

SOUTHERN CONVEYOR PROJECT



MINISTRY OF AGRICULTURE, NATURAL RESOURCES AND ENVIRONMENT
WATER DEVELOPMENT DEPARTMENT

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Cover Photograph:

- Laying of main conveyor

FOREWORD

Water resources development in Cyprus initially focused on groundwater and until 1970 groundwater was the main source of water supply for both drinking and irrigation purposes. As a result almost all aquifers were seriously depleted because of over pumping and seawater intrusion was observed in most of the coastal aquifers.

The increase of population as well as the increase in the tourist and industrial activities have led to an increase in the demand for water and have created an acute shortage of potable water.

Under these conditions, the implementation of the Southern Conveyor Project was a necessity and a basic prerequisite for the further agricultural and economic development of the island.

The Southern Conveyor Project is the largest water development project ever undertaken by the Government of Cyprus. The basic objective of the project is to collect and store surplus water flowing to the sea and convey it to areas of demand for both domestic water supply and irrigation. Basically the project aims at the agricultural development of the coastal region between Limassol and Famagusta, as well as to meet the domestic water demand of Limassol, Larnaca, Famagusta, Nicosia, a number of villages and the tourist and industrial demand of the southern, eastern and central areas of the island.

The total cost of the project is estimated at C£163 million approximately. The project when completed will be able to supply 33 million cubic metres of water for the irrigation of 13 926 hectares and another 33 million cubic metres of water for domestic purposes.

This publication aims to describe, in a simplified manner, the importance and the characteristics of the Southern Conveyor Project. To the management and staff of the Water Development Department who have contributed in any way towards the preparation of this publication, I express my thanks and sincere congratulations.

Costas Themistocleous
**Minister of Agriculture,
Natural Resources and Environment**

November, 2000

SOUTHERN CONVEYOR PROJECT



SOUTHERN CONVEYOR PROJECT

One of the most serious problems that Cyprus is facing is that of water shortage. Droughts are a very usual phenomenon and many times in the past Cyprus came close to desertion as a result.



Drought effects

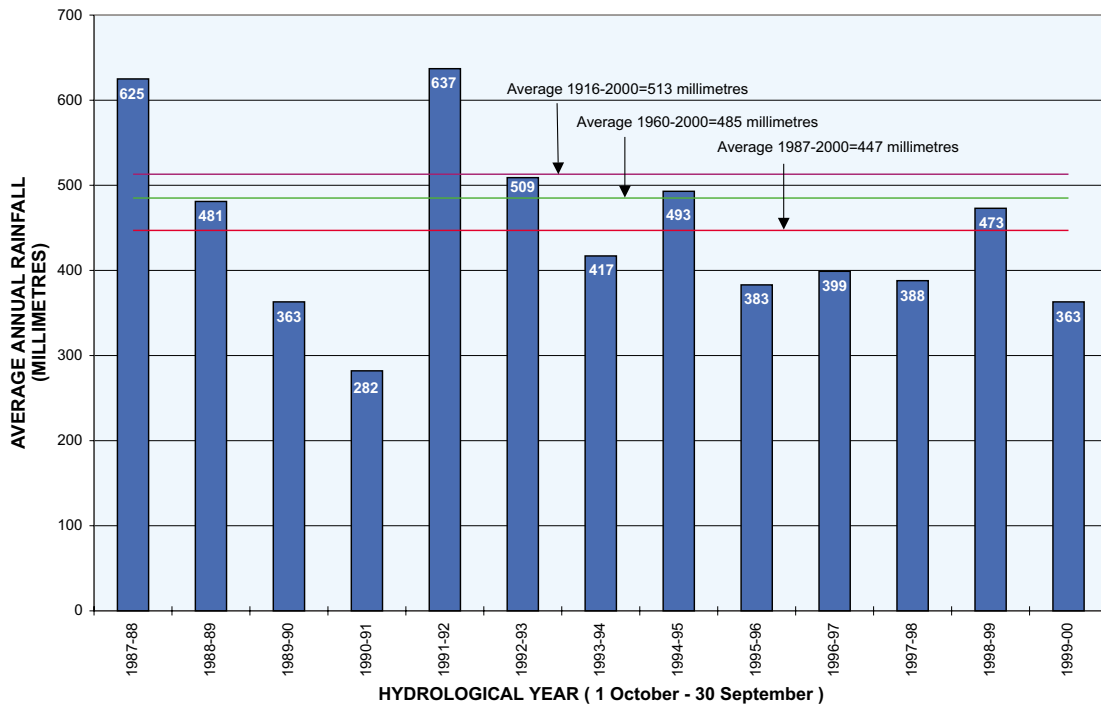
The mean annual rainfall is about 500 millimetres but records indicate that rainfall has decreased considerably and the average for the last thirteen years is now estimated at 447 millimetres.

Since groundwater is reliable, clean and most importantly cheap, water resources development in Cyprus initially focused on groundwater, and until 1970 groundwater was the main source of water for both drinking and irrigation purposes. Consequently almost all aquifers were seriously depleted because of overpumping and seawater intrusion was observed in most of the coastal aquifers. At the same time large quantities of surface water were lost into the sea.

Cyprus has no rivers with perennial flow while rainfall is always low with regional and annual

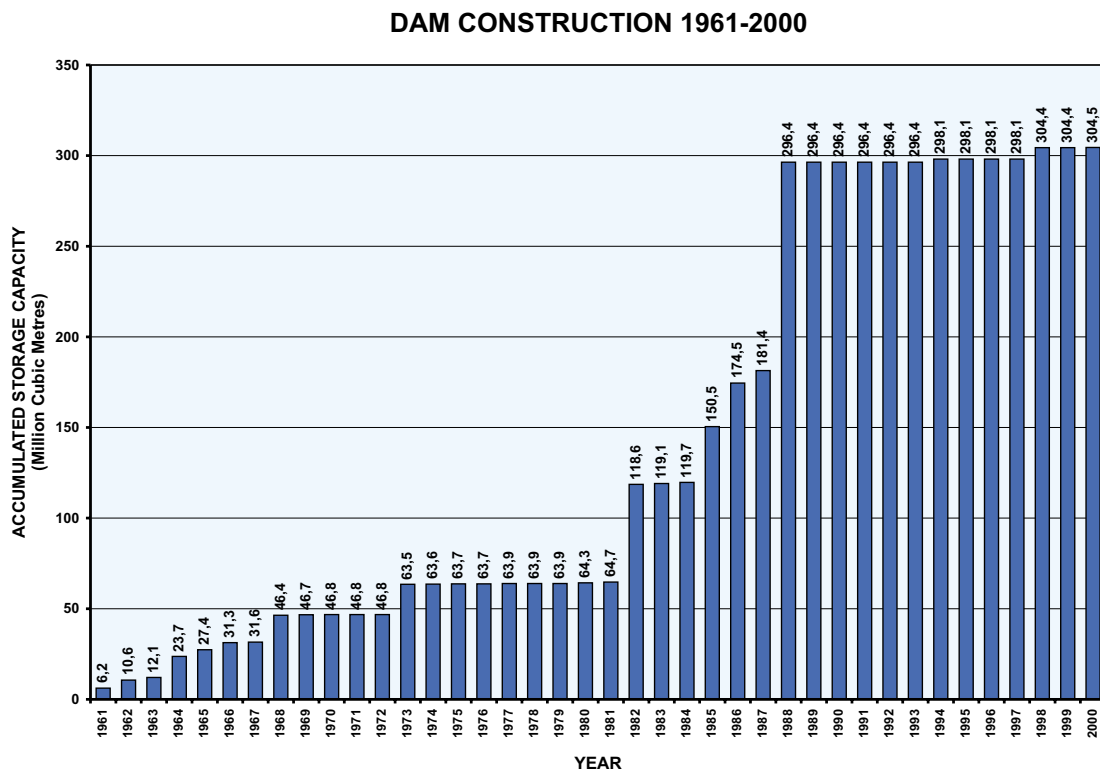
The relevant Authorities identified the water shortage problem in time and in consultation with International Organisations, prepared a long-term plan for solving the problem.

