

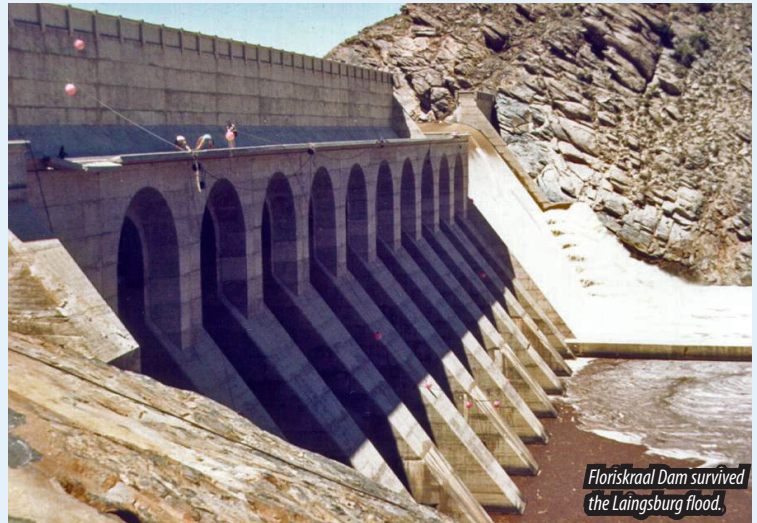
## A WALK DOWN MEMORY LANE:

### Remembering the golden years of dam building

*When the young Will Alexander joined the then Irrigation Department in 1950 after completing his engineering degree at the University of the Witwatersrand and serving in the Second World War (WWII) he probably never dreamed that he would be part of the 'golden years' of water resource development in South Africa. The Water Wheel received the following personal account of his first two decades in the water sector, dedicated to former fellow engineer, Robbie Myburgh.*

Immediately after WWII, the authorities embarked on a substantial infrastructure development programme, particularly in water supplies, rail and road. Many of the construction staff at all levels were ex-servicemen. As a result, we had a fundamentally different view on life, and our responsibilities.

I returned home from 'Up North' in February 1945, resumed my studies at Witwatersrand University, graduated in 1949, married the girl next door in January 1950, and joined the Department of Irrigation (now Water Affairs) in February. After ten days in the office I was entitled to be transferred as Assistant



Courtesy Will Alexander

Engineer to Rooikrans Dam near King William's Town, in the Eastern Cape. For the next 20 years my wife and I were like nomads as we moved from one construction site to another while raising our family.

When we arrived at the site we were treated like members of the family. Back then, each construction site was like a village of temporary houses occupied by the employees and their families. There was also a much greater emphasis on the social aspects. Each site had a tennis court paved with material from the local ant heaps, a jukskei field and, most importantly, a recreation hall. Recreation activities included weekly 'bioscopes' (cinema shows) and monthly recreation activities when funds were collected for the big Christmas party where presents were distributed to all the children. Each activity had a small committee. Staff ranks played no part in these activities. All funds were subject to departmental audit procedures.

#### ROOIKRANS DAM

The Resident Engineer at Rooikrans Dam was 'Jumbo' Downes – an ex-boxer with cauliflower ears and previously Lieutenant in the 22 Field Park Company,

which was our sister company during the war. The dam was a large earth dam that would supply water to King William's Town and the neighbouring Zwelitsha.

My colleague, Anton Wejtko, was in charge of the materials used in the construction of the dam. During WWII he fled from Poland when it was invaded by the Germans and later served in the Polish army in the UK. He had a strong sense of humour. He was later in charge of the department's soils laboratory in Pretoria.

Colin Stegman later took over from Downes, and was more formal in his approach. He did not like the idea of having to walk to my office every time he had something to discuss with me, so he instructed the mechanical foreman to put a bell in my office so that he could ring me. The only bell was one of those huge red fire alarm bells. I stuffed some paper into the bell so that it buzzed instead of clanging. One day the bell did not work. Colin stormed into my office, saw the paper stuffing, and demanded "What is that for?" I told him that the sound of the bell was enough to awaken the dead. His immediate response was "That was exactly what it was intended to do!"

