Oostelike Nasionale Water Draer
Eastern National Water Carrier

Omatakodam — S von Bachdam Komponent
Omatako Dam — S von Bach Dam Component

4 MEI / MAY 1984

THE OMATAKO DAM – SARTORIUS VON BACH DAM COMPONENTS

OF THE

EASTERN NATIONAL WATER CARRIER

Brochure issued for the opening of the scheme on 4 May 1984

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During this period the present Department of Water Affairs in South West Africa was a Branch of the Department of Water Affairs of the Republic of South Africa.

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THE OMATAKO DAM – VON BACH DAM COMPONENT OF THE EASTERN NATIONAL WATER CARRIER

The Omatako Dam and the pumping scheme to the Sartorius Von Bach Dam is an integral part of the Eastern National Water Carrier. In its own right it will serve as a flood catchment dam, and in addition, it will act as a balancing dam for water transported from the Okavango River on the northern border of South West Africa. It is, however, in its role as one of the major sources of a total "integrated" National Water Carrier that its greater importance lies.

The location of the various components of the Water Carrier and also related regional state water schemes are shown in FIGURE 1.

BACKGROUND

It is the purpose of the Eastern National Water Carrier to provide an assured source of water for the augmentation of the existing internal water resources of the country. The proposal arose out of the 1974 Master Water Plan.

The Water Carrier will eventually link the perennial Okavango River on the northern border with the central areas of South West Africa. In all the Eastern National Water Carrier comprises of four components;

1. The S von Bach Dam – Windhoek Component being the S von Bach Dam, water purification works and pumping main to Windhoek.

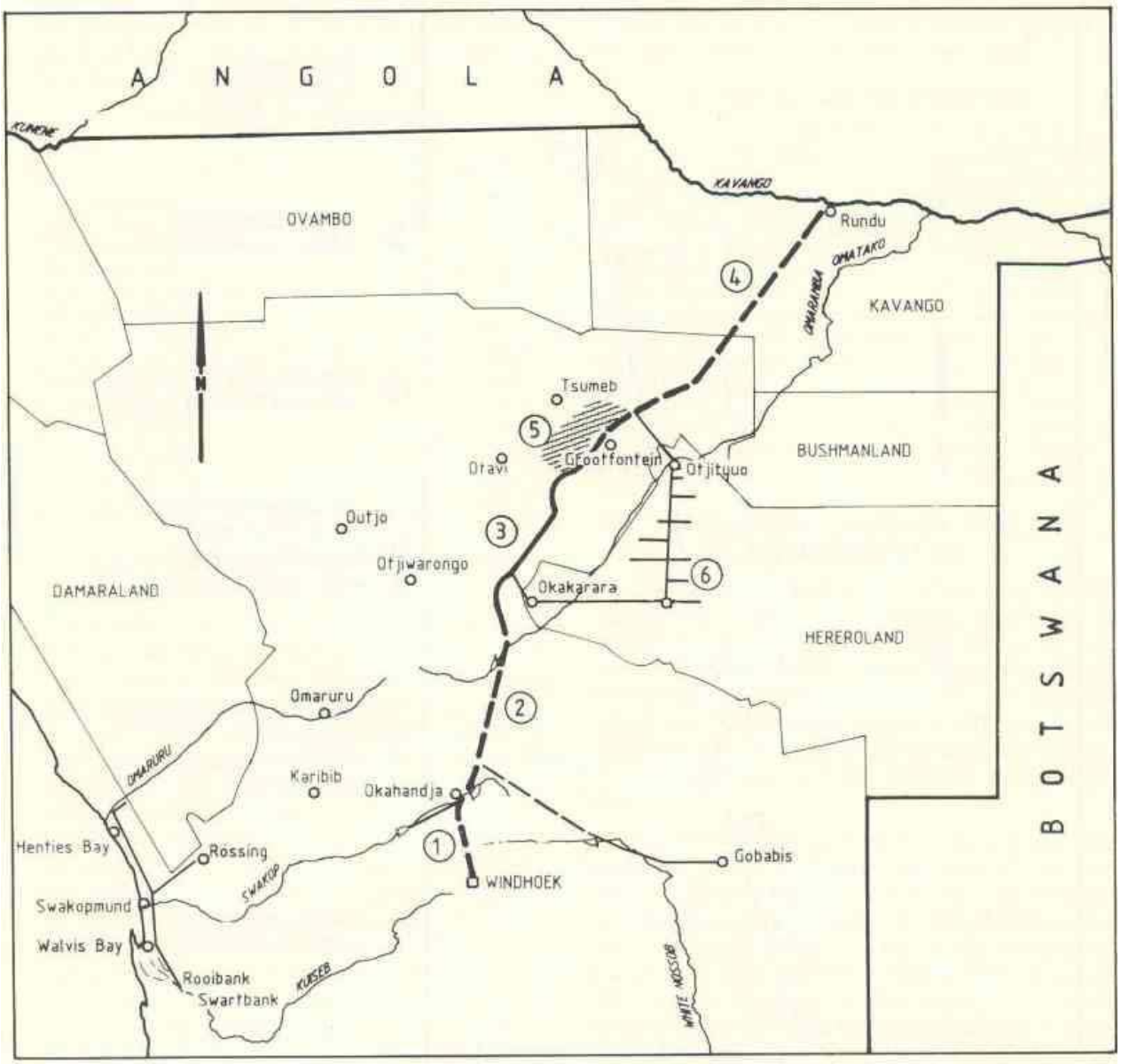
2. The Omatako Dam – S von Bach Component being the Omatako dam, pumping and gravity main to the S von Bach Dam.

