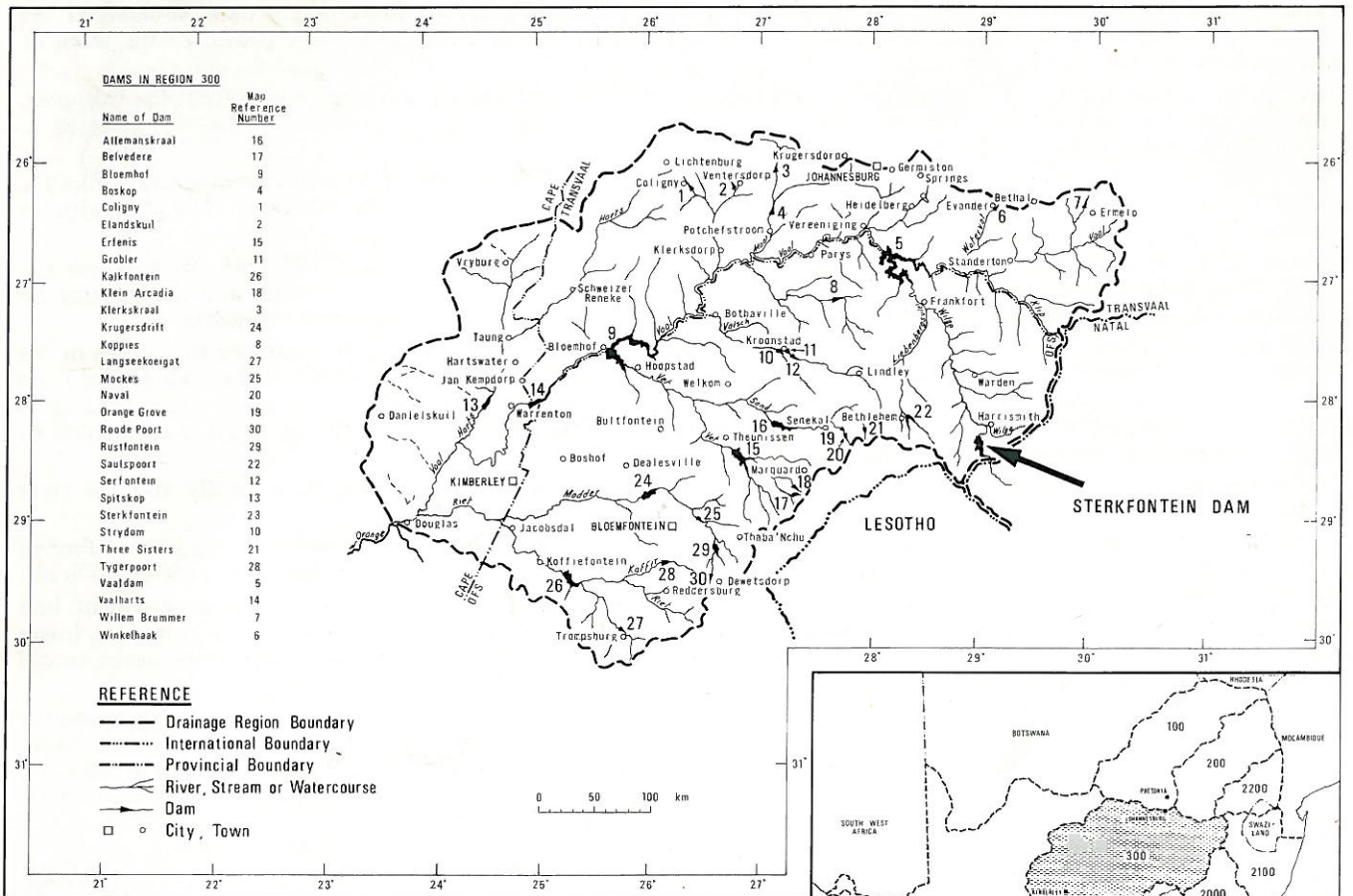


# STERKFONTein DAM



## DRAINAGE REGION 300



# STERKFONTein

## DATA

	Initial dam	Final dam
Year of completion.....	1977	
River.....		Nuwejaarspruit
Nearest town.....		Harrismith
Province.....		Orange Free State
Type.....		Earth
Height above lowest foundation.....	63 m	93 m
Length of crest.....	2 290 m	3 060 m
Volume of content of dam.....	5 701 000 m <sup>3</sup>	17 000 000 m <sup>3</sup>
Gross capacity of reservoir.....	1 203 000 000 m <sup>3</sup>	2 656 000 000 m <sup>3</sup>
Purpose.....		Water supply
Maximum discharge capacity of outlet.....		220 m <sup>3</sup> /s
Type of spillway.....		None
Owner.....		Department of Water Affairs
Engineering by.....		Department of Water Affairs
Construction by.....		Department of Water Affairs

## DESCRIPTION

### Sterkfontein Dam

The Tugela-Vaal Government Water Scheme is a major inter-basin water transfer undertaking to supplement water supplies to the Pretoria-Witwatersrand-Vereeniging urban and industrial complex. Sterkfontein dam, situated at the edge of the Drakensberg escarpment in the headwaters of the Vaal system about 19 km south-west of the town of Harrismith, is the key storage unit.

Water pumped from the upper Tugela river to Sterkfontein is held in reserve while Vaaldam, which feeds the Complex, is operated at relatively high risk of supply failure. When supply failure at Vaaldam is imminent water is released at a high rate to make good the shortfall.

Sterkfontein has a deep basin and lies in a high-rainfall low-evaporation area. Net evaporation averages only about a fifth of that at Vaaldam and so the pumped water can be held in reserve for many years between droughts without significant loss.

Located in the Nuwejaarspruit, the dam commands a relatively small catchment—about 193 km<sup>2</sup>—from which the runoff, even under extreme conditions, is insignificant compared with the capacity of the basin and accordingly no provision is needed for spillage. Sterkfontein is probably the largest dam without spillway in the world.

In the first phase of the Tugela-Vaal project, which was commissioned in 1974, waters of the upper tributaries of the Tugela river are brought by diversion canals to the Jagersrust pumping station at the foot of the escarpment from where high-lift pumps raise water 500 m at rates of up to 5 m<sup>3</sup>/s through pipes and tunnels to the canal leading to Sterkfontein. In winter, when the flows in the upper tributaries decline, the supply canal to Jagersrust is augmented by pumping from Driel barrage some distance downstream.