AVERAGE ANNUAL RAINFALL OF CYPRUS (AREA UNDER GOVERNMENT CONTROL) 1987 - 2000



Right after independence, attention was turned to the systematic study and construction of water development works, both for storage and recharge purposes. The first step involved the carrying out of a comprehensive survey of the island's water resources followed by the implementation of a long term plan for the construction of major development projects, which involved the construction of a large number of dams.

So today, the storage capacity of surface reservoirs has reached 304,5 million cubic metres (MCM) from a mere 6 MCM in 1960, a truly impressive achievement when compared to other



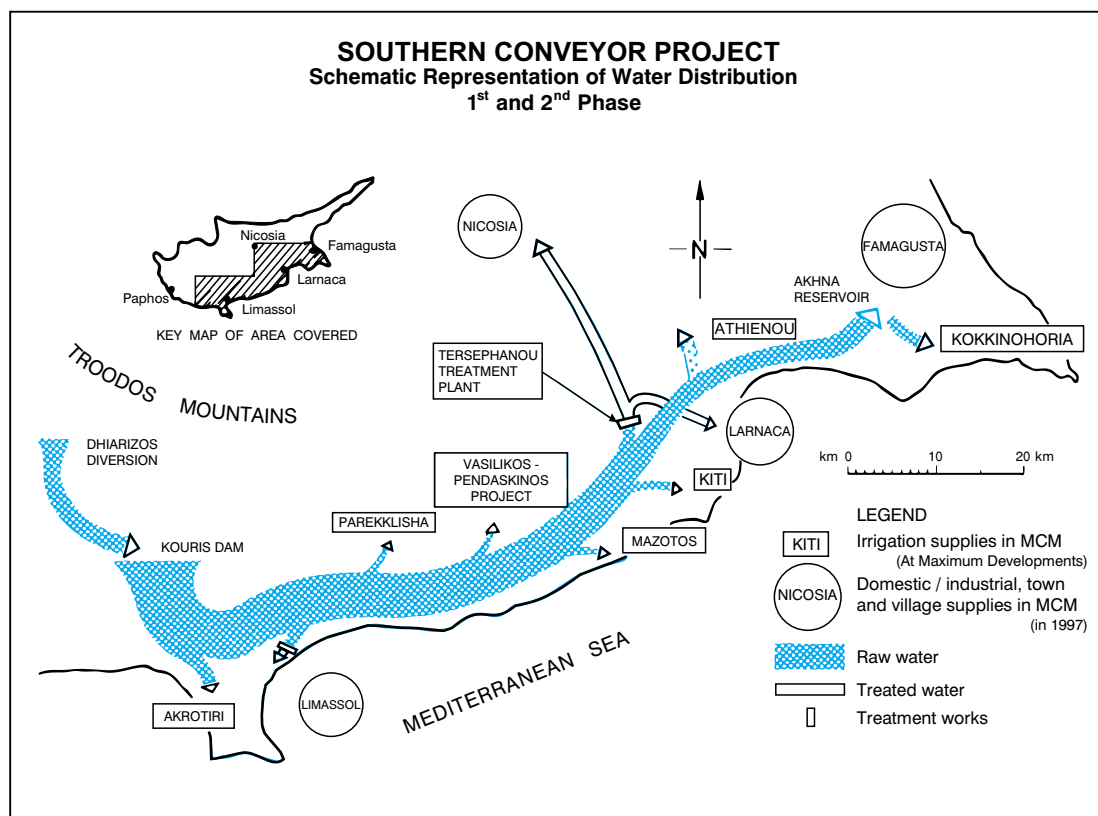
countries of the same size and level of development as Cyprus.

The Major Water Development Works, such as the Southern Conveyor, Vasilikos-Pendaskinos, Pitsilia, Paphos and Khrysokhou, as well as some other smaller works, were constructed in the context of this plan. These works constitute the basic infrastructure on which the agricultural

development, the domestic water supply of urban and rural areas as well as the development of many other sectors of the economy rely and depend.

The largest and most important development project, however, is the Southern Conveyor Project. For Cyprus standards the project is large, complex and costly but vital for Cyprus.

The basic objective of the project is to collect and store surplus water flowing to the sea and convey it to areas of demand for both domestic water supply and irrigation. Basically the project aims at the agricultural development of the coastal region between Limassol and Famagusta, as well as to meet the domestic water demand of Limassol, Larnaca, Famagusta, Nicosia, a number of villages and the tourist and industrial demand of the southern, eastern and central areas of the island.



The project area extends along the southern coast, between the Dhiarizos river in the west and the Kokkinokhoria irrigation area in the east. In view of the large investment and lengthy construction period involved, it was decided to implement the project in two phases.

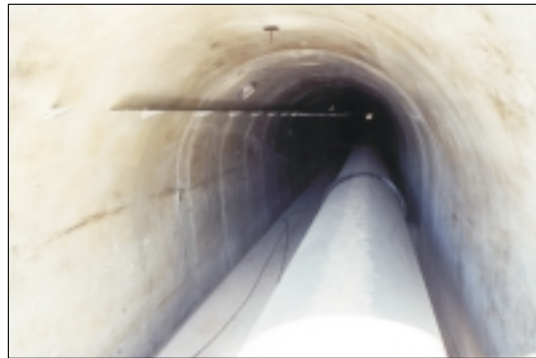
Phase I started in 1984. It includes the construction of Kouris dam on Kouris river with a capacity of 115 MCM, the main conveyor a 110 Km long pipeline, the Akhna terminal reservoir with a



Kouris Dam



Laying of the main conveyor



Laying of the main conveyor



Akhna Dam

capacity of 6,8 MCM, the telemetry system and the Kokkinokhoria, Athienou, Troulli and Avdellero irrigation schemes having a total area of about 9 767 hectares. Phase I was completed in 1994 at a total cost of C£97 million approximately.