3. The Grootfontein-Omatako Canal Component being a concrete lined canal and siphons from Grootfontein to the Omatako Dam.

4. The Rundu-Grootfontein Component being a pumping main from Rundu to Grootfontein.

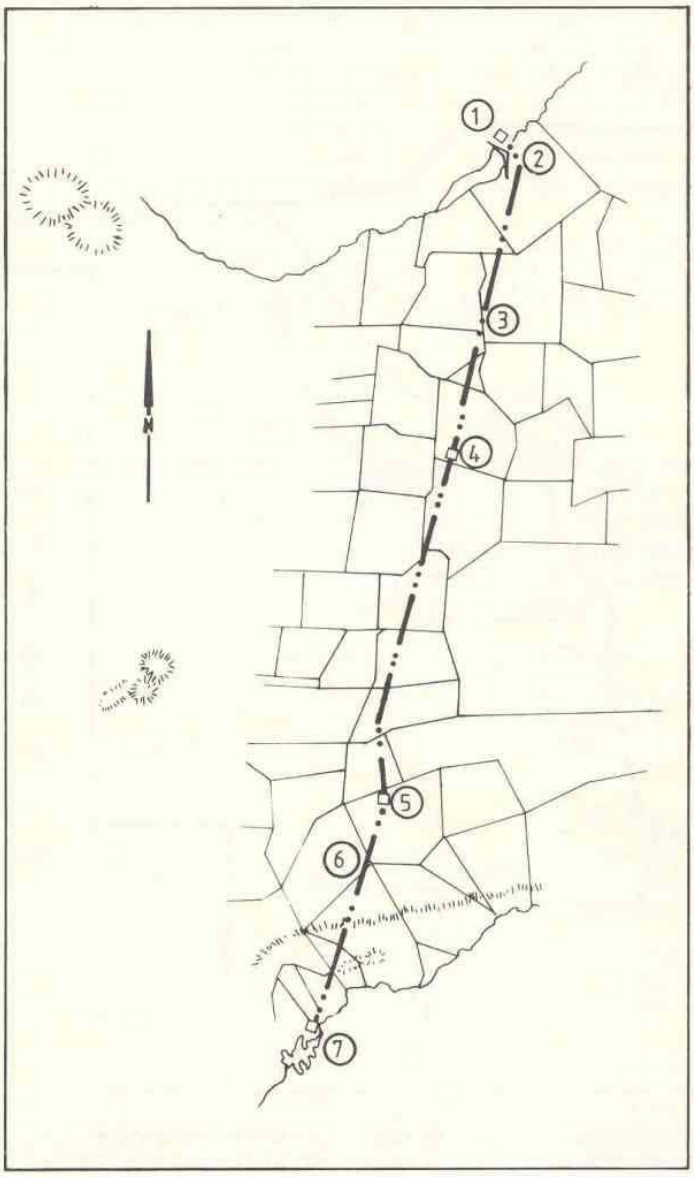
In 1975 investigations into the feasibility of a flood catchment dam on the Omuramba Omatako were started with exploratory drilling. By March 1976 proposals for the Omatako Dam-Von Bach Component were completed and work began on the design phase. Funds were provided and by the end of 1978 work on the construction of the dam commenced.