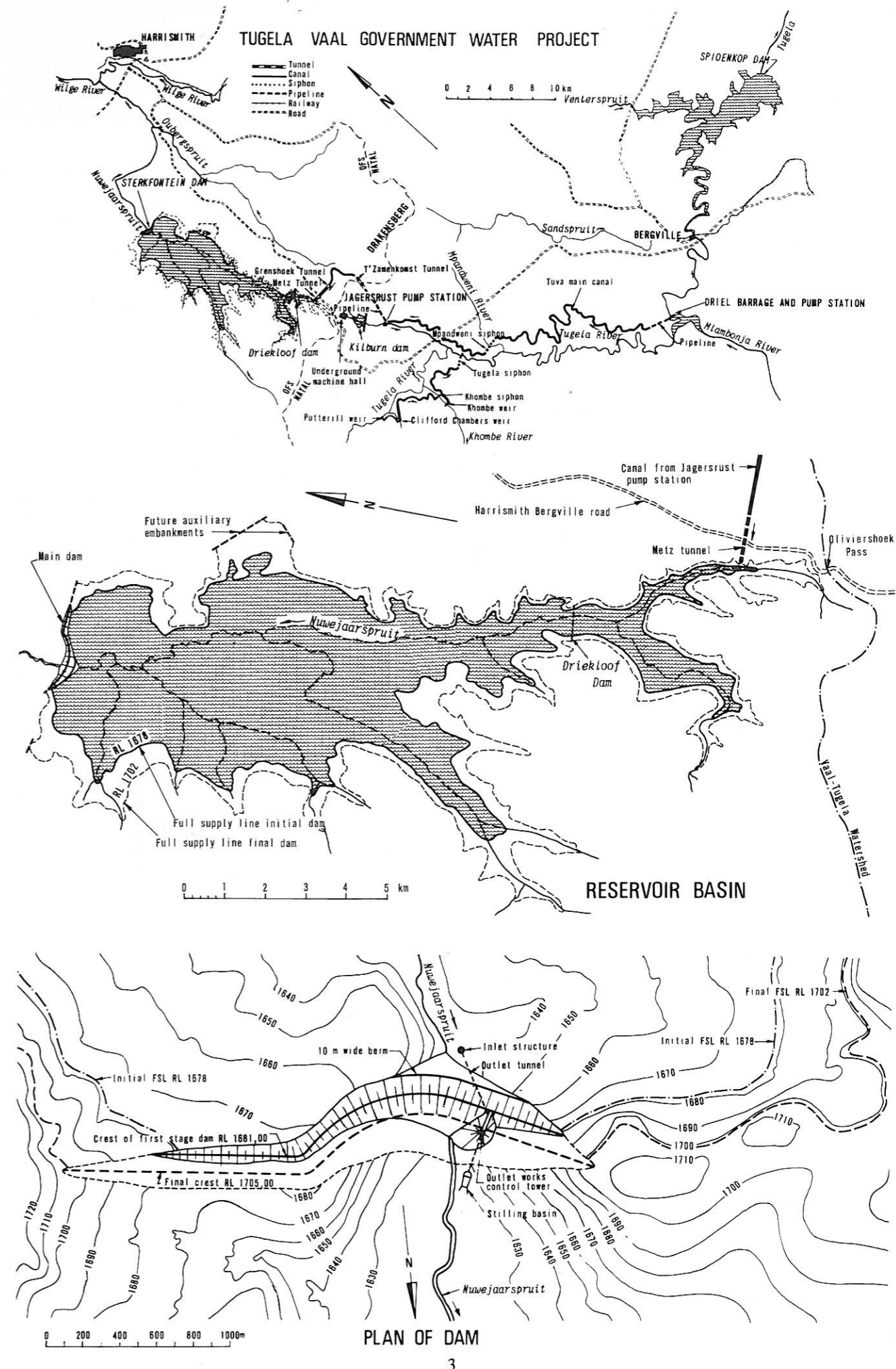
On average about 130 000 000 m<sup>3</sup> of water is transferred to Sterkfontein from the Tugela annually and the river downstream is re-regulated by Spioenkop dam, near Bergville.

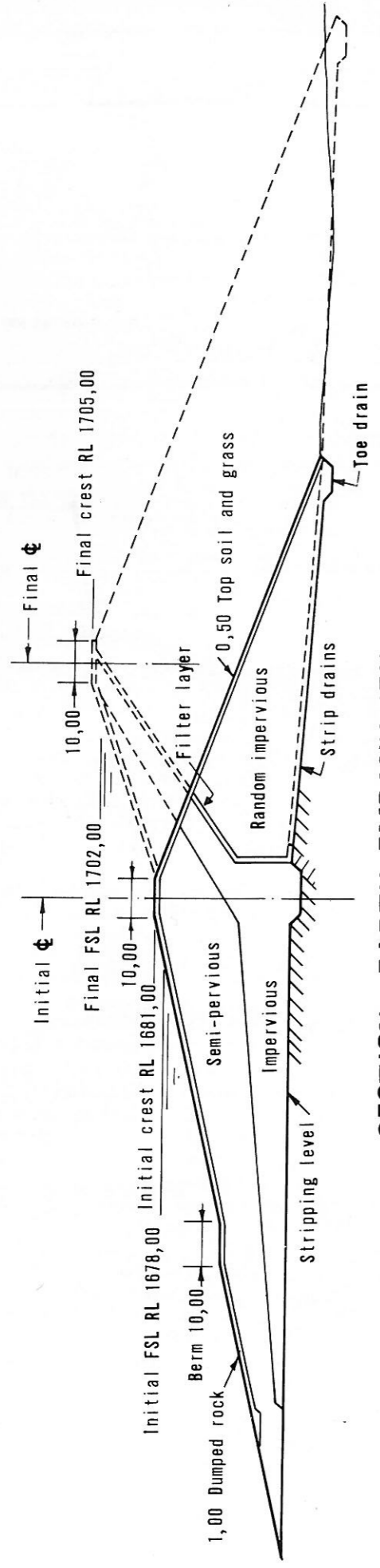
Provision has been made for the 63 m high Sterkfontein dam to be raised to 93 m by adding more than 11 × 10<sup>6</sup> m<sup>3</sup> of earthfill to the downstream side of the embankment, thus more than doubling the storage capacity to 2 650 000 000 m<sup>3</sup>.

