

STATISTICS BOTSWANA

BOTSWANA ENVIRONMENT STATISTICS WATER & CLIMATE DIGEST 2015

Copyrights © Statistics Botswana 2015

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 2015

Published by

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

Contact Unit:
Environment Statistics Unit
Phone: 3671395

Copyright Reserved © 2015

Extracts may be published if
Sources are duly acknowledged

ISBN: 978-99968-464-2-7

PREFACE

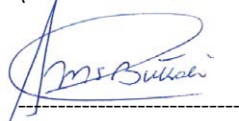
This is the first bi-annual edition of the Botswana Environment Statistics: Water and Climate Digest. The purpose of the Digest is to provide data for use by decision-makers in water management as well as for monitoring trends related to climate.

The indicators in this report cover data on dam levels, dam abstractions, water production, rainfall and temperature. The dam abstraction is a newly introduced indicator. 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.

The sustained production of the Water and Climate Digest would depend on the cooperation of relevant data providers to provide the necessary data. I therefore 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).



Dabilani Buthali
Acting Statistician General
December 2015

Contents

1. WATER	7
1.1. Dam Levels.....	7
1.2. Abstractions.....	9
1.3. Water production.....	10
1.3.1. Waterproductionbysettlements.....	11
1.3.2. WaterproductionbyManagementCenters(MCs).....	13
2. CLIMATE	16
2.1. Rainfall.....	16
2.2. Temperature.....	20
2.2.1 Mean monthly Minimum temperatures.....	21
2.2.2 Mean monthly maximum temperatures.....	21

REFERENCES	22
-------------------------	-----------

List of Tables

Table 1.1: Dam Capacities.....	7
Table 1.2: Percentage dam levels in 2014-15.....	7
Table 1.3: Monthly abstractionsfromselecteddams(kilolitres).....	9
Table 1.4: List of water management centres (MCs).....	10
Table 1.5: Six months water production forselected settlements(2014).....	11
Table 1.6: Southern water production by management centres (kilolitres).....	13
Table 1.7: Northern water production by management centres (kilolitres).....	14
Table 1.8: Total production (kilolitres).....	15
Table 2.1: List of synoptic stations used.....	16
Table 2.2: List of rainfall stations used.....	16
Table 2.3: Monthly total rainfall (millimetres).....	17
Table 2.4: Total annual rainfall (mm) by rainfall stations 2012/13 to 2014/15.....	19
Table 2.5: Mean monthly minimum temperatures(°C) October to March 2014/15).....	20
Table 2.6: 2013/14 and 2014/15 October to March mean monthly minimum temperatures averaged 20	
Table 2.7: Mean monthly maximum temperatures(°C) October to March 2014/15).....	21
Table 2.8: 2013/14 and 2014/15 October to March mean monthly maximum temperatures averaged 21	

List of Figures

Figure 1.1: Percentage change in dam capacities (October 2014 to April 2015).....	8
Figure 1.4: Six months average water production by settlements (April to September 2014).....	11
Figure 1.5: Water production for cities and towns (2013 and 2014).....	12

EXECUTIVE SUMMARY

Botswana is a semi-arid country with erratic rainfall and limited surface water resources. "The country's proximity to the subtropical high-pressure belt of the southern hemisphere accounts for its largely arid or semi-arid climatic regime." (Statistics Botswana: 2005). The aridity of the country and the scarcity of water resources necessitate prudent management of the resource. This in turn necessitates conscientious monitoring of water resource availability and use.

This report looks at water and climate statistics, based on the indicators of dam levels, water abstraction and production, rainfall, and temperatures.

Dam Levels

Botswana has nine dams from which surface water is sourced. Over the period reviewed, October 2014 to March 2015, three of the dams gained in levels, while six (6) had falling levels. All dams generally had lower levels in 2014/15 than in the previous year, 2013/14.

Water Abstraction

Water abstraction is the removal of water from any source for treatment to produce drinking water, however water may also be removed for direct use (eg irrigation) without any treatment. In this report discussion is on removal of water from dams.

Water abstraction was highest from Gaborone, Shashe and Bokaa dams. Gaborone dam's water abstraction fell gradually over the months, as the dam level also fell. The October 2014 to March 2015 water abstraction from Gaborone dam was close to half the abstraction for the same period in 2013/14. Bokaa dam had varied abstraction, while Shashe dam had a generally more stable abstraction trend. Lotsane dam abstractions are increasing.

Water Production

Water production constitutes treatment of water to produce drinking water for distribution to users. The densely populated Gaborone management centre (MC) continues to have the highest water production. Southern MCs have higher water production than the northern MCs. Southern MCs used less water between April and September in 2014 than in 2013, while northern MCs used more.

Rainfall

There are various rainfall stations around the country. Twenty-seven (27) stations are examined in this report, with only those with full monthly data for 2014/15 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, Ghanzi, Maun and Tsabong, and Sir Seretse Khama airports, and Mochudi, Molepolole, and police stations.

More total rainfall was recorded in 2013/14 than in 2014/15. The highest total rainfall recorded between October 2014 and March 2015 is that of Francistown, at 360.1 mm.