FIGURE 1: EASTERN NATIONAL WATER CARRIER



1. Von Bach Dam – Windhoek Component
2. Omatako Dam – Von Bach Dam Component
3. Grootfontein – Omatako Canal
4. Rundu – Grootfontein Component
5. Karstland Boreholes – Grootfontein Regional State Water Scheme
6. Hereroland Regional SWS

FIGURE 2: OMATAKO DAM- VON BACH COMPONENT LAYOUT



1. Omatako Dam
2. Base Pump Station
3. 1200 mm pumping main
4. Booster station and surge tower
5. Otukarru break pressure reservoir
6. Gravity pipeline
7. Von Bach Dam

Not to scale

DESCRIPTION OF THE SCHEME

The Omatako Dam is a flood catchment dam designed to harness the flood water of the Omuramba Omatako. As a flood catchment dam it will be operated on a high draft low security basis. On a long term basis the average yield of the Omatako Dam will be 10 million cubic metres per annum. FIGURE 2 shows the location and general layout of the Omatako Dam-Von Bach Component.

Hydrological Characteristics

Description	Quantity
Catchment area	5 320 km²
Mean annual rainfall	403 mm
Mean annual runoff at dam site	38,96 Mm³
Gross mean annual evaporation	2 200 mm
Unit run-off	7,3 mm
Full storage capacity	40,3 Mm³
Yield on a low assurance basis	10 Mm³/a
Surface area at full supply level	1 112 ha
Reach at full supply level	9,3 km
Flood Discharge	
1 in 20 years	700 m³/s
1 in 100 years	1 100 m³/s
1 in 200 years	1 400 m³/s
1 in 500 years	2 100 m³/s

DAM SITE GEOLOGY AND DAM STRUCTURE

The dam site and basin lie in an area of low relief and few rock outcrops. The area is generally covered by a thick layer of red silty “residual sand”. Below this is encountered superficial deposits of calcrete and silcrete up to 25 m thick in places. The bedrock consists of red sandstone of the Stormberg Series containing dark dolerite dykes and sills.