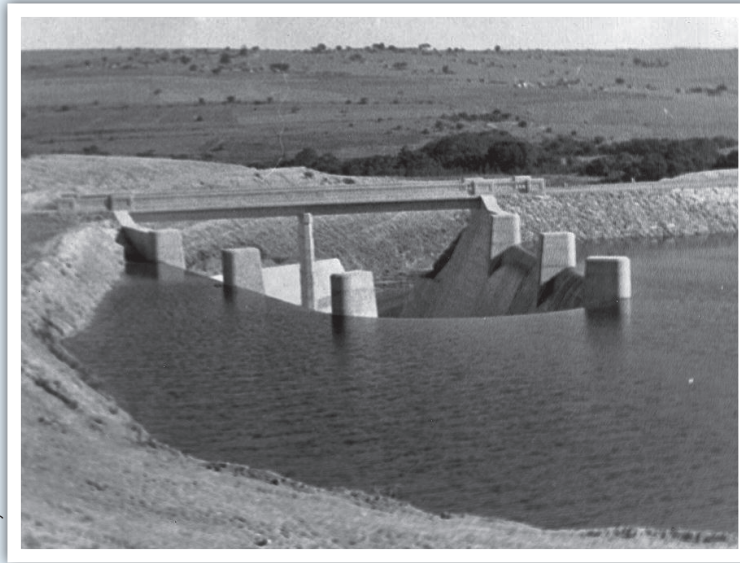
## CAPE MIDLANDS CIRCLE

When Rooikrans Dam neared completion I was transferred to the Circle Office in Cradock where Duncan Campbell was the Circle Engineer. At that time soil erosion was rampant in the Cape Midlands. Lake Arthur, which was one of the four major dams in the region, had already silted up, and was in the process of being replaced by another dam further upstream. Large areas were purchased by the State, and taken out of production. The Department of Agriculture designed, constructed and subsidised anti-soil erosion measures while my responsibility in the Circle Office was to design subsidised farm dams and water-supply schemes for irrigation and town water supplies.

In those years civil engineers were fewer in numbers, and of necessity we were jacks of all trades. Where solution methods were not available we had to develop them ourselves. Both the soil conservation works, as well as spillways for farm dams required estimates of design floods for small catchments. These, in turn, required estimates of the short duration rainfall-frequency relationships. I produced maps of the Eastern Cape, which included curves showing corresponding short duration rainfall. It was now possible to determine design rainfall for any position on the map.

The next step was the development of calculation methods for the solution of the rational method as well as the associated Bransby Williams formula for calculating the time of concentration. Slide rulers were too cumbersome for calculations involving powers of numbers, so I developed nomographs for the solution of both equations.

The only instruments required for design flood determination were a school ruler and a pencil. It seemed obvious to me that the runoff coefficient  $C$  in the rational method should vary with the return period. It was only much later in my career that I



Side-channel spillway at Rooikrans Dam.

Courtesy Will Alexander

found out that this preceded its use in overseas applications by some ten years.

That was in 1954, but somebody higher in the chain of command in the department noticed!

## HEAD OFFICE

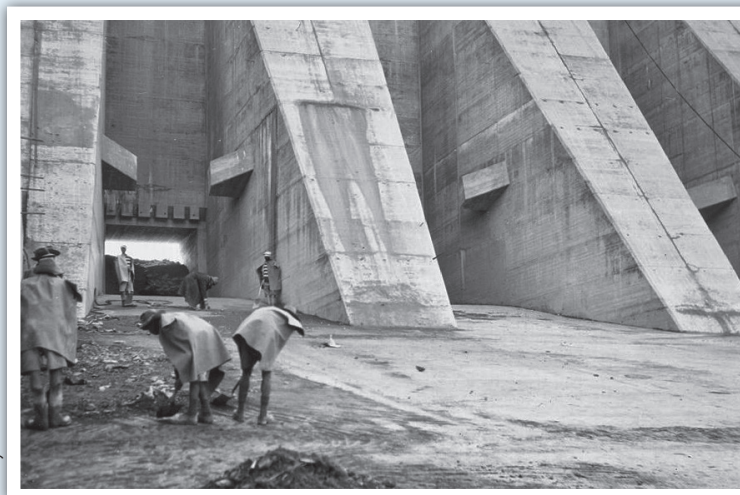
After three years in Cradock I was transferred to head office in Pretoria under Director, Jan Jordaan. My task was to check and approve for subsidies large municipal water supply and distribution projects. For the only time in my long career I was thoroughly bored, and welcomed my transfer back to construction 18 months later. I was appointed as Assistant Engineer at Floriskraal Dam

near Laingsburg. I boarded the train for Laingsburg happily.