Temperatures

Data used for temperature in this report is of 8 stations across the country. The lowest mean monthly minimum temperature recorded between October 2014 and March 2015 was 11.9 oC recorded at Tsabong in October 2014, while the highest mean monthly maximum temperature for the same period was 36.1 oC recorded at Shakawe in October 2014. Looking at the period reviewed it shows that 2014/15 had cooler minimum temperatures than 2013/14 in most of the stations. All the stations recorded warmer maximum temperatures in 2014/15 than in the previous year 2013/14, between October 2014 and March 2015.

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 Dikgatlong 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
Nnywane	2.3
Shashe	85
Ntimbale	26.6
Lotsane	40
Thune	90
Dikgatlong	400
Molatedi (Republic of South Africa)	201

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. Dikgatlong 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.

The wet season is from October to March in Botswana. This report looks at dam level trends between October 2014 and June 2015.

Table 1.2: Percentage dam levels in 2014-15

	Dam	Gaborone	Nnywane	Bokaa	Letsibogo	Shashe	Ntimbale	Thune	Lotsane	Dikgatlong	Molatedi
2014	17 th February	13.2	74.7	38.5	100.9	98.3	100	41.6	99.1	101	20.2
	14 th March	16	-	57	103.7	103.4	102	55.5	108.3	106.5	26
	14 th April	15.1	73	56.2	97.7	97.3	98.4	55.7	96.4	98.9	35.3
	16 th May	13.7	67.6	50.2	93.6	94.3	97.5	58.7	94.2	98.3	34.6
	15 th July	11.3	54.6	41.8	86.6	87.9	94.1	58.7	84.5	95.6	31
	29 th August	9.8	54.1	36.3	77.5	83.4	90.5	52	82.9	95.4	28.4
	23 rd September	8.5	51.1	30.5	78.7	80.6	88.7	51.2	80.7	92.3	26.8
	8 th October	7.5	47.0	27.3	75.9	78.9	87.3	49.9	77.5	91.2	24.7
	14 th November	6.1	40.2	22.0	72.3	75.1	84.1	48.1	75.2	88.2	21.7
	15 th 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
	17 th February	4.2	94.2	21.2	69	95.8	95	47.2	75	88.8	15.2
	9 th March	3.4	88.4	18.4	65.2	93.9	92	46.8	72.2	87.4	15.2
	15 th April	2.7	85.6	15.5	58.3	92.6	97.9	45.5	70.0	85.6	13.4
	15 th June	1.7	73.3	8.2	53.1	95.1	93.9	43.1	64.8	82.5	11.5

Dash (-) = no data

*January data interpolated using average of two nearest neighbours

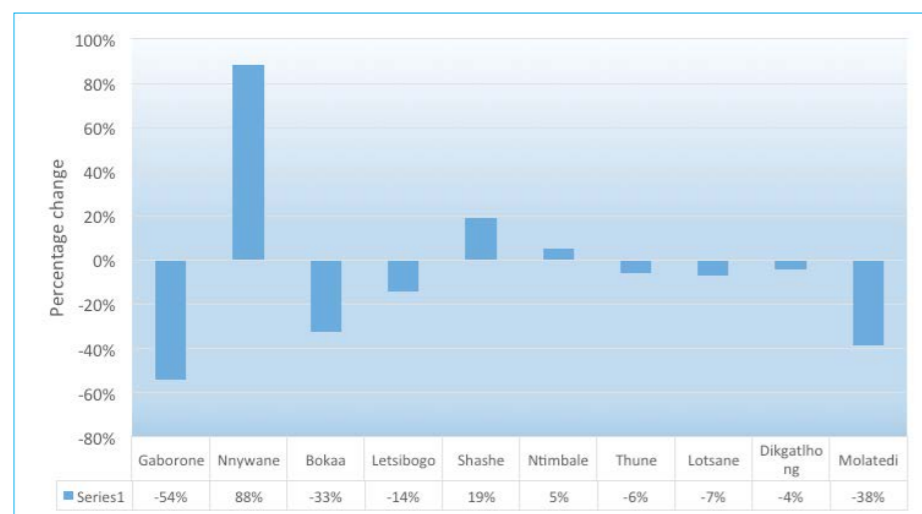
Source: Water Utilities Corporation publications

Table 1.2 above shows the percentage levels of dams from February 2014 to June 2015. Gaborone, Bokaa and Molatedi dam (South Africa) had continuously falling levels. Gaborone dam reached the failed status at 1.7 percent in June 2015.

Seven (7) out of the ten (10) dams display a falling trend in their levels during the wet season. Only three (3) of the dams, Nnywane, Shashe and Ntimbale had higher levels in March 2015 than in October 2014.

Figure 1.1 below shows the percentage change in the dam level between October 2014 and March 2015 for each of the dams.

Figure 1.1: Percentage change in dam levels (October 2014 to March 2015)



Over the period October 2014 to March 2015, Nnywane dam had 88 percent increase in its level, followed by Shashe dam at 19 percent and Ntimbale dam had 5 percent increase in its level. Gaborone dam had the highest percentage decrease, its level dropping by 54 percent, followed by Molatedi at 38 percent and Bokaa at 33 percent.

