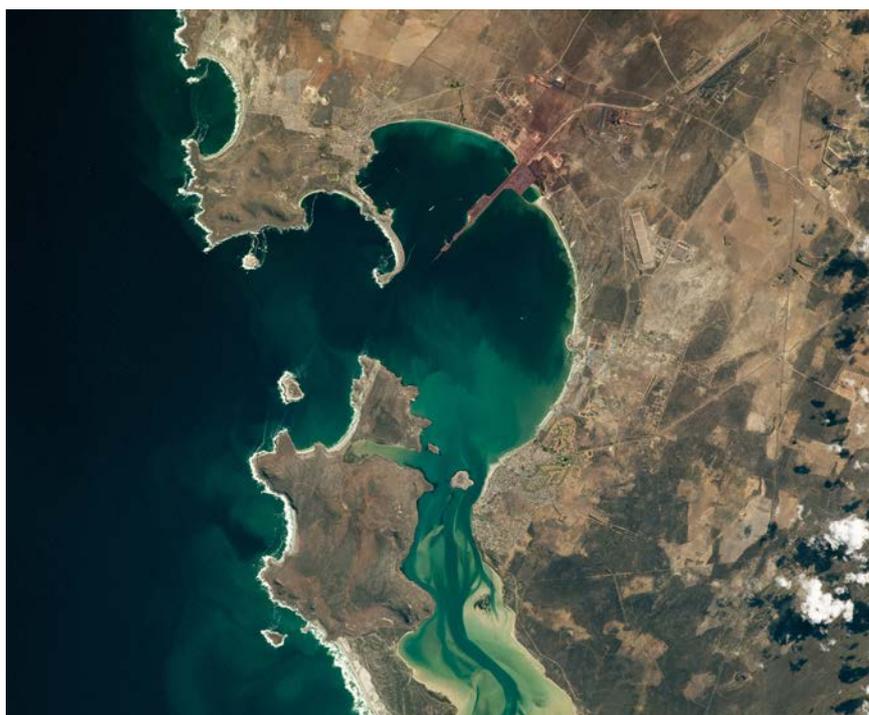


# MUNICIPAL WATER SUPPLY

## Saldanha's water tightrope: Balancing industry dreams with scarce supplies



*Water supply challenges have long prevented Saldanha Bay – South Africa's largest natural harbour – from realising its full potential. Article by Sue Matthews.*

It's been a case of one step forward, two steps back in the years since big industry set its sights on Saldanha Bay. The closure of anchor tenant Saldanha Steel in 2020 dealt a blow to the Industrial Development Zone (IDZ), and a number of other proposed projects have been withdrawn or delayed. Now, with plans to create a green hydrogen hub gaining traction, there is renewed hope that the IDZ will live up to its potential. But can the area's water supply sustain significant economic development and population growth?

### Early days

When Captain Samuel Castleton sailed the first ship into Saldanha Bay in April 1612, he went ashore and bartered with the local Khoekhoe for a calf and a sheep, but his crew could find no water apart from a small puddle. For the next three centuries, despite the establishment of small settlements of French, Dutch and British inhabitants at various intervals, the lack of water remained the major constraint to the area's development. It was only during the Second World War, when Saldanha Bay was designated a military and naval port, that the population expanded rapidly enough to warrant government action in securing a water supply.

Construction of a 55 km pipeline from the Berg River began in 1942, and the first water was delivered in February 1943. Initially, the water supply was reserved for military personnel and businesses serving the military, and it took some years before all formal housing in Saldanha had piped water and indoor plumbing. The reasons for that are detailed in the fascinating account "Water for Saldanha: War as an agent of change" by Visser and co-authors, published in the journal *Historia* in 2008.

By the early 1970s, the town had a thriving fish-processing industry served by trawlers, purse-seiners and rock lobster boats operating from a small harbour within the bay, but the approval of the Sishen-Saldanha project in April 1973 brought rapid change. A deep-water port was constructed to accommodate the bulk carriers that would transport iron ore – delivered to Saldanha Bay from the mine at Sishen via an 861 km purpose-built railway line – to offshore markets. The railway and port were both completed in 1976 and the first ore exports left the same year.