## FLORISKRAAL DAM

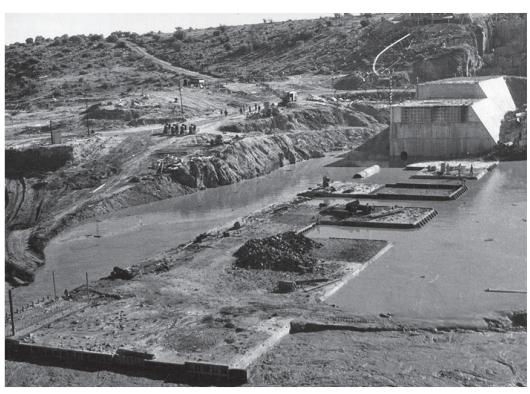
Morris Selibowitz whom I was to replace met me at the station, and congratulated me. The Resident Engineer had just resigned and I was to take over from him. For the next six months I was the only engineer on the site.

Floriskraal was a large concrete gravity-buttress dam with ten large steel floodgates at riverbed level to reduce the rate of sediment deposition in the dam basin. The construction of the dam was well underway. The senior construction staff were all old hands, some of them had been in



Construction of floodgates at Floriskraal Dam.

Courtesy Will Alexander



**Top:** Leeuw Gamka Dam nearing completion.

**Above:** The Erfenis coffer dam overtopped during a flood.

the department since the Depression years of the 1930s.

My main duties were those of the Assistant Engineer – surveying and setting out, rather than the managerial functions of the Resident Engineer. My first managerial decision was when the earth coffer dam protecting the construction of the downstream apron was overtopped by a minor flood (for the sixth time I was told). I decided to replace it with a crude concrete structure filled and shuttered with large stone ‘plums’. It worked because we had no floods after that, and we had some difficulty in breaking it up using explosives when the apron was completed.

The rock used for the coarse aggregate was the local tillite which, when crashed, broke into sharp, elongated fragments. The local sand was also of poor quality. The concrete was volume-batched. All the material was transported to the mixers in cocopans, where Jonas regulated the water added to each batch. The mixed concrete was poured down a zigzag series of

chutes to awaiting cocopans below, which were then pushed to the box being filled, where it was compacted by pneumatic vibrators.

I reported that we were having difficulty in meeting the cube strength requirements. Dr Kaplan of the CSIR was sent to visit us, and recommended that we switch to weigh-batching methods, but I preferred to continue relying on Jonas’ judgement. In 1981, 25 years later, the dam was put to the test when floods occurred at Laingsburg. Murphy was very active that day, and everything went wrong that could have gone wrong, but the dam survived any other damage.

The ten floodgates at riverbed level had never been opened since the opening ceremony at the dam. In fact, the dam had only filled on one occasion since then. The flood destroyed most of the town of Laingsburg some 20 km upstream of the dam where more than 100 lives were lost. One of the worst flood disasters in SA history.

The water bailiff was in his boat rescuing people who had been washed into the dam. The flood overtopped the saddle dam and destroyed the power lines from the generator to the gates, which were never opened. The water level continued to rise until it reached a level 4,5 m above the design high flood level, and 2,5 m above the top of the concrete parapets of the non-overspill section of the dam.

The only damage was to the parapets. Jonas must be given a lot of credit for the success. The lesson to be learnt is that practical experience often outweighs technological expertise.

## LEEUEW GAMKA DAM

As the construction of Floriskraal Dam drew to a close, I transferred the whole organisation to the Leeuw Gamka Dam site near Beaufort West where we were to build a moderately sized earth wall dam upstream of the older dam built

by animal drawn equipment in 1918. Before construction could start I had to select the site for the construction camp, plan the township layout, build access roads, houses and works buildings, and install water and electricity supplies and toilet systems.

My Assistant Engineer was Dennis Tidswell. The medical orderly was responsible for treating everything from children’s ailments to construction injuries.

The construction of the dam was straightforward and proceeded without incident. There were no instructions or guidelines for optimum excavation and placing of the material, so I bought, studied and applied the procedures in the thick handbook titled ‘*Moving the earth*’.

