

Values are December levels for that year

Shaded area shows that the dam was not yet operational

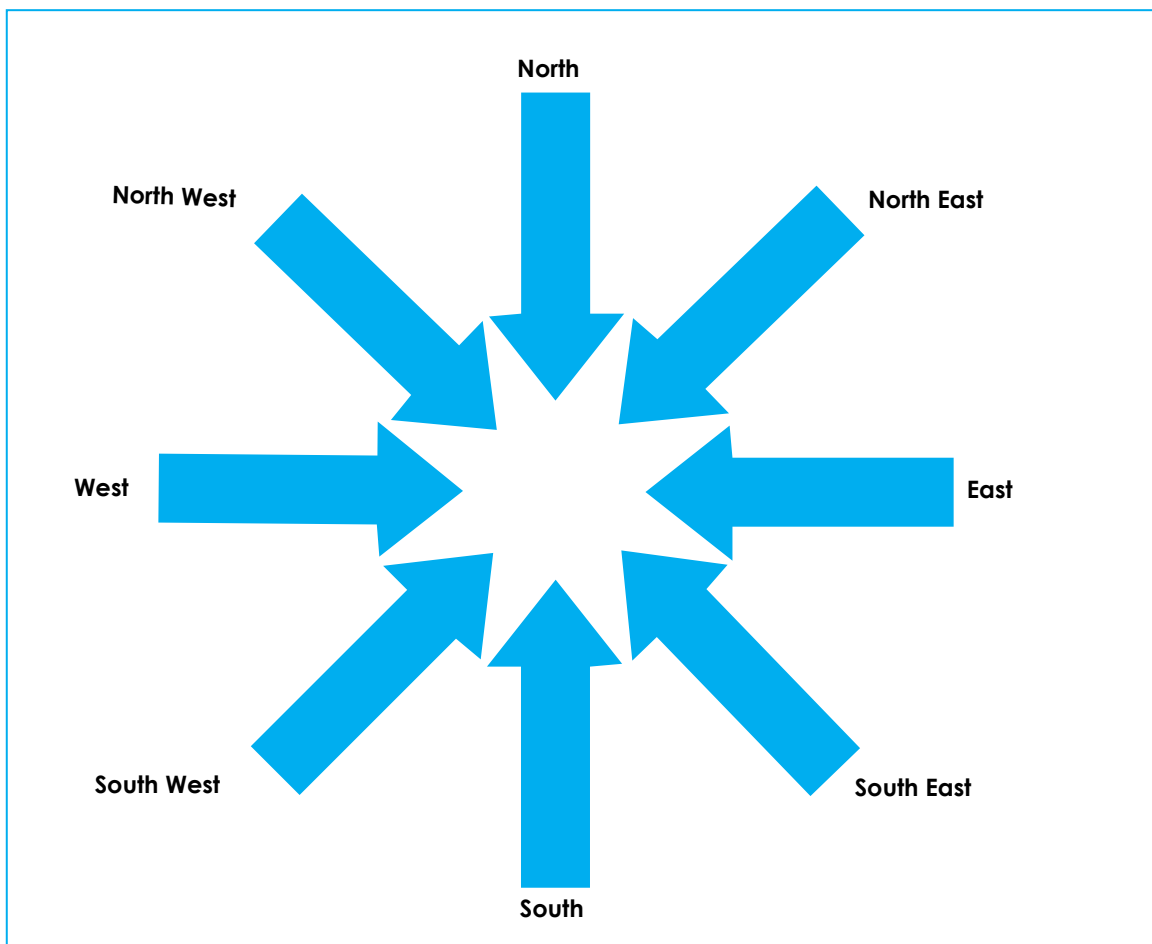
Source: Water Utilities Corporation.

Annex 5: Beaufort Winds Scale

m/s	Km/h	Beaufort scale	Label	Effects
0 - 0.2	1	0	Calm	Calm. Smoke rises vertically.
0.3-1.5	1-5	1	Light Air	Wind motion visible in smoke.
1.6-3.3	6-11	2	Light Breeze	Wind felt on exposed skin. Leaves rustle.
3.4-5.4	12-19	3	Gentle Breeze	Leaves and smaller twigs in constant motion.
5.5-7.9	20-28	4	Moderate Breeze	Dust and loose paper raised. Small branches begin to move.
8.0-10.7	29-38	5	Fresh Breeze	Branches of a moderate size move. Small trees begin to sway.
10.8-13.8	39-49	6	strong Breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
13.9-17.1	50-61	7	Near Gale	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
17.2-20.7	62-74	8	Gale	Twigs broken from trees. Cars veer on road.
20.8-24.4	75-88	9	Severe Gale	Larger branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
24.5-28.4	89-102	10	Storm	Trees are broken off or uprooted, saplings bent and deformed, poorly attached asphalt shingles and shingles in poor condition peel off roofs.
28.5-32.6	103-117	11	Violent Storm	Widespread vegetation damage. More damage to most roofing surfaces, asphalt tiles that have curled up and/or fractured due to age may break away completely.
>32.7	>118	12	Hurricane	Considerable and widespread damage to vegetation, a few windows broken, structural damage to mobile homes and poorly constructed sheds and barns. Debris may be hurled about.

Source: Windfinder.com

Annex 6: Winds Direction illustration



Source: Statistics Botswana

