

LEARNING FROM CRISIS

A series of modular learnings from the 2017-2018
Cape Town water crisis

☺☺☺ THE RESILIENCE SHIFT

THE CAPE TOWN
DROUGHT RESPONSE
LEARNING INITIATIVE

module

10

System management and operational issues

The impact of the drought would not have been nearly as severe had the water supply system been managed effectively and according to its own rules. Underlying systemic issues significantly exacerbated the situation.

Text component of module 10, accompanying the film www.vimeo.com/cinesouth/ctdri-trs-lfc-module-10

Duration: 20:35

System management and operational issues

The severe, multi-year drought in the Western Cape was not the sole cause of the 2017-2018 Cape Town water crisis. The impact of the drought was exacerbated by underlying systemic issues in the management and operation of the water supply system. In the years preceding the crisis the system was not operated effectively and in accordance with its own rules. Invasive alien vegetation clearing in catchment areas, infrastructure maintenance, and pumping of water between dams to avoid spillage was not done as required by the rules and policies of the system. There was over-abstraction from the system in the early phase of the drought, with restrictions implemented late and not enforced. The stochastic model used to project dam levels was not up to date, and its reliability impacted by the fact that the operating rules were not being followed. It has been estimated that, had the system been operated effectively and according to agreed-upon rules, dam levels at the end of the rainy season of 2017 would have been substantially higher, possibly by as much as 18 percentage points, in which case there would have been no Cape Town water crisis.



If the system had been managed according to the rules and had been managed optimally, the level of the dams at the end of winter 2017 would have been substantially higher than they were, essentially negating the threat of Day Zero

Dr Rolfe Eberhard

Had the operating rules been followed in the system, Day Zero would not have been on the cards at all

Dr Gisela Kaiser

The longer-term management was inadequate

Alderman Ian Neilson

EXECUTIVE SUMMARY

- The severity of the drought is not the sole or fundamental reason for the crisis: severe as the drought was, it would not have resulted in a crisis had the water supply system been managed effectively and in accordance with its own rules in the preceding years
- Had the system been operated according to agreed-upon rules and policies, dam levels at the start of the 2017/2018 hydrological cycle would have been as much as an estimated 18 percentage points higher, at 50 or 54 percent, rather than the actual 37 percent, and the situation would never have deteriorated to crisis levels – Cape Town would not have experienced the threat of Day Zero
- Alien vegetation was not cleared from catchment areas to the degree required
- There was over-abstraction from the system in the early years of the drought; releases to agriculture, in particular, were not done according to the rules; restrictions were implemented late and were not enforced
- Infrastructure maintenance, such as the clearing of silted-up canals feeding water into dams, was not done as required
- Pumps were not operating when they should have been, and transfers between dams were not made when they should have been made, resulting in a lower yield from the system than should have been the case
- The accurate modelling of the system was detrimentally affected by two factors: the model was not up to date, and its results are based on the assumption that the operating rules of the system are followed, which was not the case
- The national Department of Water and Sanitation has long been malfunctioning, plagued by leadership instability, financial mismanagement and skills erosion
- The severity of the drought therefore does not exonerate government from responsibility for the crisis; while the drought was indeed severe when set against the levels of assurance of supply and the severity of drought the system is designed to be able to cope with, the impact would not have been nearly as severe if the system had been managed effectively and according to its own rules
- It would consequently be misguided to place the emphasis on the drought as an extraordinary climatic event outside human control, as this takes the focus away from the underlying systemic issues – multiple weaknesses and failures in the operation and management of the system that should be addressed urgently to improve both water security and resilience to climate shocks

Interviewees in order of appearance:**Dr Rolfe Eberhard**

Independent public policy advisor

Dr Gisela Kaiser

Previously Executive Director: Informal Settlements, Water and Waste, City of Cape Town

Alderman Ian Neilson

Deputy Mayor: City of Cape Town

Mike Mulcahy

CEO: GreenCape

Claire Pengelly

Water programme manager: GreenCape

Councillor Xanthea Limberg

Mayoral Committee member: Informal Settlements, Water & Waste Services and Energy, CoCT

Peter Flower

Recently retired Director: Water and Sanitation, City of Cape Town

Dr Lloyd Fisher-Jeffes

Water resources engineer: Aurecon

Full interviews on [Cape Town Drought Response Learning Initiative](#) website

Opinions expressed by interviewees are personal viewpoints
and do not necessarily reflect those of their organisations

STRUCTURE

00:00:05

Hooks:

- If system had been managed according to the rules and had been managed optimally, dam levels end winter 2017 would have been substantially higher than they were, negating threat of Day Zero (RE)
- Had system operating rules been followed, Day Zero would not have been on the cards at all (GK)
- The longer-term management was inadequate (IN)