The outlet control tower has been built to final height and the outlet control works, located within the embankment, had to be specially designed to release water at up to 220 m<sup>3</sup>/s to meet the demands at Vaaldam and to minimize losses along the 300 km of riverbed between the two storage units. The resulting velocities of up to 40 m/s in the outlet tunnel called for special precautions to avoid cavitation damage.

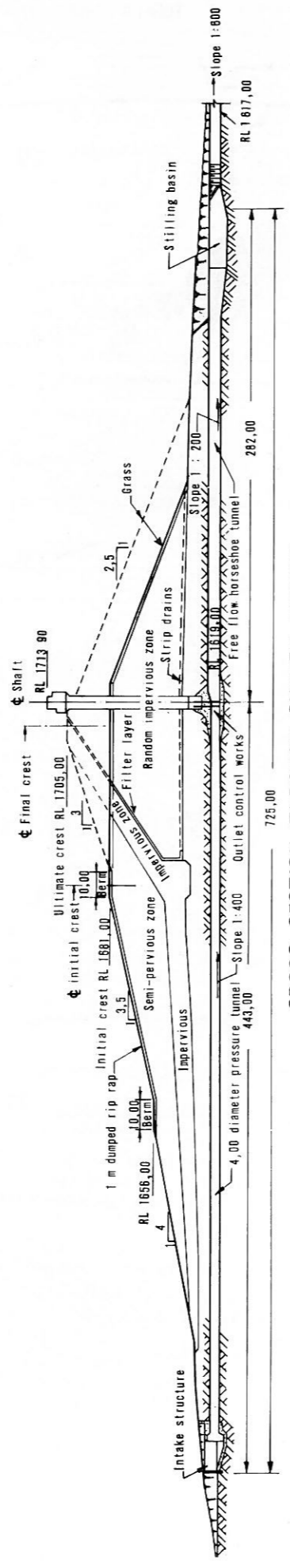
The intake structure to the 750 m long pressure-and free-flow tunnel beneath the embankment embodies a buoyancy gate by means of which the tunnel can be closed off for maintenance. The gate is the first of this type used in South Africa. At the bottom of the control tower, located 443 m downstream of the intake, the pressure tunnel bifurcates at a central pier and in each branch is a control gate and an emergency gate of the solid slab type. Extensive model tests were undertaken to perfect the design of the stilling basin at the end of the free flow portion of the tunnel.

Construction of the second phase of the Tugela-Vaal Scheme, known as the Drakensberg Pumped Storage Project, is well advanced. The inter-basin transfer of water is combined, in collaboration with the Electricity Supply Commission, with a 1 000 MW pumped storage hydro scheme. Water will be pumped from Jagersrust at 11 m<sup>3</sup>/s to the tail pool of the scheme formed by the Kilburn dam from where it will pass into the underground station and be pumped during off-peak hours at 174 m<sup>3</sup>/s to the head pool formed by the Driekloof dam located in an arm of the Sterkfontein reservoir. Except for the water bled off for transfer into the Sterkfontein dam at the average rate of 11 m<sup>3</sup>/s, the balance will return to Kilburn through the four 250 MW pump-turbines generating power for the national grid during peak hours.

