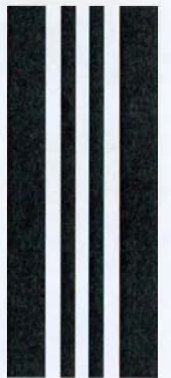


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REPUBLIC OF CYPRUS



MINISTRY OF AGRICULTURE & NATURAL RESOURCES

WATER DEVELOPMENT DEPARTMENT

ANNUAL REPORT 1989

C. ST. LYTRAS, M Sc DIC B Sc
Director

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WATER DEVELOPMENT DEPARTMENT
ANNUAL REPORT 1989

Abbreviations

m	Metre
mm	Millimetre
MCM	Million cubic metres
m ³	Cubic metres
ha	Hectare
WDD	Water Development Dept.
£	Cyprus pound

Conversion factors

Donum	=	0.134	Hectares
	=	0.3306	Acres
	=	14,400	Sq. feet
	=	1,340	Sq. metres
hectare	=	7.4627	Donums
Acre	=	3.0248	Donums

In 1988 the value of the Cyprus £ on average (daily basis) was:-

\$	2.0201
£ st	1.2333
DM	3.7879
Drachma	327.2565

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PART I: DEPARTMENT OF WATER DEVELOPMENT

Background

Water Development activities in Cyprus were for the first time assigned to a single organization, the Department of Water Supply and Irrigation in 1939. The responsibilities of this Department were confined to those of small scale Water Supply and Irrigation projects. In 1954 the Water Supply and Irrigation was reorganised to enable it to carry out general Water Development projects. Following the Independence in 1960 the Department of Water Development (WDD) was placed under the Ministry of Agriculture and Natural Resources.

The Department of Water Development is responsible for formulating and executing the Government's policy on Water Resource Development. In this respect the Department plans, designs, and constructs water development works and projects on the Island. These works and projects include domestic water supplies, irrigation networks, drainage, flood protection, groundwater development, recharge, protection against pollution of water resources, and other relevant works.

The Department cooperates with other Government Departments, Ministries and water distribution organizations in the Management of Water Resources and Water Development projects.

Since 1982 the Department undertakes the planning design and construction of sewerage and sewage disposal works for refugee housing estates, Government Institutions and villages.

Organizational Structure.

The organizational structure of the Department is made of eight (8) Divisions, three (3) Regional Offices, the Mechanical and Electrical Services and Workshop, the Office Management and the Sector of Major Projects Implementation.

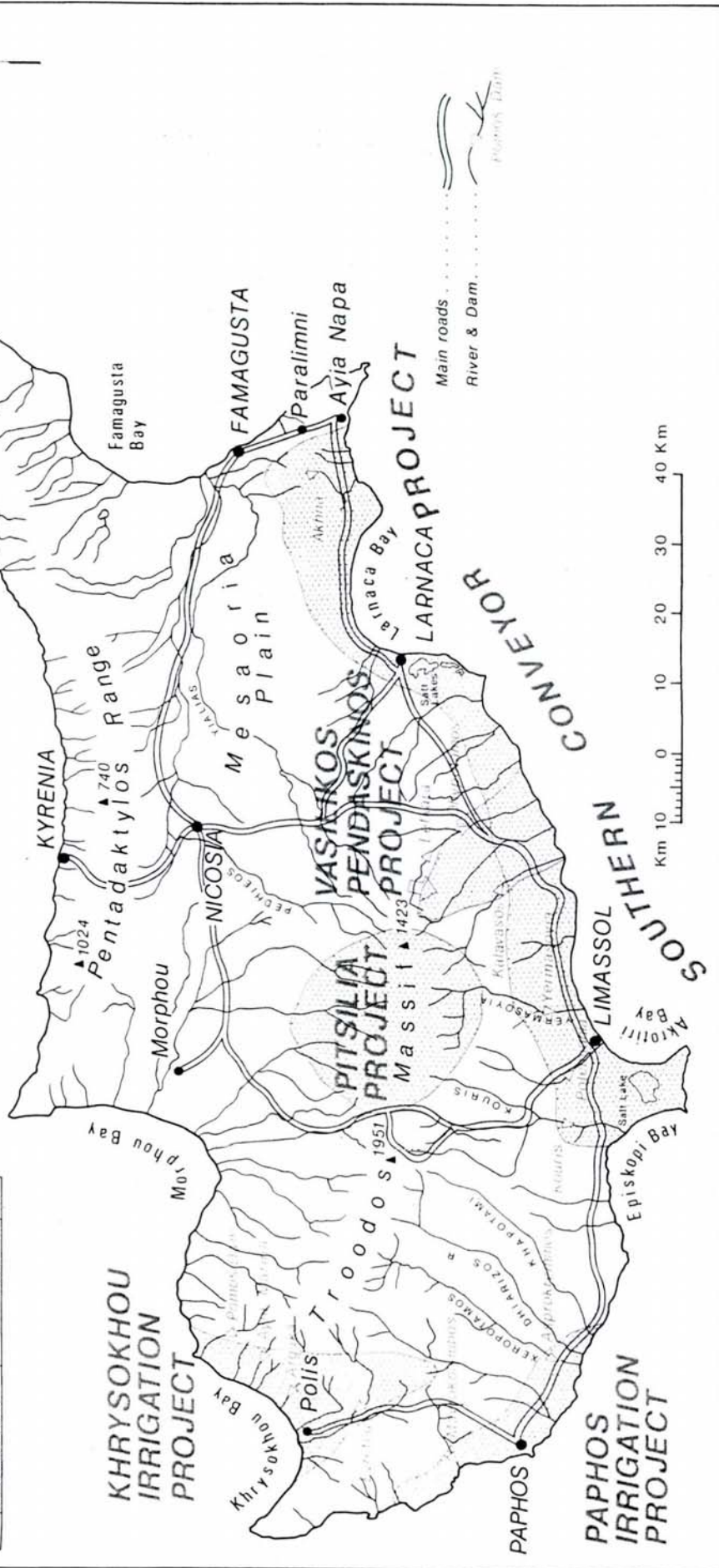
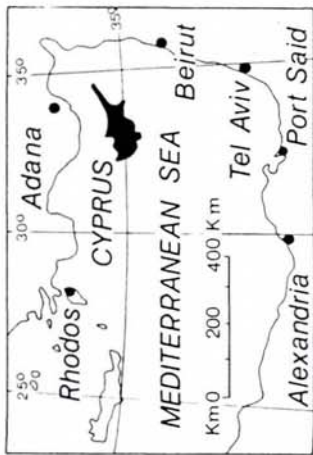
The Organizational structure of the Department is shown on drg No Bm general 519 page

The various organizational components of the Department are the following:

The Division of Water Resources groups together all services required for the collection and interpretation of hydrological and hydrogeological data both for ground and surface water and control of groundwater extraction.

The Division of Hydrology is responsible for the evaluation of the surface and groundwater resources and their present and future management.

CYPRUS PHYSICAL FEATURES AND LOCATION OF MAJOR WATER DEVELOPMENT PROJECTS



The Division of Planning deals with the preparation of reconnaissance and feasibility and detailed design of water projects. The works for planning include field investigations for hydraulic structures, laboratory testing for these structures, water use studies, hydrological evaluations, evaluation of benefits, technoeconomic studies as well as engineering geology problems. Systems analysis and mathematical modelling techniques with the help of electronic computer are widely used in these studies.

The Division of Rural Projects Planning plans and designs rural irrigation and domestic water supply projects and sewage disposal schemes which are of a rather routine nature and do not need elaborate planning and design procedure.

The Division of Design prepares detailed designs, contract documents and specifications required for water projects after feasibility stage.

The Division of Construction is responsible for all construction work whether carried out by direct labour or by contract.

The Division of Operation and Maintenance (Town Water Supplies) controls the administration, operation and maintenance of Government town water supply schemes and rural regional water supply schemes.

The Division of Operation and Maintenance (Irrigation) deals with the management, operation and maintenance of Government irrigation works.

Regional Offices. The WDD had regional offices in Famagusta, Limassol, Larnaca, Paphos and Kyrenia. After the 1974 Turkish invasion the regional offices were reorganized and reduced to the following three: Larnaca-Famagusta, Limassol and Paphos. A new office for Nicosia is planned. These regional offices collect hydrological and engineering data and are responsible in their respective districts for the operation and maintenance of projects, investigation, and planning for small projects and control of construction work.

The Mechanical and Electrical Services and Workshop is responsible for all mechanical and electrical activities of the Department, new electrical and mechanical and maintenance of existing electrical and mechanical equipment of water projects.

The Office Management includes the Registry and the Accounts of the Department. The Registry is responsible for the administration and office services, staff and labour matters. The Accounts is responsible for all accounting work, financial control and coordination and stores.

Sector of Major Projects Implementation is the coordinating body for the implementation of major Water Development Projects.

All legal matters concerning the day-to-day operation of the WDD are referred to the Legal Adviser of the Department at the Attorney General's Office.

The WDD is headed by a Director and the management of the Department is subdivided between an Assistant Director and a Principal Water Engineer. The Assistant Director oversees the Divisions involved in Design, Construction and Maintenance. In addition he is responsible for the Construction of the Southern Conveyor and for overseeing the work of the Regional Engineering Office at Larnaca/Famagusta and for work in the Nicosia Region which is presently managed from WDD, headquarters. The Principal Water Engineer oversees the Divisions dealing with Water Resources, Hydrology and Planning and is responsible for the Kouris Dam, and Dhiarizos Diversion and Tunnel construction and for overseeing the work of the Regional Offices at Limassol and Paphos. This developed to its present complex form gradually over the years in order to meet growing work and to resolve certain staff considerations.

The WDD has a large technical staff that is well qualified in most of the disciplines pertaining to water. At present a large proportion of the staff is concentrated on the design and supervision of major new works perhaps to the detriment of the hydrogeology and resource planning divisions.

The technical staff on 31/12/89 can be summarised as follows:-

- Director
- Assistant Director
- Principal Water Engineer
- 10 No. Senior Water Engineers
- 2 No. Senior Hydrogeologists
- 47 No. Executive Engineers
- 2 No. Mechanical Engineers
- 2 No. Geologists
- 4 No. Hydrologists
- 2 No. Chemists
- 6 No. Topographical Irrigation Engineers
- 7 No. Senior Technical Superintendents
- 14 No. Technical Superintendents
- 39 No. Senior Technicians
- 242 No. Technicians
- 7 No. Chief Foremen
- 20 No. Assistant Chief Foremen
- 57 No. Foremen
- 2 No. Sanitary Engineers

Drawing No.BM/G/245 on page I-7 summarises the Distribution of the personnel to the various Divisions of WDD.

The WDD uses extensively the services of the Geological Survey, mainly Engineering Geology, Geological mapping, hydrogeology and geophysics together with well drilling and testing.

Administrative, Clerical and Accounts staff are attached to WDD from The Personnel and Treasury Department respectively as follows.

- 4 No. Accounts Officers
- 15 No. Accounts Clerks
- 40 No. General Clerks & Secretaries
- 1 No. Administrative Officer
- 1 No. Telephone Operator
- 4 No. Messengers

The Department has no financial staff as all financial matters are theoretically dealt with in the Ministry of Finance, but a considerable burden of financial work falls on the technical staff of the Department.

In addition to the above, the Department employs a number of Consultants for specific jobs.

Consultants employed by the Department

The following consulting firms were employed by the Department for the design and supervision of various components of projects.

SOGREAH, France, in association with Hydroconsult, Nicosia, for the design and supervision of construction of Kouris Dam, Southern Conveyor Project.

Sir William Halcrow and Partners, Swindon, England in association with Balfours, London, for the design, contract documents and supervision of construction of the Southern Conveyor Project together with the SCP team of WDD staff.

Rofe Kennard and Lapworth in association with the Southern Water Authority, for the institutional study for the establishment of an entity for the development, management and allocation of water resources in Cyprus.

Rofe, Kennard and Lapworth for the final design and construction drawings for Xylourikos dam on Limnatis River.

Soviet organisation "Shelkozpromexport" for the preparation of the feasibility study on utilization of the Karyotis river runoff to supply potable water to Nicosia.

TECHNICAL STAFF OF WDD ON 31.12.1989

DRG No BM/G/245

TECHNICAL STAFF		D	AD	PWE	SWE	SH	EE	TIE	SE	ME	Geo	H	Ch	STS	TS	ST	T	CF	ACF	F	TOTAL	REFERENCE																										
1	i	Permanent Ordinary Staff	1	1	1	10	2	38	4	2	2	2	4	2	7	14	39	189	7	20	52	397																										
	ii	Casual Staff					3	2									41					46	D Director AD Assistant Director PWE Principal Water Engineer SWE Senior Water Engineer SH Senior Hydrogeologist EE Executive Engineer TIE Topographer Irrigation Eng. SE Sanitary Engineer ME Mechanical Engineer Geo Geologist H Hydrologist CH Chemist STS Senior Tech. Superintendent TS Technical Superintendent ST Senior Technician T Technician CF Chief Foreman ACF Assistant Chief Foreman F Foreman O&M Operation & Maintenance																									
TOTAL NUMBERS		1	1	1	10	2	41	6	2	2	2	4	2	7	14	39	230	7	20	52	443																											
DISTRIBUTION OF STAFF																																																
2	DIRECTORATE		1	1	1																	3																										
		i	Water Resources Management																																			1										
		ii	Hydrology																																						28							
		iii	Planning																																								12					
		iv	Rural Projects Planning																																								54					
		v	Design																																								13					
		vi	Construction																																										30			
		vii	Operation & Maintenance - DWS																																											38		
		viii	Operation & Maintenance - Irrig.																																												17	
		i	Mechanical and Electrical Services *																																												24	
4	REGIONAL OFFICES																																															
		ii	Regional Office, Famagusta - Larnaca																																										15			
		iii	Regional Office, Limassol																																											20		
		iv	Regional Office, Paphos																																												51	
5	MAJOR PROJECTS																																															
		i	Paphos Irrigation Project (PIP) O&M stage																																											41		
		ii	Pitsilia and Vasilikos-Pendaskinos Projects																																												13	
		iii	Southern Conveyor Project (SCP)																																													54
6	Various Postings																																															
		iv	Khrysokhou Irrigation Project (KIP)																																											14		
7	Vacancies																																															
		v	TOTAL NUMBERS																				1	1	10	2	41	6	2	2	4	2	7	14	39	230	7	20	52	443								

* Six officers belonging to the EMS were working with our Electromechanical Services Division on the 31.12.1989 as follows:
 2 Mechanical Eng.
 1 Electrical Eng.
 3 Technicians

• Missing since 1974 invasion

■ On scholarship or study leave

Note: Four Executive Engineers, one Technical Superintendent and four Technicians are transferred to Limassol Regional Office but posted at SCP sites and are listed under SCP on this table

Energoprojekt, Yugoslavia for the preparation of the detail designs and contract documents for all engineering components of the 2nd phase of the Southern Conveyor Project.

Howard Humphreys & Sons of UK in association with I A Theophilou, Nicosia for the detail design, contract documents and supervision of construction of Vizakia dam.

Relation of WDD with other Government bodies:

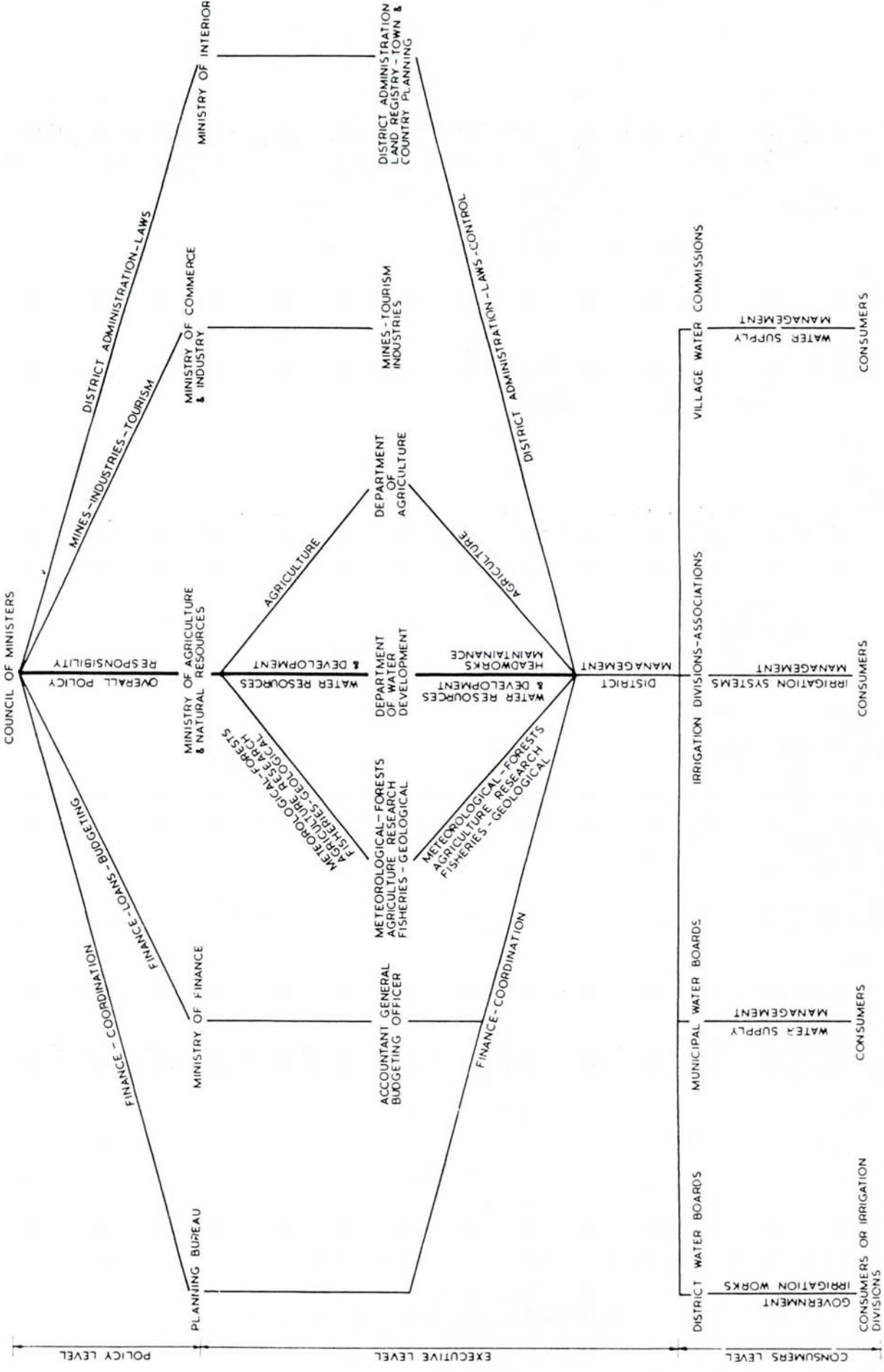
The interrelations of WDD with other Government bodies with respect to Water Resource Conservation and Development the lines of authority and communication, the mode of policy formation and application are presented in graphical form on the chart in page

Membership of WDD to International Organization.

The WDD is member of the following International Organization.

- Unesco International Hydrological Program (IHP).
- International Atomic Energy Agency (IAEA).
- International Commission on Large Dams (ICOLD).
- National Action Committee for International Drinking Water Supply and Sanitation Decade (IDWSSD).
- International Commission on Irrigation and Drainage (ICID).
- International Water Supply Association (IWSA).

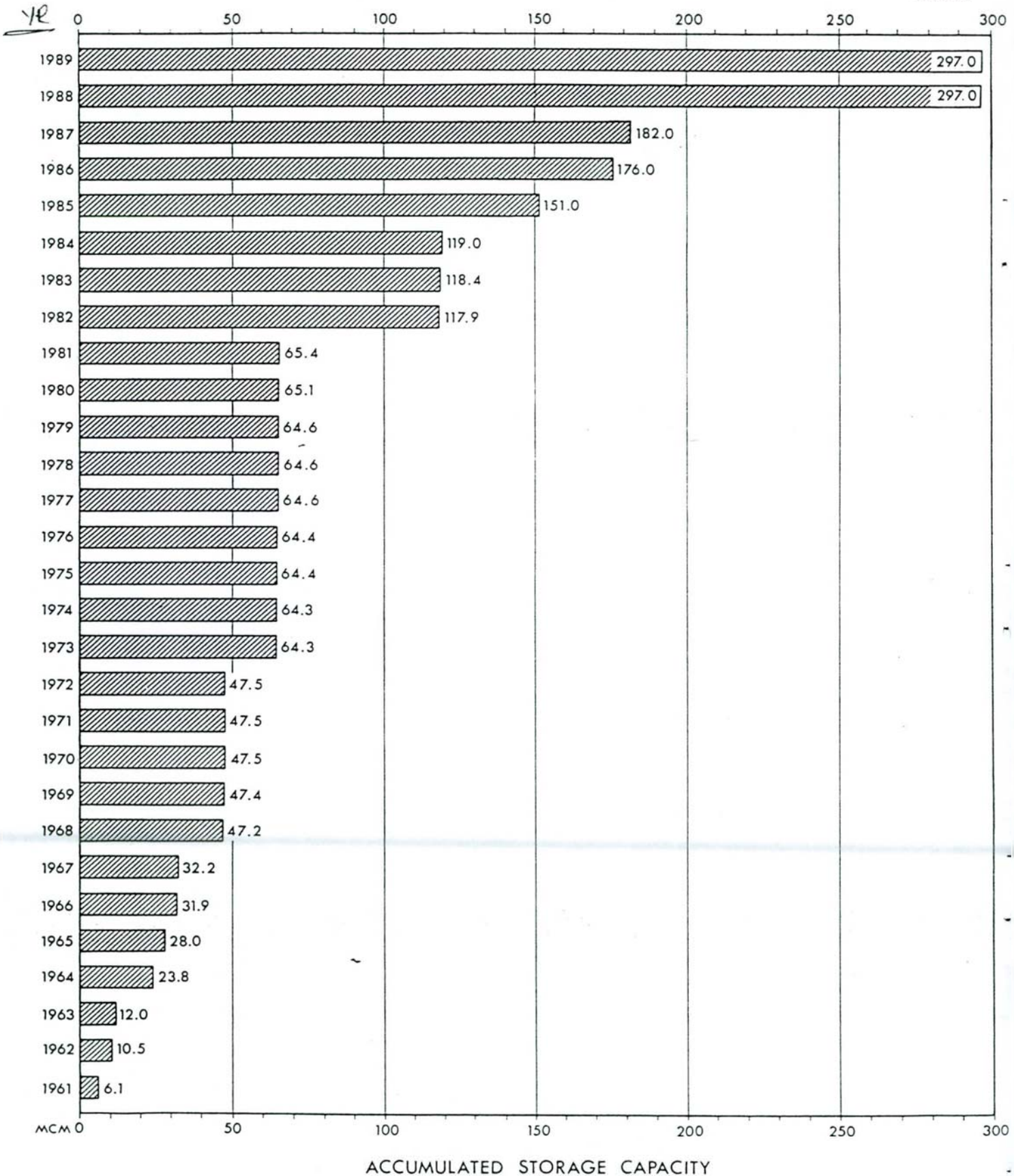
The following section of this report, part II, describes the situation with respect to water and gives a brief review of the main activities of the Department during 1989.



WATER RESOURCES CONSERVATION & DEVELOPMENT
GOVERNMENT INSTITUTIONAL SET UP

DEPARTMENT OF WATER DEVELOPMENT
 PROGRESS IN DAM CONSTRUCTION

AG/IR/80



DAMS CONSTRUCTED UP TO 1960

No	DAM	TYPE	HT 1000m	YEAR	
1	Kouklia	Earth	6	1900	
2	Lymbia	Grav. 5	18	1945	
3	Lythrodhonda	Grav. 11	32	1945	
4	Kalokhorio (KI)	Grav. 9	82	1947	
5	Akroudi	Grav. 7	23	1947	
6	Galin	Grav. 11	23	1947	
7	Petra	Grav. 9	32	1948	
8	Petra	Grav. 9	23	1951	
9	Lythrodhonda	Grav. 10	32	1952	
10	Kalizes	Grav. 23	113	1953	
11	Ayios Loukas	Earth	3	455	1955
12	Gyptos	Earth	3	100	1955
13	Kendou	Grav. 15	34	1956	
14	Perpedhi	Grav. 22	55	1956	
15	Prygos	Grav. 22	285	1957	
16	Trimikini	Grav. 33	340	1958	

Total Storage Capacity 6.174 m³ x 10⁶

MAJOR DAM PROJECTS FROM 1960-70

No	DAM	TYPE	HT 1000m	YEAR	
17	Prodromos	Earth	10	122	1962
18	Morphou	Grav. 13	1,879	1962	
19	Lefka	Grav. 35	368	1962	
20	Geunyei	Earth	15	1,045	1962
21	Athalassa	Earth	18	791	1962
22	Kani Keu	Earth	19	1,113	1963
23	Argaka	Rockfill	41	1,150	1964
24	Mia Milia	Earth	22	355	1964
25	Ovagos	Earth	16	845	1964
26	Kiti	Earth	22	1,614	1964
27	Agros	Earth	26	99	1964
28	Liopetri	Earth	18	340	1964
29	Polemithia	Earth	45	3,864	1965
30	Ayia Marina	Rockfill	33	311	1965
31	Kolopanayiotis	Earth	40	391	1966
32	Mavrokolymbos	Earth	45	2,180	1966
33	Pamos	Rockfill	38	859	1966
34	Yermatoyia	Earth	49	13,600	1968
35	Syngross	Earth	7	1,115	1968

Total Storage Capacity 32.041 m³ x 10⁶

MAJOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT 1000m	YEAR	
36	Ayios Yeoryios	Earth	6	90	1962
37	F'via Antifliad	Earth	8	165	1963
38	Ayios Nikolaos	Earth	2	1,365	1964
39	Paralimni Lake	Earth	1	1,365	1964
40	Fresh Water Lake	Earth	3	4,545	1964
41	Makryta	Earth	8	195	1966
42	Akhna (Metonia)	Earth	4	90	1967
43	Morphou spreading grounds	Earth	5	130	1968
44	Ormidhia	Earth	5	100	1968
45	Vrytaules	Earth	7	140	1969
46	Protospas	Earth	6	90	1970

Total Storage Capacity 8,275 m³ x 10⁶

HT refers to height in meters from foundation
YEAR is the year of completion

Phrenaros (6) means six small dams in Phrenaros area
*Inundated by New Lymbia Dam. See ref. No 69

MINOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT 1000m	YEAR	
47	Sotira	Earth	8	45	1962
48	Panayia (F)	Earth	7	45	1962
49	Paralimni (4,5)	Earth	5	115	1963
50	Ayia Napa (7)	Earth	8	55	1963
51	F'via Recharge	Earth	5	50	1963
52	Phrenaros (6)	Earth	5	115	1964
53	Dherynia	Earth	6	23	1964
54	Phrenaros (3)	Earth	7	45	1966
55	Avgora (7)	Earth	3	68	1966
56	Kandea (2)	Earth	5	82	1966
57	Xylophaghos (4)	Earth	7	86	1966
58	Sotira (4)	Earth	5	32	1966
59	Lysi	Earth	7	77	1967
60	Ay Yeoryios (9)	Earth	3	68	1967
61	Ay Epiktinos (6)	Earth	6	34	1968
62	Akathia (6)	Earth	6	45	1968
63	Akhna (3)	Earth	4	50	1968
64	Xyloymbou (5)	Earth	5	40	1969

Total Storage Capacity 1,075 m³ x 10⁶

MAJOR DAM PROJECTS FROM 1971-80

No	DAM	TYPE	HT 1000m	YEAR	
65	Lefkara	Rockfill	71	13,850	1973
66	Massari Recharge Dam	Earth	15	2,273	1973
67	Palekhori-Kumli	Grav. 33	620	1973	
68	Arakapas	Grav. 23	129	1975	
69	New Lymbia	Grav. 12	220	1977	
70	Ayios Vavatinios	Arch	14	53	1980
71	Ayios Vavatinios	Earth	10	55	1980
72	Ephlagaona No 1	Earth	10	92	1980
73	Khandia	Earth	10	70	1980
74	Melini	Earth	10	59	1980
75	Pelendria	Earth	10	123	1980

Total Storage Capacity 17,544 m³ x 10⁶

MAJOR DAM PROJECTS FROM 1981-90

No	DAM	TYPE	HT 1000m	YEAR	
76	Ephlagaona No 3	Earth	10	65	1981
77	Akaponou-Ephlagaona	Earth	9	132	1981
78	Kato Mylos	Earth	10	104	1981
79	Ephlagaona No 2	Earth	8	127	1982
80	Arakapas	Earth	10	192	1982
81	Asprokremnos	Earth	53	51,000	1982
82	Xylatas	Rockfill	42	1,250	1982
83	Agriothia	Earth	10	59	1983
84	Kyperounda	Earth	10	270	1983
85	Lagouthera	Earth	10	71	1983
86	Ora	Earth	10	62	1983
87	Ayios Vavatinios No 2	Earth	10	43	1984
88	Pharmakos No 1	Earth	10	21	1984
89	Pharmakos No 2	Earth	10	61	1984
90	Arakapas No 2	Earth	8	120	1984
91	Dhirona	Earth	10	159	1984
92	Khirkithia	Earth	10	205	1984
93	Esso Galatia	Earth	10	35	1985
94	Kalavatos	Rockfill	60	17,000	1985
95	Dhyipotamos	Rockfill	60	15,000	1985
96	Evretou	Rockfill	70	25,000	1987
97	Akhna	Earth	16	5,800	1987
98	Aradhippou (Parth)	Grav. 10	90	90	1987

Total Storage Capacity 116,866 m³ x 10⁶

GRAND TOTAL UP TO END OF 1988: 297.0 m³ x 10⁶

Notes
Ref. Nos 71 to 80 and 83-93 are PVC lined earth ponds

Total Storage Capacity 27,675 m³ x 10⁶

TOTAL CAPACITY: 297.0 m³ x 10⁶

MAJOR DAM PROJECTS FROM 1981-90 (Cont.)

No	DAM	TYPE	HT 1000m	YEAR	
99	Kouris	Rockfill	110	115,000	1988

Total Storage Capacity 115,000 m³ x 10⁶

PROPOSED DAMS

No	DAM	TYPE	HT 1000m	YEAR
100	Aradhippou (Rech.)	Earth	14	375
101	Vizakia	Earth	30	900
102	Ayios Theodoros	Rockfill	100	22,500
103	Akaki - Malounda	Earth	39	2,000
104	Xylourikos	Rockfill	39	1,900

Total Storage Capacity 27,675 m³ x 10⁶

TOTAL CAPACITY: 297.0 m³ x 10⁶



- (1) Dams constructed up to 1960
- (17) Major dam projects from 1960-70
- (65) Major dam projects from 1971-80
- (36) Major recharge dams from 1960-70
- (47) Minor recharge dams from 1960-70
- (62) Major dam projects from 1981-90
- (63) Proposed

DEPARTMENT OF WATER DEVELOPMENT
CYPRUS
DAM PROJECTS

DECEMBER 1989

DRG. No AG/IR/77

REGISTRE DES BARRAGES EN
REGISTER OF DAMS IN CYPRUS

Drq.No. AG/IR/68

L I G N E L N O	NOM DU BARRAGE NAME OF DAM	ANNÉE D'ACHÈ- VEMENT YEAR OF COMPLE- TION	SITUATION - LOCATION			SITUATION D'ÉTAN- CHÉTIÉ POSITION AND NATURE OF SEALING ELEMENT	HAUTEUR AU DESSUS DE LA FONDATION HEIGHT ABOVE LOWEST FOUNDATION (m)	LONGUEUR DE CRÈTE LENGTH OF CREST (m)	VOLUME DU BARRAGE CONTENT OF DAM (10 ³ m ³)	CAPACITÉ TOTALE DU RÉSÉROIR CAPACITY OF RESERVOIR (10 ³ m ³)	CAPACITÉ MAXIMALE DES ÉVACUA- TEURS MAXIMUM CAPACITY OF SPILL- WAYS (m ³ /s)	TYPE DES ÉVACUA- TEURS TYPE OF SPILL- WAYS	PROPRIÉTAIRE OWNER	BUREAU D'ÉTUDES ENGINEERING BY	CONSTRUCTEUR CONSTRUCTION BY	L I G N E L N O		
			COURS D'EAU RIVER	VILLE LA PLUS PROCHE NEAREST CITY	ÉTAT PROVINCE OU DÉPAR- TEMENT STATE PROVINCE OR COUNTRY													
1	ABITZEN	1951	Nicosia	Nicosia	PG	R	23	27	4	113	54	L	Lefka Irr. Div.	MDD	MDD	1		
2	KASHARI	1956	Limasol	Limasol	PG	R	15	53	2	36	59	L	Kandou Irr. Div.	MDD	MDD	2		
3	PAPAPHOS	1956	Limasol	Limasol	PG	R	22	62	4	55	107	L	Perapetis Irr. Div.	MDD	MDD	3		
4	PYGOS	1957	Nicosia	Nicosia	PG	R	22	66	5	285	125	L	Pyrgos Irr. Div.	MDD	MDD	4		
5	TRIKLINI	1958	Limasol	Limasol	PG	R	33	76	6	30	59	L	Trinklini Irr. Div.	MDD	MDD	5		
6	ATHLASSA	1962	Nicosia	Nicosia	TE	R/S	18	447	103	793	48	L	Government	MDD	MDD	6		
7	GEORGI	1962	Nicosia	Nicosia	TE	R/S	15	256	50	280	173	L	Georgi Irr. Div.	MDD	MDD	7		
8	LEFKA	1962	Nicosia	Nicosia	PG	R	35	149	11	308	246	L	Lefka Irr. Div.	MDD	MDD	8		
9	SARPHI	1962	Nicosia	Nicosia	TE	S	13	1 436	206	1 879	764	L	Morphou Irr. Div.	MDD	MDD	9		
10	PRODROROS	1962	Limasol	Limasol	TE	R/S	10	756	73	600	-	L	Prodroros Irr. Div.	MDD	MDD	10		
11	KALIA KUDY	1963	Nicosia	Nicosia	TE	R/S	19	311	47	1 113	116	L	Kalia Key Irr. Div.	MDD	MDD	11		
12	AGROS	1964	Limasol	Limasol	TE	R	26	180	61	399	6	L	Agros Irr. Div.	MDD	MDD	12		
13	ARGAKA	1964	Paphos	Paphos	ER	R	41	173	138	1 150	280	L	Government	Howard Humphreys & Sons, UK	MDD	MDD	13	
14	KITI	1964	Larnaca	Larnaca	TE	S	22	990	193	1 614	602	L	Government	Il Nuovo Casatoro, Italy	MDD	MDD	14	
15	LIOPETRI	1964	Famagusta	Famagusta	TE	S	18	579	50	360	150	L	Liopetri Irr. Div.	MDD	MDD	15		
16	MIA MILIA	1964	Nicosia	Nicosia	TE	R/S	22	140	54	355	24	L	Mia Milia Irr. Div.	MDD	MDD	16		
17	OUROS	1964	Nicosia	Nicosia	TE	S	16	743	130	865	786	L	Morphou Irr. Div.	MDD	MDD	17		
18	ATIA HARBIA	1965	Paphos	Paphos	ER	R	33	142	61	311	161	L	Ayia Marina Irr. Div.	Energo projekt, Yugoslavia	MDD	MDD	18	
19	POLEMIKHIA	1965	Limasol	Limasol	TE	R/S	45	196	215	3 864	581	L	Government	Energo projekt, Yugoslavia	MDD	MDD	19	
20	SALOPANAYIOTIS	1966	Nicosia	Nicosia	TE	R	40	137	156	110	207	L	Government	Howard Humphreys & Sons, UK	MDD	MDD	20	
21	MAVROKRYTHOS	1966	Paphos	Paphos	TE	R/S	45	528	267	2 180	340	L	Government	Energo projekt, Yugoslavia	CTBAKU, Cyprus	MDD	MDD	21
22	PPHOS	1966	Paphos	Paphos	ER	R	38	302	153	859	300	L	Pamos Irr. Div.	Energo projekt, Yugoslavia	MDD	MDD	22	
23	VERMASORIA	1968	Limasol	Limasol	TE	R	49	409	539	13 600	850	Y	Government	Energo projekt, Yugoslavia	CTBAKU, Cyprus	MDD	MDD	23
24	LEFKARA	1973	Larnaca	Larnaca	ER	R	74	240	820	13 850	316	L	Famagusta Water Board & Lefkara Irr. Div.	Howard Humphreys & Sons, UK	L. Fairclough UK and HELCON Cyprus	MDD	MDD	24
25	MASARI	1973	Nicosia	Nicosia	TE	S	15	929	245	620	622	Y	Government	MDD	MDD	25		

NOTES:
FOOTNOTES

MDD : Water Development Department
IR. Div. Irrigation Division

REGISTRE DES BARRAGES EN
REGISTER OF DAMS IN CYPRUS

Org. No. AG/IR/69
19

1	2	3	4	5			6	7	8	9	10	11	12	13		14	15	16	17	18	19
				ANNEE YEAR	COURS RIVER	VILLE CITY								ÉTAT COUNTRY	SITUATION TYPE						
1	1	1973	Makki	Sivostia	Sivostia	IV	R	R	33	131	27	620	100	05	I	Government & Fitchhart Irr. Div.	MIP	J & P, Cyprus			
2	2	1975	Kyrenia	Larnaca	Larnaca	IV	R	R	23	97	10	129	20	205	I	Arakapas Irr. Div.	MIP	MIP			
3	3	1980	011-24100m	Larnaca	Larnaca	II	Ip	S	17	125	32	55	5			Palambetia-Sophiolumont Irr. Div.	MIP	Iacovou Bros, Cyprus			
4	4	1980	011-24100m	Larnaca	Larnaca	II	Ip	S	16	390	46	11	11			Kokkinoplia Irr. Div.	MIP	Iacovou Bros, Cyprus			
5	5	1980	011-24100m	Larnaca	Larnaca	II	Ip	S	35	82	41	17	17			Kambos tou Pophtati Irr. Div.	MIP	CYBICO, Cyprus			
6	6	1980	011-24100m	Larnaca	Larnaca	II	Ip	S	22	116	32	59	13			Melani Irr. Div.	MIP	Iacovou Bros, Cyprus			
7	7	1980	011-24100m	Larnaca	Larnaca	II	Ip	S	18	229	59	123	21			Amnos Irr. Div.	MIP	HYSCO, Cyprus			
8	8	1981	011-24100m	Larnaca	Larnaca	II	Ip	S	18	280	67	132	26			Alapinou - Fichtagena Irr. Div.	MIP	Iacovou Bros, Cyprus			
9	9	1981	Kapsalokos	Larnaca	Larnaca	VA	R	R	19	58	2	53	12			Palambetia-Sophiolumont Irr. Div.	MIP	MIP			
10	10	1981	011-24100m	Larnaca	Larnaca	II	Ip	S	23	240	41	106	12			Vatera Irr. Div.	MIP	Phoenix Constructions, Cyprus			
11	11	1982	011-24100m	Larnaca	Larnaca	II	Ip	S	18	119	25	59	12			Kladhos Irr. Div.	MIP	Iacovou Bros, Cyprus			
12	12	1982	Arropomias	Paphos	Paphos	II	R/S	R/S	56*	260	2 097	51 000	2 590	1 484	I	Government	Sir H MacDonald & Partners UK	Joint Venture J & P and HBCO, Cyprus			
13	13	1982	011-24100m	Larnaca	Larnaca	II	Ip	S	27	172	96	273	36			Pterika Irr. Div.	MIP	Iacovou Bros, Cyprus			
14	14	1982	Lagouthera	Sivostia	Sivostia	IK	R	R	42	155	250	1 290	96	100	I	Government	MIP	General Construction Co Cyprus			
15	15	1983	011-24100m	Sivostia	Sivostia	II	Ip	S	36	123	63	106	20			Amnos Irr. Div.	MIP	Joint Venture Phoenix Const. & HBCO, Cyprus			
16	16	1984	011-24100m	Larnaca	Larnaca	II	Ip	S	25	130	30	63	16			Petalia - Pelosato Irr. Div.	MIP	Chr. Charalambos, Cyprus			
17	17	1984	011-24100m	Larnaca	Larnaca	II	Ip	S	26	167	59	159	27			Draastera Irr. Div.	MIP	Ch. Apostolides, Cyprus			
18	18	1984	011-24100m	Larnaca	Larnaca	II	Ip	S	16	460	95	205	11			Irr. Div. to be set up	MIP	Iacovou Bros, Cyprus			
19	19	1985	Pendakinos	Larnaca	Larnaca	IK	R	R	69	390	1 090	15 000	1 180	I	Government	Rode, Kennard & Lapworth & Evans & Partners, UK	Shephard-Hill, UK with C.P. Zachariades, Cyprus				
20	20	1985	Kapsalokos	Larnaca	Larnaca	IK	R	R	57	482	1 200	17 000	1 268	I	Government	Rode, Kennard & Lapworth & Evans & Partners, UK	Joint Venture Phoenix Const. & HBCO, Cyprus				
21	21	1986	Stavros Vias	Paphos	Paphos	IK	R/S	R/S	70**	260	1 400	25 000	360	I	Government	Sir William Halcrow and Partners, UK	Shephard-Hill, UK with C.P. Zachariades, Cyprus				
22	22	1987	011-24100m	Larnaca	Larnaca	II	Ip	S	23	272	210	5 800	35	I	Government	Sir William Halcrow and Partners, UK	Iacovou Bros, Cyprus				
23	23	1988	Kapsalokos	Larnaca	Larnaca	II	R	R	113	550	9 400	115 000	1 250	I/S	Government	Saurabh, Italy with J & P, Cyprus	Impregilo, Italy with J & P, Cyprus				
24	24																				
25	25																				

NOTES

* 100% concrete dam with 20m deep below lowest foundation.
** 100% concrete dam with 10m deep below lowest foundation.

**PART II,
MAIN ACTIVITIES OF
THE DEPARTMENT OF WATER DEVELOPMENT
BRIEF REVIEW**

Introduction

Cyprus is a semiarid island. The temporal and spatial distribution of precipitation is highly erratic. Long periods with no rainfall at all are not uncommon. This together with the fact that there are no rivers with year round flow drove the inhabitants to develop groundwater for higher certainly for their water supplies.

Nonetheless groundwater alone could not meet the growing demands. In order to meet the latter, Cyprus authorities decided to plan and carry out comprehensive development of the Island's water resources. The Department of Water Development played the most important part in this respect. The range of activities of the Department during the early years of Independence focused on the identification, inventory and assessment of the water resources of Cyprus, followed by planning, designing and executing various water works. The successful outcome of all these efforts is confirmed by the fact that about 75% of the Island's water resources have been developed.

Intensive construction activities of water works is reflected by the progress in dam construction. In 1961 the total amount of water stored in dam was about 6 MCM, while by the end of 1989 it reached 297 MCM. This progress is shown on page I-10.

During 1989 the Department of Water Development concentrated most of its efforts on the realisation of the major water development projects the implementation of which is vital to growth in all sectors of development in Cyprus.

The Department's resources were utilised for the execution of the various components of the Southern Conveyor Project (SCP) which is the largest single project ever undertaken by the WDD. Construction work on SCP started in mid 1984 and by mid 1988 several of its components such as the Kouris and Akhna dams, the 115 km long pipeline connecting the two dams were completed. Approximately 95% of the Kokkinokhoria irrigation system was completed and put into operation.

Precipitation during the Hydrological year 1988-89 was 480.5 mm or 93% of the longterm average rainfall 1941-1970. (hereafter referred to as normal).

Kouris Dam was inaugurated on the 22nd of April 1989 by the Presiden of the Republic Mr. George Vassiliou.

Water impoundment in dams during 1989 amounted to 126 MCM up to the end of September 1989 as compared to 188 for 1987-88, 118 MCM for the hydrological year 1986-87, 32 MCM for 1985-86, 43 MCM for 1984-85 and 35 MCM for 1983-84.

A quantity of 133 MCM remained in the dam reservoirs at the end of the hydrological year 1988-89 for over annual storage, compared to 136 MCM for 1987-88, 64 MCM for 1986-87, 20 MCM for 1985-86, 32 MCM for 1984-85 and 23 MCM for 1983-84. Thus the contingency of having over-year storage for years of low precipitation is served well.

During 1989 and for sixteen years running the only access with the northern part of Cyprus, still occupied by Turkish troops since 1974, was through the office of UN Peace keeping Force, for the unified water supply of Nicosia.

Brief review of the main activities of WDD:

Water Resources. The collection and evaluation of hydrological data continued through 1989 covering also the requirements of the major projects.

The general conclusion obtained from the study of 61 river flow gauging stations is that the flow in most of them was about normal. In December 88 - January 89 high precipitation was recorded, but precipitation for the whole year was below average.

No substantial changes were noted on the ground water level of most aquifers. The situation however, in some places i.e. Kokkinokhoria remained critical.

The hydrometeorological situation summarised below refers to the southern part of the Island, as the northern part is still under the occupation of Turkish troops and no such data are available to us.

The precipitation during the hydrometeorological year 1988-89 averaged 480.5 mm which is 93% of normal. The total precipitation amounts during the period under review were below normal in most areas and ranged between 75% and 100% of normal.

The maximum amount of rainfall in a 24 hour period was 151.6 mm, recorded on the 9th of January 1989 at Platania climatological station.

The first snowfall occurred on Mount Olympus, the highest peak of Troodos mountain range, on the 18th November 1988 and the last snowfall on the 14th March 1989.

The air temperature as a whole was below normal. The extreme maximum temperature was 42.5°C recorded at Nicosia town Climatological Station on the 15th July 1989 and the extreme minimum temperature was 8.5°C recorded at Prodromos on the 12th February 1989.

The maximum annual evaporation measured from a U.S.W.B. pan was 2269 mm recorded by Larnaca Airport Synoptic Station and minimum annual evaporation was 1289 mm at Stavros Psokas.

Hydrology. The Division of Hydrology and Water Resources Management which was established in 1982, continued in 1989 the formulation of methodology and processing of hydrological and hydrogeological data with the aim of providing the Department with the basic information about the water resources of the island so that decisions could be made on the exploitation, additional development and allocation for use of these resources.

Appraisal of the exploitation and development of water resources and its consequences as to quantity and quality as well as management and conjunctive use is carried out through the latest techniques including radioisotopes and mathematical models.

Some highlighted activities of the Division during 1989 were:

- Hydrology of Ayios Mamas tributary for Gourri dam at Kaoukaridhes;
- Hydrology of Kryos river for the diversion to the Sylikou ponds;
- Surface runoff evaluation for the Pyrgos-Moni river at the Nicosia-Limassol Highway bridge;
- Hydrology of Avgas river at Pano Arodhes;
- Preparation of input data and initiation of calibration runs for runoff simulation at Kryos Nero, Akaki, Peristerona and Pouzis rivers;
- Hydrological data update for rainfall and observed flows;
- The water balance of the Akrotiri Salt lake;
- Inventory of wells and groundwater conditions at Kokkinokhoria area;
- Inventory of wells and groundwater use in the Akrotiri aquifer;
- Use of radioisotopes in Hydrology;
- The developing groundwater conditions in the Akrotiri aquifer;
- The developing groundwater conditions in the Kokkinokhoria area;
- The groundwater conditions in the Kiti-Pervolia aquifer;
- The groundwater conditions in the Pareklisia aquifer;
- Phini-Mylos proposed dam-leakage assessment;
- Southern Conveyor Project new studies;
- The hydrological conditions at Akhyritou-Dherinia area;
- The water supply of Paphos and Lower Villages from Xeropotamos river;

- Evaluation of the feasibility for artificial recharge at the Anglisidhes area;
- Operation of the Yermasoyia reservoir and aquifer;
- Releases from the Asprokremmos reservoir;
- Kouris Delta Emergency scheme (monitoring);
- Phassouri recharge pond (monitoring);
- Management study of the Kryos Watershed water resources;
- Akhna reservoir seepage monitoring;
- Flood evaluation at Kyros stream at Ayia Mavri;
- Flood estimates for the ash disposal site for the proposed Vasilikos Power Station;
- Flood evaluation at Nicosia-Limassol road bridge on Pyrgos Moni river;
- Seepages at Kouris dam;
- Computer software application and development.

Planning of Projects. A great number of applications by villages for the planning of major water works have been dealt with during 1989 by the Planning Division. Most were only examined at the spot and some others were studied further at preliminary or feasibility level.

A general outline of the Planning of Projects carried out follows.

Krasokhoria Integrated Rural Development Project, the original design for a rockfill dam at Xylourikos was undertaken by the British Consultants who had prepared the feasibility designs. After the decision to increase to more than twice the reservoir capacity due to unforeseen technical problems arising in the design, new design has to be done till 1990 for a concrete gravity dam. The Planning Division carried out the design for the irrigation component of the Project which includes the conveyance and distribution of water to the irrigation areas as well as a cost estimate and the economic evaluation both for this part of the project as well as for the Project as a whole. This study together with recommendation for proceeding the Project further have been submitted to the M.A. & N.R.

Karyotis Project. During 1989 the implementation of the Karyotis project was under consideration by the Government. The economics, of the project and the various possibilities for the assignment of the detailed designs to Consultants were issues brought to the Council of Ministers. Furthermore contacts were made with the Soviet Consultants for the possibility of continuation of the project designs.

Design of Projects. During 1989 the Design Division was involved with the appointed Consultants for the preparation of the final designs of the various components of the Second Phase of the Southern Conveyor Project. In addition, the designs or studies of other schemes started or were completed. Such schemes were Vizakia Irrigation, Athienou Irrigation, Aradhippou recharge dam, new pipeline for Larnaca Water Supply, new pipeline connecting Lakatamia and Engomi reservoirs, pipelines to and from Limassol Water Treatment Plant and reservoir for the water supply of the new industrial area of Limassol.

Construction of Projects. Construction expenditure of the Department during 1989 reached the amount of £14,524,990 against £18,362,857 for 1988 (See table VII-1 under DIVISION OF CONSTRUCTION).

A general description of the major water resources Projects constructed is given below. Location of the projects is shown on page I-3 together with the principal physical features.

Southern Conveyor Project. Phase I: Kouris Dam. Construction of Kouris Dam, which is the largest dam in Cyprus and constitutes the main water source of the Southern Conveyor Project, started in September 1984 and was substantially completed by September 1988. It is a 115 m high earth dam with a central clay core, a total fill volume of 9.4 MCM and a reservoir capacity of 115 MCM.

Various works were completed during 1989 such as the asphalt access road, surface runoff drainage canals, the meteorological station and several other remedial works.

During 1989 works continued in the evaluation of the Contractors claims.

Main Conveyor. Construction work for the 1400-800 mm dia, 115 km long Ductile Iron (DI) pipeline from Kouris Dam to Akhna Dam started in October 1985 and was substantially completed by mid 1988.

During 1989 the Contractor carried out remedial work on certain structures pointed out by the supervising staff. After ascertaining that the work was completed the Consultants are preparing the issue of a final completion certificate.

During 1989 the site staff carried out measurements and was involved in the evaluation of the claims submitted by the Contractor. This evaluation is estimated to be completed by mid 1990.

Akhna Dam was completed in December 1987. It has a capacity of 5.8 MCM and it acts as a balancing reservoir for water conveyed from Kouris Dam to the Kokkinokhoria irrigation area. It must be mentioned here that water can be drawn also directly from the main conveyor.

Three construction contracts of a total value of £5.25 million for the construction of the Kokkinokhoria Irrigation System commenced in March-April 1987 as follows:-

- (i) Construction of four balancing reservoirs awarded to G P Zachariades. These reservoirs were completed by the middle of 1989.
- (ii) Construction of 15 reservoirs for the 15 central distribution points of the Kokkinokhoria distribution system awarded to CYBARCO. All of these reservoirs were completed in April 1989.
- (iii) Construction of 19 pumping stations 15 of which belong to the central distribution points, 3 to the balancing reservoirs and one to Akhna dam awarded to the Chinese firm China Water + Electric who have already delivered all of them for pump installation. When the electromechanical installations are completed China Water will return to carry out all necessary finishing work. Four of the pumping stations will be ready for commissioning in January 1990. By mid 1990 all the pumping stations will be in operation.

The construction of Kokkinokhoria Distribution Network main and secondary pipelines was undertaken by the Construction Division of the Department in June 1986 at an estimated cost of £5.5 million. By the end of 1989 approximately 95% of the network was completed and the remaining part is expected to be completed during the beginning of 1990. The main pipeline of 1000-300 mm dia AC pipes are 30 km long and the secondary pipelines of 600-80 mm AC pipes are approximately 250 km long.

Construction of the Tertiary Irrigation Network started in September 1989. This work is also being carried out through direct labour by the WDD at an estimated cost of £3.5 million and is expected to be completed by mid of 1991.

Utilisation of SCP water during 1989. As from May 1988 it was possible to supply water for the irrigation of an area of 7383 ha by auxiliary pumping sets and temporary by-passes. A total quantity of 12.8 MCM was supplied to farms belonging to the communities of Akhna, Avgorou, Xylophaghrou, Ormidhia, Liopetri, Sotira and Phrenaros. An additional quantity of 3.97 MCM was stored in Akhna Dam. At the same time a quantity of 0.99 MCM was made available for irrigation in other areas such as Kiti, Mazotos, Alaminos, Meneou etc. A quantity of 10.8 MCM was released from Kouris Dam for irrigation and recharge in the Akrotiri Delta. An additional quantity of 3.2 MCM was supplied from Kouris Dam for the water supply of Larnaca and Famagusta through Khirokitia Treatment Plant.

SCP Supply Contracts: By the end of 1989 most of the supply contracts for SCP have been executed. These were for the supply of DI pipes for the main conveyor (£19 million) pumping equipment (£3 million) and AC pipes, valves, water meters, farm hydrants etc. (approx. £5.6 million).

The total expenditure for SCP upto the end of 1989 including expenditure for design work etc. of the SCP 2nd phase is estimated at £82 million.

Southern Conveyor Project - Phase II. Dhiarizos Diversion. The construction drawings and contract documents were completed and by the end of 1988 prequalified Contractors were invited to submit tenders. On the 1st December 1989 a contract was signed with the Joint Venture Meyreder Craus/G.P. Zachariades of a value of approximately £12 million with construction work scheduled to start early in 1990.

Limassol Water Treatment Plant. On the 19th of October 1989 a contract was signed with a British firm of a value of £5,133,784 out of which a sum of £1,171,315 (St£1,470,000) is granted by the British Government. Charilaos Apostolides of Cyprus has undertaken to build the structures of the Treatment Plant which is scheduled to start functioning by April 1992.

The Irrigation Distribution Systems of Kiti area (1600 ha) Mazotos area (660 ha) and Parekklissha area (320 ha) are in the process of the preparation of detail designs. Regarding the Akrotiri area (1755 ha) distribution system, construction drawings and tender documents have been completed and it is expected that by the beginning of 1990 tenders will be invited for the construction of these distribution networks and for the supply of materials. The laying of the main conveyors of the irrigation network which has been undertaken by the WDD Limassol regional Office has been completed.

Tersephanou Water Treatment Plant and Tersephanou-Nicosia Conveyor Pipeline. Tender documents are being prepared for the supply and installation of the electro-mechanical equipment for the Tersephanou Treatment Plant whereas for the Tersephanou-Nicosia pipeline the detail drawings have been completed. Prequalified contractors will be invited to submit tenders at the beginning of 1990.

Khrysokhou Irrigation Project (KIP) 1st & 2nd Phase. The main construction activities during the year 1989 were limited to the works for replacement of the Pomos open canal by a Pipe Conveyor which forms part of Phase II of the Project.

Apart from the above the Department still has to undertake installation of the irrigation networks over a total area of about 300 ha for the villages of Peristerona, Simou, Philousa and Argaka. Purchase of all necessary pipes and other equipment has been completed but the installation works had to be postponed for 1990 due to a delay in commencing works for the construction of farm access roads.

project expenditure up to the end of 1989 reached the total sum of £16 million while the total cost for full completion of both phases of the project is estimated at £20.5 million.

Operation and Maintenance-Domestic Water Supplies. The rainfall during 1988/89 winter season was below normal and consequently the quantities of water impounded in the various dams were small. However the water supply demand was met satisfactorily due to the existing stocks of water impounded during the previous year.

The Department of Water Development is responsible for the management, operation and maintenance of the Nicosia Water Supply System comprising all sources of water supply for Nicosia including the treatment and conveyance of the water to the service reservoirs at the outskirts of the town. The water is sold in bulk to the Nicosia Water Board at the service reservoirs. The Nicosia Water Board undertakes the distribution of water within the area of supply. Responsibility for the distribution of water within the old, walled city is borne by the Nicosia Water Commission which operated its own sources up to October 1988. This division of responsibility has been in force since early 1980 when, by decision of the Council of Ministers, the Nicosia Water Board extended its area of supply to cover the area of the Greater Nicosia Scheme.

The total quantity of water produced by the Nicosia Water Supply System in 1989 was 13.082MCM out of which 12.273MCM came from government sources and 0.808MCM was purchased from private sources. A further quantity of 0.001MCM was the yield of the Nicosia Water Commission sources. Included in the government sources is a quantity of 0.844MCM produced by the 1982-1984 emergency schemes. Of the total production, the quantity of water delivered to the Nicosia service reservoirs was 12.106MCM. A quantity of 1.135MCM was consumed en route by a number of villages, camps and industries connected to the system. The total expenditure during 1989 for the operation and maintenance of the Nicosia Water Supply System was £724,108 and the revenue generated from the sale of water was £2,226,417 including outstanding accounts.

The Department is also responsible for the management, operation and maintenance of the Central Water Supply System which includes a number of borehole sources at Khirokitia, Skarinou, Alethriko, Anglisidhes and Klavdhia, a Water Treatment Works at Khirokitia fed from Yermasoyia and Kalavastos Dams and the Southern Conveyor and a number of major conveyors extending from Yermasoyia to Famagusta.

The Central Water Supply System supplies water to Famagusta and Larnaca towns and a number of villages and Refugee Housing Estates in the Districts of Larnaca and Famagusta. The total quantity of water produced by the system was 8.58MCM. The quantity of water drawn from Yermasoyia, Lefkara and Kalavastos Dams and the Southern Conveyor was 0.16, 0.13, 4.45 and 2.93MCM respectively (net of losses at the treatment works). The total expenditure for

the operation and maintenance of the system during the year was £351,900 and the revenue generated £2,006,304 (including outstanding accounts).

Water continued to be supplied to the Turkish sector of Nicosia and the occupied town of Famagusta although no payment is being received for the supply.

The total quantity of water delivered to the Nicosia Water board service reservoirs was 12.106MCM which corresponds to the unrestricted demand of the town, as there was no deficit. No restrictions on the hours of supply to Nicosia town were imposed.

The Water Board of Limassol controls both the sources of supply and the distribution system of the town. The water supply demand was met satisfactorily and the town enjoyed a regular supply throughout the year. The total quantity of water produced from all sources during 1989 was 11.062MCM.

The town of Larnaca received 2.63MCM of water from the Central Water Supply System and the production of its own and leased sources was 1.22MCM totalling 3.85MCM. This quantity could meet the demand of the town and the Water Board of Larnaca did not have to impose restrictions on the supply.

Paphos Water Supply comes under the direct control of the Municipality. The water supply sources of the Municipality met satisfactorily the demand and the water supply of the town was not augmented this year from the Paphos Lower Villages Scheme. The total quantity of water available to the town during the year was 2.17MCM which could meet the increased demand and no restrictions were imposed on the supply.

The Department is also responsible for the operation of a number of Regional Water Supply Schemes. these schemes are "Paphos Lower Villages", "Ambelitis", "Arminou", "Timi" and "Phrenaros".

Operation and Maintenance of Projects -Irrigation Works. The management of major irrigation works is done either by the WDD or by the Government Water Works Committees as the case may be whilst the management of small irrigation and village water supply schemes is done by the District Administration and local committees, under the supervision of the District Administration and with the technical assistance of the WDD.

In the year under review the total water available in all dams, water extracted from boreholes and water taken from river diversions in Cyprus, in the Governmnet controlled areas, amounted to 234.775 MCM. From this quantity a total of 95.968 MCM were utilized i.e. 53.217 MCM were used for the irrigation of 9897 hectares, 15.408 MCM were used for domestic water supplies and 27.343 MCM were used for recharge. From the remaining 138.807 MCM, 123.571 MCM were retained in the dams as over-annual storage and the rest 15.236 MCM were lost in the distribution systems or lost in the form of leakages. Another 2.761 MCM seeped through or below the dams and 12.702 MCM were lost as evaporation.

Water available for utilization from Government Projects reached the figure of 221.455 MCM. Out of this only 83.638 MCM were utilized, 48.159 MCM for irrigation 15.408 MCM for domestic water supply 20.071 MCM for recharge. Irrigation water was utilized for the irrigation of 8284 hectares of land planted with citrus, bananas, vines, deciduous, vegetables, potatoes, cereals and olives. The gross income from the sale of water amounted to £2,418,987 not including water for domestic use shown elsewhere. The total operation, maintenance and energy costs amounted to £1,023,781 and the net income to the Government was £1,395,206. The Operation, Maintenance and Energy expenses breakdown is as follows: Operation £425,128, Maintenance £762,022 and Energy cost £177,631.

Water available for utilization from contributory schemes was 6.048 MCM out of which 5.058 MCM were used for the irrigation of 1,613 hectares.

Recharge works in the Government controlled areas represent only 13.1% of the total recharge capacity available in Cyprus. In the year under review a quantity of 7,272 MCM was collected in the recharge dams.

Due to Flood Damages in January 1989, a total amount of £39,805 was spent for the antiflood works.

International Hydrologic Program. The main objective for the I.H.P. which is the major component of UNESCO's Water Resources program is to develop a scientific and technological basis for the rational management of water resources both as regards quantity and quality. The Cyprus National Committee for the I.H.P consists of the following:

Chairman

C. St. Lytras, Director of WDD

Secretary

I. St. Iacovides

Members

The Directors of

Agricultural Research Institute,
Department of Agriculture,
Department of Forests,
Geological Survey Department,
Meteorological Service

During the year a number of questionnaires and data were prepared and supplied as requested by the IHP Secretariat of UNESCO regarding on going activities of the program. The Cyprus National Committee is convened only when special cases arise.

International Atomic Energy Agency (IAEA). The IAEA continued to support studies and research on the use of radioisotopes in hydrology in Cyprus through their Regular Technical Assistance Program and also through the Research Contracts Program.

The study of "Isotopes in Hydrology-Kouris Delta", initiated in 1982 and continued in 1983 was extended to cover the whole of the Akrotiri aquifer in 1984. This has continued through 1989. In the same year a research contract was initiated for the "Use of isotopes in the operation and management of the Yermasoyia aquifer". In 1988 a final report (H/89) was prepared and submitted to IAEA and a supplementary report (H/82) was submitted in 1989. These two studies are being carried out with I S Iacovides, Senior Hydrogeologist as the chief investigator. The IAEA, besides the technical assistance and analytical facilities that it offers, it provides considerable support in equipment.

A new project was initiated in 1989 concerning the use of radioisotopes in the evaluation of leakages from dams.

Furthermore, samples for isotopic analysis were obtained and analyzed in the IAEA laboratories in Vienna in connection to the Evretou, Akhna and Kouris seepage studies.

International Commission on Large Dams. The International Commission on Large Dams (ICOLD) is a non-profit seeking organization with 75 member countries. As set out in its constitution: "The objects of the Commission are to encourage improvement in the design, construction, maintenance and operation of large dams by bringing together information thereon and by studying questions relating thereto".

The Cyprus National Committee on Large Dams (CYNICOLD) was elected to full membership of ICOLD in 1969. During 1989 the National Committee was composed of the following:

Chairman

C St Lytras, Director, WDD

Vice-Chairman

K C Hassabis, Assistant Director, WDD

Secretary

N P Stylianou, Senior Water Engineer.

Members

Dr C A Christodoulou, Principal Water Engineer, WDD.

Chr Marcoullis, Senior Water Engineer, WDD.

A Papadopoulos, Representative of the Association of Civil Engineers and Architects.

During the year the secretary continued the exchange of correspondence with the Central Office of ICOLD in Paris and its technical committees and has both received and supplied technical information on dams and related subjects. The Departmental Technical Library has been enriched by the addition of several recent ICOLD publications.

The 57th Executive Meeting of ICOLD was held in Copenhagen (Denmark) between 7 and 8 July 1989. The Executive Meeting selected the following Technical Questions or topics for the 17th Congress which will take place in Vienna 1991.

Question 64: Environmental Issues in Dam Projects.

Question 65: Ageing of Dams and Remedial Measures.

Question 66: Dams on Difficult Foundations.

Question 67: New Developments for Fill Dams and Fill Cofferdams.

The Cyprus National Committee was not represented at this Executive Meeting.

The 58th Executive meeting of ICOLD with Associated Meetings of the Technical Committees and Symposium will be held in Sydney (Australia) in May 1990.

Meetings of the Director with the staff etc.

Several meetings were held during the year under the chairmanship of the Director with the Heads of the various Divisions, Regional Engineers as well as with other members of the staff to discuss various aspects of works and personal matters. Interdepartmental meetings with the Departments of Agriculture, Forests, ARI, the Geological Survey Department, Meteorological Office, Fisheries Department and the District Administrations were also held during the year.

The Director briefed the President of the Republic Mr. George Vassiliou during his visit to the Department on the 13th January 1989, about the present activities of the Department of Water Development.

Staff Matters

Appointments. Charalambos Chr. Omorphos to the permanent post of Executive Engineer II, on probation, with effect from 1.2.89.

Sophia-Evangelia Taraktsoglou Georghiou to the permanent post of Sanitary Engineer II with effect from 15.4.89.

Charalambos HjiPakkos to the permanent post of Sanitary Engineer II, on probation, with effect from 15.4.89.

George Kouppis, Louiza Parouti, George Economou, to the permanent post of Technician 2nd Grade, on probation, with effect from 8.11.85.

The following were appointed to the permanent post of Foreman, on probation with effect from 3.10.89.

Andreas Mitas	Demetris Pavlides
Andreas Antoniou	Andreas Sofocleous
Andreas Yiakoumi	Soteris G. Tsiakka
Panais Yiannakou	Christodoulos A. Christodoulou
Kyriakos Evlavi	Demetris Paschalides
George Theophanous	Panayiotis K. Karayiannides
Anastasios Okkarides	Andreas G. Polydorou

Acting Appointments. Kyprianos Hassabis as acting Director for the period between 2.11.89-11.11.89.

Promotions. To the permanent post of Senior Water Engineer with effect from 1.2.89.

Charalambos Kridiotis	Elias Kambourides
Demosthenis Patsalides	Kyriacos Spanos

To the permanent post of Clerk 1st Grade, G.C.S. with effect from 1.4.89.

Myrianthi Michaelidou	Theonitsa Constantinou
Maria Ioannou	Maria Ermolaou
Margarita Malekkou	Varnavas Papanicolaou
Maria Karaoli	Panayiota HjiLoizou

Kyriaki Ioannou Kalyva to the permanent post of Chemist I, with effect from 1.4.89.

Andreani Nicolaou to the permanent post of Executive Engineer I, with effect from 1.9.89.

Kyveli Panayiotou to the permanent post of Stenographer Greade I, General Clerical Staff with effect from 1.8.89.

Andreas N Eleftheriou to the permanent post of Technical Superintendent with effect from 15.9.89.

Chrysanthos Kommatos, George Socratous, to the permanent post of Assistant Chief Foreman with effect from 15.9.89.

Kosmas Karayiannis to the permanent post of Chief Foreman with effect from 15.9.89.

Retirements. Costas Matheou, Chief Foreman with effect from 1.1.89.

Nicolas Christou, Foreman with effect from 1.1.89.

Savvas HjiPavlou, Technical Superintendent with effect from 1.5.89.

George Mamantos, Assistant Chief Foreman with effect from 1.8.89.

Phidhias Metaxas, Assistant Chief Foreman with effect from 1.10.89.

Deaths. Neophytos Orphanides, Foreman on 9.11.89.

Resignations. Costas Themistocleous, Technician 2nd Grade, on a casual basis, with effect from 1.1.89.

Elias G. Elia, Technician 2nd Grade, on a casual basis, with effect from 15.5.89.

Dionysis Mavronicolas, Executive Engineer II, on a casual basis, with effect from 24.10.89.

Philippos Nicolaou, Technician 2nd Grade, on a casual basis with effect from 29.11.89.

Pavlidis Demetrios Technician 2nd Grade, on a casual basis, with effect from 2.10.89.

Transfers. George Charalambous, Messenger to, this Department with effect from 19.1.89.

Ioannis Vilanides, Accounting Officer I, to this Department with effect from 16.1.89.

Vassos Mavrakis, Administrative Officer, to Aliens Department with effect from 9.2.89.

Ivi Constantinidou, Clerk 2nd Grade, General Clerical Staff, to Ministry of Agriculture and Natural Resources with effect from 16.2.89.

Mamas Malais, Clerk 2nd Grade, General Clerical Staff, to this Department with effect from 16.2.89.

The following Executive Engineers I to District Office of Water Development Department Paphos with effect from 3.4.89.

Nicodemos Nicodemou
Soteris Paschalides

Demosthenis Antoniou
Georgoulla Chrysostomou

Kyriaki Panayiotou, Technician 1st Grade, to the District Office Water Development Department Paphos with effect from 3.4.89.

Eleni Kyriacou, Technician 2nd Grade, to the District Office Water Development Department Paphos with effect from 3.4.89.

Marikka Christodoulou, Clerk 2nd Grade, General Clerical Staff, to the District Office Water Development Department Paphos with effect from 14.3.89.

Maroulla Drousiotou, Clerk 2nd Grade, General Clerical Staff, to District Land Consolidation Office Paphos with effect from 14.3.89.

Koulla Kourouklari, Clerk 2nd Grade, General Clerical Staff, to this Department with effect from 17.5.89.

Andreana Sevastedou, Clerk 1st Grade, General Clerical Staff to the Ministry of Education with effect from 17.5.89.

Elias Kambourides, Senior Water Engineer as District Engineer of the District Office Water Development Department Limassol with effect from 1.7.89.

Demosthenis Patsalides, Senior Water Engineer as District Engineer of the District Office Water Development Department Larnaca with effect from 1.9.89.

Anthoulla Symeou, Executive Engineer I, to the District Office Water Development Department Larnaca with effect from 1.7.89.

Andreas Thodorou, Senior Technician to the District Office Water Development Department Larnaca with effect from 1.7.89.

Constantinos Lambrides, Ioannis Kolokotronis, Technicians 2nd Grade, to the District Office Water Development Department Larnaca with effect from 1.7.89.

Andreas Demetriou, Executive Engineer I, to the District Office Water Development Department Larnaca with effect from 3.10.89.

Phivos HjiIoannou, Technical Superintendent to Headquarters Nicosia with effect from 3.10.89.

Xanthippi Zenonos, Clerk 2nd Grade General Clerical Staff to the Ministry of Foreign Affairs with effect from 3.10.89.

Costas Savva, Superintendent of Accounts to the Forest Department with effect from 20.11.89.

Demetris Patsias, Accounting Officer 2nd Grade to this Department with effect from 20.11.89.

Postings. Mr Kyriacos Spanos, Senior Water Engineer, as District Engineer of District Office Water Development Department Paphos with effect from 15.3.89.