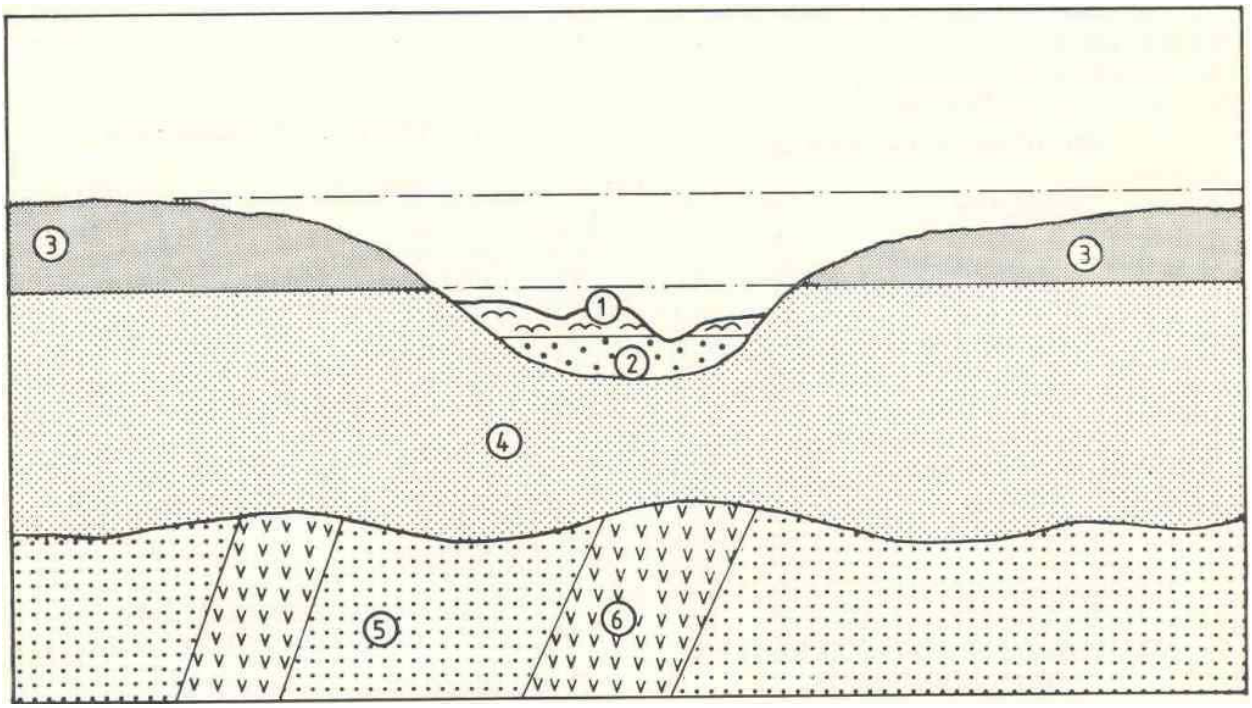
Along its course, the river has eroded the older residual sand and has carved its bed into the underlying calcrete. At a later stage, the valley has been partially filled with river sand and high-level flood deposits consisting of silt and clay. The river sediments are up to 10,5 m in thickness, the high-level flood deposits account for between 2 m and 7 m of this total. FIGURE 3 illustrates a geological cross section at the dam site.

The dam structure consists of an earthfill embankment 16 m in height and 3 460 m crest length and has a side chute spillway with a discharge capacity of 2 000 m³/s. Floods of greater magnitude can be handled by an adjacent section of embankment which is slightly lower than the rest.

Except in the 200 metre wide riverbed and flood plain section where the sound calcrete is much deeper due to being eroded through river action, the impermeable central core extends through the residual sand to sound calcrete. A special cut-off was created to control seepage through the deep alluvial river deposits in the riverbed and flood plain section. This consisted of a bentonite slurry trench cut-off, which proved to be novel and innovative solution to an engineering problem.

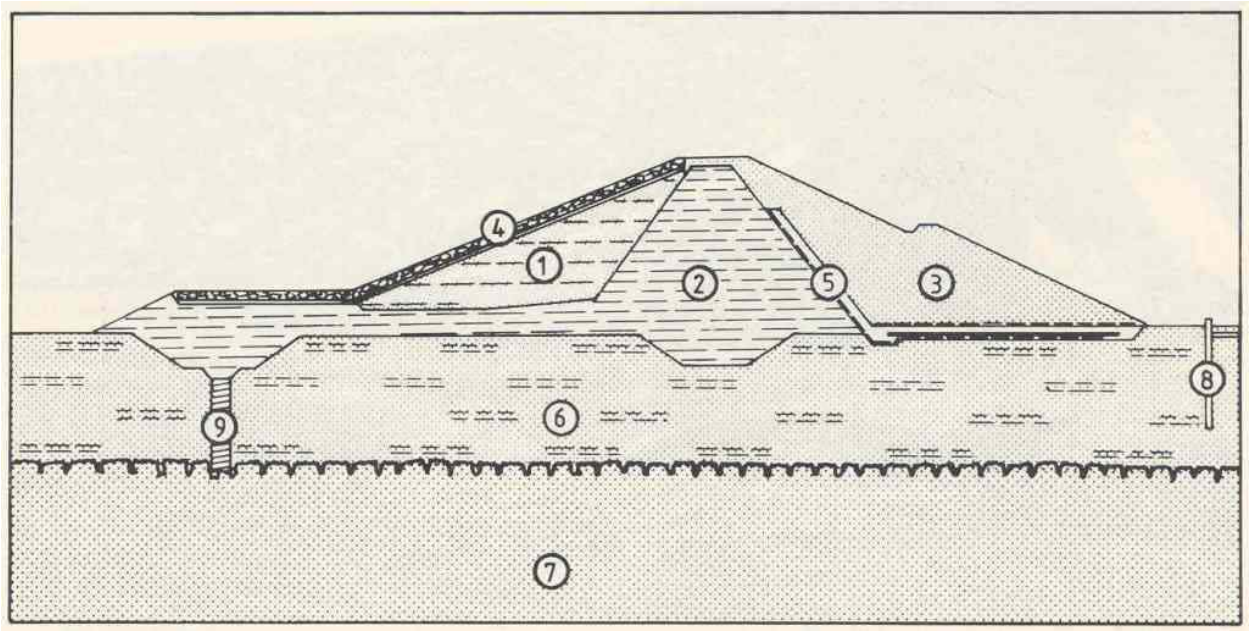
A section through the dam wall is shown in FIGURE 4.