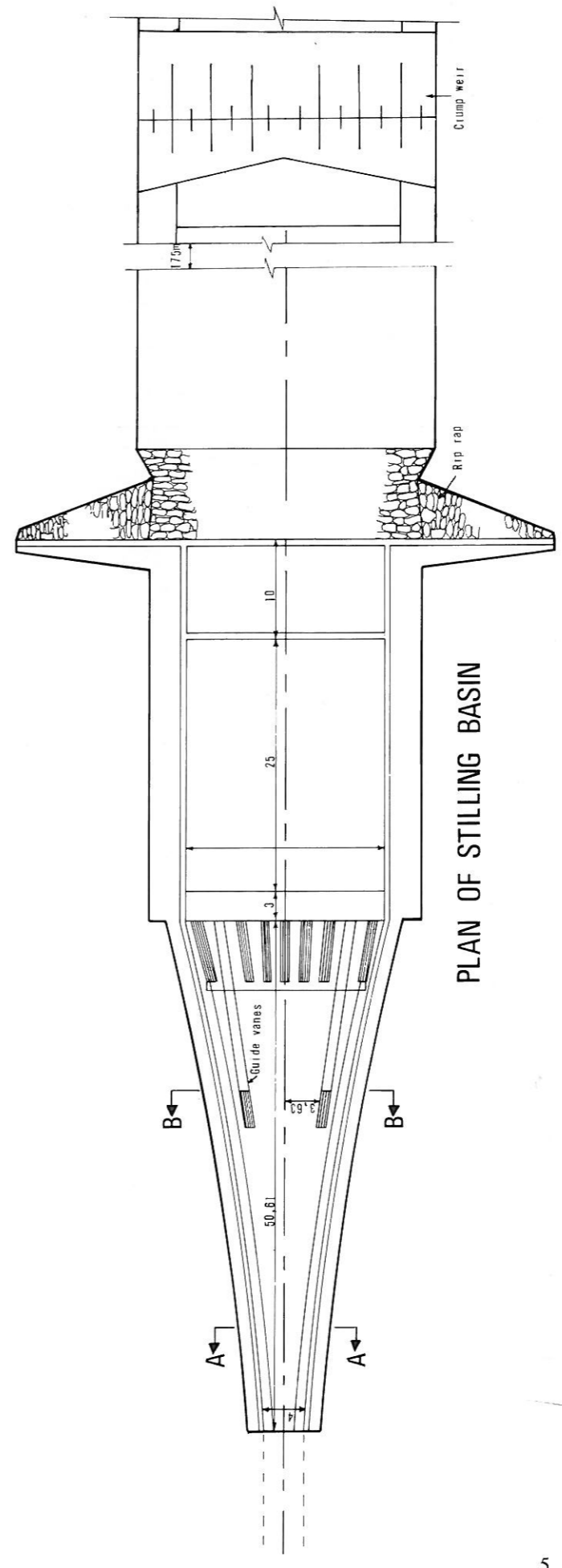




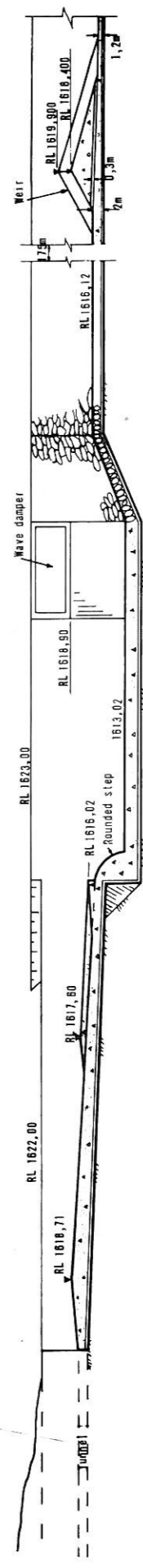
SECTION EARTH EMBANKMENT