While there are slight rises in some of the dams as a result of rains and inflows, the general trend shows decline for most of the dams. Dikgathong dam has since commenced abstraction, hence the decline. Nnywane dam's gains were mostly during the month of November 2014, while Shashe, Ntimbale and Lotsane dams made gains between December 2014 and February 2015. Nnywane dam's relatively small capacity means it fills up faster and with less rainfall or inflows during the wet seasons, hence its steep percentage gains over a short period of time. Only Shashe and Ntimbale recorded a slight rise in levels after April 2015.

1.2. Abstractions

Table 1.3: Monthly abstractions from selected dams (kilolitres)

Year	Month	Lotsane	Gaborone	Ntimbale	Nnywane	Shashe	Bokaa
2013/14	April	-	2,596,227	252,278	-	1,218,720	289,546
	May	-	2,826,661	242,584	-	1,248,208	238,956
	June	-	2,568,316	239,466	-	767,341	247,985
	July	-	2,174,694	214,469	-	1,398,654	14,788
	August	-	2,378,188	193,170	-	1,083,368	184,866
	September	-	2,554,855	226,840	-	1,127,816	-
	Total	-	15,098,941	1,368,807	-	6,844,107	-
	October	28,162	2,442,599	228,684	-	1,080,087	-
	November	51,668	2,294,301	203,624	-	1,043,973	-
	December	51,367	2,055,383	238,196	-	1,031,396	345,191
2014/15	January	53,897	1,991,606	233,473	28,532	1,050,359	128,055
	February	44,837	2,332,800	202,450	28,271	1,063,121	144,848
	March	43,078	1,927,449	142,199	69,951	1,178,520	-
	Total	273,009	13,044,138	1,248,626	-	6,447,456	-
	April	59,079	1,994,433	194,954	79,699	1,183,268	522,538
	May	54,963	2,243,195	232,990	49,972	1,147,394	768,738
	June	55,711	1,729,362	192,557	24,711	1,148,065	248,897
	July	69,510	1,508,016	184,251	57,528	1,177,841	409,465
	August	69,418	1,617,353	246,740	57,835	1,121,600	555,595
	September	73,015	1,391,683	182,467	47,495	1,162,194	672,369
Total	381,696	10,484,042	1,233,959	317,240	6,940,362	3,177,602	
2014/15	October	85,167	1,454,040	176,043	67,699	1,245,337	526,914
	November	78,144	1,357,362	246,666	48,312	1,205,012	95,994
	December	70,673	904,981	202,126	30,117	1,146,691	55,745
	January	72,010	1,521,468	254,048	65,451	1,259,308	245,935
	February	67,030	870,051	224,640	68,143	1,173,501	-
	March	83,492	657,612	226,620	78,607	1,257,803	-
	Total	456,516	6,765,514	1,330,143	358,329	7,287,652	-

Table 1.3 shows monthly abstractions of water from selected dams. Gaborone dam had the highest abstractions during the 2013/14 and 2014/15 financial years, to satisfy demand of the high population concentrated in the Greater Gaborone area. However, Gaborone dam experienced declining abstraction due to lower availability of water in the dam, as supplementary water was sourced from the northern parts of the country through the North-South Carrier pipeline.

The Gaborone management centre also supplies the town of Lobatse. Bokaa dam had incremental abstraction between April and September 2014, probably to supplement supply to Gaborone management centre as Gaborone dam abstractions fell. Bokaa dam's abstractions however later fell between September 2014 and January 2015, as the dam's levels fell. Nnywane dam serves some of Gaborone management centre and has a low capacity compared to the rest, and thus has a varying abstraction.

Comparison of the six months total abstractions shows decreasing abstraction for Gaborone, where the October to March 2014/15 period shows abstraction that is close to half for the same period in 2013/14. Lotsane abstractions have increased considerably while Ntimbale and Shashe dam abstractions were more stable.

Factors that contribute to abstraction levels are dam levels or water availability, and the water needs of various management centres. Some reservoirs may have increased abstractions in order to supplement other management centres that may have had supply challenges.

1.3. 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.

Table 1.4: 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

The WUC management centres in the country are shown in Table 1.4 above.

1.3.1. Water production by settlements

Table 1.5: Six months water production for selected settlements (2014)

	April	May	June	July	August	September	Average
Gaborone	1,046,296	1,884,506	1,359,261	1,431,729	1,426,843	1,602,529	1,458,527
Francistown	905,940	954,071	859,154	878,874	890,118	919,174	901,222
Phikwe	449,957	541,375	372,026	413,654	477,532	462,568	452,852
Lobatse	345,512	380,177	359,168	392,007	428,493	384,796	381,692
Molepolole	277,045	291,983	321,182	353,632	354,124	347,826	324,299
Tlokweng	481,017	296,817	324,490	323,482	281,953	215,703	320,577
Kanye	282,165	240,530	318,360	315,150	321,412	306,399	297,336
Serowe	128,791	198,767	233,869	181,594	197,131	282,755	203,818
Mogoditshane	193,090	197,660	180,950	172,680	192,310	180,500	186,198
Jwaneng	173,030	194,639	153,696	167,795	189,194	220,061	183,069
Palapye	158,797	124,549	154,932	100,001	88,150	110,692	122,854
Sowa	29,080	24,400	25,500	21,042	23,000	19,940	23,827