Central Distribution Point at Kokkinokhoria



Hydrant with three outlets



Laying of pipes at Kokkinokhoria



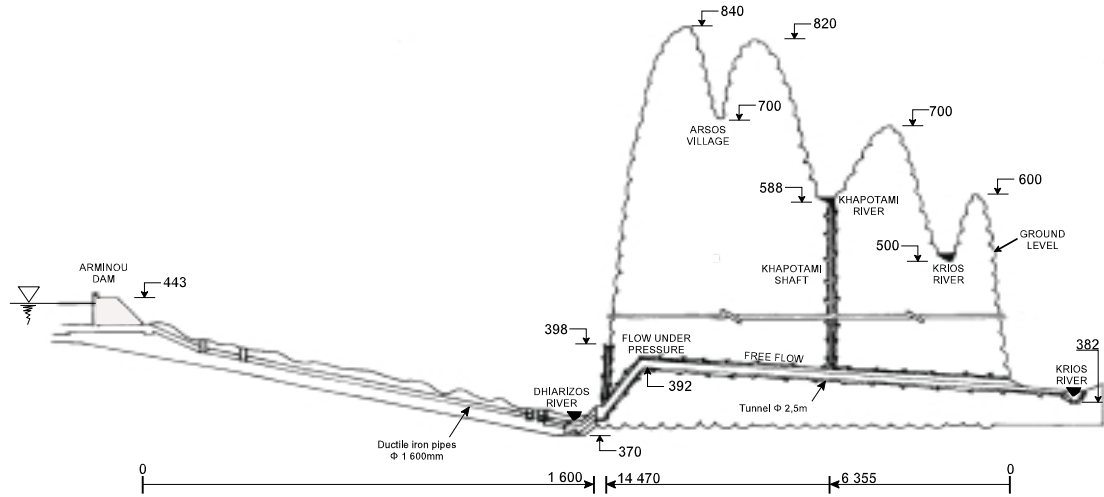
Irrigation at Kokkinokhoria



Telemetry system - Control room

Phase II includes the Dhiarizos diversion conveying water from Dhiarizos river through a 14,5 Km

DHIARIZOS & KHAPOTAMI RIVERS DIVERSION



Dhiarizos diversion tunnel



Limassol Water Treatment Plant

long tunnel to Kouris dam, the Khapotami scheme, the Limassol and Tersephanou water treatment plants, the Tersephanou-Nicosia conveyor a 36,5 Km long pipeline, the water supply scheme to villages



Tersephanou Water Treatment Plant



Administration building - Tersephanou Water Treatment Plant



Reservoir at Akrotiri

west of Limassol and the Akrotiri, Parekklisha, Mazotos, Kiti and Aradhippou irrigation schemes having a total area of about 4 159 hectares. The Limassol and Tersephanou water treatment plants, the water supply scheme to villages west of Limassol, the Akrotiri, Parekklisha and Kiti irrigation networks, the Dhiarizos diversion, the Tersephanou-Nicosia conveyor and the Khapotami scheme have been completed.



Hydrant

Mazotos and Aradhippou irrigation networks have not yet been completed. All phase II works are expected to be completed by 2002 at a total cost of C£66 million approximately.

SUMMARY OF EXPENDITURE

No.	DESCRIPTION	EXPENDITURE TILL 31.12.1999 in C£
PHASE I		
1	Kouris Dam	29.283.765
2	Main Conveyor	35.525.714
3	Akhna dam	1.710.738
4	Irrigation Systems	
	<i>Kokkinokhoria</i>	24.151.641
	<i>Athienou</i>	2.441.551
	<i>Troulli - Avdellero</i>	316.831
5	Domestic Water Supply Development	370.910
6	Central Control System	1.557.210
7	Institutional Restructuring and Preparation of Civil Engineering Works	151.620
8	Buildings and Equipment	351.351
9	Land Consolitation*	683.980
10	Miscellaneous	131.234
SUB-TOTAL PHASE I		96.676.545

No.	DESCRIPTION	EXPENDITURE TILL 31.12.1999 in C£
PHASE II		
1	Dhiazizos Diversion	17.899.900
2	Irrigation Systems	
	<i>Akrotiri</i>	5.967.206
	<i>Parekklisha</i>	2.039.849
	<i>Kiti</i>	3.719.220
	<i>Mazotos</i>	4.822
	<i>Aradhippou</i>	
3	Land Consolidation*	383.175
4	Water Treatment Plants	
	<i>Limassol</i>	7.706.561
	<i>Tersephanou</i>	8.880.772
5	Tersephanou - Nicosia Conveyor	9.104.446
6	Villages Water Supply Scheme	2.036.500
7	Buildings & Equipment	2.272
8	Administration-Supervision-Consultants	2.715.917
SUB-TOTAL PHASE II		60.460.640
GRAND TOTAL PHASE I & II		157.137.185

Note:

Estimated expenditure for the completion of the Project

Phase I: C£ 270.000

Phase II: C£ 5.048.000

** Expenses by the Land Consolidation Department are not included
Alassa Village relocation expenses are not included*

Unfortunately, because of the reduction in rainfall, the quantities of water available from the project are 65% less than planned with a water deficit of 43 million cubic metres approximately. The same also applies for the other development projects.

Water rationing measures have been introduced in the past few years because of this deficit. These rationing measures had adverse effects not only on agriculture but also on the everyday life and generally on the economy of the island.

Therefore, in order to eliminate the dependency of the towns and tourist centers on rainfall and satisfy the increasing water demand the Government has decided to proceed with the construction of seawater desalination plants. Desalination of seawater was first introduced in April 1997, with the operation of the first