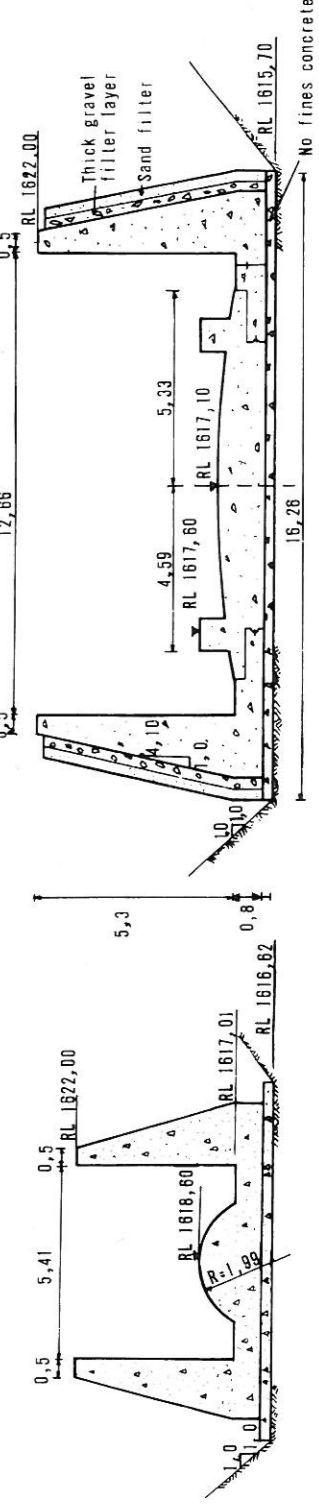
CROSS SECTION THROUGH OUTLET WORKS



PLAN OF STILLING BASIN