Table 1.5 shows the six month (April to September 2014) 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 1.4: Six months average water production by settlements (April to September 2014)

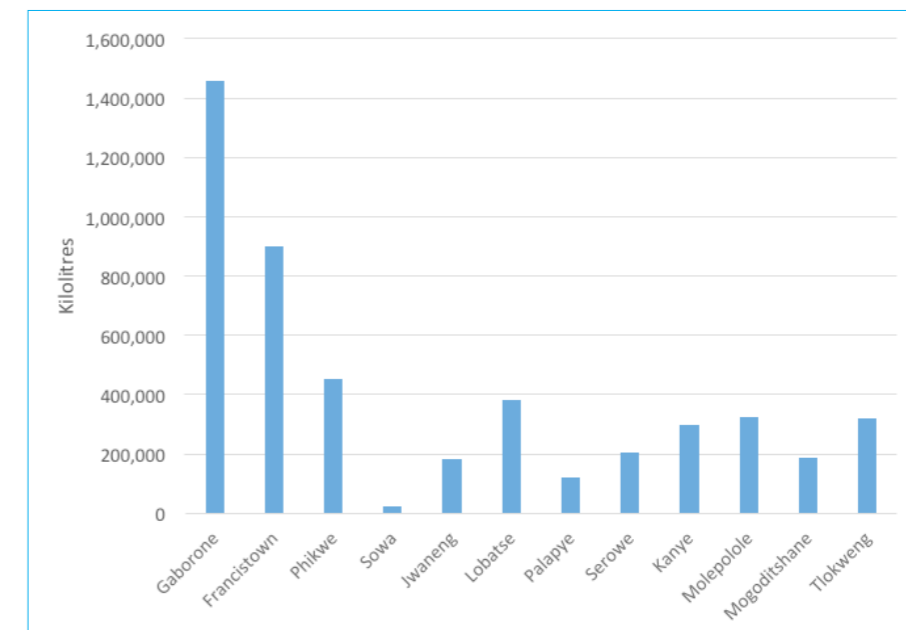


Figure 1.4 shows the average monthly water production for the selected settlements over the six month period of April to September 2014. Gaborone and Francistown typically have the highest amount of water needs.

Figure 1.5: Water production for cities and towns (2013 and 2014)



Figure 1.5 juxtaposes some selected urban settlements' (cities and towns) water production patterns for the six month period (April to September) for the two successive years 2013 and 2014. Indications are that Gaborone used less water for the same period in 2014 than in 2013. This is likely due to water shortages and conservation measures as Gaborone, Bokaa and Molatedi dams continued their downward trend in dam levels. Sowa, Jwaneng and Selibe Phikwe also have used slightly less water for the same period. Lobatse shows a slight increase in its water production for 2014, compared with that of 2013, over the same period.

1.3.2. 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 Gaborone is situated. Most of the county's surface water resources are located in the northern parts of the country.

Table 1.6: Southern water production by management centres (kilolitres)

Year	Month	Gaborone	Molepolole	Lobatse	Mochudi	Kanye	Tsabong	Ghanzi	Total Southern Region
2013	Jan	2,458,374.0	380,825.0	826,833.0	314,696.0	524,711.0	26,145.0	128,724.0	4,660,308.0
	Feb	2,445,300.0	358,022.0	645,293.0	314,086.0	497,319.0	25,135.0	121,731.0	4,406,886.0
	Mar	2,897,066.0	370,169.0	686,330.0	280,390.0	636,285.0	29,490.0	131,864.0	5,031,594.0
	Apr	2,941,956.0	347,989.0	687,568.0	287,045.0	590,007.0	107,384.0	125,772.0	5,087,721.0
	May	2,580,440.0	326,156.0	757,968.0	299,738.0	624,734.0	117,946.0	119,539.0	4,826,521.0
	Jun	2,691,511.0	375,533.0	645,399.0	265,141.0	567,436.0	110,917.0	126,416.0	4,782,353.0
	Jul	2,590,229.0	347,075.0	578,556.0	224,238.0	515,836.0	125,554.0	112,046.0	4,493,534.0
	Aug	2,555,954.0	358,510.0	738,497.0	267,384.0	572,396.0	131,696.0	115,160.0	4,739,597.0
	Sep	2,443,516.0	330,456.0	776,988.0	305,670.0	497,060.0	103,323.0	120,948.0	4,577,961.0
	Oct	2,487,473.0	373,110.0	701,207.0	250,369.0	583,448.0	129,310.0	114,761.0	4,639,678.0
	Nov	2,497,082.0	381,658.0	593,363.0	300,643.0	557,212.0	138,095.0	112,607.0	4,580,660.0
	Dec	2,059,495.0	367,424.0	609,847.0	269,572.0	501,727.0	113,611.0	102,341.0	4,024,017.0
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

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

Table 1.7: Northern water production by management centres (Kilolitres)