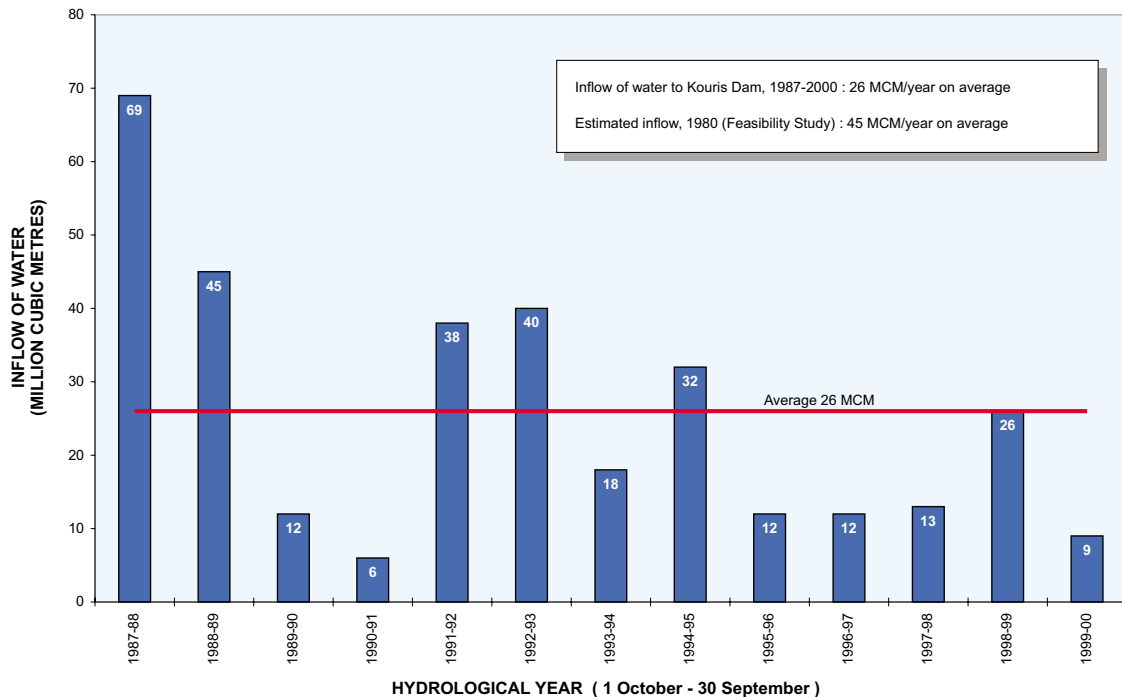
desalination plant at Dhekelia, while the second desalination plant, to be built near the Larnaca airport, is expected to commence operation by the beginning of 2001.

The desalination programme of the Government envisages also the construction of another two plants. One at Limassol and the other at Paralimni.

With the operation of all desalination plants the continuous water supply to the towns of Nicosia, Larnaca, Famagusta and Limassol will be secured.

Fortunately, the cost of desalinated water is decreasing, and if this continues, it will allow us to consider the use of desalinated water for irrigation purposes as well.

INFLOW OF WATER TO KOURIS DAM 1987 - 2000



PROJECT DATA

Feasibility study

O.D.A. (U.K.) with Sir William Halcrow and Partners, jointly with Water Development Department

Consulting engineers for the detailed design and supervision

Phase I: Sir William Halcrow and Partners, U.K.

Phase II: Energoprojekt Hydroinzenjering, Yugoslavia

General responsibility for design, supervision, operation and maintenance

Water Development Department

Construction period

Phase I: 1984 - 1994

Phase II: 1988 - 2002

Loans from

European Investment Bank

International Bank for Reconstruction and Development

Kuwait Fund for Arab Economic Development

Funding

Republic of Cyprus

Storage Reservoirs

Kouris Dam	115,0 MCM
Akhna Dam	6,8 MCM

Water Treatment Plants

Limassol	40 000 - 80 000 m ³ /day
Tersephanou	60 000 - 90 000 m ³ /day

Irrigation distribution systems

Kokkinokhoria area.....	9 270)	
Athienou area	451)	
Troulli-Avdellero area	46)	
Akrotiri area.....	1 737)	13 926
Parekklisha area.....	351)	hectares
Kiti area.....	1 206)	
Mazotos area	615)	
Aradhippou area.....	250)	

Conveyance system

Dhiarizos diversion tunnel	14,5 Km, Φ tunnel 2,4-2,6 m
Southern Conveyor	110,0 Km, Φ 1400-600 mm, ductile iron
Tersephanou-Nicosia Conveyor	36,5 Km, Φ 900 mm, ductile iron

Project water sources

Kouris dam (average)	45 MCM/year
Dhiarizos diversion (average)	21 MCM/year
Akrotiri aquifer (average)	6 MCM/year
Kiti / Mazotos aquifer (average)	2 MCM/year
Kokkinokhoria aquifer (average)	10 MCM/year
Recycled Water (average)	11 MCM/year

(Estimates during Feasibility Study, 1980)

Additional sources of potable water

Dhekelia desalination plant	13,14 MCM/year
Larnaca desalination plant*	16,97 MCM/year

* under construction

Water allocation

(From Kouris Dam)

(Based on operation period 1988-1999)

Domestic uses	11,6 MCM/year
Irrigation	11,5 MCM/year

Domestic water tariff

Unified bulk water tariff	33,5 cent/m ³
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Irrigation water tariffs

Akrotiri	5 cent /m ³
Kokkinokhoria, Athienou, Troulli-Avdellero, Parekklisha, Kiti, Mazotos	6 cent /m ³

Main crops

Citrus, deciduous, olives, vegetables, potatoes, etc.

MCM Million Cubic Metres.

IRRIGATION AND LAND CONSOLIDATION AREAS

	REGION	IRRIGATED AREA in Ha	CONSOLIDATION in Ha
1	KOKKINOKHORIA		
1.1	Ayia Napa	36	
1.2	Avgorou	1494	
1.3	Akheritou	128	
1.4	Akhna	786	
1.5	Dherinia	435	
1.6	Liopetri	1518	
1.7	Xylymbou	198	179
1.8	Xylophagou	1311	1097
1.9	Ormidhia	1166	870
1.10	Sotira	1173	
1.11	Phrenaros	1025	
	TOTAL	9.270	2.146

2	ATHIENOU		
2.1	Athienou	451	451
	TOTAL	451	451

3	TROULLI-AVDELLERO		
3.1	Troulli-Avdellero	31	
3.2	Avdellero	15	
	TOTAL	46	0

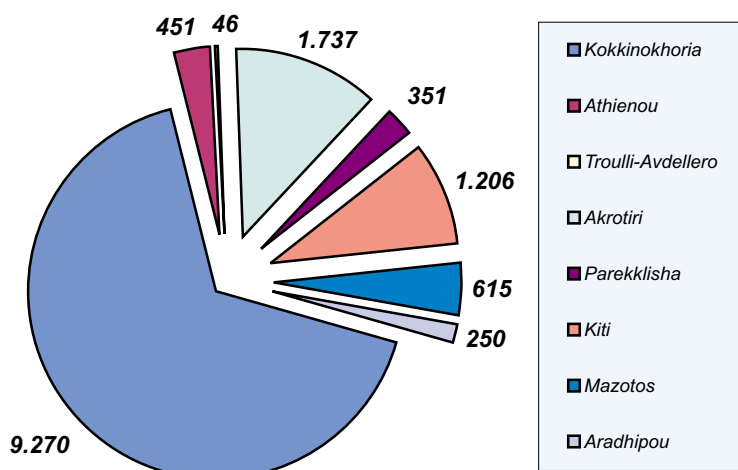
4	AKROTIRI		
4.1	Erimi	155	55
4.2	Episkopi	540	
4.3	Kandou	94	
4.4	Ypsonas	318	298
4.5	Kolossi	303	
4.6	Polemidthia	57	
4.7	Akrotiri	270	184
4.8	Kouris Delta		
	TOTAL	1.737	537