Scholarships and study leave. Christodoulos Christodoulou, Principal Water Engineer has been granted a scholarship offered by the Government of Germany for a ten days course on Safety of Dams between 16.10.89-22.10.89.

Adonis Georghiou, Geologist I, has been granted a scholarship offered by the Government of Austria between 21.8.89-30.9.89 for training on Groundwater Training Techniques.

Sophia-Evangelia Georghiou, Sanitary Engineer II, has been granted a scholarship offered by the Council of Europe between 2.10.89-12.12.89 for an Intensive Short-Training course for Operations Managers of Waste Water Treatment Plants at Opatija - Yugoslavia.

Nicolas Christophides, Executive Engineer I, completed his studies in Msc Construction Engineering and resumed his duties on 23.10.89.

Odysseas Odysseos, Technician 2nd Grade, has been granted study leave in U.K. to obtain a B.sc degree in Quantity Surveying.

Seminars, Conferences, Duty Abroad. Constantinos Lytras, Director, visited Greece between 11.4.89-15.4.89 to deliver a lecture on the subject "Water Development in Cyprus".

Dedalos Kypris, Senior Hydrogeologist, visited Palma Mayiorka between 20.4.89-22.4.89 to attend the Meeting of the Mediterranean Water Institute.

Kyprianos Hassabis, Assistant Director, Savvas Theodosiou, Mechanical Engineer I, visited London-Reading-Coleford between 10.4.89-15.4.89 for Final Inspection of Pumping Units for Contract S3.

Constantinos Hadjisavvas, Mechanical Engineer I, Efstathios Efstathiou, Technician II, visited Milano-Italy, between 19.2.89-5.3.89 for training on Kouris dam Valve Chamber lift.

Constantinos Hadjisavvas, Mechanical Engineer I and Andreas Yiangou, Technician II, visited Israel between 2.4.89-12.4.89 to participate in lectures and practical works in Bermad's International Seminar on Operation and Maintenance of Control Valves.

Vlasis Partassides, Executive Engineer I, Sofoclis Aletraris, Topographer Irrigation Engineer I, Elias Eliades, Technical Superintendent, visited Salonica between 2.5.89-7.5.89 in order to witness to testing of Hydrants for Southern Conveyor Project - Contract S6.

Constantinos Lytras, Director, visited Greece between 5.6.89-7.6.89 and signed an Agreement between the Government of Greece and Cyprus which provides for the Department of Water Development to be the Consultant for the Geotechnical, Civil and Hydraulic Engineering for the construction of two ponds on the islands of Lesbos and Samos.

Maria Zachariou, Executive Engineer I, visited Norway between 23.6.89-28.6.89 to participate at the International Conference on Operation and Maintenance of small biological sewage treatment plants.

Costas Andreou, Senior Water Engineer, visited Split Yugoslavia to participate to the workshop on the Codes of Practice for Solid and Liquid Waste Management in the Mediterranean Region between 25.9.89-28.9.89.

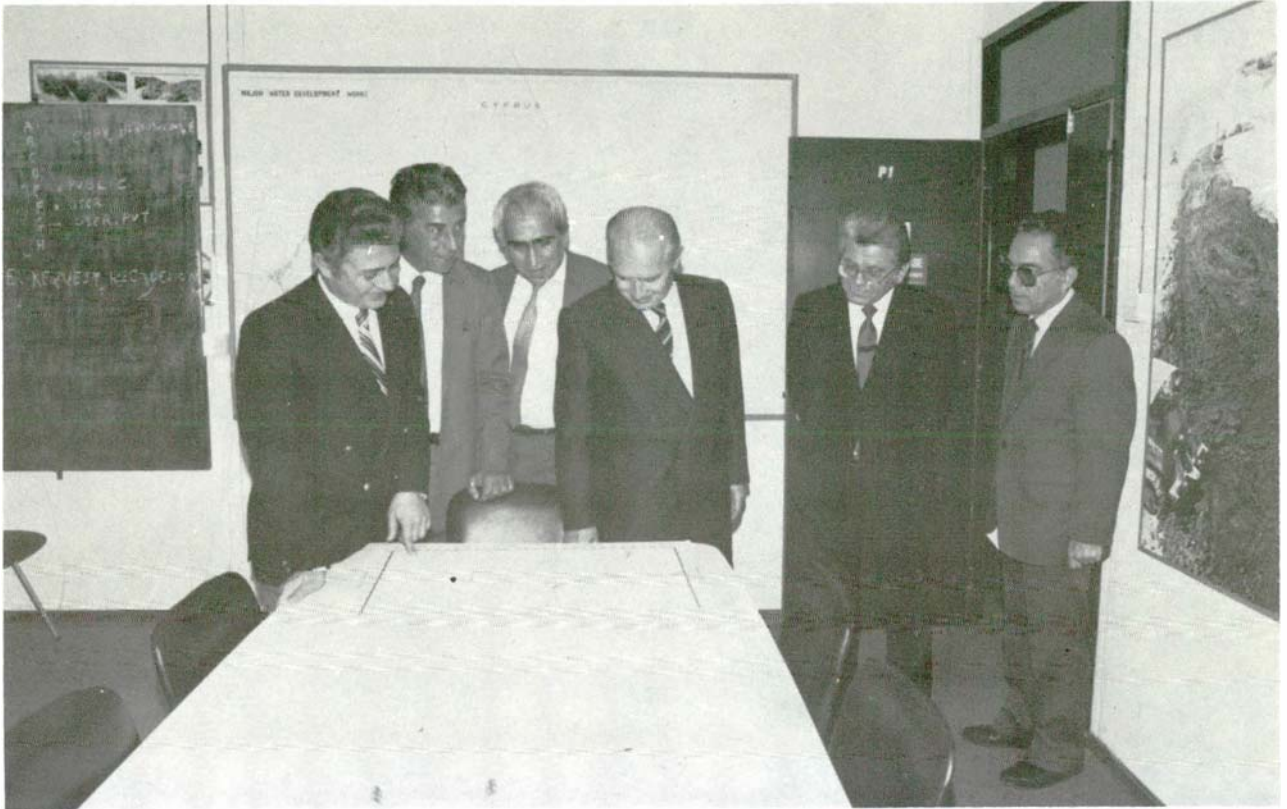
Kyprianos Hassabis, Assistant Director, visited Italy from 10.9.89 -16.9.89 to participate as a delegate to the International Colloque about Irrigation in Developing Countries.

Antonis Ellinas, Technician 2nd Grade, Marinos Michael, Technician 2nd Grade, Costas Avlonitis, Assistant Chief Foreman, visited Greece between 3.9.89-28.9.89 for Inspection of the manufacture of Hydrants for the Southern Conveyor Project Kokkinokhoria.

Christodoulos Artemis, Senior Water Engineer, Savvas Theothosiou, Mechanical Engineer II, between 1.10.89-7.10.89 inspect with Manager of Nicosia Water Board in England and Italy tenderers for the provision of Telemetry System for Nicosia Water Supply network.

Constantinos Lytras, Director, visited the Sultanate Oman between 9.10.89-16.10.89 as a member of a delegation of Specialists under the Minister of Agriculture and Natural Resources to provide services within the context of the Agreement for Technical and Scientific Cooperation.

Elias Kambourides, Senior Water Engineer, visited Milano Italy and London England between 13.11.89-18.11.89 to participate at the International Meeting World Water 1989 and visit the Seli Co. for Scada Systems.



The President of the Republic Mr. George Vasiliou visited the Department of Water Development on the 13th January 1990. The President was briefed by the Director on the activities of the Department.
WDD Photo F65EN-16&19 (13.1.89).



Finance, Expenditure and Revenue

During the year 1989 the total actual expenditure by the Department from WDD budgeted and other non-budgeted votes amounted to £20,094,505 out of a total budget of £29,343,890.

The general picture is as follows:

TABLE I-1
GENERAL BUDGET-EXPENDITURE FIGURES FOR 1989

Description	Budget £	Expenditure £
a. WDD Development Estimates		
Govt. £17 115 245		11 842 240
including loans)		
Loan: 1 549 745		674 079
Total	18 664 990	<u>£12 516 319</u>
b. WDD Ordinary Estimates	5 968 459	5 382 078
c. Non-budgeted votes for Pitsi- lia Project, refugee housing estates, works for other Government Departments, private developers and village deposits	<u>2 710 441</u>	<u>2 196 108</u>
Total	£27 343 890	£20 094 505

For the level of expenditure on construction works carried out during 1989 from WDD and other votes, see table VII-1 under CONSTRUCTION DIVISION

The largest single item of expenditure was for the Southern Conveyor Project at £9,406,098.

Loan Proceeds

Description of loans	Amount withdrawn during 1989 £
- Loan No. 2279 CY(IBRD) US\$ 16,000,000 for Khrysokhou Irrigation Project	123 537

Loans for SCP

	Amount received in 1989 £
- Loan No. 2386 CY from IBRD US\$27,000,000	520 242
- Loan No. 1.2109 from E.I.B (Major Loan) ECUS 26,500,000 (Completed)	2 380 807
- Loan No. 6.0553 from E.I.B. (Special term Loan) ECU'S 3,700,000 (Completed)	331 673
- Loan No. 277 from K.F.A.E.D.K.D. 2,940,000	598 505
Credit Facilities from the Standard Chartered Merchant Bank of U.K for part of the Contract S3 - S.P.P. Projects Ltd of U.K.	450 403

Revenue

A sum of £5,695,186 was collected during the year 1989 as revenue mainly from the sale of water for Nicosia and Famagusta Water Supplies and Paphos Irrigation Project (See table I-5).

TABLE I-2
EXPENDITURE FOR THE YEAR 1989

Ser. No.	Description	Government Contr.		Village Contr.	Total
		Ordinary £	Development £	(Loans) £	
A WDD Votes					
1	Administration	3 329 858	-	-	3 329 858
2	Greater Nicosia W S scheme running expenses	732 265	-	-	732 265
3	Nicosia-Larnaca- Famagusta, Central W S system (formerly styled Famagusta W S scheme)	352 515	-	-	352 515
4	Government W S schemes for villages running expenses	72 547	-	-	72 547
5	Irrigation, drainage and dams	878 700	10 714 797	136 809	11 730 306
6	Town water supplies	-	147 906	103 923	251 829
7	Village water supplies .	-	559 430	433 347	992 777
8	Government water supply schemes	-	120 700	-	120 700
9	Drilling & prospecting .	16 193	-	-	16 193
10	Hydrology	-	131 168	-	131 168
11	Surveys & investigations	-	99 928	-	99 928
12	Purchase of machinery and equipment	-	41 480	-	41 480
13	Others	-	26 831	-	26 831
14	Studies for the Utilization of treated sewage effluent	-	-	-	-
Total		£5 382 078	£11 842 240	£674 079	£17 898 397

TABLE I-2 (Cont.)

B Non-budgeted Votes

	£
1 Pitsilia Project (i) Government Contribution £11 043	
(ii) Village Contribution £ <u>5 982</u>	17 025
2 Refugee housing estates	115 900
3 Works for other Government Departments	
(i) Government Contribution	1 695 516
(ii) Village Contribution	<u>258 310</u>
4 Works through village deposits	323 552
5 Works for private developers	44 114
Total	£ 2 454 417
Grand Total	£20 352 814

(i) Breakdown of Administration Expenditure

	Ordinary £	Development £	Total £
1 Personal emoluments	2 970 556	-	2 970 556
2 Casual technical assistance	6 105	-	6 105
3 Extra Assistance	82 501	-	82 501
4 Travelling	80 880	-	80 880
5 M'ce & operation of motor transport	12 742	-	12 742
6a Office expenses	69 333	-	69 333
6b Purchase of drawing materials - tools etc.	88 699	-	88 699
7 Government water supply	13 841	-	13 841
8 M'ce & operation of data processing and other equipment	5 201	-	5 201
Total	<u>£3 329 858</u>	<u>-</u>	<u>£3 329 858</u>

(ii) Breakdown of Irrigation,
Drainage and Dams Expenditure

	Government £	Village £	Total £
1 Minor irrigation works	251 475	124 386	375 861
2 Consultants fees	-	-	-
3 Major waterworks Paphos	73 531	-	73 531
4 Major waterworks Vasilikos- Pendaskinos	453 207	-	453 207
5 Major waterworks Southern Conveyor	9 406 098	-	9 406 098
6 Major waterworks Khrysokhou	413 954	-	413 954

TABLE I-2 (Cont.)

	Government £	Village £	Total £
7 Other major waterworks	50 961	12 423	63 384
8 M'ce of dams & distribution system	878 700	-	878 700
9 River training	47 609	-	47 609
10 Major waterworks Karyotis	9 592	-	9 592
11 Major waterworks Vizakia	17 962	-	17 962
Total	£11 603 089	136 809	11 739 898

TABLE I-3
WDD ORDINARY BUDGET
STATEMENT OF MONTHLY EXPENDITURE FOR THE YEAR 1989

Head 20A Water Development

	£
1989 approved	5 982 308
Less special warrants	13 849
Total	£5 968 459

Month	Monthly expenditure £	Cumulative expenditure £	%
January	223 127	223 127	3.73
February	376 419	599 546	10.04
March	308 660	908 206	15.21
April	467 980	1 376 186	22.98
May	488 751	1 864 937	31.24
June	368 760	2 233 697	37.42
July	405 520	2 639 217	44.21
August	380 537	3 019 755	50.59
September	495 712	3 515 467	58.90
October	483 765	3 999 232	67.00
November	430 346	4 429 578	74.21
December	952 500	5 382 078	90.17

Summary

	£	%
Amount approved	5 968 459	100
Less actual expenditure ..	5 382 078	90.17
Balance	£ 586 381	9.83

TABLE I-4
WDD DEVELOPMENT BUDGET
STATEMENT OF MONTHLY EXPENDITURE FOR THE YEAR 1989
(Not including village loans)
Head 2D Water Development

	£
1989 approved	17 105 373
Add special warrants	9 872
Total	<u>£17 115 245</u>

Month	Monthly expenditure £	Cumulative expenditure £	%
January	159 076	159 076	0.92
February	654 072	813 148	4.75
March	812 949	1 626 097	9.50
April	1 300 275	2 926 372	17.09
May	922 169	3 848 541	22.48
June	614 488	4 463 028	26.07
July	918 556	5 381 584	31.44
August	474 284	5 855 869	34.21
September	922 198	6 778 067	39.60
October	755 563	7 533 630	44.01
November	644 330	8 177 960	47.78
December	3 664 280	11 842 240	69.20

Summary	£	%
Amount approved	17 115 245	100
Less actual expenditure .	11 842 240	69.20
Balance	<u>£5 273 005</u>	<u>30.80</u>

TABLE I-5
STATEMENT OF REVENUE COLLECTED
DURING THE YEAR 1989

Description	£
Drilling charges	295
Nicosia water supply	2 195 818
Nicosia-Larnaca-Famagusta Central water supply system	1 920 213
Regional village water supply schemes	74 461
Khrysokhou irrigation scheme - Sale of water	69 949
Paphos irrigation scheme - Sale of water	677 941

TABLE I-5 (Cont.)

Description	£
Xyliatos irrigation scheme	22 602
Repayment of Nicosia Water Board's debt capital	77 799
Repayment of Nicosia Water Board's debt interest	108 651
Other fees	129 897
Southern Conveyor Project	417 560
Total	£5 695 186

Note: The amounts contributed from TAEP (Cyprus relief fund for displaced and affected persons) are not included in this chapter. For the exact amount contributed from TAEP please refer to the relevant schemes in chapter VII DIVISION OF CONSTRUCTION.

II DIVISION OF WATER RESOURCES

by
D C Kypris
Senior Hydrogeologist
Head of Division

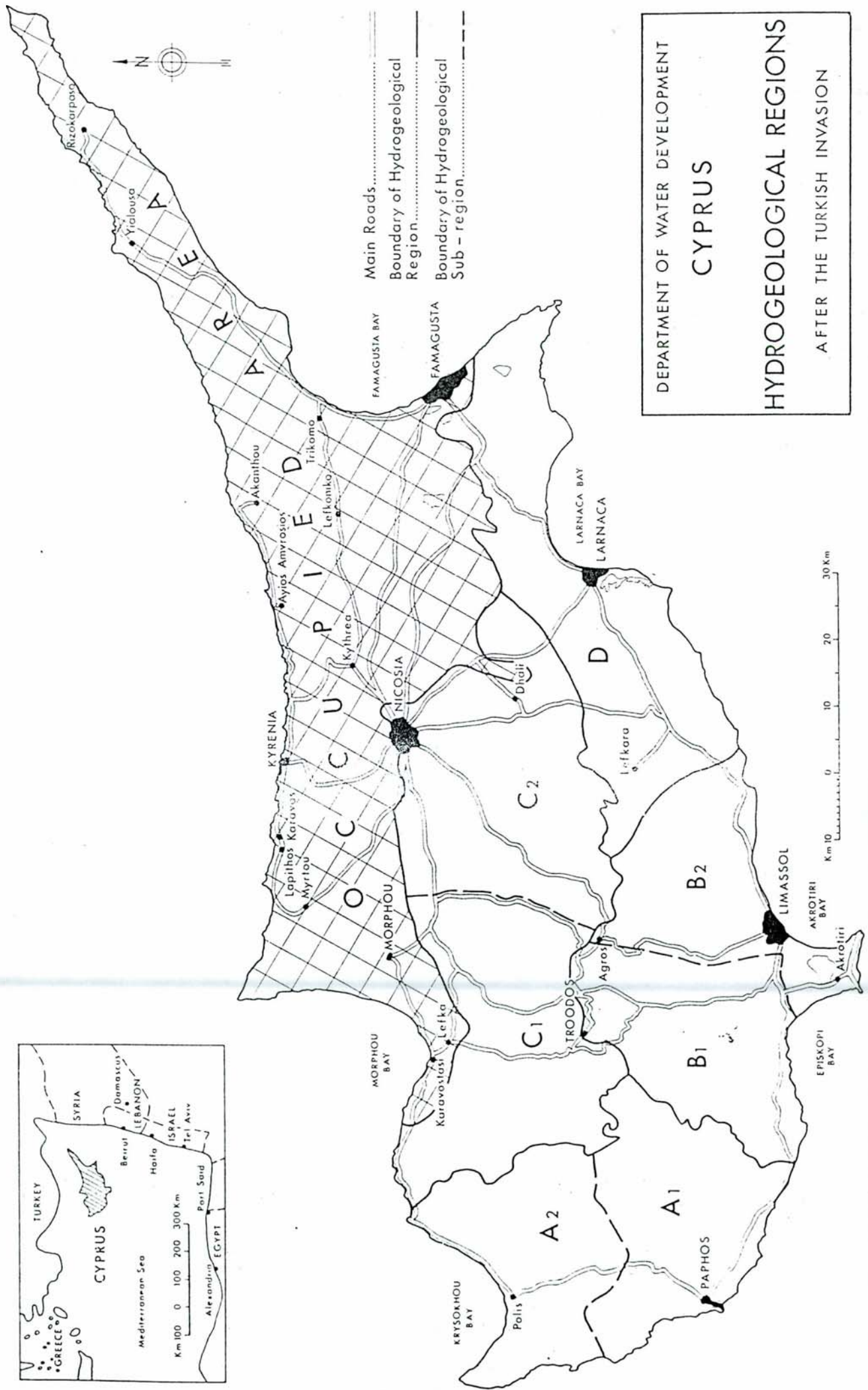
GENERAL

During 1989 again no hydrological data could be collected by this Department in the Northern part of Cyprus still, occupied for the fifteenth year by the Turkish troops, approximately amounting to 40% of the Cyprus land. So the behaviour of both surface runoff and groundwater bodies could not be followed or recorded in the Northern part of the country during the year under examination.

INTRODUCTION

The main tasks assigned to the Division of Water Resources are the collection and processing of Hydrological and Hydrogeological data, regarding both ground and surface water, to deal with hydrogeological problems as connected with the planning and execution of water works projects, to carry out auxiliary drilling operations, to control groundwater extraction and use, monitor water quality for the purpose of both pollution control and advising on water supply problems.

Cyprus has been divided into eleven hydrogeological regions based on both hydrogeological and administrative criteria, which were followed for reasons of better control on the collection of hydrogeological data and thorough hydrogeological studies, until July 1974 when the Turkish invasion occurred. For the year under examination, since the Turkish troops are still occupying part of



DEPARTMENT OF WATER DEVELOPMENT
CYPRUS
 HYDROGEOLOGICAL REGIONS
 AFTER THE TURKISH INVASION

Cyprus, a new arrangement is followed. (see page 11-2)

During 1989, D C Kypris, Senior Hydrogeologist, was the Head of the Division. M Peppis, Geologist Class I, was the Assistant Head, the Head of the Drilling Permits and Water Control Branch and acted also as the chairman of the specially formed advisory committee for the issue of well permits. Dr St. Papatryphonos, Hydrologist Class I, was the Head of Hydrometry Branch, Dr A. Christodoulides, Hydrologist Class I, who was transferred in September to the Water Resources Division, was given the responsibility of the Data Computerization and Publications Branch.

DRILLING OPERATIONS

Drilling operations for water continued this year on a small scale. One drilling rig Ruston Bucyrus 22W was engaged, with which the following operations were carried out:

- Cleaning of 11 existing boreholes
- Drilling of 7 boreholes. Total penetrated depth 325 m.

TEST PUMPING

In order that the Department will be in a position to express views on the water supply sources proposed to be used for the division of land into building plots or the erection of hotels, industries or other establishments, it undertakes to carry out pumping tests, the results of which are communicated to the appropriate authorities.

Pumping tests are also carried out for Government works.

During 1989, 38 test pumpings were carried out as follows:-

- 32 for building permits with total hours pumped..... 75
- 1 To test village water supply. Hours pumped..... 3
- 5 For the division of irrigated agricultural land..... 40

METEOROLOGICAL SUMMARY FOR THE HYDROMETEOROLOGICAL YEAR 1988-1989

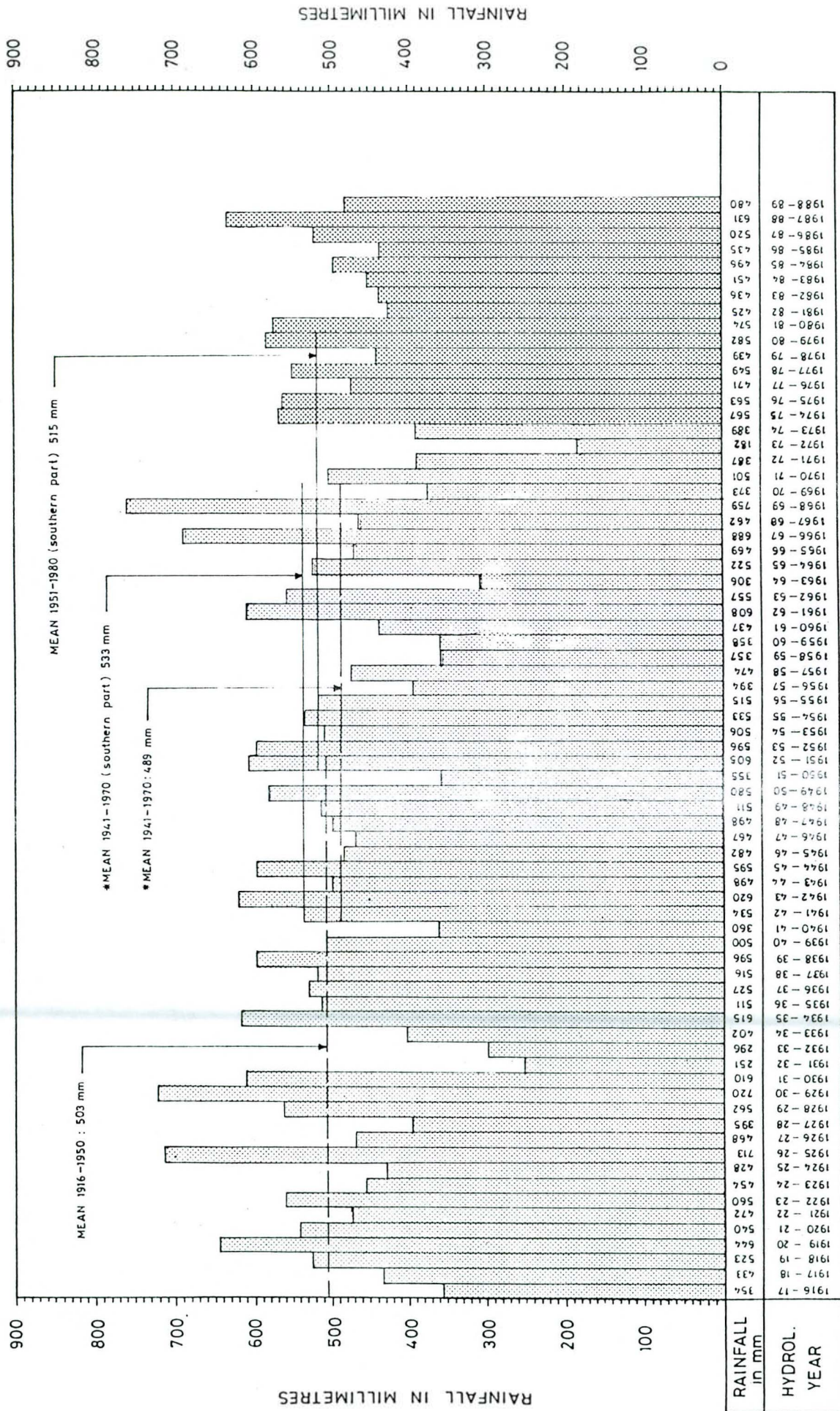
As it is not possible for the Meteorological Service of the Republic of Cyprus to obtain measurements of various meteorological elements in the Northern part of the island because it is occupied by Turkish troops, the data given below relate to the weather experienced in the Southern part of the island during the hydrometeorological year 1988-1989.

Precipitation

The yearly total precipitation averaged over the part of the island under Government control during the hydrometeorological year October 1988 - September 1989 was 480.5 mm which is 93% of normal. Normal is considered the average rainfall over the southern part of the island during the period 1951-80. (See diagram II-I). Cumulative precipitation amounts for the hydrometeorological year were below normal in most areas and ranged mainly between 75% and 100% of normal. However precipitation was slightly above normal in small parts of the eastern and western coastal areas, in parts of the central plain and in small parts of the Troodos mountains and slopes. (See page II-6).

As regards the monthly distribution of precipitation, it was well above normal

ANNUAL AVERAGE RAINFALL OF CYPRUS 1916 - 1989



* Mean rainfall refers to calendar years here
 Note Annual average as from 1974-75 refers to southern part of Cyprus only

in October and December 1988, above normal in November 1988 and January 1989 and below normal in all the remaining months. (See diagram II-2).

The following table, giving the incidence of rainfall during the hydrometeorological year 1988-89, illustrates the situation:-

TABLE II-1
INCIDENCE OF RAINFALL DURING THE HYDROMETEOROLOGICAL YEAR 1988-1989

Months	Rainfall (in mm)	Rainfall (in inches)	Percentage of yearly total	Percentage of monthly normal
October	57.4	2.26	12	177
November	57.8	2.27	12	115
December	164.9	6.49	34	143
January	137.0	5.39	29	125
February	16.2	0.64	3	21
March	33.7	1.33	7	54
April	0.2	0.01	0.1	1
May	8.9	0.35	2	46
June	3.0	0.12	0.6	46
July	0.7	0.03	0.1	29
August	0.3	0.01	0.1	10
September	0.4	0.02	0.1	8
Totals	480.5	18.92	100	-

Note: Yearly total as percentage of yearly normal: 93%

The maximum amount of rainfall in a 24-hour period during the hydrometeorological year was 151.6 mm. This was reported on the 9th January 1989 by Platania climatological station. Considerably high amounts were reported on this day in some areas where the amount of precipitation in 24 hours exceeded their normal value for the whole month.

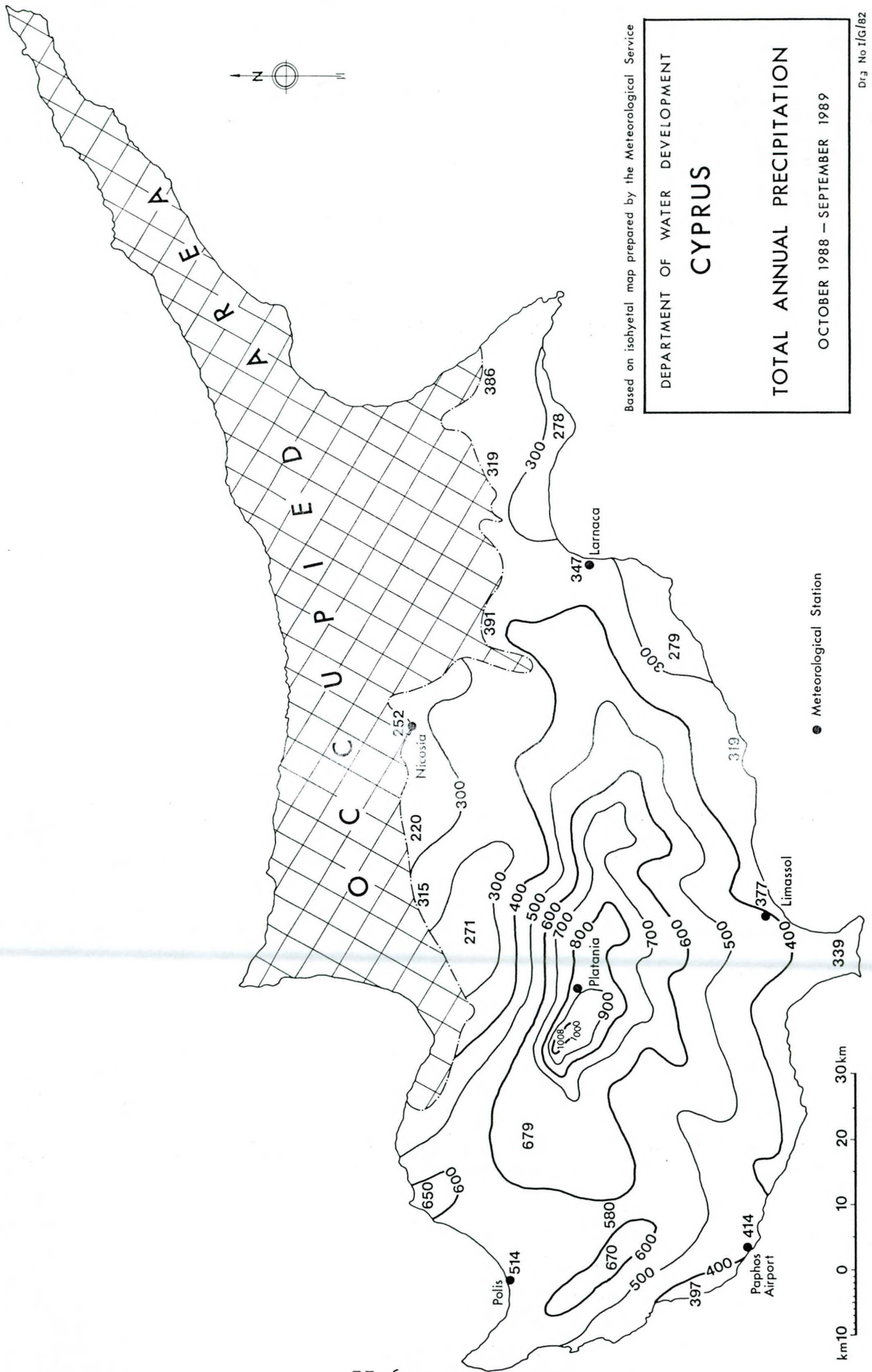
The first snowfall occurred on the higher parts of Troodos mountains on the 18th November 1988 which is about 10 days earlier than the median date for the first snowfall in Cyprus. Subsequent snowfalls occurred during the ensuing months till March. The last one occurred on Olympus on the 14th March 1989 which is about three weeks earlier than the median date for the last snowfall in Cyprus.

Isolated hail was reported in the period from October 1988 to July 1989.

Temperature

During the hydrometeorological year 1988-89 as a whole air temperature was below normal. In particular, monthly mean temperatures were well below normal in November and January, below normal in October, December, February and June, around normal in August, above normal in March, May, July and September and well above normal in April 1989.

The extreme maximum and extreme minimum air temperature recorded during the hydrometeorological year under review was as follows:-



GRAPHICAL PRESENTATION
OF INCIDENCE OF RAINFALL 1988-1989

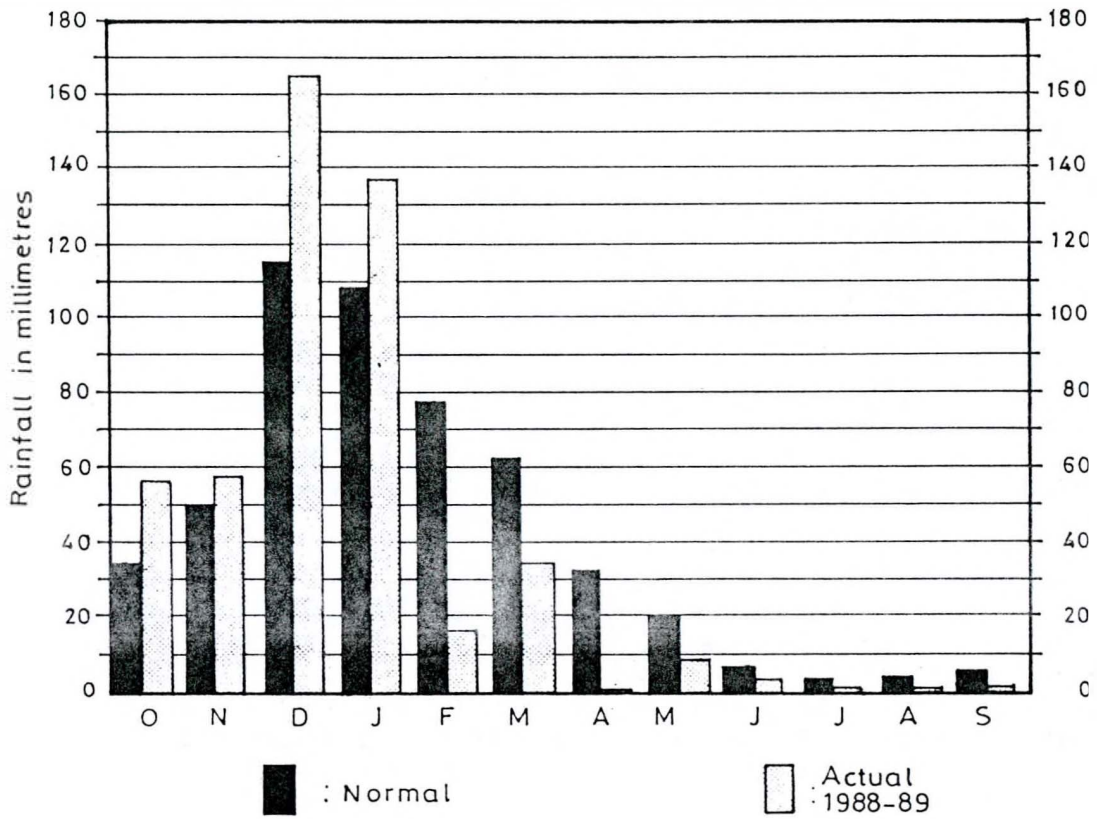


TABLE II-2
INCIDENCE OF MAXIMUM AND MINIMUM TEMPERATURES 1988-1989

Station	Extreme maximum temperature in oC and date	Extreme minimum temperature in oC and date
Nicosia.....	42.5 15th July	-0.9 4th January
Limassol Garden.....	37.0 16th May	0.3 4th January
Larnaca Airport.....	37.7 16th May	0.5 4th Jan.&12th Febr.
Paphos Airport.....	33.7 15th July	0.4 13th February
Panayia Bridge.....	40.0 16th July	-6.5 12th February
Saittas.....	40.5 15th July	-4.0 4th Jan.&13th Febr.
Amiandos.....	32.5 16th July	-8.0 12th February
Prodhromos.....	33.0 16th July	-8.5 12th February
Stavros.....	38.5 15th July	-3.8 12th February
Kornos.....	39.2 14th July	-1.0 25th Jan.&13th Febr.
Platania.....	33.5 16th July	-6.5 4th Jan.&13th Febr.
Phasouri.....	37.0 23rd July	-3.0 4th January

Evaporation

Monthly total evaporation (in mm) measured from United States Weather Bureau (U.S.W.B.) class "A" pan during the hydrometeorological year 1988-89 at selected stations is given in table II-3.

TABLE II-3
MONTHLY EVAPORATION FROM CLASS "A" PAN IN mm

Station	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Total
Nicosia.....	114	55	39	47	56	98	195	243	261	309	247	197	1861
Paralimni.....	147	70	59	72	77	98	182	258	259	272	233	205	1932
Larnaca Airport	184	107	76	87	103	138	221	272	280	299	267	235	2269
Saittas.....	83	44	43	43	69	87	171	210	230	259	220	173	1632
Akhelia.....	134	80	75	63	76	104	173	212	205	223	204	180	1729
Yermasoyia....	120	72	56	58	76	96	180	231	240	262	227	193	1811
Polemihia....	124	71	54	48	72	97	161	224	236	268	223	194	1772
Prodhromos....	63	65	26	*	*	*	169	185	191	231	206	145	-
Stavros Psokas	68	32	30	19	33	61	142	167	184	218	187	148	1289

* = No Records Available

SURFACE WATER

Permanent Stream Gauging Stations

On important streams at selected places, permanent flow gauging stations equipped with automatic water level recorders have been established for the purpose of calculating the quantity of water flowing through each station. All these stations have to be inspected regularly i.e. every week, fortnight or month for the purpose of checking and maintenance of equipment, change of charts, velocity measurements of flowing water with current meter for calibration purposes, etc. During the wet season the visits are more frequent for high flow measurements and sampling for suspended sediment and chemical analysis. The condition of float wells and weirs is also checked and cleaned when necessary.

Out of all our stations only 61 could be regularly inspected, because in the northern part of the island we have not been able to attend any flow gauging stations, due to the presence of the Turkish invasion troops, still occupying almost 40% of Cyprus for the fifteenth year now.

The general conclusion obtained from the study of this year's records of the above flow gauging stations, is that the flow was about average. Particularly there was a high flow in January, as a result of the high precipitation of December and January. Most flow gauging stations maintained a good flow until early spring time, which dropped sharply due to poor rainfall in subsequent months.

The annual flow of some selected flow gauging stations are presented in table II-4.

TABLE II-4

DISCHARGES OF SELECTED STREAMS AS CALCULATED AT SELECTED FLOW GAUGING STATIONS FOR THE YEAR 1988-1989

Ser. No.	Station	Stream	Location	Watershed Area Km ²	Annual flow MCM
1	1-2-7-90	Dhiarizos	Kouklia	260	26.9
2	1-4-9-80	Ezusas	Akhelia	210	18.4
3	2-2-6-60	Stavros-tis-Psokas	U/S Evretou Dam	78	10.2
4	2-3-4-80	Magounda	U/S Argaka Dam	45	4.5
5	2-8-3-10	Limnitis	Saw Mill	48	12.0
6	3-3-3-95	Karyotis	Evrykhou	63	14.4
7	3-5-4-40	Elea	Vyzakia	81	9.8
8	3-7-1-50	Peristerona	Panayia Br.	77	20.1
9	3-7-3-90	Akaki	Malounda	90	17.8
10	6-1-1-80	Ay. Onoufrios	Kambia	14.5	3.0
11	6-1-1-85	Pedhieos	Kambia	29	7.2
12	6-5-3-15	Yialias	Nisou	91	8.7
13	8-4-5-30	Tremithios	U/S Kiti Dam	135	3.0
14	8-7-2-60	Syrkatis	U/S Dhipotamos Dam	61	2.0
15	8-7-3-60	Mylou	U/S Dhipotamos Dam	32	4.0
16	8-9-5-40	Vasilikos	U/S Kalavastos Dam	86	11.2
17	9-2-3-85	Yermasoyia	U/S Yermasoyia Dam	110	18.4
18	9-2-4-95	Yialiadhes	U/S Yermasoyia Dam	31	2.4
19	9-6-2-90	Kryos	U/S Kouris Dam	67	5.5
20	9-6-4-90	Kouris	U/S Kouris Dam	96	19.0
21	9-6-7-70	Limnatis	U/S Kouris Dam	115	21.8

Repairs and Improvements to Existing Flow Gauging Stations

During the year under review repairs and improvements were carried out on the following flow gauging stations.

Ayia River near Ayia Forest Station: Alterations to the invert of the flow gauging station by the construction of a "V" shaped structure 3m wide, slope 1:5.

Limnatis River upstream Kouris Dam: Repairs to the apron and the access road which suffered serious damages during the high flows of January.

Yermasoyia River near Phinikaria: Repairs to the apron and access road which suffered serious damages during the high flows of January.

Flood Discharges

During the hydrological year 1988-89 high precipitation occurred only in December and January, as a result of which high floods were recorded during these two months on almost all our flow gauging stations. On certain stations, those were the highest floods ever recorded. The most noteworthy floods are listed on table II-5.

TABLE II-5

FLOOD DISCHARGES

Station No	Stream	Location	Watershed area (km ²)	Maximum flow (m ³ /s)	Date
1-2-4-95	Dhiarizos	Philousa	125	60	9. 1.89
1-2-7-90	Dhiarizos	Kouklia	260	91	9. 1.89
1-3-5-05	Xeros	Lazaridhes	67	38*	9. 1.89
1-4-2-15	Ayia	Ayia F.S.	22	8.6*	9. 1.89
1-4-4-50	Ezusas	Kannaviou	81	40	9. 1.89
1-4-7-10	Ezusas	Moronero	180	62*	9. 1.89
1-4-9-80	Ezusas	Akhelia	210	67	9. 1.89
2-2-3-95	Khrysokhou	Skoulli	64	22	9. 1.89
2-2-6-60	Stavros-tis-Psokas	Skarphos	78	26*	9. 1.89
2-8-3-10	Limnitis	Limnitis Saw Mill	48	24	9. 1.89
3-3-3-95	Karyotis	Evrykhou	63	18	9. 1.89
3-5-1-50	Lagoudhera	Lagoudhera Br.	13.5	15*	9. 1.89
3-5-4-40	Elea	Vizakia	81	33	9. 1.89
3-7-1-50	Peristerona	Panayia F.S	77	37	25.12.88
				125	9. 1.89
3-7-3-90	Akaki	Malounda	90	28	25.12.88
				140	9. 1.89
6-1-1-80	Ayios Onoufrios	Kambia	14.5	18.5	9. 1.89
6-1-1-85	Pedhieos	Kambia	29	20	25.12.88
				73*	9. 1.89
6-5-1-85	Yialias	Kotchati	73	42	9. 1.89
6-5-3-15	Yialias	Nisou	91	46	9. 1.89
8-4-3-40	Tremithios	Ayia Anna	94	27	9. 1.89
8-2-2-50	Maroni	Vavla	31	16	9. 1.89
8-9-5-40	Vasilikos	U/S Kalavastos Dam	86	30*	9. 1.89
9-2-3-85	Yermasoyia	U/S Yermasoyia Dam	110	67	9. 1.89
9-2-4-95	Yialiadhes	U/S Yermasoyia Dam	31	25	9. 1.89
9-4-3-80	Garyllis	U/S Polemidhia Dam	66	62*	9. 1.89
9-6-2-90	Kryos	U/S Kouris Dam	67	18.5*	9. 1.89
9-6-4-90	Kouris	U/S Kouris Dam	96	52*	9. 1.89
9-6-7-70	Limnatis	U/S Kouris Dam	115	88*	9. 1.89

* Maximum discharge ever recorded.

Inflow of Water in Dams and Ponds

During 1988 out of 76 most important dams and ponds in Cyprus which were under regular observations in the past, only 59 could be observed as the remaining are situated in the northern part of the island which is still under Turkish occupation. The water accumulated in the 59 dams and ponds under regular observa-

tion. The water accumulated in the 59 dams and ponds under regular observations, was the highest ever.

The maximum volume of water accumulated was 207.4 MCM or 75.8% of the total capacity of these dams and ponds which is 273.3 MCM. All small dams and ponds as well as some of the major dams were overflowing for a long period. Asprokremmos dam, the second biggest dam in the island, overflowed for this year as well. Analytically the situation is shown on table II-6.

Spring Discharges

Most of the springs and minor streams are gauged on a routine basis while a number of them are gauged for a short period after the request of another Departmental Division.

During the hydrological year 1988-89, 1788 spring and minor stream discharges were taken on 127 springs and minor streams; 408 discharges were taken on 35 springs which are under regular monthly observations and 1380 discharges were taken on 93 springs and minor streams for a certain period at various intervals.

As there was a high precipitation upto January, there was an increase of flow on springs upto January or February. Due to the low precipitation during the months that followed the flow of most springs was below normal during spring and summer months.

TABLE II-6

ACCUMULATION OF WATER IN THE DAMS AND PONDS DURING 1989

Ser. No.	Name of Dam/ Pond	Capacity Mcm	Storage 1.10.89 Mcm	Max. Storage Mcm - Date	Min. Storage Mcm - Date	Overflow Period
1	Agridhia	0.059	0.014	0.059-26.1.89	0.009- 4.12.89	26.1-15.4
2	Agros	0.080	0.001	0.080- 1.2.89	0.001-20.12.89	11.3-20.4
3	Akapnou - Ephtagonia	0.13	0.042	0.13 -20.1.89	0.023- 1.12.89	20.1- 2.5
4	Akhna	6.8	3.4	5.3 - 1.3.89	3.1 - 4.12.89	
5	Akrounda	0.022	0.022	0.022 1.1.89	0.022	
6	Arakapas Dam	0.13	0.018	0.13 - 1.1.89	0.017- 1.10.89	10.10.88- 15. 6.89
7	Arakapas Pond No 1	0.19	0.059	0.19 -15.2.89	0.040- 1.12.89	15.2-20.4
8	Arakapas Pond No 2	0.12	0.004	0.12 -20.3.89	0.002- 1.12.89	20.3-10.4
9	Argaka	0.99	0.170	0.99 - 6.1.89	0.007- 5.12.89	6.1- 1.4
10	Asprokremmos	52.4	38.8	52.4 -10.1.89	36.4 -28.12.89	10.1-27.1
11	Athalassa	0.80	0	0.072-16.1.89	0 3. 8.89	
12	Ayia Marina	0.30	0.050	0.30 - 1.1.89	0.014-13.11.89	27.12.88- 16. 4.89
13	Ayii Vavatsinias	0.053	0.022	0.053- 1.1.89	0.021-26.10.89	26.12.88- 20. 6.89
14	Ayii Vavatsinias No 1	0.055	0.022	0.055- 1.1.89	0.016- 7.12.89	9.12.88- 11. 5.89
15	Ayii Vavatsinias No 2	0.043	0.020	0.043- 5.4.89	0.015- 7.12.89	5.4-15.5

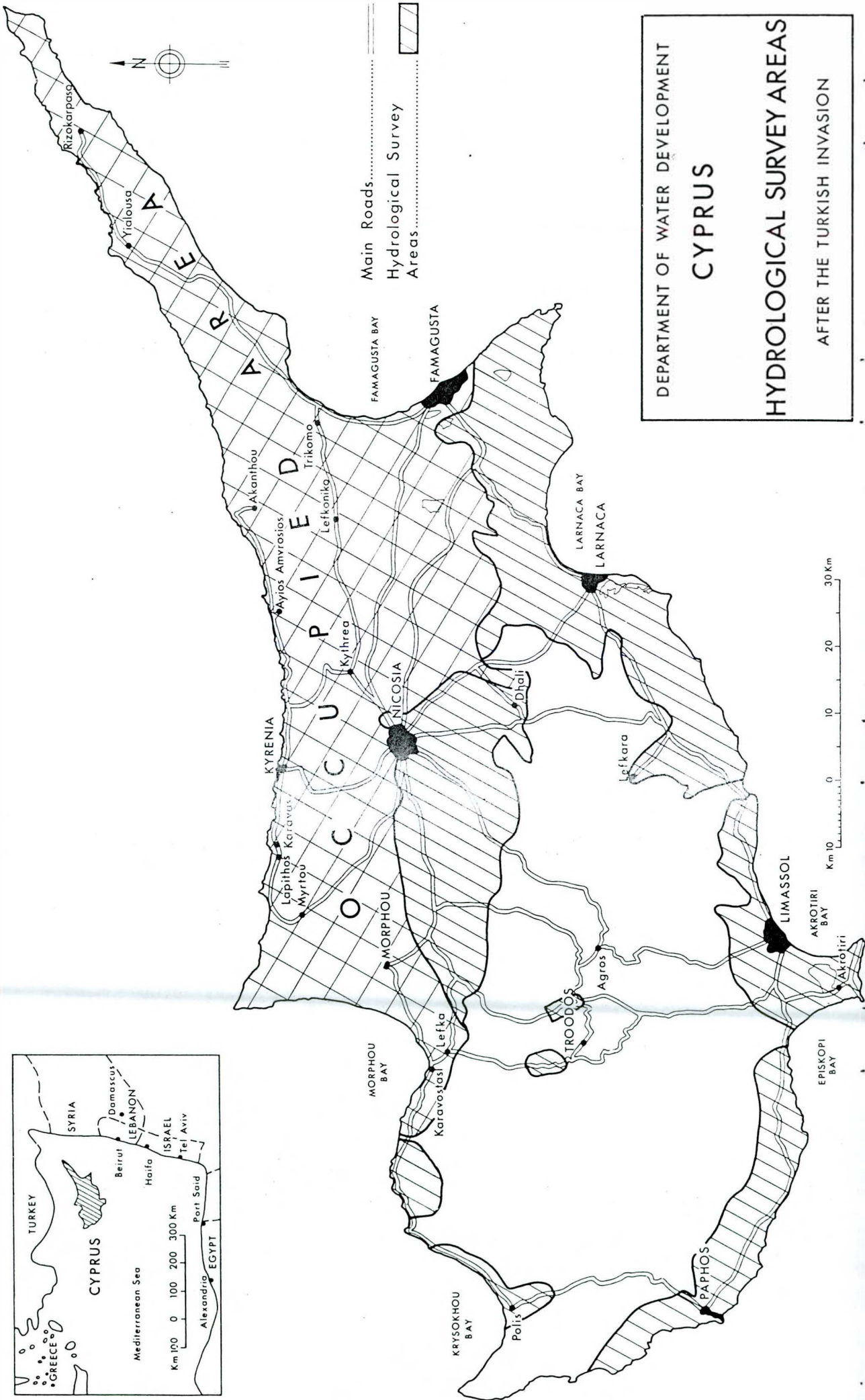


TABLE II-6
ACCUMULATION OF WATER IN THE DAMS AND PONDS DURING 1989 (cont.)

Ser No	Name of Dam/ Pond	Capacity Mcm	Storage 1.10.89 Mcm	Max. Storage Mcm - Date	Min. Storage Mcm - Date	Overflow Period
16	Dhierona	0.16	0	0.16 -20.4.89	0 - 3.10.89	20.4-27.4
17	Dhypotamos	13.7	6.16	10.0 - 5.4.89	5.85 -27.12.89	
18	Ephtagonia No 1	0.092	0.008	0.092- 1.2.89	0.001- 1.12.89	1.2-26.3
19	Ephtagonia No 2	0.13	0.025	0.13 -20.3.89	0.003- 1.12.89	20.3-25.4
20	Ephtagonia No 3	0.065	0.023	0.064-10.2.89	0.016- 1.12.89	
21	Esso Galata	0.035	-0.011	0.035-15.1.89	0.008-12.10.89	15.1-20.4
22	Evretou	25.5	9.4	14.15 -11.1.89	8.75 -29.12.89	
23	Kalavasos	17.1	11.0	17.1 -21.2.89	10.45 -15.12.89	21.2-12.4
24	Kalokhorio	0.032	0.013	0.032- 1.1.89	0.008-16.10.89	18.12.88- 25. 4.89
25	Kalopanayiotis	0.36	0.060	0.36 - 7.5.89	0.027- 1.12.89	
26	Kandou	0.038	0.005	0.038- 1.1.89	0.005- 1. 1.89	Jan.-Jun.
27	Kato Mylos	0.10	0	0.10 - 9.3.89	0 - 3.10.89	9.3-20.4
28	Khandria	0.070	0.002	0.060-20.4.89	0 - 3.10.89	
29	Khirokitia	0.20	0	0.20 -11.5.89	0 -29. 9.89	11.5-18.5
30	Kiti	1.6	0	1.6 -15.3.89	0 - 3. 5.89	15.1-19.1
31	Kourris	115	53.1	73.1 -31.3.89	47.7 -31.12.89	
32	Kyperounda No 1	0.053	0.004	0.053-23.1.89	0.001-30.10.89	23.1-25.4
33	Kyperounda No 2	0.27	0.008	0.27 -10.3.89	0.002- 4.12.89	10.3- 3.5
34	Lagoudhera	0.070	0.009	0.070-25.1.89	0.002-22.11.89	25.1-10.2
35	Lefka-Kafizes	0.11	0	0.11 - Jan.	0 - Aug	
36	Lefka Marathasa	0.37	0.10	0.37 - Jan.	0.040-30.10.89	
37	Lefkara	13.8	4.4	6.2 -20.4.89	2.7 -31.12.89	
38	Liopetri	0.32	0	0	0	
39	Lythrodonda U	0.032	0	0.032-15.2.89	0 -13. 8.89	15.4-24.4
40	Lythrodonda L	0.032	0	0.032-20.1.89	0 -29. 9.89	20.1-25.4
41	Lymbia	0.22	0.034	0.22 -26.12.88	0.022-13.10.89	26.12.88- 15. 4.89
42	Mavrokolymbos	2.2	0.36	2.1 -28.3.89	0.080-22.12.89	
43	Melini	0.059	0.016	0.059-10.1.89	0.002-23.11.89	10.1-23.6
44	Ora	0.062	0.003	0.062-19.1.89	0 -15.10.89	19.1- 1.6
45	Pakhyamos	0.043	0	0.043- 5.1.89	0 -30. 7.89	5.1- 8.2
46	Palekhorio	0.62	0.10	0.62 - 4.1.89	0.05 -14.11.89	4.1-15.4
47	Pelendria	0.12	0.020	0.12 -24.1.89	0.015-30.10.89	24.1-10.4
48	Pera Pedhi	0.055	0.002	0.055- 1.1.89	0.002- 3.10.89	1.11.88- 3. 7.89
49	Petra Upper	0.010	0	0.010- 1.1.89	0 -31. 8.89	1.1-15.7
50	Petra Lower	0.025	0.001	0.025- 1.1.89	0 -12.10.89	1.1- 1.5
51	Pharmakas No 1	0.021	0.04	0.021-20.1.89	0.002-24.11.89	20.1- 8.5
52	Pharmakas No 2	0.061	0	0.031-13.2.89	0 -18. 9.89	
53	Polemidthia	3.4	1.5	3.4 -12.1.89	1.1 -12.12.89	12.1- 3.4
54	Pomos	0.86	0.12	0.86 - 1.1.89	0.051-10.11.89	1.1-13.4
55	Prodhromos	0.12	0.039	0.12 -26.4.89	0.030-15.12.89	Apr. - May
56	Pyrgos	0.28	0.17	0.28 - Jan.	0.015-30.10.89	Jan.-Apr.
57	Trimiklini	0.34	0.10	0.34 -23.4.89	0 -30.10.89	Apr.-July
58	Xyliatos	1.2	0.62	1.2 - 1.1.89	0.53 -28.12.89	1.1- 9.4
59	Yermasoyia	13.5	6.0	13.5 -11.1.89	4.1 -26.12.89	11.1-22.1 19.3-11.4
Totals		273.3	136.1	207.4	121.2	

GROUND WATER

Ground Water Hydrological Work

Hydrological surveys of the ground water bearing systems were carried out on small scale by this Department before 1960. Since then, they were rapidly amounting in scale until the most important known aquifer systems were brought in a few years time under Hydrological Observation. It is unfortunate that most of our maps with the well location and other information were destroyed by fire, during the events of 1974, or lost in the area occupied by the Turkish troops. So, during the year under review, the plotting of boreholes/wells and the collection of other hydrological information continued in the free areas, where hydrological work was being carried out before. The area during the current year where such work has been carried out was 3165 sq. km (see page II-12). The springs wells/boreholes which were on register at the end of 1989 were 34242.

The new areas brought under hydrological observation during the year have an extent of about 73 square kilometers. A number of 930 wells/boreholes and springs were plotted or replotted in this area with their relative information recorded. A supplementary plotting was also carried out in the areas already covered for 467 new wells/boreholes.

Through the hydrological Surveys all wells/boreholes, springs and chain-of-wells are registered and plotted on maps. A dense network of observation boreholes, is being levelled. Through these observation boreholes/wells, the water level is being measured twice a year, at the end of the dry season (November), when it is expected to be at lowest and at the end of the wet season (March), when it is expected to be at highest level. In areas where more detailed information is necessary, a network has been established of observation boreholes where monthly or bimonthly measurements are taken. The number of observation boreholes monitored twice during 1989 is 1236 and, every month or fortnight 416.

For the purpose of establishing the quantity of water pumped from our aquifers a questioning program is carried out once a year, through which information from our farmers is sought as regards the extent and type of plantations, the irrigation system used and other relative information from which the amount of water used is determined, crosschecked wherever possible from water meter readings, or electricity meter readings and pump output. It has been established through questioning that during 1989 15025 wells/boreholes and springs were in use in our most important irrigating areas.

Out of a large portion of the above network of wells and boreholes, water samples are obtained twice a year (November and March), for chemical analysis to evaluate the trends of any quality change of the water in each aquifer.

During 1989 the number of groundwater samples from observation boreholes analysed for Cl was 2427.

As regards groundwater situation, in spite of the high rainfall that occurred during December 88-January 89. No improvement was noted in general, as rainfall on the whole was below average. Still in some places, i.e. Kokkinochoria area, the situation remains critical.

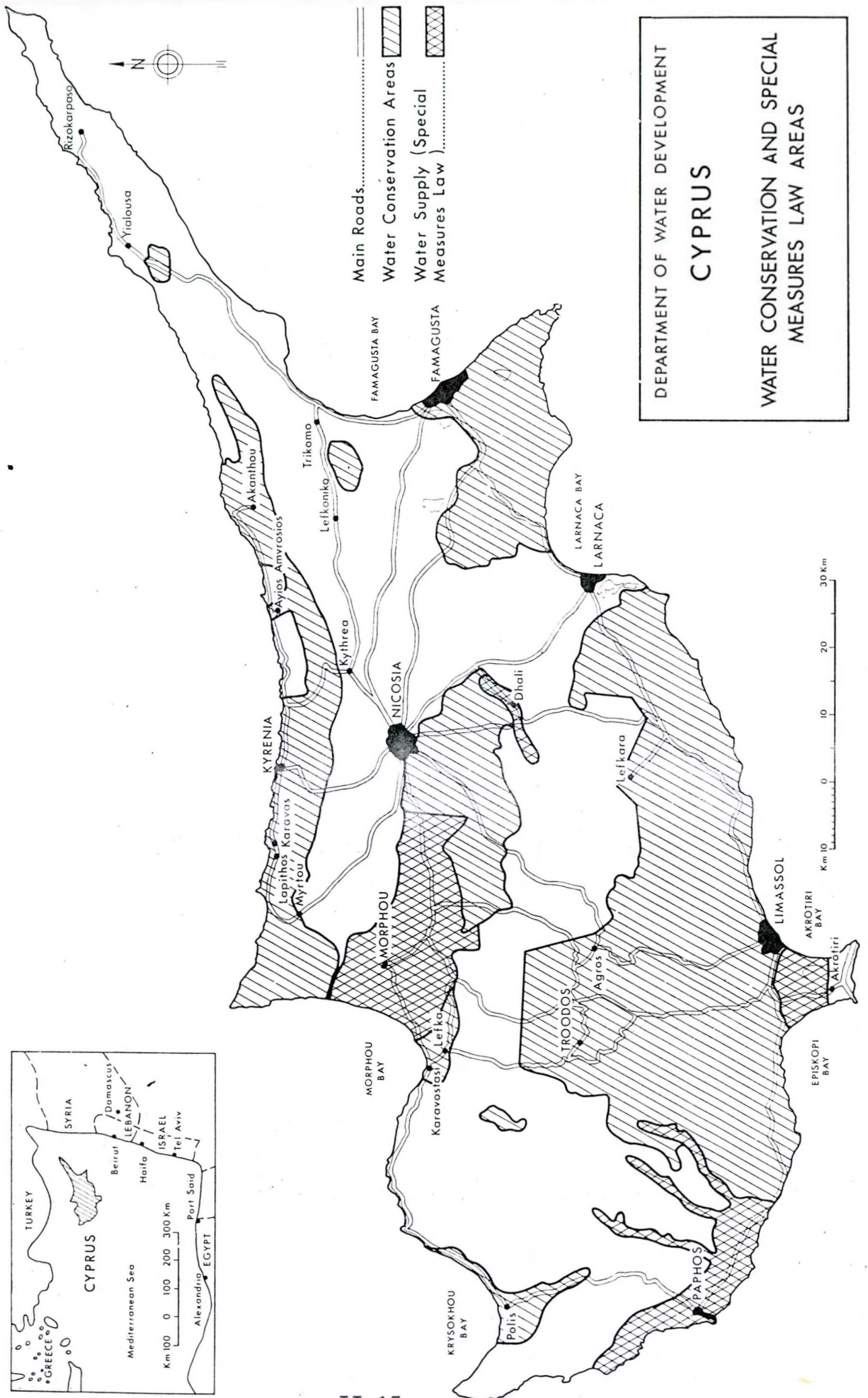


TABLE II-7
SELECTED OBSERVATION BOREHOLES

Serial No.	Hydr. No.	Village	Water Level increase (+) or decrease (-)					
			March 1987	November 1987	March 1988	November 1988	March 1987-88	November 1987-88
71/51	66	Xylophagou...	- 18.59	- 17.71	- 17.51	- 16.59	+ 1.08	+ 1.12
126/59	26	Xylophagou...	- 6.31	- 6.38				
56/56	192	Liopetri.....	- 0.18	- 0.28	- 0.58	- 0.21	0.40	+ 0.07
126/50	105	Ormidhia.....	- 29.20	- 28.10	- 27.60	- 27.28	+ 1.60	+ 0.82
94/52	234	Ormidhia.....	+ 11.62	+ 11.52	+ 11.52	+ 11.17	- 0.10	+ 0.35
72/56	975	Phrenaros....	+ 8.19	+ 8.17	+ 7.96	+ 8.17	- 0.23	0.00
Priv.B/H	429	Sotira.....	- 1.17	- 1.10	- 1.19	- 1.22	- 0.02	- 0.12
88/54	24	Kolossi.....	+ 0.85	- 0.25	+ 0.85	- 0.55	0.00	- 0.30
51/63	813	Limassol.....	+ 2.13	+ 1.73	+ 2.03	-	- 0.10	-
45/63	811	Zakaki.....	+ 1.43	+ 1.13	+ 1.43	+ 1.13	0.00	0.00
107/61	17	Yermasoyia...	+ 11.83	+ 2.39	+ 10.13	+ 2.96	- 1.70	+ 0.57
180/59	8	Yermasoyia...	+ 33.52	+ 16.05	+ 30.41	+ 17.15	- 3.11	+ 1.10
134/59	27	Yermasoyia...	+ 9.33	+ 1.70	+ 8.22	+ 2.39	- 1.11	+ 0.69
161/50	180	K. Trimithia.	+186.91	+186.84	+186.16	+185.97	- 0.75	- 0.87
90/50	106	K. Trimithia.	+190.28	+190.10	+190.15	+190.07	- 0.13	- 0.03
125/60	15	Episkopi.....	+ 27.06	+ 23.16	+ 24.11	+ 22.16	- 2.95	- 1.00
EB 94/70	1236	Akrotiri.....	+ 0.46	- 0.09	+ 0.11	- 0.14	- 0.35	- 0.05
P.B. 12	2671	Kouklia.....	+ 2.20	+ 1.40	+ 2.10	+ 1.45	- 0.10	+ 0.05
51/72	2946	Nikoklia.....	+ 40.49	+ 40.04	+ 40.04	+ 38.94	- 0.45	- 1.10
43/63	2948	Mandria.....	+ 24.43	+ 5.10	+ 14.88	+ 4.50	- 9.55	- 0.60
Priv.B/H	639	Kouklia.....	+ 4.46	+ 0.14	+ 3.74	+ 0.54	- 0.72	+ 0.40

CONTROL AND CONSERVATION OF GROUND WATER

The Advisory Committee for the issue of well permits established by the Ministry of Agriculture and Natural Resources operated this year with Mr M Peppis, as chairman on behalf of the Director of Water Development Department. Representatives of the Directors of Geological Survey and Agricultural Departments are members of this committee, whose task is to advise the Director of Water Development Department on matters related to well sinking permits. At the meetings, the District Engineer of the district where applications were to be examined, participated.

The committee performed during 1989, 36 meeting and examined 2451 applications sent to the Director, WDD by the District Officers, as follows:-

Water Supply (Special Measures) Law areas.....	384
Water Conservation areas.....	1 556
Non Water Conservation areas.....	511

Water Conservation Areas (Wells Law Cap 351)

An area is declared as a Water Conservation Area, when the exploitation of its water resources is such, that it may affect the quantity or quality of the water of that area.

On page II-15 the areas which have been declared as "Water Conservation Areas" under the wells Law Cap 351 are shown. Particulars of these areas are also shown in the table II-8.

Applications for well permits falling within a Water Conservation Area, are being sent by the District Officers to the Water Development Department for technical advice and recommendations. These recommendations, which are based on the knowledge of the existing water situation of each aquifer, the development in the area and the existence of other wells or boreholes, chain-of-wells and springs, as well as any other Government water works are mandatory to the District Officer.

TABLE II-8
WATER CONSERVATION AREAS

Ser No	Water Conservation Area	Order No	Date	Cazette No	Date
1	Kokkinotrimithia-Ayii Trimithias, Paleometokho, Mammari.....	556	31.10.51	3584	31.10.51
2	Nicosia.....	556	31.10.51	3584	31.10.51
3	Tersephanou-Klavdhia.....	376	18. 8.52	3639	27. 8.52
4	Laxia.....	374	18. 8.52	3639	27. 8.52
5	F'sta, Phrenaros, Paralimni, Ormidhia, Xylotymbou, Pergamos, Kouklia, Avgorou etc.....	164	3. 3.56	3924	8. 3.56
6	Akrotiri, Phasouri, etc.....	165	3. 3.56	3924	8. 3.56
7	Morphou, Syrianokhori, Prastio, Nikitas, Elea, Pendayia.....	1052	30.10.56	3995	8.11.56
8	Dhali, Potamia.....	1194	29.11.56	4008	6.12.56
9	Ayios Andronikos, etc.....	916	26. 9.57	4081	3.10.57
10	Morphou, Peristerona, Astromeritis, Akaki etc.....	314	3. 5.58	4133	15. 5.58
11	Vasilia, Lapithos, Kyrenia, Ayios Epiktitos, etc.....	245	28. 4.59	4228	30. 4.59
12	Makedonitissa, etc.....	544	16.11.59	4277	26.11.59
13	Moni, Pyrgos.....	226	27. 7.61	75	27. 7.61
14	Yermasoyia.....	443	8.12.61	112	8.12.61
15	Dhiorios (Djipi Loc.).....	324	21. 6.62	163	21. 6.62
16	Yialia, Ayia Marina, Argaka, Polis....	359	7. 7.62	168	7. 7.62
17	Yialias River (Potamia, Dhali, Nisou, Mathiati).....	189	25. 4.63	245	25. 4.63
18	Kiti, Pervolia, Meneou, Dromolaxia....	50	28. 1.65	384	28. 1.65
19	Kouklia, Anarita, Timi, Akhelia.....	529	26. 8.65	435	26. 8.65
20	Lapathos, Gypsos.....	545	9. 9.65	438	9. 9.65
21	Moni (Extension).....	642	14.10.65	444	14.10.65
22	Lakatamia, Dheftera, Anayia, Pera etc.	744	21.11.65	453	25.11.65
23	Ayia Erini.....	280	19. 5.66	499	2. 6.66
24	Paramali, Evdhimou.....	SBA 68	29. 7.67	212	29. 7.67
25	Lysi, Kondea.....	776	7. 9.67	599	22. 9.67
26	Akanthou.....	777	7. 9.67	599	22. 9.67
27	Pergamos (Extension).....	889	19.10.67	606	3.11.67
28	Ayios Amvrosios.....	890	19.10.67	606	3.11.67
29	Kyrenia Range Limestone Mass.....	817	7.11.68	693	22.11.68

TABLE II-8
WATER CONSERVATION AREAS (cont.)

Ser. No	Water Conservation Area	Order No	Date	Cazette No	Date
30	Vasilikos, Xeropotamos.....	862	28.11.68	697	13.12.68
31	Yeroskipos, Konia, Ktima, Peyia.....	741	4. 9.69	748	19. 9.69
32	Karavostasi, Peristeronari.....	50	29.12.69	771	16. 1.70
33	Yeri.....	75	8. 1.70	773	23. 1.70
34	Neokhorio, Androlikou.....	845	14.10.71	904	29.10.71
35	Yiolou, Loukrounou, Skoulli.....	845	14.10.71	904	29.10.71
36	Pissouri, Evdhimou.....	576	10. 8.72	958	25. 8.72
37	Kormakitis, Myrtou, Dhiorios.....	851	7.12.72	979	15.12.72
38	Akanthou (Extension).....	288	15.11.73	1054	30.11.73
39	Ayios Ioannis (Malounda).....	307	25.11.74	1158	25.11.74
40	Kambos Chakistra.....	-	-	1180	4. 4.75
41	Parekklisha.....	206	23.10.75	1233	7.11.75
42	L'ssol-Paphos-L'ca Extension of W. Conservation areas.....	215	30. 9.77	1429	3. 3.78

Water Supply (Special Measures) Law 32/64

The major aquifers of Western Mesaoria and Akrotiri Peninsula, which were declared as water conservation areas in the past, have been covered by the Water Supply (Special Measures) Law, since 1965 whose purpose is to further and more efficiently protect and control the water resources. The Paphos coastal area and the Paphos Major river valleys, which will be covered by the Paphos Irrigation Project, have also covered by that Law in 1974 and 1975.

The areas covered by this Law shown on map II-4 and particulars are given in the table II-9.

For the above areas:-

- The District Officer, with the concurrence of the Director of Water Development Department, can withdraw any permit for any well or can apply any modifications on the extraction of water as required.
- On the permits which are renewed yearly, conditions are imposed regarding the quantity of water to be extracted, the method of extraction, the area to be irrigated, the measurement of water, the conveyance of water and the utilization of water.

TABLE II-9
WATER SUPPLY (SPECIAL MEASURES) LAW AREAS

Ser No	Area	Order No	Date	Cazette No	Date
1	Western Mesaoria (Pendayia-Morphou Kokkinotrimithia).....	-	-	331	9. 7.64
2	Akrotiri peninsula.....	-	-	331	9. 7.64

TABLE II-9
WATER SUPPLY (SPECIAL MEASURES) LAW AREAS (cont.)