Year	Month	Selibe Phikwe	Palapye	Serowe	Letlhakane	Mahalapye	Kasane	Masunga	Francistown	Maun	Total Northern Region
2013	Jan	649,735.0	185,456.0	294,463.0	109,289.0	463,778.0	128,880.0	439,893.0	1,243,500.0	-	3,514,994.0
	Feb	644,922.0	256,155.0	267,014.0	115,283.0	373,197.0	104,470.0	518,242.0	1,234,420.0	-	3,513,703.0
	Mar	762,589.0	267,088.0	289,682.0	109,154.0	427,319.0	159,570.0	425,181.0	1,302,746.0	-	3,743,329.0
	Apr	671,254.0	210,106.0	297,054.0	117,310.0	388,360.0	116,401.0	482,813.0	1,178,641.0	84,550.0	3,461,939.0
	May	681,496.0	285,883.0	328,241.0	105,235.0	354,221.0	119,900.0	463,149.0	1,208,080.0	105,430.0	3,546,205.0
	Jun	656,850.0	154,735.0	219,343.0	116,308.0	343,991.0	118,830.0	449,932.0	873,175.0	100,051.0	2,933,164.0
	Jul	661,222.0	331,475.0	324,149.0	105,368.0	386,590.0	126,110.0	434,865.0	1,409,844.0	98,443.0	3,779,623.0
	Aug	671,657.0	184,786.0	203,890.0	107,664.0	350,848.0	117,380.0	436,877.0	1,140,350.0	117,931.0	3,213,452.0
	Sep	715,122.0	221,334.0	298,158.0	101,144.0	340,735.0	113,400.0	461,000.0	946,190.0	112,441.0	3,197,083.0
	Oct	906,665.0	288,851.0	252,421.0	98,057.0	372,609.0	112,300.0	472,078.0	1,306,370.0	116,980.0	3,809,351.0
	Nov	822,638.0	210,887.0	230,607.0	117,480.0	378,055.0	106,800.0	372,516.0	1,343,766.0	338,971.0	3,582,749.0
	Dec	766,469.0	156,502.0	253,904.0	109,020.0	373,114.0	118,900.0	454,536.0	1,153,961.0	319,862.0	3,386,406.0
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	351,870.2	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

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

Tables 1.6 and 1.7 show the monthly water production trends by management centres in the northern and southern regions. Water demand is 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 1.8: Total production (Kilolitres)

SOUTHERN MCs	Total April to September 2013	Total April to September 2014
Gaborone MC	15,803,606.00	12,711,402.00
Molepolole MC	2,085,719.00	3,292,541.00
Lobatse MC	4,184,976.00	4,589,107.00
Mochudi MC	1,649,216.00	1,707,441.00
Kanye MC	3,367,469.00	3,656,691.00
Tsabong MC	696,820.00	699,942.60
Ghanzi MC	719,881.00	634,505.10
Total	28,507,687.00	27,291,629.70
NORTHERN MCs		
Selibe Phikwe MC	4,057,601.00	3,853,470.00
Palapye MC	1,388,319.00	1,261,418.40
Serowe MC	1,670,835.00	1,414,783.00
Letlhakane MC	653,029.00	686,953.00
Mahalapye MC	2,164,745.00	2,139,566.00
Kasane MC	712,021.00	856,685.00
Masunga MC	2,728,636.00	2,265,515.20
Francistown MC	6,756,280.00	7,027,801.00
Maun MC	618,846.00	1,820,722.30
Total	20,750,312.0	21,326,913.90

Table 1.8 compares the April to September 2014 total water production for the management centres with that of the same period during the previous year 2013. For the southern MCs, Gaborone MC and Ghanzi MC produced less water in April to September 2014 than for the same period in 2013. All the rest produced more water for the period in 2014 than in 2013.

For the northern MCs, Masunga, Serowe, Selibe Phikwe, Palapye and Mahalapye all used less water between April and September 2014 than for the same period in 2013. Maun, Francistown, Kasane and Letlhakane on the other hand had higher water production in 2014 than in 2013, during the period under review. Total water production between April and September was less in 2014 than in 2013 for the southern MCs and more in 2014 than in 2013 for the northern MCs.

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	Lethakane
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	Lethakane 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.

Table 2.3: Monthly total rainfall (millimetres)

	1	2	3	4	5	6	7	8	9	10	11	12
	Francistown Met. Station	Gaborone Met H/Q	Ghanzi Airport	Kanye Seepapitso SSS	Lobatse Police Station	Mahalapye Met. Station	Maun Airport	Mochudi Police Station	Molepolole Police Station	Palapye Police Station	Serowe Police Station	Shakawe Met. Station
2013/14												
Jul	-	20.6	0.0	4.8	2.0	0.0	0.0	0.0	16.1	0.0	0.0	0.0
Aug	-	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sep	-	2.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0
Oct	-	10.0	16.8	30.2	21.6	14.5	7.0	7.0	0.0	0.0	13.5	9.4
Nov	-	33.3	39.7	13.1	23.4	57.7	20.8	82.0	29.5	28.0	51.6	0.8
Dec	-	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	0.0	128.5	97.3	-	-	156.1	0.0	167.5	174.0	-	-	282.4
Apr	16.9	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	0.6	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
Sep	0.0	0.0	0.0	-	-	0.0	1.4	0.0	0.0	-	-	0.0
Oct	1.5	0.3	1.4	-	-	18.1	1.3	7	5.8	-	-	0.0
Nov	111.3	52.6	46	-	-	26	33	92.5	148	-	-	77.3
Dec	167.1	90.6	7.5	-	-	134.9	78.5	72	101.6	-	-	49.6
Jan	0.0	80.6	5.0	-	-	51.4	0.0	71.0	22.0	-	-	114.1
Feb	41.9	41.1	29.2	-	-	18.6	0.0	22.0	31.5	-	-	6.1
Mar	38.3	19.9	55.6	-	-	48.3	0.0	33.0	6.5	-	-	5.2
Apr	37.6	25.5	117.1	-	-	1.8	0.0	3.0	0.0	-	-	134.1