	REGION	IRRIGATED AREA in Ha	CONSOLIDATION in Ha
5	PAREKKLISHA		
5.1	Parekklisha	105	105
5.2	Pyrgos	92	92
5.3	Moni	64	64
5.4	Monagroulli /2	38	38
5.5	Pendakomo	52	52
	TOTAL	351	351

6	KITI		
6.1	Kiti/Softades	523	485
6.2	Pervolia	343	273
6.3	Dromolaxia	111	
6.4	Meneou	85	
6.5	Tersephanou	144	147
	TOTAL	1.206	905

7	MAZOTOS		
7.1	Mazotos	130	130
7.2	Alaminos	175	76
7.3	Anafotia	203	203
7.4	Ayios Theodoros	70	
7.5	Kivisilli	37	
	TOTAL	615	409

8	ARADHIPPOU		
8.1	Aradhippou	250	250
	TOTAL	250	250



SOUTHERN CONVEYOR PROJECT IRRIGATION AREAS
Existing Water Tariffs and Other Charges

14

No.	DESCRIPTION	UNIT	Kokkinokhoria	Athienou	Troulli-Avdellero	Akrotiri	Parekllisha	Kiti	Mazotos
1	WATER PRICE								
1.1	Irrigation, Irrigation Divisions	cent/m ³	6,00	6,00	6,00	5,00	6,00	6,00	6,00
1.2	Irrigation, Farmer	cent/m ³	7,00	7,00	7,00	6,00	7,00	7,00	7,00
1.3	For Industrial use	cent/m ³	20,00	20,00	20,00	20,00	20,00	20,00	20,00
1.4	For Industrial use (Return flow to the system)	cent/m ³	15,00	15,00	15,00	15,00	15,00	15,00	15,00
1.5	For animal husbandry	cent/m ³	13,00	13,00	13,00	13,00	13,00	13,00	13,00
1.6	Water from reservoir spills	cent/m ³	1,00	1,00	1,00	1,00	1,00	1,00	1,00
2	OTHER TARIFFS								
2.1	For over consumption (For quantities of water in excess of 10% approved by W.D.D.)	cent/m ³	33,00	33,00	33,00	26,00	33,00	33,00	33,00
2.2	Fixed Annual Tariff (Because of benefits from Project)	£/decario	1,00	1,00	1,00	1,00	1,00	1,00	1,00
3	CHARGES								
3.1	<u>Connection (only once)</u>								
	(a) Water meter (regular) #	£/meter	40,00	40,00	40,00	40,00	40,00	40,00	40,00
	(b) Water meter (automatic)	£/meter	40,00	40,00	40,00	40,00	40,00	40,00	40,00
	(c) Filter	£/decario	3,00	3,00	3,00	3,00	3,00	3,00	3,00
3.2	<u>For Maintenance / Replacement / Connection (annualy)</u>								
	(a) Water meter (regular)	£/meter	8,00	8,00	8,00	8,00	8,00	8,00	8,00
	(b) Filter	£/decario	1,00	1,00	1,00	1,00	1,00	1,00	1,00
3.3	Reconnection of supply	£/farmoutlet	15,00	15,00	15,00	15,00	15,00	15,00	15,00

Water meter, regular, diameter 2 1/2 inches
Water meter, automatic, diameter 2 inches

ENGINEERING DRAWINGS

FOR THE SOUTHERN CONVEYOR PROJECT

- I. SCHEMATIC DIAGRAM OF SOUTHERN CONVEYOR PROJECT

- II. SCHEMATIC DIAGRAM OF AKROTIRI IRRIGATION SYSTEM

- III. SCHEMATIC DIAGRAM OF WATER SUPPLY TO LIMASSOL AND THE VILLAGES WEST OF LIMASSOL

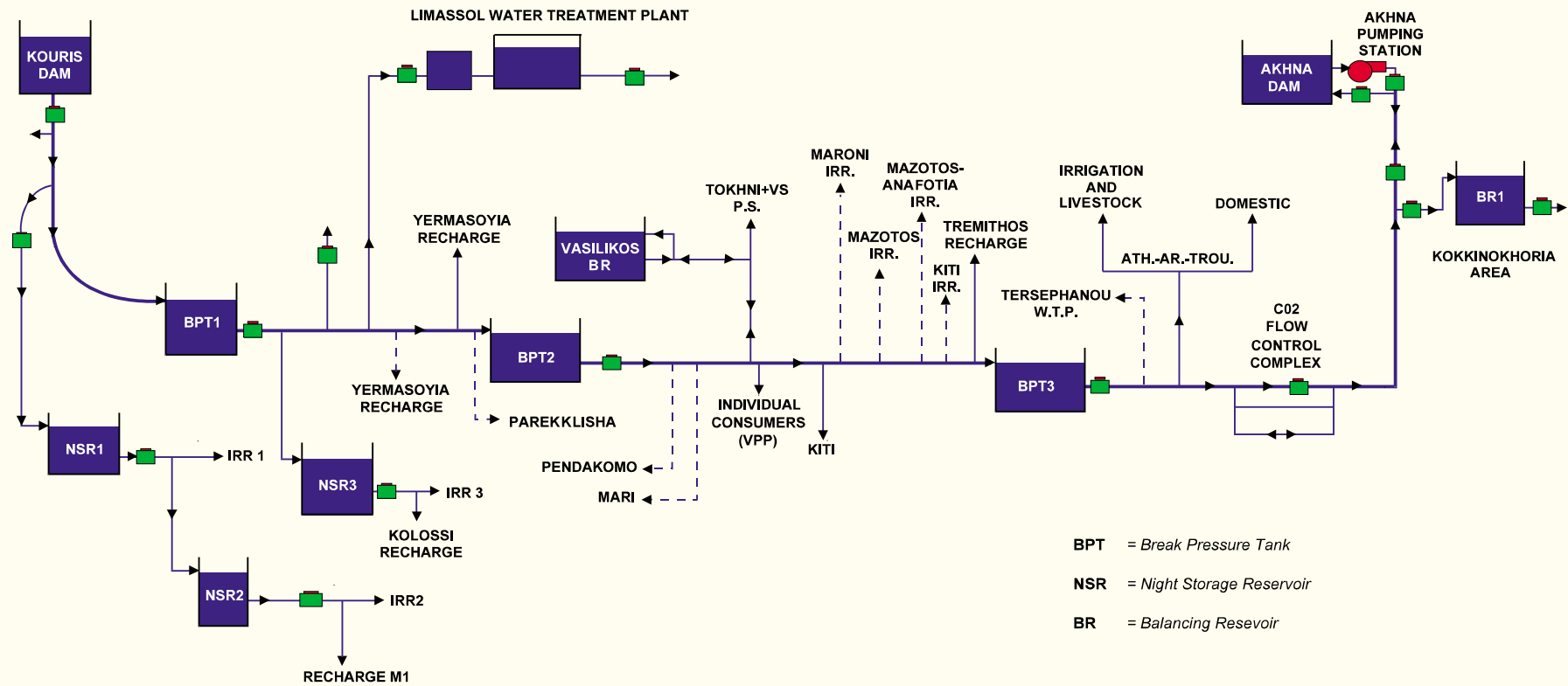
- IV. SCHEMATIC DIAGRAM OF PAREKKLISHA IRRIGATION SYSTEM