3	South-Eastern Mesaoria (F'sta - Paralimni-Ormidhia-Akhna), later withdrawn.....	-	-	331	9. 7.64
4	Potami.....	89	12. 2.66	479	24. 2.66
5	Dhiarizos River.....	196	23. 5.74	1104	21. 6.74
6	Xeropotamos River.....	196	23. 5.74	1104	21. 6.74
7	Ezouzas River.....	196	23. 5.74	1104	21. 6.74
8	Peyia-Aspros River (Ext. of Yeroskipos Peyia W C A West of Peyia village).....	196	23. 5.74	1104	21. 6.74
9	Mavrokolympos River (Ext. of Yeroskipos-Peyia W C A).....	196	23. 5.74	1104	21. 6.74
10	Kouklia-Paphos-Peyia.....	111	6. 6.75	1193	6. 6.75
11	Nisou-Potamia valley.....	274	15.12.78	1488	15.12.78
12	Xylophagou-Ormidhia Area.....	72	12. 3.78	1760	12. 3.82
13	Larnaca-Famagusta Area.....	247	21.10.88	2355	21.10.88

Water Meters

The preservation of the aquifers through the close control of the groundwater extraction and use, which is the object of the declaration of an area under the provisions of the Water Supply (Special Measures) Law, cannot be effected with out metering the water pumped from each borehole or well.

According to the provisions of the above referred law, water meters should be installed in the Water Supply (Special Measures) Law areas. Information about the installation and operation of water meters are not available for Western Mesaoria area, since this area is still under Turkish occupation. For Paphos, Xylophagou-Ormidhia and Nisou-Potamia valley Area, the Law has not yet been completely enforced. In Limassol-Akrotiri area during 1989 there were 420 water meters installed of which 409 are in continuous operation. The total volume of water recorded is 16.5 MCM. During the year 6 illegal pumpings have been presented by the District Officer, to Court.

Private Drillers (Wells Law, Section 36)

According to the above law, no one is allowed to operate a drilling rig without a Driller's licence. Such a licence is issued by the Director of the Water Development Department, after the interested person to become a Driller applies for it and when the Director of the Department is satisfied that the applicant is competent to carry out such a job. A fee is paid for the licence and each year for its renewal.

According to the same law, every driller has to notify the Director of the Water Development Department of his intention to drill a borehole, to keep samples from the rocks penetrated and send to the above said Director, together with a technical report on each borehole drilled.

During 1989 this Department renewed 58 Drillers Licences, and issued 10 new Licences. The number of private drilling rigs which drilled for water during 1989, was 62.

During 1989, 20 private Drillers were reported to the District Officers for illegal drilling.

WATER QUALITY

Chemical Analyses

During the year 1989, 249 samples of water were sent to the Government Analyst and Geological Department Laboratory and 864 to the WDD Laboratory for chemical analyses. Out of those 520 samples were taken from springs, wells or boreholes, which are used or proposed as water supply sources. The remaining 577 samples were taken from rivers, springs, observation boreholes and other miscellaneous sources.

Bacteriological Analyses

The bulk of sampling for bacteriological analysis is carried out by the Health Inspectors. However for special purposes samples for bacteriological analysis are taken by this Department as well.

During the year 60 samples were sent to the Government Analyst.

Suspended Sediment Analyses

A number of large dams have been constructed in Cyprus. The evaluation of reservoir sedimentation may prove important, so the sediment sampling programme was continued this year also.

During the year 115 samples of river water were taken for suspended sediment analyses.

CENTRAL COMMITTEE FOR THE ISSUE OF LOANS AND THE REACTIVATION OF TURKISH CYPRIOT OWNED WELLS

The Council of Ministers, at its meeting of the 19th February, 1976-Decision No14694 - decided the establishment of the above said Committee. The terms of reference of the committee are to accept and examine applications from Greek Cypriot displaced farmers to use wells/boreholes abandoned by their Turkish Cypriot owners and to grant loans for the purchase, repair and installation of pumping plants and pipelines for the irrigation of abandoned fields of Turkish Cypriot ownership. For this purpose, the Government placed at the disposal of the Committee, the sum of 457,500 for the above said loans.

According to the above said decision of the Council of Ministers, the Committee is chaired by the Director-General, Ministry of Agriculture and Natural Resources, who transferred the chairmanship to the Director of Water Development Department. Other members are the Director-General, Ministry of the Interior, the Director-General, Ministry of Finance, the Director-General, Planning Bureau, the Commissioner for Co-operative Development, the Director, Department of Agriculture and the representatives of the Ministry of Agriculture and Natural Resources at the District Committees for the protection of Turkish Cypriot properties, or their representatives.

The Committee convened at its first session on 27th March, 1976 and at the beginning, the rules and procedures have been decided upon which it would function. Accordingly, special application forms have been prepared, obtainable from the District Officer and the Water Development Department, which displaced farmers could fill when applying to be granted a loan to purchase and install pumping plants and pipelines and/or permission to utilise existing pumping

equipment on the specific well/borehole for which application was made. The applications, which in most cases are from groups of farmers at the first stage are examined by the District Officer and the District Agricultural Officer. When the applicant or applicants are lawful tenants of abandoned by their owners Turkish Cypriot fields, leased to them by the central Committee for the protection of Turkish Cypriot Property - the District Engineer transmits the application with suggestions as to which fields may be irrigated from the same borehole or group of boreholes accompanied by an irrigation scheme, where necessary, with the estimated cost, to the Committee which decides as to the fields to be irrigated and the loan to be granted.

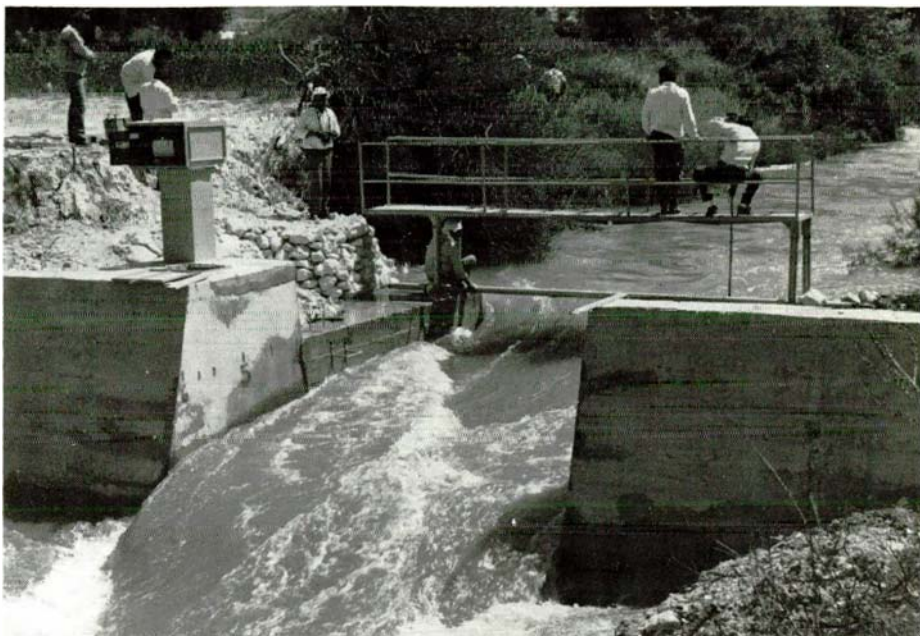
The decisions of the Committee are then notified to the Loan Commissioner, who releases the proper amount to the interested farmers, who sign an agreement for the repayment of 1/3 of loan and the running expenses as well. The remaining 2/3 of the amount is given to the farmer ex gratia. The repayment period for the loans has been set to ten years with an interest of 4.5%.

When part or the whole pumping unit of Turkish Cypriot ownership exists on the borehole/well, a loan may be granted for the purchase of what is missing and the value of the existing equipment with its anticipated life is calculated. Taking into account these parameters and after subtracting the residual value which the pumping plant is expected to have after a maximum of eleven years or at the end of its expected life, an amortization rate is calculated which has to be repaid every year by the involved farmer or farmers. The farmer has to repay only the 1/3 of the amount the remaining 2/3 is given ex gratia.

From its establishment the Central Committee for the issue of loans and the reactivation of Turkish Cypriot owned wells/boreholes had 57 meetings during which it approved 441 applications from 1275 displaced farmers for the irrigation of 12293 donums of land. The amount of loans granted by the end of this year was 376904 CP and the initial value of the pumping plants of Turkish Cypriot ownership to 42190 CP.

During the year under examination no applications were made by farmers to be examined by the above said committee and so no meeting was convened.

Flow gauging station on
Stavros-tis-Psokas river
downstream Evretou Dam.
Calibration Measurements.
WDD Photo No. F91EN-23 (5.4.89)



Flow gauging station on
Dhiarizos river near
Kouklia.
WDD Photo No. F63EN18 (11.1.89)



Flow gauging station on Ayios
Onoufrios river near Kambia.
WDD Photo No. F68EN-7 (12.1.89)



III DIVISION OF HYDROLOGY
AND WATER RESOURCES MANAGEMENT

by
I St Iacovides
Senior Hydrologist
Head of Division

Introduction

The Division was formally established in 1982 within the framework of the reorganization of the Department.

The main tasks and activities of the Division of Hydrology and Water Resources Management aim at providing the Department with basic information about the water resources of the island to enable

- Decisions on the exploitation of water resources;
- Development of additional water resources;
- Allocation for water use;
- Appraisal of the exploitation and development policy of water resources and its consequences as to quantity and quality;
- Formulation and evaluation of new water projects;
- Management and conjunctive use of surface and groundwater resources;
- Applied research in all the above fields;

The Division of Hydrology and Water Resources Management operates as a central unit with minimal staff, making use of the staff available at the Regional Offices for field data and observations.

The Division consists of four major Branches:

- Surface Hydrology Branch
- Groundwater Hydrology Branch
- Water Resources Management Branch and

- Engineering Hydrology Branch

The functions of each Branch geared to the present and those of the immediate future needs of the Department are outlined on the organization chart.

During 1989, the Division consisted of the following staff:

- One Senior Hydrologist
- One Geologist I
- One Executive Engineer I
- One Hydrologist I
- One Hydrologist II
- One Technical Superintendent
- Two Senior Technicians
- One Technician I
- Five Technicians II (Three of them on contract)

Of the above, Dr. A Christodoulides (Hydrologist I) was transferred to the Division of Water Resources as of the 1st of September 1989 and Philippos Nicolaou (Technician II on contract) resigned on November 1989 to pursue further studies in the U.K.

The Division moved to new premises, on the corner of Prodromos and Kanari street, on the 21st of March 1989. This became imperative due to the additional space required. The new office is only 5 minutes walk from the WDD.

Some of the main activities of each Branch are outlined herebelow. The four Branches do not operate as tight units. Instead, extensive contribution and exchange is made among the Branches depending on the type of activity.

Main activities of each Branch

SURFACE HYDROLOGY BRANCH

The main function of this branch involves:

- i) Regional surface hydrology evaluation and watershed behaviour;
- ii) Evaluation of runoff and forecast of flows;
- iii) Watershed runoff simulation by rainfall-runoff models;
- iv) Maintenance of processed hydrological data, surface water resources inventory etc.

During the year the following studies were carried out:

- Hydrology of Ayios Mamas for Gourri dam at Kaoukaridhes.

The rainfall-runoff model was used to simulate flows for the period of 1916-1987 on the basis of instantaneous flow measurements for the years 1980/81 to 1982/83. At a coefficient of variation of 0.557 the mean annual flow for the simulation period, resulted to 0.564 Mm³.

- Hydrology of Kryos river for the diversion to the Sylikou ponds

Simulated flows by use of the rainfall-runoff model for the

period of 1916-1987, on the basis of adjusted model parameters as these were derived in an earlier effort for the same river, have resulted to a mean annual gross runoff of 2.9Mm³.

In view of other commitments on the flow of Kryos in this area for implemented and/or planned schemes, totalling to 1.7 to 2.5 Mm³, further studies have been proposed for the optimum utilization of the water resources in the area. This aspect was dealt with by the Engineering Hydrology Branch.

- Surface runoff evaluation for the Pyrgos-Moni river at the Nicosia-Limassol highway bridge.

The hydrology at this site was studied in connection to the envisaged sewage treatment plant for the Limassol area which is to be sited just downstream.

The surface runoff was simulated by the rainfall-runoff model using parameters derived from similar catchments in view of the lack of observed runoff data at the site.

The mean annual depth-area-rainfall, over the period of 1916 to 1988, of 467.8 mm on the 63 km² catchment area produces an average gross runoff of 3.7 Mm³ per year with a standard deviation of 1.8 Mm³.

Of this quantity, an estimated 0.5 Mm³/year is abstracted for upstream use.

- Hydrology of Avgas river at Pano Arodhes

Having considered the catchment characteristics and the available poor record at Toxeftra, a location further downstream, an 8% runoff factor was assumed. This resulted to an average runoff of 0.4 Mm³/year. This flow was considered as adequate to fill annually a 100 000 m³ pond at an 80% reliability level.

- Preparation of input data and initiation of calibration runs for runoff simulation at:

- i) Kryo Nero at Mitsero
- ii) Akaki river (update of hydrology)
- iii) Peristerona river and
- iv) Alethrico (Pouzis river)

- Data update

i) Filling-up of missing records and updating of data for 76 rainfall stations between the years of 1986 to September 1988. These rainfall stations are used for the rainfall-runoff simulation model.

ii) The observed flows at 20 gauging sites were processed and incorporated on the computer data bank up to September 1988.

iii) The Akrotiri Salt lake was continued to be monitored in view of improving its evaluated water balance.

iv) All the rainfall data were sorted on individual diskettes.

- The water-balance of the Akrotiri Salt Lake

The development and calibration of the water balance simulating model for the lake continued during the year by incorporating additional data on the water level fluctuation of the lake. Closer monitoring on the inflows has been made whilst plans have been prepared for establishing permanent gauging stations.

The results so far indicate the following:

- The storage (average of 10 Mm³) in the lake is governed mainly by local rainfall (53%);
- the subsurface groundwater inflow from the Akrotiri aquifer in the north (47%) and
- the evaporation from the free water (72%) and damp ground (28%) in the lake which account for all the outflow, practically drying out the Lake annually.

Surface flows from the Kouris river do not appear to be of significance and only indirectly could the impoundment in Kouris dam could affect the lake. This indirect effect would be through the reduced recharge of the aquifer and reduction of subsurface inflows. The latter is not expected to occur though, due to topographic conditions and the water resources management plan for the area.

GROUNDWATER HYDROLOGY BRANCH

- Inventory of wells and groundwater conditions at Kokkinokhoria area

A comprehensive survey was carried out in the Kokkinokhoria area in September to November 1986 by 7 Technical Assistants. This survey which covered 8500 wells and boreholes, spread in 9 village boundaries, was carried out within the framework of the SCP. It involved more than 80 items of information for each well ranging from data on the well itself, the pumping plant, the area irrigated, type of crop etc.

This mass of data was computerized using the dBase III software. The last survey of this type was carried out in 1979.

A preliminary report on the current groundwater conditions in the Kokkinokhoria area (H/62 Feb. 1987) indicated that the total number of boreholes in operation were 6194 irrigating a total of 7170 hectares by extracting 28.5 Mm³/y of groundwater.

On the basis of this data bank, reports on the water resources of each of the Irrigation Blocks which are being set up under the Southern Conveyor Project were prepared. Reports of five of these Irrigation Blocks were prepared in 1987 whilst during 1988 nine more Blocks were completed.

In 1989 six more reports were prepared as per table below bringing the total to 20 with two more reports remaining.

SCP-KOKKINOKHORIA: IRRIGATION BLOCKS PREPARED IN 1989

Report No.	Irrig. block	Area	Date of preparation
H/80	IVb	Ormidhia-Xylophagou	February 1989
H/81	V	Xylophagou	May 1989
H/83	IIIb	Ormidhia	June 1989
H/84	IIIa	Akhna-Ormidhia-Xylophagou	July 1989
H/85	VI	Xylophagou-Avgorou-Liopetri	October 1989
H/86	XIIIa	Dherinia-Phrenaros-Sotira	November 1989

On the basis of the 20 Irrigation blocks that were considered by the end of 1989 covering an area of 8563 ha and for a total of 17.1 Mm³ water demand that existed in 1980, some 5.4 Mm³ per year are expected to be met from local groundwater and 11.7 Mm³ are to be met from the Southern Conveyor Project.

The table that follows presents a comparison of selected information items between the 1978 and 1986 surveys for the Irrigation Blocks considered so far and indicates the changes that have occurred within this period.

- Inventory of wells and groundwater use in the Akrotiri aquifer

Within the framework of the SCP (Phase II) a survey was set up by the Division and carried out by the WDD Regional Office in Limassol for all the wells in the Akrotiri aquifer.

The survey which was carried out in the Autumn of 1987 covered 664 wells and boreholes irrigating 2350 hectares consisting of citrus (1625 ha), vineyards (414 ha) and seasonal and other trees (311 ha).

For each well, 89 items of information have been collected and have been stored on computer using the dBase III software.

The information for each well covers the location, the owner and his address, particulars of the well like elevation, depth, pump suction and fuel consumption, use, yield etc. Also for each well its legal status and the District Office file and permit number as well as quoted irrigated area are recorded. Furthermore details of the pumping facilities and water meter information are available. In addition, the facility of each farmer to obtain water from other sources like the Yermasoyia-Garyllis, distribution network, the Kouris dam or other wells is included in the database. Finally, the area irrigated and the type of crop including method used are available in the same database.

SOUTHERN CONVEYOR PROJECT - KOKKINOHORIA AREA

COMPARISON OF SELECTED ITEMS BETWEEN 1978 AND 1986 IN EACH IRRIGATION BLOCK

SERIAL No	IRR. BLOCK No	AREA (Ha)	VILLAGE BOUNDARY	No of FUMING BOREHOLES			AVERAGE YIELD/BOREHOLE (cu.m./h)			AVERAGE FUEL COST IN 1986 (cent/cu.m.)	AREA IRRIGATED IN 1986 (Ha)	EXTRACTION (10 ¹³ cu.m.)			PONDS IN 1986 (cu.m.)		
				1978	1986	% INCREASE DECREASE	1978	1986	% INCREASE DECREASE			1978	1986	% INCREASE DECREASE	No	TOTAL CAPACITY	
1	01	388	AVGOROU AXINA				2.6	1.0	-62	7.6	69.0						
				104	136	+31	1.5	1.2	-20	3.1	40.5				60	7357	
2	02	452	AVGOROU AXINA				2.0	1.0	-50	5.8	66.1						
				49	115	+135	2.1	1.1	-48	6.3	43.6				44	4526	
3	03a	542	AXINA ORMIDHIA XYLOTYMBOU								41.8						
				52	62	+19	2.6	1.3	-50	6.7	7.6				27	2770	
											6.6						
4	03b	484	ORMIDHIA				16.3	6.3	-61	4.8	298.3	2075	1392	-33	47	7600	
5	04a	512	AVGOROU XYLOFHAGOU ORMIDHIA					1.2		5.1	129.6						
				58	194	+234	4.0	1.6	-60	5.7	101.0				47	5745	
								1.0			4.5						
6	04b	571	ORMIDHIA XYLOFHAGOU					4.3		8.2	368.0						
				191	238	+25	19.6	4.7	-76	6.0	329.0				108	24700	
								6.4									
								4.7				3990	2436	-39			
7	05	354	XYLOFHAGOU					5.0		6.2	60.7	93	200	+115	9	1640	
8	06	543	XYLOFHAGOU AVGOROU LIOFETRI					3.0		6.0	116.7						
				53	135	+155	9.2	3.0	-67	5.6	73.0				44	6400	
								1.2									
9	07a	274	LIOFETRI				6.0	2.0	-67	5.0	132.9	319	427	+34	31	5050	
10	07b	408	LIOFETRI XYLOFHAGOU							4.4	105.1						
				46	110	+139	11.0	4.4	-60	4.0	75.7				34	6250	
												677	604	-11			
11	08	440	LIOFETRI SOTIRA				14.7	4.3	-71		471.4						
				146	328	+125		6.4		4.0	17.4				109	20500	
12	09	362	SOTIRA LIOFETRI							9.0							
				151	508	+236	14.0	1.3	-91	8.2					144	18730	
											371.2	1270	1918	+51			
13	10a	433	LIOFETRI SOTIRA				11.5	1.6	-86	7.0	150.0						
				120	337	+181	12.7	1.1	-91	9.5	130.4				96	12780	
												1117	1179	+6			
14	10b	357	SOTIRA AYIA NAFI				9.6	2.3	-76	7.7	189.6						
				90	221	+145					16.7				77	7260	
												386	895	+132			
15	11	481	LIOFETRI SOTIRA PHRENAROS				6.0	2.6	-57	5.5	107.5						
				102	220	+116	5.4	2.0	-63	8.7	63.5				70	8800	
											56.0						
												613	918	+50			
16	12a	392	PHRENAROS AVGOROU LIOFETRI				9.0	3.2	-64	4.7	92.0						
				37	141	+281	2.4	0.8	-67	6.6	34.2				41	6500	
							4.0	2.0	-50	5.0	45.0						
												285	704	+147			
17	12b	500	AVGOROU PHRENAROS				1.7	1.1	-35	6.0	63.0						
				39	117	+200	10.0	3.4	-66	5.0	70.0				46	5250	
												413	551	+33			
18	13a	398	DIERINTIA PHRENAROS SOTIRA														
				136	181	+33				2.0	104.0	438	306	-30	73	5560	
19	13b	475	PHRENAROS SOTIRA DIERINTIA								49.3						
				109	120	+10				1.0	30.4				43	4100	
											1.1						
												240	296	+23			
20	15	197	XYLOTYMBOU							1.0	15.1	61	65	+7	5	700	
				34	38	+12											
TOTAL				8563			1683	3516	+109	2.8	6.1	4147.5	15621	16418	+5	1155	162218

The database is at present well developed although further refinement is still required. It is expected that this database will assist in the improved management of the water resources of the area together with the SCP and Polemidhia-Yermasoyia Project.

During the latter part of 1989, efforts were made for the first practical application of the data base. This effort will result to the issuing of the pumping permits for the first time in early 1990, by using the computer. This has become a necessity in view of the differences between the 1967 survey which is being used by the Limassol District Office and the actual plantations as they were recorded by the survey of 1987. These are shown on the table below.

CITRUS (Ha)		VINEYARDS (Ha)		CLOVER (Ha)		VEGATABLES AND OTHER (Ha)	
District Office data	1987 Survey	D.O	1987	D.O	1987	D.O	1987
1146	1580	351	191	24	73	171	207

- Use of radiosotopes in Hydrology

The sampling of groundwater in the area of the Kouris Delta aquifer was extended to cover the whole of the Akrotiri aquifer. The analytical work for Tritium and the Stable Isotopes is being done in Vienna at the International Atomic Energy Agency which finances the study. The groundwater flow regime, sources of recharge and magnitudes as well as residence time of the water in the aquifer are the expected output of the Tracer mathematical model being developed for this area. The model is being developed on an IBM PC AT microcomputer which has been provided by the IAEA in September 1985. In 1988, the study concerning the evaluation of the operation of the Yermasoyia surface and groundwater reservoirs using environmental isotopes was completed. This study was carried out as a research contract (no: RC3976/RB) by the IAEA and covered the period 1984 to 1987. A report (H/69) was issued in April 1988 and was well received by the Agency.

A supplementary report presenting the one-dimensional groundwater flow and tracer model of Yermasoyia riverbed aquifer was prepared and sent to IAEA on May 1989. With this report the research contract RC 3976/RB came to conclusion.

A new project has been prepared and is expected to start in early 1990 with the support of the IAEA. This project will be dealing mainly with the use of isotopes and tracers in the evaluation of leakage from dams. The main effort will be concentrated on Kouris and Akhna dams.

- The developing groundwater conditions in the Akrotiri aquifer

The major part of the recharge for this aquifer depends now on releases made from the Kouris dam. During the year under review a total of 11.7Mm³ were released for irrigation and recharge pur-

poses of which some 10Mm^3 are considered to have infiltrated the aquifer.

These controlled releases from the Kouris dam plus the recharge from water imported from Yermasoyia and from local rainfall enabled the maintenance of the water level conditions by November 1989 at about the same elevation as for the previous year. A minor area near Trachoni and the upstream part of the Kouris Delta showed, by November 1989, a lower water level of 0.5 m compared to that of the same month in 1988. The rest of the aquifer had water levels at about the same level as in the previous year.

Throughout the year some groundwater losses to the sea were observed seasonally from the Kouris Delta area whilst lower water levels were observed in the Trachoni-Asomatos area, the greatest drawdown being in August and generally reducing and balancing out by October.

These groundwater conditions in the aquifer are due to the distribution of recharge and the time required of groundwater to travel from the Delta area, where the recharge occurs, towards the Trachoni-Asomatos area.

Suitable sites were determined for the creation of recharge ponds for the improved distribution of recharge water from the Kouris Dam.

- The developing groundwater conditions in the Kokkinokhoria area

The general rising trend of the water levels by 1 to 2 meters per year continued to be observed in the area with the greater recovery being observed in the sea intruded areas. This reflects the reduction in pumping (13Mm^3 were provided by the SCP) in most of the areas and especially so in the sea intruded parts of the aquifer. It can be stated that the downward trend of the water levels in the aquifer of the past 30 years has finally been checked and reversed. A minor drop of up to 0.5 m continued to be observed only in the areas of shallow water levels as in Avgorou and Xylotymbou.

- The groundwater conditions in the Kiti-Pervolia aquifer.

In early January 1989 the Kiti dam overflowed. The additional recharge exceeded 1.6Mm^3 . This has resulted to a general recovery of the water levels with a 2 m rise upstream the Kiti village and 2.5 m rise downstream in the main part of the aquifer. Recovery of 0.3 m was observed in the Pervolia and Meneou areas.

- The groundwater conditions in the Pareklisha aquifer

A 7 to 20 meter drop was observed in this aquifer reflecting the drier conditions of 1989 in comparison to those of 1988. The large change in water levels reflects the small specific yield of the aquifer. The main part of the aquifer has exhibited an average of 7 m drop increasing to 10 m towards Moni village. A larger drop was observed in the poorer parts of the aquifer North-Northwest of Pareklisha.

- Phini-Mylos proposed Dam - leakage assessment

Following the reconnaissance geologic investigation (by the GSD) at the proposed dam and in view of the possibility of leakage from the bedrock underneath the dam and from its abutments, an assessment of such leakage was made. This resulted to a total of approximately 1300 m³/d distributed into 600 and 300 m³/d for the right and left abutment respectively and 400 m³/d from below the dam. An increase by 10-20% of the total leakage may be expected from the reservoir through deep percolation.

- Southern Conveyor Project new studies

Within the second phase of the Project the following studies are envisaged to be carried out by using Consulting Engineers for short time spans.

- a) SCP System Operation;
- b) Coastal aquifer Simulation and Management;
- c) Artificial aquifer recharge, and
- d) Reuse of Treated Effluent in the areas of Larnaca and Limassol.

The Division had discussions with R. Cheney of the U.S. Bureau of Reclamation (11.4.89-19.4.89) on the contents of a draft agreement and proposed adjustments to be incorporated in the final document.

- The hydrological conditions at Akhyritou-Dherinia area (Irr. Block XVI)

A study on this area indicated that the quality of the groundwater presents problems due to sea-intrusion. An increased content of Boron has also been noted. The yield of the boreholes is in the range of 3 to 15 m³/h which is considered as sufficient although it exhibits a reduction trend. In view of the above the S.C.P. is to cover certain areas planted with citrus.

- The water supply of Paphos and Lower Villages from Yeropotamos river.

A review of the situation was made. The aquifer downstream the dam can provide up to 6-7000 m³/d which is the present conveyor capacity, for the water supply of Paphos. This included releases for recharge from the dam. There are 3 boreholes in operation and 2 more boreholes which can be used. The yield of the boreholes in this area is about 100 m³/h from a depth of water level of 15-20 m.

The aquifer upstream the dam presents problems in the Summer and Autumn due to drainage and reduction of yields. There are 7 Boreholes for the Lower Villages and 3 for Paphos. It is proposed that 4 boreholes are drilled within the reservoir on elevated ground which can provide water infiltrated through the gravels from the reservoir itself.

Drilling of these boreholes started in the latter part of 1989.

- Evaluation of the Feasibility for artificial recharge at the Anglisidhes area.

Two locations were proposed for the construction of recharge ponds at Loutra and Tjipi at Anglisidhes. The water level fluctuation in the aquifer was monitored for the period of 1986 to 1989. This has shown that the water levels do not follow any downward trend, except for a few boreholes in the northern part within the Lava rocks.

The natural recharge occurs through the lava formation which appears to be weathered and permeable. The chalk formation in the Southern part of the area appears to be of low permeability and the artificial recharge possibilities are quite small. In the Lava formation there appears to be no surface runoff. The Loutra locality is within the Chalk area whilst Tjipi is in the Lava formation. The conclusion of the study is that the potential for artificial recharge in either area is quite small and not recommended.

WATER RESOURCES MANAGEMENT BRANCH

This Branch was mainly involved in the conjunctive use of the Yermasoyia and the Asprokremmos reservoirs and aquifers as well as the monitoring of the Kouris Delta emergency scheme for irrigation and the supplementary supply to the Limassol Water Board. Monitoring of the performance of the Phassouri recharge pond was also maintained during the year under review.

- Operation of the Yermasoyia reservoir and aquifer

The extraction from the Yermasoyia riverbed aquifer for the water supply of the Limassol Town, as well as of the Amathous, Yermasoyia, Potamos Yermasoyia and the Moutayiaka village for the last 6 years depends almost completely on the controlled releases of water from the Yermasoyia dam.

The total extraction from the aquifer in 1989 for water supply purposes was 8.3 Mm³ distributed as follows (in Mm³/yr):

Limassol W.S.	Amathous	Yermasoyia & Potamos Yermasoyias	Moutayiaka	Total
5.510	0.920	1.278	0.559	8.267

The total extraction in 1989 thus increased by 7.3% compared to that of 1988. To maintain the extraction, releases were made from the dam for recharge of the aquifer. A total of 5.152 Mm³ were recharged into the aquifer released from the Yermasoyia dam. In addition to this quantity additional recharge was accomplished during the periods that the dam was overflowing, namely on 11.1.1989 to 23.1.1989 and on 19.3.1989 to 11.4.1989.

The monitoring of all the hydrologic and hydrogeologic changes was maintained throughout the year.

- Releases from the Asprokremmos reservoir

The total pumpage from the Xeropotamos aquifer downstream the dam for domestic water supply was about 1.0 Mm³ whilst the total releases made during the year totalled 0.5 Mm³. In addition to this, recharge occurred from the overflow of the dam in the period of 10.1.1989 until 27.1.1989.

The releases were made at an average rate of 2500 to 5000 m³/d into a series of four recharge ponds immediately downstream the dam.

- Kouris Delta Emergency Scheme

The boreholes of the Kouris Delta did not have to supplement the supply from Yermasoyia and Polemidhia dams for the irrigation of some areas in Akrotiri-Phassouri during 1989.

A total quantity of 3.738 Mm³ was extracted from four boreholes of the scheme for the Limassol Water Supply.

The performance of the aquifer was monitored during the year and on a monthly and/or a 15-day base the water level, quality changes and progressive yield records were monitored.

- Phassouri recharge pond.

For the purpose of evaluating the artificial recharge potential in the Akrotiri alluvial aquifer, the Division continued to monitor the existing recharge pond in the Phassouri plantation (0.054 Mm³ storage capacity).

The water for recharge purposes is obtained from the Kouris river through an intake after releasing water from the dam and directly from the dam itself through a pipeline. Water is also supplied through a pipeline from the Yermasoyia dam irrigation distribution network in the area.

For the purpose of evaluating infiltration rates, the inflow from Kouris diversions into the pond, the overflow and one intake used for irrigation is monitored with weirs and continuous automatic water level recorders. Also a storage capacity curve was prepared for the pond and a limnigraph recorder was installed. Existing observation wells and boreholes (11) were also monitored every 15 days. In the period of January to December 1989 a total of 2.2 Mm³ were entered into the pond. Of this quantity 0.02 Mm³ evaporated allowing the remainder of 2.1 to infiltrate into the aquifer. The average infiltration rate was 6000 m³/day. This information is expected to be useful both in the water-balance evaluation of this aquifer but also in the case of designing similar waterworks in the future.

- Releases from the Kouris dam for recharge and spate irrigation

During 1989 a total quantity of 11.7 Mm³ was released from the Kouris dam for recharge purposes and for spate irrigation. The latter is also considered as effective recharge since it allows a spatial distribution of the released water. The distribution of

TABLE III-1. RELEASE OF WATER FROM KOURIS DAM FOR AKROTIRI AREA (m³)
-1989-

MONTH	FOR IRRIGATION			FOR RECHARGE			EST. RETURN FLOW			SEE PAGE	TOTAL	REMARKS
	PIPELINE	SPATE	TOTAL (1+2)	RIVERBED POUNDS	PHASOURI POND	TOTAL (4+5)	PIPELINE (10%)	SPATE (20%)	TOTAL (7+8)			
	1	2	3	4	5	6	7	8	9	10	11	12
JAN							0	0	0	105000	105000	105000
FEB							0	0	0	168000	168000	168000
MAR	19500	330200	349700	445300		445300	1950	66040	67990	205000	1000000	718290
APR	25200	672900	698100	932600		932600	2520	134580	137100	194000	1824700	1263700
MAY	38200	405700	443900	463300	228000	691300	3820	81140	84960	179000	1314200	955260
JUN	113200	279400	392600	1206800	226000	1432800	11320	55880	67200	174000	1999400	1674000
JUL	23000	46400	69400	1110200	261900	1372100	2300	9280	11580	113000	1554500	1496680
AUG	69433	16935	86368	1187903	209090	1396993	6943	3387	10330	88000	1571361	1495323
SEP	87009	34775	121784	607796	191320	799116	8700	6955	15655	69000	989900	883771
OCT	39720	13044	52764	458876	136460	595336	3972	2609	6581	62000	710100	663916
NOV	14700	0	14700	59100	114800	173900	1470	0	1470	52000	240600	227370
DEC	1450	200	1650	71450	112400	183850	145	40	185	52000	237500	236035
TOTAL	431412	1799554	2230966	6543325	1479970	8023295	43141	359910	403052	1461000	11715261	9887347

the releases was as shown on the Table III-1.

- Management study of the Kryos Watershed water resources

In view of the planned off-channel ponds at Sylikou and the other existing and planned commitments of Kryos river, a watershed management study was carried out to verify the water availability for all existing and planned schemes. A similar study was carried out for the Elea watershed and it appears that gradually such studies will be needed for those watersheds for which a number of schemes are being planned or studied. The Kryos river is already committed to supply the Paramali-Avdimou area through a diversion ($1.1 \text{ Mm}^3/\text{yr}$), existing local uses (Pera-Pedhi dam etc.) of about $2.2 \text{ Mm}^3/\text{yr}$ and to contribute to the Kouris dam further downstream. The new demands arise from the planned ponds at Sylikou ($0.7 \text{ Mm}^3/\text{yr}$), Ayios Therapon ($0.06 \text{ Mm}^3/\text{yr}$) and Ayios Amvrosios ($0.22 \text{ Mm}^3/\text{yr}$). The study involves the optimization of the utilization of its runoff potential. The study is well progressed and the results are expected in 1990.

ENGINEERING HYDROLOGY BRANCH

This branch deals with hydrological applications on waterworks as distinct to pure hydrological aspects of the Surface Hydrology Branch. Its main functions are, water balances of surfaces storages, evaluation of leakage and evaporation from dams, flood studies, hydrologic aspects of river training etc.

- Akhna reservoir seepage monitoring

The Akhna reservoir which offers a balancing storage of 6.8 Mm^3 within the Southern Conveyor Project was investigated before construction and seepages to the local aquifer were estimated to be of the order of 0.2 to $0.6 \text{ Mm}^3/\text{year}$. These seepages were expected to occur through a sandy horizon at the sides of the reservoir.

For the purpose of evaluating the quantity of seepage, 24 monitoring boreholes were drilled in the general area outside the reservoir, 15 of which are shallow tapping the upper horizon and 9 boreholes tapping the lower aquiferous horizon. Water level monitoring in these wells started on October 1988 and continued on a 15-days schedule. In addition, 4 continuous water-level recorders were installed.

In 1988 when the first filling of the Akhna reservoir occurred up to 2.5 Mm^3 of its capacity, the estimated losses through seepage were of the order of 0.3 to 0.4 Mm^3 . These losses though included bank storage. The rate of seepage has been tentatively put to $1100 \text{ m}^3/\text{d}$. Losses from evaporation have been estimated to be of the order of $1 \text{ Mm}^3/\text{year}$.

During 1989 the contents in the reservoir varied from 2.5 to 5.2 Mm^3 . An assessment of the losses was carried out during the period of April to July 1989 when the contents dropped from 5.1 to 4.0 Mm^3 . During this period no inflow occurred and this way the unknowns were limited. The average rate of loss during this period was assessed to be $12 \text{ mm}/\text{day}$ or about $10800 \text{ m}^3/\text{day}$. Of this quantity, about $8 \text{ mm}/\text{day}$ or $7200 \text{ m}^3/\text{day}$ were due to evapora-

tion leaving 4 mm/day or 3600m³/day as net loss to the aquifer.

The response to the aquifer due to this loss is reflected by the total volume of aquifer material which has been saturated with an effective porosity of 24 per cent. Thus the original pre-construction estimates of losses to the aquifer appear to be valid.

It is obvious that the loss to the aquifer includes a large proportion of bank storage which is occurring for the first time and it is expected that in time the net loss will be reduced to 25 per cent of this quantity.

The water balance of this reservoir will be further monitored for obtaining more definite values of seepage, especially at full reservoir. An important element of the water balance would be the accurate measurement of the inflow to the dam which has not been set up as yet.

- Flood evaluation at Kryos stream at Ayia Mavri

The 1 in 20 years frequency flood at the above site was evaluated as requested by the P.W.D. for the construction of a bridge. For a catchment area of 15.4 sq.km, the total volume of flood of 0.97 Mm³ with a peak flow rate of 50 m³/s was produced by a total rainfall of 130 mm of which 63 mm were determined as effective rainfall.

- Flood estimates for the ash disposal site (WD 246439) for the proposed Vasilikos Power Station

Floods at 10,25 and 100 years were evaluated for the proposed site. Additional hydrologic data were also provided. This work was within the framework of the Environmental Study carried out for the E.A.C.

- Flood evaluation at Nicosia-Limassol road bridge on Pyrgos-Moni river.

The flood estimates were carried out in view of the location of the proposed site for the sewage treatment works of Limassol.

The evaluation was based on a computer program calculating flood hydrographs for ungaged watersheds.

A 63 sq.km catchment area produces floods of 1.5 and 3.1 Mm³ at peak rates of 90 and 174 m³/s at a frequency of 1 in 10 and 1 in 100 years respectively.

- Seepages at the Kouris dam

With the impoundment of water in the Kouris dam certain seepages appeared at both abutments at various points. The Division together with the site engineers monitored these seepages throughout the year and samples for chemical and isotopic analysis were obtained on a number of occasions. Furthermore a dye test using rhodamin-B was carried out in October to investigate

the flowpath of these leakages. Further detailed investigations were carried out in 1989.

The purpose of these investigations was to define and possibly locate the zones of leakage.

The maximum leakage appeared on March 1989 when the water level in the reservoir was at its maximum level of 232.5 mmsl. The total leakage was 70 l/s, this being 37 l/s from the right and 33 from the left abutment. By June 1989 at a water level in the dam of 230 mmsl and after remedial grouting was carried out on the left abutment the total leakage was 40 l/s, being 26 l/s at the right and 14 at the left abutment. Besides the monitoring of the quantity of flow, quality and isotopic content of the water at various seepages, the following methods were employed in all the observation boreholes of diameter equal or greater than 2 inches:

- a) Dilution tests where the whole water column is labelled by NaCl solution. The dispersion of this column suggests areas at inflow and outflow;
- b) Electrical conductivity tests;
- c) Temperature variation tests;
- d) Gamma-ray log and
- e) Flowmeter log (using a micromoulinet) for the determination of vertical velocities.

The analysis of all the data is expected to be completed in early 1990. The general zones of seepages have been more or less defined as being located in the abutments near their contact with the dam.

- Computer software application and development of new software

The existing software for spreadsheets database and word processing were introduced to almost all the personnel of the Division and gradual application has been implemented for data storage, retrieval and processing. Furthermore computer software specific to the needs of the Division started being developed for data manipulation and processing.

A coding system for all the software used by the Division was set up and implemented. In a similar way work has started in developing a coding system for all the data diskettes which eventually will develop into a data Bank.

A number of new software has been introduced and developed or further adapted to the needs of the Division as for example for flood studies, groundwater contouring etc.

DIVISION OF HYDROLOGY
AND
WATER RESOURCES MANAGEMENT

1. SURFACE HYDROLOGY BRANCH 2. GROUNDWATER HYDROLOGY 3. WATER RESOURCES MANAGEMENT 4. ENGINEERING HYDROLOGY BRANCH
BRANCH. BRANCH.

Function:	Function:	Function:
1.1 Regional surface hydrology evaluation; watershed behaviour.	2.1 Regional groundwater balance evaluations.	4.1 Water balance of surface storages.
1.2 Evaluation of runoff	2.2 Geological properties for aquifers through pumping tests.	4.2 Leakage from dams.
1.3 Forecasts of flow	2.3 Siting of wells, design and evaluation of yield.	4.3 Evaluation of evaporation losses from surface storage.
1.4 Watershed runoff simulation by rainfall-runoff models.	2.4 Aquifer simulation models; description and forecast of behaviour as to quantity and quality.	4.4 Optimization and forecast models for operating and managing surface water systems and resources.
1.5 Evaluation of floods and droughts.	2.5 Updating of the inventory of groundwater resources.	4.5 Stratification and Limnological aspects of dams, sediment data.
1.6 Recommendations for surface hydrology.	2.6 Groundwater recharge; artificial recharge; Streambed recharge.	4.6 Flood studies.
1.7 Surface water pollution evaluation and studies for its prevention.	2.7 Hydrogeological aspects of leakage from dams.	4.7 Design of surface water measuring structures.
1.8 Surface water quality.	2.8 Status and inventory of domestic water supply resources.	4.8 Hydrological aspects of artificial recharge, dewatering.
1.9 Applied research on the above fields.	2.9 Groundwater pollution, evaluation management; sea-intrusion evaluation.	4.9 Hydrologic aspects of river training diversion structures, etc.
1.10 Maintenance of processed data on rainfall, runoff, floods, droughts, diversions and other hydrologic parameters on computer.	2.10 Environmental radionuclides and tracers use in Hydrology.	4.10 Operation methods, software and computer control aspects of hydrological data.
1.11 Contact with the International Hydrologic Programme (I.H.P.) of UNESCO and with WMO.	2.11 Safe yield of wells, springs, aquifers.	4.11 Applied research on the above fields.
1.12 Environmental radionuclides and tracers use in surface Hydrology.	2.12 Applied research on above fields.	
1.13 Operation methods, software and computer control aspects of surface hydrological data.	2.13 Maintenance of hydrographs, quality trends, groundwater level contours, extractions etc. for immediate use in the various studies on computer. Groundwater inventory.	
	3.1 Based on the studies and results of the other Branches, formulation of constraints for decision making on the availability and use of water resources; allowable yields of aquifers; spacing of wells.	
	3.2 Advice on new development projects and follow-up of these projects, water-supply or irrigation.	
	3.3 Operation studies on surface and groundwater resources and their conjunctive use; operation rules; emergency schemes on droughts; frequency of droughts.	
	3.4 Appraisal of the exploitation policy of water resources and its consequences as to quantity and quality.	
	3.5 Recommendation with respect to pollution control.	
	3.6 Inventory of existing and planned demands on surface and groundwater according to catchment and potential of area. Data storage and retrieval on computer.	
	3.7 Aquifer simulation models; description and forecast of behaviour as to quantity and quality.	
	3.8 Operation methods, software and computer control aspects of water resources management data.	

Fig. III-1

Tracer dilution test on
BH TW4 for the Kouris
Dam Leakage study on
17.2 89 with Dr. A.
Plata of IAEA.



Fig. III-2

Electrical Conductivity
monitoring during a
tracer dilution test at
Kouris Dam.



Fig. III-3

The Phassouri Recharge
Pond receiving water
from the Kouris Dam.



IV DIVISION OF PLANNING

by
Chr Marcoullis
Senior Water Engineer
Head of Division

Introduction

The Planning Division of the Department comprises the following three branches:

- Reconnaissance and Feasibility Studies.
- Geotechnical Investigations and Laboratory
- Topography

The first one, which is almost entirely staffed with qualified personnel, is directed by the Head of the Division and deals with the preparation of studies for water development projects involving major structures of local or interbasin importance.

The other two branches, which are headed by a Senior Water Engineer and a Senior Technical Superintendent respectively, extend their services to cover the corresponding needs of the whole of the Department, including major works under construction. The activities of the two branches are described separately below.

The Division works in close cooperation with other Divisions of the Department and particularly with the Design Division in an effort to successfully cope with the increasing demand for water works.

During 1989 the personnel of the Division, not including that of the two separate branches, comprised:

- One Senior Water Engineer, Head of the Division
- Three Executive Engineers Class I
- One Irrigation Engineer Class I
- One Hydrologist Class I
- Two Irrigation Engineers on Contract
- One Senior Technician
- Two Technicians Class II

Summary of Activities

As with 1989 the activities of the Division were focussed on the reconnaissance and feasibility studies of small projects of rather local importance.

However the two major projects i.e. the Krasokhoria Integrated Rural Development Project and the Karyotis Project which were initiated in 1984 and 1985 respectively were also under consideration.

In addition the Division through its Head has taken part in the Technical Committees of the Department which deal with the evaluation of tenders or with decisions on contract variations and claims associated with the major projects of Khrysokhou Irrigation Project including Evretou Dam and the Southern Conveyor Project including Kouris Dam.

Studies for water works of local importance

During 1989 the Division has dealt with the applications by villages for the construction of water works, mainly dams or off-stream ponds for irrigation. Some of these applications involved only an on the spot examination, which resulted either in a direct negative answer in case where topographical, geological, or hydrological conditions were quite unfavourable, or taken up for a preliminary study.

Other cases involved the preparation or review of preliminary studies or feasibility studies of proposed schemes which were examined either in 1988 or during previous years. All the cases, which were dealt with, as classified by the study and the scheme involved and by district are tabulated below:

District	On the Spot Examination			Preliminary Study		Feasibility Study	
	Pond	Dam	Other	Pond	Dam	Pond	Dam
Nicosia	-	-	-	-	1	2	2
Limassol	2	1	-	1	1	2	-
Larnaca	-	1	-	1	2	-	-
Paphos	-	1	-	-	-	1	-
Famagusta	-	-	1	-	-	-	-
Total	2	3	1	2	4	5	2

Preliminary studies were prepared for:

- A dam for Palekhorri village
- A dam for Phini village
- A pond for Prastio village
- A pond for Kato Dhrys village
- A recharge dam for Alethriko village

Feasibility studies were completed or initiated for:

- A pond for Pano Arodhes village
- A pond for Mathikoloni village
- A pond for Orounda village
- A pond for Ay. Epiphanius village
- A pond for Pelendria village
- Review and reestimate of the studies for a pond and a dam for Kannavia village and ponds for Sarandi, Melini and Ora villages.
- A dam ("Siphilos") for Alona, Platanistasa, Ay. Marina and Kato Moni.
- A dam for Gourri village.

Major Projects Planning

The two major water development projects under planning during 1989 were those of Karyotis Project and the Krasokhoria Integrated Rural Development Project.

Karyotis Project

The purpose of the project is to determine the most rational utilization of the flows of the Karyotis river and other neighbouring rivers for the enhancement of the Nicosia area domestic water supplies (D.W.S), after satisfying the local demand for irrigation.

The feasibility study of the project was undertaken by the Soviet Organization "Shelkozpromexport". The relevant contract was signed in Oct. 1984 and the study commenced in Sept. 1985. The contract was administered by WDD, which would contribute to the study in terms of general engineering, topographical work and geotechnical investigations. Other inputs to the study included geological investigations by GSD and agricultural data by the Dept. of Agriculture.

A brief description of the project was given in the 1988 Annual Report.

During 1989 the implementation of the project was under consideration by the Government. The economics of the project and the various possibilities for the assignment of the detailed designs to consultants were issues brought to the Council of Ministers. Furthermore contacts were made with the Soviet Consultants for the possibility of continuation of the project designs.

At the same time geotechnical investigations were initiated on the Korakou damsite for the future design of the dam.

Krasokhoria Integrated Rural Development Project

A brief description of the water development component of the project was given in the 1987 annual report.

The main activities on the project during 1989 were concentrated on the two dams envisaged by the project.

The new damsite on the Dhiarizos-Phini river was extensively geotechnically investigated. The site seems to present the usual geological problems of deep river terrace deposits and talus. On the west abutment a possible buried channel was detected by geophysical methods. The relevant geotechnical report was prepared in September 1989. At the same time the design of the dam at a feasibility level was initiated with studies on the spillway.

The detailed design of the Xylourikos dam which was undertaken by the British Consultants Rofe, Kennard and Lapworth, was faced with major problems emanating basically by the decision to increase the height of the dam. The new spillway, which was tested on a physical hydraulic model, proved to be very costly and therefore a change in the type of the dam was recommended. The new design provides for a concrete gravity dam, which will be constructed with the new Roller Compacted Concrete method (R.C.C), which leads to substantial savings in cost due mainly to the shortening of the construction period. The Consultants have secured the services of specialists in this type of dam and the design will commence early in 1990.

Other Studies

- (a) Environmental impact assessment of "Kapoura" dam for Ayios Georghios (Kafkallou) village.

The above study was undertaken jointly by the Departments of Water Development and Forestry and the Environmental Services of the Ministry of Agriculture and Natural Resources. This report is the first of its kind and examines the various effects on the environment of a Water Project which in this case is a rockfill dam. It also endeavors to give a detail account of all the aspects that have positive or negative effects on the environment in general and provides guidelines for their evaluation. Furthermore it recommends measures to be taken either to prevent certain adverse effects or to remedy such negative environmental impacts. The recommendations of the study on this particular proposed dam were favourable.

- (b) Environmental Study and Management Plan for the Akrotiri Salt Lake and Wetlands and Impact Study for the Dhiarizos Diversion and Tunnel (S.C.P Phase II).

Prequalification documents were received from 74 Consultants/ Consulting Firms interested to be included in a short list to tender for the above mentioned study. The Study is to be financed by the World Bank. All submissions were evaluated and a short list prepared and sent to the Main Tender Board for final decision. All necessary Tender documents were prepared and the study is planned to start in 1990 with an anticipated maximum period for completion of one year.

(c) River Training Works.

A study was carried out for the planning and designing river training works in the Dhiarizos and Xeros river valleys. The objective of the study is to protect the riparian lands and the wellfields located in the valleys from possible floods. By the end of 1989 the study was in its final form and the necessary plans and designs are expected to be ready early in 1990 so as to start the river training works during the Summer of 1990. The works are to be constructed in stages and completed in 1991.

(d) P.V.C. membrane lining of Agros dam.

A detailed design for the lining of the existing Agros dam with P.V.C membrane started at the end of the year and a cost estimate of the work was near completion. This work was undertaken on the request of the farmers using the water of the dam after reports over many years of heavy leakages from the dam.

(e) Nicosia - Anthoupolis - Kokkinotrimithia Highway - Pipelines relocation.

The planned construction by PWD of the above highway involves the relocation of some government and private pipelines.

Within the framework of the Highway Project, WDD has undertaken the planning and design of these relocations which refer to the following:

1. Laying of the pipelines listed below:
 - (a) 13.5 km of AC pipes ranging in dia from 100 to 400 mm.
 - (b) 0.4 km of DI pipes ranging in dia from 250 to 400 mm.
 - (c) 3.7 km of steel pipes ranging in dia from 150 to 300 mm.
 - (d) 3 km of 100 mm dia Galvanised nom. pipes.
2. Removal of existing pipelines.
3. Construction of ten culverts.

The cost estimate of these works amounts to £890,000. The construction which will be undertaken directly by WDD is expected to commence in July 1990. Tenders for the supply of pipes and fittings will be invited early in 1990.

(f) Detailed designs for the Kokkinokhoria area distribution network (S.C.P.)

The preparation of the detailed designs for the Kokkinokhoria area within the framework of the Southern Conveyor Project was administered by this Division as of April 1987 under the personal supervision of the Assistant Director. During 1989 the following progress was recorded:

- (a) The secondary irrigation systems of Blocks IIIa, VI and XIV covering areas of 535,576 and 269 ha respectively or a total of 1380 ha were fully completed and passed over for construction.

- (b) Block XVI covering an area of 317 ha had to be redesigned during 1989 due to changes.
- (c) The tertiary irrigation systems of Blocks VIIa, XIIIb, II, IX, Xa and XV covering areas of 285, 475, 486, 367, 438 and 195 ha respectively or a total of 2246 ha were fully completed and passed over for construction.
- (d) Block XIV covering an area of 269 ha was in progress and will be completed early in 1990.

Concurrently the study of extending irrigation to permanent plantations located outside the project area was in progress.

In total by the end of 1989 (including 1987 and 1988) detail designs of the secondary irrigation system were prepared for all the 22 blocks of the Kokkinokhoria covering an area of 9,200 ha.

(g) Ascertainment and record of water rights

(i) Akaki-Malounda Dam

As part of the feasibility study of the Akaki-Malounda proposed dam, sited near the village of Malounda on the Akaki tributary of Serrakhis river, the Minister of Agriculture and Natural Resources appointed in April 1988 Water Commissioners under the Government Waterworks Law CAP 341 Article 6 in order to ascertain and record the nature, extent and situation of existing water rights that may be injuriously affected by the proposed dam.

During the year 1989, the Department of Land and Surveys on the request and in collaboration with the Water Commissioners undertook an investigation on the W.D.D. findings on possible water rights affected by the proposed project and prepared a short report. Furthermore the Water Commissioners proceeded to complete the final draft report with the addition of further chapters, on the Department's of Land and Surveys information, the minutes of the inquiries in the various villages and the Water Commissioners views on existing water rights.

The work is still in progress and expected to be completed during 1990.

(ii) Siphilos Dam

A similar investigation was also undertaken for the Peristerona River on the Platanistasa tributary of which "Siphilos" dam is under feasibility study. The inquiry was firstly assigned to the Director of the Department, but due to the complexity of the case, the formal appointment of Water Commissioners seemed more appropriate for this river as well.

This investigation which was initiated during 1988 is still in progress and expected to be completed by the end of 1990 the earliest. During the year 1989 the Division collected information on the existing weirs, channels, water mills and irrigated area along the river downstream the proposed dam likely to be affected by the proposed project and prepared a preliminary drawing. A draft chapter, part of the final report was also prepared based on information collected in the office but mainly during the site visits of W.D.D. personnel.

INVESTIGATIONS AND LABORATORY BRANCH
by Ch Kritiotis, Senior Water Engineer

General

In 1989 the Site Investigations, Laboratory and Grouting Section of the Division of Planning, was involved with almost all major and minor projects undertaken by the Department. Furthermore, site investigation and laboratory testing was carried out for other Government Departments and private organizations.

The full capacity of the section was mobilised in order to satisfy the requirements of both ongoing works and site investigations for proposed new projects.

Site investigation and laboratory work related mainly to providing subsurface geological, geotechnical and construction materials data for projects at the feasibility and final design stages. Laboratory work was also related to quality control at ongoing projects mainly for earthworks and concrete.

Departmental projects for which site investigation work was carried out were as follows:-

Southern Conveyor Project - Phase I:

Kouris Dam:

- a) Drilling of observation wells for investigation and monitoring of leakages
- b) Drilling of drainage fans and drainage curtain in both abutments for relief of pore pressures
- c) Drilling and grouting in left abutment gallery to reduce leakages.

Akhna Dam:

Drilling investigation and monitoring boreholes in left abutment to investigate excessive settlements of clay cut off and leakages.

Kokkinokhoria Irrigation:

Drilling of boreholes for earthing at pumping stations.

Southern Conveyor Project - Phase II

Aradhippou - Athienou Pipeline:

Investigation along route of proposed pipeline by the use of excavator.

Kiti Night Storage Reservoir

Site investigation and material investigation.

Evretou Dam:

Drilling for installation of standpipe piezometers at upstream portal slide area.

Asprokremmos Dam:

Drilling for installation of standpipe piezometers.

Karyotis Project - Korakou Dam:

Investigation at proposed Dam Site by drilling of core boreholes.

Alethriko Dam:

Investigation at proposed Dam Site by drilling of auger and core boreholes.

Dhiarizos Phini Dam:

Investigation at proposed Dam Site by drilling of core boreholes and fill material investigations.

Xylourikos Dam:

Fill material investigations with the use of an excavator.

Kapouras Dam:

Fill material investigations with the use of an excavator.

Orounda Pond

Investigation of proposed site by excavating exploratory pits.

Site investigations or drilling work undertaken for other Government Departments and private organisations, included:

- Hanseatic Building Limassol - Drilling
- Peko Paphos - Drilling
- Limassol Water Supply Board - Drilling for site investigations at two reservoir locations

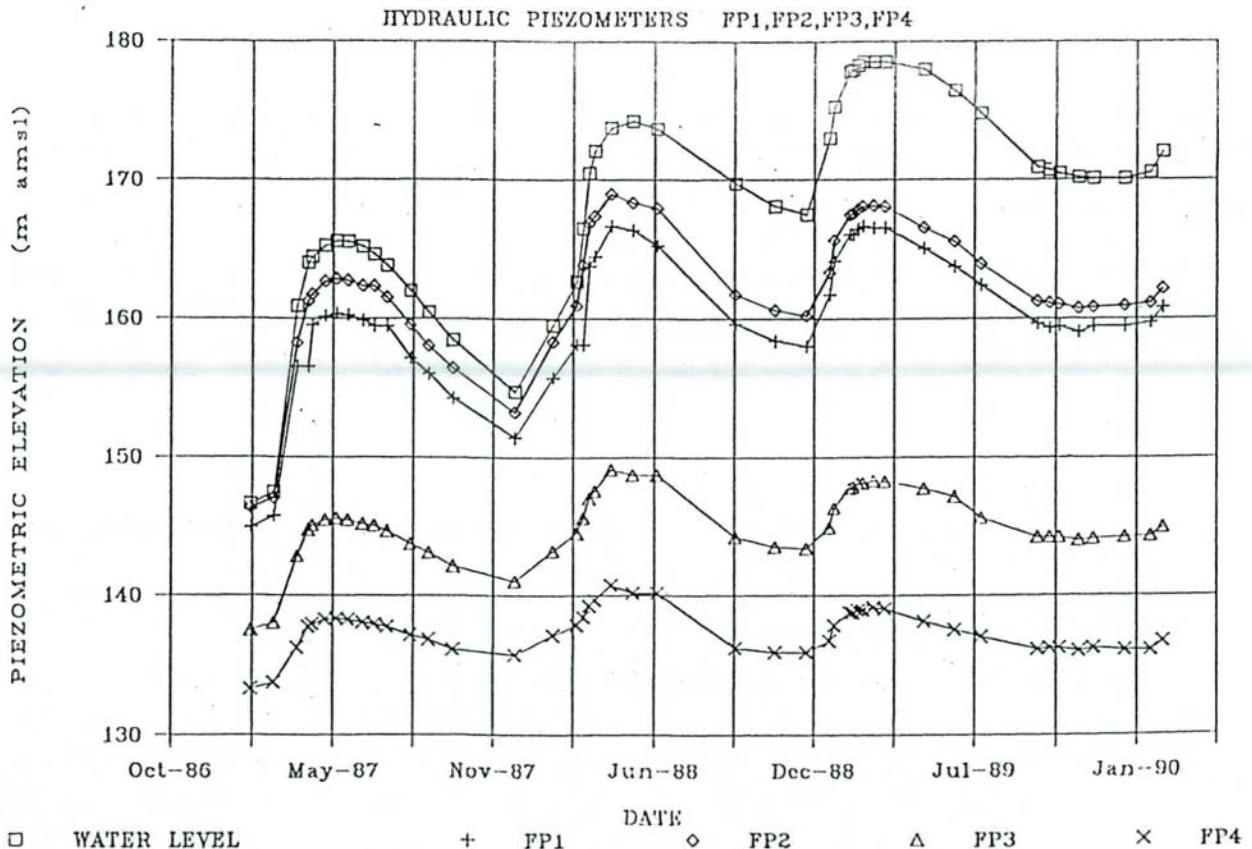
- Archangelos Michael Monastery - Drilling for installation of inclinometers for landslide monitoring
- Symvoulos Dam, Episkopi (British Bases) - Rent of one of our drilling rigs and crew to grouting subcontractor for the construction of the dam.

Dam Monitoring

Considerable progress has been achieved during 1989 with the development of an Electronic Database System for storing instrumentation records from the various dams. Electronic storage allows fast retrieval and processing of information, features which are essential when performing periodical evaluations and analyses. Instrumentation records may be transformed into graphical outputs (see below typical graph from Kalavassos Dam) that are particularly useful for the assessment and evaluation of dam behaviour and safety.

Presently, processing of instrumentation records is carried out on two microcomputers in the Nicosia main office and the Paphos district office. The possibility of employing a high power central computer system that would allow a more efficient processing of information is presently investigated. The Dam Monitoring Unit is accordingly studying monitoring procedures in more developed countries like the United States, the U.K., France and Germany.

KALAVASSOS DAM—FDN PIEZOMETERS AT CH175



SOIL LABORATORY TESTS DURING 1989

PROJECT- Type of Test	PHINI DAM	KOURIS DAM	AYIOS SOZOMENOS BIOLOGICAL STATION	KOKK. IRR. AREA	DHIARIZOS	KAPOURAS DAM	ARADHIPPON BALANCING RESERVOIR	ARADHIPPON PUMPING STATION	XYLOURIKOS DAM	ARADHIPPON DAM	ATHIENOU RESERVOIR	AKHNA DAM	KITI IRRIGATION	PRIVATE FIRMS	MISCELLANEOUS	TENDERS	TOTAL
Sieve Analysis	6		2	90	5			1			4			12	151	35	306
Hydrometer	59		6			33	10	32	29	13	1	6	20		6		215
Atterberg Limits	59		5	3		33	10	31	29	13	5	6	20		7		221
Specific Gravity	59		6			33	10	32	29		1	6	20		6		202
Moisture Content	59	25		30				109				46	20		140		429
Compaction Test	15			28		13	4		8	3	2	6	7	1	10		97
Permeability	15					8			6	2					1		32
Shear Box														1	1		2
Water Absorption & Sp.Gr.				2										6	10		18
Soundness		5												4	6		15
Swelling pressure													1				1
Los Angeles														7	5		12
Potential volume change											1		1				4
In situ density		14	4	156							1	43					229
Mix design				7										2	10		19
Pinhole						2											2
Triaxial(Undrained with PWP)	2		1			2	1			2							9
Relative Density														1			1
Ultrasonic pulse velocity														1			1
Flakiness and Elongation														4			4
Silt Content				115											50		165
Alkali Reactivity														2	1		3
Slump				710											240		950
CBR				1													1
Suspended sediment																	105
Crushing strength (cores)																	105
Cube Crushing Strength				1220										8			8
TOTAL	274	19	49	2362	5	124	37	205	101	33	14	113	90	49	1081	369	4925

TOPOGRAPHY BRANCH

by
A Evripidhou
Senior Technical Superintendent

The Topography Branch performs all the survey work required by the Department and operates within the Planning Division. These surveys are of the engineering type and are necessary during the investigation, design, construction and after construction stages of projects under consideration.

By the end of 1989 the staff of the Branch comprised 1 Senior Technician, 4 Technicians I, 9 Technician II, 15 Rodmen, 7 Labourers and 4 vehicle drivers. The technical personnel is trained interdepartmentally on engineering surveying methods and field procedures as well as the use of modern surveying instruments and equipment so as to be able to undertake to conduct surveys such as: cross-sectioning, profile levelling, contour surveys, setting-out of Project outlines and take instrumental observations for movement detection of major structures.

During the year under review the Topography Branch has dealt with the following Projects:-

PROJECT:- SOUTHERN CONVEYOR PHASE I

SCHEME	Type of Topographical Work							REMARKS
	Setting out	Contour survey	Profile levelling	Cross-sectioning	Levelling of BNS	Monitoring observations	General Work	
KOXAJHOKHORIA IRRIGATION	X		X		X			IRRIGATION NETWORK
KHALASSA IRRIGATION SCHEME		X	X					DIVERSION SITE & PIPELINE
AKHHA DAM					X			OBSERVATION B/Hs.
LIOPETRI AYIA THEKLA	X		X					WATER SUPPLY SCHEME
KOURRIS DAM		X						PROPOSED TUNNEL UNDER SPILLWAY

PROJECT:- SOUTHERN CONVEYOR PHASE II

Type of Topographical Work

SCHEME	Setting out	Contour survey	Profile levelling	Cross-sectioning	Levelling of BMS	Monitoring observations	General Work	REMARKS
KITI IRRIGATION NET WORK H.S.P.					X			ESTABLISHING M.S.L. DATUM BENCH MARKS
AKPOTIRI	X		X					IRRIGATION NET WORK
KITHASI DHIARIZOS RIVER	X							PLOTTING TRIAL PITS & BOREHOLES
LIMASSOL WATER TREATMENT PLANT	X							LIMASSOL WATER SUPPLY LAND & ACQUISITION
TERSEPHANOU WATER TREATMENT PLANT & PIPELINE	X				X			ESTABLISHING M.S.L. DATUM BENCH MARKS & P.Is.

PROJECT:- KRASOKHORIA

Type of Topographical Work

SCHEME	Setting out	Contour survey	Profile levelling	Cross-sectioning	Levelling of BNS	Monitoring observations	General Work	REMARKS
PHINI DAM		X						EXTENSION SURVEY BORROW AREA
AYLOURIKOS DAM		X						BORROW AREA

PROJECT:- KARYOTIS

Type of Topographical Work

SCHEME	Setting out	Contour survey	Profile levelling	Cross-sectioning	Levelling of BMS	Monitoring observations	General Work	REMARKS
KARYOTIS DAK							X	PLOTTING OF BH'S

PROJECT:- ROUTINE WORKS

Type of Topographical Work								
SCHEME	Setting out	Contour survey	Profile levelling	Cross-sectioning	Levelling of BMS	Monitoring observations	General Work	REMARKS
MATHIKOLONI POND		X						EXTENSION SITE SURVEY
PSEVDAS WEIR		X						SITE SURVEY
LEFKARA XHIROKITIA PIPELINE			X					PLOTTING OF AIR & SLUICE VALVES
PLATRES SEWAGE			X		X			LEVELLING PIPELINE ROUTE
ARCHANGELOS ARADHIPPOU DAM	X							SETTING OUT PLAN
F/STA WATER SUPPLY		X						SITE SURVEY
PETRA UPPER DAM		X						DETERMINATION OF CAPACITY
OROUNDA					X			LEVELLING OF IRRIGATION CANALS

PROJECT:- ROUTINE WORKS

Type of Topographical Work								
SCHEME	Setting out	Contour survey	Profile levelling	Cross-sectioning	Levelling of BMS	Monitoring observations	General Work	REMARKS
KORAKOU DAM							X	PLOTTING TRIAL PITS BOREHOLES
YZAKIA DAM							X	PLOTTING TRIAL PITS
YIALIAS RIVER		X						RIVER TRAINING
STAVROYOURI KOPHINOU AREA		X	X		X			IRRIGATION SCHEME & BALANCING RESERVOIR
SYFILOS DAM							X	GATHERING OF FIELD DATA FOR PREPARATION OF IRRIG. SCHEME
PRASTIO EVDHYMOU POND						X		IRRIGATION PIPELINE
KITI DAM		X						SEDIMENTATION STUDIES
KOPHINOU LARHAKA ROAD							X	RELOCATION OF W.S. PIPELINES

PROJECT:- ROUTINE WORKS

Type of Topographical Work								
SCHEME	Setting out	Contour survey	Profile levelling	Cross-sectioning	Levelling of BHS	Monitoring observations	General Work	REMARKS

MARATHASA DAK		X						SEDIMENTATION STUDIES

LYMPIA DAK		X						SEDIMENTATION STUDIES

ARADHIPPOU RIVER		X						ANTIFLOOD WORKS

ALETHRIKO DAK							X	PLOTTING OF TRIAL PITS BOREHOLES

ANTHOUPOLIS AREA								RELOCATION OF WATER SUPPLY PIPELINES
PROPOSED ROAD DIVERSION ROUTE	X							

KHANDRIA POND No.1 & No.2		X						DETERMINATION OF CAPACITY

ARAKAPAS POND		X						DETERMINATION OF CAPACITY

XYPEROUNDA POND		X						DETERMINATION OF CAPACITY

PROJECT:- ROUTINE WORKS

Type of Topographical Work

SCHEME	Setting out	Contour survey	Profile levelling	Cross-sectioning	Levelling of BMS	Monitoring observations	General Work	REMARKS
KHIROKITIA WATER TREATMENT PLANT							X	COMPLETION PLANT
YAVATSINIA	X		X					PIPELINE & WEIR SITE
LAKATAKIA ENGOMI			X					NICOSIA WATER SUPPLY
AYIOS EPIPHANIOS			X					PIPELINE & DIVERSION SITE
LIHASSOL INDUSTRIAL AREA		X						RESERVOIR SITE SURVEY
SARANTI PONO		X						EXTENSION SURVEY

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AE/MB

PROJECT:- MONITORING OBSERVATIONS

Type of Topographical Work

SCHEME	Setting out	Contour survey	Profile levelling	Cross-sectioning	Levelling of BMS	Monitoring observations	General Work	REMARKS
XYLIATOS DAM						X		
AKHNA DAM						X		
KALAVASOS DAM						X		
DHYPOTAHOS DAM						X		
KALOPANAYIOTIS DAM						X		
LEFKARA DAM						X		

V DIVISION OF DESIGN

by: N.P. Stylianou
Senior Water Engineer
Head of Division

Introduction

The Design Division of the Water Development Department deals mainly with the preparation of detailed designs of major projects undertaken by the Department. These projects may involve the design of dams, ponds and other hydraulic structures, irrigation networks and domestic water supply schemes.

When such works are to be constructed by contract, the designs are supplemented with all necessary contract documents.

In some cases the final design of major projects is undertaken by consulting firms. In these cases the Design Division undertakes the overall supervision of the work been carried out by the Consultants and forms the link between the Consultants and WDD. The supervision includes mainly:

- (a) Discussions with the Consultants on all detailed design aspects of the project.
- (b) Supply all technical and other information required for the implementation of the designs.
- (c) Organize and supervise all topographical survey works and geotechnical investigations required for the design.
- (d) Review of the design work, contract documents and drawings prepared by the Consultants.
- (e) Arrange for the invitation of tenders for the supply of plant and equipment or for the construction of the works.
- (f) Carry out evaluation of tenders received.

Although in principle the activities of the Design Division are within the above mentioned frame of works, it is often required to extend its activities by undertaking the preparation of feasibility studies for projects of local importance. The activities of this Division extend even further into assisting in the supervision of the construction works, either to ensure that construction is carried out in full agreement with the designs and specifications or to help in solving problems encountered during the construction stage.