Table 2.3: Monthly total rainfall (Millimetres) continued

		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	Letlhakane Met. station	Panda -matenga		
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	0.0	151.5	131.6	127.4	-	-	-	-	-	-	34
	Apr	8.4	0.4	-	17.4	0.0	36	3.4	29	17	0.0	-	-	-	-	-	-	3.8
	May	19.1	21.6	-	0.0	0.0	1.8	0.9	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
2014/15	Jul	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	-	14	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	-	-	-	-	-	-	0.0
	Oct	1.1	3.1	-	0.0	0.0	10.5	10.6	0.0	0.0	0.0	-	-	-	-	-	-	0.0
	Nov	94.5	24.1	-	38.8	0.0	16.4	57.3	38.5	24	0.0	-	-	-	-	-	-	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	-	35.8
	Feb	24.1	30.1	-	20.5	0.0	5.4	4.7	39.4	12.9	0.0	17.4	35.6	43.7	2.2	136.8	-	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	-	24.0
	Apr	1.4	32.6	-	17.6	0.0	28.4	21.3	10.0	32.4	0.0	27.7	14.3	19.9	47.9	0.0	-	0.0

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

The meteorological year starts in July and ends in June of the subsequent year. Table 2.3 shows the total monthly rainfall for the rainfall stations for the period ranging from July 2013/14 to April 2014/15.

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

Monthly rainfall trends are in consonance with Botswana's seasonal variations. The main rain season covers the period beginning in October and ending in April. (Statistics Botswana: 2005) The winter months of June and July are normally dry. Rainfall during these months is an unusual occurrence.

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.

Table 2.4: Total annual rainfall (mm) by rainfall stations 2012/13 to 2014/15

	2012/13	2013/14	2014/15
Francistown Met. Station	-	-	360.1
Pandamatenga	-	-	326.2
Rakops	-	-	320.6
Molepolole Police Station	309	384.2	315.4
Mochudi Police Station	192.9	478.9	297.5
Mahalapye Met. Station	347.9	512.4	297.3
Sowa Town	-	-	295
Lephephe	-	-	286.4
Gaborone Met H/Q	363.6	464.8	285.1
Lerala	-	-	277.2
Goodhope	-	-	270.7
Shakawe Met. Station	405.5	745.3	252.3
Tshane Met. Station	149.4	498.5	247.3
Oliphant's Drift	-	-	167.3
Tsabong Airport	160.3	435.8	165.3
Ghanzi Airport	172.5	604.9	144.7
Maun Airport	355	341.3	112.8
Moshupa Police Station	-	-	87.9
Francistown Airport	387.5	716.9	-
Kanye Seepapitso SSS	289.8	-	-
Lobatse Police Station	241.1	-	-
Palapye Police Station	351.1	-	-
Serowe Police Station	396.3	-	-
Kasane Airport	406.4	-	-
Bobonong Police Station	-	438.5	-
Bokspits Agromet	-	652.6	-
Gumare	-	588	-
Kang	-	652.6	-

Note - figures based on meteorological year (July to June)
- Dashes show no data available
- 2014/15 total rainfall is provisional data
Source: Department of Meteorological Services

In Table 2.4, analysis of the latest wet season, October 2014 to March 2015 shows that the wettest area was Francistown meteorological station, where a total of 360.1mm fell during the main wet season. Pandamatenga follows with a total of 326.2 mm of rainfall, followed by Rakops with 320.6 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) (October to March 2014/15)

	2014			2015		
	Oct	Nov	Dec	Jan	Feb	Mar
Gantsi	15.6	17.6	19.4	18.7	19.6	18.4
Shakawe	20.5	18.4	19.7	19.3	18.3	18.8
Maun	20.4	21.1	21.3	20.8	21.1	20.5
Francistown	15.0	17.3	18.0	16.9	17.2	16.2
SSKA	15.1	18.8	19.9	19.9	19.8	18.6
Mahalapye	15.2	17.5	18.4	18.8	18.7	18.6
Tsabong	11.9	17.2	20.2	20.2	18.8	18.1
Tshane	14.8	17.3	20.6	20.0	21.4	18.8

Source: Department of Meteorological Services

Table 2.5 shows the stations' mean monthly minimum temperatures for the period under review, October 2014 to March 2015. The lowest mean monthly minimum temperature recorded during the period under review was 11.9 °C recorded at Tsabong in October 2014. The highest mean monthly minimum temperature for the same period was 21.4 °C recorded at Tshane in February 2015.