00:00:58

FUNDAMENTAL REASON FOR THE CRISIS: NOT THE SEVERITY OF THE DROUGHT, BUT FAILURE TO OPERATE SYSTEM ACCORDING TO RULES

- Water system is designed to cope with climate variability; if well managed and maintained, will be able to cope with drought periods without there having to be a crisis (RE)

00:01:52

LONG LIST OF SYSTEMIC MANAGEMENT AND OPERATIONAL ISSUES

- Alien vegetation clearing in catchment areas not done as required
- Releases, particularly to agriculture, not done according to rules, with resulting uncertainty detrimentally impacting city's water security
- System and its infrastructure not maintained as required, an example being the silting up of canals supplying water to the dams
- Pumps not operating when they should have been, and transfers between dams were not made when they should have been, resulting in a lower yield from the system than should have been the case
- Restrictions were implemented late and were not enforced – as a result the system was over-allocated, and in the early part of the drought there was over-abstraction from the system
- Stochastic model of system not up to date, and its accuracy affected by fact that operating rules of the system were not being followed
- National Department of Water and Sanitation plagued by leadership instability, financial mismanagement and skills erosion (IN, RE, MM, CP, XL, PF)

00:04:19

HAD RULES BEEN FOLLOWED, THERE WOULD HAVE BEEN NO CRISIS

- Dam levels would have been around 18 percentage points higher – at 50 or 54 percent, compared to the actual 37 percent – at start of hydrological cycle, had system been operated according to its rules, and the city would never have come close to crisis levels (GK, MM)

00:18:36

GOVERNMENT NOT EXONERATED BY SEVERITY OF DROUGHT

- Yes, drought was severe, but government should accept some responsibility, because impact would not have been nearly as severe if system had been managed effectively and according to rules (RE)

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- 00:00:58 “It is misleading to see the water crisis only as a drought requiring a drought response. There are underlying systemic issues that influence the ability of the system to respond to periods of low rainfall. The danger is if the drought is only characterised as this very unusual event requiring a single drought response it takes the focus away from addressing the underlying issues.”
- “The water management system in South Africa is designed to cope in a context of climate variability and will have to manage in a context of climate change. This system, if it is well designed and managed, will then be in a much stronger position to respond to periods of low rainfall, without there needing to be a crisis.”
- 00:01:52 “Certainly now, when we’ve been able to reassess some of the information, it’s very clear that, years back, when the Berg River dam was built, when what was called the Western Cape water supply system, operating system, was put into place, rules were determined at that stage how the system should be operated. And we now know that if it had been operated entirely according to those rules, we would not have got into such a low situation in our dam levels, that would have made all the difference in terms of how we had to react to it at the last phase.”
- Many factors: required vegetation clearing in the catchment areas did not happen; the management of the releases of water in the early parts of the drought, particularly to agriculture, should have been limited more; there were issues of lack of maintenance, an example being the silting up of the canals supplying Voëlvlei dam; pumps in the Berg River supplement scheme not operating when they should have operated; “all of these together combined to this scenario; we know that the longer-term management was inadequate.”
- 00:04:19 “The way that the system operated was not ideal. And the theoretical calculation is that dam levels would have been 18 percent fuller [ie, 18 percentage points of dam capacity] prior to the winter of 2017, and that’s where our dam levels got to 20 percent.”
- “Had restrictions been implemented, had the operating rules been followed in the system, then dam levels would have been significantly fuller in 2017, and Day Zero would not have been on the cards at all, I’m pretty sure of that.”
- 00:05:33 “The severity of the drought was not the fundamental reason for the crisis. The Western Cape water supply system is managed in terms of a set of allocations and then a set of rules around how restrictions are applied, and the availability of water is dependent on those allocations and rules being applied in the way that they were set out. And there’s evidence to suggest that the system was over-allocated and that people, users used more water than they were entitled to, and

that restrictions, where they were implemented, were implemented late, and also not enforced, so in the early period of the drought there was over-abstraction from the system, more than should have been if the rules had been strictly applied.”

“On top of that, the availability of water is also affected by alien vegetation, and the estimation of how much water is available is dependent on assumptions about the control of the alien vegetation, and there’s evidence that the alien vegetation has not been controlled to the extent that it should have been, and that has also contributed to less water being available in the system.”

“A third factor has to do with the management of the system. So during the winter pumps need to operate, canals need to be cleaned to let water flow, and the timing of releases and the drawing from different dams needs to be optimised to get the most out of the system. If those factors are not done correctly, then the availability of water is also reduced.”