In addition to the Division Branches involved in the above mentioned type of works, this Division incorporates the Drawing and Records Branch of the Department. This Branch carries out all drawing work of all major and minor projects, keeps the technical records, helps in the preparation of technical reports, runs the library of the Department and undertakes all photographic reproduction and photo-process lab work.

During 1989 the following qualified personnel was working with the Design Division.

- One Senior Water Engineer, Head of the Division
- Seven Executive Engineers Class I
- One Senior Technical Superintendent
- Three Senior Technicians
- Nineteen Technicians (One qualified Civil Engineer)

MAIN ACTIVITIES

During 1989, the main activities of the Design Division were the supervision of the design work for the various components of Phase 2 of the Southern Conveyor Project (SCP) and the preparation of designs and studies for other schemes. The final design work for SCP - Phase 2 was undertaken by Energoprojekt, a firm of consulting engineers from Yugoslavia, who signed an agreement with WDD in November 1985 for the preparation of the detailed designs and contract documents for all engineering components of the Second Phase of the project. The supervision work undertaken by the Design Division was as outlined above at the beginning of this chapter.

The main components comprising the Second Phase of the Southern Conveyor Project and the work carried out during 1989 are described in Chapter VIII.

Other schemes for which the Design Division was involved or on which work was carried during 1989 are the following:

1. Vizakia Irrigation Scheme

The scheme comprises the construction of the Vizakia off-stream dam, a diversion weir with a diversion pipeline and an irrigation network as described below.

The total area to be irrigated is 217 hectares (1,630 donums) gross and is distributed to the following villages: 925 donums for Vizakia, 310 donums for Nikitari, 245 donums for Potami and 150 donums for Koutraphas. The irrigated area will undergo land consolidation and the estimated cost for the irrigation network is about £820,000.

The dam will have a capacity of 1,100,000m³ which shows an increase from the capacities considered at the feasibility stage. The volume of the earthfill embankment will be about 300,000m³ having a maximum height of 35.0 m. The spillway width will be 5.0 m and the discharge capacity 30.0 m³/s. A diversion pipeline 2.0 km long and 450 mm in diameter will divert the water into the dam. The estimated cost for the construction of the dam and diversion works is about £1,560,000.

During 1989, the draft design and documents which were submitted by the Consultants, Howard Humphreys & Partners of England, in December 1988, were reviewed by the Department. These are expected to be finalized during 1990.

2. Athienou Irrigation Scheme

The purpose of this scheme is to convey water from the Main Conveyor of the Southern Conveyor Project to Athienou village and two other nearby villages mainly for irrigation and a limited quantity for drinking of livestock.

Water from the main conveyor will gravitate towards a reservoir at Aradhippou through a 400mm diameter 1.6km long ductile iron pipeline and then will be pumped through a 450mm dia ductile iron pipeline 9.8 km long, to another reservoir at Athienou which is connected to the irrigation network. Both reservoirs have a storage capacity of 3,500m³. A pumping station will be constructed adjacent to the Aradhippou reservoir. Three pumps will be installed (one stand-by) delivering 227 liters per second against a total head of 200 metres. The irrigated area is 267 ha at Athienou and 65 ha at the villages of Avdhellero and Troulli.

During 1989 the final detailed design and drawings for the 1.6 km and 9.8 km long conveyors, two storage reservoirs and the pumping station were completed, as well as the Contract Documents and Price Schedules for the supply of pipes, fittings, valves and meters.

The Bill of Quantities and cost estimates for the construction of the above conveyors and structures and the cost estimate for the supply of pipes, fittings, valves and meters were also prepared. This scheme will be constructed by the Water Development Department using direct labour.

The total cost of the scheme is estimated to be £2.26 million.

3. Larnaca Water Supply

Because of the inadequate capacity of the existing main pipeline supplying water to Larnaca town from the Larnaca service reservoir, the Larnaca Water Board asked the Water Development Department to study the problem and prepare a design of a new water main, which together with the existing one should satisfy the demand for both Larnaca town and the tourist area along the Larnaca-Dhekelia road.

To enable the design of the new water main, it was necessary to review and update the water demand for both Larnaca town and the tourist area up to the year 2020. For this reason, a study was undertaken and projections made for both the Larnaca population increase and the tourists expected in the area.

The new conveyor will be of asbestos-cement pipes, class 15 and class 20, having a total length of about 16.5 km and a diameter varying from 700 mm to 200 mm. The preliminary cost estimate was about £990,000.

Larnaca Water Board has decided to proceed with the construction of the conveyor in stages. The first stage will be the construction of a pipeline 4.5 km in length and 700 mm in diameter starting from Larnaca reservoir.

The detailed design of the first stage has started. This includes the preparation of documents for the supply of pipes, fittings, valves and meters and the preparation of construction drawings. It is expected that these will be completed in early 1990.

4. Lakatamia-Engomi Conveyor

The Lakatamia-Engomi conveyor will connect two main reservoirs used for the water supply of Nicosia. It will be of asbestos-cement pipes, about 7 km in length and the diameter will vary from 600 mm to 500 mm. The project will be financed by the Water Board of Nicosia.

The preparation of construction drawings and tender documents for the supply of pipes, fittings and valves has started in 1989. The total estimated cost is about £525,000.

5. Kolossi Reservoir

This reservoir will supply the Kolossi Industrial Area with potable water which will be conveyed from the Limassol Water Treatment Plant. The total capacity of the reservoir will be of the order of 3,000 cubic meters. The estimated cost is about £150,000.

During 1989, the detailed design and construction drawings were completed.

6. Ponds on the Greek Islands of Samos and Lesbos

The design of two off-stream earth ponds which are to be constructed on the Greek Islands of Samos and Lesbos was undertaken by the Water Development Department. This work was the

result of an agreement for technical co-operation between the respective Ministries of Agriculture of Greece and Cyprus. Both ponds will be used for irrigation purposes and will be rendered water-tight using the PVC membrane lining, a method used very successfully in Cyprus.

The pond on Samos island, called Theophytos pond, is situated 3km north-east of Myteleni village and will have a storage capacity of about 150,000 m³. Water will be diverted into the pond from a nearby stream through a 1500 m long, 300 mm diameter PVC pipeline at a maximum rate of 120 lit/sec. For this purpose a concrete diversion weir will be constructed on the stream. The total volume of earthworks involved is estimated at 58,300 m³ and the membrane lining required to line the pond, 27,000 m².

During 1989, the detailed design and drawings, which were started in 1988, were completed.

The pond on Lesbos, given the name of Ayiasos Pond, is situated about 4 km north-west of Ayiasos village and will have a storage capacity of about 530,000 m³. Water from a number of springs will be diverted into the pond from a nearby stream, through a 1100m long, 300mm diameter PVC pipeline, at a maximum discharge rate of 150 lit/sec. The total volume of earthworks for the construction of the pond is estimated at about 114,000 m³ and the membrane lining required to line the pond 184,000 m².

The detailed design and drawings for Ayiasos Pond and its diversion weir were completed in 1989. The design and drawings for the diversion pipeline are still pending due to lack of information.

DRAWING AND RECORDS BRANCH
by S C Pitsillides STS
Head of Branch

The Drawing and Records Branch is made up of the following sections:-

- The Drawing and Cartography Section.
- The Plan Registry and Plan Reproduction Section.
- The Photographic Section and Photo Process Laboratory.
- The Technical Library and the Technical Information Section.

At the end of 1989 the Drawing and Records Branch staff numbered 23 i.e. one Senior Technical Superintendent, Head of Branch, 2 Senior Technicians, 10 Technicians I, 7 Technicians II, one Technician II on casual basis and 2 hourly paid Assistants of the plan reproduction section.

Two Technicians worked throughout the year on SCP construction sites. At the end of the year the Technician II on casual basis was shared between the HQs design team of SCP and the Kokkinokhoria Irrigation Area site offices of SCP.

Drawing and Cartography Section

The organisation of the Drawing and Records Branch continued on similar lines as that of the year 1988. The Assistant Head of the Branch continued to have full charge of the Drawing Office with the Head of the Branch having full knowledge of incoming work and final check of all finished outgoing work, thus affording him the Head of the Branch time for other general duties given him by the Director including publicity duties as required by the MANR.

Committees carried on work for:

- Instruments, equipment and materials purchase
- Exhibitions, inaugurations
- Formulation of drafting standards and
- a special team for cartographic work, model making and exhibitions-inaugurations supported as required by all the staff.

For the general organisation of the D & RB see Table V-2.

Training of staff is a never ending process and is carried out along with the execution of work. Nevertheless during 1989 members of the D&RB have, for varying periods attended the following courses:-

- Cyprus Productivity Center. Lessons in Autocad.
- Interdepartmental lessons in Lotus-123

TABLE V-3
WORK CARRIED OUT BY THE DRAWING AND RECORDS BRANCH DURING 1989.

Ref.	Description	Time spent in hrs.	Man months	% of total
a.	Existing dams (completion plans, sedimentation maps, control monuments etc.) and proposed dams	2993	19.2	7.8
b.	Irrigation distribution systems for dams	336	2.3	0.8
c.	Routine irrigation schemes	1477	9.4	3.8
d.	Routine domestic water supply schemes	4369	28.2	11.4
e.	Krasokhoria project	150	0.9	0.5
f.	Pitsilia integrated rural development project	-	-	-
g.	Vasilikos-Pendaskinos project .	354	2.2	0.9
h.	Southern Conveyor project	8614	55.2	22.3
i.	Khrysokhou irrigation project .	-	-	-
j.	Karyotis project	345	2.2	0.8
k.	Samos & Lesvos ponds	655	4.2	1.7
i.	Recharge works	67	0.4	0.2
m.	Antiflood and river training works	188	1.4	0.4
n.	Watershed surveys	1002	6.5	2.8
o.	Hydrological	-	-	-
p.	Programmes and organisation ...	608	3.9	1.5
q.	Sewage disposal	648	4.2	1.8
r.	Completion plans and reports ..	1989	12.7	5.2
s.	Agricultural show	-	-	-
t.	General-Odd jobs	1498	9.6	3.8
u.	Productivity centre course	26	0.1*	
v.	Auxiliary services			
	(i) Library	1763	11.4	4.6
	(ii) Plan registry	524	3.3	1.3
	(iii) Plan reproduction	1602	10.3	4.2
	(iv) Drawing materials store .	436	2.8	1.2
	(v) Photographic section and photo process lab	1827	11.7	4.7
	Total for auxiliary services ..	6152	39.5	16.0
w.	Leave etc.			
	(i) Leave paid	3519	22.6	9.2
	(ii) Leave without pay	202	1.3	0.6
	(iii) Sick leave	2649	17.0	6.8
	(iv) Maternity leave	428	2.7	1.2
	(v) D.C.	221	1.4	0.5
	Total for leave etc.	7019	45.0	18.3
	Grand total	38464	247	100%

* Carried out in members own time

The largest load of work during 1989 was again by far for the Southern Conveyor Project being 22.3% of the total time of the 20 No staff as can be seen on table V-I. Following was work for routine domestic water supply schemes (11.4%) and third was for existing and proposed dams (7.8%).

The main demand of the Southern Conveyor Project was for assistance at the Project sit of Ayios Athanasios for the main conveyor, at Ormidhia for the Kokkinokhoria Irrigation Area (KIA) and Kouris Dam (although this was afforded by the WDD Limassol Regional Office). At the Nicosia HQs the Drawing and Records Branch carried out work for the SCP design teams mainly for KIA irrigation networks. To a lesser extent the WDD HQs staff have also had to deal with information furnished to the SCP 2nd Phase Consultants, Energoprojekt of Yugoslavia.

Extraordinary demands on the D&RB during 1989 was:-

-- For the preparation of the inauguration of Kouris dam the Drawing and Records Branch took part in the organisation generally and also produced large information and photograph posters and information booklet on the occasion of the inauguration.

-- The preparation of a greek english version of the map of Kokkinokhoria Irrigation Area of the Southern Conveyor Project 1:50,000 showing the Irrigation Distribution Network of the area of Kokkinokhoria.

-- Preparation of bulletin for the 50 years anniversary of the Department of Water Development 1939-1989.

Plan Reproduction and Plan Registry Section

Two continuous Process ammonia plan printing machines have been used, the older one as a standby. A total number of 16,345 prints were prepared of all types and sizes through some 2,685 orders to the Print Room. The plan registry work was shared by the Drawing Office staff.

The Photographic Section and Photo Process Laboratory.

Photographic coverage of construction works of the Department was carried out throughout 1989 in black and white, colour and colour slides, still photography as well as colour video recording and in certain instances in colour cine filming. Periodic visits were made to Kouris Dam although the responsibility for photographic coverage lies with the contractors.

As was the case for the past year compact automatic cameras (5 No) during 1989 were distributed to various construction sites for on the spot photographic coverage. At the end of 1989 two of those cameras were held at SCP Kokkinokhoria Irrigation Area for the contracts in progress there, one was used at SCP main conveyor construction sites, one at Kouris Dam and one at Khrysokhou Project construction sites.

The Photographic section was non-the-less required to carry out monthly visits to the Kokkinokhoria Irrigation area contract sites for still colour photos and video recording/cine filming.

The photo process laboratory carried out all the photolithographic work of the department including preparatory work for our colour maps, base maps for SCP distribution networks as well as enlargements reductions and reproduction of drawing/maps.

Technical Library and Technical Information Section.

During the year under review £976 was spent on the purchase of 20 books and subscription to 14 periodicals.

The Library continued to issue bi-monthly notes on material received and of articles of special interest in periodicals.

Following are lists of books purchased of periodical subscriptions and of WDD reports.

MATERIAL PURCHASED IN 1989

Books (20 No.)

P WOOD-L GROVE. Developments in valves and actuators for fluid control. Conference proceedings. 2nd International conference. Manchester, England 28-30 March, 1988. London, 1988. Book No. B476. Stg.£57.00. (Requested by K C Hassabis AD)

B T COMMINS. Asbestos fibres in drinking water. Scientific and technical report STR-1. Berkshire, 1988. Book No. B477. Stg.£32.00 (Requested by K Ioannou (Ms) CH-II).

R B BULMAN. Prodigious rainfall and flood estimation. England, 1984. Book No. B478. Stg.£14.00. (Requested by D Kypris SH).

WAYNE AMSBURY. Structural basic and beyond. Maryland, 1980. Book No. B480. £14.95 (Requested by Dr A Christodoulides H-I).

SHELLY AND CASHMAN. Computer fundamentals with application software. Boston, 1986. Book No. B481. £18.50 (Requested by Dr Christodoulides H-I)

T M PANKRATZ. Screening equipment handbook for industrial and municipal water and wastewater treatment. Lancaster, 1988. Book No. B542 SFR81.00. (Requested by S C Pitsillides STS)

DAVID EWING. 1-2-3 Marco. Library 2nd edition USA, 1986. Book No. B543 C£19.95. (Requested by Dr A Christidoulides H-I).

J R RYDZEWSKI. Irrigation development planning. An introduction for engineers. London, 1987. Book No. B544 Stg.£55.00. (Requested by Chr Marcoullis, SWE)

L FLETCHER. Design and operation of pipeline control systems. New York, 1984. Book No. B551. Stg.£6.00. (Requested by N Tsiourtis, SWE)

T HOWARD. Seismic design of embankments and caverns. New York, 1983. Book No. B552. Stg.£9.00. (Requested by Ch Kridiotis, SWE)

J A SERAFIM. Safety of dams with Addendum. Rotterdam, 1984. Book Nos B642, B643. Hfl. 271.50. (Requested by Dr K Kyrou, EE-I).

JONATHAN KAMIN. MS-DOS. Πλήρες εγχειρίδιο χρήστη. Μετάφραση της 2ης Αμερικάνικης έκδοσης 1987. Αθήνα, 1989. Αρ. Βιβλίου, B691. Δραχμές 3400. (Ζητήθηκε από Δρ. Γ Σωκράτους, EE-I).

JOHN DONOVAN. Πλήρες εγχειρίδιο του WORDSTAR 2000. Μετάφραση της 1ης Αμερικάνικης έκδοσης 1987. Αθήνα, 1988. Αρ. Βιβλίου, B692. Δραχμές 3000. (Ζητήθηκε από Δρ. Γ Σωκράτους, EE-I).

DAVID GOBEL. Αναλυτική παρουσίαση του LOTUS HAL. Μετάφραση της 1ης Αμερικάνικης έκδοσης 1987. Αθήνα, 1988. Αρ. Βιβλίου, B693. Δραχμές 3400. (Ζητήθηκε από Δρ. Γ Σωκράτους, EE-I).

G B SHELLY & TH J CASHMAN. Εισαγωγή στον προγραμματισμό της γλώσσας BASIC. Αθήνα, 1988. Αρ. Βιβλίου, B694. Δραχμές 3500. (Ζητήθηκε από Δρα Γ. Σωκράτους, EM-I).

MULLER & SCHELLER. Προγράμματα σχεδίασης σε BASIC με έμφαση στις συναρτήσεις Spline 16 προγράμματα για μικροπολογιστές 39 σχήματα. Αθήνα, 1987. Αρ. Βιβλίου, B695. Δραχμές 1700. (Ζητήθηκε από Δρ. Γ Σωκράτους, EE-I).

ALAN SIMPSON. Dbase III plus - 2η έκδοση. Μετάφραση της 1ης Αμερικάνικης έκδοσης 1986. Αθήνα, 1988. Αρ. Βιβλίου, B696. Δραχμές 3400. (Ζητήθηκε από Δρ. Γ Σωκράτους, EE-I).

BSI. BS1 standards cataloue, 1989. London, 1989. Book Nos B747, B748. Stg.£22.00. (Requested by K C Hassabis, AD).

Subscription to periodicals

ASCE. Journal of Irrigation and Drainage Engineering

ASCE. Journal of Geotechnical Engineering

ASCE. Journal of Hydraulic Engineering

ASCE. Journal of Construction Engineering and Management

ASCE. Journal of Water Resources Planning and Management

THE INSTITUTION OF WATER AND ENVIRONMENTAL MANAGEMENT. Journal of Water and Environmental Management.

CONCRETE SOCIETY. Journal of concrete.

WATER & WASTE TREATMENT. Journal of Water & Waste Treatment.

DEPARTMENT OF EMPLOYMENT (UK) - HMSO. Employment Gazette.

THE INSTITUTION OF CIVIL ENGINEERS. Proceedings.

THE INSTITUTION OF CIVIL ENGINEERS. Geotechnique.

AMERICAN WATER WORKS ASSOCIATION. AWWA Journal.

Journal of the Irrigation Engineering and Rural Planning.

Waste and Water International.

WDD REPORTS (32 No.)

GSD & WDD E KYRIACOU-K KYROU. Orounda pond. Site investigation. Report No. F/88. Nicosia, December, 1988. Book Nos B482, B483.

WDD I IACOVIDES-A GEORGHIOU-A CHRISTODOULIDES-S KATSIANIS. Southern Conveyor Project. Kokkinokhoria area. Irrigation block XIIIb. Phrenaros-Sotira-Dherinia. Report on the ground-water resources. Report No. H/78. Nicosia, December, 1988. Book No. B484.

WDD I IACOVIDES-A GEORGHIOU-A CHRISTODOULIDES-S KATSIANIS. Southern Conveyor Project. Kokkinokhoria area. Irrigation block XV Xylotymbou. Report on the ground-water resources. Report H/79. Nicosia, December, 1988. Book No. B485.

WDD S PAPAGEORGHIOU. Technical staff lists as on 31.12.88. Report No. L/54. Nicosia, January, 1989. Book No. B487.

WDD K SPANOS. Khrysokhou Irrigation Project. Progress report No.11. Covering the period 1.7.88 - 31.12.88. Nicosia, March, 1989. Report No. D/311. Book Nos B506, B507.

WDD D M PATSALIDES. Southern Conveyor Project. (Phase 1). Progress report No. 9. Covering period 1.7.88 to 31.12.88. Nicosia, March, 1989. Report No. D/409. Book Nos B508, B509.

WDD K KYROU. Vizakia off-stream reservoir. Site and fill material investigations (1988). Nicosia, February, 1989. Report No. F/89. Book Nos B510, B511.

TAY - Π ΝΕΟΦΥΤΙΔΗΣ. Τεχνικός εμπλουτισμός υπογείων νερών (2η συμπληρωμένη έκδοση). Λευκωσία, Μάρτιος, 1989. Αρ. εκθέσεως Η/66/1. Αρ. βιβλίων Β512, Β513.

WDD. I IACOVIDES - A GEORGIU - A CHRISTODOULIDES - S KATSIANIS. Southern conveyor Project. Kokkinokhoria area. Irrigation block IVb Ormidhia Xylophagou. Report on the ground water resources. Nicosia, February, 1989. Report No. H/80 Book No. B514.

WDD. G SOCRATOUS. Domestic water tariffs 1984-1995. Report No. L/56. Nicosia, February, 1989. Book Nos B515, B516.

WDD. G SOCRATOUS - A HJIPANTELI. Domestic water tariffs 1984-1995 Vol.II. Appendices, Nicosia, February, 1989. Report No. L/56B. Book Nos B517, B518.

WDD G SOCRATOUS - A HJIPANTELI. Domestic water tariffs 1984-1995. Vol. III. Computer Programme Listings. Nicosia, February, 1989. Report No. L/56C. Book No. B519, B520.

WDD. Dr C CHRISTODOULOU & G SOCRATOUS. A model for optimal development of the water resources of an island. A case study from Cyprus. Nicosia, April, 1989. Report No. L/57 Book Nos B521, B522.

WDD C ST LYTRAS. Annual reports for the years 1985, 1986 and 1988. Nicosia, 1989. Book Nos. B586, B587, B588.

TAY ΠΕΤΡΟΣ ΝΕΟΦΥΤΙΔΗΣ. Σχέδιο Βασιλικού-Πεντάσχοινου. Αρ. εκθέσεως C/154. Λευκωσία, Μάιος 1989. Αρ. Βιβλίων, B555, B556.

TAY. ΠΕΤΡΟΣ ΝΕΟΦΥΤΙΔΗΣ. Εμπλουτιστικά έργα στους ποταμούς Περιστερώνα-Ακάκι. Αρ. Εκθ. D/171. Λευκωσία, Μάιος, 1989. Αρ. βιβλίων B557, B558.

WDD. I IACOVIDES - A GEORGIU - A CHRISTODOULIDES - A KATSIANIS. SCP Kokkinokhoria area. Irrigation block V (Xylophagou) Report on the ground-water resources. Report No. H/81. Nicosia, May, 1989. Book Nos B560, B561.

WDD. A CHRISTODOULIDES. One-dimensional groundwater circulation model of the Yermasoyia river aquifer. Report No. H/82, Nicosia, May, 1989. Book Nos B562, B563.

WDD. I IACOVIDES - A GEORGHIOU - A CHRISTODOULIDES - S KATSIANIS. SCP. Kokkinokhoria area. Irrigation area. Irrigation block IIIb (Ormidhia). Report on the ground water resources. Report No. H/83. Nicosia, June, 1989. Book Nos B564, B565.

WDD. I IACOVIDES - A GEORGHIOU - A CHRISTODOULIDES - S KATSIANIS. SCP. Kokkinokhoria area. Irrigation block IIIa (Akhna-Ormidhia-Xylytymbou). Report on the ground-water resources. Report No. H/84. Nicosia, July, 1989. Book Nos B566, B567.

WDD. N TSIOURTIS - I NICOLAOU. Report on review of irrigation water charges for the years 1989-1995 from the government waterworks. Report No. L/52A. Nicosia, May, 1989. Book Nos B571, B572.

WDD. PH ROUSSIS. Dam water balance and utilization 1988. Report No. L/58. Nicosia, May, 1989. Book Nos B573, B574.

WDD. K SAVVIDES. Monitoring programme for the treatment of water from Kouris dam at Khirokitia water treatment works No.1. Nicosia, March, 1989. Book No. B575.

TAY - ΠΕΤΡΟΣ ΝΕΟΦΥΤΙΔΗΣ. Αρδευτικόν έργον άντλησης Κάτω Λεύκαρα. Αρ. Εκθ. D/173. Λευκωσία, Αύγουστος, 1989. Αρ. Βιβλίων B603, B604.

TAY - ΠΕΤΡΟΣ ΝΕΟΦΥΤΙΔΗΣ. Υδρολογική λεκάνη Διαρίζου. Υδρολογία και έργα εκτροπής Κούρη. Αρ. Εκθ. D/175. Λευκωσία, Οκτώβριος 1989. Αρ. Βιβλίων B605, B606.

WDD - D PATSALIDES. Southern Conveyor Project (Phase 1) Progress report No. 10 covering period 1/1/89 to 30/6/89. Report No. D/410. Nicosia, August, 1989. Book Nos B599, B600.

TAY - Γ ΣΩΚΡΑΤΟΥΣ. Μαθηματικό μοντέλο για τη βέλτιστη ανάπτυξη των υδατικών πόρων της Κύπρου. Αρ. Εκθ. L/60. Λευκωσία, Ιούλιος, 1989. Αρ. Βιβλίων B601, B602.

M ΙΩΑΝΝΟΥ (ΤΑΥ) - Α ΑΝΤΩΝΙΟΥ (ΥΓ & ΦΠ) - Τ ΤΣΙΝΤΙΔΗ (ΤΔ).
Περιβαλλοντική μελέτη φράγματος Καπουρά-Αγίου Γεωργίου Καυκάλου,
Λευκωσία, Οκτώβρης, 1989. Αρ. έκθεσης D/176. Αρ. Βιβλίων B791,
B792.

DR G SOCRATOUS - SCP (Phase 1). Interim progress report No.
1989/Q3 (Year 1989, 3rd Quarter) Covering period 1.7.89 to
30.9.89. Nicosia, October, 1989. Report No. D/410/Q3. Book Nos
B793, B794.

I IACOVIDES - A GEORGHIOU - A CHRISTODOULIDES - S KATSIANIS SCP
Kokkinokhoria Area. Irrigation block VI Xylophagou-Avgorou
Liopetri - Report on the ground water resources. Nicosia,
October, 1989. Report No. H/85. Book Nos B795, B796.

S PAPAGEORGHIOU. Contracts for Cyprus. Major Water Development
Works. Nicosia, Revised December, 1989. Report No. L/63. Book Nos
B797, B798.

A GEORGHIADES & K GEORGHIOU. Schedule of Rates and Prices.
Revised. Nicosia, October, 1989. Report No. S/17. Book No. B799.

TABLE V-2

WDD — DRAWING AND RECORDS BRANCH (D & RB)

ORGANIZATION CHART 31.12.1989

Head : S C Pitsillides STS
Asst head : S Selipo ST

Plan registry, plan reproduction & drg materials : E Hkyriacou ST

A INCOMING WORK		B AUXILIARY SERVICES (DEPARTMENTAL)	
1	2	1	2
MAJOR PROJECTS	ROUTINE DWS, IRRIGATION SEWAGE DISPOSAL & OTHER WORKS	PLAN REPRODUCTION DRG MATERIALS (PURCHASE & STORE)	PHOTOGRAPHIC VIDEO - GRAPHIC SECTION, PHOTOLITHOGRAPHY PROCESS LAB
Distributed to the Drawing and Records Branch staff by the Asst Head — Where several staff are required for a particular job a senior member is asked to take charge	COMPLETION PLANS AND FOLLOW - UPS	-Plan printing -Machine maintenance & operation -Requirements of instruments, equipment and materials -Orders, tenders and local purchases -Drg materials store -Report collation binding (For Branch)	-Photo process lab for enlargements reductions, repros -Photolithography for cartographic work -Site visits for still, cine and video from ground and air -Negatives and process lab registry -Purchases, photo materials -equip -Maintenance & records for equipment -Orders & distribution of photos -Video documentaries production -Computer input for photos, slides films, videos
DRAWING AND RECORDS BRANCH STAFF ON 31.12.88			
Senior Technical Superintendent 1 No			
Senior Technicians 2 No			
Technician grade I 10 No			
Technician grade II 8 No			
Plan reproduction assistants (Hourly) 2 No			
Total 23 No staff			
C COMMITTEES - SPECIALIZED WORK ETC			
1	2	3	4
COMMITTEES	SITE & REGIONAL OFFICES D & RB STAFF	STAFF TRAINING	CARTOGRAPHIC SECTION GRAPHICS, MODEL MAKING, EXHIBITIONS etc
I. Instruments, equipment & materials purchase D & RB Head and Asst Head plus 2 or 3 D & RB staff	-Materials, instruments supplies -Periodic visits by D & RB Head	-Within D & RB -Within the Department -Productivity Centre -The private sector	D & RB Head and Asst Head plus 2 or 3 D & RB staff
D. SUNDRY DUTIES OF DO STAFF			
II. Exhibitions D & RB Head and Asst Head plus 2 or 3 D & RB staff	a Dam capacities files b D's office graphs - map c Annual report graphs etc d Staff charts e Orders to print room f Maps store g Watershed surveys store	g Requisitions to DLS h Standard sheets j Log. paper k Lettraset - tetralone l Plans in tubes & archives tubes m P R box files n Drawing tags	
III. Drafting standards D & RB Head and Asst Head plus 2 or 3 D & RB staff			

VI RURAL PROJECTS PLANNING DIVISION

By

C Andreou
Senior Water Engineer
Head of Division

Introduction

The Rural Projects Planning Division deals especially with rural domestic water supply and the planning and design of contributory irrigation schemes. Other activities of the Division is the rehabilitation of water supply and irrigation schemes, in the Rural Development Project areas of Orini (Larnaca), Marathasa, Tylliria and Krasokhoria, water supply schemes of touristic and livestock areas, encroachment in rivers and streams, quarrying in river beds, design of sewage systems for Refugee Housing Estates and communities in rural areas and the examination of applications for building permits and permits for the division of building plots.

By the end of 1989 the staff of the Division was consisting of the following:

- One Senior Water Engineer - Head of the Division
- One Executive Engineer Class I
- Two Sanitary Engineers Class II
- One Senior Technical Superintendent
- One Technical Superintendent
- Three Senior Technicians
- One Technician I
- One Technician II
- Two Technicians II (Temporary)
- One Secretary - Typist

VILLAGE WATER SUPPLY SCHEMES

The general village water supply situation during 1989 is described in Tables VI - 1 and VI - 2. There are no villages in Cyprus without piped water.

During 1989 only 53 out of a total number of 619 villages remained with public fountains i.e 0.83% of the total village population.

Out of 566 villages with house to house supply systems 545 enjoyed a per capita daily rate of over 130 litres (29 gallons).

Water Supply Schemes Prepared during 1989

A total number of 68 schemes were prepared and submitted to the District Officers during 1989 at a total estimated cost of 2,501,910 CY.P. as shown on Table VI-3.

Another 37 schemes were in the course of preparation by the end of the year as per Table VI-4.

Besides the above mentioned schemes a total number of 14 water supply schemes were prepared for the housing of displaced persons (Refugee self-housing and housing estates), at a total estimated cost of 241,230 as per table VI-3A, which were submitted to the Department of Town Planning and Housing.

In 1989, two schemes to supply water to livestock areas were prepared at a total estimated cost of 16,600 as per table VI-3B.

Another four schemes to supply water to municipalities were prepared at a total estimated cost of £438,000 as per Table VI-3C.

Domestic water supply schemes for touristic areas are also included in the schemes already mentioned.

In cases where there are no established Water Boards, the Division deals also with the design of town water supply schemes.

Brief description of important water supply schemes prepared during 1989

Nicosia District

Alambra: Additional supply from borehole 54/88 at a total estimated cost of £95,000.

Alambra: Improvements to the existing house to house scheme at a total estimated cost £80,000.

Lakatamia: Improvements to the existing house to house distribution system at a total estimated cost £72,000.

Archangelos Michael Gov.Housing (Lakatamia): House to house distribution system at a total estimated cost £40,000.

Laxia Industrial Zone: Supply of water to industrial plots and factories at a total estimated cost of £156,000.

Orounda: Improvements to the existing house to house schemes at a total estimated cost £56,000.

Lakatamia: Improvements to the existing house to house distribution system at a total estimated cost £185,000.

Nicosia International

Airport : Replacement of pumping main at a total estimated cost £75,000.

Spilia Replacement of conveyor main and improvements to the existing house to house systems at a total estimated cost £125,000.

Limassol District

Kyperounda: Construction of new water supply tank Replacement/extensions of pipeline estimated 157,000.

Apsiou: Additional supply from "Loutsiaes" spring construction of new water supply tank. Replacement of pipes estimated £92,000.

Ayios Athanasios municipality: Replacement of pumping main construction of new water supply tank estimated £108,000.

Paphos District

Peyia: A scheme was prepared to construct a new St. tank and to replace the distribution pipelines at an estimated cost of £242,000.

Argaka: A scheme was prepared to supply additional amount of water to the village from borehole no. 64/86 and to replace the distribution pipelines at an estimated cost of 146,000.

IRRIGATION SCHEMES

The planning and design of irrigation schemes aims at increasing the irrigated area near the sources for self employed farming organizations such as Village Irrigation Associations or Divisions.

The main target is to increase permanent irrigation annually which can be implemented with the financial participation by the farmers.

As the main principles of this special programme is the quick and effective use of water at or near the source combined with intensive agriculture methods, design considerations are usually based on land and water use data furnished by the District Agricultural Offices. Project evaluation is undertaken by a joint Interdepartmental Committee.

The advantages of the rural projects programme, the beginning of which dates back to the creation of the Department is "speed of reaction" in all phases of project development, "wide participation" of farming communities, "greater flexibility" in budgetary procedure and "greater exploitation" of the existing agriculture and agro-economic background of the island.

The planning and design of these schemes can be undertaken at a greater advantage by technical staff, whose skill has been acquired by long experience in construction methods and long friction with local problems and practices.

The main types of schemes planned and designed, postulated water conservation either by the improvement of the old obsolete intake and distribution system, the construction of small reservoirs for night or seasonal storage the exploitation of new boreholes and the artificial recharge of depleted aquifers.

A certain number of schemes have been designed and are now under construction with government contribution.

During 1989 a total number of 40 irrigation schemes was prepared and submitted to District Officers at a total estimated cost of £1488,308 as per Table VI-5.

Another 24 schemes were in the course of preparation or under investigation by the end of 1989 as per Table VI-7.

Brief Description of Important Irrigation Schemes prepared during 1989

Nicosia District

Kakopetria (Buffer Zone): Pumping scheme from borehole 62/87 and distribution system for the irrigation of 21,5 Ha. Estimated cost £68,500.

Evrykhou: Lining of existing earth channels in RCC for a total length of 3036 meters for the irrigation of 22.3 Ha. Estimated cost £95,000.

Ayios Ioannis (Maloundas) Lining of existing earth channels in RCC for a total length of 2473 meters for the irrigation of 17Ha. Estimated cost £61,000.

Limassol District

Asgata: Development of borehole 95/85 Estimated £64,700

Trimiklini: Replacement of "Zenon" irrigation division Estimated £8,700.

Moniatis : Construction of weir construction of tank 500m3 pipeline Estimated 43,000.

Paphos District

Yiolou-Miliou A scheme was prepared to irrigate an area of 67 Ha using borehole 55/78 and 111/81 at an estimate of cost £200,000.

Interdepartmental Committee for Small Irrigation Projects

The Committee is functioning in conformity with directions of the Director General of the Ministry of Agriculture and Natural Resources, for the purpose of assessing project viability for budgeting purposes and coordinates the activities of the District Agriculture Services for the supply of agro-economic data in the preparatory stages of the projects. During 1989 thirty schemes have been approved by the Committee as per Table VI-6.

SEWAGE SCHEMES

During 1989 two sewage schemes have been prepared:

a. Kornos Army Camp Sewage Scheme Included the design of the collection network within the camp. The total cost for the scheme is estimated to be around £144,900. It includes the cost for the collection network, of the Treatment Plant and the cost for the irrigation network within the camp which will utilize the treated effluent.

b. Livadhia-Aradhippou Scheme: The purpose of the works is to treat piggery wastes with the method of waste stabilization ponds. Estimated cost is around £90,000.

TABLE VI-1

VILLAGE WATER SUPPLIES

Villages with House-to
House distribution systemVillages with Public
FountainsVillages without
a piped supply

Year	Villages with House-to House distribution system				Villages with Public Fountains				Villages without a piped supply			
	Schemes completed	Total No. of villages	Villages %	Population %	Total No. of Villages	Villages %	Total No. of villages	Villages %	Population %	Total No. of villages		
1960	--	90	14.33	--	441	70.23	--	97	15.44	--	628	
1961	41	131	20.86	--	428	68.19	--	69	10.95	--	628	
1962	59	190	30.25	--	380	60.55	--	58	9.20	--	628	
1963	67	257	40.90	--	324	51.60	--	47	7.50	--	628	
1964	39	296	47.13	66.71	323	51.43	32.29	9	7.44	1.00	628	
1965	5	301	47.93	66.86	321	51.11	30.44	6	0.96	0.70	628	
1966	7	308	49.05	69.81	316	50.31	29.95	4	0.64	0.24	628	
1967	11	319	50.80	71.40	307	48.88	28.46	2	0.32	0.14	628	
1968	27	346	55.10	75.72	282	40.90	24.28	-	-	-	619	
1969	14	360	57.32	78.60	268	42.68	21.40	-	-	-	619	
1970	32	392	62.42	83.23	236	37.58	16.77	-	-	-	619	
1971	16	408	64.95	85.42	220	35.05	14.58	-	-	-	619	
1972	29	437	69.60	88.70	191	30.40	11.30	-	-	-	619	
1973	67	504	81.40	95.10	115	18.60	4.90	-	-	-	619	
1974	22	526	85.00	97.20	93	15.00	2.80	-	-	-	619	
1975	6	532	85.94	97.55	87	14.06	2.45	-	-	-	619	
1976	11	534	87.72	97.60	76	12.28	2.40	-	-	-	619	
1977	8	551	89.02	98.04	68	10.98	1.96	-	-	-	619	
1978	6	557	89.98	98.20	62	10.02	1.80	-	-	-	619	
1979	2	559	90.30	98.27	60	9.70	1.73	-	-	-	619	
1980	1	560	90.47	98.04	59	9.53	1.96	-	-	-	619	
1981	1	561	90.63	98.06	58	9.37	1.94	-	-	-	619	
1982	--	561	90.63	98.06	58	9.37	1.94	-	-	-	619	
1983	--	561	90.63	98.06	58	9.37	1.94	-	-	-	619	
1984	1	562	90.79	98.10	57	9.21	1.90	-	-	-	619	
1985	1	563	90.95	98.11	56	9.05	1.89	-	-	-	619	
1986	--	563	90.95	98.11	56	9.05	1.89	-	-	-	619	
1987	1	564	91.12	98.12	55	8.88	1.88	-	-	-	619	
1988	2	566	91.44	98.17	53	8.56	0.83	-	-	-	619	
1989	2	566	91.44	98.17	53	8.56	0.83	-	-	-	619	

TABLE VI-2

WATER SUPPLY SITUATION AT THE END OF 1989

District	Satisfactory piped supply Supply rate 90 l/head/day&over						Unsatisfactory piped supply Supply rate 90 l/head/day&over						Total No of Villages	Total popula- tion 1969				
	Villages with House to House			Villages with fountains			Villages with House to House			Villages with Public fountains								
	No	Pop.	%	No	Pop.	%	No	Pop.	%	No	Pop.	%						
Nicosia	150	88.76	119263	95.95	10	5.92	1230	0.99	5	2.96	3104	2.50	4	2.36	699	0.56	169	124296
Kyrenia	39	82.98	30786	93.50	2	4.26	59	0.18	1	2.13	540	1.64	5	10.63	1542	4.68	47	32927
Famagusta	82	83.68	82644	92.12	3	3.06	444	0.50	6	6.12	5695	6.34	7	7.14	934	1.04	98	89717
Limassol	104	91.22	72527	97.87	4	3.51	65	0.09	4	3.51	1417	1.91	2	1.76	99	0.13	114	74108
Paphos	114	84.85	48813	93.93	11	9.10	2006	4.02	5	3.78	685	1.32	3	2.28	191	0.72	132	51695
Larnaca	56	94.92	40238	99.27	2	3.39	156	0.38	0	0.00	0	0.00	1	1.69	140	0.35	59	40534
TOTAL	545	88.05	394271	95.40	32	5.17	3960	0.96	21	3.39	11441	2.77	21	3.39	3605	0.87	617	413277

TABLE VI - 3

VILLAGE WATER SUPPLY SCHEMES
 PREPARED IN 1989 AND SUBMITTED TO DISTRICT OFFICERS,
 GOVERNMENT DEPARTMENTS AND LOCAL AUTHORITIES

NICOSIA DISTRICT

SER. No.	Village	Nature of Schemes	Est. Cost CY. P
1	Kochatis	Water supply to plots for poor families	9,800
2	Alambra	Additoinal supply from BH 54/88	95,000
3	Alambra	Improvements to the existing House to house system	80,000
4	Menico	Additional supply from BH 99/88	26,000
5	Mathiatis	Additional supply from BH 161/87	15,300
6	Laxia Industrial Zone	Water supply to industrial plots & factories	156,000
7	Agrokipia	Additional supply from BH 161/88	5,100
8	Ayia Marina - Xyliatos	Excavation and building of Kopri spring	11,060
9	Kokkinotrimithia	Replacement of pipes	16,200
10	Livadhia (Pitsilias)	Additional supply from BH 81/76	19,000
11	Menico	Water supply to plots for poor families	3,300
12	Kokkinotrimithia	Water supply to plots for poor families	4,000
13	Orounda	Improvements to the existing House to house system	65,800
14	Kokkinotrimithia	Replacement of pumping main of BH 31/81	24,000
15	Kambia	Extensions	6,600

TABLE VI - 3 (Cont.)

NICOSIA DISTRICT (Cont.)

SER. No.	Village	Nature of Schemes	Est. Cost CY. P
16	Ayia Varvara	Water supply to plots for poor families	13,000
17	Ministry of Defence	Water supply to National Guard outposts(Yeri Area)	13,800
18	Shia	Extensions	3,900
19	Aredhiou	Additional supply from BH 16/89B	3,200
20	Ministry of Defence	K.E.N. Athalassa camp House to House scheme	43,000
21	Nicosia Internat. Airport	Replacament of pumping main	75,000
22	Mammari	Extensions	3,600
23	Kambi (Pharamaka)	Extensions	3,700
24	Xyliatos	Extensions	3,500
25	Mammari	Division of plots for poor families	3,500
26	Ayii Trimithias	Extensions	3,900
27	Yeri	Division of plots for poor families	4,800
28	Spilia	Replacement of conveyor main & improvements to the existing house to house system	125,000
29	Mitsero	Replacement of pipes	2,100
30	Politiko	Division of plots for poor families	8,800
31	Pano Dheftera	Replacement of pipes	3,700
32	Shia	Extensions	1,700
33	Aredhiou	Replacement of pipes	10,600
TOTAL			863,960

TABLE VI - 3 (Cont.)

LIMASSOL DISTRICT

SER. No.	Village	Nature of Schemes	Est. Cost CY. P
1	Dhieroná	Pipeline for division of plots for poor families	4,100
2	Paramali	Using of BH 70/88 for additional WS	38,000
3	Palodhia-Paramytha Spitali	Replacement part of pipeline of Maramenos spring	10,200
4	Akrounda	Replacement of WS main pipeline	12,800
5	Kyperounda	Construction of new WS tank Replacement/Extension of WS pipeline	157,000
6	Prastio (Kellakiou)	Additional WS from BH 16/88 Replacement of WS pipelines	21,800
7	Apsiou	Additional WS from Loutsiaes spring construction of a new WS tank	92,500
8	Ayios Pavlos	Replacement of pipeline of "Taouti"	6,700
9	Paliomylos	Replacement of pipes	31,000
10	Kandou	Replacement of pipes	38,500
11	Kilani	Replacement of pipes	68,500
12	Sotira	Replacement of pipes	16,750
13	Trozena	Additional WS from "Titsilia" spring	15,000
14	Vouni	Construction of a new WS tank	11,800
TOTAL			524,650
PAPHOS DISTRICT			
1	Ayia Marina & Nea Dhimmata	Replacement of main conveyor	22,200
2	Timi	House-House distribution system	40,000
3	Peyia	House-House distribution system	242,000

TABLE VI - 3 (Cont.)

PAPHOS DISTRICT

SER. No.	Village	Nature of Schemes	Est. Cost CY. P
4	Tala	House-House distribution system	74,000
5	Episkopi	Replacement of main conveyor	10,000
6	Eledhiou	Improvements	1,100
7	Kelokedhara	Improvements	15,000
8	Pakhyamos	Replacement of main conveyor	14,700
9	Argaka	Supplementary supply from BH 64/86 and new distribution system.	146,000
10	Ayia Marinoudha	Improvements	16,000
11	Lyso	House-House distribution system	76,000
TOTAL			657,000

LARNACA DISTRICT

1	Kophinou	Replacement of main conveyor pipeline	58,000
2	Skarinou- Alaminos Ayios Theodoros	Replacement of main conveyor pipeline of spring "Vrysi tou Mylou"	48,000
3	Alethrico	Replacement of existing distribution system	56,000
4	Ormidhia	Construction of new st. tank and improvements	82,000
5	Aradhippou	Extensions to "Kamares"	90,000
6	Goshi (Army Camp)	Extensions	35,000
7	Ayios Theodoros - Alaminos	Replacement of existing main conveyor pipeline	15,000
8	Troulli	Construction of new st. tank and installation of new pumping unit	30,000
TOTAL			414,000

TABLE VI - 3 (Cont.)

FAMAGUSTA DISTRICT

SER. No.	Village	Nature of Schemes	Est. Cost CY. P.
1	Ayia Napa	Extensions and replacements	16,300
2	Paralimni	Replacements	26,000
TOTAL			42,300

Summary of Table VI-3

District	No. of Schemes	Est. Cost CY P.
Nicosia	33	863,960
Limassol	14	524,650
Paphos	11	657,000
Larnaca	8	414,000
Famagusta	2	42,300
Total	68	2,501,910

TABLE VI - 3A

WATER SUPPLY SCHEMES FOR REFUGEE HOUSING OR SELF HOUSING ESTATES
PREPARED AND SUBMITTED IN 1989

NICOSIA DISTRICT

SER. No.	Village	Nature of Schemes	Est. Cost
1	Archangelos Michael III Lakatamia	House to House scheme	40,000
2	Pano Lakatamia Gov. Housing	Replacement of pipes	2,000
3	Yeri	Self Housing (Phase L)	6,000
4	Kotsatis	Replacement of pipes	20,000
5	Pano Lakatamia Gov. Housing	Installation of chlorination unit	1,200
TOTAL			69,200

LIMASSOL DISTRICT

1	Polemidhia	WS for 23 new plots (phase Θ)	6,500
2	Polemidhia	WS for 37 new plots (phase K)	12,000
3	Mouttayaika	WS for phase "K"	8,400
4	Polemidhia	WS for phase "H"	3,950
5	Trakhoni	WS for phase "E"	1,100
6	Armenikhori	WS for phase "Γ"	25,700
7	Polemidhia	WS for phase "Z"	23,280
TOTAL			80,930

PAPHOS DISTRICT

1	Ayios Georghios	Distribution system.	3,100
2	Mandria	House-House distribution system.	88,000
TOTAL			91,100

TABLE VI-3A (Cont.)

Summary of Table VI-3A

District	No. of Schemes	Est. Cost CY P.
-----	-----	-----
Nicosia	5	69,200
Limassol	7	80,930
Paphos	2	91,100
Larnaca	-	---
Famagusta	-	---
	-----	-----
Total	14	241,230

TABLE VI - 3B

WATER SUPPLY TO LIVESTOCK AREAS IN 1989

LIMASSOL DISTRICT

SER. No.	Village	Nature of Schemes	Est. Cost
1	Kolossi	WS of Kolossi Livestock area	13,000

LARNACA DISTRICT

1	Dromolaxia-livestock	Extensions	3,300
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TABLE VI - 3C

VILLAGE WATER SUPPLY SCHEMES
 PREPARED IN 1989 AND SUBMITTED TO MUNICIPALITIES

NICOSIA DISTRICT

SER. No.	Village	Nature of Schemes	Est. Cost
1	Lakatamia	Extensions	72,000
2	Laxia	Improvements to the existing House to house system	73,000
3	Lakatamia	Improvements to the existing House to house system (Makarios str.)	185,000
TOTAL			330,000

LIMASSOL DISTRICT

1	Ayios Athanasios	Repalcement of pumping main	108,000
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Summary of Table VI-3C

District	No. of Schemes	Est. Cost CY P.
Nicosia	3	330,000
Limassol	1	108,000
Paphos	-	-
Larnaca	-	-
Famagusta	-	-
Total	4	438,000

TABLE VI - 4

VILLAGE WATER SUPPLY SCHEMES PENDING BY THE END OF 1989

NICOSIA DISTRICT

SER. No.	Village	Nature of Schemes
1	Lagoudhera Sarandi	Additional supply from BH
2	Korakou	Supply from "Livadhi tou Papaphilippou " spring
3	Kakopetria	Additional supply from Atsoutopotemino spring
4	Malounda	Improvements to the existing House to House system
5	Ayios Ioannis (Maloundas)	Additional supply from BH 250/89 & improvements to the existing House to House system
6	Peristerona	Extensions
7	Lythrodhondas	Division of plots for poor families
8	Lazania	Additional supply from BH
9	Klirou	Improvement to the existing House to House system
10	Kambos	Extensions
11	Pano Lakatamia Gov. Housing	Division of plots for refugees self housing
12	Kannavia	Additional from BH 86/87
13	Kalokhorio (Klirou)	Extensions

LIMASSOL DISTRICT

1	Parekklishia	Replacement of pipes
2	Ayios Ioannis (Agros)	Replacement of pipes
3	Palodhia-Paramytha Spitali	WS scheme
4	Kato Mylos	Additional WS from Loutsiaes spring

Table VI-4 (Cont.)

PAPHOS DISTRICT

SER. No.	Village	Nature of Schemes
1	Philousa Khrys.	Replacement of conveyor pipeline.
2	Kissonerga	Replacement of conveyor pipeline (Krya Vrysi).
3	Pano Arkhimandrita	House-House scheme.
4	Kathikas	Improvements to Distribution system and additional water supply from BH 91/88.
5	Skoulli	Additional water supply.
6	Mosphileri	Replacement of conveyor pipeline.
7	Kinousa	House-House scheme.
8	Khoulou	Additional supply from BH 147/88.
9	Pano Pyrgos	Replacement of pumping mains.
10	Panayia	Additional supply from "Zandi" sprin
11	Kholetria	Additional supply from BH 18/69 and replacement of distribution system.

LARNACA DISTRICT

1	Kato Dhrys	New st. tank and developments.
2	Vavatsinia	New borehole. New st. tank and developments.
3	Kornos	Developments and extensions.
4	Aradhippou	Extensions to Kamares II
5	Mosphiloti	Developments
6	Kalavassos	Extensions

FAMAGUSTA DISTRICT

1	Paralimni	Developments to tourist area New st. tank.
2	Sotira	Replacement of main conveyor pipeli
3	Phrenaros	Developments

TABLE VI - 4A

WATER SUPPLY TO LIVESTOCK AREAS PENDING BY THE END OF 1989

LARNACA DISTRICT

SER. No.	Village	Nature of Schemes
-----	-----	-----
1	Alethriko	New Livestock area.

LIMASSOL DISTRICT

1	Erimi	WS of Livestock area
2	Pelendria	WS of Livestock area

TABLE VI - 5

IRRIGATION SCHEMES PREPARED IN 1989 AND SUBMITTED TO DISTRICT OFFICES

NICOSIA DISTRICT

SER. No.	Village	Division or Association	Locality	Nature of proposed work	Est. Cost CY P.	% Village cont.
1	Phlasou	Division	Selloshis	Lining of channels in RCC	26,000	33
2	Evrykhou	"	"	"	95,000	33
3	Aredhiou	"	"	"	49,500	33
4	Nikitari	"	Lambirithkia	Extension of distribution pipeline	6,500	33
5	Akaki	Association	Riatiko	Lining of channels in RCC	80,000	40
6	Meniko	Division	Gyros	"	5,800	33
7	Meniko	"	Lytharakes	"	197,000	33
8	Katokopia	"	Toumba (Buffer zone)	Pumping scheme and distribution pipes	14,508	33
9	Ayios Ioannis(M)	"	"	Lining of channels in RCC	61,000	33
10	Argates	"	"	"	48,250	33
11	Orounda	Association	Maoutsos Limni	"	13,500	40
12	Peristerona	Division	"	"	38,500	33
13	Chakistra	"	Theophylou	Pumping scheme	43,100	33

TABLE VI - 5 (Cont.)

NICOSIA DISTRICT (Cont.)

SER. No.	Village	Division of Association	Locality	Nature of proposed work	Est. Cost CY P.	Village cont. %
14	Kambos	"		Repairs and improvements of existing RCC channels	8,350	33
15	Peristerona	"	Elefthera Ktirka (Buffer zone)	Pumping scheme distribution pipes	22,000	33
16	Kochati	"		Lining of channels in RCC	30,000	33
17	Avlona	Private Company		Extension of distribution pipeline and repairs to the chain of wells.	34,500	--
18	Spilia	Division	Anemourka	Distribution pipelines	4,800	33
19	"	"	Pervolouthkia	" " "	3,450	33
20	"	"	Arkondou	Storage tank and distribution pipeline	10,000	33
21	"	"	Mosphili	Construction of weir and distribution pipelines	6,200	33
22	"	"	Kria Vrysi	Distribution pipelines	2,200	33
23	Katokopia	"	Kato Mazeri (Buffer zone)	Pumping scheme distribution pipes	68,500	33
24	Akaki	"	Kalonerio No. 2	New storage tank	--	--
25	Galata	"	Vasilica	Main conveyor pipeline	5,250	33
TOTAL					873,908	

TABLE VI - 5 (Cont.)

LIMASSOL DISTRICT

SER. NO.	Village	Division or Association	Locality	Nature of proposed work	Est. Cost	Village cont.
					CY P.	%
1	Kato Amiandos	Association	Fournia	Replacement of RCC channels	1,850	40
2	Dhymes	Division	Kambos - Kardhama	Improvements	5,000	33
3	Kilani	"	"	Improvements	1,450	33
4	Asgata	"	"	Utilization of BH 95/85	64,700	33
5	Ay. Dhimitrios	"	Potamia - Kaloghiros	Replacement of RCC channels	6,700	33
6	Trimiklini	Association	Zenonas	Improvements	8,700	42
7	Agridhia	Division	Panayia	Improvements	3,600	33
8	Moniatis	Division	Zaraes, Lattouphidhes, & water tank Mouskarkou	Construction of weir	43,000	33
					135,000	

LARNACA DISTRICT

1	Odhou	Division	Kaloupos	Pumping scheme from BH 83/85 and distribution system.	41,000	33
2	Alaminos	"	Stavrovouni	Pumping scheme and distribution system.	78,000	33
				TOTAL	119,000	

TABLE VI - 5 (Cont.)

PAPHOS DISTRICT

SER. No.	Village	Division or Association	Locality	Nature of proposed work	Est. Cost CY P.	%
1	Kelokedhara	Division	Ziriphillis	Pumping scheme from BH 7/88	52,000	33
2	Kritou Terra	"	Kephalovrysos	Pumping scheme from BH 115/85	65,000	33
3	Yiolou-Miliou	"	-	Pumping scheme from BH 55/78 & 111/81	200,000	33
4	Nea Dhimmata	"	Symvoulios	Pumping scheme from BH 41/88	35,400	33
5	Panayia	"	Sarka	New st. tank	8,000	33
TOTAL					360,400	

Summary of Table VI-5

District	No. of Schemes	Est. Cost CY P.
Nicosia	25	873,908
Limassol	8	135,000
Paphos	5	360,400
Larnaca	2	119,000
Famagusta	-	--
TOTAL	40	1,488,308

TABLE VI - 6

MINOR IRRIGATION SCHEMES APPROVED BY THE INTERDEPARTMENTAL COMMITTEE IN 1989

SER. No.	Village	Locality
1	Orounda	Maoutsos - Limni
2	Phlasou	Selloshis
3	Meniko	Lytharkes
4	Ayios Theodoros Agrou	Lois
5	Aredhiou	--
6	Meniko	Gyros
7	Akaki	Riatiko
8	Ayios Ioannis (M)	--
9	Kritou Terra	Kephalovrysos
10	K. Pyrgos	Katouris
11	Odhou	Kaloupos
12	Argates	--
13	Nikitari	Lambirithkia
14	Kaliana	--
15	Evrykhou	--
16	Katokopia	Toumba(Buffer zone)
17	Peristerona	Elefthera Ktirka
18	Chakistra	Theophylou
19	Kochati	--
20	Peristerona	--
21	Kambos	Palio Ardheftiko
22	Katokopia	Kato Mazeri (Buffer zone)
23	Agridhia	Panayia
24	Avlona	Private company
25	Trimiklini	Zenonas
26	Spilia	Anemourka
27	Spilia	Pervolouthkia
28	Spilia	Mosphili
29	Spilia	Kria Vrysi
30	Spilia	Arkondou

MINOR IRRIGATION SCHEMES NOT APPROVED BY THE INTERDEPARTMENTAL COMMITTEE IN 1989

N I L

TABLE VI - 7

IRRIGATION SCHEMES IN THE COURSE OF PREPARATION, UNDER INVESTIGATION OR PENDING DURING 1989

NICOSIA DISTRICT

SER. No.	Village	Locality	Nature of proposed work
1	Kakopetria	Apotheri	Improvements
2	Orounda - Peristerona - Astromeritis		Lining of channels
3	Klirou	Laoura	Pumping scheme and distribution system
4	Nikos		Pumping scheme and distribution system
5	Alona		Distribution pipeline
6	Katokopia	Ktirka (Buffer zone)	Replacement of main conveyor pipeline
7	Malounda		Pumping scheme from BH 13/85 & BH 105/87
8	Nikitari		Distribution pipeline
9	Pedhoulas		Improvements

PAPHOS District

1	Lemona	BH 134/84	Pumping scheme
2	Eledhiou	Katinou	Pumping scheme
3	Pretori	BH 21/88	Pumping scheme
4	Amargeti	Ziripillis	Improvements
5	Amargeti	BH 127/87	Pumping scheme
6	Theletra	---	Distribution system
7	Terra	Dhialos BH 58/61	Pumping scheme
8	Polemi	Proodhos BH 17/89	Pumping scheme

TABLE VI - 7 (Cont.)

LARNACA DISTRICT

SER. No.	Village	Locality	Nature of proposed work
-----	-----	-----	-----
1	Odhou	Stavri	Pumping scheme from BH 21/84/85
2	Kophinou	Stavrovouni	Pumping scheme from BH 52/83

TABLE VI-8

SEWAGE SCHEMES PREPARED IN 1989

SER. NO.	Village	Nature of work	Est. Cost
1	Kornos (Army Camp)	Collection network	144,900
2	Livadhia- Aradhippou	Piggery waste Disposal scheme	90,000

VII DIVISION OF
CONSTRUCTION

by
A P Georghiades
Senior Water Engineer
Head of the Division

Introduction

The Division of Construction is one of the major divisions of the Department, and it deals with the planning, supervision and control of all the constructional activities of the Department by direct labour. The Division also plays an important role when projects are constructed by contract. The Division is sub-divided in the following branches:

- The Planning and Control Branch
- The Tenders and Land Acquisition Branch.
- The Major Projects Construction and Control Branch.
- The Minor Projects Construction and Control Branch.

During 1989 the Division consisted of the following staff which was involved either directly with its activities, or posted to specific projects under Project Management.

- 1 Senior Water Engineer - Head of the Division
- 1 Executive Engineer Class I - Assistant Head of the Division.
- 7 Executive Engineers, Class I
- 3 Executive Engineers, Class II
- 1 Senior Technical Superintendent
- 7 Technical Superintendents
- 4 Senior Technicians
- 39 Technicians Grade I & II
- 2 Chief Foreman
- 8 Assistant Chief Foremen
- 45 Monthly paid Foremen (Including Regional Offices)
- 37 Weekly paid Foremen (Including Regional Offices)

155 Total Staff

In addition to the above technical staff the Department engaged a daily average of 874 regular workmen of various trades, mostly skilled and also 120 casual labour, mostly unskilled for the execution of the various schemes approved for construction during 1989, throughout the Island.

The Planning Branch of the Division continued during 1989 to collect data regarding actual rates of construction, standards of materials and equipment for the revision of the manual "Schedule of Rates and Prices", which was revised during the year, and was distributed to all Divisions and Technical Officers of the Department.

This year the commencement of the construction of the new schemes, especially the contributory ones, started earlier due to the early approval of the Development Budget by the House of Representatives.

Still we believe that the administrative formalities for the approval of the schemes by the beneficiaries and the procedure required for the allocation of the funds are considerably long and new ways and means should be introduced to speed up all these formalities.

CONSTRUCTION PROGRAMME AND PROGRESS

The Planning Branch of the Division prepared as usually, a construction programme for all the schemes that were approved for construction in 1989. These schemes were mainly included in the Development Budget of the Department whilst few others in the budget of other Government Departments or Ministries. Over and above these budgeted schemes the Department had to respond and deal with all non-budgeted water projects for emergency schemes or for villages and private developers. Due to the early approval of the budget it was made possible to prepare the construction programme at the very beginning of the year which was distributed to District Officers and appropriate Government Departments. For Specific Major Projects, more detailed programmes of either contract supervision or forced account works were prepared by others under Project Management.

All these schemes undertaken for construction during 1989, may be classified into three main groups as follows:

- All projects, new and carry over, approved in the Department's Development Budget,
- All other projects, covering a wide range of types, approved in the budgets of a number of Ministries, or Departments and
- All types of non-budgeted projects, i.e. improvements to existing water supply and irrigation schemes, laying of distribution mains for land development, etc., carried out from funds deposited in full by villages or private developers.

In total during 1989 the Department had to deal with 567 schemes of an estimated value of £28,019,730. The overall expenditure incurred on all these projects during 1989 reached the amount of £14,524,990, against £18,362,857 for 1988, £26,223,982 for 1987, £37,086,855 for 1986, and £22,462,514 for 1985. The major part of this expenditure was incurred for the Southern Conveyor Project.

Table VII-1 gives a summary of the work executed by the Department during 1989. Detailed lists showing all the schemes undertaken for construction, with more information are given in separate tables and short description reports that follow, further on in this report.

TABLE VII-1
SCHEMES UNDERTAKEN FOR CONSTRUCTION DURING 1989

Ser.	Description	No of schemes	Amount alloc. for 1989 £	Expenditure incurred during 1989 £
1	Rural domestic water supply schemes	47	1 299 363	996 875
2	Minor irrigation schemes	25	432 576	357 189
3	Other major irrigation works	4	54 931	43 546
4	Town water supply schemes and Government water supply schemes	9	449 225	392 647
5	Vasilikos Pendaskinos Project	3	522 282	452 371
6	Southern Conveyor Project ...	10	21 509 000	9 382 711
7	Paphos Irrigation Project ...	1	97 672	73 541
8	Khrysokhou Irrigation Project	1	700 000	413 207
9	Pitsilia Integrated Rural Development Project (mainly maintenance).....	12	28 307	17 052
10	Refugee housing and self-housing schemes	35	216 078	177 690
11	Schemes undertaken for construction for other Government Departments	156	1 958 591	1 605 095
12	Schemes undertaken for construction for villages (non-budgeted) from deposits	83	601 743	555 952
13	Schemes undertaken for construction for private developers (non-budgeted) from deposits	181	149 962	57 114
	Total	567	£28 019 730	£14 524 990

PLANNING BRANCH

The main activities of this branch during 1989 may be classified as follows:

- The programming and pricing of all schemes approved for construction mainly by direct labour.
- The preparation of a construction programme for all schemes approved for construction.

- The preparation of a monthly progress report showing all budgeted schemes, and the progress and expenditure incurred each month.
- The assessment of the Department's annual requirements for Minor Projects in materials and equipment, such as pipes and fittings, pumping units, etc., and their order through the Government Central Stores Department in time so that the schemes approved for construction are executed smoothly and uninterruptedly.
- The checking of the estimates of the schemes designed by other Divisions of the Department, so as to conform with the current rates and to ensure their execution within the estimated cost.
- The collection of data regarding actual rates of construction, standards of materials and equipment for the revision of the manual "Schedule of Rates and Prices" which was revised during the year and distributed to all Divisions and Technical officers of the Department.

TENDER AND LAND ACQUISITION BRANCH

The main activities of this Branch are:

The invitation of tenders direct for the supply of materials that are not available at the Government Central Stores, such as pumping units, building materials etc, for Minor Projects.

- The advertisement and distribution of contract documents prepared by other Divisions of the Department to prospective tenderers, for Major Projects.
- The evaluation of tenders, and award through Tender Board is dealt directly by the Division of Construction and Project Management.
- All matters of land acquisition and requisition of the Department.

MINOR PROJECTS CONSTRUCTION AND CONTROL BRANCH

The main activities of this Branch are to plan, execute and control the construction of all the schemes where the Division is directly involved. It has to follow up and see that all construction programmes are adhered to, or revised if required by the supervising technical staff, that the progress of the works under construction is attained at reasonable standards and as planned. The quality of the works of all schemes under construction has also to be followed up very carefully and controlled in consultation with the Soils and Concrete Laboratory.

Another objective of this Branch is to ensure that the schemes under construction are completed within the estimated time and approved amount. Another objective of this Branch is the distribution of resources and manpower to the various schemes under Construction.

All projects outside Nicosia District are constructed directly by the three District Offices of the Department i.e. Limassol, Larnaca-Famagusta and Paphos in close association with the senior Technical Officer of the Division who acts as the co-ordinator between the District Offices and the Headquarters in Nicosia.

In addition to that, the head of the Division and the tender section play a great role in the planning and execution of the various schemes under construction in the Districts.

The Division is always kept informed on the progress of the schemes in the Districts through site visits by the technical co-ordinator, and the monthly progress reports which are prepared by the supervising staff of the Districts and forwarded to the headquarters. These monthly progress reports are being utilized for the preparation by the Planning Branch of the Division of the general monthly progress chart which covers all schemes in all Districts.

MAJOR PROJECTS CONSTRUCTION AND CONTROL BRANCH

The Division is either involved directly in the execution of these major projects given to forced account or is involved indirectly through the head of the Division and supervising staff for these projects which are given to contract and are controlled by a project director on a project management basis.

The Head of the Division apart from being a member of the Major Project committee for the implementation and evaluation of claims he also participates on arbitration proceedings on various projects.

In the case of forced account works the Division plays a more important role in the planning, manpower distribution, recruitment of machinery and labour from the private sector and the preparation of progress reports and cost estimates.

LABOUR FORCE

For the construction of a scheme the Department usually engages gangs consisting of a monthly, or weekly (hourly) paid foreman, regular artisans of the Department of various trades, and casual, skilled or unskilled labour force which is recruited locally through the Government Labour Offices.

The average daily labour force engaged by the Division including the Workshops during 1989 for the construction of all the schemes was 994. Out of this figure 874 employees were regular and 120 were casual. They cover a variety of trades i.e. builders carpenters, pipelayers, etc.

The total expenditure incurred during 1989 on wages alone on schemes constructed by direct labour by the Department reached the amount of £5,703,963.

Table VII-2 shows the monthly average labour force engaged direct by the Department in 1989.

TABLE VII-2
LABOUR FORCE FOR 1989

Month	Skilled	Unskilled	Regular	Casual	Total
January	788	229	909	108	1017
February	769	234	898	105	1003
March	746	218	860	112	972
April	747	218	853	112	965
May	756	227	862	118	980
June	800	225	878	149	1027
July	798	218	847	166	1013
August	797	212	876	133	1009
September	808	195	868	135	1003
October	795	189	850	134	984
November	804	198	897	105	1002
December	785	172	894	63	957
Daily average No.	783	211	874	120	994
Daily average %	79	21	88	12	100

PIPES AND PIPE FITTINGS

The majority of pipes and pipe-fittings of all types used by the Department for the execution of the schemes approved for construction during 1989, were purchased through the Government Purchasing and Supply Department. A reasonable stock of fast moving materials is always kept on a permanent basis for requisitioning by all Government Departments.

In exceptional cases where our requirements could not be met by the Purchasing and Supply Department due to the execution of emergency schemes, where a special type of pipes were used, such as P.V.C. or ductile iron, then these pipes were purchased direct either by our Department or, the Purchasing and Supply Department through the usual procedure of open public tenders.

However, it should be noted that for specific major projects which are being financed by the World Bank or other International Finance Organizations, pipes and pipe-fittings as well as other materials used, have to be purchased after the invitation of International tenders by our Department.

The annual requirements of our Department in pipes and pipe-fittings of all types, are assessed by the Planning Branch of the Division as soon as the Development Budget is approved and an order is put through the Purchasing and Supply Department, early before the commencement of the schemes. During 1989 a length of 650,205 running meters of various types and diameters of pipes were purchased at a value of £2,143,157 and laid all over the free Island for the execution of all the schemes approved in the 1989 Development Budget.

Table VII-3 shows in detail all types, lengths and value of pipes laid during 1989.

SUMMARY OF ALL TYPES OF PIPES LAID DURING 1989

Ser. No.	Type	Length m	Value £
I	Galvanized steel pipes	76 409	228 513
II	Steel pipes (coated) plain ended .	18 645	185 090
III	Asbestos cement pressure pipes - class 15	109 016	911 363
IV	Asbestos cement pressure pipes - class 20	30 135	151 775
V	Asbestos Cement Pressure pipes-class 25	2 141	10 170
VI	Polythene pipes	88 994	91 034
VII	Unplasticized PVC pipes	324 332	516 738
VIII	Ductile iron pipes	531	48 474
	Total	<u>650 203</u>	<u>£ 2 143 157</u>

**TABLE VII-3
PIPES LAID DURING 1989
I GALVANIZED STEEL PIPES**

Nominal dia inches	Length m	Value £
1/2	2 938	1 494
3/4	1 074	681
1	2 454	2 237
1 1/4	3 114	4 034
1 1/2	4 248	6 350
2	8 448	16 820
2 1/2	10 170	24 800
3	20 226	64 466
4	23 737	107 628
Total	<u>76 409</u>	<u>£ 228 513</u>

TABLE VII-3
 PIPES LAID DURING 1989
 II STEEL PIPES (COATED-PLAIN ENDED)

Nominal dia mm	Length m	Value £
150	9 106	86 695
200	4 104	41 757
250	2 977	24 723
300	2 168	25 561
350	154	3 226
525	72	1 656
550	8	184
600	56	1 288
Total	<u>18 645</u>	£ <u>185 090</u>

III ASBESTOS CEMENT PRESSURE PIPES - CLASS 15

Nominal Dia mm	Length m	Value £
100	24 530	87 994
125	125	488
150	15 596	58 420
200	15 122	83 074
225	2 280	18 691
250	10 950	76 334
300	10 904	102 428
350	5 532	63 835
400	1 750	22 466
450	14 317	217 369
500	7 236	162 305
600	204	5 871
800	370	8 852
900	100	2 966
Total	<u>109 016</u>	£ <u>911 363</u>

TABLE VII-3
 PIPES LAID DURING 1989
 IV ASBESTOS CEMENT PRESSURE PIPES - CLASS 20

Nominal Dia mm	Length m	Value £
100	11 728	31 996
125	231	1 023
150	7 576	32 914
200	4 244	29 913
250	6 356	55 929
Total	<u>30 135</u>	£ <u>151 775</u>

V ASBESTOS CEMENT PRESSURE PIPES-CLASS 25

Nominal Dia mm.	Length (m)	Value £
100	1 576	5 706
125	78	948
150	487	3 516
	<u>2 141</u>	<u>10 170</u>

VI POLYTHENE PIPES

Nominal dia inches	Length m	Value £
1/2	10 992	1 996
3/4	29 209	7 777
1	10 754	5 038
1 1/2	1 784	1 549
2	10 820	14 457
2 1/2	8 264	13 928
3	17 171	46 289
Total	<u>88 994</u>	£ <u>91 034</u>

TABLE VII-3
PIPES LAID DURING 1989

VII UNPLASTICIZED PVC PIPES - (6, 10 and 16 bar)

Nominal dia mm	Length m	Value £
63	19 879	10 516
75	43 908	45 653
90	63 390	88 545
110	163 182	230 535
140	9 142	26 054
160	22 455	102 833
200	2 376	12 602
Total	<u>324 332</u>	£ <u>516 738</u>

VIII DUCTILE IRON PIPES

Nominal dia mm	Length m	Value £
700	357	26 218
900	60	6 800
1000	114	15 456
Total	<u>531</u>	£ <u>48 474</u>

CONSTRUCTION PLANT

For the execution of the schemes approved for construction in 1989, the Department had to hire Government machinery through the Electrical and Mechanical Services (E.M.S). If Government machinery was not available then the Department had to hire machinery from the private sector through open tenders.