Table 2.6: 2013/14 and 2014/15 October to March mean monthly minimum temperatures averaged

	2013/14 Average	2014/15 Average
Gantsi	18.5	18.2
Shakawe	20.1	19.2
Maun	20.3	20.9
Francistown	18.7	16.7
SSKA	18.8	18.7
Mahalapye	17.6	17.9
Tsabong	18.6	17.7
Tshane	18.3	18.8

Table 2.6 compares the 2013/14 and 2014/15 six-month averages, which are calculated using the mean monthly minimum temperatures for the period October to March.

2.2.2. Mean monthly maximum temperatures

Table 2.7: Mean monthly maximum temperatures (°C) (October to March 2014/15)

	2014			2015		
	Oct	Nov	Dec	Jan	Feb	Mar
Gantsi	34.1	31.7	32.0	34.7	35.9	31.3
Shakawe	36.1	31.4	31.0	33.0	35.1	33.6
Maun	35.5	32.2	32.1	33.1	34.5	33.1
Francistown	32.8	32.3	30.1	31.2	33.8	31.6
SSKA	31.6	30.3	31.2	32.6	35.1	31.6
Mahalapye	31.6	31.0	30.5	31.5	34.3	31.5
Tsabong	32.0	31.7	35.1	35.3	35.2	32.4
Tshane	33.3	32.0	32.8	34.5	35.0	31.2

Source: Department of Meteorological Services

Table 2.7 shows the stations' mean monthly maximum temperatures for the period under review, October 2014 to March 2015. The highest mean monthly maximum temperature of the period under review was 36.1 °C recorded at Shakawe in October 2014, while the lowest was 30.1 °C recorded at Francistown in December 2014.

Table 2.8: 2013/14 and 2014/15 October to March mean monthly maximum temperature averaged

	2013/14 Average	2014/15 Average
Gantsi	30.2	33.3
Shakawe	31.8	33.4
Maun	31.5	33.4
Francistown	30.3	32.0
SSKA	30.0	32.1
Mahalapye	30.0	31.7
Tsabong	32.0	33.6
Tshane	31.0	33.1

To compare the 2013/14 and the 2014/15 mean monthly maximum temperatures for the same period (October to March), Table 2.8 Shows the averages calculated from the mean monthly maximum temperatures for the 6 (six) months period for each of the meteorological years. All the stations recorded warmer maximum temperatures for the period under review, in 2014/15 than in the previous year 2013/14.

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

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

Year	Gaborone	Lobatse	Jwaneng	Selibe-Phikwe	Francistown	Sowa	Villages	Sales (Pula)
2003	23,977,709.0	2,589,689.0	1,594,425.0	9,054,474.0	6,759,856.0	536,518.0	-	430,247,650.0
2004	24,529,020.0	2,607,674.0	1,686,921.0	8,681,348.0	7,185,879.0	463,493.0	-	501,353,260.0
2005	19,643,169.0	505,326.0	505,326.0	9,305,079.0	7,715,038.0	501,959.0	-	405,119,463.0
2006	20,669,603.0	2,282,253.0	1,543,636.0	8,594,176.0	8,419,012.0	517,717.0	-	421,029,698.0
2007	23,973,239.0	2,656,014.0	1,736,555.0	8,906,098.0	8,566,130.0	441,988.0	-	466,665,882.0
2006 Q1	4,706,577.0	503,632.0	364,865.0	2,034,483.0	1,945,758.0	113,840.0	-	100,987,421.0
Q2	4,848,705.0	562,527.0	382,175.0	2,175,378.0	2,037,438.0	154,352.0	-	102,143,777.0
Q3	5,200,148.0	588,340.0	373,851.0	2,053,131.0	2,187,229.0	120,814.0	-	103,728,623.0
Q4	5,914,173.0	627,754.0	422,745.0	2,331,184.0	2,248,587.0	128,711.0	-	114,169,877.0
2007 Q1	6,128,022.0	664,125.0	446,651.0	2,341,251.0	1,973,254.0	109,111.0	-	122,336,154.0
Q2	6,109,970.0	697,300.0	463,525.0	2,412,454.0	2,194,094.0	119,979.0	-	118,216,374.0
Q3	5,710,645.0	620,014.0	400,689.0	2,019,773.0	2,353,476.0	96,390.0	-	112,601,298.0
Q4	6,024,602.0	674,575.0	425,690.0	2,132,620.0	2,045,306.0	116,508.0	-	113,512,056.0
2008 Q1	6,109,627.0	628,172.0	481,920.0	2,152,639.0	2,336,645.0	127,764.0	-	117,500,096.0
Q2	6,291,264.0	766,555.0	268,133.0	2,520,308.0	2,294,401.0	123,374.0	-	122,621,556.0
Q3	6,313,052.0	758,330.0	388,979.0	2,260,705.0	2,368,583.0	125,146.0	-	124,434,575.0
Q4	6,943,420.0	815,662.0	439,575.0	2,414,659.0	2,269,867.0	125,611.0	-	137,885,712.0
2009 Q1	6,845,188.0	819,656.0	381,132.0	2,228,727.0	2,220,849.0	116,972.0	-	13,049,724.0
Q2	7,236,338.0	849,652.0	403,243.0	2,208,227.0	2,544,499.0	109,833.0	-	13,564,692.0
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	-	14,591,445.0