In the meantime, work had begun on a new water supply scheme to meet the anticipated increase in water demand, as

# Municipal water supply

well as address the water quality problems that were being experienced by abstracting water about 53 km upstream from the Berg River mouth. The river is tidal for almost 70 km, so the water would have been slightly saline from seawater intrusion during summer, but winter runoff from the area's Malmesbury shale soils also causes a natural increase in salinity. This has been compounded by land-use changes and cultivation practices that have a major impact on the mobilisation and transport of salts. Pollution from sources higher in the catchment, such as effluent discharges and agricultural runoff, also rendered the water unfit for human consumption without treatment.

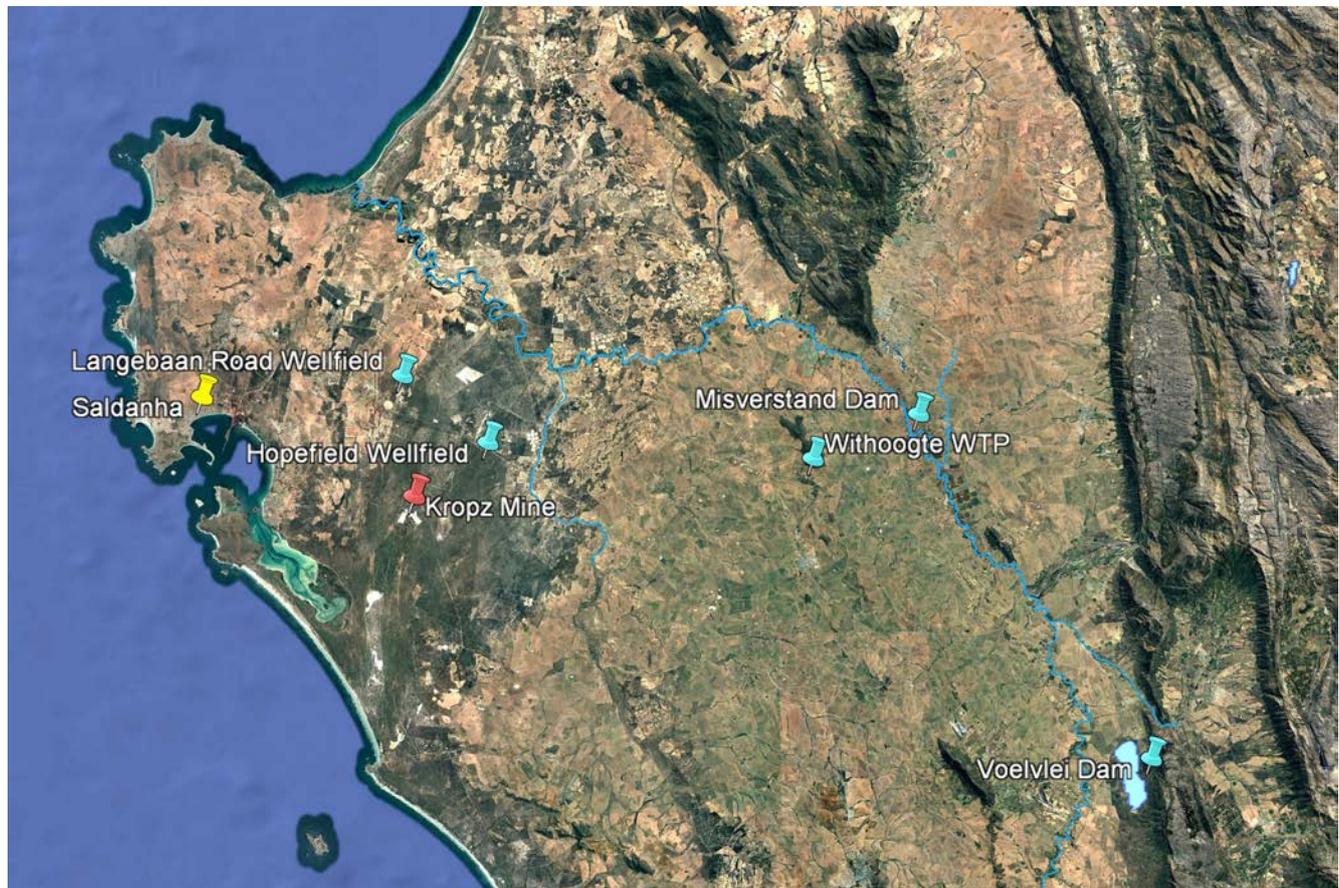
The new scheme, implemented in 1978, involves abstracting water just above a weir built across the Berg River at Misverstand, 70 km upstream of the original abstraction point, and piping it 17 km to the Withoogte water treatment works (WTW) north of Moorreesburg. Treated water is then distributed via various reservoirs to Saldanha, Langebaan, Hopefield, Vredenburg, Paternoster, St Helena Bay and Stompneusbaai in Saldanha Bay Municipality, as well as Velddrif and Dwarskersbos in the Berg River Municipality and Moorreesburg and Koringberg in Swartland Municipality. Nowadays, the WTW is operated by the West Coast District Municipality (WCMD) under a service delivery agreement with the three local municipalities, but is on Saldanha Bay Municipality's asset register, as the scheme's largest water user. The current water licence permits a total raw water abstraction at Misverstand of 23,440 million m<sup>3</sup> per year, of which Saldanha Bay Municipality is allocated 20,427 million cubic m<sup>3</sup>.