BUILDING AND OTHER MATERIALS

As usually all building materials such as cement, aggregates, sand etc. are purchased locally from the private sector through open tenders. However, materials such as mild steel, water meters etc. are requisitioned through the Department of Government Purchasing and Supply.

When cement is required in quantities of over 12 tons, it is purchased direct from the two local cement factories. However when cement is required in smaller quantities it has to be purchased through the Department of Government Purchasing and supply. During 1989 the Division purchased and used materials of various types at a cost of £257,505.

Table VII 4-I shows in detail all building materials purchased and used during 1989. Table VII4-II shows in detail all water meters installed by the Department during 1989 for the execution of the schemes approved.

TABLE VII-4-I

BUILDING AND OTHER MATERIALS USED DURING 1989

Ser. No.	Description	Quantity	Value £
1	Cement	1595 tons	34 410
2	Rapid hardening sulphate resisting cement.....	5.25 tons	1 365
3	Sand for bedding	75 635m ³	82 081
4	Sand	5 488m ³	15 563
5	Aggregates	4 741m ³	13 328
6	Havara	1 182m ³	4 749
7	Mild Steel	425 tons	74 998
8	Ready mix concrete	508m ³	11 770
		Total	238 264

Table VII-4 - II
WATER METERS INSTALLED DURING 1989

Dia in inches	Water meters in Number	Value £
1/2	694	2 730
3/4	4	19
1	46	504
1 1/4	15	197
1 1/2	26	920
2	25	1 035
2 1/2	20	956
3	53	2 479
4	86	5 358
6	15	1 783
8	6	721
10	2	679
	1	410
	2	1 450
Total	995	£ 19 241

RURAL DOMESTIC WATER SUPPLY SCHEMES

The construction programme for 1989 included 47 rural domestic water supply schemes of an estimated value of £1,299.363. The expenditure incurred on all these schemes during the year reached the amount of £996,875.

These 47 schemes were split all over the Island and mostly were related to supplementary water supply schemes and improvements to existing distribution systems and construction of new storage reservoirs.

A summary of these schemes by district is given below. Detailed list showing all 47 schemes which were undertaken by the Department for Construction during 1989 are given below in table VII-5.

SUMMARY OF RURAL DOMESTIC WATER SUPPLY SCHEMES UNDERTAKEN FOR CONSTRUCTION DURING 1989

District	No. of schemes	Amount allocated for 1989 £	Expenditure incurred in 1989 £
Nicosia	17	365 959	262 770
Larnaca	11	387 562	319 935
Famagusta	3	191 723	133 838
Limassol	10	197 604	161 905
Paphos	6	156 515	118 427
Totals	47	£ 1 299 363	£ 996 875

TABLE VII-5
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1989
NICOSIA DISTRICT

Ser. No.	Scheme	Amount Allocated		Total	Expenditure		Total	Remarks
		Govt	Village		Govt	Village		
		£	£	£	£	£	£	
1	Yeri-Supplementary supply from BH 37/82 and B/H 70/85	42 911	928	61 595*	23 966	8 628	47,933*	completed
2	Kapedes-Supplementary W-S from BH 162/87.....	23 667	11 833	35 500	22 429	11 215	33 644	completed
3	Nisou-Pera Khorio Supplementary supply from Dhyptomamos-Nicosia Pipeline.....	9 500	--	19 000*	7 493	4 271	14 987*	completed
4	Paleometokho -Supplementary supply from BH 86/85	28 243	28 243	56 486	17 018	17 018	34 036	Completed
5	Paleometokho-Improvements to existing distribution system	12 011	12 011	24 022	9 003	9 003	18 006	Completed
6	Tseri-Supplementary Supply from BH 52/54.....	6 418	2 979	12 837*	5 434	2 522	10 868*	Completed
7	Ayia Varvara-Improvements to existing distribution system	4 104	1 871	6 155*	2 741	1 250	4 092*	Completed
8	Ayii Trimithias-Supplementary supply from BH 40/85.....	23 223	5 725	33 445*	3 367	1 886	6 734*	Completed
9	Galata-New main conveyer....	1 426	9 577	11 003	1 426	3 490	10 916	Completed
10	Klirou-Supplementary Supply from BH 51/83.....	4 541	4 542	9 083	1 970	1 970	3 940	Completed
11	Kokkini Trimithia-New reservoir	6 358	4 878	14 054*	7 005	4 878	13 983*	Completed
12	Mitsero-Supplementary Supply from BH 129/85.....	3 421	1 932	5 353	2 535	1 432	3 967	Completed
13	Orounda-Supplementary supply from BH 6/86.....	2 709	2 140	5 418*	1 752	1 384	3 504	Completed
14	Pera Orinis-Extension to existing distribution system and replacement of a pumping unit.....	3 077	2 308	6 154*	1 213	909	2 425*	Completed
15	Palechori (0) Improvements to existing distribution system	1 527	727	2 254	196	98	294	Completed
16	Kaliana-Combined irrigation domestic w.s.	15 734	7 866	23 600	12 651	6 326	18 977	Completed
17	Lythrodontas- Supplementary supply from BH 181/83 and improvements to existing distribution system.....	20 000	20 000	40 000	17 232	17 232	34 464	Completed
Totals for Nicosia District		209 470	117 560	365 959	137 431	99 512	262 770	

TABLE VII-5
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1989 (Cont)
LIMASSOL DISTRICT Constructed by the Limassol District Office)

Ser. No.	Scheme	Amount allocated		Expenditure		Total	Remarks
		Govt £	Village £	Govt £	Village £		
1	Ephthagonia-Supplementary Supply from BH 50/85 and replacement of existing distribution system	10 955	5 477	16 432	5 826	2 913	8 739 Completed
2	Erimi-Kolosi Supplementary Supply from BH 69/86	3 512	2 213	7 025*	1 389	8 750	2 778* Completed
	Supply from BH 114/84.....	11 833	5 917	17 750	10 297	5 148	15 445 Completed
	Moutayaiaka-Replacement of the main conveyor.....	2 692	1 939	4 631	2 179	1 577	3 756 Completed.
5	Ypsonas-Polemidthia Supplementary supply from new borehole	11 326	6 229	22 652*	11 122	6 116	22 243* Completed.
6	Kalokhorion	8 328	4 170	12 508	663	331	994 Completed
7	Dhymes-Supplementary Supply from BH 81/80.....	15 000	5 000	20 000	13 886	4 629	18 515 Completed
8	Kato Mylos-Supplementary supply from BH 66/76.....	2 700	900	3 600	2 310	770	3 080 Completed.
9	Pelendria-Supplementary Supply from Pirillos spring	5 534	2 766	8 300	4 046	405	6 069* Completed
10	Pissouri-Replacement improvements and extension to existing distribution system	37 554	47 152	84 706	40 143	40 143	80 286 Work in progress
Totals for Limassol District		109 444	81 763	197 604	91 861	70 782	161 905

TABLE VII-5
RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1989 (cont)
LARNACA DISTRICT (Constructed by L'ca-F'sta District Office)

Ser. No.	Scheme	Amount Allocated		Total	Expenditure		Total	Remarks
		Govt	Village		Govt	Village		
		£	£	£	£	£	£	
1	Kiti Installation of main conveyor from new reservoir and replacement distribution system	18 500	21 302	39 802	16 421	16 421	32 842	Completed
2	Ayia Anna- Supplementary supply from BH 11/86 and replacement of existing distr. system	27 000	4 500	36 000*	25 468	4 231	33 941*	Completed
3	Kornos-Supplementary Supply from Dhypotamos Nicosia-Pipeline	40 000	20 000	60 000	38 548	19 274	57 822	Completed
4	Maroni-Replacement of existing distribution system	25 333	12 667	38 000	8 344	4 172	12 516	Work in progress
5	Ormidhia-Replacement of existing distribution system.....	10 000	8 948	32 960*	12 448	8 776	24 895*	Completed
6	Psevdas - Replacement of the main conveyor and construction of a new reservoir....	19 333	8 120	29 000*	18 929	7 950	28 392*	Completed
7	Xylophagou-Replacement of existing distribution system	15 000	15 000	30 000	8 766	8 766	17 532	Completed
8	Moshiloti	2 500	-	2 500	2 499	-	2 499	Completed
9	Xylymbou-Replacement of a the existing distribution system	15 000	85 000	100 000	35 811	59 026	94 837	Work in progress
10	Delikipo-Construction of new concrete reservoir.....	10 000	-	10 000	8 451	-	8 451	Completed
11	Ayios Theodoros	6 975	2 325	9 300	4 656	1 552	6 208	Completed
Total for Larnaca District		<u>£189 641</u>	<u>£177 862</u>	<u>£387 562</u>	<u>£180 341</u>	<u>£130 168</u>	<u>£319 935</u>	

TABLE VII-5
RURAL DOMESTIC WATER SUPPLY SCHEMES - Expenditure 1989 (Cont)
FAMAGUSTA DISTRICT (Constructed by L'ca-F'sta District Office)

Ser. No.	Scheme	Amount Allocated		Govt E	Village E	Total E	Govt E	Village E	Expenditure Total E	Remarks
		Govt E	Village E							
1	Avgorou - Replacement of existing distribution system	15 000	24 374	39 374	7 870	15 740	7 870	7 870	15 740	Work in progress
2	Dherynia - Replacement of existing distribution system	76 000	12 769	88 769	45 932	58 611	45 932	12 679	58 611	Work in progress
3	Liopetri - Replacement of existing distribution system.....	31 790	31 790	63 580	29 743	59 487	29 743	29 744	59 487	Completed
Totals for Famagusta District		£122 790	£68 933	£191 723	£83 545	£133 838	£83 545	£50 293	£133 838	

TABLE VII-5
 RURAL DOMESTIC WATER SUPPLY SCHEMES-EXPENDITURE 1989 (Cont.)
 PAPHOS DISTRICT (Constructed by the Paphos District Office)

Ser. No.	Scheme	Amount Allocated		Expenditure		Remarks
		Govt £	Village £	Govt £	Village £	
1	Mesoyi-New distribution system	7 686	7 686	7 203	7 203	14 406 Completed
2	Kannaviou-Supplementary Supply from BH 8/86.....	3 000	-	3 000	-	3 000 Completed
3	Khlorakas-Replacement of the Main Conveyor and Construction of a new reservoir.....	24 540	43 983	24 546	10 650	35 196 Work in progress
4	Yeroskipos-Replacement of existing distribution system	28 100	29 310	27 882	27 882	55 764 Completed
5	Kilinia.....	7 800	-	5 653	-	5 653 Completed
6	Khoulou	2 205	2 205	2 204	2 204	4 408 Completed
Totals for Paphos District		73 331	83 184	70 488	47 939	118 427

MINOR IRRIGATION SCHEMES

The construction programme for 1989 included 25 minor irrigation schemes of an estimated value of £432,576. The overall expenditure incurred on all these 25 schemes during the year reached the amount of £375,189.

These 25 schemes were split all over the Island and were mostly related to:

- Improvements and extensions to existing irrigation systems.
- Pumping schemes from Boreholes.
- Lining of channels with reinforced concrete.
- New pipe distribution systems.

A summary of these schemes by District is given below. Detailed list showing all 25 schemes which were undertaken by the Division for construction during 1989 are given below on table VII-6.

SUMMARY OF MINOR IRRIGATION SCHEMES UNDERTAKEN FOR CONSTRUCTION DURING 1989

District	No. of schemes	Amount allocated for 1989 £	Expenditure incurred during 1989 £
Nicosia	15	222,225	194,934
Limassol	5	42,045	38,344
Paphos	5	168,306	141,911
Total	<u>25</u>	<u>£432,576</u>	<u>£375,189</u>

TABLE VII-6
MINOR IRRIGATION SCHEMES-EXPENDITURE 1989
NICOSIA DISTRICT

Ser. No.	Scheme	Amount Allocated		Expenditure		Total E	Remarks
		Govt E	Village E	Govt E	Village E		
1	Aredhiou-Pumping scheme and distribution system from BH 58/81	7 898	3 949	11 847	7 153	3 576	10 729 Completed
2	Kambia-Pumping Scheme and distribution system from BH 105/83	8 414	4 207	12 621	7 933	3 967	11 900 Completed
3	Kato Moni-Pumping scheme from BH 14/84	7 542	3 771	11 313	3 733	1 866	5 599 Completed
4	Spilia-Kleftis Irr. Div. Kavalorotsos Irr. Div. and Sklidros Irr. Div.....	1 025	512	1 537	1 022	511	1 533 Completed
5	Tseri Irr. Div. Lining of Channels	12 067	6 033	18 100	9 725	4 862	14 587 Completed
6	Linou-Linopsas	331	165	496	264	132	396 Completed
7	Akaki-Riatiko Irr. Div. Extension of Irrigation chan. Kaliana Irr. Div.-Combined Irrigation and water supply scheme	13 979	10 682	26 757*	14 023	11 751	27 649* Completed
9	Meniko Irr. Div.-Extension of R.C.C. channels	27 600	13 800	41 400	25 835	12 917	38 752 Completed
10	Nikitari Irr. Div.-Pumping Scheme from BH 121/78.....	3 867	1 933	5 800	2 474	1 237	3 711 Completed
11	Palekchori Irr. Ass.-Pano avlaki-Maroullena. Extension to distribution system.....	4 333	2 167	6 500	4 178	2 088	6 266 Completed
12	Pano Koutraphas Irr. Div.- Pumping scheme and distribution system from BH 77/80.....	8 333	4 167	12 500	5 775	4 182	9 957 Completed
13	Recharge schemes-Gabion type at Kokkinotrimithia	16.667	8 333	25 000	15 328	7 664	22 992 Completed
14	Phlasou-Linou-R.C.C. channels	17 104	-	17 104	11 999	-	11 999 Completed
15	Galata Sina Oros	17 333	8 667	26 000	16 518	8 259	24 777 Completed
		3 500	1 750	5 250	2 725	1 362	4 087 Completed
Total for Nicosia District		£149 993	£ 70 136	£222 225	£128 685	£64 374	£194 934

TABLE VII-6
 MINOR IRRIGATION SCHEMES-EXPENDITURE 1989 (Cont)
 LIMASSOL DISTRICT (Constructed by the Limassol District Office)

Ser. No.	Scheme	Amount Allocated		Expenditure		Total	Remarks
		Govt £	Village £	Govt £	Village £		
1	Agros-Pano Lambata Irr. Div. Improvements to existing distribution system	2 200	1 100	2 186	1 093	3 279	Completed
2	Ayios Ioannis Agrou-Macheras Irrigation Division New distribution system	10 000	5 000	9 798	4 899	14 697	Completed
3	Ayios Ioannis Agrou Teratsia Irr. Div-Installation of distribution system	8 764	4 381	7 507	3 753	11 260	Completed
4	Kyperounda-Stremmata Irr.Div. Installation of distribution system	4 733	2 367	4 020	2 010	6 030	Completed
5	Potamitissa-Improvements to distribution system	2 333	1 167	2 052	1 026	3 078	Completed
Total for Limassol District		<u>£28 030</u>	<u>£14 015</u>	<u>£25 563</u>	<u>£12 781</u>	<u>£38 344*</u>	

Note* Indicates that a contribution from TAEP is included.

TABLE VII-6
 MINOR IRRIGATION SCHEMES-EXPENDITURE 1989 (Cont.)
 PAPHOS DISTRICT (Constructed by the Paphos District Office)

Ser. No.	Amount Allocated Scheme	Expenditure		Village E	Total E	Govt E	Village E	Total E	Remarks
		Govt E	Total E						
1	Yiolou-Ayios Georghios Utilization of BH 96/80.....	12 108	18 163	6 055	18 163	10 826	5 413	16 239	Completed
2	Yiolou-Ayios Nipios Utilization of BH 66/80 and BH 90/80	29 569	44 353	14 784	44 353	29 098	14 549	43 647	Completed Pending the electricity Supply.
3	Miliou "Liskiari" Irr. Div. Distribution system and Construction of new weir....	16 989	25 484	8 495	25 484	12 254	6 127	18 381	Completed Pending the electricity Supply.
4	Pendalia Irr. Div.- Utilization of BH 67/83.....	36 000	54 000	18 000	54 000	25 153	12 576	37 729	Completed
5	Lemona-Khoulou Utilization of Spring 'Amati' and distribution system	17 538	26 306	8 768	26 306	17 277	8 838	25 915	Completed
Total for Paphos District		£112 204	£168 306	£56 102	£168 306	£94 608	£47 303	£141 911	

**OTHER MAJOR IRRIGATION WORKS
(SUPPLEMENTARY WORKS)**

During 1989 the Division had to deal with supplementary works for 4 major irrigation schemes of an estimated value of £54,931. The overall expenditure incurred on these 4 schemes during 1989 reached the amount of £43,546.

Details of all the 4 major irrigation works which were undertaken for construction during 1989 is shown on table VII-7.

TABLE VII-7
OTHER MAJOR IRRIGATION WORKS - EXPENDITURE 1989.

Ser. No.	Scheme	Amount Allocated		Expenditure		Total	Remarks
		Govt E	Village E	Govt E	Village E		
1	Yermasoyia-Polemihia Replacement of pipes for Akrounda Irrigation Network	5 000	-	5 000	2 449	2 449	Completed
2	Ayios Ioannis (Agrou) Combined Irrigation and Water Supply from BH 65/76.....	10 479	3 623	14 102	6 878	10 317	Completed
3	Galata-Sina Oros Completion of pond and extension to distribution system.....	13 553	6 277	19 830	10 310	5 155	15 465 Completed
4	Yierakies-Tsakistra-Kambos Purchase and installation of a stand-by pumping unit.....	12 000	3 999	15 999	11 486	3 829	15 315 Completed
Total		E 41 032	E 13 899	E 54 931	E 31 123	E 12 423	E 43 546

TOWN WATER SUPPLY AND GOVERNMENT WATER SUPPLY SCHEMES

The construction programme for 1989 included four main categories of schemes:

- Improvement of water supply sources, refineries, pumping stations and conveyors for Town and other Municipalities Water Supplies.
- New schemes for Town and Other Municipalities Water Supplies.
- Improvement of water supply sources, Refineries Pumping Stations and Conveyors for Government Water supply schemes.
- New Government water supply schemes.

For the four above categories of schemes an amount of £449,225 was allocated during 1989 for the execution of 9 different schemes. The overall expenditure incurred during 1989 on these schemes was £392,647.

Most of these schemes aimed to improve the existing water supply for towns, municipalities and villages which depend on Government Sources of Supply and replacement of existing distribution systems.

A list showing all schemes executed during 1989 is given on table VII-8.

TABLE VII-8
A NEW SCHEMES FOR TOWN AND OTHER MUNICIPALITIES WATER SUPPLIES

Ser. No.	Scheme	Amount Allocated		Expenditure		Total	Remarks
		Govt £	Village £	Govt £	Village £		
1	Laxia-Supplementary water Supply from the Main Pipe- line Dhyptomos-Nicosia	18 000	4 500	11 283	2 820	22 566*	Completed
2	Lakatamia-Replacement of distribution system	29 000	11 600	25 839	10 335	51 679*	Completed
3	Paralimni Replacement of distribution system	25 000	28 914	22 347	22 347	44 694	Completed
4	Athienou - Replacement of distribution system	17 000	47 000	7 770	47 000	54 770	Completed
5	Pano Lefkara - New Reservoir and replacement of distribution system	67 365	22 407	64 259	21 420	85 679	Completed
	Total	156 365	114 421	131 498	103 922	259 388	

* Indicates that a contribution from TAEP is included.

B IMPROVEMENT OF WATER SUPPLY SOURCES, REFINERIES, PUMPING STATIONS AND CONVEYORS

Ser. No.	Scheme	Amount allocated in 1989 £	Expenditure incurred during 1989 £	Remarks
1	Kokkini-Trimithia	15 000	13 984	
	Replacement of main Conveyor	-----	-----	
	Total	£15 000	£13 984	

C NEW GOVERNMENT WATER SUPPLY SCHEMES

Ser. No.	Scheme	Amount allocated in 1989 £	Expenditure incurred during 1989 £	Remarks
1	Amathous Extension to distribution system	43 500	36 768	Completed
2	Pissouri Supplementary Supply from Phasoula	20 000	18 921	Completed
3	Paphos Low Villages Replacement of the main pipeline	69 041	63 586	Work in progress
	Totals.....	£132 541	£119 275	
	Grand Totals.....	£449 225	£392 647	

REFUGEE HOUSING AND SELF-HOUSING SCHEMES

During 1989 the Department had to deal with 35 schemes related to water supplies and sewage schemes for Government Housing Estates and Self Housing Schemes.

Thirtyfour schemes were related to water supplies for Government Housing Estates and Self Housing schemes one scheme was related to Sewage schemes for Government Housing Estates and Self housing schemes.

A summary of these schemes by District is given below. Detailed list showing all 35 schemes which were undertaken by the Department for Construction during 1989 are given on table VII-9.

REFUGEES HOUSING AND SELF-HOUSING SCHEMES
SUMMARY OF ALL DISTRICTS

A. WATER SUPPLY FOR GOVERNMENT HOUSING ESTATES AND SELF HOUSING SCHEMES.

Ser. No.	Description	Number of schemes	Amount allocated in 1989 £	Expenditure incurred during 1989 £
1	Nicosia District...	10	23 397	14 519
2	Limassol District..	7	94 841	85 729
3	Larnaca District ..	8	70 700	62 421
4	Famagusta District.	1	9 900	1 549
5	Paphos District ...	8	14 940	11 172

B SEWAGE SCHEMES FOR GOVERNMENT AND SELF HOUSING SCHEMES

1	Paphos District ...	1	2 300	2 300
	Total	35	£216 078	£177 690

TABLE VII-9

A. WATER SUPPLY FOR REFUGEE HOUSING AND SELF HOUSING SCHEMES
 I NICOSIA DISTRICT

Ser. No.	Scheme	Amount allocated in 1989 £	Expenditure incurred during 1989 £
1	Tseri	1 300	1 745
2	Yeri K.....	4 720	2 358
3	Tseri K	1 600	1 863
4	Phlasou A	800	390
5	Nissou H.....	2 600	2 261
6	Dhali D.....	3 300	2 337
7	Ayios Eleftherios	1 922	1 725
8	Archangelos Michael B ...	1 838	469
9	Ayios Mamas	1 339	759
10	Pano Lakatamia	3 978	612
	Totals	£23 397	£14 519

II LIMASSOL DISTRICT (Constructed by Limassol District Office)

Ser. No.	Scheme	Amount allocated in 1989 £	Expenditure incurred during 1989 £
1	Kollossi ΣΤ	5 655	5 388
2	Moutayiaka Δ.....	22 000	20 108
3	Moutayiaka E.....	21 356	20 754
4	Trakhoni E.....	1 100	827
5	Moutayiaka H	29 400	28 750
6	Moutayiaka A	15 000	9 596
7	Ayios Ioannis.....	330	305
	Totals.....	£94 841	£85 729

WATER SUPPLY FOR REFUGE HOUSING AND SELF HOUSING SCHEMES
 III LARNACA DISTRICT (Constructed by Larnaca-Famagusta District
 office)

Ser. No.	Scheme	Amount allocated in 1989 £	Expenditure incurred during 1989 £
1	Kophinou	49 000	43 261
2	E.A.C-A.....	3 986	8 325
3	E.A.C-B.....	5 035	3 141
4	E.A.C-C.....	979	371
5	Dhromolaxia	7 800	4 444
6	Kalon Khorion.....	1 100	660
7	Kelia.....	2 400	1 974
8	Xylophagou	400	245
	Totals.....	<u>£70 700</u>	<u>£62 421</u>

IV FAMAGUSTA DISTRICT (Constructed by Larnaca-Famagusta District
 office)

Ser. No.	Scheme	Amount allocated in 1989 £	Expenditure incurred during 1989 £
1	Akhna	9 900	1 549
	Total	<u>£9 900</u>	<u>£1 549</u>

V PAPHOS DISTRICT (Constructed by Paphos District office)

Ser. No.	Scheme	Amount allocated in 1989 £	Expenditure incurred during 1989 £
1	Kouklia.....	1 078	789
2	Axiothea.....	1 296	1 060
3	Kiniras II.....	866	817
4	Lemba B.....	1 600	1 398
5	Mandria.....	2 300	1 590
6	Khrysokhou.....	700	700
7	Ayios Yeorghios-Mamonia ..	3 100	2 105
8	Yeroskipos.....	4 000	2 713
Totals.....		£14 940	£11 172

B. SEWAGE SCHEMES FOR GOVERNMENT HOUSING ESTATES AND SELF HOUSING SCHEMES.

Paphos District (Constructed by Paphos District office)

Ser. No.	Scheme	Amount allocated in 1989 £	Expenditure incurred during 1989 £
1	Moutallos	2 300	2 300
Total		£2 300	£2 300

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER GOVERNMENT DEPARTMENTS

For many years, it has become the normal practice for the Department to undertake the construction of all schemes related to water works which are included in the budget of other Government Departments.

These schemes cover a wide field and include:

- Domestic water supply schemes
- Minor irrigation schemes
- Water supply schemes to livestock,
- Relocation of pipelines due to construction of new roads or widening of the existing roads.
- Sewage schemes,
- Improvements of water supply or irrigation schemes for Turkish villages where now Refugees have been housed.

During 1989 the Division had to deal with the construction of 156 such different schemes all over the Island of an estimated value of £1,958,591. The overall expenditure incurred on all these schemes during the year reached the amount of £1,605,095, compared with £1,290,565 during 1988, £1,177,341 during 1987 and £541,441 during 1986. From the above figures it is obvious that this category of works represents a fair amount of the Department's constructional activities and the volume of works increased from year to year.

A summary of these schemes by District is given below. Detailed list showing all 156 schemes which were undertaken by the Department for Construction during 1989 are given on table VII-10.

SUMMARY OF SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER GOVERNMENT DEPARTMENT DURING 1989.

District	No of schemes	Amount allocated for 1989 £	Expenditure incurred during 1989 £
Nicosia.....	74	654 777	476 076
Larnaca-Famagusta	48	791 230	702 266
Limassol	22	289 504	229 440
Paphos.....	12	223 080	197 313
	---	-----	-----
Totals	156	1 958 591	1 605 095

TABLE VII-10
 SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
 GOVERNMENT DEPARTMENTS DURING 1989
 NICOSIA DISTRICT

Ser. No.	Description	Amount allocated in 1989 £	Expenditure incurred during 1989 £
1	Morphou-Nicosia Pipeline ..	6 678	3 722
2	Athalassa Farm	600	560
3	Lakatamia Livestock.....	6 200	2 753
4	Kokkinotrimithia Livestock.	95 210	71 427
5	Athalassa Farm.....	4 300	3 968
6	Athalassa Experimental Farm	3 000	3 000
7	Pera Khorio Nisou Livestock	2 000	212
8	Pharmakas-Limokhoro.....	1 200	400
9	Antiquities investigation...	2 000	1 837
10	Ayios Ioannis (Malounda)...	5 501	5 501
11	Kotsiatis w.s.	360	324
12	Potamia w.s.	775	471
13	Ergates.....	615	365
14	Ayia Varvara	100	100
15	Kalo Khorio w.s.	22 000	13 061
16	Ergates w.s.	2 300	1 475
17	Potamia w.s.	4 650	2 840
18	Nicos .w.s.	3 150	2 406
19	Moutoullas Irrig.	3 300	2 661
20	Moutoullas Irrig.	16 667	8 579
21	Ayios Sozomenos w.s.	800	753
22	Kato Pyrgos Irrig.....	19 000	18 452
23	Yeri w.s.	20 480	15 338
24	Tseri w.s.	3 440	2 911
25	Pera Khorion w.s.	4 085	3 222
26	Lymbia phase B w.s.	114 000	72 271
27	Akaki Riatiko Irrigation...	1 875	1 875
28	Lymbia-Shia-Alambra W.S....	1 557	1 557
29	Laxia W.S	13 500	8 462
30	Ayios Sozomenos	5 450	5 450
31	Kotsiatis W.S	474	436
32	Pedoulas W.S	20 000	19 999
33	Peristerona W.S	1 000	937
34	Pedoulas W.S.....	10 000	9 997
35	Nisou-Pera Khorion W.S.	5 415	4 271
36	Olympic Shooting Organ.W.S..	9 500	7 615
37	Kokkinotrimithia W.S.....	2 218	2 100
38	Ayii Trimithias W.S.....	4 497	1 481
39	Orounda W.S	569	367
40	Lakatamia W.S	11 000	10 101

TABLE VII-10
SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
GOVERNMENT DEPARTMENTS DURING 1989 (Cont.)

Ser. No.	Description	Amount allocated in 1989 £	Expenditure incurred during 1989 £
41	Lakatamia W.S	6 400	5 401
42	Koutraphas-Nikitari Irrig..	206	206
43	Ayios Sozomenos W.S	300	116
44	Mitseron irrig.....	6 200	2 664
45	Kalopanayiotis W.S..	6 166	4 485
46	Tsakistra Irrig.....	13 667	11 947
47	Moutoulas	1 333	1 317
48	Anayia W.S	5 000	3 750
49	Kalopanayiotis	12 000	9 970
50	Kambos Irrig.....	5 567	228
51	Alambra W.S.....	12 200	1 357
52	Ayios Sozomenos W.S.....	1 000	938
53	Rural Development Irrig....	2 400	1 500
54	Lefka Irrig.(Kaphizides)...	5 000	4 300
55	Katokopia (Naos) Irrig.....	2 000	1 818
56	National Guard-Yeri.....	12 200	6 843
57	Pera Orinis	769	303
58	katokopia (Naos) Irrig.....	500	454
	<u>Relocation of Pipes for P.W.D.</u>		
59	Anayia	24 800	24 045
60	Ayia Varvara.....	23 500	23 015
61	Dheftera	9 800	9 613
62	Kalopanayiotis.....	14 000	8 452
63	Moutoullas	10 000	9 195
64	Lymbia-Shia-Alambra.....	2 000	1 951
65	Lymbia	1 350	1 237
66	Athalassa	3 280	3 280
67	Pedoulas Irrigation	10 500	3 216
68	Vyzakia	11 500	4 099
69	Ergates(Phourkismenos)	4 496	3 032
70	Linou-Phlasou	4 950	3 654
71	Aredhiou	4 027	3 769
72	Pharmakas (Limokhoro).....	100	100
73	Aredhiou-Malounda- Ayios Epiphaniou	6 800	5 610
74	Yiannis Ritsos road	1 300	927
	Totals for Nicosia District	£654 777	£476 078

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
GOVERNMENT DEPARTMENTS DURING 1989 (Cont.)

LARNACA AND FAMAGUSTA DISTRICT (Constructed by the
Larnaca-Famagusta District office)

Ser. No.	Description	Amount allocated in 1989 £	Expenditure incurred during 1989 £
1	Aradhippou-Livadhia	9 000	4 850
2	Klavdhia Livestock	19 275	19 176
3	Meneou experimental farm	3 840	3 298
4	Mari Livestock	3 000	2 075
5	Dromolaxia	120	89
6	Aplanda National Guard.....	10 500	10 494
7	Vrisoulles W.S.....	18 000	9 252
8	Kalavastos W.S	26 000	23 949
9	Ormidhia W.S	14 012	3 672
10	Klavdhia W.S	6 800	6 222
11	Ayios Theodoros W.S	17 000	16 038
12	Alaminos W.S	11 000	9 612
13	Alaminos W.S	300	169
14	Anaphotia W.S.....	700	563
15	Ora W.S	11 250	10 957
16	Kelia W.S	28 212	23 850
17	Ayia Anna W.S	4 500	4 242
18	Tersephanou W.S	35 000	33 261
19	Psevdhas W.S.....	1 547	1 513
20	Livadhia W.S	26 000	25 154
21	Vavatsinia W.S	14 250	13 300
22	Kornos National Guard W.S...	1 200	1 194
23	Ayios Theodoros-Alaminos- Skarinou	266	261
24	Ayios Theodoros-Alaminos Skarinou	2 083	2 053
25	Lefkara W.S	11 250	11 114
26	Ormidhia W.S	5 500	3 601
27	Vavla W.S	600	378
28	Kornos National Guard	3 300	2 685
29	Dhromolaxia W.S	1 800	1 209
30	Xylophagou Irrig.....	7 300	5 107
31	Alaminos W.S	10 000	9 612
32	Mosphiloti W.S	2 500	2 499

Relocation of Pipes for the
P.W.D

33	Larnaca By-Pass	213 000	212 418
34	Larnaca-Nicosia	33 300	29 153
35	Aradhippou-Dekelia	26 400	21 179
36	Rizoelia	23 000	19 189
37	Kophinou-Larnaca	98 000	91 085
38	Tefkrou Anthia (Ayia Napa)..	17 000	14 135
39	Kophinou-Larnaca	27 500	21 496
40	Kiti-Pervolia	9 000	3 341
41	Ayia Anna-Kalokhorio	7 000	5 770
42	Sotira W.S	8 000	7 429
43	Phrenaros	6 000	4 456
44	Sotira-Ayia Thekla	900	497
45	Panayia-Ematousa	4 000	1 032
46	Layia	3 000	681
47	Larnaka Airport	1 033	1 033
48	Larnaca-Kophinou-Tremithos.	7 992	7 923
		-----	-----
	Total for Larnaca-Famagusta Districts	£791 230	£702 266

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
 GOVERNMENT DEPARTMENTS DURING 1989 (Cont.)
 LIMASSOL DISTRICT (Constructed by Limassol District office)

Ser. No.	Description	Amount allocated in 1989 £	Expenditure incurred during 1989 £
1	Erimi Livestock	14 550	12 580
2	Yerasa W.S	9 450	9 411
3	Kato Platres W.S	19 479	7 098
4	Ypsonas-Polemidhia W.S	5 097	5 004
5	Tris Elies Irrig.....	3 485	3 103
6	Vouni W.S	5 400	5 982
7	Moniatis Irrig.....	16 000	15 626
8	Kato Platres W.S.....	3 867	1 888
9	Pano Platres Irrig.....	21 334	14 726
10	Lania-Dhoros Irrig.....	40 000	39 980
11	Kato Platres W.S.....	16 800	16 393
12	Yerasa W.S	1 124	1 421
13	Arkolachania-Phylagra W.S.	80 000	59 480
14	Erimi-Kolossi	1 300	513
15	Tris Elies(Drakondas Irrig.)	920	321
16	Ayios Demitrios w.S	1 386	109
17	Kaminaria-Ayios Vasilios..	10 487	4 286
18	Ayios Georghios W.S.....	7 200	5 468
19	Kato Mylos-Vatera Irrig...	500	500
20	Phini Irrig.....	15 033	10 359
21	Platis Xylouris Irrig.....	13 880	13 575
22	Pelendria	2 212	1 617
	Totals for Limassol District:	289 504	229 440

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER
 GOVERNMENT DEPARTMENTS DURING 1989 (Cont.)
 PAPHOS DISTRICT (Constructed by Paphos District office)

Ser. No.	Description	Amount allocated in 1989 £	Expenditure incurred during 1989 £
1	Eledhio-Paphos.....	600	600
2	Salamiou W.S.....	37 116	34 608
3	Theletra W.S	7 667	6 751
4	Phasoula Irrig.	20 000	16 862
5	Phasoula Irrig.....	40 000	30 514
6	Mamonia Irrig.....	20 000	19 180
7	Nikoklia Irrig.	18 000	17 963
8	Phasoula Irrig.....	42 640	39 136
9	Kato Pyrgos Platis	5 250	5 250
10	Pano and Kato Pyrgos.....	9 207	7 080
11	Pano and Kato Pyrgos.....	2 050	2 045
12	Piyenia	20 550	17 324
Totals for Paphos District		£223 080	£197 313

SCHEMES UNDERTAKEN FOR CONSTRUCTION WITH FUNDS FROM VILLAGE DEPOSITS

During 1989 the Department had to respond to the requests of the District Officers or the Village Water Commissions, or Village Irrigation Committees for the execution of 83 schemes of various types.

Most of these 83 schemes undertaken by the Department during 1989 from funds deposited direct by the beneficiaries were mostly related to:

Maintenance and repairs to pumping units used for domestic or irrigation purposes, extensions, improvements or maintenance of existing water supply or irrigation distribution systems, etc. This practice is followed for many years because the villages do not have the means to execute the works by themselves, and because this Department has the experience and the expertise to design and execute such schemes.

It should be noted that the funds deposited for the execution of these schemes are borne entirely by the villages and there is no Government contribution at all. For the execution of these 83 schemes an amount of £601,743 was deposited during 1989 and the overall expenditure incurred by the end of the year reached the amount of £555,952. Out of the 83 schemes 70 were related with water supply and 13 schemes with irrigation systems.

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR PRIVATE DEVELOPERS

During 1989 the Department responded to the request of private developers for the construction of 181 schemes relating to water works.

These schemes were related mainly to distribution systems for land development, pumping tests, hiring of moulds for reservoirs, etc., and were split all over the island.

The amount deposited for the execution of these schemes was £149,962 and the overall expenditure incurred during 1989 reached the amount of £57,114. This expenditure includes departmental charges ranging between 20% and 32%.

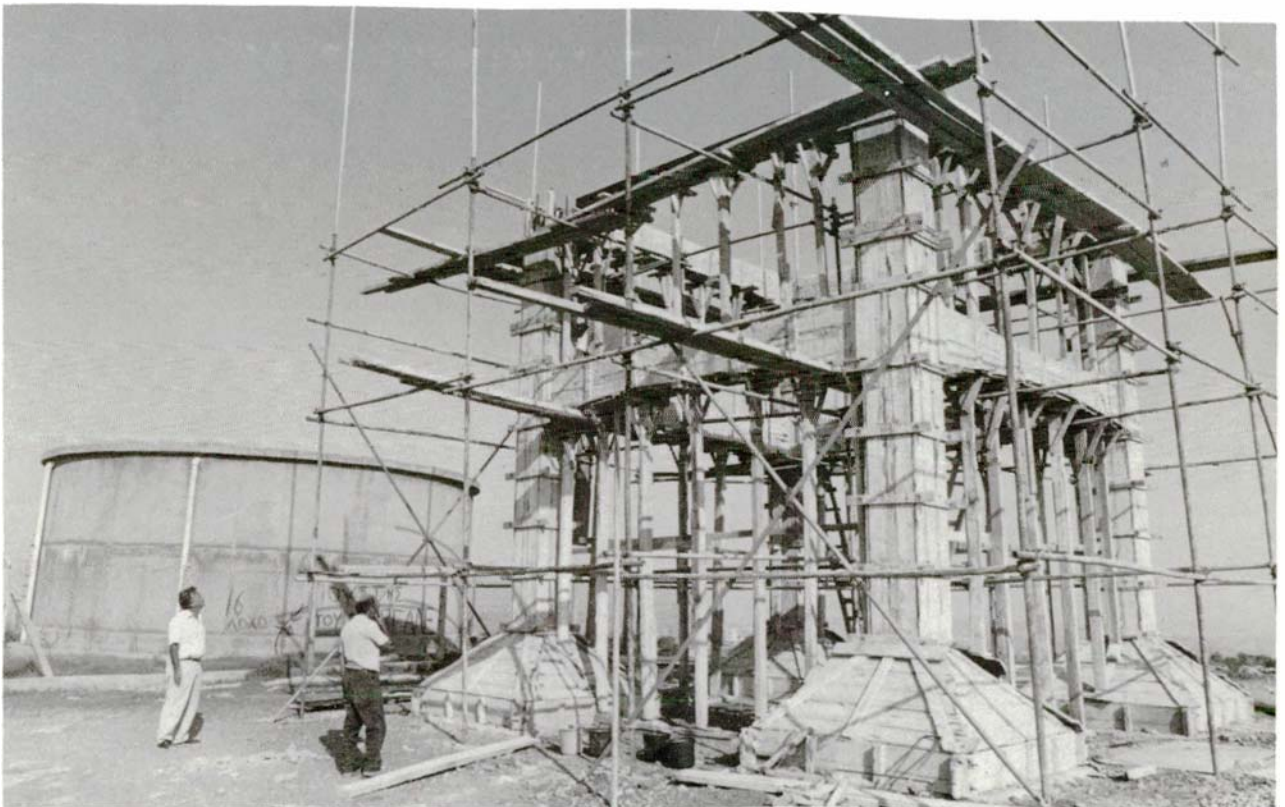
In the past all such works were executed by the Department so that the standard of work was maintained at the same level as the existing schemes and the interests of towns and villages were safeguarded.

Recently and after the request of District Officers, private developers and land owners were allowed to give to the private sector the execution of some water supply schemes under the supervision of the Department.

It must be noted that no scheme can be constructed by a private Contractor unless it is supervised by a Technical Officer of the Department.



Erimi-Kolossi-Ypsonas Water Supply Scheme. Housing of the pumping station and reservoirs.
WDD Photo G12EN-2 (12.10.89)



Construction of elevated tank for Kokkinotrimithia livestock area.
WDD Photo G4EN-4 (29.8.89).

VIII(1) KHRYSOXKHOU IRRIGATION PROJECT

by
K. Spanos SWE
Project Manager

All major components of Phase I of the Project have been completed early 1988 and about 1800ha have been covered with irrigation distribution networks with irrigation supplies being available to this area from Evretou dam.

During the year 1989 a total quantity of 2,494,450m³ was released from the dam into the distribution networks out of which 1,867,800m³ were utilised for the irrigation of about 640 Ha of land in the areas of Phase I of the Project, 390,530m³ were supplied to Argaka area and 236,120m³ were lost through the distribution systems. The details on the operation and maintenance works carried out during 1989 on this project are given under Chapter X of this report.

The only part of Phase I of the Project which has not yet been constructed is the irrigation distribution system in Sector ID of the Project of total area of about 150 ha in the villages of Peristerona, Simou and Philousa. This work is planned to be constructed in 1990 after the completion of land consolidation roads in this area.

As regards Phase II of the Project through which the dams of Argaka-Magounda, Ayia Marina and Pomos will be connected with Evretou dam so that the irrigated area along the coastal plain will be increased to about 1,000 ha, the Government had approved the construction of the following:

- (a) Replacement of Pomos main canal by pipeconveyor,
- (b) the connection of the Argaka-Makounda dam with Evretou and
- (c) the installation of the distribution network over about 150 ha in Argaka area which will receive water directly from Evretou.

The connection of Argaka-Makounda dam with Evretou was completed in 1988 with the installation of a 400mm dia pipeline. During 1989 the construction activities were limited on the replacement of the Pomos open canal by a pipeconveyor. This work, which was undertaken by the Department through direct labour force, was nearly completed by the end of the year 1989. Connections of the existing distribution network to the new conveyor and some improvement works to the existing networks will be carried out during the first half of the year 1990.

The remaining components for the full completion of Phase II of the Project include the connection of Evretou dam with Ayia Marina, Yialia and Pomos areas and their cost had been evaluated at about £3 million. Their construction was scheduled for the years 1990-92 but this will depend on the availability of funds in the Government Development Estimates' budget.

PROJECT COST ESTIMATES AND EXPENDITURES

Project expenditure by the end of the year 1989 reached the total of £15 971 508 of which £413 206 were spent in 1989. The total cost of Phase I of the project together with the parts of Phase II related with Argaka and Pomos areas whose implementation has been already approved is now evaluated at about £17.84 million without the cost of on-farm equipment which will have to be born by the farmers. Breakdown of the expenditure and cost estimates are given in the table herebelow:-

TABLE VIII-1
KIP EXPENDITURE DURING 1989

Item	Expenditure during 1989 £	Total Expend. Up to 31/12/1989 £	Estimated Total cost £
1 Evretou Dam.....	29,986	9,083,508	9,450,000
2 Main Conveyor and Branches up to Argaka Diversion.....			
(i) Supplies.....	-	1,768,858	1,768,858
(ii) Installation.....	55,582	1,238,866	1,238,666
3 Irrigation Networks and Farm Roads Sectors IA, IB and IC			
(i) Supplies.....	-	707,963	707,963
(ii) Installation.....	20,598	1,468,564	1,500,000
4 Main Conveyor of Pomos and Irrigation Networks of Sector ID and Argaka and other works by WDD	227,339	361,634	1,250,000
5 Supervision and Management Costs	20,703	615,508	700,000
6 Consultants and Experts	6,662	333,939	342,000
7 Land Acquisition.....	21,952	263,700	320,000
8 Land Consolidation.....	30,385	128,968	310,000
9 Ground Water Development.....	-	-	250,000
TOTAL	413,206	15,971,508	17,837,407

FOREIGN FINANCING

The Government of Cyprus has signed a loan agreement with the World Bank for the sum of £16 000 000 towards the financing of the foreign currencies of the Phase I Project costs. BY the end of the year 1989 the total disbursements from this loan reached the sum of £ 887 402.

VIII(2) SOUTHERN CONVEYOR PROJECT

KOURIS DAM - CONTRACT C1

by
Dr C A Christodoulou
Principal Water Engineer
Project Manager

Kouris Dam constitutes the main water storage component of the Southern Conveyor Project, the basic objective of which is to collect and store surplus water and convey it by means of a regional carrier for use in areas where the water is most needed. Water collected in the Kouris reservoir will be used for irrigation as well as for domestic and industrial needs. Kouris Dam has been constructed on Kouris River near Khalassa village some 15 kilometres North-West of Limassol.

The dam has a central clay core zones earthfill embankment with a height of 110 metres and a crest length of approximately 550 metres providing a water storage volume of 115 million cubic metres.

The volume of the embankment is approximately 9.4 million cubic metres consisting mainly of river gravel and older terrace gravel deposits excavated from borrow areas in the vicinity of the dam. The maximum discharge of the spillway is 1925 cubic metres per second and approximately 61,000 cubic metres of concrete have been used for its construction. The diversion tunnel is 633 m long and 4.2 m in diameter whilst the 5.4 m diameter intake tower/shaft reaches a height of 111 metres. For the grouting works a total length of some 40,000 metres of holes had been drilled and approximately 1,500 tonnes of cement bentonite grout injected to the foundations and abutments.

The village of Khalassa which was located within the reservoir area has been relocated on a site overlooking the reservoir between the Kouris and Limnatis valleys.

The detailed design for the dam commenced in 1981 by Consulting Engineers SOGREAH of Grenoble France in association with Hydroconsult of Cyprus whilst the Water Development Department and the Geological Surveys Department carried out site and fill investigations testing. The Contract for the construction of Kouris Dam was awarded in July 1984 to a Joint Venture comprising of IMPREGILO S.p.A. of Italy and Ioannou and Paraskevaides of Cyprus.

Construction works for the dam commenced on 1st September 1984 and were substantially completed in September 1988. Finishing works such as the crest stone masonry walls and access roads were completed by the 31st December, 1989 and a list of outstanding as well as defective items was prepared and forwarded to the Contractor. Such items as reinstatement of borrow areas,

finishing works and remedial works to be concreted are expected to be completed by the middle of next year.

Recognising the importance of storing of water at the earliest practical moment, construction was accelerated so that impounding of the river flows could commence in time for the water of 1987/88 approximately 10 months before construction was due to be completed.

Despite difficult foundation conditions which necessitated a significant increase in the volume of construction work (introduction of upstream and downstream toe weights) the impounding target was achieved early in November 1987 by the use of additional earthmoving equipment, following an agreement with the Contractor to accelerate the works for the sum of CE 1,300,000.

Release of water from Kouris Dam started in February 1988 for irrigation (Akhna Dam, Kokkinokhoria area, Kiti Dam, Akrotiri area), aquifer recharge purposes (Kouris Delta and Kiti areas) and from domestic purposes (via the Khirokitia Water Treatment Plant). Up to the 31st December 1989 a quantity of 31.80 million cubic metres of water was released from Kouris Dam whilst 47.75 million cubic metres of water were stored in the Kouris reservoir by the end of November, 1989.

As part of the second phase of the Southern Conveyor Project water from Dhiarizos River will be diverted into the Kouris reservoir via a tunnel 14.5 km long.

The Engineer issued a Certificate of Completion on 12th September 1988 confirming that the works were substantially completed on 1.9.1988 and defining at the same time all outstanding finishing works.

On 22.4.89 Kouris Dam was inaugurated by the President of the Republic of Cyprus Mr George Vassiliou.

On the 1.9.1989 a payment of (CE 498,862.80 - 53,000.00) i.e. CE 445,862.80 was made to the Contractor this being the second half of retention which was due at the end of the maintenance period. A sum of CE 53,000 was held back this being the assessed cost of work remaining to be executed.

Out of CE 53,000 the amount of CE 25,000 has been paid to the Contractor for works completed during the said period.

By the end of December 1989 a substantial part of site reinstatement has been carried out and the culverts to the dam access road have been completed.

The meteorological station has been completed on 20.12.1989 by WDD Limassol and the Meteorological Service have installed the prescribed instruments which are now fully operational.

Total payments made to the Contractor by 31.12.89 were
C£ 20,562,000.

The Contractor has submitted claims covering the period up to
31.12.89 totalling C£ 8.3 million.



Southern Conveyor Project - Kouris Dam
Inauguration of the Project by the President of the Republic Mr. G. Vassiliou on the 22nd of April 1989. The ceremony was attended by Members of the Council of Ministers, the Diplomatic Corp. and other officials.



VIII (3) SOUTHERN CONVEYOR PROJECT
Main Conveyor, Akhna Dam, Irrigation Distribution Systems,
Domestic Water Works.

By: K.C. Hassabis, A.D.
Project Manager

Dr. G. Socratous, E.E.I.
Deputy Project Manager

GENERAL

Objectives

The Southern Conveyor Project (SCP) is planned to collect and store surface water from the southwestern catchments of the island and to convey the surplus to the areas of demand eastwards for both domestic water supply and irrigation purposes.

The main objectives at full development of the Project are:

- (a) To secure reliable domestic including commercial, industrial and touristic water supplies until the end of this century to the four major population areas of Cyprus, i.e., Nicosia, Limassol, Larnaca and Famagusta, and to a large number of villages in the south and central part of Cyprus.
- (b) To provide irrigation water so as to maintain and even expand the agricultural production at the Kokkinokhoria area and to expand irrigated agriculture in four areas along the southern coast of the island i.e. Akrotiri, Parekklisha, Mazotos and Kiti.

Phasing of the Project

It was initially decided to implement the Project in two Phases. The two Phases however, are now being implemented concurrently following the decision of the Council of Ministers to accelerate the construction of the second Phase, Decision No. 25.686 of the 10th April, 1985.

Phase I of the Project

Phase I includes the construction of the Kouris Dam, the Main Conveyor, Akhna Dam, the Kokkinokhoria Irrigation System, Domestic Water Supply Works and the Telemetry System. The Athienou Irrigation System was subsequently added by a decision of the Council of Ministers.

Phase II of the Project

Phase II includes the construction of the Dhiarizos Diversion, the Limassol and Tersephanou Water Treatment Plants, the Tersephanou-Nicosia Pipeline, the Irrigation Systems of Akrotiri, Parekklisha, Mazotos and Kiti and certain Village Domestic Water Supply Works, mainly referring to the villages west of Limassol whose sources have been affected by the construction of Kouris Dam.

STAFF

- Mr. K. C. Hassabis, Assistant Director, WDD, continued to offer his services as Project Manager for both Phases of the Project except for Kouris Dam and Dhiarizos Diversion.
- Dr. C. A. Christodoulou, Principal Water Engineer, WDD, continued to practise his duties as Project Manager for both the Kouris Dam and the Dhiarizos Diversion.
- Dr. G. Socratous, Executive Engineer I, has been appointed as Deputy Project Manager (Engineering) since September 1st, 1989, replacing Mr. D.M. Patsalides. The latter was promoted and appointed to another post.
- Mr. A. Ioannou, Agricultural Officer I, Department of Agriculture, has continued to practise his duties as Deputy Project Manager (Agriculture).

Supervisory Staff

The appropriate supervisory staff consisting of engineers, technicians (surveyors, laboratory technicians etc.) Drg. No. BM/G/246 have continued to practise their duties in the field and at the site offices.

CONSULTING ENGINEERS

Sir William Halcrow and Partners (U.K.)

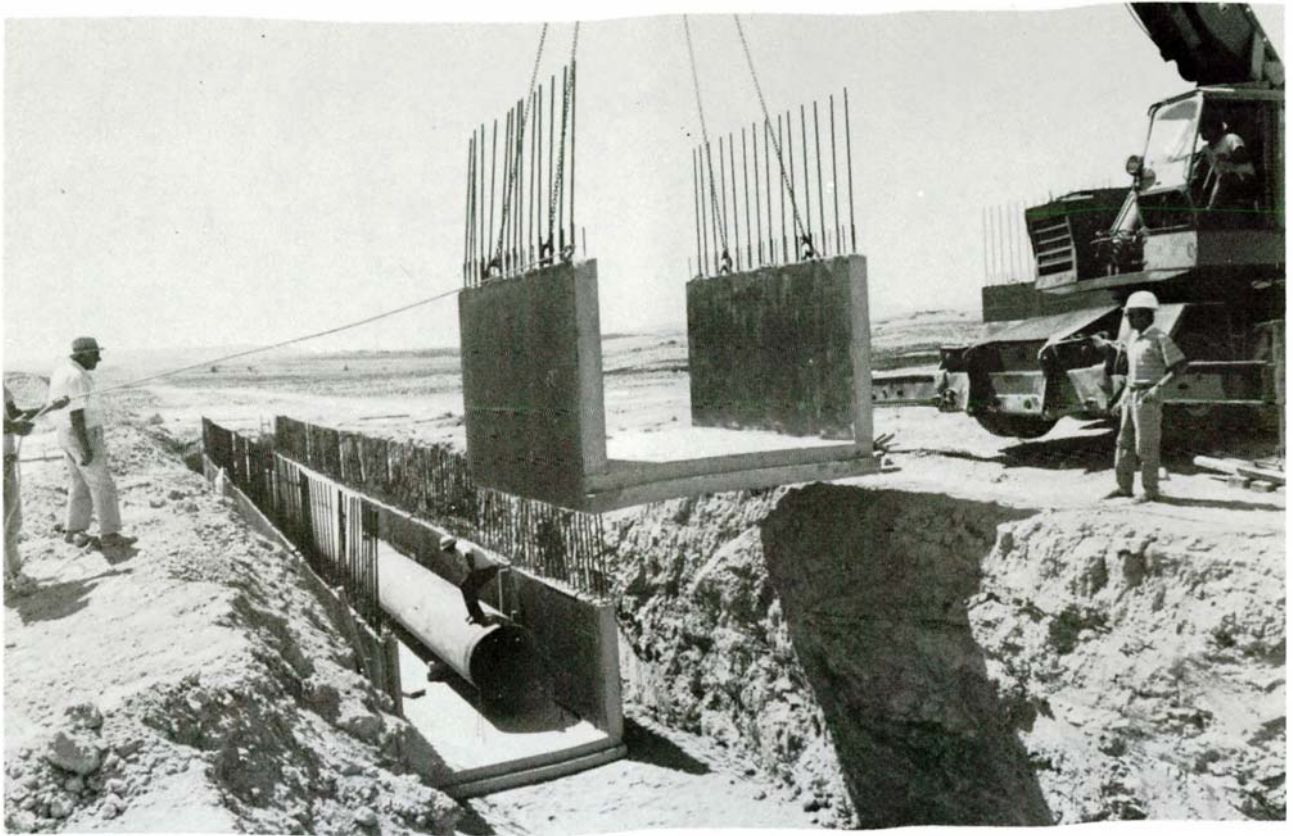
Sir William Halcrow and Partners in association with Balfours, continue their duties in connection with site supervision of selected Phase I works, i.e. the Main Conveyor (under maintenance) Akhna Dam (under maintenance) and the Kokkinokhoria Irrigation System (Balancing Reservoirs, Central Distribution Point Reservoirs, Pumping Stations).

Supervision of the thirteen supply contracts, i.e., S2, S4 to S6, S12 to S14 -see Tables III (4) 3 & 4- and supervision of the supply and install contract S3 (Pumping Plants) continued.

The Consulting Engineer's telemetry specialist Mr. D.W. Matthews came to Cyprus in February to prepare a report on pre-qualification submissions for contract S8, Telemetry System. Mr. Matthews prepared a draft tender document for telemetry. It was submitted to WDD in October and is till under review.

The Resident Engineer for Contract C2/C3 -Main Conveyor- Mr. S.W. Hodgkins, left Cyprus on the 31st July. He came back on the 20th of November, for nineteen days for assessing the claims made by the contractor, Cybarco/Shand Joint Venture.

The Consulting Engineer's Technical Director, Mr. J.C. Beaver, visited the Project from the 17th to the 22nd of July.



Southern Conveyor Project. Relocation of main Conveyor, using precast concrete elements under the new Nicosia-Larnaca highway.
WDD Photo G8EN-20 (21.9.89).



Southern Conveyor Project. Phase II. Akrotiri Irrigation Network.
Valve chamber of junction J2 of Akrotiri main pipeline to the Southern Conveyor.
WDD Photo F84EN-4 (9.3.89).

Energoprojekt (Yugoslavia)

Energoprojekt of Yugoslavia continued with the detailed design and with the drafting of the specifications and tender documents of the Phase II works.

Sogreah (France)

Sogreah of France continued with the supervision of the remaining construction works of Kouris dam but especially with the assessment of the Contractor's claims. These claims total to C£8.34 million.

FURTHER STUDIES

Water Entity

The Consultants, Rofe, Kennard and Lapworth of the UK, in association with the Southern Water Authority of the U.K., submitted in June the final report for the Phase II of the "Institutional Study for Establishment of an Entity for Development Management and Allocation of Water Resources in Cyprus" as well as summary reports for both Phase I and II studies. Copies of the reports have been distributed to the involved Services and Ministries for their views. The reports are still under review.

Kouris Dam Hydropower Plant

No further developments occurred in 1989. The final decision as to whether the hydropower plant at Kouris dam will be erected will be taken after Kouris dam becomes fully operational and when more data become available.

Water Abstraction and well Inventory in Kokkinokhoria Area

A total of twenty reports have been published to-date. There remain another two reports for the completion of the study whose purpose is to present:

- (a) The current groundwater conditions (1986)
- (b) The developing groundwater situation
- (c) A forecast on the groundwater availability after 1990.
- (d) The use of groundwater in conjunction with the SCP surface water for irrigation purposes.

Re-design of Kokkinokhoria Network

After the completion of the re-design of the primary and secondary distribution network by WDD the design of the tertiary distribution network has been also undertaken by WDD. Eight out of twenty two irrigation blocks of the whole distribution system have been designed by the end of 1989. It is anticipated that the design process will be completed by the end of 1990.

Special Studies

These studies are:

- (a) SCP System Operation
- (b) Coastal Aquifer Simulation and Management
- (c) Artificial Aquifer Recharge and
- (d) Re-use of Treated Effluent in the Areas of Larnaca and Limassol.

Initial discussions were held with the United States Bureau of Reclamation (USBR) in April 1989, when a senior officer of this organisation visited Cyprus, regarding an engagement agreement for USBR to undertake these studies. Final discussions will be held at the beginning of 1990.

PANEL OF EXPERTS

The members of the Panel for both Akhna and Kouris dams are: Prof. E. Nonveiller (Yugoslavia), Dr. J. Newberry (U.K.), Mr. A.A. Abidi (Pakistan) and Mr. C.A.C.Konteatis (Cyprus)

During the reporting period the panel did not visit any of the sites because the relevant works have been completed.

The members of the Panel for the Dhiarizos Diversion are: Mr. Stavros C. Bandis (Greece), Mr. John Sharp (UK) and Mr. Ernst Buchi (Switzerland).

The panel had its second meeting on the 5th of June 1989.

FOREIGN FINANCING

Foreign Loans

Phases I and II of the Southern Conveyor Project are financed by five foreign financiers. These financiers, as well as loan details, are listed in Table VIII(3)-1.

TABLE VIII(3)-1 Foreign Loan Amounts and Items to be Financed

Financier	Date of Agreement	Loan	Project Items to be Financed out of the Proceeds of the Loan
<u>PHASE 1</u>			
IBRD	Apr. 84	\$27,000,000 (CY 2386)	-Kouris Dam (Civil Works), -Akhna Dam (Civil Works), -Consultant's Fees, -Office Equipment, -PVC Pipes, Equipment and Materials for KIA Tertiary Distribution System -Unallocated.

TABLE VIII(3)-1 (cont.)

Financier	Date of Agreement	Loan	Project Items to be Financed out of the Proceeds of the Loan
KFAED	Dec. 84	KD2,940,000 (KF 277)	-Supply of Pipes and Fittings for KIA Network. -Construction of Pumping Stations Balancing Reservoirs and Central Distribution Points Reservoirs
EIB		ECUs	Kouris Dam - (Civil Works)
Major Loan	Sep.85	26,500,000	Major Loan No.1.2109.00
Minor Loan	Sep.85	<u>3,700,000</u>	Minor Loan No.6.0553.00
Total		30,200.000	
Consortium of French Banks	Jul. 85	DM 78,074,566* (Cr.Agr.1231)	Supply of Ductile Pipes and Fittings for the Main Conveyor
Standard Chartered Merchant Bank Ltd (UK)	Mar. 87	Stg£ 1,973,800	Pumping Plant for KIA.
<u>PHASE II</u>			
IBRD	May 88	\$30,000,000 (CY 2914)	-Dhiarizos Diversion (Civil Works) -Equipment materials, pipes and fittings -Technical assistance and training -Unallocated
KFAED	Feb.88	KD4,300,000 (KF 336)	-Irrigation Networks Force accounts and contract works Imported pipes and fittings -Nicosia/Tersephanou Conveyor Construction Supply and installation of equipment -Tersephanou Water Treatment Plant Construction -Engineering and Supervision -Unallocated

Notes: *85% of the CIF Contract price
KIA= Kokkinokhoria Irrigation Area

Grant Aid

A grant was made available in April 1987 to the Government of Cyprus by the Government of the United Kingdom for the purpose of purchasing certain goods wholly produced in the United Kingdom and for services performed by U.K. residents with regard to the construction of the pumping stations of the Kokkinokhoria Irrigation System, i.e., Contract S3.

The Aid amounts to Stg£870,000 out of which Stg£113,174 and Stg£1,549 are committed for services and guarantees.

A second grant aid amounting to Stg£1,470,000 was awarded by the Government of the United Kingdom to the Government of Cyprus for the design and construction of the Limassol Water Treatment Plant.

Disbursements

The disbursement situation for each of the loans as well as for the two Grant Aids as at the end of December, is given the Table VIII(3)-2.

TABLE VIII(3)-2 Disbursements by the End of December, 1989

Financier	Loan	Total Disbursements 31.12.89	Balance Undisbursed 31.12.89
<u>PHASE I</u>			
1. IBRD	\$27,000,000	\$20,435,651	\$6,564,348.80
2. KFAED	KD2,940,000	KD1,979,403	KD 960,596.235
3. EIB	ECUs 30,200,000	ECUs 30,200,000	ECUs NIL
4. Consortium of French Banks	DM80,427,363.85*	DM78,074,566	DM2,352,797.85
5. Standard Chartered Merchant Bank Ltd (UK)	Stg£ 1,973,800	Stg£1,114,280.00	Stg£ 859,580.00
6. Grant Aid	Stg£755,277	Stg£ 623,425.83	Stg£ 131,851.17
<u>PHASE II</u>			
1. IBRD	\$30,000,000	--	--
2. KFAED	KD4,300,000	--	--
3. Grant Aid	Stg£ 1,470,000	--	--

* Including supplies for Khrysokhou Project (C£1,317,590).

PHASE I, PROGRESS ON CIVIL WORKS CONTRACTS

Kouris Dam - Contract C1

Details on progress for Kouris Dam are given in Chapter VIII/II.

The Main Conveyor (Kouris to Akhna) - Contract No. C2/C3

Contractor	:	Cybarco-Shand JV (Cyprus-UK)
Commencement date	:	17th October, 1985
Substantial Completion	:	5th November, 1988
Operation	:	March, 1988
Extended contract completion date	:	15th July, 1988
Tender sum	:	C£6,157,031.00
Total certified 31.12.89	:	C£6,181,824.54
Amount certified in 1989	:	C£450,804.54

Work on minor outstanding items was completed and the Maintenance Certificate was issued on the 14th of December, 1989. Some progress has been made on measurement and contractual matters, including claims evaluation. Claims evaluated by the Contractor at a total of C£3,511,780 have been submitted, against which C£297,730 has been certified.

Akhna Dam - Contract No. C4

Contractor	:	Iacovou Bros (Const. Ltd.)
Commencement date	:	18th June, 1986
Date of substantial completion	:	3rd December, 1987
Tender sum	:	C£1,312,980.00
Total certified (31.12.89)	:	C£1,109,496.00
Amount certified in 1989	:	C£76,011.00

All claims, variations and measurements have been agreed and the final account settled. Some minor defects remain to be rectified.

(At the beginning and end of 1989 the water content in the reservoir was 3.00 and 3.90 million cubic meters respectively).

Kokkinokhoria Irrigation System, Main Distribution Network

Balancing Reservoirs, Contract No. C5(A)

Contractor	:	George P. Zachariades, Ltd.
Commencement date	:	22nd April, 1987
Contractual completion date	:	22nd March, 1989 (Further extension under consideration)
Actual completion date	:	6th April, 1989
Tender sum	:	C£1,416,964.00
Total certified (31.12.89)	:	C£1,258,684.00
Amount certified in 1989	:	C£227,359.00

The Certificate of Completion for the whole of the Works was issued on the 11th of July, 1989.

There is a substantial amount of work ahead on settling variations, assessing claims in excess of C£ 475,000 and completing the final account and record drawings.

Central Distribution Points - Contract No. C5(C)

Contractor : Cybarco Ltd.
Commencement date : 22nd April, 1987
Extended contract completion date : 29th March, 1989
(Further extension under consideration)
Actual completion date : 12th April, 1989
Contract price : C£2,179,600.00
Total certified 31.12.89 : C£1,561,890.00
Total certified in 1989 : C£407,610.00

The Certificate of Completion for the whole of the Works was issued on 10th April 1989.

The only site work remaining is the landscaping which has been postponed, by mutual consent, for a later date. There is still a substantial amount of work ahead in settling variations, assessing claims and completing the final account.

Pumping Stations / Civil Works - Contract No. C6

Contractor : China International Water and Electric Corporation
Commencement date : 30th March, 1987
Extended contractual completion date : 23rd October, 1989
Tender sum : C£1,649,000.00
Total certified 31.12.1989: C£1,268,608.00
Amount certified in 1989 : C£443,442.00

The contract is divided into four separate Sections comprising of 4 or 5 pumping stations each, making 19 stations in all. Each Section is divided into two Stages, i.e., I and II.

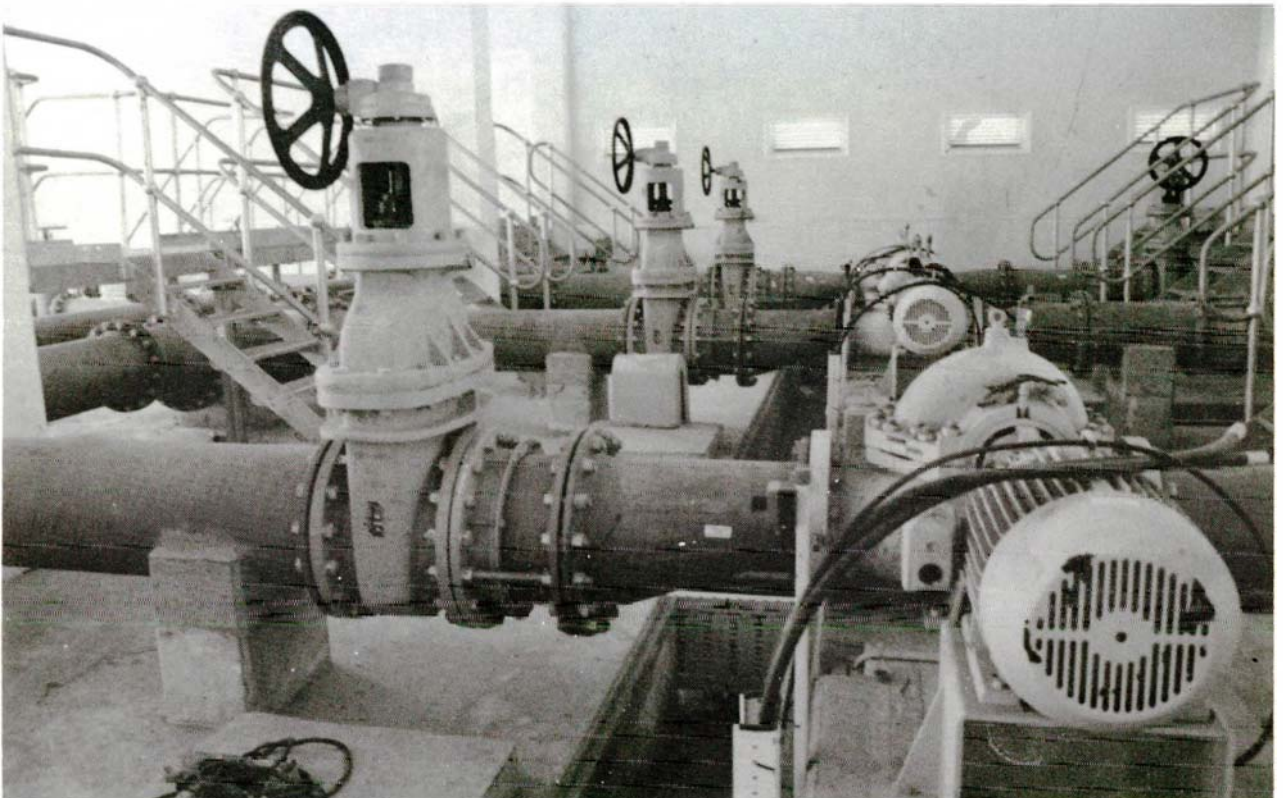
Having completed the first Stage works, the Contractor has reduced his resources and continues to work at a rate largely governed by progress on the mechanical and electrical Contract No. S3. The current Stage II works comprise building-in work associated with contract S3, backfilling, external groundworks and installation of steel walkways, handrails and ladders, etc. Stage II Works are nearing completion in the first of the four Sections.