- V. SCHEMATIC DIAGRAM OF KOKKINOKHORIA IRRIGATION SYSTEM

- VI SCHEMATIC DIAGRAM OF TELEMETRY SYSTEM

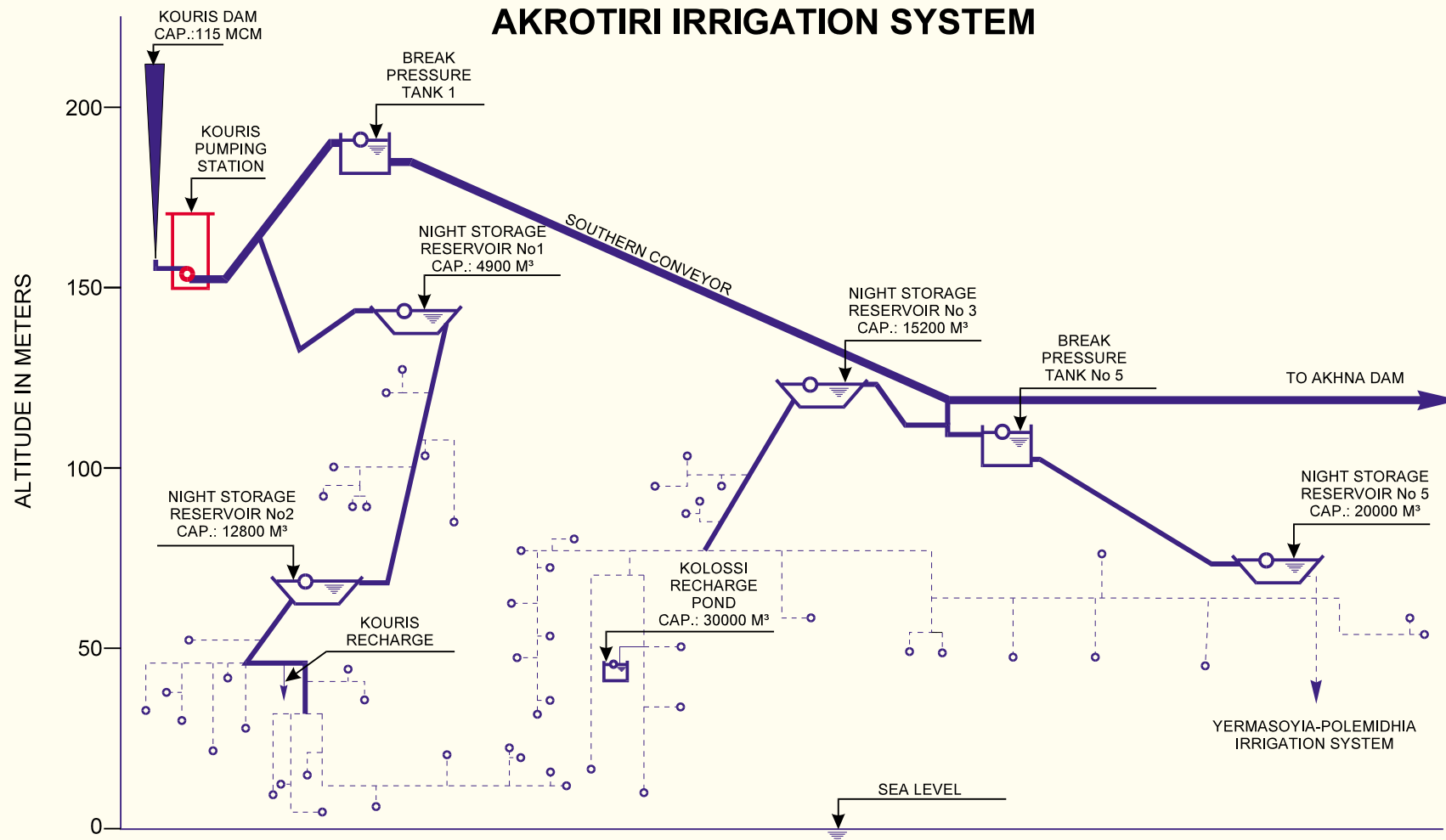
SCHEMATIC DIAGRAM SOUTHERN CONVEYOR PROJECT

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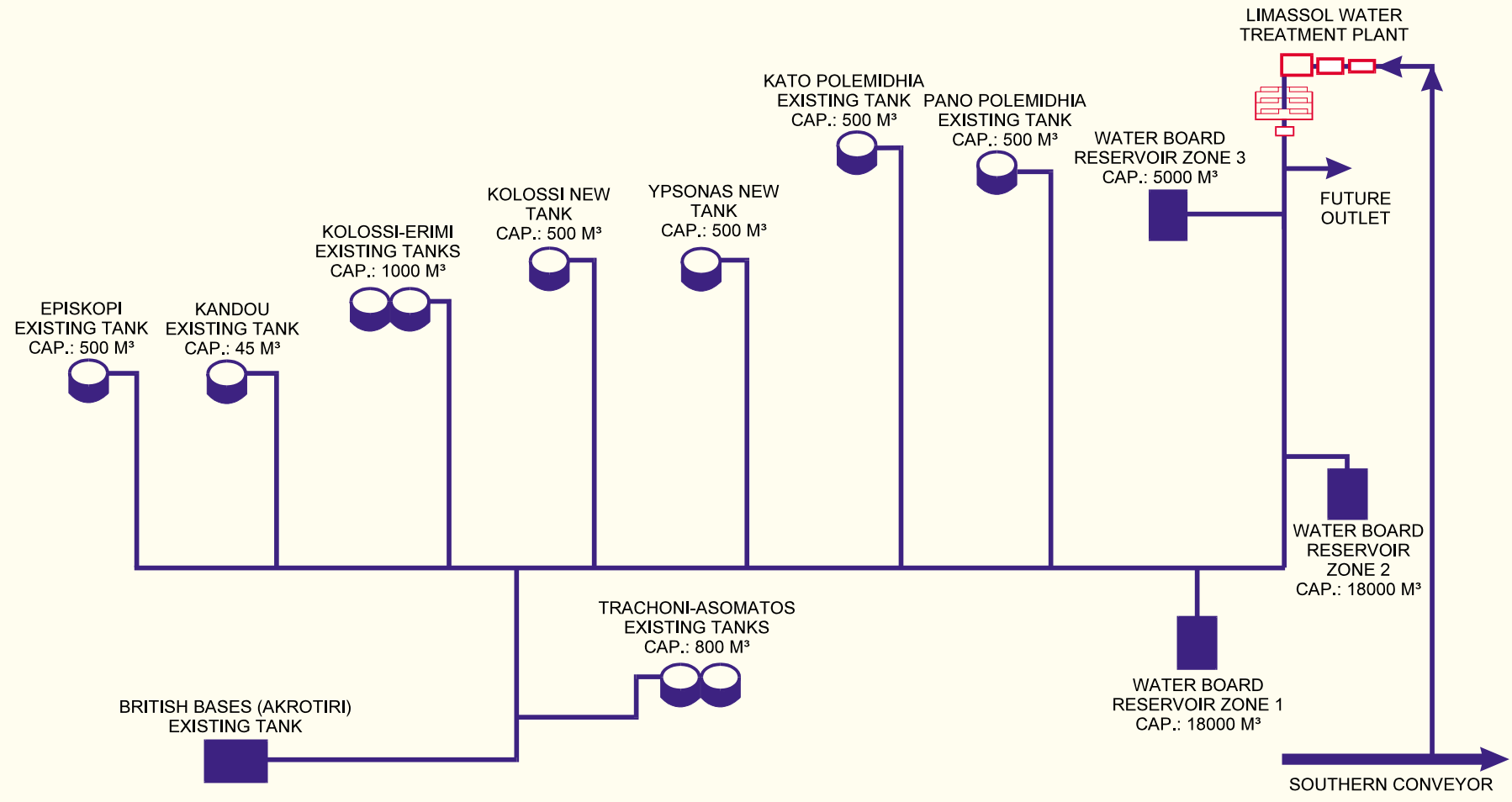