## The '90s growth spurt

Water availability became a contentious issue in the mid-1990s, when Iscor and the Industrial Development Corporation (IDC) partnered in a joint venture to beneficiate the iron ore brought to Saldanha by constructing a steel plant capable of producing hot-rolled coils for export. Before it was given the go-ahead, the plant's water demand and potential pollution impacts were significant concerns. An environmental impact assessment (EIA) conducted by the CSIR found that there was no appreciable risk of pollutants reaching the bay through groundwater contamination. This was important because mussel-farming was already well established in the bay, and there were fears that the sensitive ecosystems of the adjoining Langebaan Lagoon – protected within the West Coast National Park and designated a Ramsar wetland – might be affected.

Saldanha Steel's daily water requirement was originally pegged at 16 000 m<sup>3</sup>, but this estimate was subsequently halved by changing the design of some cooling systems. The groundwater in the vicinity of the site was known to be too saline to use as a water supply, but both the EIA and the Steyn Commission, which was appointed by the Minister of Environmental Affairs and Tourism to assess the plant's environmental threat, recommended that the Langebaan Road Aquifer be investigated as an alternative water source. The aquifer had already been extensively studied through geophysical surveys, exploratory drilling, pumping tests and monitoring as part of consecutive projects initiated by the then Department of Water Affairs

Google Earth



*Saldanha's water supply primarily relies on water abstracted from the Berg River at Misverstand weir and treated at the Withoogte plant, but the two wellfields will provide an emergency back-up during droughts.*

(DWAF) in 1974, culminating in two reports by Timmerman in 1985. In fact, it was considered so important as a future urban water supply that it had been proclaimed a subterranean water control area by the government in September 1976.

In response to the Steyn Commission recommendations, the CSIR was tasked with further investigations, which initially involved modelling exercises to re-evaluate the results of the earlier studies and additional pumping tests on the existing boreholes. A new wellfield was then established and more tests and monitoring carried out by teams from the CSIR and Toens and Partners between 1998 and 2001. Ultimately, the WCDM was granted permission to abstract 4 000 m<sup>3</sup> per day – or 4 ML/day – with various conditions imposed.

### MAR and mining

As it turned out, the wellfield in the Langebaan Road Aquifer has been operational only intermittently over the past 25 years, partly due to vandalism. It came into its own as an emergency water supply during the 2016–2018 drought, though. Four new production boreholes were drilled in an extension to the wellfield, bringing the number to eight, and the Department of Water and Sanitation (DWS) issued an amended licence allowing just over 15 ML/day to be extracted for the first six months, stepping down to 12 ML/day for the next six months and then reverting to a long-term allowance of 8 ML/day, which is still in place today. The higher abstraction rate was based on previous research suggesting that groundwater levels would recover through natural recharge once the rains returned.