FIGURE 3: GEOLOGICAL CROSS SECTION AT THE DAM SITE



1. Silt and clay flood deposits
2. River Sands
3. Residual red sand
4. Calcretes and silcrete
5. Red sandstone
6. Dolerite dykes

FIGURE 4: SECTION THROUGH THE DAM EMBANKMENT



1. Zone 1: Sandy Clay
2. Sone 2: Clay Core
3. Zone 3: Calcrete
4. Rip rap
5. Sand drain
6. Alluvial sand with clay lenses
7. Calcrete and silcrete
8. Pressure relief wells
9. Cut-off trench

Dam Characteristics

Description	Quantity
Main Embankment	
Height of crest above riverbed	16 m
Crest length	3 460 m
Crest width	5 m
Upstream slope of embankment (vertical: horizontal)	1: 2,5
Downstream slope of embankment (vertical: horizontal)	1: 2,0
Length of cut-off trench	140 m
Depth of cut-off trench below riverbed	12 m
Spillway and chute	
Length of spillway crest	210 m
Length of spillway chute	450 m
Width of spillway chute:	
at narrow end	50 m
at wide end	120 m
Spillway discharge capacity	2 000 m^3/s

RAW WATER INTAKE WORKS

The raw water intake works consist of a concrete tower in the dam wall situated on the northern flank of the river bank.

CANAL FROM GROOTFONTEIN

The canal from the Grootfontein dolomitic area, eventually augmented by the pumped supply from the Okavango River, will be able to supply water at a rate of $2m^3/s$. This supply will be able to either flow into the dam or by-pass the dam directly to the base pump station. This will ensure that in times of drought there will be an assured source of supply from the north to prevent any shortfall in supply being experienced.

BASE AND BOOSTER PUMP STATION

Both the base pump station and the booster station are installed with two pump sets allowing either single or parallel operation of the pump sets. Power is supplied to the pump stations via a specially built 66 kV overhead power line running from the Osona distribution station of SWAWEK near Gross Barmen. The overall operation of the scheme is maintained by a computer based remote monitoring system linked by radio to the control centre located at the Von Bach Purification Works. A diagrammatic layout of the pumping scheme is shown in FIGURE 5.

Details of the Pumping Scheme

Description	Quantity
Maximum static pumping height	196 m
Maximum flow capacity	2 m^3/s
Number of pumps per station	2
Maximum power drawn by pumps	2 400 kW