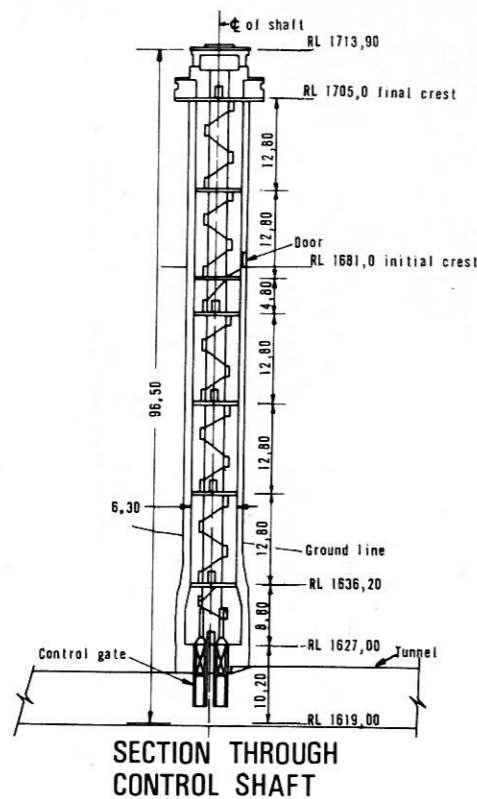
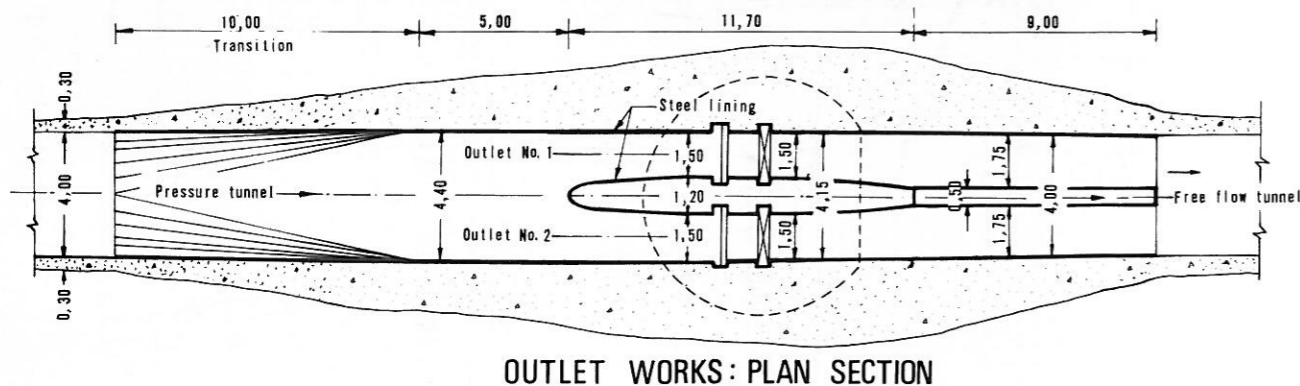
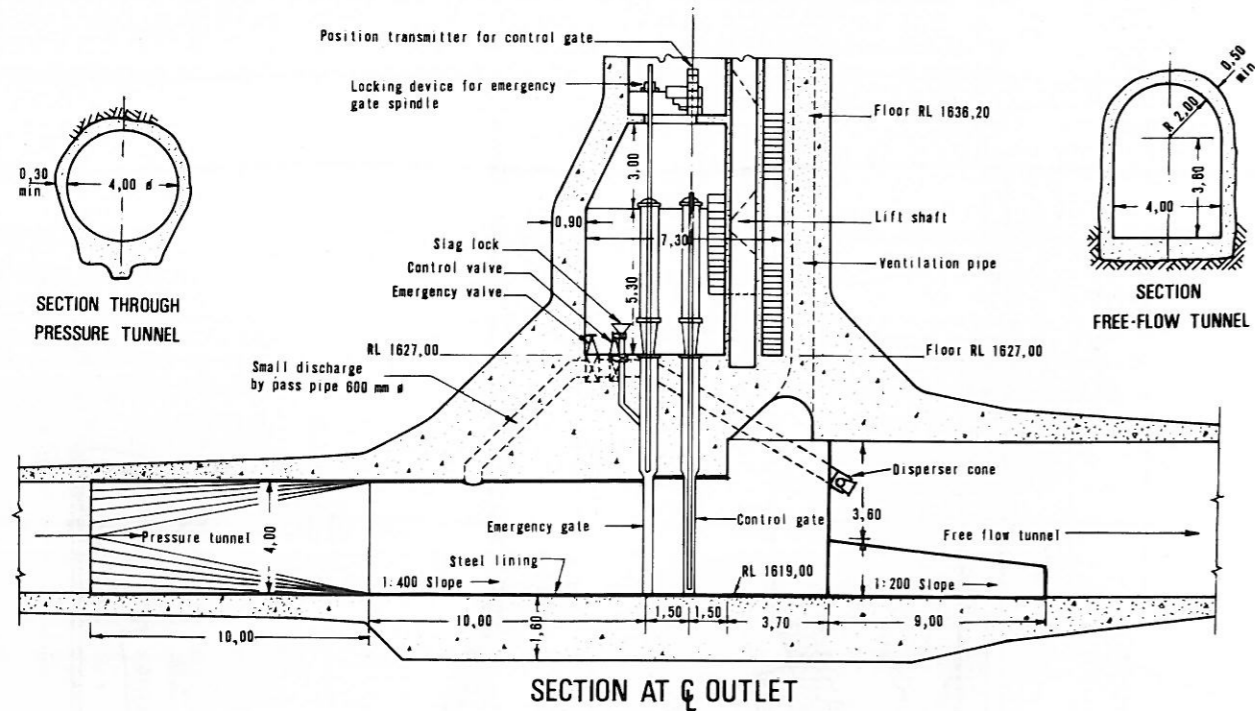