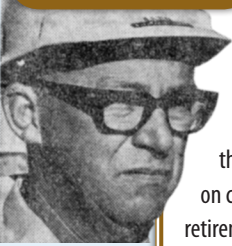
## ERFENIS DAM

A year later I was transferred to the construction of Erfenis Dam near Theunissen in the Free State. It was the third-largest dam in South Africa at that time. The local sand was too fine for conventional concrete, and in an innovative solution Chief Design Engineer, Robbie Myburgh, decided to use mortar intrusion concrete. This would be the largest concrete structure using this method anywhere in the world as far as we knew.

The 3,3 m-high boxes were filled with large diameter quarry run crushed stone. The mortar was mixed at the mixer stations and then pumped through long pipelines into the boxes. No artificial cooling was attempted as the stones were in contact with one another and shrinkage was not considered to be a problem.

The method also highlighted some interesting information on the setting properties of cement. Problems were experienced with cement that exhibited a false set soon after mixing. The cement also contained steel ‘cylpebs’ that were the remnants of large pieces of steel used in the manufacturing process. These wreaked havoc with the high-speed mixing and pumping

**MORE ABOUT  
WILL ALEXANDER**



**W**ill Alexander served with the Department of Water Affairs for 34 years from 1950 to 1984. For 19 of those years he was in the field on construction. From 1970 to his retirement in 1984, Will occupied the posts of Chief of the Division of Hydrology and Manager of Scientific Services in the department. He was personally responsible for national water resource management and flood routing during regional droughts and floods. Close to 100 technical reports were printed by the government printer during this period. He also initiated the popular 'Hydro' courses for practitioners starting in 1975. From 1985 to 2000 Will was a professor in the Department of Civil Engineering at the University of Pretoria. From 2000 he has been undertaking research on advanced water resource analyses and the climate change issue.

equipment. The cement manufacturers were cooperative, and both problems were solved.

**GAMTOOS CANALS**

**O**n the completion of Erfenis Dam I moved to the construction team to Patensie in the Gamtoos River valley near Humansdorp. My colleague Dale Hobbs – also an ex-serviceman – was in charge of the construction of Kouga Dam, while I was in charge of the water distribution project in the Gamtoos Valley down to the Loerie Dam that was to be built as an additional water supply to Port Elizabeth.

William Phillips, son of the famous missionary, built the first tunnel in South Africa at Hankey in 1841. We were soon to follow in his footsteps. I realised that tunnelling through the soft Enon Conglomerate was a more economical option than the originally proposed benched



*The news headlines during the Gamtoos floods.*

canals around the steep side slopes.

A sad experience was when a major flood occurred and I ordered the construction teams on the far side of the river to return to the camp across the low-level causeway. One truck with a number of labourers on board ran off the causeway and overturned. Six labourers were drowned in front of my eyes.

**ORANGE FISH TUNNEL**

**W**e soon picked up speed in the construction of the canals, tunnels and pipelines and had already passed the halfway mark when I was appointed as Departmental Resident Engineer in overall charge of the construction of the 82 km-long Orange Fish Tunnel beneath the continental divide as part of the huge Orange River Project (ORP).

With a few key staff members I set up a small camp on the banks of the Orange River. We were the first to arrive on the site of the ORP, which at that time consisted of two major dams (Gariep and Van der Kloof) and the Orange Fish Tunnel, which was the least visible but the most costly component. Robbie designed both dams and refused to allow the consulting engineers to redesign them.

The possibility of diverting water from the Orange River into the Fish River valley and then into the Sundays River was first proposed in 1928. Contractually, I was in charge of the project. I had spent the previous ten years in the field on large construction projects, and I had

more knowledge on all aspects of hydraulic tunnels than the consulting engineers. I was not prepared to accept a passive role of the client's representative on site, and insisted that I be consulted on all implementation aspects.

This caused some strained relationships, particularly with the overseas component of the consortium of consulting engineers. They protested to the Minister but my actions were supported by the Minister and the head of the department. Still, it was not a satisfactory arrangement.

The construction of the tunnel was well on the way to completion and there were few remaining issues that required my intervention when I was transferred on promotion to the Planning Division in Pretoria in 1969.

I thoroughly enjoyed my 34 years in the service of the department, more than half of which were in the field of construction. □



*Left: The Orange Fish Tunnel during excavations.*

DWA



*Below: The Alexander children grew up on dam construction schemes.*

Courtesy Will Alexander