Because of delays by the pumping plant Contractor extensions of time are being granted automatically to a date six weeks later than the date upon which the last station in each section is handed over for commencement of Stage II Works.

Sundry claims have been submitted amounting up to now to over C£350,000. These have yet to be evaluated in detail but they appear to be exaggerated.



SCP-Kokkinokhoria Irrigation Area Central Distribution Point CDP XVI
Pumping station and reservoir.
WDD Photo G10EN-7 (10.10.89).



SCP-Kokkinokhoria Irrigation Area. Pumping Station PS2.
WDD Photo G10EN-21 (10.10.89).

PHASE I, PROGRESS ON SUPPLY CONTRACTS

Main Conveyor - Contract Nos. S1, S2 and S7

TABLE VIII(3)-3 Supply Contracts for the Main Conveyor

Contract No.	Brief Title	Contractor (Manufacturer)	Tender Sum (C£)	Total Certified 31.12.89 C£	Amount Certified in 1989 C£
S1 (a)	Pipes & Fittings	Pont -a- Mousson S.A.	562,653	562,653	NIL
S1 (b)	Pipes & Fittings	Pont -a- Mousson S.A.	19,382,266	20,312,909*	6242

Contract No.	Brief Title	Contractor (Manufacturer)	Tender Sum (C£)	Total Certified 31.12.89 C£	Amount Certified in 1989 C£
S2	Valves	Caramondani Bros (Biwater)	664,454	678,409	32,825
S7	Flowmeters	Bestobel Sparring	58,639	63,820	1,751
TOTAL			20,688,012	21,617,791	40,818

* Including C£1,317,590 for Khrysokhou Irrigation Project

Deliveries under these contracts have been completed although there are still some outstanding matters on Contract No. S2. Measurement under these contracts is nearing completion.

Kokkinokhoria Irrigation System

Primary and Secondary Distribution Network
Contracts Nos. S3 to S6, S8 and S12 to S14

There are twelve supply contracts and two supply and install contracts under this heading. Contract S3 is by far the most important because its total cost is almost equal to the cost of all the other contracts put together. Accordingly, it is treated first. The remaining contracts are summarised in Table VIII(3)-4.

Pumping Plant for Kokkinokhoria Irrigation Area -
Contract No. S3

Contractor : SPP Projects Ltd., (UK)
 Commencement date : 21st May 1987
 Completion date : 19th October, 1989
 Tender sum : C£ 3,041,177
 Total certified 31.12.89 : C£ 2,063,357 of which
 Government funding : C£708,304
 UK Grand Aid : C£484,402 or Stg£ 623,426
 Standard Chartered : C£839,567 or Stg£1,080.523
 Merchant Bank Ltd. (UK)
 (Guarantor ECGD) : C£839,567 or Stg£1,080.523
 Amount certified in 1989 : C£1,103,270 (equivalent)

As in the case of Contract No. C6, this Contract is divided into four Sections of 4 to 5 pumping stations each. All continue to be well behind programme.

The Contractor's application for an extended completion period to April 1990 is still under consideration. The Contractor has, however, almost completed the installation of five of the 19 stations and soon will be ready to apply to EAC for an inspection of their electrical installations.

There is a problem with cracks appearing in flange welds in a number of the station pipework, which is of Korean origin. While a procedure has been established for repairing them it has recently become evident that some cracks are still appearing, even after successful hydrostatic testing. The Contractor has been instructed to submit his proposals for remedying the defects. The contractor has submitted a statement of account for variations/additional works and claims amounting to C£356,137 of which C£56,952 has been certified to date.

TABLE VIII(3)-4 Supply Contracts for Kokkinokhoria Primary and Secondary Distribution Network

Contract No.	Brief Title	Contractor (Manufacturer)	Tender Sum (C£)	Amount Certified	
				Total to 31.12.89	In 1989
				C£	C£
S4(a)*	A.C.Pipes	Amiantit	890,456	931,933	1,067
S4(b)*	uPVC Pipes	Kosmo-Plast	167,743	152,141	6,932
S4(c)*	Cast Iron Fittings	P N Epiphaniou (F Metalicas)	33,889	32,280	NIL
S4(d)	uPVC Pipes	Kosmo-Plast	101,257	97,544	81,645
	uPVC Fittings	Kosmo-Plast	37,785	36,278	5,309
S4(e)*	Cast Iron Fittings	C.W.W. (O.H.) Kassardjian)	173,553	170,697	11,930

TABLE VIII(3)-4 (cont.)

Contract No.	Brief Title	Contractor (Manufacturer)	Tender Sum (C£)	Amount Certified	
				Total to 31.12.89 C£	In 1989 C£
S5(a)*	Butterfly & Gate Valves	PLE (VAG)	176,717	171,377	12,610
S5(b)*	Air Valves	Guest & Chrimes	44,857	69,871	NIL
S5(c)	Control Valves	S Stavrinides (Bermad)	98,111	77,052	77,052
S6	Hydrants	S Stavrinides (Apco/Bermad)	333,446	336,910	63,253
S8	Telemetry	Not awarded yet			
S12*	Cast Iron Fittings	P N Epiphaniou (F Metalicas)	30,585	28,885	NIL
S13	A.C.Pipes	C.P.I.	860,000	1,002,924	142,832
S14	Cast Iron Fittings	C.W.W. (O.H. Kassardjian)	305,412	180,398	153,677
IRR.1*	Irr. Eq'ment	Kosmo-Plast	6,558	6,558	NIL
TOTAL			2,960,369	3,294,848	556,307

* Contract completed.

A.C. = Asbestos Cement

C.P.I. = Cyprus Pipes Industries

C.W.W. = Cyprus Water Works

Deliveries under Contracts Nos S4(a) to (e), S5(a), S5(b) and S12 have been completed. Some deliveries remain under the other contracts, and some further orders are being placed as the irrigation network design is finalised.

The Telemetry tenders are not yet published. Twenty six firms have pre-qualified to tender.

Contract IRR.1 is for the supply of 20 complete irrigation systems to be installed at the Central Distribution points, CDPs.

Tertiary Distribution Network -
Contract Nos. T1 and ST1 (LOT 1 to 6)

The supply contracts, for the Kokkinokhoria tertiary distribution network are listed in Table VIII(3)-5.

TABLE VIII(3)-5 Supply Contracts for the Kokkinokhoria
Tertiary Distribution Network

Contr.	Brief Title	Contractor (Manufacturer)	Tender Sum	Date Contract Signed	Amount Certi- fied in 89 C£
T1*	uPVC Pipes	J.V. Kosmo-Plast & United Plastic Lordos	C£44,184	15 Nov.88	NIL
T1*	uPVC Fittings	CPC/UK	C£85,625	15 Nov.88	NIL
ST1 (LOT1)	uPVC Pipes	J.V. Kosmo-Plast & United Plastic Lordos	C£159,680	22 Sep.89	25,891
ST1 (LOT2)	uPVC Fittings	C.W.W. (O.H Kassardjian)	\$105,269	12 Oct.89	NIL
ST1 (LOT3)	Cast Iron Fittings	CPC/UK	C£16,300 \$818,528	30 Oct.89	NIL
ST1 (LOT4)	Gate Valves	CPC/UK	C£6,800 \$409,500	22 Sep.89	NIL
(LOT5)	Irr.Meters	N.Demetriou (Schlumberger Fr. Nemitsas Cy.)	C£322,500	15 Sep.89	NIL
ST1 (LOT6)	Irr.Filters	S. Stavrinides	£69,172 \$783,959	6 Sep.89	6,917

C.W.W.= Cyprus Water Works

CPC = Consolidated Pipes and Contracting Co Ltd. (UK)

* Contract completed.

PHASE I, PROGRESS ON WORKS BY DIRECT LABOUR

Kouris Dam Pumping Station

The construction of the Kouris Dam Pumping Station has been undertaken by the Limassol Regional Office of the Water Development Department and is substantially completed. The only outstanding work is the fencing of the area around the station. This work, however, cannot be executed before installation of the pumping plant and the completion of the pipework. The total cost up to the end of December was C£158,316.

Kokkinokhoria Irrigation System

Primary (Main) Distribution Network - Contract No. C5(B)

The work consisted of laying 29.4Km of pipelines of various diameters. It was undertaken by the Department by direct labour.

It commenced in June 1986 and by December 1987, 97 percent of the work was completed. During the period under consideration the whole of the works have been fully completed. The total cost amounts to C£783,000.

Secondary Distribution Network - Contract C7

The secondary distribution network covers an area of 9184 ha and 268 Kms of pipes. The execution of the work was undertaken by the Department using force account. The work commenced in 1987 and by the end of December 1989, 96 percent of the pipework has been laid and 93 percent of the area has been covered, see Figure VIII(3)-1. The total cost of the work by the 31st of December, 1989, amounted to C£4,237,750 which represents 94 percent of the total cost.

Tertiary Distribution Network - Contract No. C7 (A)

Work for the construction of the tertiary distribution network has started by the end of the period under consideration. Consequently, no progress can be yet recorded.

Kophinou Pumping Station

The construction works started on 15 February, 1989 and were completed by the end of September, 1989. The pumping station was commissioned at the end of July, 1989. Reinstatement was completed on the 28th of December, 1989.

The total cost, including the swabbing of the Khirokitia-Famagusta conveyor, amounts to C£233,000.

Alethriko Pipeline

This scheme provided for the laying of a 3,900m long A C Pipeline 400 mm dia class 15 from a point upstream of Alethriko Break Pressure Tank to the Larnaca Water Board reservoirs at Tremithos. The construction works started at the end of January, 1989, and were completed by the end of August, 1989.

The final cost amounts to C£106,123.

PHASE II, PROGRESS ON CIVIL WORKS CONTRACTS

Dhiarizos Diversion

The works consist of a diversion weir on the Dhiarizos river near Arminou village, a 1.6Km long pipeline with 1.60 diameter and a 14.5Km long tunnel with 2.70m diameter. The diversion is planned to convey on an average 21.5 million cubic meters of surplus water per year from the Dhiarizos river at a rate of 6.5 cubic meters per second in the months of November to April.

The construction of the diversion works have been awarded in October, 1989, to the joint venture of Meyreder Kraus & Co. of Austria and G.P.Zachariades Ltd. of Cyprus for the total sum of C£12,025,785. The project is expected to be completed in three years. By the end of 1989 the total expenditure amounted to C£1,535,729. This includes mainly the advance payment to the Contractor.

PHASE II, PROGRESS ON SUPPLY CONTRACTS

Eight supply contracts have been awarded so far. They all relate to the construction of the Akrotiri Primary Irrigation Network. Details are given in Table VIII(3)-6.

TABLE VIII(3)-6 Supply Contracts for the Akrotiri Pumping Distribution Network

Contract	Brief Title	Contractor (Manufacturer)	Tender Sum in C£	Total Expendi- ture till Dec.89 in C£
S4(a)*	Ductile Iron Pipes and Fittings	S. Nicolaides (Integral, Korea Lebanon)	173,831	258,584
	Ductile Iron Fittings for A.C. Pipes	S. Nicolaides (Integral, Korea Lebanon)	67,875	
S5(a)*	Ultrasonic Flow Meters	N. Demetriou (Flutec, France)	FF228,726 C£ 450	16,625
	Gate Valves	S. Nicolaides (Integral, Korea Lebanon)	£28,497	29,572
	Air Valves	S. Nicolaides (Integral, Korea Lebanon)	£ 2,486	
	Flow Control Valves	S. Stavriniades (Bermad, USA)	£27,409.86 £26,780.06	53,575
	Float Gate Valves	S. Stavriniades (Bermad, USA)	£26,780.06	
	TOTAL			

* Contract completed.

PHASE II, PROGRESS OF WORKS BY DIRECT LABOUR

Akrotiri Irrigation System

The Akrotiri Irrigation System

The Akrotiri Irrigation System is being constructed by the WDD, Limassol District Office, using direct labour.

The works extend over an area of 1883 hectares. They commenced in January, 1988 and are expected to be completed in two years time. By the end of 1989 14.2Km of main pipeline (200-1000mm in diameter, DI and AC pipes) were installed. The total amount certified was C£1,445,853 while the total cost is estimated to reach C£6.00 millions.

The irrigation of existing plantations is at present practised via the existing earth channels and through temporary outlets.

PHASE II, TURNKEY PROJECTS

Limassol Water Treatment Plant

The contract that was awarded to the Water Engineering Ltd. (UK) and signed on the 19th October, 1989, includes the design, supply and erection of the electro-mechanical equipment and the construction of all civil and building works. The construction of the civil works will be done by the Cypriot contractor Charilaos Apostolides Ltd., under a sub-contract.

The contract price is C£5,133,784 from which the sum of C£1,171,315 will be covered by the grant aid offered by the British Government. The total expenditure by the end of 1989 amounted to £123,462.

The works have commenced on the 20th of October, 1989 and are to be completed in two and a half years.

The Limassol Water Treatment Plant will treat water from Kouris Dam to satisfy the requirements of the town and suburbs of Limassol and of some villages west of Limassol. The plant will have a capacity of 40,000 cubic meters per day with the possibility of future expansion to 80,000 cubic meters per day.

PROJECTS EXPENDITURE

The Project expenditure for Phase I of the project works including expenditure for Kouris Dam, reached the figure of C£78,840,058 by the end of December, 1989. Out of this total cost C£7,560,253 incurred during 1989.

The Project expenditure for Phase II of the Project works, including expenditures for Dhiarizos Diversion, reached the figure of £3,375,364 by the end of December, 1989, out of which C£1,864,145 incurred during 1989.

An analysis of the expenditure incurred is given in Table VIII (3)-7 for both Phases I and II of the Project.

TABLE VIII(3)-7 Summary of Total Expenditure
by the end of December, 1989, for Phases I & II

Description of Activities	Total Expenditure as from 1.1.83 - 31.12.88 C£	Expenditure 1.1.89- 31.12.89 C£	Total Expenditure till 31.12.89 C£
<u>PHASE I</u>			
1. PART 'A'-KOURIS DAM	24,365,170	688,971	25,054,141
2. PART 'B'-MAIN CONVEYOR	33,259,909	816,944	34,076,853

TABLE VIII(3)-7 Cont.

Description of Activities	Total Expenditure as from 1.1.83 - 31.12.88 C£	Expenditure 1.1.89- 31.12.89 C£	Total Expenditure till 31.12.89 C£
3. PART 'C'-AKHNA DAM	1,283,675	254,990	1,538,665
4. PART 'D'-KOKKINOKHORIA IRR. DISTR. NETWORK	11,360,325	5,280,308	16,640,633
4a PART 'D'-ATHIENOU IRR.	-	1,117	1,117
5. PART 'E'-DOMESTIC WATER SUPPLY DEVELOPMENT	168,620	178,109	46,729
6. PART 'F'-CENTRAL CONTROL SYSTEM	-	-	-
7. PART 'G'-INSTITUTIONAL RESTRUCTURING AND PREPARATION OF ENGINEERING WORKS	66,003	68,735	134,738
8. PART 'H'-BUILDINGS & EQUIP.	344,232	7,573	351,805
9. PART 'I'-LAND CONSOLIDATION	450,171	215,166	675,337
10. PART 'J'-MISCELLANEOUS	-	30,040	30,040
SUB-TOTAL-PHASE I	71,298,105	7,541,953	78,840,058
<u>PHASE II</u>			
1. PART 1-DHIARIZOS DIVERSION	288,578	1,252,779	1,541,357
2. PART 2-IRRIGATION SYSTEMS	1,091,294	334,713	1,426,007
3. PART 3-LAND CONSOLIDATION & FARM ROADS	3,000	102,791	105,791
4. PART 4-ON FARM IRRIGATION EQUIPMENT	-	-	-
5. PART 5-LIMASSOL TREATMENT WORKS	35,236	88,226	123,462
6. PART 6-TERSEPHANOU TREATMENT WORKS	-	-	-

TABLE VIII(3)-7 (cont.)

Description of Activities	Total Expenditure as from 1.1.83 - 31.12.88 C£	Expenditure 1.1.89- 31.12.89 C£	Total Expenditure till 31.12.89 C£
7. PART 7-TERSEPHANOU-N/SIA CONVEYOR	19,531	18	19,549
8. PART 8-VILLAGE WATER SUPPLY	-	-	-
9. PART 9-BUILDINGS & EQUIPMENT	-	2,271	2,271
10.PART 1-TRAINING SERVICES	-	-	-
11.PART 1-ADMINISTRATION SUPERVISION- CONSULTANTS	73,580	84,347	156,927
SUB-TOTAL-PHASE II	1,511,219	1,864,145	3,375,364
GRAND TOTAL - PHASES I & II	72,809,324	9,406,098	82,215,422
<u>KHIROKITIA WATER TREATMENT</u>			
1. KHIROKITIA WATER TREATMENT- WORKS EXTENSION	235,403	-	235,403
SUB-TOTAL-KHIROKITIA W.T.W. EXTENSION	235,403	-	235,403
GRAND TOTAL	73,044,727	9,406,098	82,450,825

VIII(4) SOUTHERN CONVEYOR PROJECT - PHASE II

by: N.P. Stylianou
Senior Water Engineer
Head of Design Division

C.S. Katsavras
Executive Engineer I
Assistant Head of Design Division

The main components comprising the Second Phase of the Southern Conveyor Project and the work carried out during 1989 are as follows:

1. Dhiarizos Diversion, which will convey water from Dhiarizos river into Kouris reservoir. The maximum diversion capacity of the works will be about 6.5 m³/sec with a mean annual diverted of 4.5 million cubic metres. The works will comprise the construction of the following:
 - (i) A concrete diversion weir with stilling basin and intake works on the upper reaches of Dhiarizos River.
 - (ii) A 1.6 km long diversion pipeline, 1.6 metres in diameter, and
 - (iii) A 14.5 km long concrete lined diversion tunnel of 2.5 metres internal diameter.

Tenders were invited on the 17th of January 1989 from 33 prequalified firms and joint ventures. Eventually only twelve tenderers submitted their offers (a total of 29 offers, including both basic and alternative offers) which were opened publicly on the 9th of May, 1989. The lowest tender price was £10,604,219 and the highest £28,456,169. Following the evaluation of tenders, the award of Contract was made to the joint venture of Mayreder, Kraus and Co. of Austria and G.P. Zachariades of Cyprus for the sum of £12,025,785. The Contract agreement was signed on the 1st of December, 1989 and the Contractor is expected to start work early 1990.

2. Irrigation Distribution Networks. An area of about 4,300 hectares will be irrigated under Phase II of the Southern Conveyor Project. The area is distributed into four schemes as follows:
 - (i) Akrotiri Irrigation Network, which will now irrigate a total area of about 1880 hectares (new areas totalling 128 hectares have been added) out of which 550 will undergo land consolidation. Initially the construction of the irrigation network was to be carried out under a civil works Contract but now it has been decided for these works to be constructed by WDD.

During 1989, the final detailed design and drawings for the initial distribution network were completed by Energoprojekt of Yugoslavia. The design regarding the new areas which were included later was done by WDD.

The documents for the two supply Contracts (S4 for pipes and S5 for valves, water meters, hydrants and filters) were also finalized by the Consultants. Supply Contract S4 will be financed by the Kuwait Fund and supply Contract S5 will be financed by the World Bank.

In December 1989, tenders were invited for supply Contract S4 where as for supply Contract S5 invitations for tenders are expected to be announced early 1990.

The installation of 15.7 km long pipelines for the main conveyors along with the relevant gate, air and control valves which started in 1988, was completed. The work was carried out by the WDD Limassol District Office and the total cost (materials and construction costs) was £1,459,340. The installed pipelines are used for the temporary supply of water to existing irrigation intakes which were affected after the closing of the gates of Kouris Dam. It has been decided that the Limassol District Office of WDD will complete the construction of the remaining distribution network. The estimated total cost for the remaining work is £4.50 million. The three night storage reservoirs and break pressure tank will be constructed under a contract agreement.

- (ii) Kiti Irrigation Network, which was originally planned to irrigate an area of 1660 hectares will now have its distribution network area readjusted. A considerable part of the original area will be affected by the creation of a tourist zone and the extension of Larnaca airport runway. Due to these changes the completion of the final design and construction drawings has been temporarily suspended until the irrigation area is finalized. The original cost estimate for the network was £4.00 million.
- (iii) Mazotos Irrigation Network, was to irrigate total area of about 660 hectares. Due to various issues brought up by the interested villages the location of the plots to be irrigated will be reexamined. The completion of the final design and construction drawings has been therefore temporarily suspended. The original cost estimate of the distribution network was £2.50 million.
- (iv) Parekklisha Irrigation Network, will irrigate a total area of about 320 hectares which will undergo land consolidation except for 20 hectares. Land consolidation for the village of Parekklisha has already been completed and the drawings will be sent to the Consulting Engineers in order to proceed with the final design and drawings of the irrigation network. The original total estimated cost for this scheme was £2.00 million.

3. Domestic Water Supply Works.

- (i) Limassol Water Treatment Plant. The Limassol treatment works will be supplied with raw water from the Southern Conveyor and deliver the treated water to regional storage tanks. The output of the plant will be 40,000 m³/day, to be increased to 80,000 m³/day at a later stage.

The design and construction of the treatment works will be on a turnkey basis. The original total cost estimate was £5.90 million.

Tenders for the design, construction, supply and erection of the works were received in January 1988. The tender prices ranged from £4.1 to £7.2 million. Following the evaluation of the tenders by the Consultants and WDD, the Tender Board, in September

1989, awarded the Contract to Water Engineering Ltd. of U.K. for the sum of £5,133,784 of which £3,962,469 will be Government funding and £1,171,315 will be received as Grant Aid from the U.K. Government. The Contract Agreement was signed on the 19th of October, 1989 and design work began immediately. The sub-contractor for the civil works will be Charilaos Apostolides Ltd. of Cyprus. Construction of the civil works is expected to start early 1990.

- (ii) Main pipeline connections to Limassol Water Treatment Plant.

A pipeline, 900 mm in diameter and 1.5 km long, will convey raw water from the Southern Conveyor to Limassol Water Treatment Plant. The pipeline will start from a location situated near Ayios Athanasios round-about and will follow the road to Phasoula. At the final stage the pipeline will convey 0.978 m³/sec of raw water to the treatment works. Structures for swabbing purposes will also be constructed.

Another pipeline with a diameter varying from 900 mm to 450 mm and 2.6 km long will deliver at peak demand 0.984 m³/sec of treated water from Limassol W.T.P. to three service reservoirs (Ayia Phyla, Mesayitonia and Ayios Photis) and temporarily, until a new reservoir is built, to Kapsalos suburb.

During 1989, the detailed design and drawings were started.

- (iii) Tersephanou Water Treatment Plant.

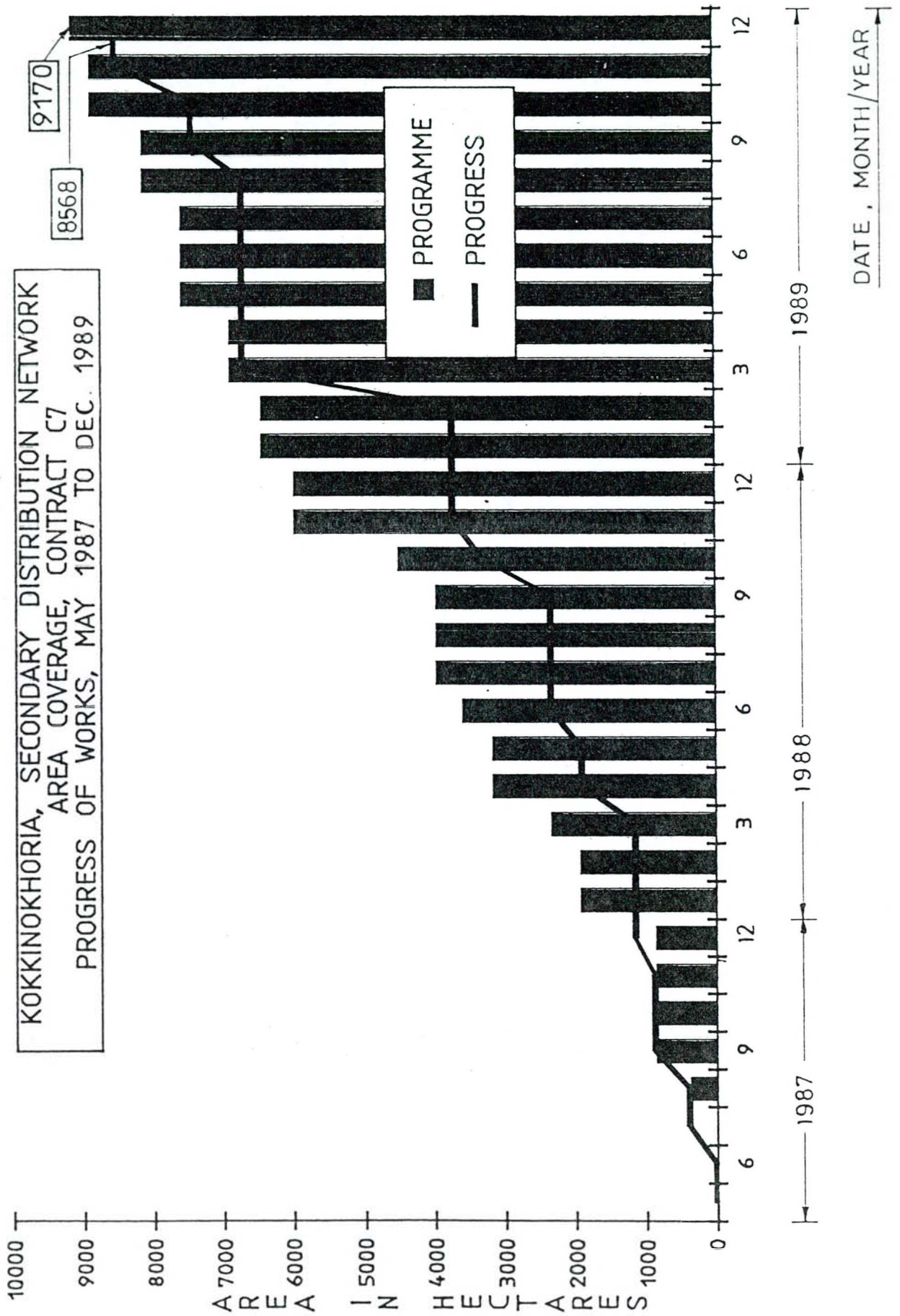
The plant will have an output of 60,000 m³/days increased to 90,000 m³/day at a later stage. The treated water will be conveyed to Nicosia and Larnaca. The new estimated cost for this project is about £6.8 million.

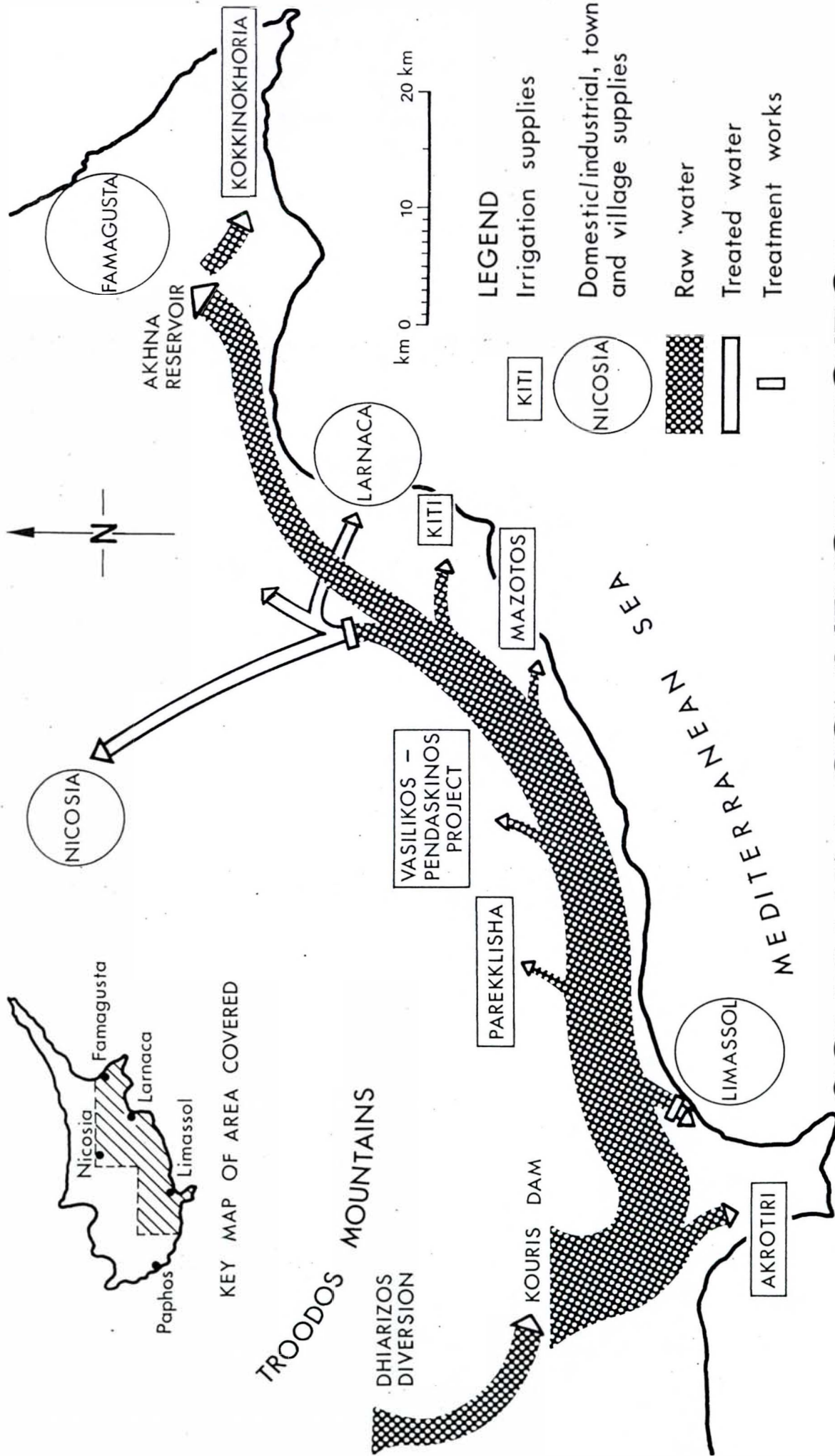
During 1989, the Consultants proceeded with the preparation of the final documents for the supply and erection of the electromechanical equipment. It is expected to invite tenders for the design, supply, erection and commissioning of the electromechanical equipment during the first half of 1990.

(iv) Tersephanou-Nicosia Pipeline
Conveyance System



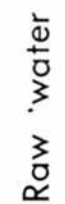
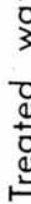

The conveyor will deliver treated water from Tersephanou W.T.P. to Nicosia service reservoir at Lakatamia. The scheme comprises a 35 km long pipeline, 900 mm in diameter, a pumping station at Tersephanou W.T.P. and a Balancing Reservoir at Dhali. The water will be pumped into Dhali Reservoir and from there delivered by gravity to Lakatamia reservoir. The estimated total cost of the scheme is about £5.90 million.

During 1989, the draft final design of the conveyor which was prepared by the Consultants, was reviewed by WDD. The drawings and contract documents will be finalized during 1990.





LEGEND

-  Irrigation supplies
-  Domestic/industrial, town and village supplies
-  Raw water
-  Treated water
-  Treatment works

SOUTHERN CONVEYOR PROJECT

Diagrammatic Representation of Water Distribution

1st and 2nd Phase

IX DIVISION OF OPERATION AND MAINTENANCE-
TOWN WATER SUPPLY

by
C C Artemis
Senior Water Engineer
Head of Division

Introduction

The main activities of this Division are the administration, operation and maintenance of Government Town Water Supply Schemes and Rural Regional Water Supply Schemes. Presently, the following Government schemes are in operation.

- The Nicosia Water Supply System consisting of:
 - (a) All sources of supply and conveyance systems for the water supply of Nicosia town and suburbs.
 - (b) the Nicosia Water Supply component of the Vasilikos Pendaskinos Project. This component comprises Dhypotamos Pumping Station, Kornos Water Treatment Works and Pumping Station, Stavrovouni Balancing Reservoir, and Lefkara-Dhypotamos part of the old Lefkara-Khirokitia pipeline and the pipeline from Dhypotamos Pumping Station to Nicosia.
- The (non potable) water supply system of Government residences and institutions in Nicosia.
- The Central Water Supply System which is the main source of water supply of the towns of Famagusta and Larnaca and of over 40 communities and refugee housing estates in the above two districts and

- The Government Rural Water Supply Schemes, namely:
 - (a) Paphos Lower Villages Regional Water Supply Scheme
 - (b) Arminou Regional Water Supply Scheme
 - (c) Timi Water Supply Scheme
 - (d) Ambelitis Water Supply Scheme
 - (e) Phrenaros pumping station and rising main for Paralimni and Ayia Napa water supplies.

Another activity of this Division is its participation in the administration of the Nicosia, Limassol, Famagusta and Larnaca Water Boards. Senior officers of the Division and the District Engineers attend water board meetings as representatives of the Director of the Department. In its capacity as a member of the Water Boards this Department acts as their technical adviser and also undertakes, other commitments permitting, the design and construction work for major developments in their distribution systems.

Water Supply Situation in General

The rainfall during the 1988/89 winter season was poor and had an adverse effect on the impoundment of water in dams, and the recharge of aquifers. However the water supply demand was met satisfactorily due to the available stocks of water in dams impounded during the previous year. The water supply of the towns was therefore unrestricted throughout the year under review. The swabbing of the second section of the Khirokitia-Famagusta pipeline (from Alethriko Break pressure tank to Phrenaros Reservoir) was carried out in March 1989 and the theoretical carrying capacity of the pipeline, which is 25,000m³/day, was restored.

A significant, though diminishing, contribution was also the production of the boreholes of the 1982/84 emergency schemes which in 1989 was 1.480MCM.

The water supply of Nicosia Town was augmented this year by 7.184MCM from Kornos Treatment Works which was in operation throughout the year under review.

Nicosia Town

The Town enjoyed unrestricted supply in 1989. A total of 12.106MCM of water was delivered to the service reservoirs representing an increase of only 2.5% on the previous year's figure. The low figure is partly due to the measures taken by the Water Board to reduce its unaccounted for water and partly due to the high water rates which have conditioned the consumer towards the saving of water. Figures IX-1 to IX-3 give in graphical condensed form the daily consumption of the town over the years 1987 to 1989. The seasonal variation in demand and the effects of restrictions and weather conditions are all reflected in these charts.

Limassol Town

The production of the Water Board owned sources met the water demand of the town satisfactorily and the town enjoyed an unrestricted supply throughout the year. The total quantity of water produced by the Water Board's own sources was 11.061MCM. This figure, compared with that of 1988, showed an uncrease of 11.23%.

Larnaca Town

The town enjoyed unrestricted supply throughout the year. The total quantity delivered to its service reservoirs reached 3.878MCM of which 2.634MCM was supplied from the Central Water Supply System and 1.244MCM was produced by the Water Board's own borehole sources in the Tremithos river aquifer. The corresponding figures for 1988 were 3.599MCM, 2.892MCM and 0.707MCM. Comparison of the figures shows an increase in overall production of 7.75%. The Tremithos borehole yield shows a marked increase caused by the natural recharge of the aquifer. Thus the quantity required by the town from the Central Water Supply System was less than in 1988, by 0.258MCM.

Paphos Town

The town did not experience a water shortage problem during the year and no restrictions were imposed on the supply. The total quantity of water delivered to the service reservoirs of the town was 2.174MCM. The corresponding figure for 1988 was 1.978MCM. The sources of the Municipality met satisfactorily the demand and the water supply of the town was not supplemented from the Paphos Lower Village Water Supply Scheme. The main weaknesses of the system are the limited capacities of service reservoirs and the main conveyor to the town.

Table IX-1 gives some useful statistical data on the water supply of the towns over the last eighteen years.

Table IX-1
URBAN WATER SUPPLY IN CYPRUS

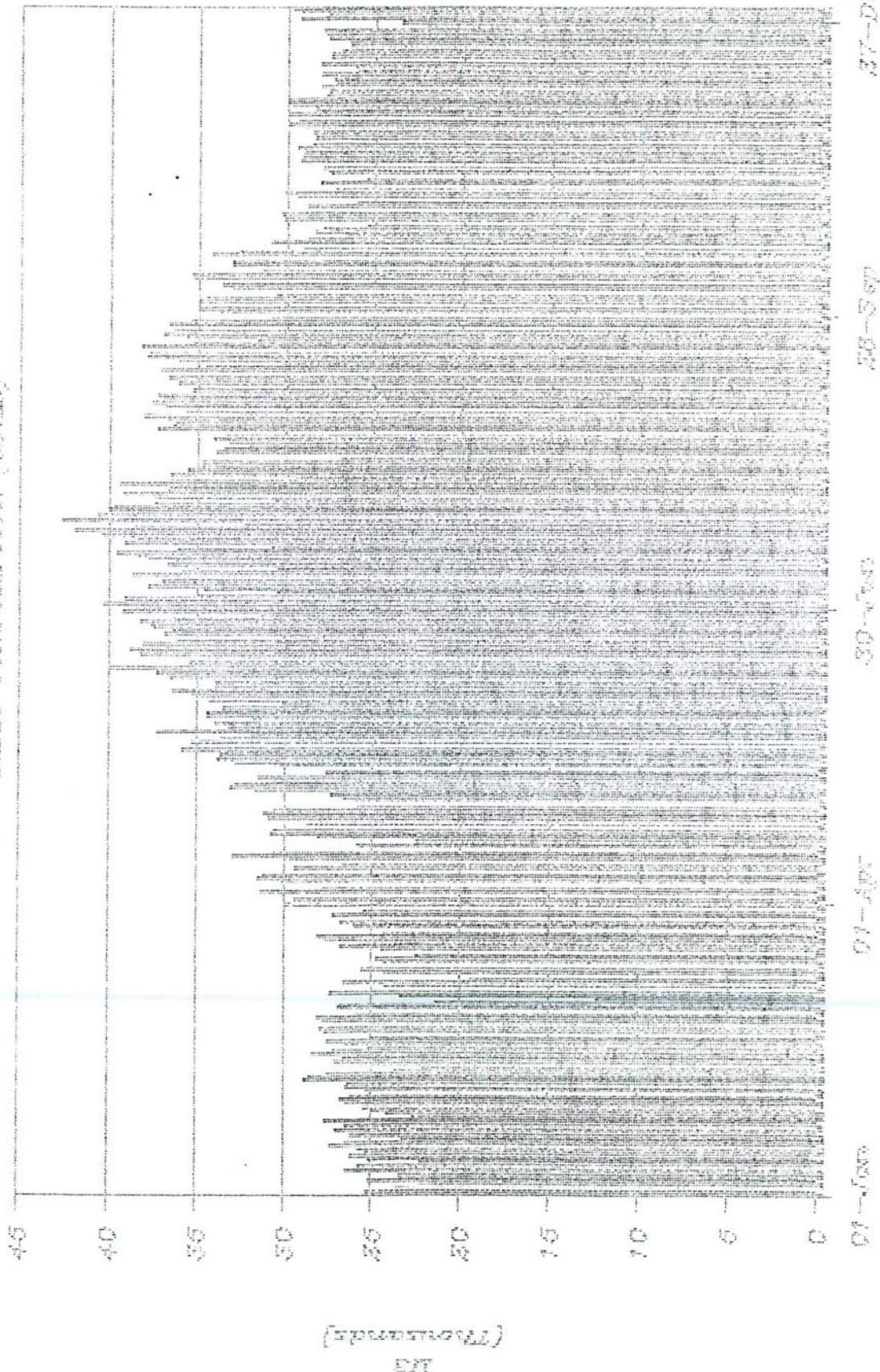
Year	Consumers*		Input into System (at Service Area Outlets) m ³ **
	Number at end of year	Increase %	
		Nicosia	
1972	17 601	-	7 564 804
1973	18 989	7.9	7 460 286
1974	20 796	9.5	7 550 913
1975	21 978	5.7	7 532 363

* Due to lack of information on the number of consumers in the Turkish occupied sector the figures in this column refer to the Government controlled area of Nicosia only.

** These figures cover the whole of Nicosia.

NICOSIA WATER SUPPLY 1987

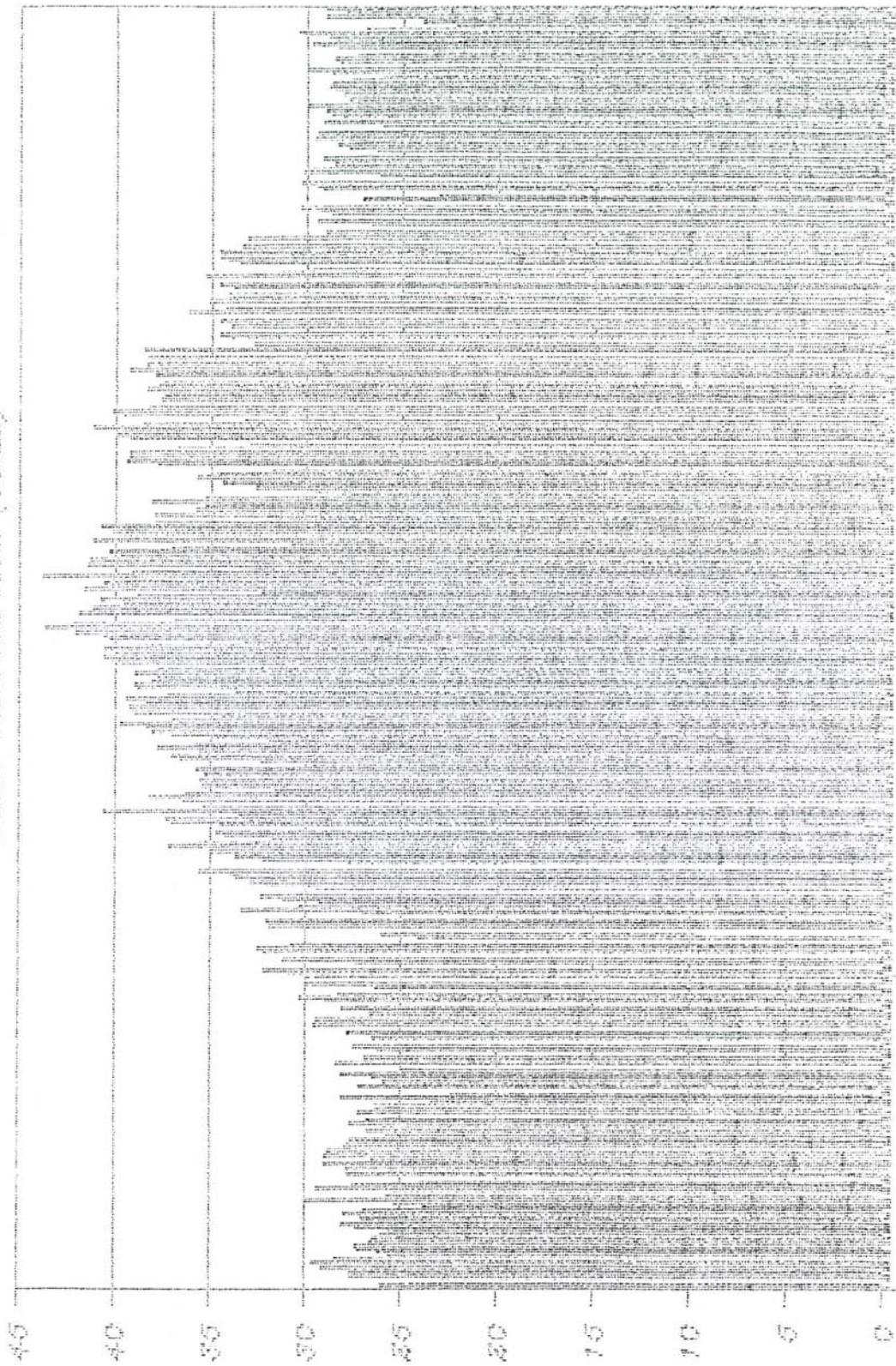
DAILY CONSUMPTION (CU.M.)



DATE GROUP BY SCOPED BY 1.8390 E.1.1.80-588

NICOSIA WATER SUPPLY 1988

DAILY CONSUMPTION (GAL.)



31-Dec

30-Nov

30-Oct

31-Aug

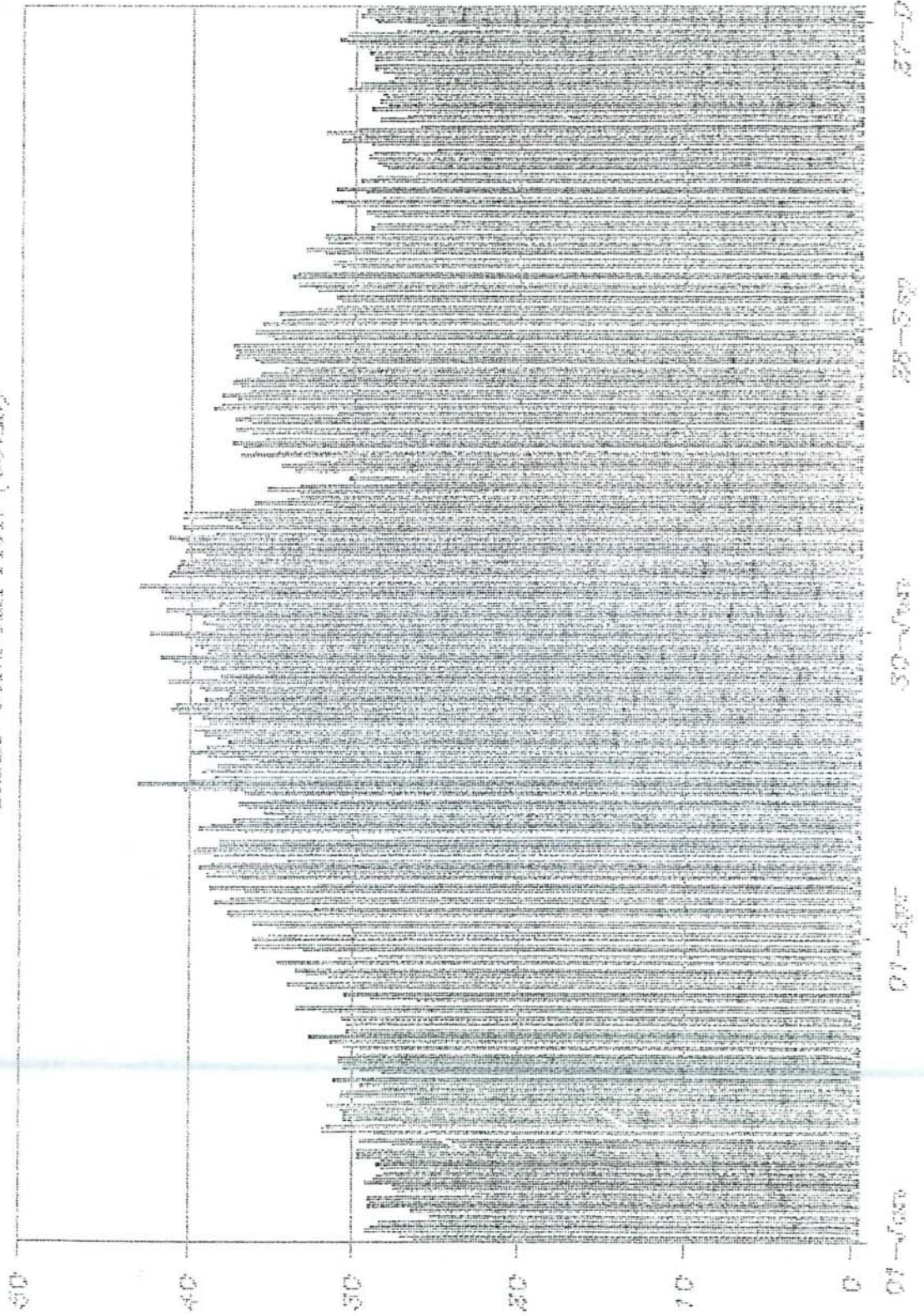
01-Jan

AF-00000 (1988) Nicosia Water Supply 1988

(Supplement)
BY

NICOSIA WATER SUPPLY 1989

DAILY CONSUMPTION (CUM.)



(CUMULATIVE)
CUM.

NOV 4 00:30 AM '89 33150 INY 31530 T. 13103400

Table IX-1 (continued)
URBAN WATER SUPPLY IN CYPRUS

Year	Consumers*		Input into System (at Service Area Outlets) m ³ **
	Number at end of year	Increase %	
Nicosia			
1976	23 628	7.5	8 137 580
1977	25 646	8.5	8 551 570
1978	27 944	9.0	8 307 170
1979	30 337	8.6	8 559 184
1980	34 181	12.7	9 152 909
1981	35 366	3.5	8 676 120
1982	37 513	6.1	9 001 875
1983	39 554	5.4	8 984 890
1985	42 412	2.7	10 393 365
1986	43 984	3.7	10 218 459
1987	45 550	3.6	10 911 284
1988	47 200	3.6	11 314 893
1989	48 762	3.3	11 796 863
Limassol			
1972	17 927	-	4 952 521
1973	19 015	6.1	4 999 405
1974	19 435	2.2	4 990 401
1975	19 800	4.1	4 175 035
1976	20 305	2.6	5 181 567
1977	20 989	3.4	5 935 146
1978	21 908	4.4	6 342 758
1979	23 840	8.8	6 560 782
1980	26 416	10.8	7 214 542
1981	28 392	7.5	7 411 301
1982	30 311	6.7	7 692 378
1983	31 885	5.2	7 711 306
1984	34 034	6.7	7 831 767
1985	37 621	10.5	8 443 089
1986	39 921	6.1	8 837 964
1987	41 219	3.2	8 837 785
1988	42 592	3.3	9 694 918
1989	44 076	3.5	10 863 777
Larnaca			
1972	5 812	-	1 659 680
1973	5 950	2.4	1 313 750
1974	6 065	1.9	1 528 990
1975	6 023	0.7	1 819 820
1976	7 515	24.7	2 015 900

* Due to lack of information on the number of consumers in the Turkish occupied sector the figures in this column refer to the Government controlled area of Nicosia only.

** These figures cover the whole of Nicosia.

Table IX-1 (continued)
URBAN WATER SUPPLY IN CYPRUS

Year	Consumers		Input into System (at Service Area Outlets) m ³
	Number at end of year	Increase % Larnaca	
1977	8 133	8.3	2 315 590
1978	9 513	17.0	2 523 680
1979	10 578	11.2	2 669 100
1980	11 776	11.3	2 593 540
1981	13 487	14.5	2 931 690
1982	15 047	11.6	2 770 700
1983	16 453	9.3	2 471 510
1984	17 150	4.1	2 900 270
1985	17 979	4.6	3 474 580
1986	18 441	2.5	3 208 960
1987	19 492	5.7	3 372 380
1988	20 241	3.6	3 531 470
1989	21 135	4.4	3 822 200
Paphos			
1972	-	-	-
1973	-	-	-
1974	2 258	-	669 191
1975	2 332	3.3	645 228
1976	2 500	7.2	777 800
1977	2 706	8.2	808 772
1978	2 939	8.6	889 668
1979	3 851	31.0	973 361
1980	4 413	14.6	1 119 059*
1981	4 921	11.5	1 200 597*
1982	5 602	13.8	1 247 972*
1983	6 155	9.9	1 293 881*
1984	6 685	7.9	1 434 666*
1985	7 306	8.5	1 535 789*
1986	8 048	10.2	1 759 244*
1987	8 691	8.0	1 803 350*
1988	9 364	7.7	1 978 181*
1989	10 113	8.0	2 174 083*

* These figures have been corrected by subtracting quantities supplied to Mandria village en route.

NICOSIA WATER SUPPLY

Institutional Arrangements

The water supply of Nicosia town and suburbs is faced jointly by three authorities:

- the Water Development Department which is responsible for all sources and conveyors up to the service reservoirs and sells the water in bulk to the Nicosia Water Board.
- the Nicosia Water Board which has the responsibility for the distribution of water to Nicosia town and suburbs, and,
- the Nicosia Water Commission which has the responsibility for the distribution of water to the old town of Nicosia within the walls. The Commission operated its own sources which were the boreholes P1 and P2 and the Arab Ahmet chain of wells. Use of the two boreholes for potable water supply was discontinued during the year 1985. Use of the Arab Ahmet chain of wells was suspended in October 1988.

Several important sources and conveyance systems serving the town of Nicosia are located within the occupied area. These sources are the Morphou-Pendayia boreholes which make a very significant contribution to the total water requirements of the capital and the Dhikomo boreholes and Sykhari Adit which have been reported dry. There is a common distribution system for the whole of the town which serves both the Greek and Turkish sectors. There are service reservoirs in both sectors. The water supply of the whole town thus operates as a single unified system and the cooperation of both sides is necessary to achieve the desired results.

The Government provides spare parts or replaces pumping units installed on sources of the systems within the area under Turkish occupation and also provides the Turkish side with repair materials for the pipelines conveying water to Nicosia in order to keep up a continuous supply to the town.

The contribution of the United Nations personnel, in providing liaison between the two sides, is much appreciated.

Demand Estimates

As already mentioned, the supply to the town in 1989 was unrestricted. The total consumption during the year including losses, was 12.106MCM. This figure is by 2.5% higher than that of 1988 which was 11.81MCM and corresponds to an average daily consumption of 505 l per consumer meter. For fifteen years, from 1972 to 1986, restrictions have had to be imposed on the hours of supply to the consumers and the unrestricted demand was not known. Estimates of unrestricted demand had until recently assumed an average daily consumption of 700 l per consumer meter, which is considerably higher than the actual unrestricted demand of 1988 and 1989.

It is believed that the restrictions imposed on the water supply of the town for many years and the campaigns to save water, together with the introduction of increased water rates and measures to reduce unaccounted for water by the Nicosia Water Board in recent years have depressed the gross water supply demand. The totally unrestricted demand may therefore take a few years of unrestricted supply to develop and even then it may emerge that earlier estimates of totally unrestricted demand and the effect of restrictions may have been too high.

Sources and Production

The main water supply sources of Nicosia town and their production over the years 1985 to 1989 are given in Table IX-2.

Table IX-2
NICOSIA WATER SUPPLY SYSTEM
YIELD OF SOURCES IN MCM PER ANNUM 1984-88

Source	1985	1986	1987	1988	1989
1 Morphou Bay Scheme	3.280	2.977	3.162	2.985	2.627
2 Dhikomo-Sykhari	NIL	NIL	NIL	NIL	NIL
3 Paliometokho- Kokkinotrimithia-Dhenia- Airport	0.431	0.286	0.256	0.258	0.268
4 Tseri	0.686	0.598	0.476	0.504	0.485
5 Dhali	NIL	NIL	NIL	NIL	NIL
6 Peristerona-Akaki	1.087	0.788	0.765	0.974	0.758
7 Laxia-Athalassa- Makedonitissa	0.142	0.182	0.127	0.078	0.089
8 Nicosia Water Commission Sources	0.419	0.199	0.243	0.271	0.001
9 Purchased from Private BH	1.114	1.019	0.871	0.817	0.808
10 Lefkara Dam (CWSS)	2.290	—	—	—	—
11 1982-84 Emergency Schemes					
(a) Stavrovouni	0.849	0.805	0.692	0.663	0.598
(b) Dhenia	0.182	0.186	0.136	0.140	0.186
(c) Dhali-Kattoudhia-Yeri	0.547	0.533	0.410	0.036	0.060
12 Kornos Treatment Works ..	0.266	3.414	4.792	6.086	7.202
	11.293	10.987	11.930	12.812	13.082

During 1989, the total quantity of water produced was 13.082MCM of which 12.273MCM came from Government sources 0.001MCM was the yield of the Nicosia Water Commission sources and 0.808MCM was purchased from private boreholes.

Consumption

Of the total 1989 production of 13.082MCM, 12.106MCM were delivered to Nicosia and 1.135MCM were consumed en route by a number of communities and other consumers connected to the system. The total consumption exceeds total production by 0.158MCM. The difference is attributed to meter inaccuracies and/or the different times at which meter readings are taken.

The lack of information on population served in the Turkish controlled part of the area of supply makes it difficult to calculate accurate figures for per capita consumption of the town. Nevertheless, based on information available on the number of consumers within the Government controlled part of the area of supply, on the quantity consumed in the Turkish sector and assuming an average of 3.0 persons per consumer connection, it is estimated that an average supply of 168 l/capita/day or 505 l per day per consumer meter was delivered to the service reservoirs of the town this year.

Villages and other Consumers served by the Nicosia Water Supply System

Table IX-3 below gives the communities and other consumers served by the Nicosia Water Supply System and the quantities supplied to them over the years 1985-1989.

Table IX-3
NICOSIA WATER SUPPLY SYSTEM
VILLAGES AND OTHER CONSUMERS SERVED

Community Served	Consumption in MCM				
	1985	1986	1987	1988	1989
Kokkinotrimithia	0.068	0.022	0.002	--	--
Mammari-Dhenia	0.037	0.045	0.059	0.066	0.054
Mosphiloti	0.049	0.045	0.055	0.051	0.066
Psevdhas	0.025	0.020	0.027	0.020	0.025
Pyrga	0.026	0.023	0.026	0.028	0.030
Lymbia, Sha, Kornos regional W.S. Scheme	0.042	0.093	0.145	0.218	0.170
Alambra	0.010	0.029	0.076	0.060	0.064
Dhali	0.047	0.122	0.146	0.105	0.119
Laxia	--	0.111	0.171	0.237	0.276
Various camps industries and miscellaneous consumers ...	0.157	0.146	0.107	0.236	0.331
Totals	<u>0.461</u>	<u>0.656</u>	<u>0.814</u>	<u>1.021</u>	<u>1.135</u>

New Schemes

There were no new schemes put into operation during the year under review.

Water Supply Prospects

The operation of Kornos Treatment Plant has solved the water shortage problem of Nicosia Town for a few years only. Due to the increasing demand for water and the continuous reduction in the yield of boreholes presently supplying Nicosia, deficits are likely to develop again especially if there is inadequate rainfall during the next few years.

The long term solution of the water shortage problem will be provided by the Southern Conveyor Project the second phase of which will become operational in 1993. This Project was planned to meet the water demands of Nicosia upto the year 2000 and of Limassol, Larnaca and Famagusta and of a large number of communities upto the year 2010. However the dramatic rate of increase in demand exhibited in recent years, especially in the area of Ayia Napa and Paralimni due to the booming tourist trade is already pointing to the need for planning additional water works to come on stream by 1997 for the Famagusta Area.

Expenditure and Revenue

A statement showing expenditure for the operation and maintenance of sources and conveyors and revenue from the sale of water for the year 1989 is given in table IX-4.

Table IX-4
NICOSIA WATER SUPPLY
EXPENDITURE AND REVENUE ACCOUNT FOR 1989

Expenditure

Morphou Bay Scheme

	£
Maintenance expenses	1 069
Electricity.....	165 451
Wages.....	20 118
Miscellaneous expenses.....	3 112
Total.....	<u>£189 750</u>

Tseri Scheme

Maintenance expenses.....	2 106
Electricity and fuel.....	16 459
Wages.....	22 335
Miscellaneous expenses.....	2 331
Total.....	<u>£43 231</u>

Peristerona-Akaki Scheme

Maintenance expenses.....	4 270
Electricity and fuel.....	31 956
Wages.....	22 335
Miscellaneous expenses.....	2 314
Total.....	<u>£55 861</u>

Kokkinotrimithia-Paleometokho Installations

Maintenance expenses.....	4 576
Electricity and fuel.....	22 470
Wages.....	29 206
Miscellaneous expenses.....	1 998
Total	<u>£58 250</u>

Dhali-Laxia Installations

Maintenance expenses	428
Electricity	2 365
Wages	--
Miscellaneous expenses	324
Total	<u>£3 117</u>

Maintenance Expenses of Civil Engineering Works

Motor Transport expenses	5 691
Wages	32 866

Table IX-4 (continued)
NICOSIA WATER SUPPLY

EXPENDITURE AND REVENUE ACCOUNT FOR THE YEAR

	£
Purchase of materials & equipment	4 525
Miscellaneous expenses	<u> </u>
Total	£43 082
Pyrga-Stavrovouni and Yeri-Dhali-Kattoudhia Emergency Schemes	
Maintenance expenses	6 171
Electricity and fuel	30 391
Wages	27 014
Miscellaneous expenses	1 646
Total	<u> </u> £65 222
Dhypotamos-Lakatamia-Installations	
Maintenance expenses	2 197
Electricity	69 222
Wages	7 318
Miscellaneous expenses	825
Total	<u> </u> £79 562
Kornos Water Treatment Works and Pumping Station	
Maintenance expenses	3 476
Electricity	48 272
Wages	50 480
Miscellaneous expenses	36 976
Total	<u> </u> £139 204
Purchase of Water from Private Sources	£45 829
GRAND TOTAL	£724 108
Revenue	
Value of water delivered to Nicosia Water Board* (@ 16.3 cents/m ³)	1 973 086
Value of water delivered directly to other consumers in 1989	253 331
Total value of water delivered in 1989	<u> </u> £2 226 417

* This figure is calculated at the actual rates at which the Water Board is charged. As from 1.3.1982 these rates represent only 75% of the actual cost of the water. The balance is a government grant to the Water Board on account of the quantity it supplies to the turkish-occupied sector of Nicosia for which no payment is received by the Board.

Table IX-4 (continued)
NICOSIA WATER SUPPLY

	£
Less amount actually collected in 1989 in respect of water delivered in 1989	1 608 805
Amount outstanding on 31.12.89 for water delivered in 1989	£ 617 612
EXPENDITURE AND REVENUE ACCOUNT FOR 1989	
Amount outstanding by 31.12.88	1 109 033
Less amount collected in 1989 in respect of water delivered before 31.12.88	980 725
Amount outstanding on 31.12.1989 for water delivered before 31.12.88	128 308
Total amount outstanding on 31.12.1989	745 921
Total amount collected in 1989	£2 589 530

This statement does not include for the amortization of the Government installations and equipment of the system. The amortization cost of these installations and equipment is estimated at £1,211,860 annually as given in Table IX-5. Without taking into account office overheads the surplus for the year 1989 amounts to £290,459.

SUMMARY OF EXPENDITURE AND REVENUE

	£
- Operation and Maintenance expenses:	724 108
- Amortization Cost	1 211 860
Total Expenditure	1 935 968
- Revenue generated (excl. value of water supplied to turkish occupied areas)	2 226 417
Surplus	290 459

If outstanding payments are not considered as revenue then there is a deficit of £327,163 as follows:

- Total expenditure	1 935 968
- Amount actually collected in 1989	1 608 805
Deficit	327 163

Table IX-5
NICOSIA WATER SUPPLY
AMORTIZATION COSTS

Installations	Year comple- ted	Capital Cost £	Period Years	Annual Amorti- zation Cost £
Pre-1982 installations	--	1 748 300	Varies	107 760

Table IX-5 (continued)
NICOSIA WATER SUPPLY
AMORTIZATION COSTS

Installations	Year completed	Capital Cost £	Period Years	Annual Amortization Cost £
Vasilikos-Pendaskinos Project Phase I (Dhyptomamos Pumping Station and Dhyptomamos- Stavrovouni-Lakatamia Pipeline)				
- Civil works	1982	2 650 000	40	246 344
- E & M plant	1982	350 000	15	43 420
1982 Emergency Schemes				
Dhenia	1982	90 000	5	23 138
Stavrovouni	1982	78 000	5	20 053
1983 Emergency Schemes (Pyrga-Stavrovouni- Yeri-Dhali-Kattoudhia)				
	1983	75 100	5	19 307
1984 Emergency Schemes (Pyrga-Dhali-Kattoudhia)				
	1984	17 767	5	4 567
Vasilikos Pendaskinos Project Phase II (Kornos Treatment Works and Pumping Station)				
- Civil Works	1986	1 398 470	40	130 000
- E & M Plant	1986	1 128 000	20	123 570
Dhyptomamos Dam and Maroni Diversion Water Supply Component				
		(5 900 800)		
	1986	4 337 090	40	403 180
Vehicles				
Allocated to Water Supply	1986	(50 000) 25 000	5	6 430
Consultants fees				
48.6% allocated to Water Supply	1986	(990 000) 481 140	40	44 730
Total				£1 211 860

Note: Figures in parentheses indicate total cost.

Water Supply to Government Residences and Institutions in Nicosia

In addition to the water supplied for domestic use by the Nicosia Water Board, Government houses, offices and other institutions are supplied, in most cases free of charge, with water for irrigation and cleaning purposes by a separate water supply system. The sources of this system are four boreholes situated

within the built up area of Nicosia. The total quantity of water produced from these sources during 1989 was 104,650m³ which met satisfactorily the demand. The total expenditure, (which is borne by Government) for the operation and maintenance of this system for 1989 was £13,841 as follows:

- Electricity	1,050
- Wages	10,266
- Maintenance	1,795
- Miscellaneous expenses	730
Total	<u>£13,841</u>

Note: Expenditure under the heading "Wages" includes also the wages for the maintenance and repairs to large water meters which are carried out by the same gang operating this system.

Kornos Water Treatment Works

During 1989, the Water Treatment Works at Kornos was operated at various throughputs upto its full capacity of 32,000m³ per day and covered a substantial part (about 55%) of Nicosia's water supply demand.

The raw water treated by the plant, is either obtained by gravity from Lefkara Dam or boosted from Dhypotamos Dam via Dhypotamos Pumping Station. After a well controlled treatment process the water is pumped via Kornos Pumping Station to Stavrovouni Balancing Reservoir and hence conveyed by gravity to Lakatamia Service Reservoir south of Nicosia.

The total quantity of water produced was 7,308,950m³ against a total energy consumption (including pumping) of 2067480kWh. The consumption of chemicals was as follows:

Aluminium Sulphate	219 350 kg
Polyelectrolyte	884 kg
Calcium Hydroxide (Lime)	--
Chlorine Gas	11 000 kg

The water quality throughout all the steps from the source to the destination, was assured by careful control and monitoring. Bacteriological and chemical analyses were performed regularly at Kornos Water Treatment Laboratory.

In addition to the above analyses, water samples from various sources of drinking and irrigation water supplies within the Nicosia district are also subjected to a complete ionic analysis on a routine basis. The ionic analysis includes determination of the electrical conductivity, hardness, pH, total dissolved solids, chlorides, sulphates, carbonates, bicarbonates, nitrates, sodium, potassium, calcium and magnesium. Other specific analyses concerning the determination of aluminium residual, total iron content, total alumina, suspended solids, sludge cohesion, sludge concentration, turbidity, colour, chlorine residual, taste and odor, aggressiveness, suspended solids and alkalinity were also carried out.

Within the activities of the Kornos Water Treatment Laboratory were also:

- (i) The collection and analysis of various water samples in connection with: a) Plant-research projects aiming to improve certain operational parameters, related to the filtration and coagulation processes and/or to suggest treatment modifications which tend to lower the cost of water production (eg. use of direct filtration to treat the raw water from Lefkara dam). b) Departmental projects such as the monitoring of water quality in Kouris, Lefkara and Dhypotamos Reservoirs, Vasilikos-Pendaskinos irrigation area and "mobile" filtration units.
- (ii) The application of analytical methods for the determination of boron, copper, chromium, manganese, fluoride, nitrites, chemical oxygen demand (COD), dissolved oxygen (DO), Langelier Index (LI) in water, by using UV/VIS spectrophotometer and ion-selective electrodes.
- (iii) The operations of chemical reagents and glassware stores and records-keeping of various analytical methods and drinking water standards.

The analyses carried out at Kornos Water Treatment Works Laboratory amounted to 1116 of which 1025 were chemical analyses and 91 were bacteriological analyses.

Thus:

- (i) 641 complete sets of ionic analysis (each one consists of 13 determinations) were carried out of these 406 analyses were performed on samples from Nicosia district 120 from Engomi reservoir and the remaining on samples taken from Kornos Treatment Works as well as Lefkara and Dhypotamos Dams.
- (ii) In addition 384 specialised analyses were carried out of which: 132 were determinations of aluminium, 25 of iron, 13 of copper, 127 of boron, 29 of dissolved oxygen, 6 of Langelier Index, 18 of sludge concentration, 26 of suspended solids, 3 of manganese and 3 of chromium.
- (iii) The bacteriological analyses were performed on samples of raw and final water from both Kornos and Khirokitia Water Treatment Works as well as on samples from the large dams.

The operation of the Treatment Plant was carefully controlled throughout all stages and the routine maintenance was programmed and performed successfully. In addition, all items of mechanical equipment have been serviced and maintenance work has been carried out on buildings and civil engineering structures. Thus, water reservoirs, reagent tanks, pipelines, dosing pumps, chlorinators, valves, boosters and many other items of equipment and machinery were appropriately maintained and painted with standard characteristic colours. The modification of certain parts of the existing electromechanical installation and the application of additional accessories improved substantially the operational efficiency of the plant.

CENTRAL WATER SUPPLY SYSTEM

The System

The Central Water Supply System (CWSS) is the former Famagusta Water Supply Scheme which has gradually been enlarged with the addition of new sources and the connection of new demand centres to a point where it now serves the Towns of Larnaca and Famagusta and more than 40 communities in the respective districts.

The system provides both underground water being pumped from several boreholes in the areas of Khirokitia, Skarinou, Alethriko, Anglisidhes and Klavdhia villages and surface water from Yermasoyia, Kalavastos and Kouris Dams. The Southern Conveyor Project supplies water via a temporary cross connection, upstream of Tokhni Pumping Station.

The water from Yermasoyia dam is pumped to Akrounda Phinikaria Balancing Reservoir and thence, gravitated to Vasilikos Pumping Station from where it is boosted to the Raw Water Balancing Reservoir at Khirokitia Treatment Works. The provision of water from Yermasoyia dam was discontinued on 31.5.1989 after the connection of the System to the main conveyor of the Southern Conveyor Project. The water of the Yermasoyia dam will in future be used for local irrigation and recharge of the aquifer downstream of the dam where there are a number of boreholes supplying water to Limassol Water Board, Amathus, and Mouttayaika Regional Scheme.

The water from Kalavastos dam is conveyed by gravity along a pipeline to Tokhni Pumping Station and from there it is pumped to the Raw Water Balancing Reservoir at Khirokitia Treatment Works.

The surface water is being treated at the Khirokitia Treatment Works which had been extended in 1985 and its capacity increased to 32,000m³/day. Treated and borehole water is conveyed along the 70 km long Famagusta pipeline running from Khirokitia to Phrenaros reservoir south of Famagusta.

Borehole sources and communities are connected at various points along the Famagusta pipeline which in effect forms the backbone of the CWSS.

The water held in storage in the Yermasoyia dam reservoir on 1st January, 1989 was 7,420,000m³ representing 55% of the reservoir capacity and by the 1st January, 1990 the total water storage was 4,106,000m³ representing 30.4% of the reservoir capacity. The total inflow net of overflow and net of seepage losses during the year was 10,376,000m³ and the total drawoff including water for irrigation, domestic, recharge and evaporation was 13,483,000m³. The quantity drawn off by the CWSS for domestic purposes was 170,785m³.