“And if you put those three factors together – the issue of abstractions, the implementation of restrictions, and the management of the system – if the system had been managed according to the rules, and had been managed optimally, if the allocations and restrictions and management had been done according to agreed-upon rules and policies, the level of the dams at the end of winter 2017 would have been substantially higher than they were, essentially negating the threat of Day Zero.”

00:07:45 “There are a range of management areas in the overall catchment and the overall system that could have been improved.” These include alien vegetation control and infrastructure maintenance. “Some of the analysis shows that the dams in theory could or should have had something in the region of 50 or 54 percent water, moving into this year’s hydrological cycle, when in reality it was closer to 37 percent as we entered into the drought.”

“Each of these individual pressures perhaps not enough to really precipitate a crisis like Day Zero, but when you start stacking the pressures on top of each other – over-allocation, sophisticated and contested users, a weak regulator, maintenance and alien invasive species control that could have been done slightly better – you start to really see how the system that is providing water to the city of Cape Town and broadly the Western Cape has a tremendous amount of pressure, and can be improved dramatically through some fairly simple interventions to increase the yield of the supply.”

00:09:47 Agriculture using about a third of water from dams; urban two thirds. “In previous years, the national Department of Water and Sanitation, which is responsible for managing the entire system, did not ensure that agriculture was reduced in terms of their allocations despite the fact that the city had been

adhering to the restriction levels. So there was a concern that as we were leaving winter, towards mid to late 2017, and we could see that the dam levels were not recovering at the rate that they should, and that in fact we were at a real danger of running out of water during the course of that summer, that there was a risk that agriculture would not be curtailed to the extent that was expected.”

00:10:49 “Agriculture’s consumption was concerning to us. It was clear that national government weren’t enforcing restrictions and weren’t acting on non-compliance. Agriculture in the previous hydrological year hadn’t stuck to what they needed to consume; we were largely doing so. But agriculture in the summer periods draws more water than the city does, and so they were also a large risk to our overall water security, and the lack of enforcement was something that we were very concerned of at the time.”

00:11:33 “The national Department of Water and Sanitation is responsible to maintain much of the national water resource infrastructure that supplies cities and industries. The status of the national department is a matter of public record. There have been eight director-generals in a period of nine years, so a lot of leadership instability in the department. The department has been in the news for financial mismanagement and for audit issues related to its financial statements with serious problems related to project management and cost controls around projects. The capability of the department has eroded over time; it is I think a well-known fact that in many cases there aren’t the skilled personnel to be undertaking the planning and the infrastructure management and maintenance that is necessary to maintain South Africa’s important water assets.”

00:12:34 Stochastic model that is run simulating the operation of the dam system, giving probabilistic predictions of dam levels. Two issues: this model had not been updated for a long time; and the model is based on the assumption that the rules of the system are being applied, which had not been the case. Actual dam levels were starting to run outside the envelope of projections.

The system was not being managed as it should have been in terms of transfers between the subsystems. Excess water was not being transferred timeously between dams to avoid spillage as it should have been in terms of the policies for the optimal management of the system. The yield of the total system is greater than the sum of the individual yields – if it is operated effectively. But this was not done.

“The other rule that needs to be obeyed is the rule of restrictions. No water supply system anywhere in the world would be able to operate without some level of restriction at some point in time. Now unfortunately a lay person thinks when you go into restrictions the water supply system has failed. Now that’s not the case. Restrictions are very much part of effectively operating the system ... It

was being compromised now because the model wasn't necessarily giving the absolutely correct picture going forward. And with the lethargy, if you like, of the department not applying restrictions timeously it also compromised the way in which this whole drought scenario played out."

00:17:14 Before a drought complacency tends to set in. We should include inefficiencies in planning. This is not unique to the developing world or to under-resourced countries. Shortcomings and failures seem to be common around the world.

00:18:36 "There is an argument that exonerates government, which is based on the fact that the severity of the drought means that sufficient water could not be made available to the system. And to some extent I agree with that view because of the very low probability of such an event, and the system was not designed for that severity of event. At the same time, government should assume some responsibility because if the system had been operated in terms of its own rules and had been effectively managed, the impact of the drought would have not been nearly as severe."

00:19:21 System was designed to give us a 1 in 50 year level of assurance of supply. But because of some of the management challenges in the system, in reality the level of assurance of supply was dramatically less. "Effectively this means that just by increasing the management and maintenance activities the city can have a pretty big increase in the level of assurance of supply, back up to the 1 in 50, and as augmentation and new strategy around water rights allocation come on line, that level of assurance of supply can increase even further."

Source material from the Cape Town Drought Response Film Library,
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