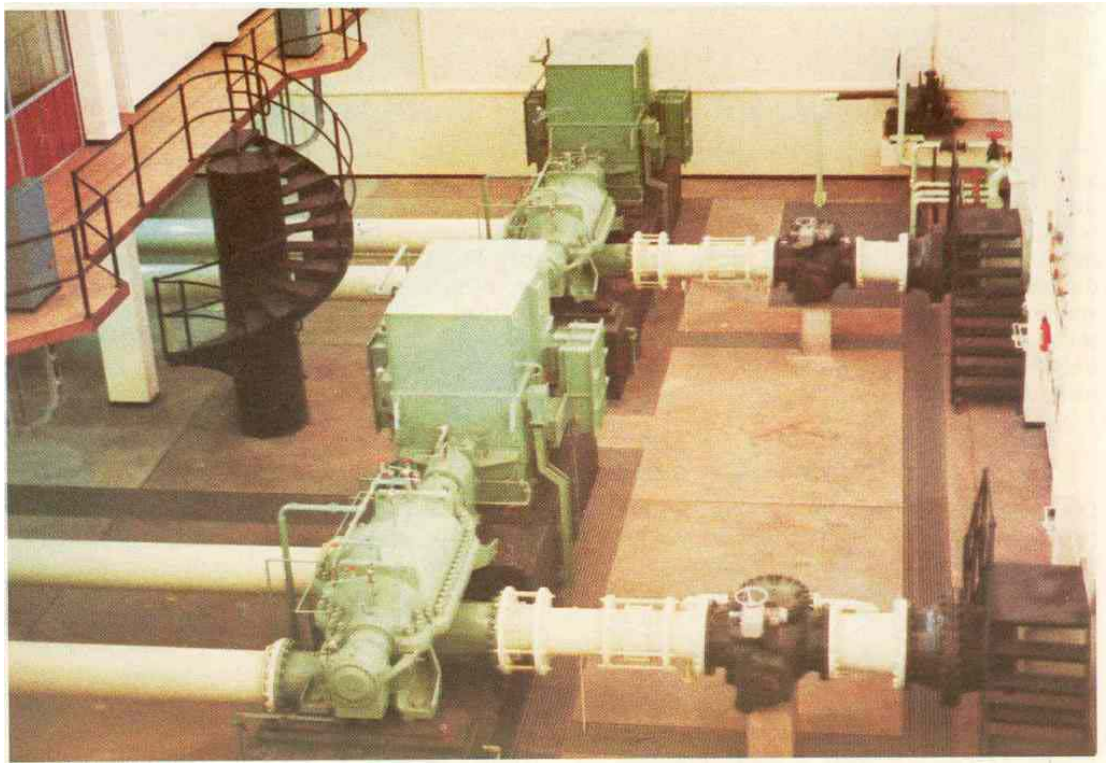
PIPELINE TO VON BACH DAM

The pipeline to Von Bach Dam consists of a pumping main to the watershed at Otukarru and a gravity main into the Von Bach Dam.

At Otukarru water from the pumping main is fed into a ground level reservoir, the water then flows from this reservoir into gravity pipeline over a V-notch weir which ensures that the pipeline fills slowly enough to prevent pressure surges at low lying points. Due to the nature of the terrain traversed by the pipeline 12 kilometres were built above ground, with the pipes being supported on concrete pedestals.