The water held in storage in the Kalavastos dam reservoir on 1st January, 1989 was 9,284,000m³ representing 54.3% of the reservoir capacity and by the 1st January, 1990 the total water storage was 10,471,000m³ representing 61.2% of the reservoir

capacity. The total inflow net of seepage losses during the year was 10,856,000m³ and the total drawoff including water for irrigation, domestic and evaporation was 9,497,000m³. The draw off quantity for domestic purposes was 4,648,258m³.

Water from the Southern Conveyor is drawn as from January, 1989. The total quantity drawn during the year was 2.925MCM.

The total quantity of water pumped and/or treated from all sources of this scheme during 1989 was 8,583,770m³ (including losses and quantities supplied to Akrounda-Phinikaria local irrigators) and the total consumption was 8,795,474m³. (excluding 66,470m³ supplied to Akrounda-Phinikaria irrigators).

The total demand on the system during 1989 was 8.80MCM compared to 8.39MCM during 1988.

New Schemes and Improvements

Kophinou Pumping Station

The object of the scheme is to increase the carrying capacity of the Famagusta conveyor to meet the increased demand. At present the pumping station will operate for a few months in summer to meet the peak demands.

The scheme provided for the construction of a pump house, the installation of 2 No. centrifugal pumps with electric motors rated at 200kw each, and the installation of automatic operation system. The pumps operate alternatively and the output of each one is 1384m³/hr, which correspond to the output of Khirokitia Treatment Plant. With the operation of the Pumping Station, the carrying capacity of Famagusta conveyor, has increased by 20%.

Work for the execution of the scheme started on 15.2.1988 and was completed at the end of September, 1989, at a total cost of £198,606, of which £80,000 was the value and installation expenses of electromechanical equipment.

Extension of Khirokitia Stores

As a result of the extension in 1985, of the Khirokitia Treatment Plant, the existing storage, space proved inadequate to store the required quantities of Alum and Chlorine. Plans were prepared and the necessary funds were made available in 1988.

Work on the extension of the alum and chlorine stores commenced on 28.9.1988 and was completed on 7.4.1989 at a total cost of £23,000. The alum store was extended by 102m² and the chlorine store by 21m². The alum store can now accommodate easily 250 tons and the Chlorine store, 18 drums of 1,000kg each.

Larnaca Water Board New Connection

This scheme provided for the laying of a 4,500m long A.C. pipeline, 400mm dia, Class 15 from a point upstream of Alethriko Break Pressure Tank to the Board's Reservoirs at Tremithos. The aim of the scheme is to supply increased quantities of water to

the Board, from the Famaguta conveyor. At a later stage this pipeline, will be modified to work in the opposite direction to convey water from the proposed Tersephanou Water Treatment Works to Alethriko Break Pressure Tank.

Work for the execution of the scheme commenced on 21.1.1989 and was completed in August 1989 at a total cost of £106,000.

Sources and Production

The main sources of the Central Water Supply System and their production over the years 1986 to 1989 are given in table IX-6 below.

Table IX-6
CENTRAL WATER SUPPLY SYSTEM
YIELD OF SOURCES IN MCM PER ANNUM 1986-1989

Source	Year			
	1986	1987	1988	1989
Khirokitia Treatment Works				
- Drawing from Yermasoyia	2.315	2.854	2.745	0.163
- Drawing from Lefkara Dam	0.025	--	0.040	0.131
- Drawing from Vasilikos Subsurface Dam	--	0.044	0.115	0.002
- Drawing from Kalavastos Dam	3.876	4.739	4.607	4.445
- Southern Conveyor	—	—	—	2.925
Sub-total Khirokitia Treatment Works	6.216	7.637	7.507	7.666
Old Boreholes				
- Khirokita group	0.091(2)	0.039(2)	0.039(1)	0.055(1)
- Alethriko group	0.069(1)	0.051(1)	0.182(2)	0.160(2)
Sub-total old boreholes	0.160	0.090	0.221	0.215
Yermasoyia dam (for irrigation)	0.356	0.339	0.335	0.066
1982-83 Emergency Schemes				
- Skarinou	0.110(3)	0.104(3)	0.092(3)	0.060(1)
- Alethriko	0.115(3)	0.119(3)	0.156(3)	0.152(3)
- Klavdhia	0.294(5)	0.192(5)	0.264(5)	0.301(5)
- Khirokitia	0.065(1)	0.029(1)	0.002(1)	0.003(1)
- Anglisidhes	0.263(1)	0.314(1)	0.222(1)	0.121(1)
Sub-total Emerg.Schemes	0.847	0.758	0.736	0.637
Totals	7.579	8.824	8.792	8.584

Note: Figures in parentheses indicate the number of boreholes. The quantities for the treatment works production are given net of treatment losses.

Bulk Consumption

Table IX-7 shows the bulk consumption of the various communities served by the CWSS over the years 1986-89.

Table IX-7
 CENTRAL WATER SUPPLY SYSTEM
 BULK CONSUMPTION IN MCM PER ANNUM 1986-1989

Community Served	Consumption from CWSS in MCM			
	1986	1987	1988	1989
Western Region Villages				
Pano Lefkara	0.042	0.037	0.028	0.033
Kato Lefkara	0.009	0.008	0.008	0.009
Kato Dhrys	0.006	0.008	0.003	0.001
Vavla	0.006	0.007	0.005	0.007
Alethriko	0.039	0.036	0.028	0.035
Mazotos	0.048	0.042	0.045	0.054
Kivisil	0.024	0.026	0.024	0.026
Tokhni	0.029	0.026	0.026	0.025
Menoyia	0.005	0.005	0.005	0.006
Khirokitia	0.024	0.002	--	--
Maroni	0.033	0.036	0.041	0.048
Zyyi	0.027	0.036	0.045	0.052
Psematismenos	0.010	0.011	0.014	0.015
Kophinou	0.063	0.082	0.091	0.064
Alpanda-Anaphotia	0.040	0.037	0.043	0.054
Meneou-Dhromoaxia-Tersephanou	0.491	0.553	0.422	0.286
Klavdhia	0.034	0.030	0.031	0.030
KaloKhorio	0.002	0.023	0.006	--
Mari	0.004	0.025	0.023	0.019
Governor's Beach	--	--	0.001	0.004
Skarinou	--	--	--	0.002
Ayios Theodoros	--	--	--	0.005
Sub-total Western Villages	0.936	1.030	0.889	0.775
Eastern Villages				
Aradippou	0.274	0.298	0.331	0.307
Xyloymbou	0.135	0.142	0.151	0.155
Dherinia	0.180	0.192	0.205	0.223
Avgorou	0.156	0.177	0.201	0.204
Phrenaros	0.039	0.051	0.066	0.068
Livadhia	0.125	0.136	0.166	0.203
Voroklini	0.087	0.096	0.096	0.107
Sotira	0.137	0.146	0.148	0.172
Paralimni	0.462	0.618	0.694	0.895
Ayia Napa	0.475	0.719	0.855	1.135
Kellia	0.024	0.026	0.021	0.028
Troulli	0.041	0.042	0.048	0.051
Aradippou-Livestock area	--	--	--	--
Anzio Camp	0.028	0.013	0.017	0.013
Akhna Forest (Displaced Persons)	0.098	0.105	0.115	0.182
Pyla	0.098	0.103	0.116	0.125
Ormidhia	0.027	0.068	0.101	0.141
Xylophagou	0.127	0.217	0.202	0.242
Vrysoulles	--	0.007	0.024	0.028
Liopetri	--	--	0.060	0.109
Sub-total Eastern Villages	2.513	3.156	3.617	4.388

Table IX-7 (continued)
CENTRAL WATER SUPPLY SYSTEM
BULK CONSUMPTION IN MCM PER ANNUM 1985-1988

Community Served	Consumption from CWSS in MCM.			
	1986	1987	1988	1989
Towns				
Larnaca	2.801	3.213	2.892	2.634
Famagusta (Turks)	0.980	0.976	0.982	0.983
Sub-total Towns	<u>3.781</u>	<u>4.189</u>	<u>3.874</u>	<u>3.617</u>
Irrigators & Minor Consumers	0.368	0.369	0.346	0.082
Grand Total	<u>7.598</u>	<u>8.744</u>	<u>8.726</u>	<u>8.862</u>

Expenditure and Revenue

A statement showing expenditure and revenue of the Central Water Supply System for the year 1989 is shown in table IX-8 below.

Table IX-8
CENTRAL WATER SUPPLY SYSTEM
EXPENDITURE AND REVENUE ACCOUNTS FOR 1989

Expenditure

Khirokitia Installations

	£
Electricity	10 028
Wages	56 172
Materials and others	42 682
Total	<u>£108 882</u>

Yermasoyia-Vasilikos Installations

Electricity	25 216
Wages	16 914
Materials and others	4 462
Total	<u>£46 592</u>

Pumping and Maintenance Expenses

Electricity	22 532
Wages	32 742
Materials and others	15 079
Total	<u>£70 353</u>

Khirokitia-Lefkara Regional Water Supply Scheme

Electricity	10 003
Maintenance	998
Total	<u>£11 001</u>

Table IX-8 (continued)
 CENTRAL WATER SUPPLY SYSTEM
 BULK CONSUMPTION IN MCM PER ANNUM 1985-1989

Maintenance Expenses for Civil Engineering Works

Wages	15 692
Materials and others	23 720
Total	<u>£39 412</u>

Tokhni Pumping Station Installations

Electricity	61 361
Wages	14 299
Materials and others	--
Total.....	<u>£75 660</u>

GRAND TOTAL	<u>£351 900</u>
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Notes on Expenditure Account

(a) This statement does not include for the amortization cost of the installations of the CWSS. Details of capital costs and annual amortization are given in table IX-9. It is seen from the table that the total annual amortization cost of the system amounts to £1,016,020.

(b) Expenditure under the heading "Khirokitia Installations" refers to Khirokitia Treatment Works and Kophinou Pumping Station.

The total quantity of water treated during the year reached 7,666,000m³ and the unit running cost was 1.42 cents/m³.

(c) Expenditure under the heading "Yermasoyia-Vasilikos Installations" refers to the running expenses of Yermasoyia Boosting Station, Vasilikos Boosting Station and Vasilikos Subsurface Dam Pumping Scheme.

(d) Expenditure under the heading "Pumping and Maintenance Expenses" refers to the following installations:

- BH 4/69 in the Khirokitia area
- BHs 45/73, 35/73 in the Alethriko area

1982-1983 Emergency Scheme Installations

- BHs 114/80, 127/80, 112/80, 38/82, 16/79 in the Klavdhia area.
- BHs 73/80, 15/83, 75/83 in the Alethriko area.
- BH 55/83, in the Skarinou area.
- BH 45/61 in the Khirokitia area.
- BH 141/83 in the Anglisidhes area.

The total quantity produced by these borehole sources during 1989 was 851,300m³. The unit cost of pumping and maintenance was therefore 8.26 cents/m³.

(e) Expenditure under the heading "Khirokitia-Lefkara Regional Water Supply Scheme" refers to the running expenses of two boosters, pumping treated water to Pano Lefkara, Kato Lefkara, Kato Dhrys and Vavla villages. The total quantity of water boosted during the year was 50,963m³.

(f) Expenditure under the heading "Maintenance Expenses for Civil Engineering Works" refers to maintenance expenses for the Yermasoyia-Khirokitia, Lefkara-Khirokitia Tokhni-Khirokitia Khirokitia-Phrenaros pipeline conveyors and other installations.

(g) Expenditure under the heading "Tokhni Pumping Station Installations" refers to the running expenses of four boosters at Tokhni Pumping Station pumping raw water from Kalavasos dam and Southern Conveyor to Khirokitia Reservoir.

Revenue

Revenue Generated in 1989

	£
Value of water delivered to Larnaca Water Board in 1989	571 634
Value of water delivered to Famagusta area occupied by Turks in 1989	213 220
Value of water delivered to other consumers in 1989 ..	1 221 450
	<hr/>
*Total value of water delivered in 1989	2 006 304
Less amount actually collected in 1989 in respect of water delivered in 1989	750 605
	<hr/>
*Amount outstanding on 31.12.1989 for water delivered in 1989	1 255 699
**Amount outstanding on 31.12.1988	2 701 881
Less amount collected in 1989 in respect of water delivered before 31.12.1988	916 488
	<hr/>
Amount outstanding by 31.12.89 for water delivered before 31.12.88	1 785 393
***Total amount outstanding by 31.12.1989	3 041 092
Total amount collected in 1989	1 667 093

Notes on Revenue Account

* Includes an amount of £213,220 representing the value of 982,580m³ of water supplied to Famagusta area occupied by Turks.

** Includes an amount of £1,594,590 representing the value of 13,990,042m³ of water supplied to Famagusta area occupied by Turks during the years 1974-1988.

*** Includes an amount of £1,807,810 representing the value of 14,972,622m³ of water supplied to Famagusta area occupied by Turks during the years 1974-1989.

Table IX-9
LARNACA-FAMAGUSTA-CENTRAL WATER SUPPLY SYSTEM
AMORTIZATION COSTS OF CAPITAL INVESTMENTS

Installations	Year completed	Capital Cost £	Period Years	Annual Amortization Cost £
Vasilikos & Khirokitia BHs & Conveyors	1970	239 800	40	22 290
Khirokitia Phrenaros pipeline	1970	879 300	40	81 740
Lefkara Dam	1974	1 266 600	40	117 740
Lefkara-Khirokitia pipeline	1974	367 000	40	34 120
Khirokitia Treatment Works	1974	227 200	40	21 120
Yermasoyia Dam	1968	(950 000)		
- Charged to W.S.		330 430	40	30 720
Yermasoyia Conveyor	1982	950 000	10	148 030
Emergency BHs	1983	175 777	5	45 190
Khirokitia Treatment Works extension:				
- Civil	1985	136 955	40	12 730
- M & E	1985	112 726	20	12 350
Kalavassos Dam	1985	(6 358 000)		
- 40% charged to W.S.		2 543 200	40	236 420
Kalavassos pipeline	1985	(2 194 000)		
- 40% charged to W.S.		1 633 000	40	151 800
Tokhni Pumping Station:				
- Civil	1985	193 000	40	17 940
- M & E	1985	327 000	20	35 820
Vehicles for VPP (part)	1985	45 000	5	11 570
Kophinou Pumping Station				
- Civil	1989	118 606	40	11 030
- M & E	1989	80 000	20	8 760
Famagusta Pipeline				
- Construction of chambers for swabbing	1989	50 176	40	4 660
New Larnaca Connection ...	1989	106 000	40	9 850
Khirokitia Treatment Plant				
- Extension of Alum and Chlorine Stores	1989	23 020	40	2 140
Totals		£9 804 790		£1 016 020

Chemical Laboratory of Khirokitia Water Treatment Works

The Khirokitia Water Treatment Works were commissioned in 1974. For the period 1974-78 the operators at the works carried out some simple chemical tests, (analyses) of the water to check its chlorine content, turbidity, conductivity and colour.

In early 1978 the WDD set up a modern chemical laboratory at Khirokitia Water Treatment Works which was to cater for the needs of the treatment works and to a large extent of WDD in respect of Drinking Water Supplies.

The laboratory is presently staffed with two persons only viz. one Chemist and one Technician 2nd Grade who works as a Laboratory Technician. The laboratory undertook all the chemical

analyses of drinking water from Famagusta, Larnaca, Limassol and Paphos districts and carried out chemical tests for water conductivity, pH, total dissolved solids, total hardness, chlorides, sulphates, carbonates, bicarbonates, nitrates, sodium, potassium, calcium, magnesium and aluminium. All the bacteriological tests of raw and drinking water are presently being carried out by the State General Laboratory in Nicosia.

Samples of water from existing boreholes and reservoirs being used for urban water supply are collected monthly by the WDD Regional Offices and are tested at the laboratory. Also samples of the water used for rural water supply are tested annually.

In addition to the above analyses, the laboratory also carries out several chemical tests in connection with new projects undertaken by the Department such as the Southern Conveyor Project and in cases where water from a new borehole will be used for drinking purposes.

During the year 1989, 622 chemical analyses of drinking water, were carried out at the laboratory of Khirokitia Water Treatment Works. Details of the chemical analyses are shown in Table 1.

In addition to the chemical analyses mentioned above, samples of water from the Yermasoyia, Kalavastos and Kouris Dams were collected and jar tests for estimating coagulant dosing requirements were carried out.

Table IX-10
SUMMARY OF CHEMICAL ANALYSES-KHIROKITIA CHEMICAL LABORATORY

Month	Number of samples analysed in 1989					Total
	Larnaca	Limassol	Paphos	Polis	Khirokitia	
January	12	--	--	--	16	28
February	4	--	--	--	40	44
March	--	--	--	--	28	28
April	6	--	1	--	34	41
May	3	--	--	--	15	18
June	--	2	--	--	4	6
July	--	--	--	--	--	--
August	--	--	--	--	18	18
September	11	5	15	21	28	80
October	15	3	37	--	22	77
November	46	2	34	--	3	85
December	7	3	39	--	148	197
Total	104	15	126	21	356	622

TOWN WATER BOARDS

NICOSIA WATER BOARD

The town of Nicosia enjoyed again this year an unrestricted supply throughout the year.

The leak detection and monitoring system continued to work with very encouraging results throughout the year under review. The unaccounted for water during the year has been reduced to 21.5%.

Water Supply Data

- Total quantity of water delivered to the service reservoirs (adjusted for change in storage)	12 106 260m ³
- Total quantity of water consumed as registered by area meters (including Nicosia Water Commission).....	11 796 863m ³
- Total quantity of water supplied to Greek Sector as registered by area meters	8 974 286m ³
- Total quantity supplied to Turkish quarter as registered by area meters	2 822 577m ³
- Total consumption during 1989 as registered by individual consumers meters in the Greek sector only (incl. bulk and other known consumption and adjusted for 365 days)	7 396 547m ³
- Unaccounted for water	21.5%
- Maximum daily summer consumption (Based on area meter readings and including Nicosia Water Commission. Registered on 16.5.1989-unrestricted supply)	43 014m ³
- Total number of consumers on 31.12.88 (Greek sector only)	47 200
- Total number of consumers connected in 1989 ...	1 819
- Total number of consumers disconnected in 1989	257
- Total number of consumers on 31.12.1989	48 762
- Average number of consumers during 1989	47 981
- Average gross supply per consumer	505 l/day
- Extension of distribution system (100mm and 150mm A.C.pipes)	13 910m
- Total length of distribution system as at 31.12.1989	549,587m
- Total number of Fire Hydrants installed during 1989	40
- Total number of Fire Hydrants installed as on 31.12.1989	1,950

From the information available, the quantity of water supplied to the area of Nicosia under Turkish control (As registered by area meters). was 3.823MCM or 23.32% of the total quantity delivered to the service reservoirs.

Limassol Water Board

The Water Board Sources met satisfactorily the water demand and the town enjoyed a satisfactory supply throughout the year 1989.

New Schemes

(a) Work under contract No. 3 continued throughout the year and is expected to be completed by April, 1990. The work includes the connection of 11 boreholes at Potamos-tis-Yermasoyias Area and conveyance of the water to the new 19,000³ capacity Service Reservoir of Zone 1. The total cost of the work under this contract is about £1,600,000.

(b) Work under contract No. 4 commenced and includes the installation of the Telemetry system.

(c) Work under contract No. 7 has also commenced and provides for the extension of the Service Reservoir of Zone 2 for an additional capacity of 8,500m³.

(d) Other improvements to water Supply System are envisaged under contract No. 8 which will be put in hand in 1990. The work includes the construction of two Service Reservoirs, of 3,000m³ capacity, for zone 4.

Water Supply Data

- Total quantity of water produced from all sources during 1989	11 061 713m ³
- Total quantity of water consumed as registered by area meters	10 863 777m ³
- Total consumption during 1989 as registered by individual consumers meters	8 024 124m ³
- Unaccounted for water (Production/consumption).	27.46%
- Maximum daily summer consumption (registered by area meters on 14.7.89).....	43 903m ³
- Total number of consumers connected in 1989 (new)	1 484
- Total number of consumers on 31.12.1988	42 592
and on 31.12.1989	44 076
- Average number of consumers during 1989	43 334
- Average gross supply per consumer	699 l/day
- Extension of distribution system (100mm, 150mm, 200mm and 250mm A.C. 450mm, 500mm, 600mm, 700mm and 800mm Ductile Iron Pipes) (Includes pipes laid under contract 1)	29 519m
- Total length of distribution system as at 31.12.89	515 906m

- Total number of Fire Hydrants installed during 1989	35
- Total number of Fire Hydrants installed as at 31.12.1989	1 604

Famagusta Water Board

Since the Turkish occupation of Famagusta town in 1974, the Cyprus Government is supplying water to the Turkish residents of the town without being able to recover its costs. The total quantity of water supplied during 1989 was 0.983MCM.

Larnaca Water Board

The town enjoyed unrestricted supply of water for the third year running. The water supply of this town was supplemented by 68% of its total water requirements from the Central Water Supply System. The total quantity of water delivered to Larnaca Water Board from this system during 1989 was 2.634MCM, which is less by 0.259MCM than that of 1988. The production of the Water Board owned sources was 1.223MCM representing an increase of 0.516MCM on the 1988 production.

Water Supply Data

- Total quantity of water produced from all sources during 1989	3 857 370m ³
- Total quantity of water delivered from the service reservoirs or directly into the distribution system (Reservoir Outlet).....	3 877 930m ³
- Total quantity of water consumed as registered by area meters	3 822 200m ³
- Total consumption during 1989 as registered by individual consumers meters	3 237 222m ³
- Unaccounted for water (Production/Consumption)	16.08%
- Maximum daily summer consumption (Based on area meter readings registered on 4.8.89)	14 220m ³
- Total number of consumers connected in 1989 (125 consumers were disconnected)	1 019
- Total number of consumers on 31.12.1988	20 241
and on 31.12.1989	21 135
- Average number of consumers during 1989	20 688
- Average gross supply per consumer	511 l/day
- Extension of distribution system (100mm, 150mm, 200mm and 250mm A.C.pipes)	6 415 m
- Total number of Fire Hydrants installed during 1989	21

- Total number of Fire Hydrants installed as at 31.12.1989	857
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Paphos Water Supply

The water supply of the town is administered by the Municipality. The Municipality's sources could meet the demand, and the water supply of the Town was not augmented this year from the "Paphos Lower Villages" Government Water Supply Scheme. Consequently the town enjoyed an unrestricted supply throughout the year.

Water Supply Data

- Total quantity of water produced from all sources during 1989	2 205 540m ³
- Total quantity delivered en route	31 457m ³
- Total quantity of water delivered to the service reservoirs or directly into the distribution system	2 174 083m ³
- Total consumption during 1989 as registered by individual consumers meters	1 669 117m ³
- Unaccounted for water	22.90%
- Average daily summer consumption (April-June) .	6 056m ³
- Total number of consumers connected in 1989 ...	719
- Total number of consumers on 31.12.1988 and on 31.12.1989 (200 consumers of Anavargos quarter who are not covered by the town system and are supplied from Paphos Lower Villages Scheme, are not included.)	9 364
- Average number of consumers during 1989	10 113
- Average gross supply per consumer (excluding Anavargos consumers)	9 739
- Extension of distribution system	620 l/day
- Total length of distribution system as at 31.12.1989	3 935m
- Total number of Fire Hydrants installed during 1989	162 168m
- Total number of Fire Hydrants installed as at 31.12.1989	10
- Total number of Fire Hydrants installed as at 31.12.1989	260

GOVERNMENT REGIONAL WATER SUPPLY SCHEMES

These schemes supply water to rural population on a regional basis. Water is supplied in bulk to the service reservoir of each community and the distribution is the responsibility of the village water supply committee. These schemes are composed of

the sources, balancing tanks, conveyor pipelines and associated pumping installations and are wholly financed by Government. These schemes operate with automatic control equipment.

Periodic supervision as well as maintenance work are carried out by the District Offices of the Department. During 1989 the following regional schemes were in operation.

Paphos Lower Villages

This scheme supplies water to 22 communities, to Mesoyi Industrial Estate, Anatoliko Industrial Estate, Paphos Airport and supplements the Paphos Town water supply.

The sources of this scheme are five BHs 67/84, 72/85, 90/85, 3/86 and 20/86 in Xeropotamos river and BH 7/85 near Armou village.

The total expenditure for the operation and maintenance of the scheme was £54,993 and the revenue generated was £77,405. More details on expenditure and revenue are given on table IX-11 below:

The total quantity of water produced during 1989 was 1,341,421m³ and the total quantity delivered was 1,005,717m³.

New Schemes and Improvements

- Replacement of "Konia-Armou" pumping main.

The scheme included the replacement of 1810m of 150mm ϕ steel pipes from "Konia" pumping Station to "Armou" balancing reservoir. Work for the installation of the pumping main commenced on 16.10.89 and completed in December, 1989 at a total cost of £35,153.

- Repositioning part of Main Conveyor

A length of 350m of the 300mm diameter main conveyor was laid on private land and was repositioned at a total cost of £9,000. Work commenced in June and completed in July, 1989.

- Installation of New Centrifugal pump at Nata Pumping Station

The scheme provided for the installation of a new larger, centrifugal pump with an output of 250m³/hour and a new electrical control panel, at a cost of £14,388.

Table IX-11
PAPHOS LOWER VILLAGES REGIONAL WATER SUPPLY SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1989

Expenditure	£
Electricity cost	37 728
Maintenance expenses	17 265
Total	<u>£54 993</u>

Revenue

Amount collected for 1989	47 259
Outstanding accounts for 1989	30 146
Total value of water delivered in 1989	<u>£77 405</u>
Outstanding accounts by 31.12.1988	38 143
Less amount collected in 1989	22 622
Amount outstanding for water delivered before 31.12.1988	<u>£15 521</u>
Total amount outstanding by 31.12.1989	£45 667

This statement does not include for the amortization of the capital expenditure of the schemes. The amortization cost of the installations is estimated at £38,560 p.a. Without taking into account administration expenses and other overheads, the total deficit for the year amounts to £16,148.

Arminou Regional Scheme

This scheme supplies water to nine communities. The source of the scheme is BH 56/72 in Dhiarizos river near Arminou village. The total quantity of water distributed to the nine villages in 1989 was 66,304m³. An additional quantity of 13,776m³ was supplied for irrigation to individuals from Mesana and Kedhares. The total expenditure for the operation and maintenance of this scheme was £11,785 while the revenue generated for the same year was £3,476. More details on expenditure and revenue are given in table IX-12.

Table IX-12
ARMINOU REGIONAL SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1989

Expenditure

Electricity cost	£ 3 927
Maintenance expenses	7 858
Total	<u>£11 785</u>

Revenue

Amount collected for the year 1989	1 603
Amount outstanding for 1989	1 873
Value of water delivered in 1989	<u>£3 476</u>
Outstanding account by 31.12.1988	7 306
Less amount collected in 1989	1 694
Amount outstanding by 31.12.1989 for water delivered before 31.12.1988	<u>£5 612</u>
Total amount outstanding by 31.12.1989	£7 485

This statement does not include for the amortization cost of capital expenditure of the scheme. The amortization cost of the installations is estimated at £ 6 894πα. The total deficit for the year, without taking into account administration expenses and other overheads, amounts to £15,186.

Timi Water Supply Scheme

This scheme supplies water to Timi village only. The source is BH 2821, and the total quantity of water produced during 1989 was 1,979m³. The total expenditure for the operation and maintenance of the scheme was £902 and the revenue generated was £138. This scheme was abandoned in April 1989, due to the high nitrates contents of the water of the borehole.

Ambelitis Water Supply Scheme

This scheme supplies water to Ambelitis and Kilinia villages. The source of the scheme is Kefalovrysos spring near Vrecha village. The water is conveyed to the village storage tanks by a booster pump installed near the spring. The total quantity of water pumped in 1989 was 76,773m³. The total expenditure for the operation and maintenance of the scheme was £5,011 and the revenue generated was £6,142.

New Schemes and Improvements

Kilinia Water Supply

The scheme provided for the laying of 615m long, 2"Φ, pipeline, from a point on the pumping main to the village storage tank, at a total cost of £5,388. The scheme was put in hand on 12.9.89 and completed on the 24.11.89.

Amathus Scheme

This scheme has been established under the Government Water Works Law to supply water to Amathus Tourist Development Area of a total population of 6,000 persons during summer and 2,000 persons during winter. The scheme is administered by a committee composed of the Director General of the Ministry of Interior as Chairman and the Directors General of the Ministries of Agriculture and Natural Resources, Finance, Communications and Works and Commerce and Industry, as members. The scheme is operated by the Limassol District Engineer of the Department in cooperation with the District Officer, Limassol.

The sources of this scheme are three boreholes, Hydr. No. 946, 993 and 1099, situated in Yermasoyia River. During 1989 the total quantity of water produced was 919,050m³ and the quantity distributed was 760,320m³. The total cost for the operation and maintenance of the scheme was £79,500 and the revenue generated for the same year was £59,750. More details on expenditure and revenue are given on Table IX-13.

Table IX-13
 AMATHUS WATER SUPPLY SCHEME
 EXPENDITURE AND REVENUE ACCOUNT FOR 1989

Expenditure

	£
Electricity cost	11 733
Maintenance expenses	12 063
Pumping fees (Yermasoyia aquifer).....	33 265
Connection Fees refunded	22 439
Total	£79 500
Amount credited to the Government Consolidated Fund .	50 000

Revenue

Sale of water	45 953
Connection fees	13 797
Total	£59 750

Moutayiaka Regional Scheme

This scheme supplies water to 8 communities of a total population of 14,900 persons. The sources of the scheme are two boreholes, 64/64 (Hydr.No.287) and 180/59 (Hydr.No.8) situated in Yermasoyia River. In addition to the above sources, some of the said communities have supplementary sources from springs as follows:

- 1 Ayios Athanasios village from "Ayios Demetrios" spring (for the time being the water is unsuitable for domestic use).
- 2 Phinikaria village from "Zavrarkaka" and "Vrysi tou Yianni" springs.
- 3 Armenokhori village from "Kiparishia" spring (for the time being the water is unsuitable for domestic use).

The operation and maintenance of the scheme is the responsibility of the District Officer, Limassol.

The total quantity of water distributed to these eight communities in 1989 was 503,050m³ as given below:

Village	Consumption m ³
Ayia Phyla	--
Polemidthia National Guard Camp.....	--
Ayios Athanasios	237 960
Moutayiaka	86 300
Ayios Tykhonas	61 250
Parekklisha	83 570
Moni - Moni National Guard Camp	1 200
Monagroulli	15 920
Armenokhori	12 120
Phinikaria	4 730
Total	503 050m ³

The total expenditure for the operation and maintenance of this scheme was £45,722 and the revenue generated was £45,000. More details on expenditure and revenue are given on Table IX-14:

Table IX-14
MOUTAYIAKA REGIONAL WATER SUPPLY SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1989

Expenditure

	£
Electricity cost	23 100
Operation and maintenance	15 074
Pumping fees (Yermasoyia Aquifer)	7 548
Total	<u>£45 722</u>

Revenue

Amount collected in 1989	14 360
Amount outstanding by 31.12.1989	30 640
Total	<u>£45 000</u>
Outstanding amount by 31.12.1988	28 990
Less amount collected in 1989	23 687
Total amount outstanding for water delivered before 1989	5 303
Total amount outstanding by 31.12.1989	£35 943

Yermasoyia Water Supply Scheme

This scheme supplies water to Yermasoyia village and Potamos tis Yermasoyias with a total population of 4,000 persons during Winter and increasing to 30,000 persons during summer due to a coastal area of Potamos tis Yermasoyias.

The sources of the scheme are five boreholes, 63/64, 25/72, 72/75, 107/61 and 25/81 situated in Yermasoyia river, and Ayios Photis spring. The operation and maintenance of this scheme is the responsibility of Yermasoyia Improvement Board. The total quantity of water produced during 1989 was 1,278,045m³.

The total expenditure for the operation and maintenance of the scheme was £50,180 while the revenue generated was £154,802.

More details on expenditure and revenue are given on table IX-15 below:

Table IX-15
YERMASOYIA WATER SUPPLY SCHEME
EXPENDITURE AND REVENUE ACCOUNT FOR 1989

Expenditure

	£
Electricity cost	26 860
Maintenance	23 320
Pumping fees (Yermasoyia Aquifer)*	39 888
Total	<u>£90 068</u>

Table IX-15 (continued)
 YERMASOYIA WATER SUPPLY SCHEME
 EXPENDITURE AND REVENUE ACCOUNT FOR 1989

Revenue

Sale of water	128 564.
Connection fees	--
Capital expenditure	11 238
Amount outstanding for 1988	15 000
Total	<u>154 802.</u>

* This amount has been charged by Government but has not been paid yet. A further amount of 88,875 representing pumping fees for 1986-1988 is also outstanding bringing the total outstanding amount to 128,763.

Phrenaros Pumping Station

This scheme supplies additional quantities of water to Ayia Napa, Paralimni and Protaras Tourist area. The total quantity of water pumped during 1989 was 2,128,357m³ and the unit running cost excluding overheads and amortization costs was 1.30 cents/m³.

A statement showing expenditure and revenue of the scheme is shown in table IX-16 below.

Table IX-16
 PHRENAROS NEW PUMPING SCHEME
 EXPENDITURE AND REVENUE ACCOUNT FOR 1989

Expenditure

Electricity	£ 20 629
Wages	5 568
Materials and others	1 369
Total	<u>£27 566</u>

Revenue Generated in 1989

Value added of water delivered to Ayia Napa, Paralimni and Protaras Tourist area. (Calculated at 4.6 cents/m ³ being the additional charge for pumping the water only)	£ 93 162
Amount collected in 1989 in respect of water delivered in 1989 (There were no collections during the year)	--
Amount outstanding on 31.12.1989 for water delivered in 1989 .	<u>93 162</u>
Amount outstanding by 31.12.89 for water delivered before 31.12.88 (There were no collections for the outstanding amount during the year)	134 253
Total amount outstanding by 31.12.89	<u>£227 415</u>

X DIVISION OF OPERATION AND MAINTENANCE-IRRIGATION

BY
N. Tsiourtis
Senior Water Engineer

Introduction

This Division includes the Branches dealing with:

- * The management, operation and maintenance of Government Waterworks.
- * The maintenance of contributory irrigation projects.

During 1989 the Division consisted of the following staff:

1 Senior Water Engineer - Head
4 Executive Engineers I
2 Topographer Irrigation Engineers
1 Senior Technical Superintendent
2 Technical Superintendents
2 Senior Technicians
3 Technicians I
3 Technicians II
18 Total Staff

Definitions

Government Waterworks:

These are the projects constructed under the Government waterworks Law Cap. 341. These projects are listed in Tables X-1 and X-9.

Contributory Irrigation Projects

These are projects constructed under the Irrigation Division Law Cap. 342. A list of these projects is given in Tables X-6 and X-7.

MANAGEMENT AND OPERATION PROCEDURES

The management and operation of the various categories waterworks are carried out as follows:

1. Government Waterworks

The management and operation of these projects are carried out by:

(a) Waterworks Committees established according to the provision of the relevant Law. The waterworks Committees are usually composed of the following:

Chairman

District Officer of the district in which the projects are situated.

Members

Director of the Water Development Department or his representative. Director of the Department of Agriculture or his representative. Director of the Land and Surveys Department or his representative. Two or more members elected by the farmers.

The Committee is responsible for the overall administration and management of the Government Waterworks Project such as:

- * To make recommendation on the development, conservation, management and efficient use of the available water resources of the project.
- * To manage and operate the project with a view to:
 - improve the standard of agricultural practices
 - improve the methods of irrigation
 - increase the revenue from land and water utilization to the full economic value
 - to sell the water at the nominal rates approved by the Government and see that the fees and charges are collected

(b) The Director of the Water Development Department who undertakes to operate, manage and maintain the Government waterworks. The projects whose operation and maintenance are with the Director of the WDD are the following & Khrysokhou, Paphos, Southern Conveyor, Vasilikos-Pendaskinos and Xyliatos.

The Committees and the Director of WDD have their own budgets, approved by the Minister of Finance and the Council of Ministers respectively.

The water selling rates approved by the Council of Ministers are shown on Table X-2.

2. Contributory Irrigation Projects (Major and Minor)

The operation of the contributory projects is carried out by the Irrigation Division Committees. These committees are chaired by the District Officer and members to the committees are beneficiaries elected by the general assembly meetings of the Irrigation Division beneficiaries. The Water Development Department in such cases gives technical advice both to the District Officer and to the Committees. The cost of the operation of these projects is born in total by the beneficiaries.

3. Government Recharge Waterworks

These are managed directly by the Water Development Department (See Table X-9).

MAINTENANCE PROCEDURES

The maintenance of the irrigation waterworks is carried out by the Water Development Department but depending on the type of the Project the expenses are either paid in full by the Government or are shared between the Government and the Irrigation Division. The procedures are as follows:

A. Government Waterworks:

The maintenance of these projects is carried out by the Water Development Department being the Government's Agency for waterworks and the costs are paid in full by the Government. By the term maintenance we mean routine dam and pipeline maintenance, valves and watermeters repairs or replacements, paintings of metal works or woodworks etc.

B. Contributory Irrigation Projects:

The maintenance of these projects is carried out by the Water Development Department but the costs are shared between the Government and the specific Irrigation Division usually at a ratio of 2 to 1. Some maintenance or repair works are carried out by the respective I D directly.

WATER DEVELOPMENT DATA

Cyprus is an island and all available water resources are those that result from overall precipitation. The total precipitation in an average year is estimated at 4,600 MCM, where 1,270 MCM/annum are lost in the form of evaporation, 900 MCM/annum are lost in the form of evapotranspiration from cultivated crops, 1,480 MCM/a are lost in the form of evapotranspiration from forest pasture and grass and irrigated crops. The annual surface runoff is estimated

at 600 MCM and the groundwater and springs another 350 MCM. As it is seen from the above only 950 MCM or 21% of the total precipitation are available for development both surface and groundwater. The groundwater resources being easier to develop are at present overpumped. The annual extraction from the boreholes is estimated at 370 MCM and the total springs yield is around 30 MCM. Out of these quantities 300 MCM are used for irrigation where the rest 100 MCM are used for domestic and industrial consumption.

The surface water resources being such more expensive to be developed, remained undeveloped until the beginning of the 1960's. By the beginning of 1960 the total water storage capacity of dams all over the island amounted to 6.2 MCM commanding an area of 1,525 Hectars of irrigated land. Soon after this (after independence) the Government of the Republic started a construction program to develop as much as possible more surface water resources. Many projects were constructed which increased the water storage capacity of dams, to 294.940 MCM, 276.877 MCM for irrigation and domestic water supply and the rest 18.063 MCM for recharge purposes where the commanded area has risen to 33.289 hectars.

Details on the projects and the rate of storage development are given in Drg. No. AG/IR/37 "Cyprus Dam Project and Regional Development" and "progress in Dam Construction".

SUMMARY OF MANAGEMENT, OPERATION AND MAINTENANCE DATA

The overall average precipitation during the hydrological year under review was 480.5 mm or 93% of the 30 year average of the Government controlled area, where the total volume of water available in the dams from the boreholes and river diversions in the Government controlled area amounted to 234.775 MCM. From this quantity a total of 95.968 MCM were utilized i.e. 53.217 MCM were used for irrigation, 15.408 MCM were used for domestic water supplies, 27.343 MCM were used for groundwater recharge. In the same period 2.761 MCM seeped through or below the dams and another 12.702 MCM were lost as evaporation. From the remaining 138.807 MCM, 123.571 MCM remained in the dams for over year storage and the rest 15.236 MCM were lost in the distribution system or were recorded as unaccounted. Projects in the Turkish occupied area are not included here as we cannot collect the necessary information.

The total area commanded by the irrigation projects is estimated at 33,289 Hectars where an estimated area of 9,897 hectars, has been irrigated, planted with citrus, bananas, deciduous, vegetables, potatoes etc.

Maintenance works totalling £795,334 were carried out on forty six projects. These include routine maintenance on the dam structures and the distribution systems. For the Government irrigation works a total of £762,022 were spent where for the recharge works an amount of £6,362, was spent. For the contributory projects a total of £26,950 were spent, £13,444 for the Pitsilia Project and £13,506 for the other contributory projects.

For the projects water quality samples of water were chemically analysed. Details are shown on annexes 2, 3 & 4.

Government Waterworks

In the year under review, the total quantity available from Government irrigation projects reached the figure of 221.455 MCM, 216.111 MCM in storage and 5.344 MCM from other resources i.e. river diversions and borehole extractions.

From this total, a quantity of 83.638 MCM or 37.8% was utilized, 48.159 MCM for irrigation, 15.408 MCM for domestic water supply and 20.071 MCM for recharge purposes. From the remaining 137.817 MCM, 121.832 MCM were retained in the dams as over-annual storage and the rest 15.985 MCM were lost in the distribution system or were recorded as unaccounted. In the same period 11.994 MCM were lost in the form of evaporation where another 2.761 MCM were lost as seepage or deep percolation (see Table X-1).

The irrigation water was used to irrigate fully or partly 8,284 hectares of land planted with citrus, bananas, vines, deciduous, vegetables, potatoes, cereals and olives (See Annex 1).

The gross income from the sale of water amounted to £2,418,987 being the income from the sale of water at the rates shown on Table X-3. The operational expenses amounted to £425.128 being the cost for the payment of the watermen, and the bill collectors etc., which amounted to 0.9 cent/CM of water sold or 0.5 cent/CM of water utilized. The maintenance expenses on government projects amounted to £762.022 i.e. 1.7 cent/CM of water sold or 0.9 cent/CM of water utilized. The power expenses amounted to £177,631 i.e. 0.4 cent/CM of water sold or 0.2 cent/CM of water utilized.

The total annual operation, maintenance and power expenses amounted to £1,023,781 which amounts to 2.2 cent/CM of water sold or 1.2 cent/CM of water utilized.

Evaporation losses from the reservoirs amounted to 11.994 MCM or 5.6% of the total storage capacity available. The seepage losses were estimated at 2.761 MCM or 1.3% of the total storage.

The overall water utilization and land utilization indexes are 38.7% and 30.2% respectively. Of the 48.159 MCM used for irrigation 45.512 MCM were sold at the nominal rates, (94.5%) whereas the rest 2.647 MCM, (5.5%) were given free of charge as water rights or overflows.

A summary of the above data in detail is given in Tables X-1, X-4 and X-5 where more details are given on each project under separate headings.

Table X-5 gives data on the operation and maintenance of the government irrigation projects for the last 10 years.

Table X-10 gives data on the operation and maintenance for the last two years.

Table X-11 gives data on the cost of water.

Contributory Irrigation Projects

In general there are 70 contributory irrigation projects with total capacity 9.591 MCM commanding an area of 5,896 hectares. Nine projects of total capacity 5.296 MCM or 55.2% of the total capacity of contributory schemes, commanding an area of about 3,027 hectares are situated in the Turkish occupied area and on which no data are collected. Forty one projects of total capacity 2.193 MCM, commanding an area of 998 hectares belong to the Pitsilia Project. During the year under review the total quantity of water collected from the contributory schemes amounted to 6.048 MCM out of which 5.058 MCM were used for the irrigation of 1,613 hectares of land where the rest were lost in the form of evaporation or remained in the dams and/or ponds for over year storage. See Tables X-6, X-7, and X-8 for details.

The maintenance expenses amounted to £26,950, £15,614 as Government contribution and £11,336 as Irrigation Division Contribution.

See tables X-12 and X-13 for details.

Recharge Works

On the island there are about 34 recharge projects of total capacity 18.063 MCM. Out of these projects 19 of total capacity 15.534 MCM or 86.0% of the total recharge capacity are situated in the Turkish occupied areas. On these, projects no government control is possible and no data on their use is available. In the projects situated in the Government controlled area, a quantity of 7.272 MCM was collected by some recharge dams. The maintenance expenses amounted to £6,362. For information on individual project in the Government controlled are see tables X-9 and X-14.

TABLE X-1 GOVERNMENT IRRIGATION PROJECTS - DATA FOR 1989

Project	Capacity m ³ x10 ³	Area Com. Storage hect. *	Water available m ³ x10 ³		Water used m ³ x10 ³		Losses m ³ x10 ³		Utilized Index x					
			In Storage * resourc. **	From other resourc. **	Total irrig. DNS rech.	For For rech.	Total	Evap.	Seep.	Area Irrig. hect.	Water Land			
1. Argaka	990	314	2 224	Nil	2 224	964	Nil	74	3	229.0	43.3	72.9		
2. Ayla Marina	298	201	432	Nil	432	372	Nil	29	47	46.4	86.1	23.1		
3. Pomos	860	381	927	80	1 007	892	Nil	88	146	150.3	88.6	39.4		
4. Khrysokhou-Evretou	24 000	2 000	11 351	Nil	11 351	2 258	Nil	986	Nil	639.8	19.9	32.0		
5. Paphos:														
(i) Asprokremmos	52 375)	57 537	3 365)			2 559		3 601	144)					
(ii) Mavrokolymbos	2 180)	5 110	2 207	Nil)	63 109	17 822	Nil	185	Nil)	3665.8	33.0	71.7		
6. Southern Conveyor-														
(i) Kouris	115 000	13 500	80 941	Nil	80 941	13 887	3 242	2 926	1 425	NA	34.2	NA		
(ii) Akhna	6 800	3 969	16 370)	221 458				1 218	Nil)					
7. (i) Yermasoyia	13 500)	3 025)	5 907	Nil	5 907	6 935	12 842	321	743)	2066.0	66.2	100.0		
(ii) Polemidhia	3 430)	2 066	3 025)	Nil	19 395)	5 907	Nil							
8. Vasilikos-Pendaskinos														
(i) Kalavassos	17 100	1 071	17 877	Nil)				1 215	Nil)					
(ii) Dhyptomamos	13 700	372	11 227)	32)	35 255	3 290	12 166	810	Nil)	688.6	43.8	45.1		
(iii) Lefkara	13 850	82	6 119)	Nil)				430	27)					
9. Xyliatos	1 220	308	1 342	Nil	1 342	561	Nil	94	76	133.8	41.8	43.4		
10. Kalopanayiotis	363	60	363	Nil	363	248	Nil	37	150	56.2	68.3	93.7		
11. Kiti	1 610	831	200	Nil	200	91	Nil	NA	NA	41.0	45.5	4.9		
12. Kha-Potami	1	567	--	1 385	1 385	Nil	1 385	--	--	567.0	100.0	100.0		
13. Evdtimou-Paramali	1	530	--	482	482	Nil	482	--	--	NA	100.0	NA		
Total	267 276	27 333	212 142	5 344	221 455	48 159	15 408	20 071	83 638	11 994	2 761	8283.9	38.7	30.2

* This the water that possibly may be utilized: storage and overflow or seepage that may be utilized after deducting evaporation and seepage losses.

** River Diversion and/or Borehole extraction used in project area.
1 Diversion on river

TABLE X-2 - GOVERNMENT IRRIGATION PROJECTS AND APPROVED WATER CHARGES IN CENT/M³

Ser. No.	Project	Overflow	Industrial	Flat Rate
1	Argaka	Free	--	3.5
2	Ayia Marina	0.5	--	3.5
3	Pomos	0.5	--	3.5
4	Khrysokhou.....	--	13	4.5
5	Paphos.....	--	9,13	--
	(i) Asprokremmos....	--	--	5.0
	(ii) Mavrokolymbos...	--	--	4.5
6	Southern Conveyor....	0.5	--	7.0
7	(i) Yermasoyia.....	0.5	--	3.5, 4.0
	(ii) Polemidhia.....	--	--	3.5, 4.0
8	Vasilikos-Pendaskinos	--	--	--
	(i) Kalavastos	--	17	4.5
	(ii) Dhypotamos	--	17	4.5
	(iii) Lefkara	--	--	4.0
9	Xyliatos.....	--	13	4.0
10	Kalopanayiotis.....	--	--	4.0
11	Kiti	--	--	3.0
12	Kha-Potami	--	--	--
13	Evdimou-Paramali.....	--	--	3.0

TABLE X-3 - GOVERNMENT IRRIGATION PROJECTS TOTAL UNIT COST OF WATER

Ser. No.	Project	Unit Cost cent/m ³
1	Argaka	15.10
2	Ayia Marina	9.86
3	Pomos.....	8.97
4	Khrysokhou.....	15.10
5	Paphos.....	14.36
6	Southern Conveyor.....	32.90
7	Yermasoyia-Polemidhia.....	12.75
8	Vasilikos-Pendaskinos.....	20.54
9	Xyliatos	21.30
10	Kalopanayiotis.....	29.75
11	Kiti.....	21.76

TABLE X-4 DATA ON MANAGEMENT, OPERATION AND MAINTENANCE OF GOVERNMENT IRRIGATION PROJECTS

Project	Capacity m ³ x10 ³	Area Com. hect.	In Storage * hect.	From other resourc. **	Total Water used m ³ x10 ³	Water sold m ³ x10 ³	Area Irrig. hect.	Gross Income £	Power	Expenditure £			Net Income £
										Operat.	Maint.	Total	
1. Argaka	990	314	2 224	Nil	2 224	964	607 229.0	21 245	Nil	11 390	4 495	15 885	5 360
2. Ayia Marina	298	201	432	Nil	432	372	46.4	11 392	Nil	11 714	544	12 258	-866
3. Pomos	860	381	927	80	1 007	892	150.3	27 860	1 085	17 712	859	19 556	8 204
4. Khrysokhou-Evretou	24 000	2 000	11 351	Nil	11 351	2 258	639.8	102 177	1 535	29 924	60 468	91 927	10 250
5. Paphos:													
(i) Asprokremmos	52 375)		57 537	3 365)	63 109								
(ii) Mavrokolymbos	2 180)	5 110	2 207	Nil)	61 760	20 381	17 822 3665.8	888 527	152 400	73 135	280 489	506 024	382 503
6. Southern Conveyor-													
(i) Kourris	115 000	13 500	80 941	Nil	80 941	27 706	13 887 NA	964 623	Nil	127 578	Nil	127 578	837 045
(ii) Akhna	6 800		3 969										
7. (i) Yermasoyia	13 500)		16 370)										
(ii) Polemidhia	3 430)	2 066	3 025)	Nil	19 395	12 842	5 002 2066.0	188 011	22 611	91 628	26 700	140 939	47 072
8. Vasilikos-Pendaskinos													
(i) Kalavastos	17 100	1 071	17 877										
(ii) Dhyptomatos	13 700	372	11 227)	32	35 255	15 456	3 290 686.6	161 224	Nil	46 230	37 830	84 060	77 164
(iii) Lefkara	13 850	82	6 119)										
9. Xyliatos	1 220	308	1 342	Nil	1 342	561	133.8	25 322	Nil	4 956	3 069	8 025	17 297
10. Kalopanayiotis	363	60	369	Nil	363	248	56.2	9 903	Nil	4 045	4 045	8 090	1 813
11. Kiti	1 610	831	200	Nil	200	91	41.0	4 249	Nil	2 816	2 523	5 339	-1 090
12. Kha-Potami	1	567	--	1 385	1 385	--	567.0	--	--	--	--	--	--
13. Evdimou-Paramali	1	530	--	482	482	482	NA	14 454	--	4 000	--	4 000	10 454
Total	267 276	27 393	212 142	5 344	221 455	83 638	45 512 8283.9	2418 987	177 631	425 128	762 022	1023 781	1395 206

* This is the water that possibly may be utilized: storage and overflow or seepage that may be utilized after deducting evaporation and seepage losses.

** River Diversion and/or borehole extraction used in project area.

1 Diversion on river

TABLE X-5 DATA ON WATER USE FOR THE LAST 10 YEARS FOR THE GOVERNMENT PROJECTS

Ser. No.	Description	Unit	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1	Capacity	1000m ³	37 874	37 874	89 874	91 094	91 094	120 894	120 894	147 368	260 476	267 276
2	Water available	"	34 408	50 660	35 278	37 441	55 019	68 951	67 006	117 196	231 216	221 455
3	Water utilized for irrigation	"	27 109	19 634	20 858	21 814	23 270	27 137	28 734	26 818	32 428	48 159
4	Water used for DWS	"	2 210	3 356	4 793	3 831	4 429	8 807	10 606	14 872	14 070	15 408
5	Water used for recharge ..	"	6 579	14 627	2 648	2 999	3 199	3 758	6 208	5 860	21 604	20 071
6	Total water used	"	23 609	37 617	28 299	28 644	30 898	39 702	45 548	48 350	68 103	83 638
7	Evaporation losses	"	2 587	2 618	2 646	3 218	3 789	4 219	3 152	6 451	11 527	11 994
8	Seepage losses	"	5 087	5 424	0 973	0 873	0 747	0 946	0 556	1 227	2 328	2 761
9	Water sold	"	11 748	18 644	19 542	20 101	21 210	23 958	27 359	25 887	29 536	45 512
10	Gross income	£	169 418	253 307	433 214	520 441	688 686	892 589	1043 594	1146 669	1 487 169	2418 987
11	Power cost	"	-	117 689	215 577	247 838	355 186	380 785	307 011	222 413	138 806	177 631
12	Operation cost	"	84 496	207 738	119 906	264 039	212 831	217 711	182 750	214 671	292 811	425 128
13	Maintenance cost	"	18 563	50 539	76 131	100 069	160 771	172 166	279 893	308 529	379 253	762 022
14	Total expenditure	"	103 059	258 277	411 614	611 946	728 788	770 662	769 564	745 613	810 870	1023 781
15	Net income	"	68 159	-4 838	21 600	-91 505	-40 102	121 927	274 030	401 056	676 299	1395 206
16	Area irrigated	Hectares	3 267	4 996	5 286	6 112	6 697	6 837	7 215	7 966	8 046	8 284

TABLE X-6 DATA ON CONTRIBUTORY IRRIGATION WORKS

Ser. No.	Project	Capacity m ³ x10 ³	Yield m ³ /h	Area com. hect.	Water avail. m ³ x10 ³			Water used m ³ x10 ³		
					In stor.	Other resour. **	Total	Evap. Losses m ³ x10 ³	Area Irrig hect.	
1	Akrounda	22	-	8	22	-	22	20	1 8	8
2*	Galini	22	-	174	-	-	-	-	-	-
3*	Geyneli	1 000	-	114	-	-	-	-	-	-
4*	Gypsos	113	-	85	-	-	-	-	-	-
5	Kalo Khorio (Klirou)	32	-	181	32	-	32	23	2 6	9
6	Kandou	38	-	75	38	-	38	18	3 0	7
7	Kotchatis	1	-	NA	-	NA	NA	NA	-	NA
8*	Kanli	1 100	-	535	-	-	-	-	-	-
9*	Lefka Marathasa	368	-	174	368	-	368	300	29 4	174
10*	Lefka Kafizes	113	-	103	113	-	113	104	9 0	103
11	Lymbia	220	-	126	220	-	220	66	117 0	14
12	Lythrodontas Upper	32	-	15	32	-	32	28	2 6	15
13	Lythrodontas Lower	32	-	15	32	-	32	25	2 6	15
14*	Mia Milea	330	-	174	-	-	-	-	-	-
15*	Morphou	2 000	-	902	-	-	-	-	-	-
16*	Ovgos	250	-	852	-	-	-	-	-	-
17	Pakhyamos	43	-	54	43	-	43	30	3 4	18
18	Palekhori (Kambi)	620	-	134	620	-	620	500	60 0	134
19	Pera Pedhi	55	-	26	55	-	55	30	4 4	8
20	Petra Upper	10)	-	628)	10	-	10	9	0 8	8
21	Petra Lower	25)	-		25	-	25	22	2 0	23
22	Prodromos	121	-	23	121	-	121	80	10 0	58
23	Pyrgos	283	-	214	283	-	283	260	22 6	87
24	Trimiklini	340	-	87	340	-	340	300	27 2	24
25	Kambos	2	70	36	-	80	80	80	-	44
26	Chakistra	2	70	44	-	83	83	83	-	13
27	Yerakies	2	70	29	-	50	50	50	-	47
28	Khirokitia Pond & B/H No.136/78	205	100	47	205	11	216	186	30 0	39
29	Esso Galata pond	35	-	43	35	NA	35	30	4 0	NA
Total		7 409	310	4 898	2 594	224	2 818	2 244	332.4	848

* Project in Turkish occupied areas

1 River Diversion.

2 River Diversion with Dual Pumping stage.

xx River Diversion or Borehole Extraction.

TABLE X-7 DATA ON CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT

Ser. No.	Project	Capac. $m^3 \times 10^3$	Yield m^3/h	Area comm. Decars	Water avail. in stor. $m^3 \times 10^3$	Water used for irrig. from dam $m^3 \times 10^3$	Water extr. from b/h $m^3 \times 10^3$	Total water avail. $m^3 \times 10^3$	Total water used $m^3 \times 10^3$	Evap. Losses $m^3 \times 10^3$	Area irrig. decars
1	Agros Dam & B/H 63/76	72	70	474	80	52	92	172	144	27	230
2	Akapnou-Ephtagonia Pond	132	-	248	132	90	-	132	90	13	200
3	Arakapas Dam	128	-	293	128	120	-	128	120	14	293
4	Arakapas I	192	-	381	192	130	-	192	130	20	347
5	Ayii Vavatsinias dam	53	-)	241	53	50	-	53	50	5)	227
6	Ayii Vavatsinias pond I	55	-)		55	35	-	55	35	6)	-
7	Ephtagonia I	92	-	201	92	80	-	92	80	10	185
8	Ephtagonia II	127	-	234	127	100	-	127	100	14)	
9	Ephtagonia III	65	-	120	65	40	-	65	40	7)	340
10	Kato Mylos pond & B/H 66/76	104	62	401	104	90	55	159	145	12	228
11	Khandria	70	-	187	70	60	-	70	60	7	130
12	Kyperounda I	53	-	107	53	46	-	53	46	5	107
13	Kyperounda II	273	-	690	273	240	-	273	240	26	474
14	Lagoudhera	70	-	199	70	55	-	70	55	7	39
15	Melini	59	-	147	59	50	-	59	50	6	128
16	Agridhia	59	-	123	59	56	-	59	56	6	100
17	Pelendria pond & B/H 53/76	123	160	642	123	100	NA	123	100	12	501
18	Arakapas B/H "Angoulios" 124/76..	-	50	123	-	-	23	23	23	-	100
19	Arakapas B/Hs "Scoli" 106/76 & 107/76	-	90	240	-	-	100	100	100	-	302
20	Polystypos B/H 21/77	-	15	84	-	-	8	8	8	-	84
21	Potamitissa B/Hs 67/76 & 69/79B	-	120	265	-	-	92	92	92	-	219
22	Kalon Khorio 54/76 & 11/77	-	125	526	-	-	96	96	96	-	278
23	Ayios Theodoros B/H 105/76 ...	-	65	126	-	-	Nil	Nil	**	-	126
24	Ora Pond & B/Hs 27/81 & 66/81..	62	42	181	62	54	17	79	71	7	178

TABLE X-7 DATA ON CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT (Cont.)

Ser. No.	Project	Capac. $m^3 \times 10^3$	Yield m^3/h	Area comm. Decars	Water avail. in stor. $m^3 \times 10^3$	Water used for irrig. from dan $m^3 \times 10^3$	Water extr. from b/h $m^3 \times 10^3$	Total water avail. $m^3 \times 10^3$	Total water used $m^3 \times 10^3$	Evap. Losses $m^3 \times 10^3$	Area irrig. decars
25	Pharmakas I).....	21	-)	-	21	20	-	21	20	2)	135
26	Pharmakas II).....	61	-)	181	26	22	-	26	22	3)	
27	Arakapas II.....	119	-	254	119	100	-	119	100	14	202
28	Ayii Vavatsinias II	43	-	183	43	24	-	43	24	4	52
29	Dhierona I	159	-	401	159	135	-	159	135	16	386
30	Dhierona B/H 14/82	-	54	127	-	-	63	63	63	-	149
31	Sykopetra B/H 48/82	-	45	120	-	-	27	27	27	-	115
32	Ayios Konstantinos B/Hs 123/76.8/81	-	116	401	-	-	52	52	52	-	266
33	Louvaras B/Hs 32/77, 16/81,	-	140	355	-	-	131	131	131	-	227
34	Ayii Vavatsinias B/H 35/81	-	50	134	-	-	45	45	45	-	64
35	Askas B/H 98/80	-	60	214	-	-	47	47	47	-	173
36	Alona B/H 46/80	-	50	100	-	-	39	39	39	-	60
37	Lagoydhera B/H 53/80	-	25	60	-	-	18	18	18	-	12
38	Agros B/H 21/82	-	82	241	-	-	73	73	73	-	134
39	Dhymes B/H 81/80	-	80	265	-	-	87	87	87	-	262
40	Kato Amiantos scheme	1	56	674	-	-	NA	NA	NA	-	509
41	Zoopiyi B/H 9/81	-	49	134	-	-	NA	NA	NA	-	86
		2192	1606	9977	2165	1749	1065	3230	2814	376	7648

* Some quantity of the water from the borehole was given for DWS.

** Water utilization from the river flow.

*** Borehole and river diversion scheme.

TABLE X-8
CONTRIBUTORY IRRIGATION PROJECTS-DATA FOR 1989

Item No.	Description	Unit	Data
1.	Capacity.....	1000 m ³	9 601
2.	Boreholes yield	"	1 916
3.	Water available in storage	"	4 759
4.	Water extracted from boreholes and river diversions.....	"	1 289
5.	Total water available	"	6 048
6.	Water utilized for irrigation	"	5 058
7.	Evaporation losses.....	"	708
8.	Maintenance expenses	£	26 950
9.	Government contribution	"	15 614
10.	Irrigation Division Contribution ...	"	11 336
11.	Area Irrigated	Hectares	1 613
12.	Area Commanded	"	5 896

TABLE X-9
RECHARGE WATERWORKS DATA

Ser No.	Project	Capacity m ³ x1000	Water available m ³ x1000	Water used for recharge m ³ x1000	Water lost in evaporation m ³ x1000
1*	Kouklia	4 545	-	-	-
2*	Ayios Loucas..	455	-	-	-
3	Sotira	77	NIL	NIL	NIL
4	Paralimni-Panayia	45	NIL	NIL	NIL
5	Paralimni	115	NIL	NIL	NIL
6	Ayia Napa	55	NIL	NIL	NIL
7*	Famagusta Antiflood	50	-	-	-
8	Phrenaros	160	NIL	NIL	NIL
9	Dherinia	23	NIL	NIL	NIL
10	Avgorou	68	NIL	NIL	NIL
11*	Kondea	82	-	-	-
12	Xylophaghou ..	86	NIL	NIL	NIL
13*	Lysi	77	-	-	-
14*	Ayios Yeoryios(K)	68	-	-	-
15*	Ayios Epiktitos	34	-	-	-
16*	Akanthou	45	-	-	-
17**	Akhna	40	NIL	NIL	NIL
18	Xyloymbou ...	50	NIL	NIL	NIL
19*	Syngrasis	1 115	-	-	-
20*	Ayios Yeoryios (F).	190	-	-	-

TABLE X-9
RECHARGE WATERWORKS DATA (Cont.)

Ser No.	Project	Capacity m ³ x1000	Water available m ³ x1000	Water used for recharge m ³ x1000	Water lost in evapo- ration m ³ x1000
21*	Famagusta Recharge	165	-	-	-
22*	Ayios Nicolaos Fam	1 365	-	-	-
23	Paralimni Lake	1 365	100	100	NA
24*	Fresh Water Lake	4 545	-	-	-
25*	Makrasyka	195	-	-	-
26*	Akhna Mesaoria	90	NIL	NIL	NIL
27	Vrysoulles Fam.	140	-	-	-
28*	Morphou Recharge	130	-	-	-
29*	Morphou Proto- papas	90	-	-	-
30	Ormidhia (Vathys)	100	NIL	NIL	NIL
31*	Masari	2 273	-	-	-
32	Liopetri	325	NIL	NIL	NA
33	Yialias	NA	7 172	7 172	NA
34	Merikas	NA	FULL	FULL	NA
	Total	18 063	7 272	7 272	NIL

* Projects in Turkish occupied area. Gate constantly open for recharge.

** Some of the dams of the project are in Turkish occupied area.

TABLE X-10 DATA ON MANAGEMENT AND OPERATION OF GOVERNMENT IRRIGATION PROJECTS FOR THE LAST TWO YEARS

Item No.	Data	Unit	1988	1989	% Change on 1988
1	Capacity	1000m ³	260 476	267 276	+ 2.6
2	Water available	"	231 216	221 455	+ 4.2
3	Water utilized for irrigation	"	32 428	48 159	+48.5
4	Water utilized for DWS	"	14 070	15 408	+9.5
5	Water utilized for recharge	"	21 604	20 071	-7.1
6	Total water used ...	"	68 103	83 638	+22.8
7	Evaporation losses .	"	11 527	11 994	+ 4.0
8	Seepage losses	"	2 326	2 761	+18.7
9	Water sold	"	29 535	45 512	+54.1
10	Gross income	£	1 1487 169	2418 987	+62.6
11	Power cost	"	138 806	177 631	+28.0
12	Operation cost	"	292 811	425 128	+45.2
13	Maintenance cost ...	"	379 253	762 022	+100.9
14	Total expenses	"	810 870	1023 781	+26.2
15	Net income	"	676 299	1395 206	+106.3
16	Area irrigated	Hectares	8 046	8 284	+ 3.0
17	Area commanded	"	27 393	27 393	NIL

TABLE X-11 - GOVERNMENT IRRIGATION PROJECTS - COST OF WATER

Ser.	Project	Water Sold m ³ x10 ³	Total water utilized m ³ x10 ³	Operation Cost £	Maintenance Cost £	Power cost £	Total annual cost £	Cost of water* cent/m ³	
								Sold water	total utilized
1	Argaka	607	964	11 390	4 495	Nil	15 885	2.6	1.6
2	Ayia Marina	372	372	11 714	544	Nil	12 258	3.3	3.3
3	Pomos.....	892	892	17 712	859	1 085	19 656	2.2	2.2
4	Khrysokhou.....	2 258	2 258	29 924	60 468	1 535	91 927	4.1	4.1
5	Paphos.....	17 822	20 381	73 135	280 489	152 400	506 024	2.8	2.5
6	Southern Conveyor.....	13 887	27 706	127 578	Nil	Nil	127 578	0.9	0.5
7(i)	Yermasoyia.....	5 002	12 842						
(ii)	Polemihia			91 628	26 700	22 611	140 939	2.8	1.1
8	Vasilikos-Pendaskinos..	3 290	15 456	46 230	37 830	Nil	84 060	2.5	0.5
9	Xyliatos.....	561	561	4 956	3 069	Nil	8 025	1.4	1.4
10	Kalopanayiotis.....	248	248	4 045	4 045	Nil	8 090	3.3	3.3
11	Kiti.....	91	91	2 816	2 523	Nil	5 339	5.9	5.9
12	Kha-Potami.....	Nil	1 385	--	--	--	--	--	--
13	Evdimou-Paramali.....	482	482	4 000	--	--	4 000	0.8	0.8
Total		45 512	83 638	425 128	762 022	177 631	1023 781	2.2	1.2

* It does not include capital cost.

DETAILS OF MAINTENANCE WORKS OF CONTRIBUTORY PROJECTS

A. CONTRIBUTORY IRRIGATION WORKS

1. Lymbia Dam
Cleaning of the canal. Installation of main sluice valve on the outlet pipe and a water meter. Installation of a "V" notch.
2. Lefka Kafizes dam
Repair of main pipeline. Installation of pipelines.
3. Prodromos dam
Repair and replacement of sluice valves. Burring of an existing pipeline at the edge of a road.
4. Kambos
Repair and replacement of electrical equipment. Installation of a pressure sustaining valve.
5. Tsakkistra
Repairs to electrical equipment.
6. Yerakies
Repairs and replacement of electrical equipment.
7. Pera Pedhi
Desilting of dam reservoir and maintenance of the outlet system.
8. Pakhyammos dam
Ripping of reservoir and construction of drainage ditch channels.
9. Pyrgos dam
Construction of ports and cleaning of canals and embankment.

TABLE X-12
CONTRIBUTORY IRRIGATION WORKS - MAINTENANCE COSTS

Ser. No.	Project	Govt Contr.	IDContrib.	Total Cost
1	Lymbia Dam	1253	--	1253
2	Lefka Kafizes	--	4568	4568
3	Prodromos	1479	740	2219
4	Kambos	1266	422	1688
5	Tsakkistra	307	103	410
6	Yerakies	946	316	1262
7	Pera Pedhi	569	569	1138
8	Pakhyammos	563	--	563
9	Pyrgos	<u>268</u>	<u>137</u>	<u>405</u>
		6651	6855	13506

Lymbia dam: Operation cost £600. Income from sale of water £1,967.

B. CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT

1. Dhymes B/H No.81/80
Repairs to pumping unit and distribution system.
2. Kyperounda pond No. 2
Repairs to distribution system and replacement of outlets.
3. Dhierona B/H NO. 14/82
Replacement of various fittings
4. Potamitissa B/H Nos 67/76 and 69/79B
Maintenance of pumping unit and distribution system.
5. Agros dam and B/H No. 63/76
Repairs and improvements to pipelines
6. Kyperounda pond No. 1
Improvements to distribution system.
7. Agros B/H No 21/82
Installation of filters and replacement of fittings
8. Agridhia pond
Replacement of outlets. Installation of pipelines, fittings and repairs to distribution system. Cleaning of embankment from wild vegetation.
9. Kato Mylos
Maintenance of filters and repairs to pumping unit and distribution system.
10. Ayios Constantinos B/H Nos 8/81 and 123/76
Repairs to distribution system and pumping unit
11. Arakapas B/H Nos 106/76 and 107/76
Repairs to distribution system
12. Louvaras B/H Nos 16/81 and 32/77
Repair of main pipelines.
13. Ephtagonia pond No 2
Repairs to distribution system, cleaning of drainage ditch channels and embankment.
14. Ephtagonia pond No. 3
Repairs to distribution system and installation of an air valve and other fittings.
15. Khandria pond
Repairs to distribution system
16. Ayii Vavatsinias dam and pond
Repairs to distribution system and filters
17. Ayii Vavatsinias pond No.2
Installation of pipelines and cleaning of embankment.

18. Ayii Vavatsinias B/H No. 35/81
Repairs to pumping unit
19. Ora pond and B/H Nos 27/81 and 66/81
Cleaning of embankment.
20. Melini pond
Improvements to spillway and diversion weir. Cleaning of embankment.
21. Melini B/H No. 36/83
Repairs to distribution system and installation of fittings.
22. Pelendria pond and B/h No. 53/76
Repairs to pipe breakages and membrane. Installation of an air valve. Regrading of a field.
23. Pharmakas pond
Repairs to membrane. Repairs to distribution system. Cleaning of diversion weir. Re-installation of pipelines passing through main road.
24. Kato Amiandos
Repairs to distribution system.