CROSS SECTION ON C-C OF STILLING BASIN



SECTION A-A

SECTION B-B



STERKFORTEINDAM

DIE DAM/THE DAM:

Voltooi/Completed	1985
Rivier/River	Nuwejaarspruit
Tipe/Type	Grondvul/Earthfill
Opvangsgebied/Catchment area	19300 ha
Lengte/Length	19 km
Oewerlengte/Shore line	±93 km
Maksimum wydte/Maximum width	6,0 km
Maksimum diepte/Maximum depth	82 m
Wateroppervlakte vol/Area at full supply	6940 ha
Opjaarvermoë/Capacity when full	2,617,000,000m <sup>3</sup>
Verhouding tot H. Verwoerddam/Comparison to H. Verwoerd dam	46%

DIE WAL/THE WALL

Maksimum hoogte/Maximum height	93 m
Lengte/Length	3105 m
Maksimum wydte by fondament/Maximum width at foundation level	586 m
Kruinwydte/ Crest width	10 m
Totale volume opvulling/Volume of earthfill	17,600,000 m <sup>3</sup>
Hellingsbeskerming/Slope protection	Klipbestrating 53 ha Gras 28 ha Stones 53 ha Grass 28 ha

UITLAAT TONNEL/OUTLET TUNNEL

Deursnee/Diameter	4 m
Lengte/Length	620 m
Maksimum deurstroming/Maximum flow	220 m <sup>3</sup> /s

WATER RELEASED FROM STERKFORTEIN DAM

Capacity of dam before release (percentage)	Period during which water was released	Capacity of dam after release	Volume of water released - m <sup>3</sup>
32,5	18/07/83-17/08/83	27,6	} 291,3 × 10 <sup>6</sup>
27,5	02/09/83-11/10/83	21,3	
40,3	14/06/85-31/10-85	25,6	
30,4	12/06/86-30/10/86	16,6	
32,6	22/07/87-17/09/87	27,4	