In addition, a new wellfield targeting the aquifer was established on land owned by the municipality, approximately 7 km west of the town of Hopefield and proclaimed as the Hopefield Private Nature Reserve in 1982. Construction of the so-called Hopefield wellfield only began in July 2018, shortly after the first significant winter rains had started to refill the dams of the Western Cape Water Supply System (WCWSS), and was completed a year later, once the drought had well and truly broken. Nevertheless, the wellfield is very close to the bulk water supply pipeline from Withoogte WTW, and since the groundwater is of potable quality, it only needs to be chlorinated on site before being piped to the main storage reservoir at Besaansklip. The 10 production boreholes are licensed to abstract an annual total of 4.39 ML/day.

The potential for managed aquifer recharge (MAR) in the Langebaan Road Aquifer has been investigated a few times over the years. Preliminary modelling and testing in 2008–2009 showed that injection into the aquifer's confined lower aquifer unit (LAU) caused water to rise to the surface under artesian conditions, resulting in some flooding and waterlogging at farms in the vicinity. Subsequent modelling simulations, carried out as part of a Water Research Commission project (WRC Report No. 2744/1/21) led by Dr Sumaya Israel, indicated that artificially recharging the unconfined upper aquifer unit (UAU) in the vicinity of the Hopefield wellfield is feasible as there is more storage space, but a pilot phase would be needed before full implementation. In September 2021, Groundwater and Earth Sciences consultancy GEOSS conducted injection tests at two of the Langebaan Road production boreholes drilled during the drought, primarily to test whether the installed infrastructure is

fit for purpose. The injection rate and water level were recorded hourly, and it was found that the two boreholes, at depths of 65–80 metres, were able to handle three days of continuous injection before water levels in the aquifer rose too close to the surface.

MAR is already taking place very successfully in the neighbouring Elandsfontein Aquifer, where Kropz uses open-pit mining to extract rock phosphate in an area otherwise undisturbed by agricultural or other development. The phosphate deposit lies below the natural water table in the UAU, so a network of dewatering boreholes surrounding the pit is used to lower the groundwater level. A small portion of this groundwater is used for processing activities within the plant – limited to half a million cubic metres per year – but the rest is channelled to a buffer tank and then gravity fed to 20 reinjection boreholes, in accordance with the stipulation in the water use licence that the dewatered groundwater should have minimal contact with the atmosphere and must be returned to the aquifer.

GEOSS is contracted by Kropz to implement the monitoring programme, which relies on 28 dedicated monitoring boreholes situated up- and down-gradient of the pit. Five of them are close to Geelbek in the West Coast National Park, because this is where the Elandsfontein Aquifer discharges into the southern end of Langebaan Lagoon, providing freshwater flow that supports habitat typical of an estuary.

“Mining is only taking place in the upper aquifer, which is separated from the lower aquifer by an impermeable clay layer approximately 30 metres thick,” says GEOSS Managing Director Julian Conrad. “The lower aquifer has good quality water with high yields, but that's completely hands-off – DWS wanted absolute protection of the lower aquifer.”

Every six months, GEOSS reports back to the Elandsfontein Water Monitoring Committee, which includes representatives from Kropz, DWS, SANParks, Cape Nature, the Saldanha Bay Municipality, the local farming community and groundwater consultancy Umvoto, attending on behalf of an NGO called the West Coast Environmental Protection Agency. The monitoring results have shown that groundwater levels down-gradient of the mine have risen marginally since dewatering and reinjection began in February 2017 but have remained stable at Geelbek, 11 km to the south-west. There is also no significant change in water quality.

“We've got thresholds in place, so red flags are raised if anything happens above those thresholds, whether it be water levels or chemistry,” says Conrad. “Threshold Exceedance Response Plans, or TERPs, have been established and are implemented if the red flags are raised.”