SCHEMATIC DIAGRAM AKROTIRI IRRIGATION SYSTEM

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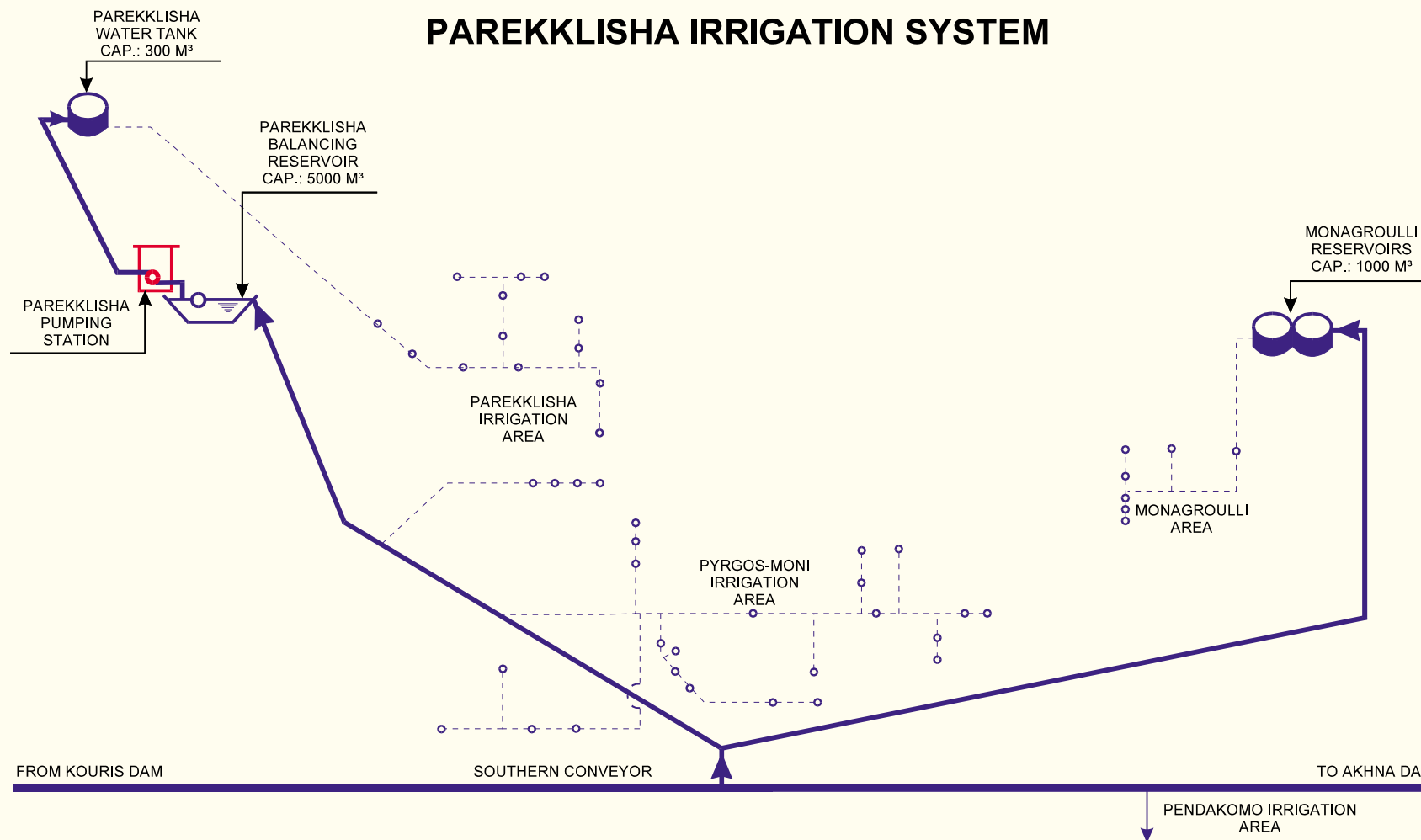


