

## **Is Cape Town suffering from the worst drought in 100 years?**

Barely six months ago, Gauteng was in the midst of “one of the worst droughts in living memory” – or so the Department of Water and Sanitation (“DWA”) would have us believe at the time. We had water restrictions and in some parts even “water throttling” (the water supply equivalent of load shedding). Transgressors of water restrictions were threatened with fines of up to R20 000. And through all of that we were warned that things would get much worse if it did not rain soon! Luckily for us in Gauteng the rain came, and then some! In recent weeks, many of us are experiencing a sense of *déjà vu* in witnessing what is happening in Cape Town and surrounds. The empty dams, severe water restrictions (level 4) and the daily count down of the number of days before the water will be finished (“*Day Zero*” as it has been labelled). It is harrowing stuff. Yesterday, the whole of the Western Cape province was declared a disaster area. Why? “In response to the current drought crisis - the worst since 1904.” Does this sound familiar?

Six months ago, I published an article here on Voices that contested DWA’s assertion that Gauteng was suffering from a severe drought ([Are Gauteng’s water troubles due to the drought?](#)). In that article, I clearly demonstrated that talk of the severity of the drought was highly exaggerated. We were not even close to the “worst drought in living memory” by any stretch of the imagination. No, Gauteng’s problems were caused by wastage and mismanagement of our water resource on a grand scale. It was merely a case of the relevant authorities trying to hide their failures and mismanagement behind a mild drought. So what is the situation in Cape Town? Is it true that it is currently suffering from the worst drought since 1904? In answering this question the reader will please forgive me if I recap quite a bit from the previous article.

When we talk about a drought there are two key parameters measuring its severity. The first parameter is a measure of how little it rains during a given year. This is normally expressed as a certain percentage below the average annual rainfall for an area. Thus if Pretoria, with average annual rainfall of 600 mm, experiences 425 mm of rain in a year, we can say it is experiencing a mild drought as that is more than 25% below the annual average. A severe drought would feature a significantly higher percentage below the average. The second parameter concerns the period of time for which the drought persists. Clearly two or more years of low rainfall, constitutes a more severe drought than one year of low rainfall.

In South Africa, we have detailed rainfall statistics that go back to 1904. These statistics tell us that although there are wide fluctuations in annual rainfall, longer periods of persistent, low rainfall are more rare. For example, the year 2015 (January to December) recorded the lowest annual rainfall (403 mm) across the country since 1904, but the driest period yet recorded is the four year period of 1930 to 1933. This clearly illustrates the impact that the duration of a dry period has.

A single year of low rainfall in a specific area may cause what is termed “*an agricultural drought*” in that area. Low soil moisture will reduce crops (or even lead to complete crop failure) and will reduce fodder and grazing for animals. Due to the low rainfall of 2015 large areas of the country were experiencing an agricultural drought throughout 2016.