GEOSS also has a three-year contract with Saldanha Bay Municipality to do all their groundwater monitoring as well as some additional modelling of the Langebaan Road and Hopefield wellfields to inform planning and management. The monitoring network has recently been expanded to include 24 DWS boreholes in the vicinity of the two wellfields.

## Looking ahead

David Wright, the Senior Manager for Bulk Water and Solid Waste at Saldanha Bay Municipality, says groundwater from the two wellfields is currently not being utilised to a large extent, partly because good rainfall over the past few years means that the WCWSS dam levels are sufficient to meet water supply needs, and also because there was a pipeline issue at the Langebaan Road wellfield extension.

“The boreholes are being pumped to keep the system operational, but at a very low level, so the volume being abstracted is only about 10–15% of what the water use licence allows. But once the pipe has been fixed, we would want to go through a period of pumping it at the full volume to give us better monitoring information about the reaction of the aquifer,” he says. “We intend to get all these wellfields in optimal operation so that we are ready should a future drought occur.”

He adds that the municipality is focusing heavily on upgrades to existing water-related infrastructure at present, but the water augmentation plan will also be updated, taking options such as water reclamation from wastewater and seawater desalination into consideration. Treated effluent from some of the municipality’s wastewater treatment works is already being used for irrigation purposes, and an EIA was undertaken more than a decade ago for the previously mooted 25.5 ML/day Danger Bay desalination plant. The environmental authorisation is valid until 2028, but the project would be too expensive for the municipality to fund on its own. The much smaller 2 ML/day Shelley Point desalination plant, which was originally implemented as a private homeowners’ initiative to irrigate a golf course but fell into disrepair, is a more realistic project and is already on the municipality’s 10-year budget.

“When Saldanha Steel ceased operations, it gave us quite a bit of reprieve in terms of water demand, because they were our largest water user. During the drought, they made use of treated effluent from the Saldanha wastewater treatment works, plus they had their own reverse osmosis plant to treat it further,” says Wright. “We’ve also found that since the drought, domestic and other users are still using water more sparingly, so we haven’t had the full bounce-back that we expected.”

This means that the municipality’s allocation from the WCWSS is more than adequate at this stage. Looking ahead, the CSIR – appointed by Freeport Saldanha IDZ to coordinate phase 1 of the West Coast Green Hydrogen Master Plan – has made it clear that the green hydrogen hub would likely rely on seawater desalination as a source of water for the electrolysis process, which splits water into hydrogen and oxygen. What’s more, the Berg River Voëlvlei Augmentation Scheme, being implemented by the Trans-Caledon Tunnel Authority (TCTA) on behalf of DWS, will increase the yield of the WCWSS by 23 million cubic metres per year, and the municipality has already concluded a Water Supply Agreement to share in the augmented resource. Scheduled for commissioning by July 2029, the scheme involves pumping water in winter from the Berg River into the Voëlvlei Dam, which is currently supplied by diverted runoff from the Klein Berg River, draining the Tulbagh valley, as well as the Twenty-Four Rivers system and the Leeu River. Some of the water stored in Voëlvlei Dam is released into a canal that

discharges into the Berg River, so part of the municipality’s existing WCWSS allocation, abstracted at Misverstand weir, flows via the Voëlvlei Dam.

Asked whether economic development is likely to be constrained by water supply issues in the near future, Wright is optimistic.

“If we’re looking at a medium growth scenario, between our allocation from the Western Cape Water Supply System, optimising the two wellfields and the Berg River Voëlvlei Augmentation Scheme coming on-stream, we should be fine until the late 2030s,” he says. “Obviously, though, our allocation is prone to drought, and I think that’s one of the big challenges for large companies that consider coming to Saldanha. They don’t want to be in a position where they can’t get the full volume they need in a drought, which is why they’re looking at alternatives like desalination.”



GEOSS

*Kropz uses open-pit mining to extract rock phosphate from the upper aquifer unit of the Elandsfontein Aquifer, which discharges into Langebaan Lagoon.*



GEOSS

*A network of dewatering boreholes prevents the pit from flooding. The abstracted groundwater is piped to a buffer tank and then gravity-fed to injection boreholes for managed aquifer recharge.*