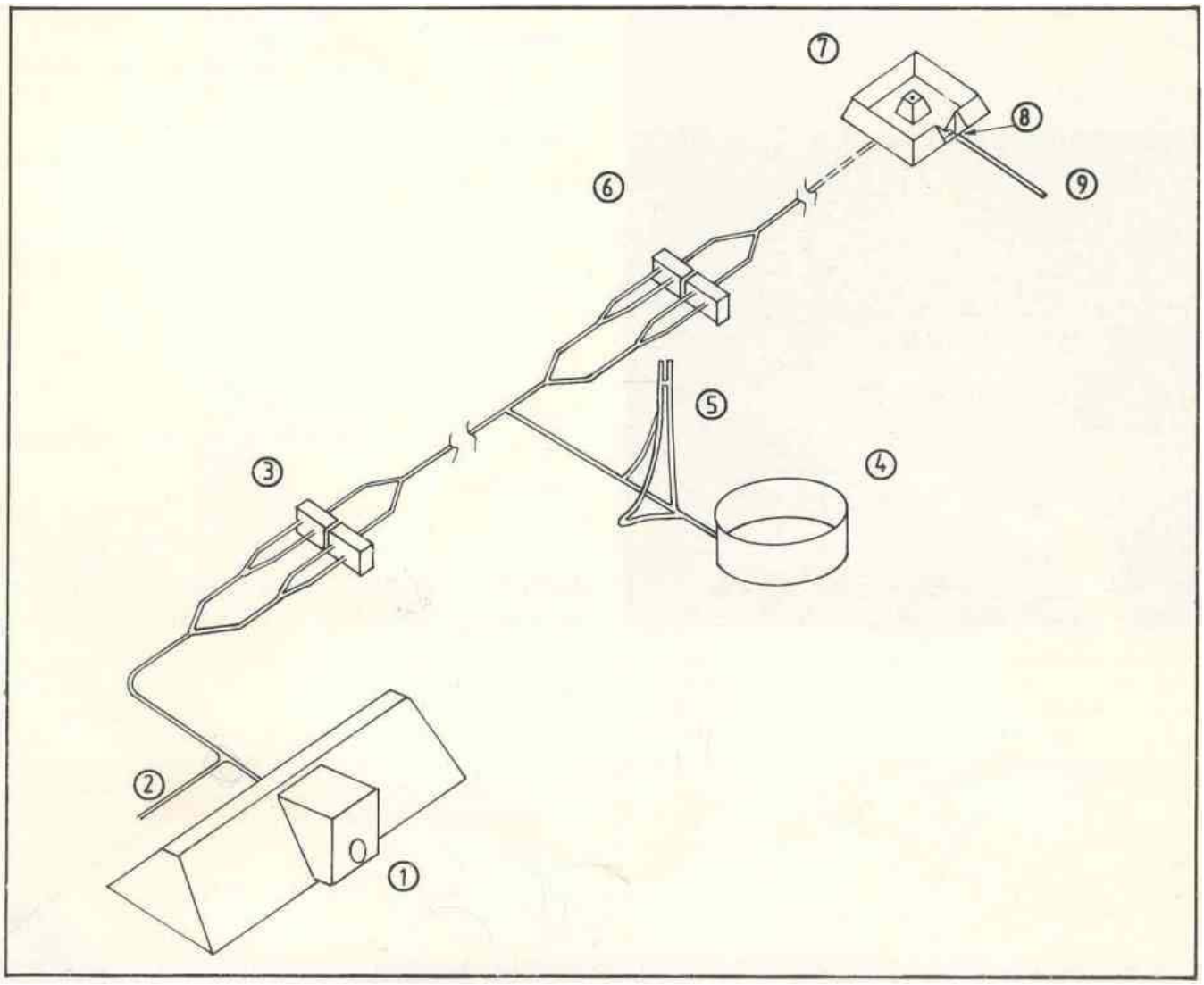
Pipeline Details

Pipe Description	Diameter	Length
Pumping Main		
Pre-stressed Concrete	1 200 mm	70 km
Gravity Main		
Pre-stressed Concrete	1 050 mm	13 km
Pre-stressed Concrete	940 mm	9 km
Asbestos Cement	900 mm	2 km



Interior of the base pump station showing the two pumps

FIGURE 5: DIAGRAMMATIC LAYOUT OF THE PUMPING SCHEME



1. Dam and intake tower
2. Canal supply
3. Base pump station
4. Reservoir 2500 m³
5. Surge tower, 30 m high
6. Booster pump station
7. Break pressure reservoir, Otukarru
8. V-Notch weir
9. Gravity line to Von Bach Dam

Booster pump station and buried pipeline

Pipeline to S von Bach

CONTRACTS, PRINCIPAL CONTRACTORS AND COST

Contract	Contractor	Cost (R)
Omatako Dam	Department of Water Affairs	10 974 000
Omatako-Otukarru Pipeline	Southern Pipeline Contractors (Pty) Ltd	15 234 000
	Department of Water Affairs	3 334 000
Pump Stations and Reservoirs	Department of Water Affairs	3 004 000
	Swastahl	124 000
Otukarru-Von Bach Pipeline	Southern Pipeline Contractors (Pty) Ltd	5 196 000
	Asbestos Cement and engineering (Pty) Ltd	259 000
	Department of Water Affairs	2 408 000
Pumps and Motors	Sulzer Brothers Namibia (Pty) Ltd	2 575 000
Pipe work, Valves and Cranes		877 000
Monitoring System	Telecall Namibia (Pty) Ltd	418 000
TOTAL		44 403 000

Site Investigations	:	Geological Survey
Planning	:	Department of Water Affairs
Design and Construction	:	Department of Water Affairs
Consulting Engineers for the Surge Tower	:	Van Wyk and Louw
Power Supply	:	South West Africa Water and Electricity Corporation