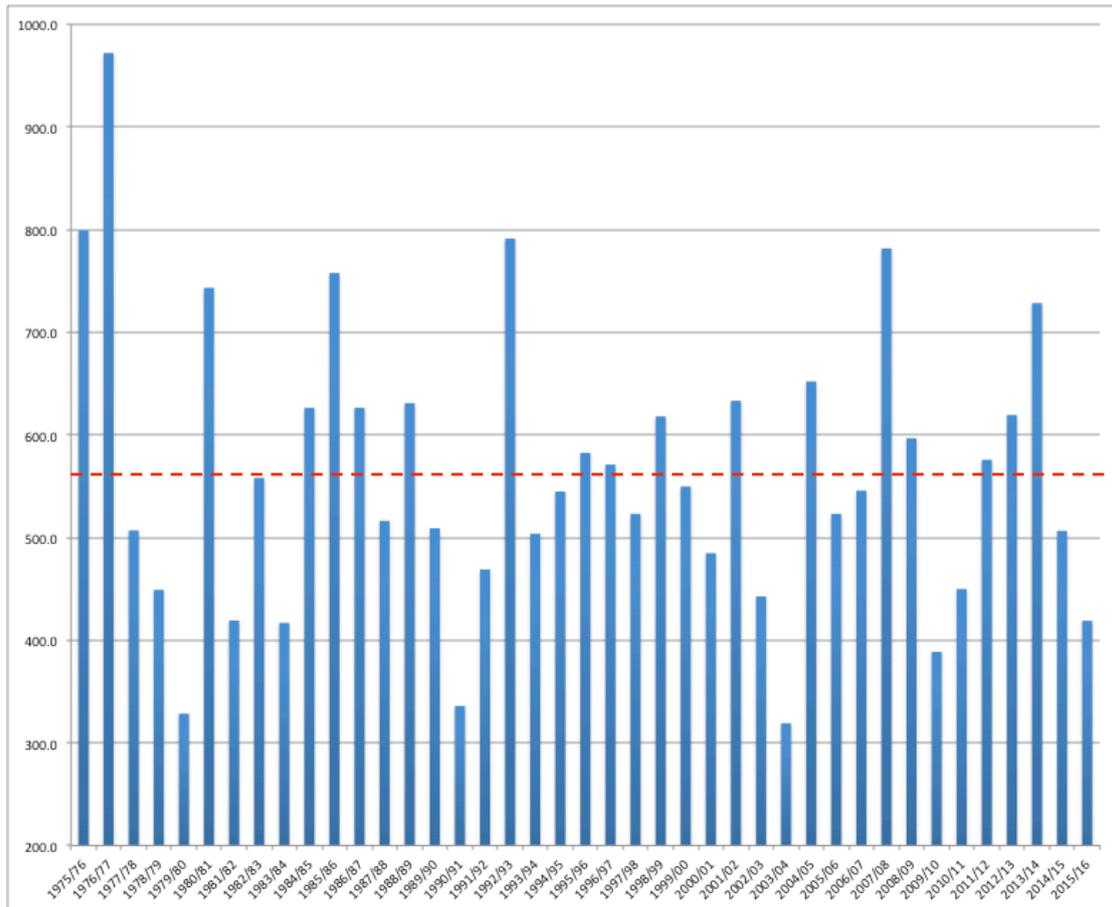
The rainfall statistics are invaluable as they assist water engineers to design reliable water supply systems. When water engineers design a water supply system that will supply water for domestic consumption (i.e. households), the design standard used is a “*98% assurance of supply*”. This means that over any 100-year period, the water supply system will be expected to deliver the design quantities of water in 98 of those years. Thus, one would only expect reduced water supply (read water restrictions) once in every 50 years – this has given rise to the term “*a 1-in-50 year drought*”. This highly conservative design standard is intended to reduce the vulnerability of domestic communities to drought. Much lower design standards are used for agricultural and industrial water supply systems. For agricultural systems, a 90% assurance of supply is generally used. This means that one would expect reduced water availability once in every 10 years, giving rise to the term: “*a 1-in-10 year drought*”.

In any given area, a drought that will threaten failure of surface water supplies and thus any domestic water supply systems reliant on it, is termed a “*hydrological drought*”. A hydrological drought can be caused by two factors: (i) a 1-in-50 year drought or (ii) high water use. In this context, high water use means persistent consumption above the design level of the supply system. High water use will also include non-compliance with the operating rules of a dam. A good example of an operating rule for a dam would be a restriction placed on irrigation water when the dam level drops below a pre-determined volume. One can see that such an operating rule would aim to maintain the respective “*assurances of supply*” of any irrigation systems and domestic supply systems.

Given this background we can return to analyse the Cape Town situation. In doing so we need to recognise that most of Cape Town's drinking water is imported from some distance away. The actual rainfall in Cape Town is of little consequence in this regard. Of far greater consequence is the rainfall in the catchment areas of the dams supplying its water. The single biggest source of Cape Town's water supply is Theewaterskloof Dam – the one that features regularly in the press these days. So, let us examine the historical rainfall figures for the catchment area of Theewaterskloof Dam to determine whether it is currently suffering from the worst drought since 1904. Simple stuff!