SCHEMATIC DIAGRAM WATER SUPPLY TO LIMASSOL AND THE VILLAGES WEST OF LIMASSOL



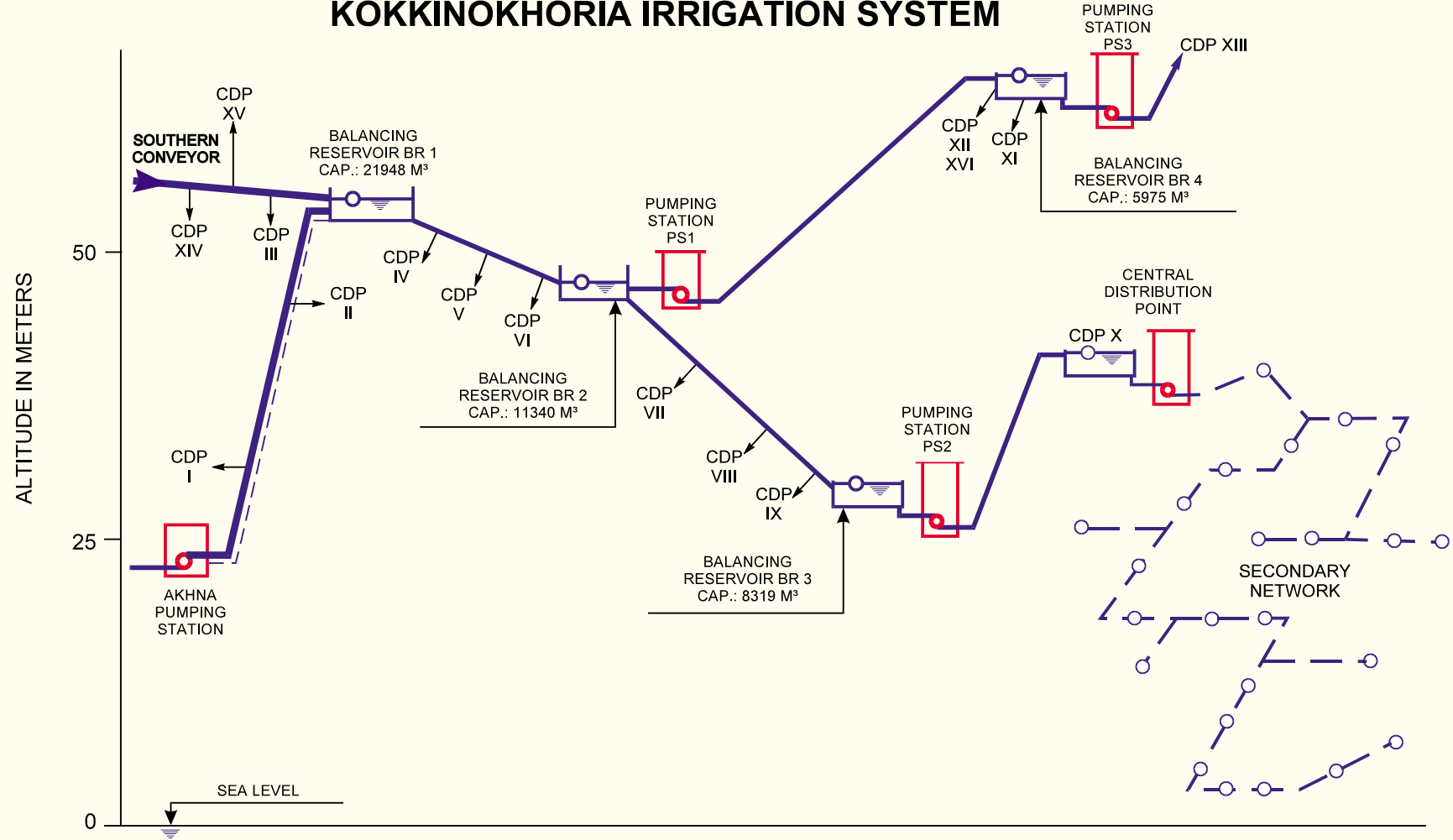
SCHEMATIC DIAGRAM PAREKKLISHA IRRIGATION SYSTEM

IV



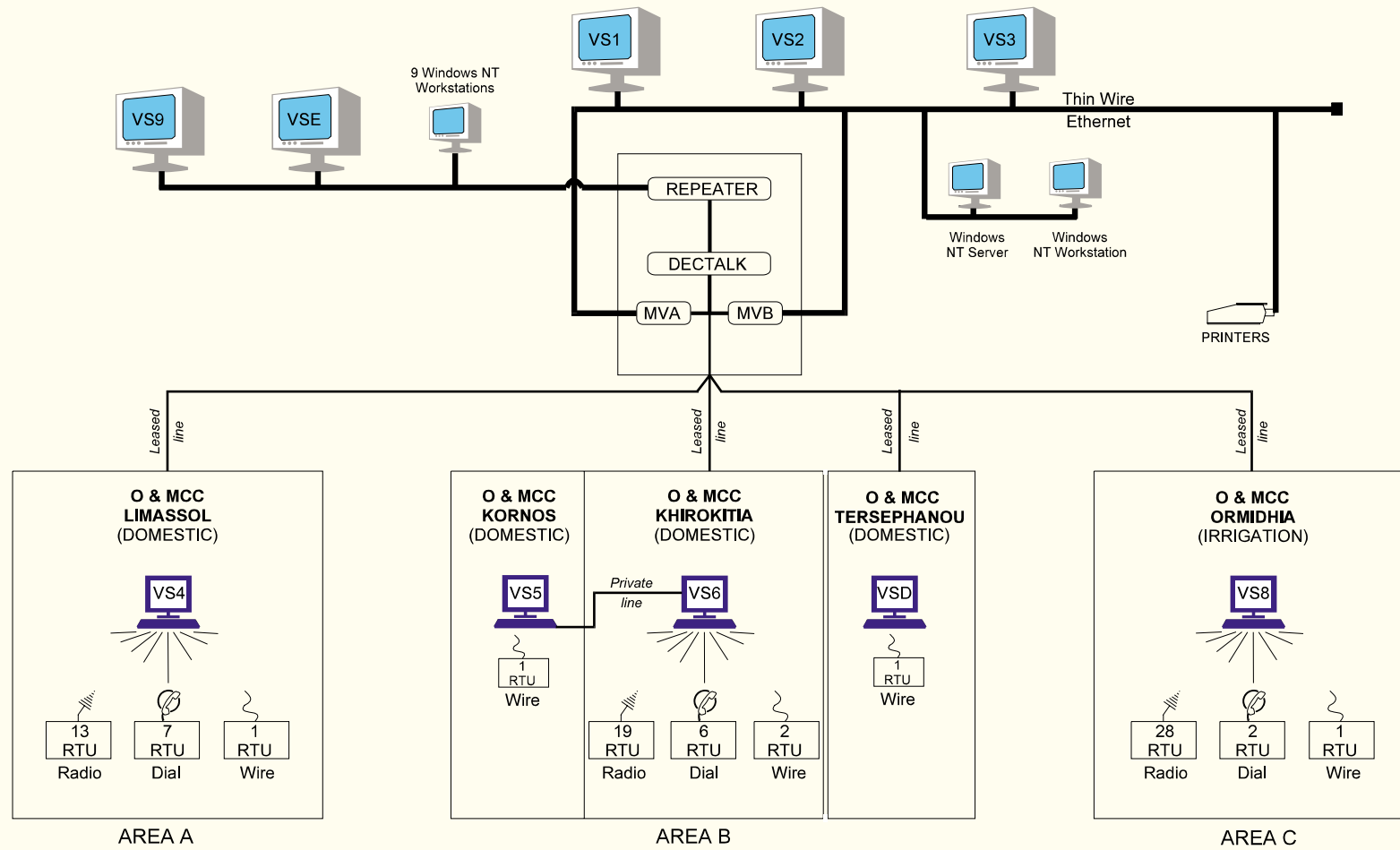
SCHEMATIC DIAGRAM KOKKINOKHORIA IRRIGATION SYSTEM

V



SCHEMATIC DIAGRAM TELEMETRY SYSTEM

VI





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