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

Year	Gaborone	Lobatse	Jwaneng	Selibe-Phikwe	Francistown	Sowa	Villages	Sales (Pula)
Q2	5,536,241.0	814,777.0	394,718.0	2,367,839.0	2,730,707.0	122,573.0	11,966,855.0	13,355,073.0
Q3	5,073,786.0	848,805.0	466,125.0	2,407,279.0	3,076,847.0	128,335.0	12,001,177.0	13,118,869.0
Q4	4,995,433.0	883,491.0	483,072.0	2,363,041.0	2,385,715.0	125,966.0	11,236,718.0	14,254,254.0
2011 Q1	4,721,472.0	876,672.0	461,423.0	1,999,938.0	1,989,304.0	124,627.0	10,173,436.0	17,586,786.0
Q2	4,752,822.0	812,314.0	476,749.0	2,297,013.0	1,942,824.0	134,441.0	10,416,163.0	13,889,992.0
Q3	4,549,912.0	827,165.0	429,377.0	1,654,294.0	1,967,235.0	127,722.0	9,555,705.0	13,327,773.0
Q4	5,153,892.0	836,107.0	507,915.0	2,961,830.0	2,154,069.0	131,053.0	11,744,866.0	21,656,285.0
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	-	-
Jun	2,691,511.0	645,399.0	230,926.0	656,850.0	873,175.0	30,810.0	-	-
July	2,590,229.0	578,556.0	223,978.0	661,222.0	1,409,844.0	26,970.0	-	-
Aug	2,555,954.0	738,497.0	179,787.0	671,657.0	1,140,350.0	26,720.0	-	-
Sep	2,443,516.0	776,988.0	142,671.0	715,122.0	946,190.0	38,990.0	-	-
Oct	2,487,473.0	701,207.0	195,082.0	906,665.0	1,306,370.0	28,060.0	-	-
Nov	2,497,082.0	593,363.0	194,401.0	822,638.0	1,343,766.0	23,260.0	-	-
Dec	2,059,495.0	609,847.0	152,228.0	766,469.0	1,153,961.0	26,730.0	-	-
2014 Jan	2,635,700.0	653,449.0	173,549.0	712,949.0	1,409,800.0	21,040.0	-	-
Feb	2,456,118.0	0.0	151,602.0	624,484.0	1,071,098.0	15,680.0	-	-
Mar	2,513,053.0	0.0	182,543.0	632,418.0	1,215,041.0	10,080.0	-	-

Dash (-) = no data

Source: Water Utilities Corporation

Annex 2: Monthly total rainfall (millimetres)

		1	2	3	4	5	6	7	8	9	10	11	12
		Francistown Airport	Gaborone Met H/Q	Ghanzi Airport	Kanye Seeppiso SSS	Lobatse Police Station	Machalapye Met. Station	Maun Airport	Mochudi Police Station	Molepolole 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 2: Monthly total rainfall (Millimetres) continued

		1	2	3	4	5	6	7	8	9	10	11	12
		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 2: Monthly total rainfall (Millimetres) continued

		13	14	15			13	14	15
		Tsabong Airport	Tshane Met. Station	Kasane Airport			Tsabong Airport	Tshane Met. Station	Kasane Airport
2010/11	Jul	0.0	0.0	0.0	2012/13	Jul	0.0	0.0	0.0
	Aug	0.0	0.0	0.0		Aug	0.0	0.0	0.2
	Sep	0.0	0.0	0.0		Sep	0.4	0.0	0.6
	Oct	0.0	23.7	10.7		Oct	3.7	0.7	6.8
	Nov	78.6	83.2	112.0		Nov	1.0	15.0	80.8
	Dec	80.4	142.9	42.8		Dec	77.1	65.3	56.4
	Jan	153.2	40.4	129.6		Jan	35.9	49.6	161.3
	Feb	18.1	26.2	55.7		Feb	5.3	6.5	95.1
	Mar	3.2	34.7	56.5		Mar	36.9	2.6	5.2
	Apr	54.0	40.9	7.4		Apr	0.0	9.7	0.0
	May	11.0	22.3	0.0		May	0.0	0.0	0.0
	Jun	14.5	1.6	1.6		Jun	0.0	0.0	0.0
2011/12	Jul	0.0	0.0	0.0	2013/14	Jul	4.2	0.0	0.0
	Aug	0.0	0.0	0.0		Aug	0.0	0.0	0.0
	Sep	0.0	0.0	0.0		Sep	0.0	0.0	0.0
	Oct	0.0	0.0	7.4		Oct	1.5	25.0	17.5
	Nov	6.9	0.2	52.5		Nov	14.0	11.2	81.7
	Dec	46.7	47.9	170.0		Dec	48.8	121.8	262.1
	Jan	27.2	37.9	126.4		Jan	47.8	19.6	-
	Feb	65.6	69.3	164.5		Feb	246.1	275.7	-
	Mar	43.4	52.2	49.1		Mar	45.9	23.2	-
	Apr	13.7	4.4	0.0		Apr	8.4	0.4	-
	May	0.0	0.0	0.0		May	19.1	21.6	-
	Jun	9.9	0.0	0.0		Jun	0.0	0.0	-

Annex 2: Monthly total rainfall (Millimetres) continued

	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	Leifhakane Met. station	Panda-matenga
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 3: 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 = new dams
Source: Water Utilities Corporation.