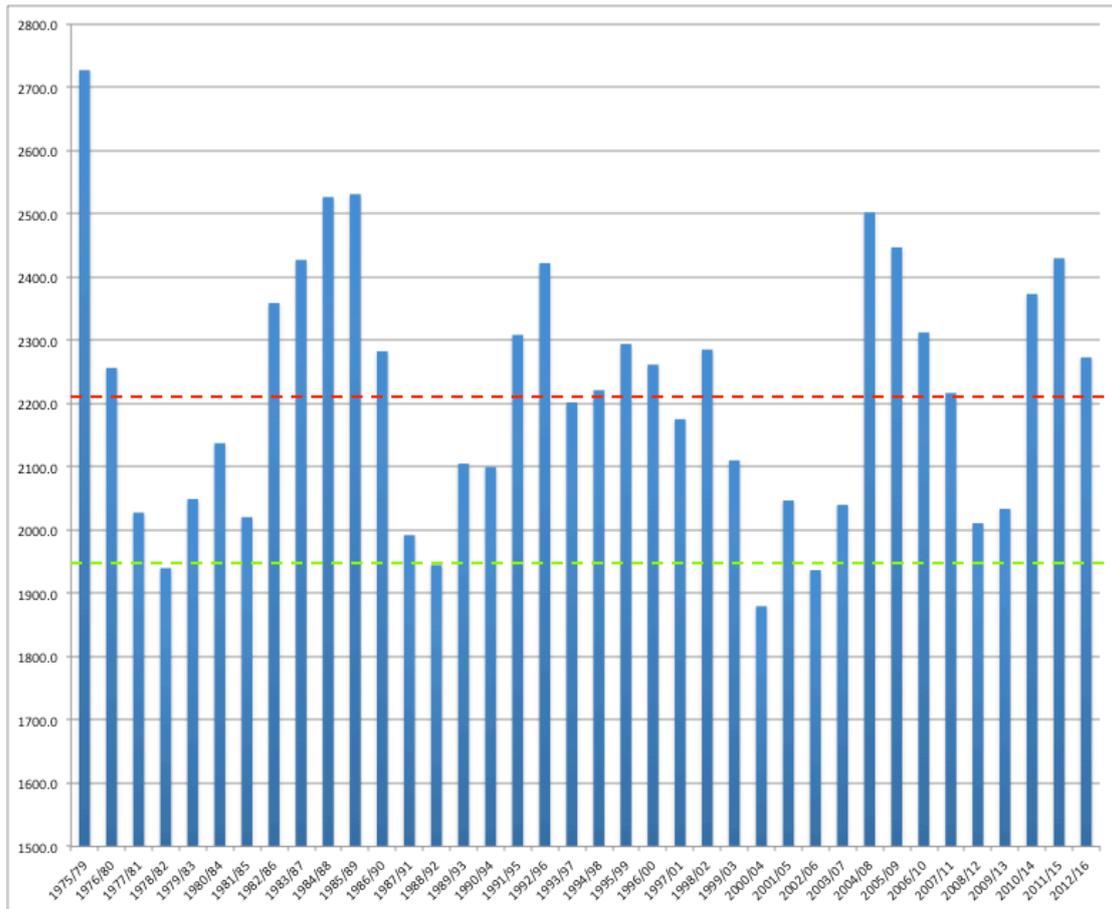
No, unfortunately it isn't that simple – not anymore at least. You see, until quite recently it was easy for anyone from the public to access the national rainfall statistics through DWA's website. I did exactly that six months ago, when I wrote the previous article. But in the interim something very curious has happened. The data has been removed and is no longer accessible to the public through DWA. In stead, one can get the data from Weather SA, but (and here's the catch) one has to pay for it - and it costs quite a lot – about R40 000 for the data of the Theewaterskloof Dam catchment and similar amounts for the catchments of each of the other dams. Daily Maverick reported on this yesterday ([GroundUp: Here's where to find data on Cape Town's water crisis](#)). I believe this is something that should be followed up urgently. This is data that has been collected through taxpayers' money and it belongs to the public. The price charged for the data seem to have only one objective: to remove the ability of the public to check the facts for themselves.

Luckily by following the links provided by GroundUp we could access the rainfall data for one station within the catchment of Theewaterskloof Dam. Unfortunately this data does not go back to 1904 but only to 1975 (thus 41 years). Still, it should give us a good idea of the status quo. The graph below indicates the annual rainfall (in mm) over this period.



In the graph above, the red line indicates the average annual rainfall over the period. What does this graph tell us? Firstly, if we look at the last two years we can see that both years featured below average rainfall. It is fair to say that this area is experiencing an agricultural drought. Is this the worst drought since 1904? Definitely not! We can see a number of periods that were significantly drier than the last two years – 1977 to 1980, 1981 to 1984 and 2002 to 2004.

Now let's ask a more difficult question: is the current drought severe enough to cause a hydrological drought? To answer this question I have (arbitrarily) calculated the 4-year cumulative rainfall for the area over the period 1978 to 2016. Clearly any 4-year period with low cumulative rainfall would signal a fairly severe drought. This data is presented in the graph below.



Now it gets interesting. In the chart above the red line represents the average cumulative rainfall over all the 4-year periods (2 216 mm). It is very clear that even in the past 40 years there have been a number of instances that have been significantly drier than what the area is currently experiencing – the early 80’s, early 90’s and most of the first decade after the turn of the century. In fact, relatively speaking we are doing quite well at the moment as we are still sitting above the average for the past 4 years. If 2017 proves to be a dry (below average) year, we will probably dip below the 4-year cumulative average for the first time since 2013.

But we can do some further analysis. If we treat these 40 odd years as representative of the past 100 years (ideally we would have liked more data!) then we can use the data to calculate the 4-year cumulative rainfall that would represent a 1-in-10 year drought. This is represented by the green line on the chart above (1 945 mm). As you can see from the chart we have experienced four 1-in-10 year droughts over the past 40 years. Eureka - it works! We can also see from the chart above that we are currently not even remotely close to a 1-in-10 year drought, never mind a 1-in-50 year drought. In fact, 2017 will have to be the driest year over the past 40 years to get us to a 1-in-10 year drought.

Let me remind you that for the Cape Town water supply system to start failing as is clearly happening, should have required a 1-in-50 year drought. What is going on? As I have found in the previous article, the current hydrological drought can only be caused by high water consumption. If this occurred over a protracted period of time (i.e. a few years running) it would boil down to blatant mismanagement of the system. The figures above and what we can see on the ground in reality leaves only two alternatives as far as Theewaterskloof dam is concerned: (i) either the rainfall figures are wrong – and the authorities do not want us to check them, or (ii) the dam has been blatantly mismanaged for a protracted period of time. In a follow-up article, I will present facts around Theewaterskloof dam that I believe will prove to any objective reader just how the dam has been mismanaged and what the consequences of such mismanagement are likely to be. For now, I will simply state what the figures above show us, in answer to the question asked in the title of this article: No, Cape Town (or at least the catchment area of its largest and most significant water resource) is not suffering from the worst drought since 1904. The current water shortage experienced is due to mismanagement of the Theewaterskloof dam.

We can spend a lot of time debating and apportioning blame for this mismanagement. That is not the aim of this article. The aim is rather to focus the attention of the broad public on the critical issues and to identify the true problem. This is important because the public can only judge the remedial steps (and some of the historical steps) proposed and taken by the relevant authorities, if we understand the root cause of the problem. I will deal more with some of the historical choices and the proposed remedial activities in a following article. And don't for one moment believe this is only a problem in Cape Town or the Western Cape. The way things are going (and given the extent of mismanagement!) we will have water restrictions again in no time in Gauteng and elsewhere. Above all, we can only prevent the authorities to hide behind silly fallacies and lies if the broad public is sufficiently informed and the public debate is elevated to the relevant facts. Just yesterday in a parliamentary committee meeting, Pravin Gordhan referred to the “arrogance” displayed by the Eskom board in dishing up any rubbish to the public and believing it will not be challenged. It is not just the Eskom board that is guilty of this arrogance....