TABLE X-13
PITSILIA PROJECT - MAINTENANCE COSTS

Ser No	Project	Maintenance Cost £		
		Gov.Cont. £	I.D. Cont. £	Total cost £
1	Dhymes B/H No.81/80	500	250	750
2	Kyperounda pond No.2	1,068	534	1,602
3	Dhierona B/H No.14/82	200	100	300
4	Potamitissa B/H Nos 67/76 and 69/79B	300	150	450
5	Agros dam and B/H No.63/76	276	138	414
6	Kyperounda pond 1	56	28	84
7	Agros B/H No21/82	200	100	300
8	Agridhia pond	700	350	1,050
9	Kato Mylos pond and B/H No. 66/76	362	181	543
10	Ayios Constantinos B/H NOs 8/81 and 123/76	650	325	975
11	Arakapas B/H Nos 106/76 and 107/76	47	23	70
12	Louvaras B/H Nos 16/81 and 32/77	60	30	90
13	Ephtagonia pond No.2	664	332	996
14	Ephtagonia pond No.3	36	18	54
15	Khandria pond	56	28	84
16	Ayii Vavatsinias dam and pond	123	64	187
17	Ayii Vavatsinias pond No.2	706	353	1,059
18	Ayii Vavatsinias B/H No.35/81	27	13	40
19	Ora pond and B/h Nos 27/81 and 66/81	280	140	420

TABLE X-13 (Cont.)

Ser No	Project	Maintenance Cost £		
		Gov. Cont. £	I.D. Cont. £	Total cost £
20	Melini pond	956	478	1,434
21	Melini B/H No.36/83	47	23	70
22	Pelendria pond and B/H No. 53/76	1,163	581	1,744
23	Pharmakas pond	357	178	535
24	Kato Amiandos	129	64	193
		-----	-----	-----
		8,963	4,481	13,444

C. RECHARGE WORKS

Paralimni lake
Cleaning of main canal. Improvement works to the chain of wells.

TABLE X-14
RECHARGE WORKS-MAINTENANCE COSTS

Ser. No.	Project	Govt Cont	Village	Total
		£	Cont. £	Cost £
1.	Paralimni lake	5,462	900	6,362

ANNEX 1
GOVERNMENT IRRIGATION PROJECTS-CROPS AND AREAS IRRIGATED IN HECTARES

Item No.	Crop	Argaka	Ayia Marina	Pomos	Khrysoxhou Paphos	SCP	Yermas.- Polem.	Vasilikos, Xyliatos, Pendaskinos	Kalopana, Kiti, Yiotis	Kha- Potami	Total	
1	Citrus	109.7	16.8	90.3	112.1	830.1	971.0	379.6	18.7	4.0	6.2	2538.5
2	Bananas	50.8	4.7	34.8	-	244.4	-	-	-	-	-	334.7
3	Table Grapes	1.7	0.4	-	12.5	363.1	516.0	0.9	-	-	567.0	1461.6
4	Deciduous	29.4	4.7	3.3	42.6	76.2	17.0	17.9	21.0	50.2	-	262.3
5	Vegetables	-	8.0	8.0	-	125.0	559.0	-	-	-	-	700.0
6	Greenhouses	-	10.7	2.7	-	68.3	-	34.2	-	-	-	115.9
7	Potatoes	-	-	-	57.5	512.5	-	46.5	-	15.6	-	632.1
8	Beans	-	-	-	-	503.4	-	10.0	-	-	-	513.4
9	Olives	-	-	3.3	-	-	3.0	23.1	24.2	0.7	-	54.3
10	Ground-nuts	-	-	-	23.0	601.3	-	-	-	-	-	624.3
11	Seasonal	25.4	-	-	111.5	148.5	-	166.7	64.2	-	18.8	535.1
12	Tobacco	-	-	-	132.0	-	-	-	-	0.4	-	132.4
13	Avocados	8.0	0.8	5.9	3.2	47.5	-	1.0	1.3	-	-	67.7
14	Alfa-Alfa	4.0	0.3	2.0	13.7	38.1	-	8.7	1.3	-	-	68.1
15	Legumes	-	-	-	-	19.8	-	-	-	-	-	19.8
16	Kiwi	-	-	-	-	-	-	-	1.3	1.3	-	2.6
17	Pistachio	-	-	-	-	-	-	-	1.3	-	-	1.3
18	Pecan	-	-	-	7.5	54.7	-	-	-	-	-	62.2
19	Other	-	-	-	-	32.9	-	-	0.5	-	-	33.4
20	Cereals	-	-	-	124.2	-	-	-	-	-	-	124.2
	Total	229.0	46.4	150.3	639.8	3665.8	2066.0	688.6	133.8	56.2	41.0	8283.9

ANNEX 2
GOVERNMENT IRRIGATION PROJECTS-WATER ANALYSIS

Ser. No.	Dam	Date Sampled	Total		ECW mmhos/cm	Cations Milleq/lit						Anions Milleq/lit						Mileg/lit	
			Solids	Hardness		Na	K	Ca	Mg	Cl	SO ₄	CO ₃	HCO ₃	NO ₃	lt	PH			
1	Argaka-Magounda	1.2.89	425	220	0.54	1.56	NIL	1.90	2.50	1.40	1.29	NIL	3.44	NIL	0.03	7.7			
2	Ayia Marina	19.2.90	690	380	0.91	2.86	0.025	2.7	4.91	3.66	1.58	NIL	5.8	NIL	NIL	7.9			
3	Pomos	30.1.89	355	180	0.46	1.39	NIL	1.50	2.16	1.49	0.64	NIL	3.03	NIL	0.03	8.0			
4	Evretou	19.7.89	550	230	0.78	3.04	0.06	2.4	2.25	2.0	1.47	0.1	3.80	0.03	NIL	8.1			
5	Asprokremmos	24.2.89	410	170	0.52	2.17	0.07	1.95	1.5	1.40	1.33	NIL	3.11	NIL	0.15	8.2			
		5.5.89	460	205	0.60	2.26	0.07	2.55	1.6	1.40	1.66	NIL	3.36	NIL	NIL	7.8			
		5.8.89	420	205	0.65	2.86	0.08	2.50	1.6	1.38	2.39	0.1	3.09	NIL	NIL	8.1			
6	Kouris	28.2.89	400	250	0.63	2.08	0.12	2.20	2.8	2.25	0.52	NIL	4.20	0.23	NIL	8.1			
		7.6.89	350	208	0.58	2.78	0.1	1.1	3.08	2.36	1.20	NIL	3.19	0.14	NIL	8.1			
		1.12.89	535	238	0.58	3.04	0.1	1.7	3.08	2.50	1.77	0.16	3.39	0.06	NIL	8.2			
7	Yermasoyia	3.4.89	490	290	0.58	1.04	0.05	1.70	4.16	1.09	0.85	NIL	4.91	0.06	0.05	8.1			
8	Polemichia	30.3.89	555	285	0.68	2.17	0.15	1.70	4.08	2.19	1.33	NIL	4.50	0.03	0.08	8.1			
9	Kalavassos	3.3.89	550	307	0.60	1.65	0.02	2.50	3.66	1.38	2.04	0.26	4.04	0.11	NIL	8.4			
10	Kalopanayiotis	12.4.89	340	200	0.41	1.04	0.02	1.50	2.50	0.78	0.56	0.40	3.11	0.06	0.04	8.3			
		26.7.89	300	218	0.50	1.87	0.02	1.55	2.80	1.38	0.70	NIL	4.00	0.17	0.07	8.5			
11	Xyhiatos	20.4.89	150	140	0.30	0.78	0.02	1.40	1.40	1.00	0.36	NIL	2.25	NIL	0.06	8.2			
		11.8.89	200	178	0.37	1.04	0.03	1.8	1.75	1.05	0.76	NIL	2.75	0.06	0.02	7.9			
12	Akhna	30.1.89	300	245	0.67	3.04	0.10	1.75	3.15	2.38	1.56	0.20	3.80	0.10	NIL	8.5			
13	Athalassa	19.1.89	395	115	0.55	3.5	0.12	1.40	0.92	2.5	1.66	NIL	1.72	NIL	0.06	7.3			
		31.3.89	960	285	1.30	8.69	0.25	3.35	2.33	7.04	3.95	NIL	3.60	NIL	0.21	7.3			

ANNEX 3
CONTRIBUTORY IRRIGATION WORKS-WATER ANALYSIS

Ser. No.	Date Sampled	Total Solids	Total Hardness	ECW mmhos/cm	Cations Mileq/lit							Anions Mileq/lit							Mileg/lit	
					Na	K	Ca	Mg	Cl	SO ₄	CO ₃	HCO ₃	NO ₃	S	PH					
1	3.4.89	915	575	0.98	1.43	0.02	2.05	9.58	2.11	0.77	NIL	10.06	0.03	0.10	8.0					
2	10.4.89	320	170	0.36	0.95	0.02	1.85	1.66	0.78	1.08	NIL	2.62	NIL	0.02	7.8					
	26.7.89	300	218	0.50	1.87	0.03	1.55	2.80	1.38	0.70	NIL	4.00	0.17	0.07	8.5					
3	4.4.89	460	250	0.64	1.69	0.08	1.10	4.00	2.31	0.45	NIL	3.93	0.11	0.15	7.6					
4	5.1.89	555	295	0.77	2.43	0.05	1.20	4.83	2.50	2.70	NIL	3.03	0.2	0.12	7.6					
	31.3.89	1020	555	1.25	4.78	0.05	6.00	5.16	4.50	8.75	NIL	2.29	0.29	0.21	7.8					
	17.8.89	1000	665	1.48	6.78	0.08	6.20	7.10	7.25	0.18	NIL	2.70	0.03	0.33	7.5					
5	31.3.89	630	345	0.80	2.43	0.02	3.50	3.50	2.00	5.00	NIL	2.45	NIL	0.02	7.9					
6	31.3.89	630	345	0.81	2.43	NIL	2.55	4.41	2.39	3.33	NIL	3.68	NIL	0.10	8.1					
	17.8.89	650	500	1.02	3.74	0.05	5.10	4.90	3.62	6.40	NIL	3.75	0.03	0.07	7.9					
7	30.1.89	490	255	0.65	2.08	0.02	2.50	2.66	2.39	1.37	NIL	3.44	NIL	0.34	7.7					
	22.5.89	440	205	0.70	3.13	NIL	1.0	3.08	2.50	2.75	NIL	2.0	NIL	NIL	7.7					
8	10.4.89	200	115	0.26	0.65	0.02	1.10	1.25	0.50	0.72	0.33	1.44	0.06	0.02	8.3					
	25.7.89	200	150	0.32	1.00	0.03	1.40	1.60	0.75	0.87	NIL	2.30	0.11	0.03	8.4					
9	30.3.89	380	235	0.41	0.52	NIL	1.15	3.58	0.59	0.45	NIL	4.34	NIL	0.02	8.1					
	26.1.89	540	290	0.65	2.08	0.02	2.40	3.41	1.89	0.92	NIL	4.75	0.11	0.07	8.2					
10	12.4.89	590	310	0.66	2.17	0.02	2.35	3.91	1.89	1.08	NIL	5.41	NIL	0.11	8.0					
	1.8.89	700	442	1.01	4.17	0.02	3.35	5.50	4.00	2.20	NIL	6.85	NIL	0.10	8.1					
11	12.4.89	200	130	0.23	0.17	NIL	0.50	2.16	0.39	NIL	NIL	2.45	NIL	NIL	7.9					
	1.8.89	180	130	0.22	0.34	NIL	0.30	2.30	0.38	0.60	0.55	1.40	NIL	0.01	9.5					
12	3.2.89	360	190	0.50	1.47	0.02	1.60	2.25	1.69	1.12	NIL	2.54	NIL	0.01	7.5					
	1.8.89	350	240	0.62	2.64	0.05	1.80	3.00	2.62	1.92	NIL	2.90	NIL	0.05	8.7					
13	19.1.89	490	270	0.65	1.73	0.02	1.80	3.75	1.60	1.66	NIL	3.85	NIL	0.07	8.2					
	31.3.89	500	270	0.64	0.95	0.02	2.50	3.00	1.60	1.45	NIL	4.18	NIL	0.07	8.0					
	17.8.89	350	220	0.56	2.43	0.05	1.10	3.30	2.12	1.86	NIL	2.90	NIL	0.09	8.3					
14	19.4.89	200	200	0.40	0.87	0.02	1.90	2.10	1.00	0.10	NIL	3.80	NIL	0.03	8.0					
	1.8.89	200	200	0.40	1.13	0.02	1.55	2.45	1.00	0.66	0.10	3.40	NIL	0.02	8.5					
15	5.8.89	200	200	0.43	1.22	0.02	2.00	2.00	1.12	0.53	NIL	3.60	NIL	0.05	7.6					
16	26.1.89	540	290	0.68	1.82	0.02	2.70	3.16	1.89	1.0	NIL	4.75	0.11	0.02	8.2					
	12.4.89	580	300	0.67	2.17	0.02	2.20	3.83	1.88	1.12	NIL	5.32	NIL	0.06	7.9					
	1.8.89	600	348	0.92	4.43	0.05	2.30	4.65	3.88	2.25	NIL	5.30	NIL	0.11	8.2					
18	30.3.89	620	295	0.81	3.13	0.10	1.15	4.83	3.52	0.45	0.40	4.83	0.14	0.33	8.3					

ANNEX 4

CONTRIBUTORY IRRIGATION WORKS OF THE PITSILIA PROJECT-WATER ANALYSIS

Ser. No.	Dam	Date Sampled	Total Solids	Total Hardness	ECW mmhos/cm	Cations Milleq/lt								Anions Milleq/lt					Mileg/lt	PH
						Na	K	Ca	Mg	Cl	SO ₄	CO ₃	HCO ₃	NO ₃	S					
1	Agros Dam	30.3.89	190	100	0.24	0.52	0.02	1.00	1.08	0.50	0.50	0.52	NIL	1.72	NIL	NIL	7.9			
2	Akapnou-Ephtagonia	29.3.89	470	270	0.58	1.39	NIL	2.30	3.16	1.29	2.70	NIL	2.78	0.14	NIL	7.9				
3	Arakapas Dam	29.3.89	430	240	0.49	0.95	1.02	1.75	3.16	0.78	1.00	NIL	4.18	0.06	NIL	7.6				
4	Arakapas I	29.2.89	420	225	0.50	1.26	NIL	2.00	2.50	1.29	0.91	NIL	3.68	0.11	NIL	7.8				
5	Ayii Vavatsinias Dam	31.3.89	370	210	0.45	0.95	0.02	2.25	2.00	0.78	0.95	NIL	3.44	NIL	0.04	8.1				
		17.8.89	300	210	0.46	1.65	0.03	1.05	3.15	1.38	1.60	NIL	2.90	NIL	0.04	8.3				
6	Ayii Vavatsinias Pond I	31.3.89	410	230	0.55	1.47	0.02	1.75	2.91	1.40	2.08	0.40	2.37	NIL	0.02	8.4				
		17.8.89	350	258	0.57	1.96	0.03	1.60	3.55	1.75	2.55	NIL	2.85	NIL	0.07	7.8				
7	Ephtagonia I	29.3.89	405	240	0.50	1.04	NIL	1.45	3.41	1.01	1.37	NIL	3.44	0.03	0.02	8.1				
8	Ephtagonia II	29.3.89	380	220	0.46	1.08	NIL	1.70	2.75	1.09	1.25	NIL	3.19	NIL	NIL	8.0				
9	Ephtagonia III	29.3.89	340	185	0.42	1.13	NIL	1.45	2.33	1.01	1.29	NIL	2.62	NIL	NIL	7.9				
10	Kato Mylos Pond	30.3.89	360	185	0.42	1.26	0.02	2.05	1.67	0.90	1.20	NIL	2.70	0.32	NIL	7.8				
11	Khandria Pond	30.3.89	190	120	0.24	0.52	NIL	1.10	1.33	0.60	0.50	NIL	1.60	NIL	NIL	7.8				
12	Kyperounda Pond I	30.3.89	235	130	0.28	0.70	0.02	1.3	1.3	0.59	0.68	NIL	2.04	NIL	NIL	7.9				
13	Kyperounda Pond II	30.3.89	520	285	0.61	1.82	0.05	0.40	2.08	2.11	0.33	0.40	4.91	NIL	0.34	8.3				
14	Lagouthera Pond	20.4.89	100	102	0.24	0.61	0.02	1.10	0.95	0.75	0.34	NIL	1.60	NIL	0.03	8.1				
		11.8.89	100	132	0.29	0.78	0.02	1.45	1.2	0.88	0.55	NIL	2.00	0.03	0.02	7.9				
		29.9.89	100	125	0.29	0.87	NIL	1.40	1.10	0.75	0.82	NIL	1.80	NIL	NIL	8.1				

ANNEX 4 (Cont.)
CONTRIBUTORY IRRIGATION WORKS OF THE PITSILLIA PROJECT-WATER ANALYSIS

Ser. No.	Dam	Date Sampled	Total Solids	Total Hardness	ECW mmhos/cm	Cations M/eq/lit						Anions M/eq/lit						M/eq/lit	PH
						Na	K	Ca	Mg	Cl	SO ₄	CO ₃	HCO ₃	NO ₃	S				
15	Melini Pond	31.3.89	420	230	0.51	1.30	NIL	2.20	2.41	0.90	1.66	NIL	3.11	0.35	NIL	8.2			
		17.8.89	300	210	0.47	1.65	NIL	1.30	2.90	1.50	1.68	NIL	2.55	0.13	0.03	8.1			
16	Agrihia Pond	30.3.89	310	180	0.36	0.65	NIL	1.35	2.33	0.59	0.83	NIL	2.95	0.06	NIL	7.9			
17	Pelendria Pond	30.3.89	295	150	0.36	0.95	NIL	1.60	1.50	0.78	0.79	NIL	2.54	0.06	0.01	8.1			
18	Ora Pond	19.1.89	335	185	0.42	1.0	NIL	1.95	1.75	0.90	0.91	NIL	2.95	NIL	0.02	8.0			
		31.3.89	360	200	0.44	1.13	NIL	1.95	2.00	0.78	1.00	NIL	3.27	NIL	0.04	8.2			
		17.8.89	200	170	0.39	1.48	NIL	1.1	2.30	1.37	1.05	NIL	2.45	NIL	0.04	8.2			
19	Pharmakas Pond I	10.4.89	190	90	0.24	0.8	NIL	1.10	0.75	0.50	0.39	0.40	1.52	NIL	0.07	8.3			
		25.7.89	100	60	0.23	1.09	NIL	0.80	0.40	1.12	1.16	NIL	3.40	NIL	0.05	7.3			
20	Pharmakas Pond II	10.4.89	210	120	0.27	0.73	NIL	1.30	1.16	0.59	0.70	0.40	1.44	0.06	NIL	8.4			
		25.7.89	150	105	0.29	1.17	0.03	0.9	1.2	1.00	0.48	NIL	1.80	0.03	0.03	7.6			
21	Arakapas Pond II	29.3.89	320	170	0.40	1.13	NIL	1.60	1.83	0.90	1.45	NIL	2.21	0.06	NIL	7.8			
22	Ayii Vavatsinias Pond II	31.3.89	340	180	0.41	1.13	NIL	1.50	2.08	0.90	0.79	NIL	3.11	NIL	0.02	8.1			
		17.8.89	200	187	0.41	1.39	NIL	1.25	2.50	1.25	0.94	NIL	2.95	NIL	0.05	8.4			
23	Dhierona Pond	29.3.89	240	125	0.31	0.95	NIL	0.90	1.66	0.78	1.04	NIL	1.72	NIL	NIL	8.1			

DETAILS ON OPERATION AND MAINTENANCE OF GOVERNMENT IRRIGATION PROJECTS

ARGAKA PROJECT

The Argaka Project consists of a rockfill type embankment dam with reservoir capacity at Spillway crest 0.990 MCM of water and a distribution system made of closed conduits commanding an area of 3,136 decars. The year of commencement of operation is 1968. The Argaka dam is connected with Evretou dam by a main conveyor with branch to Argaka storage pond.

Project Operation

Project Management and Operation is carried out by the Waterworks Committee chaired by the Paphos District Officer. The operation team consists of a part time dam attendant, two watermen and one part time bill collector.

Project Hydrology

The project hydrologic data, as recorded during the year under review are shown on table X-15. The dam reservoir was filled up to the spillway crest on the 6th January and overflow continued until the 1st April 1989. The minimum quantity in storage ever occurred was on the 5th December 1989 with quantity in storage 7,000 m³ of water.

Water Resources and System Efficiency

A quantity of 383,930 m³ was diverted to the dam reservoir from Evretou dam so that the water available reached the figure of 2.224 MCM. A quantity of 1.348 MCM of water was released from the dam reservoir and used for irrigation.

Water Utilization and Crops Irrigated

A quantity of 1.348 MCM of water was used for the irrigation of 2,290 decars of land planted with various crops as shown on Annex 1. Irrigation in the project area started mid February and continued throughout the year until the end of December 1989.

Water Sale, Income and Expenditure

Out of 1.348 MCM of water utilized, a quantity of 356,813 m³ were given free of charge because this quantity was utilized during the dam overflowing period, a quantity of 606,988 m³ was sold to the farmers at 3.5 cent/m. The rest 383,930 m³ were bought from Evretou Dam. The gross income from the sale of water amounted to £21,245. For the operation of the project an amount of £11,390 was paid to the dam attendant, water men and bill collectors. For the maintenance of the project an amount of £4,495 was spent. The net income to the project amounted to £5,360.

TABLE X-15
 ARGAKA DAM - HYDROLOGY FOR 1989

										STOR. CAPACITY 990000M3	
MONTH	STORAGE BEG. OF MONTH	VOLUME CHANGE	EVAPOR- ATION	REL. FOR IRRIGAT.	TOTAL EST. INFLOW	MEASURED SEEPAGE	LOSSES	TOTAL MEASURED INFLOW	MEASURED SEEPAGE	LOSSES	TOTAL MEASURED INFLOW
	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
JAN	880000	110000	3000	0	3536	113536	536	3536	536	3536	2280000
FEB	990000	0	4000	55751	60235	60235	484	4484	484	4484	526000
MAR	990000	0	6000	141385	147921	147921	536	6536	536	6536	303000
APR	990000	-110000	9000	132829	142347	32347	518	9518	518	9518	85000
MAY	880000	-150000	10000	165990	176526	26526	536	10536	536	10536	43000
JUN	730000	-228000	13500	161540	175558	-52442	518	14018	518	14018	3000
JUL	502000	-272000	13000	170360	183671	-88329	311	13311	311	13311	0
AUG	230000	-152000	8000	201060	209060	57060	0	8000	0	8000	0
SEP	78000	2000	4000	180400	184400	186400	0	4000	0	4000	0
OCT	80000	0	2200	101186	103386	103386	0	2200	0	2200	0
NOV	80000	-70000	1000	36640	37640	-32360	0	1000	0	1000	0
DEC	10000	40000	200	590	790	40790	0	200	0	200	40790*
TOTALS	-830000	739000	1347731	1425070	1421026	3439	77339	3280790	3439	77339	3280790
% TO STOR. CAPACITY	7.5	136.1	143.9	143.5	0.3	7.8	331.4				

NOTE: INFLOW FROM EVRETOU DAM 383930 M3. * Estimated inflow

TABLE X-16 - ARGAKA DAM - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m ³	Amount £
1	Water sold at nominal rates	606 988	21 245
2	Water given free of charge.....	356 813	Nil
3	Total quantity utilized from Argaka dam and gross income	963 801	21 245
4	Purchase of water from Evretou dam	383 930	See KIP
5	Total water utilized	1 347 731	
6	Operation cost	-	11 390
7	Maintenance cost	-	4 495
8	Total annual cost	-	15 885
9	Net Income	-	5 360

Maintenance Details

During the year under review the following maintenance works were carried out:

- Maintenance of the guardhouse
- Cleaning of embankment from wild vegetation
- Repair of flow regulating valve.
- Repair of sluice valves
- Painting of manhole metal covers
- Repair of penstock

Project performance for the last two years

Table X-17 shows the data on operation of the project for the last two years and the change of the data over the previous year.

TABLE X-17 - ARGAKA DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Data	Unit	1988	1989	% Change on 1988
1	Capacity	MCM	0.990	0.990	Nil
2	Water available	"	1.581	2.224	+40.7
3	Water utilized for irrigation	"	1.244	1.348	+ 8.4
4	Water sold from Argaka dam	"	0.632	0.607	- 4.0
5	Water given free	"	0.419	0.357	+14.8
6	Water sold from Evretou dam	"	0.193	0.384	See KIP
7	Gross income	£	22132	21245	- 4.0
8	Operation cost	"	10486	11390	+ 8.6
9	Power cost	"	-	-	-
10	Maintenance cost	"	2823	4495	+59.2
11	Total expenses	"	13309	15885	-19.4
12	Net income	"	8823	5360	-39.2
13	Area irrigated	decars	2119	2290	+ 8.1

TABLE X-18
 AYIA MARINA DAM - HYDROLOGY FOR 1989
 STOR. CAPACITY 298000 M3

	STORAGE BEG. OF MONTH	VOL. CHANGE DURING MONTH	EVAPOR- ATION	REL. FOR IRR.	TOTAL OUT	EST. INFLOW -SEEPAGE -OVERFLOW	MEASURED SEEPAGE
	m3	m3	m3	m3	m3	m3	m3
JANUARY	298000	0	1087	2471	12129	12129	8571
FEBRUARY	298000	0	1361	25057	34159	34159	7741
MARCH	298000	0	2131	29343	40045	40045	8571
APRIL	298000	-19000	3242	48885	59860	40860	7733
MAY	279000	-50000	4000	54409	66409	16409	8000
JUNE	229000	-49000	4500	43580	51080	2080	3000
JULY	180000	-44000	5000	41840	48340	4340	1500
AUGUST	136000	-46000	3700	44421	49121	3121	1000
SEPTEMBER	90000	-43000	2000	39810	42310	-690	500
OCTOBER	47000	-30000	900	31850	33050	3050	300
NOVEMBER	17000	13000	300	4499	4799	17799	
DECEMBER	30000	30000	400	6233	6633	36633	
TOTALS		-238000	28621	372398	447935	209935	46916
%			9.6	125.0	150.3	70.4	15.7

AYIA MARINA PROJECT

The Ayia Marina Project consist of an earthfill type embankment dam of capacity at spillway crest of 0.298 MCM and a distribution system made of closed conduits commanding an area of 2,010 decars. The project commenced its operation in 1968.

Project Operation.

The management and operation of the project is carried out by the Waterworks Committee chaired by the Paphos District Officer. The operation team consists of a part time dam attendant, a waterman and a part time bill collector.

Project Hydrology

The project hydrologic data as recorded during the year under review are shown on table X-21. The water reached the spillway crest on the 1st January and overflow continued until the 16th April 1989. The minimum quantity in storage at the end of the irrigation period was on the 13th November 1989 with quantity in storage 14,000 m³ of water.

Water Resources and System Efficiency

A quantity of 372,398 m³ of water was released and used for irrigation as shown on tables X-18, and X-19. It cannot be seen if there are any losses in the distribution system.

Water Utilization and Crops Irrigated

A quantity of 372,398 m³ was used for irrigation of 464 decars of land planted with various crops as shown on annex 1. Irrigation in the project area started in January and continued throughout the year until December 1989.

Water Sale, Income and Expenditure

A quantity of 372,398 m³ was sold to the farmers. Out of this quantity, 317,680 m³ were sold at 3.5 cent/m³ and the rest 54,718m³ were sold at 0.5 cent/m³ because this quantity was utilized during the overflowing period. The gross income from the sale of water amounted to £11,392. The expenditure amounted to £12,258 out of which £11,714 were spent for the operation of the project i.e. waterman and dam attendant wages. The rest £544 were spent for maintenance. The net income to the project was a deficit of £866.

TABLE X-19 - AYIA MARINA DAM - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m ³	Amount £
1	Water sold at nominal rates	317 680	11 119
2	Water sold at reduced rates	54 718	273
3	Total water sold and gross income .	372 398	11 392
4	Operation cost	-	11 714
5	Maintenance cost	-	544
6	Total cost	-	12 258
7	Net income	-	-866

Maintenance Details

The amount of £544 was spent for the following works:

- Cleaning of embankment from wild vegetation
- Painting of metal works
- Cleaning of drainage ditch channels
- Repair of pipe breakages
- Replacement of sluice valves

Project performance for the last two years

Table X-20 shows the project operation data for the last two years and the percentage change of the year under review over the previous. A decrease of 36.6% in the water available was observed. The water utilized and the area irrigated were increased by 16.6% and 24.7% respectively. The net income to the project was decreased due to the increase of the annual costs.

TABLE X-20 - AYIA MARINA DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Description	Unit	1988	1989	% Change on 1988
1	Capacity	MCM	0.298	0.298	NIL
2	Water available	"	0.682	0.432	-36.6
3	Water utilized for irrigation	"	0.319	0.372	+16.6
4	Water sold at nominal rates...	"	0.276	0.318	+15.2
5	Water sold at reduced rates ..	"	0.043	0.054	+25.6
6	Gross income	"	9 872	11 392	+15.4
7	Operation cost	"	7 107	11 714	+64.8
8	Maintenance cost	"	2 460	544	-
9	Total expenses	"	9 567	12 258	+28.1
10	Net income	"	305	- 866	-
11	Area irrigated	decars	372	464	+24.7

POMOS PROJECT

The Pomos irrigation project consists of a rockfill type embankment dam with capacity at spillway crest of 0.860MCM of water and a distribution system made of a main canal and closed type distribution system commanding an area of 381 hectares. The year of the project commencement of operation is 1968.

Project Operation

The project management and operation is carried out by the Waterworks Committee chaired by the Paphos District Officer. The operation team consists of a part time dam attendant, two watermen and a part time bill collector.

Project Hydrology

The project hydrologic data as recorded during the year under review are shown on table X-21. The water reached the spillway crest on the 1st of January and overflow continued until the 13th of April 1989. The minimum quantity ever remained in the reservoir during the irrigation period was recorded on the 10th November 1989 with quantity in storage 51,000 m³ of water.

TABLE X-21
 POMOS DAM - HYDROLOGY FOR 1989

STOR. CAPACITY 860000 M3

MONTH	STORAGE BEG. OF MONTH m3	VOLUME CHANGE m3	EVAPOR- ATION m3	REL. FOR IRR. m3	TOTAL OUT m3	EST. INFLOW -SEEPAGE -OVERFLOW m3	MEASURED LEAKAGES m3	MEASURED INFLOW m3
JANUARY	860000	0	2740	790	22530	22530	19000	303000
FEBRUARY	860000	0	3400	28837	51237	51237	19000	74000
MARCH	860000	0	5400	39428	64028	64028	19200	41000
APRIL	860000	-17000	8200	93953	120153	103153	18000	15000
MAY	843000	-136000	9000	100000	126000	-10000	17000	5000
JUNE	707000	-147000	12000	110000	137000	-10000	15000	0
JULY	560000	-160000	13000	125000	150000	-10000	12000	0
AUGUST	400000	-143000	8000	120000	138000	-5000	10000	0
SEPTEMBER	257000	-132000	3000	110000	121000	-11000	8000	0
OCTOBER	125000	-58000	2000	63000	70000	12000	5000	12000 *
NOVEMBER	67000	13000	1000	18304	22304	35304	3000	35304 *
DECEMBER	80000	35000	500	2263	4763	39763	2000	39763 *
TOTALS	-745000	68240	811575	1027015	282015	147200	525067	
%	7.9	94.4	119.4	32.8	17.1	61.1		

* Estimated inflow

Water Resources and System Efficiency

A quantity of 0.812 MCM was released from the dam and 0.080 MCM were pumped from the boreholes in the project area. A total quantity of 0.892 MCM used for irrigation.

Water Utilization and Crops Irrigated

A total quantity of 891,575 m³ was used for irrigation of 150.3 hectares of land planted with various crops as shown on annex 1. Irrigation in the project area started in January and continued throughout the year until December 1989.

Water Sale, Income and Expenditure

A quantity of 891,575 m³ was sold to the farmers. Out of the quantity, 780,075 m³ were sold at 3.5 cent/m³ and the rest 111,500 m³ were sold at 0.5 cent/m³ because this quantity was used during the dam overflowing period. The gross income from the sale of water amounted to £27,860. The total annual expenses amounted to £19,656. Out of this amount £17,712 are operation expenses, including dam attendant and watermen wages, £1,085 are power expenses and the rest £859 were spent for routine maintenance on the dam and the distribution system. The net income to the project amounted to £8,204.

TABLE X-22 - POMOS DAM - INCOME AND EXPENDITURE DATA

Item No.	Description	Quantity m ³	Amount £
1	Water sold at nominal rates	780 075	27 303
2	Water sold at reduced rates	111 500	557
3	Total quantity sold and gross income	891 575	27 860
4	Operation cost	-	17 712
5	Power cost	-	1 085
6	Maintenance cost	-	859
7	Total costs	-	19 656
8	Net income	-	8 204

Maintenance Details

The amount of £859 was spent for the following works on the dam and the distribution system.

- Cleaning of embankment from wild vegetation
- Painting of metal work and wood work
- Cleaning of drainage ditch channels
- Repairs to pipe breakages and canal joints
- Replacement of sluice valves.

Project Performance for the last two years

Table X-23 shows data regarding hydrology and operation for the last two years and the percentage change of the 1989 figures over the previous year.

TABLE X-23 - POMOS DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Item No.	Description	Unit	1988	1989	% Change on 1988
1	Capacity	MCM	0.860	0.860	NIL
2	Water available	"	1.819	0.927	-
3	Water utilized for irrigation	"	0.880	0.892	+ 1.4
4	Water sold at nominal rates...	"	0.783	0.780	+ 0.4
5	Water sold at reduced rates ..	"	0.097	0.112	-15.5
6	Gross income	£	24 309	27 860	+14.6
7	Operation cost	"	14 953	17 712	+18.4
8	Power cost	"	1 646	1 085	-34.1
9	Maintenance cost	"	2 365	859	-63.7
10	Total cost	"	18 964	19 656	+ 3.6
11	Net income	"	5 345	8 204	-53.5
12	Area irrigated	Hectares	147	150.3	+ 2.2

KHRYSOKHOU IRRIGATION PROJECT

The purpose of the Khrysokhou Irrigation Project is the development of the surface and ground water resources of the Politis Khrysokhou region. The areas to be irrigated 3,100 ha extend along the coastal belt from Neokhorio to Pomos and plains of the adjacent rivers.

The project consists of the following main elements:

- Evretou dam with rockfill type embankment and reservoir capacity 24.0 MCM at spillway crest.
- Eight storage ponds
- Magounda, Yialia and Livadhi diversion intake structures
- Main conveyance pipeline which includes the main conveyor from Evretou dam to Pomos with branches to the storage ponds, to the three existing small dam reservoirs of Pomos, Ayia Marina and Argaka-Magounda and to the three diversion intakes.
- Piped irrigation networks and farm access roads to cover the new areas to be irrigated of about 2000 hectares net.
- Groundwater development which includes the present ground water development of the existing boreholes in the Khrysokhou river as well as eight new boreholes in the area between Khrysokhou and Prodromi villages.

The civil works of phase I which includes Construction of Euretou dam, installation of main conveyor extending form dam up to Magounda diversion, four storage ponds and installation of the distribution system, were completed in 1988.

Project Operation

The project management and operation is the responsibility of the Water Development Department. The staff in charge for the project Operation and Maintenance for the year 1988 was the following:

- 1 Executive Engineer I (part time)
- 1 dam attendant
- 5 watermen
- 6 technicians
- 1 foreman
- 6 labourers
- 1 storekeeper
- 1 driver

TABLE X - 24
 EVRETOU DAM - HYDROLOGY 1989

STOR. CAPACITY 24.000 MCM

MONTH	STORAGE BEG. OF MONTH m3	VOL. CHANGE DURING MONTH m3	EVAPOR- ATION m3	REL. FOR IRRIGAT. m3	REL. FOR RECHARGE m3	TOTAL RELEASES m3	TOTAL OUT m3	EST. INFLOW -SEEPAGE m3	MEASURED INFLOW m3
JANUARY	13797000	-1414000	21212	7095	0	7095	28307	-1385693	5302000
FEBRUARY	12383000	576000	32450	15005	0	15005	47455	623455	815000
MARCH	12959000	185000	47204	61553	0	61553	108757	293757	486000
APRIL	13144000	-559000	97400	224122	0	224122	321522	-237478	178000
MAY	12585000	-472000	128120	269148	0	269148	397268	-74732	45000
JUNE	12113000	-593000	152744	360420	0	360420	513164	-79836	12000
JULY	11520000	-739000	168662	468080	0	468080	636742	-102258	4000
AUGUST	10781000	-663000	140743	429870	0	429870	570613	-92387	0
SEPTEMBER	10118000	-732000	97215	509000	0	509000	606215	-125785	0
OCTOBER	9386000	-389000	56394	204820	0	204820	261214	-127786	0
NOVEMBER	8997000	-100000	27292	49143	0	49143	76435	-23565	0
DECEMBER	8897000	-150000	16556	5295	0	5295	21851	-128149	0
TOTALS	-5050000	985992	2603551	0	2603551	3589543	-1460457	6842000	
% TO MAX STOR.		7.0	18.4		18.4	25.4			
% TO STOR. CAPACITY		4.1	10.8		10.8	15.0			28.5

Project Hydrology

The project hydrologic data as recorded during the year under review are shown on table X-24. The maximum quantity in storage was recorded on the 11th January 1989 with quantity 14.135 MCM. The minimum quantity in storage at the end of the irrigation period occurred on the 29th December 1989 with quantity in storage 8.747 MCM of water.

Water Resources and System Efficiency

A total quantity of 2.60 MCM was released for irrigation from Evretou dam. Apart from this quantity small quantities were pumped from private boreholes. From the water released a quantity of 2.258 MCM was used and the rest 0.345 MCM were lost in the distribution system. The system efficiency is 87%.

Water Utilization and Crops Irrigated

Out of 2.258 MCM of water used, 2.252 MCM were used for irrigation of 639.8 Ha of land planted with various crops as shown on annex 1. Irrigation in existing Khrysokhou Valley area, areas of Irrigation Divisions and new areas started in January and continued throughout the year until December 1989.

A quantity of 0.384 MCM was used to supplement irrigation in Argaka existing irrigation area. The rest 6,496 m³ of water was used for industrial purposes.

Water Sale, Income and Expenditure

A quantity of 2.258 MCM was sold at the nominal rates. Out of this quantity 2.252 MCM were sold at 4.5 cent/m³ for Irrigation and the rest 6,496 m³ were sold at 13 cent/m³ to Industries. The gross income from the sale of 2.258 MCM of water amounted to £102,177. The operation maintenance and power costs amounted to £91,927. The net income to the project was £10,250.

TABLE X-25 - KHRYSOKHOU PROJECT - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m ³	Amount £
1	Water sold to Khrysoukhou area.....	1 840 470	82 821
2	Water sold to Irrigation Divisions...	27 430	1 234
3	Water sold to Argaka area.....	383 930	17 277
4	Water sold to industries	6 496	845
5	Total quantity sold and gross income	2 258 326	102 177
6	Operation cost	-	29 924
7	Maintenance cost	-	60 468
8	Power cost	-	1 535
9	Total costs	-	91 927
10	Net income	-	10 250

Maintenance Details

The maintenance works carried out during the year 1989 were the following:

- Repair of pipelines and hydrants
- Cleaning and repair of water meters
- Cleaning of filters
- Cleaning of drainage ditch channels
- Cleaning and repair of sluice valves

Project Performance for the last two years

The project operation for the last two years are shown on table X-26. The water available was decreased due to the fact that the dam was kept open. The water used during 1989 was increased compared to the water used during 1988 and the area irrigated was increased too.

TABLE X-26

KHRYSOKHOU PROJECT - DATA ON OPERATION FOR THE LAST TWO YEARS

Item No.	Description	Unit	1988	1989	% change on 1988
1	Storage capacity	MCM	24.000	24.000	NIL
2	Water available	"	20.117	11.351	-43.6
3	Water sold	"	1.680	2.258	+34.4
4	Water given free	"	NIL	NIL	NIL
5	Water used for recharge	"	NIL	NIL	NIL
6	Total water used	"	1.680	2.258	+34.4
7	Gross Income	£	77 577	102 177	+31.7
8	Operation cost	£	18 136	29 924	+65.0
9	Maintenance cost	£	44 583	60 468	+35.6
10	Power cost	£	1 248	1 535	+23.0
11	Total costs	£	63 967	91 927	+43.7
12	Net income	£	13 610	10 250	-24.7
13	Area irrigated	hectares	407.8	639.8	+56.9

PAPHOS PROJECT

The aim of the Paphos Project is to irrigate about 5,110 hectares of net irrigable area lying in the south-western coastal plain of Cyprus in both sides of the town of Paphos. The water requirements for the irrigation of this area are estimated to be 32 MCM/year.

The project water resources are the following:

- Asprokremmos dam of earthfill type embankment with capacity at spillway crest 52.375 MCM of water.
- A wellfield of 24 boreholes in Dhiazizos, Xeropotamos and Ezousa river beds and surface flow Diversions in Dhiazizos and Ezousa river is capable to supply 10 MCM.
- Mavrokolymbos dam of earthfill type embankment with capacity 2.180 MCM of water.

The conveyance of the water to the irrigation sectors is done through the following routes:

- The wellfield conveyance system collecting the water extracted from boreholes or surface flow and supplying the main canal.
- The main canal extending from Asprokremmos dam to Yeroskipos fed by the dam and the river aquifers.
- The western main pipe conveyor originating from the main pumping station of the end of the main canal and from there the water is conveyed by a gravity pipeline to Ayios Yeorgios.

Pressurisation of the water supplied by the main canal and the pipe conveyors is achieved by 14 automatic pumping stations and distribution of pressurised water is ensured by branched pipeline systems.

TABLE X-27

ASPROKREMMOS DAM - HYDROLOGY FOR 1989

STOR. CAPACITY 52.375 MCM

MONTH	STORAGE BEG. OF MONTH	VOL. CHANGE DURING MONTH	EVAPOR- ATION	REL. FOR IRRIGAT. POWER ST.	REL. FOR RECHARGE	TOTAL RELEASES	TOTAL OUT	EST. INFLOW -SEEPAGE -OVERFLOW	MEASURED LEAKAGES
	m3	m3	m3	m3	m3	m3	m3	m3	m3
JANUARY	48274000	3540000	113540	3652200	0	3652200	3778087	7318087	12347
FEBRUARY	51814000	-400000	117732	2212500	0	2212500	2344125	1944125	13893
MARCH	51414000	320000	210210	808000	0	808000	1034125	1354125	15915
APRIL	51734000	-1007000	406651	1205100	0	1205100	1626698	619698	14947
MAY	50727000	-1570000	492486	1357775	0	1357775	1863904	293904	13643
JUNE	49157000	-1732000	508052	1108400	0	1108400	1629758	0	13306
JULY	47425000	-2930000	516239	2623017	81083	2704100	3233195	303195	12856
AUGUST	44495000	-3089000	440501	3192253	150847	3343100	3796241	707241	12640
SEPTEMBER	41406000	-2617000	381523	2432909	135891	2568800	2960795	343795	10472
OCTOBER	38789000	-1476000	219147	1032582	82918	1115500	1343114	0	8467
NOVEMBER	37313000	-579000	124249	534892	36128	571020	702924	123924	7655
DECEMBER	36734000	-357000	71000	246853	0	246853	325353	0	7500
TOTALS		-11897000	3601330	20406481	486867	20893348	24638319	13008094	143641
%			6.9	39.0	0.9	39.9	47.0	24.8	0.3

TABLE X-28

MAVROKOLYMBOS DAM - -HYDROLOGY 1989

STOR. CAPACITY 2.180 MCM

	STORAGE BEG. OF MONTH m3	VOL. CHANGE DURING MONTH m3	EVAPOR- ATION m3	REL. FOR IRRIGAT. m3	TOTAL OUT m3	EST. INFLOW -SEEPAGE m3
JAN	747000	719000	6064	17500	23564	742564
FEB	1466000	114000	8398	45000	53398	167398
MAR	1580000	490000	11069	72000	83069	573069
APR	2070000	-142000	16842	171500	188342	46342
MAY	1928000	-258000	39765	255500	295265	37265
JUN	1670000	-314000	32858	287000	319858	5858
JUL	1356000	-336000	29045	331000	360045	24045
AUG	1020000	-355000	21338	306000	327338	-27662
SEP	665000	-300000	11265	295000	306265	6265
OCT	365000	-180000	4988	189500	194488	14488
NOV	185000	-60000	1742	74000	75742	15742
DEC	125000	17500	1272	20000	21272	38772
TOTALS		-604500	184646	2064000	2248646	1644146
%			8.5	94.7	103.1	75.4

The project commenced operation in 1980 with water pumped from the 24 boreholes. The project was fully completed in 1983 and operates on the "on demand" mode.

Project Operation

The project management and operation is carried out by the Department of Water Development. The following staff was in charge for the project operation and maintenance:

- 1 Executive Engineer I
- 1 Mechanical Engineer I (part time)
- 3 Technicians I
- 5 Technicians II
- 1 Assistant Chief Foreman
- 5 Foremen
- 11 Watermen
- 2 Electricians
- 2 Mechanics
- 2 Pump attendants
- 2 Plant operators
- 1 Storekeeper
- 8 Drivers
- 27 Labourers

Hydrology of dams

The project hydrologic data are shown on tables X-27 and X-28. The water in the Asprokremmos dam reached the spillway crest on the 10th January and overflow continued until the 27th of January 1989. The minimum quantity in storage was recorded on 28th December 1989 with quantity 36.367 MCM of water.

The maximum quantity in storage in Mavrokolymbos dam was on the 28th March and the minimum on the 22nd December 1989 with quantities 2.080 MCM and 0.080 MCM respectively.

Water Resources and system Efficiency

The total water given for irrigation in project area amounted to 21.864 MCM. Out of this a small quantity of 1.000 MCM was pumped from private boreholes. The remaining 20.864 MCM were delivered from headworks. From the quantity delivered for irrigation only 17.822 MCM were used for irrigation and the rest 4.042 MCM were lost in the canal and pipe system. The system efficiency is 81.5%

TABLE X-29
PAPHOS PROJECT - WATER RESOURCES

Item No.	Description	Quantity m ³
1	Water released for Irrigation and power station	20 406 481
2	Water released for recharge	486 867
3	Water given to Mavrokolymbos dam	550 000
4	Total water released from Asprokremmos dam	20 893 348
5	Water given for irrigation from Asprokremmos dam	15 035 100
6	Dhiarizos and Ezousa boreholes	1 450 720
7	Dhiarizos and Ezousa surface flow	1 914 614
8	Water given Mavrokolymbos dam	2 463 800
9	Total water delivered from Headworks	20 864 234
10	Water pumped from private boreholes	1 000 000
11	Total water given for irrigation	21 864 234

Water Utilization and Crops Irrigated

A total quantity of 20.381 MCM was utilized during the year under review. Out of this a quantity of 2.559 MCM was given for recharge and then used for Paphos Domestic Water Supply. Out of the remaining 17.822 MCM, a small quantity of 0.115 MCM was utilized for industrial purposes and the rest quantity 17.707 MCM was utilized for irrigation. Apart from the water used for irrigation from project resources an additional quantity of 1.000 MCM was used from private boreholes as shown on table X-29.

Irrigation in the project area started in January and continued all over the year under review. A total of 17.822 MCM of water was used for the irrigation of 3666 hectares of land planted with various crops as shown on annex 1.

Water Quality

One sample taken from each of the dams reservoirs was chemically analysed, as shown on annex 2. The water from the dams reservoirs is of good quality with slightly high bicarbonates.

Water Sale, Income and Expenditure

A total quantity of 17.822 MCM of water was sold at nominal rates. Out of this quantity 15.402 MCM were sold at 5 cent/m³, 2.305 MCM was sold to Mavrokolymbos area at 4.5 cent/m³ and the rest 0.115 MCM were sold at 9 and 13 cent/m³ to the industries. The total income from the sale of water amounted to £888,527. The total expenses on operation, maintenance and power amounted to £506,024. The net income was of the order of £382,503.

TABLE X-30

PAPHOS PROJECT - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m ³	Amount £
1	Water sold at nominal rates	15 401 750	770 087
2	Water sold at reduced rates	2 305 543	103 749
3	Water sold at increased rates ...	114 680	14 691
4	Total water sold and gross income	17 821 973	888 527
5	Water given free of charge to Potima	Nil	Nil
6	Total water	17 821 973	888 527
7	Operation cost	--	73 135
8	Maintenance cost	--	280 489
9	Power cost	--	152 400
10	Total costs	--	506 024
11	Net Income	--	383 503

Operation of Power Station

The hydroelectric power station was set in operation in January 1989. The Station generated 0.842 million KWH of electricity during the period January-April 1989 and July-October and sold to the system of the Electricity Authority of Cyprus at the cost of £5,990. The operation and maintenance expenses amounted to £2,732.

Maintenance Details

The following maintenance works were carried out during the year under reviews:

- Cleaning of storage and regulating tanks.
- Cleaning of main canal, Canaletti and Mavrokolymbos canal.
- Cleaning of pumping stations.
- Maintenance of hydraulic equipment.
- Painting of pumping stations.
- Improvements to project warehouses.
- Repairs to pipe breakages.
- Installation of gate valves.
- Improvement of recharge area downstream Asprokremmos dam structure.
- Replacement of watermeters in Mavrokolymbos area.

Asprokremmos dam

- Planting of 355 nos forest trees
- Painting of metalwork and woodwork
- Maintenance and painting of the guardhouse.
- Cleaning of embankment from wild vegetation.

Mavrokolymbos dam

- Maintenance and painting of the guardhouse.
- Painting of metal work and woodwork.
- Cleaning of embankment from wild vegetation.

Project Performance for the last two years

The project operation for the last two years are shown on table X-31. The water available was decreased whereas the water used during 1989 was increased compared to the water used during 1988.

TABLE X-31

PAPHOS PROJECT - DATA ON OPERATION FOR THE LAST TWO YEARS

Item No.	Description	Unit	1988	1989	% change on 1988
1	Storage capacity	MCM	54.555	54.555	Nil
2	Yield	"	32.000	32.000	Nil
3	Water available	"	77.147	61.760	-19.9
4	Water sold	"	14.274	17.822	+24.8
5	Water given free	"	0.209	Nil	-
6	Water used for recharge .	"	2.021	2.559	+26.6
7	Total water used	"	16.504	20.381	+23.5
8	Gross Income	£	709 247	888 527	+25.3
9	Operation cost	£	67 618	73 135	+ 8.2
10	Maintenance cost	£	251 991	280 489	+11.3
11	Total costs	£	436 364	506 024	+16.0
12	Net income	£	272 913	382 503	+40.2
13	Area irrigated	hectares	3 676	3 665.8	- 0.3

SOUTHERN CONVEYOR PROJECT

The purpose of the Southern Conveyor Project is to collect and store surplus water from south catchments and convey it Eastwards to areas of demand for both domestic water supply and irrigation.

The main SCP objectives at full development of the project would be:

- To secure a safe domestic water supply up to the year 2010 for the towns of Limassol, Larnaca, Famagusta and Nicosia.
- To provide irrigation water in order to maintain present agricultural production in Kokkinokhoria and to expand irrigated agriculture in four other areas along the southern coast of the Island.

It was decided to implement the project in two phases because of its large size and high financial cost. Phase I includes the following:

- Kouris dam of zoned earthfill embankment construction and capacity 115 MCM. Civil works commenced in 1984 and were completed by the end of 1988.
- Main conveyor which is 110 km long pipeline of diameters ranging from 1400 mm down to 800 mm conveys the stored water to Akhna reservoir. A branch off is allowed for recharge Yermasoyia river bed boreholes downstream of Yermasoyia dam. A second branch-off supplements Vasilikos-Pendaskinos Project through a balancing reservoir. Installation works started in 1986 and were completed in 1988.
- Akhna Reservoir, an earthfill embankment dam of capacity 5.8 MCM, which provides balancing storage in the Kokkinokhoria area. Construction works started in 1986 and were completed by the end of 1987.
- Kokkinokhoria irrigation network which consists of four balancing reservoirs, fifteen central distribution points, main conveyors, secondary and tertiary systems. The area to be irrigated is 9000 ha. The laying of the main conveyors was completed in 1987 and the other construction works will be completed in 1990.

Phase II includes the following:

- Dhiarizos Diversion, conveying water from Dhiarizos river to Kouris Dam through 16 km long pipeline and tunnel.
- Irrigation distribution networks for four irrigation areas totalling some 4300 ha., Akrotiri 1755 ha, Parekklissha 320 ha, Mazotos 660 ha and Kiti 1600 ha. This component will include all connecting and distribution pipes and regulating tanks between the SCP main conveyor and hydrants at farm level.
- Domestic water supply works.

TABLE X-32

KOURIS DAM - HYDROLOGY 1989

STOR. CAPACITY 115000000 M3

MONTH	DAM DATA			RELEASES			LOSSES			TOT. OUT			INFLOW			
	REL. FOR IRRIGAT. TO KOKKINOKH. KITI	REL. FOR IRRIGAT. TO LARNAKA	REL. FOR EST. FLOW VOL. CHANGE	DAN	DAN	TOTAL	DIPEE-RENCE (1)-(2)	MEASURED EVAPORATION	TOTAL	MEASURED EVAPORATION	TOTAL	EST. INFLOW				
BEG. OF MONTH	TO LARNAKA	TO KOKKINOKH. KITI	REL. FOR EST. FLOW VOL. CHANGE	DAN	DAN	TOTAL	DIPEE-RENCE (1)-(2)	MEASURED EVAPORATION	TOTAL	MEASURED EVAPORATION	TOTAL	EST. INFLOW				
JAN	50240000	18600000	5232	14964	80720	1262000	1099000	1362916	1362916	0	104622	69588	174210	1537126	20137126	21855000
FEB	68840000	2424000	250465	13163	452840	1423982	1310000	2140450	2140450	0	167599	104054	271653	2412103	4836103	5514000
MAR	71264000	1680000	1178771	19252	598090	190000	-115000	795660	2781773	0	205494	161793	367287	3149060	4829060	5504000
APR	72944000	-2448000	1934028	33519	84420	0	-336000	1926140	3978107	0	194400	274963	469363	4447470	1999470	2308000
MAY	70496000	-2976000	1472305	151775	0	0	-343000	1145500	3108400	338820	179410	426076	605486	3713886	737886	1227000
JUNE	67520000	-3293000	748952	165068	0	0	-317000	1953900	2833500	-34420	138793	436250	575043	3408543	115543	428000
JULY	64227000	-3087000	731535	105881	0	0	-330000	1495205	2505400	172779	-112864	-477483	-590347	-3095747	8747	76000
AUG	61140000	-4289000	1755316	114798	0	0	-193000	1500458	3681000	310428	88500	379082	467582	4148582	0	67000
SEP	56851000	-3797000	1657372	117660	237160	0	-320000	930611	3300300	357497	68966	273186	342152	3642452	0	74000
OCT	53054000	-2994000	1563120	129723	697566	0	-158000	651803	3205000	162788	61543	167374	228917	3433917	439917	480000 *
NOV	50060000	-1026000	756997	83273	561718	120000	-43000	192550	1714538	15062	52977	92599	145576	1875176	849176	940000 *
DEC	49034000	-1444000	735535	39514	530000	973000	787000	186000	2375400	-88649	50224	63821	114045	2489446	1099289	1200000 *
TOTALS	-2650000	12789628	989590	3242514	3968982	1041000	10777827	33001846	31767541	1234305	1425392	2926269	4351661	37353508	35052317	39673000
§	40.3	3.1	10.2	12.5	33.9	3.7	4.0	6.0								

* Estimated inflow

- For Limassol: Untreated water main from Southern Conveyor to treatment plant and conveyors from treatment plant to service reservoirs.
- For Nicosia and Larnaca: Untreated water from southern conveyor to Tersefanou treatment plant and main conveyor from Tersefanou to Nicosia service reservoir at Lakatamia including pumping stations and balancing reservoirs.
- Larnaca storage tank.
- Two rural water supply schemes.

The second phase of the SCP will be constructed over a five year period 1988-1992.

Project Operation

The project management and operation is carried out by the Water Development Department. The staff in charge for the operation was the following:

- 1 Topographer Irrigation Engineer I
- 1 Executive Engineer I
- 1 Technical Superintendent
- 1 Senior Technician
- 2 Technicians I
- 3 Technicians II
- 19 Attendants
- 3 Foremen
- 11 Labourers

Project Hydrology

The project hydrologic data are shown on table X-32. The maximum quantity in storage in Kouris dam occurred on the 31st March with quantity 73.064 MCM of water. The minimum quantity was recorded on the 31st December 1989 with quantity was recorded on the 31st December 1989 with quantity in storage 47.676 MCM.

Water Utilization

A total quantity of 27.706 MCM was utilized as shown on table X-33 out of which 13.887 MCM were used for irrigation in Kiti, Mazotos, Alaminos, Limassol and Kokkinokhoria areas. A quantity of 3.242 MCM was given for Domestic Water Supplies and the rest 10.577 MCM were given for recharge. Apart from the quantity utilized a quantity of 3.969 MCM were given for storage to Akhna Dam.

TABLE X-33
SOUTHERN CONVEYOR PROJECT-WATER UTILIZATION

Item No.	Description	Quantity m ³
1	Water used for irrigation	13 886 858
2	Water used for DWS	3 242 514
3	Water used for recharge	10 577 371
	Total water used	27 706 743

Water Sale, Income and Expenditure

A total quantity of 13.887 MCM was sold for irrigation out of which 13.440 MCM were sold at 7 cent/m³ to Kiti-Mazotos, Alaminos and Kokkinokhoria areas and 0.153 MCM were sold to Kiti dam area at 6 cent/m³. The rest 0.294 MCM were sold at 3.5 and 4.0 cent/m³ in Limassol area.

The gross income from the sale of water amounted to £964,623. The operation expenses representing waterman wages and purchase of materials amounted to £127,578. This amount also includes maintenance cost. The net income to the project amounted to £837,045.

TABLE X-34

SOUTHERN CONVEYOR PROJECT - WATER SALE, INCOME AND EXPENDITURE

Item No	Description	Quantity m ³	Amount £
1	Water sold to Limassol area	293 489	10 870
2	Water sold to Kiti, Alaminos and Mazotos area	578 799	40 516
3	Water sold to Kiti dam area	153 050	9 183
4	Water sold to Kokkinokhoria area	12 861 520	904 054
5	Total water sold and gross income	13 886 858	964 623
6	Operation and maintenance costs	--	127 578
7	Net Income	--	837 045

Project Performance for the last two years

The project operation data for the last two years are shown on table X-35. The water available for 1989 was increased by 12% and the water used by 261% compared by 12% and the water used by 261% compared to the 1988 figures.

TABLE X-35

SOUTHERN CONVEYOR PROJECT-DATA ON OPERATION FOR THE LAST TWO YEARS

Item No	Description	Unit	1988	1989	% change on 1988
1.	Storage Capacity	MCM	115.000	115.000	Nil
2.	Water available	"	72.106	80.941	+12.2
3.	Water sold	"	3.442	13.887	+303.4
4.	Water used for DWS	"	Nil	3.242	-
5.	Water used for recharge	"	13.766	10.577	-23.2
6.	Total water used	"	17.208	27.706	+261.0
7.	Gross Income	£	274 550	964 623	+251.3
8.	Operation cost	"	34 070	127 578	+274.4
9.	Maintenance cost	"	Nil	Nil	Nil
10.	Total costs	"	34 070	127 578	+274.4
11.	Net Income	"	240 480	837 045	+248.1

YERMASOYIA - POLEMIDHIA PROJECT

The Yermasoyia-Polemidthia Project consists of two earthen type embankment dams, the Yermasoyia dam with capacity 13.5 MCM and the Polemidhia dam with capacity 3.43 MCM and a distribution system made of closed conduits commanding an area of 2066 hectares in the Zakaki, Phasouri, Akrounda and Phinikaria, Ypsonas, Trakhoni and Kolossi areas and Yermasoyia and Polemidhia Irrigation Divisions. The project started operation since the year 1968. To supplement the area with water the Kouris and Garrylis boreholes were developed during the years 1983 and 1986 respectively.

Project Operation

The project management and operation is carried out by the Waterworks Committee chaired the Limassol District Officer. The Operation and Maintenance of the project is carried out by the following staff.

Operation

- 1 Manager
- 12 Watermen/attendants
- 3 Clerks

Maintenance

- 1 Senior Technician
- 1 Technician II
- 2 Foremen
- 1 Driver
- 6 Labourers

Project Hydrology

The Project hydrologic data as recorded during the year under review are shown on tables X-36 and X-37. Overflow occurred for Yermasoyia dam during the period January 11th to January 22nd and March 19th to April 11th and for Polemidhia January 12th to April 3rd. The minimum quantity in storage ever occurred during the irrigation period was recorded for Yermasoyia dam on the 16th December and for Polemidhia dam on the 21st December 1989.

Water Resources and System Efficiency

A total quantity of 14.197 MCM was developed from the project as shown on tables X-36. Out of this quantity, 12.842 MCM were used and the rest 1.355 MCM were lost in the pipe system or as watermeter discrepancies. The system efficiency is 81% taken into consideration the water released and the water used for irrigation from both dams.

Water Utilization and Crops Irrigated

A total quantity of 12.842 MCM was used as shown on table X-38. Out of this, 6.935 were used for recharge of Yermasoyia aquifer (then pumped for DWS) and Kouris and West Limassol aquifers, and the rest 5.907 MCM were used for irrigation of 2066 Hectars of land planted with various crops as shown on Annex 1.

TABLE X-36
YERMASOYIA DAM - HYDROLOGY 1989

STOR. CAPACITY 13500000 M3

MONTH	STORAGE BEG. OF MONTH	VOL. CHANGE DURING MONTH	EVAPOR- ATION	REL. FOR IRRIGAT.	REL. FOR D.W.S.	REL. FOR RECHARGE	TOTAL RELEASES	TOTAL OUT	EST. INFLOW	MEASURED INFLOW
	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
JANUARY	7420000	4724000	35260	165820	0	823730	989550	1024810	5748810	12145000
FEBRUAR	12144000	1356000	48961	0	958410	958410	1007371	2363371	2158000	
MARCH	13500000	0	74042	732020	0	732020	806062	806062	1865000	
APRIL	13500000	-139000	138834	699480	0	699480	838314	699314	996000	
MAY	13361000	-1131000	199925	912500	0	371890	1284390	1484315	353315	476000
JUNE	12230000	-1579000	195479	843640	0	681640	1525280	1720759	141759	152000
JULY	10651000	-1412000	193541	413210	0	813030	1226240	1419781	7781	45000
AUGUST	9239000	-1783000	145801	786340	0	787420	1573760	1719561	-63439	25000
SEPTEM.	7456000	-1432000	92607	482430	0	786740	1269170	1361777	-70223	25000
OCTOBER	6024000	-1138000	54078	220870	0	788260	1009130	1063208	-74792	
NOVEM.	4886000	-559000	26093	59250	0	477740	536990	563083	4083	
DECEM.	4327000	-222000	13453	15210	0	445770	460980	474433	252433	300000 *
TOTALS		-3315000	1218074	5330770	0	6934630	12265400	13483474	10168474	18187000
% to stor.capacity		9.0	39.5	0.0	51.4	90.9	99.9	75.3	134.7	

* Estimated

TABLE X-37

POLEMIDHIA DAM - HYDROLOGY 1989

STOR. CAPACITY 3.400 MCM

MONTH	STORAGE VOL. CHANGE BEG. OF MONTH	DURING MONTH	EVAPOR- ATION	REL. FOR IRRIGAT.	REL. FOR RECHARGE	TOTAL RELEASES	TOTAL OUT	EST. INFLOW -SEEPAGE -OVERFLOW	MEASURED SEEPAGE	MEASURED INFLOW
	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
JANUARY	1743000	1652000	12798	42928	0	42928	68945	1720945	13219	3458000
FEBRUARY	3395000	5000	13501	2841	0	2841	16342	21342		572000
MARCH	3400000	0	19806	0	0	0	19806	19806		400000
APRIL	3400000	-156000	33388	9740	0	9740	224568	68568	181440	170000
MAY	3244000	-229000	50640	34399	0	34399	236904	7904	151865	76000
JUNE	3015000	-286000	50262	139258	0	139258	300458	14458	110938	46000
JULY	2729000	-547000	51029	525623	0	525623	671467	124467	94815	36000
AUGUST	2182000	-240000	37440	172467	0	172467	282760	42760	72853	35000
SEPTEMBER	1942000	-411000	25877	446968	0	446968	520279	109279	47434	41000
OCTOBER	1531000	-258000	14224	274356	0	274356	319917	61917	31337	62000 *
NOVEMBER	1273000	-140000	7340	201138	0	201138	229473	89473	20995	89000 *
DECEMBER	1133000	-39000	5022	81583	0	81583	104282	65282	17677	65000 *
TOTALS		-649000	321327	1931301	0	1931301	2995201	2346201	742573	5050000
%		9.5	56.8	56.8	88.1	56.8	69.0	21.8	148.5	

* Estimated inflow

TABLE X-38
YERMASOYIA-POLEMIDHIA PROJECT - WATER UTILIZATION

Item No	Description	Quantity m ³
1	Water used for irrigation	5 907 180
2	Water used for recharge	6 934 630
3	Water used for D.W.S	Nil
	Total water used	12 841 810

Water Sale, Income and Expenditure

From the quantity of 5.907 MCM of water used for irrigation 0.905 MCM were given free of charge to Yermasoyia and Polemidhia Irrigation Divisions, and the rest 5.002 MCM were sold to the farmers at the nominal rates 4.0 cent/m³ to the farmers and 3.5 cent/m³ to I/Ds. From the sale of water an amount of £188,011 was received. The operation maintenance and power expenses amounted to £140,939. The net income to the project was £47,072 as shown on table X-39 below.

TABLE X-39
YERMASOYIA - POLEMIDHIA PROJECT - WATER SALE
INCOME AND EXPENDITURE

Item No.	Description	Quantity m ³	Amount £
1	Water sold at the nominal rates	5 002 568	188 011
2	Water given free of charge as water rights to:		
	- Yermasoyia Irrig. Division	580 943	Nil
	- Polemidhia Irrig. Division	323 669	Nil
3	Total quantity used for irrigation/income	5 907 180	188 011
4	Operation cost	--	91 628
5	Power cost	--	22 611
6	Maintenance cost	--	26 700
7	Total costs	--	140 939
8	Net Income	--	47 072

Maintenance Details

The following maintenance works were carried out during the year under review:

- Cleaning of embankments of dams from wild vegetation
- Dams routine Maintenance
- Repairs of main water meters
- Maintenance and repair of sluice valves, flow regulators, air valves, water meters, float valves and washouts.
- Improvements to outlets.
- Maintenance and cleaning of manholes.
- Painting of metal works.
- Repairs to pipe breakages.

Project Operation data for the last two years

Table X-40 gives data regarding operation for the last two years. Last column shows the percentage variation of the 1989 data with respect to 1988 figures. In 1989 there wasn't any use of water for DWS where as the water used for recharge was increased.

TABLE X-40

YERMASOYIA - POLEMIDHIA PROJECT - DATA ON PROJECT FOR THE LAST TWO YEARS

Ser. No.	Description	Unit	1988	1989	% change on 1988
1	Capacity.....	MCM	16.930	16.930	Nil
2	Water available	"	24.391	19.395	-20.5
3	Water utilized for irrig.	"	5.185	5.907	+13.9
4	Water sold.....	"	4.333	5.002	+15.4
5	Water given free	"	0.852	0.905	+ 6.2
6	Water used for recharge .	"	5.817	6.935	+19.2
7	Water used for DWS	"	2.895	Nil	-
8	Total quantity used	"	13.896	12.842	-7.6
9	Gross income	£	163 974	188 011	-14.6
10	Operation cost	"	86 036	91 628	+6.5
11	Power cost	"	19 157	22 611	+18.0
12	Maintenance cost	"	25 950	26 700	+ 2.9
13	Total expenditure	"	131 143	140 939	+7.5
14	Net income	"	32 831	47 072	+ 7.5
15	Area irrigated	"	2 066	2 066	Nil

VASILIKOS-PENDASKINOS PROJECT

The purpose of the Vasilikos-Pendaskinos project is the development of surface and ground water resources from the Vasilikos, Pendaskinos and Maroni rivers both for the agricultural development of the area and the augmentation of the domestic water supply of Nicosia, Larnaca and Famagusta districts.

The project consists of the following:

- Kalavastos dam of rockfill type embankment and reservoir capacity 17.1 MCM.
- Dhypotamos dam of rockfill type embankment and reservoir capacity 13.7 MCM.
- Lefkara dam of rockfill type embankment and reservoir capacity 13.85 MCM.
- Maroni Diversion to divert a portion of the Maroni river flow to a point upstream of Dhypotamos dam.
- Maroni irrigation scheme which comprises an irrigation network covering about 233 hectares in the delta area of Maroni river.
- Vasilikos irrigation scheme which comprises a main conveyor from Kalavastos dam, break pressure tank and pipeline networks covering an area of about 838 hectares.

- Pendaskinos irrigation scheme which comprises an irrigation network covering about 372 hectares in the Pendaskinos area and delta area is served by the Dhypotamos dam and existing boreholes.
- A distribution system in Lefkara village for the supply of water to an area of 824 decars is served by Lefkara dam.
- Kalavastos-Khirokitia pipeline, with Tokhni pumping station, which is the main conveyor for water from Kalavastos dam to the Khirokitia treatment plant and of irrigation water to the Vasilikos irrigation area.
- Nicosia Water Supply Scheme.
The project as a whole started operation in 1985.

This part of the report will deal only with details about water utilization for irrigation where details regarding domestic water supply will be given in a separate section under the heading of Domestic Water Supply.

Project Operation

The project management and operation is the responsibility of the WDD. The following staff is in charge for the project Operation and Maintenance.

- 1 Irrigation Engineer I
- 1 Technical Superintendent
- 2 Technicians
- 6 Attendants
- 5 Labourers
- 1 Housekeeper

Project Hydrology

The project Hydrologic data are shown on tables X-41, X-42 and X-43. The water in Kalavastos dam reached the spillway crest on the 21st February and overflow continued until the 12th April 1989. The minimum quantity in storage was recorded on the 15th Decemeber 1989 with quantity 10.450 MCM of water. The maximum quantities in storage were 9.987 MCM in Dhypotamos dam on the 5th April and 6.223 MCM in Lefkara dam on the 20th April 1989. The minimum quantities in storage were 5.855 MCM of water in Dhypotamos dam on the 27th December and 2.672 MCM of water in Lefkara dam on the 31st December 1989.

Water Resources and System Efficiency

A total of 15.641 MCM were released from the three dams 7.21 MCM from Kalavastos, 5.220 MCM from Dhypotamos and 3.202 MCM from Lefkara dam. From the total quantity released, 12.166 MCM were given for DWS and the rest 3.475 MCM were given for irrigation. Of the quantity given for irrigation, 3.290 MCM were utilized. The rest were either lost in the pipe system or in water meters discrepancies. The system efficiency cannot be calculated since large discrepancies of main and individual water meters readings, were recorded.

TABLE X - 41
KALAVASOS DAM - HYDROLOGY 1989

STOR. CAPACITY 17.100 MCM

MONTH	STORAGE BEG. OF MONTH	VOL. CHANGE DURING MONTH	EVAPOR- ATION	REL. FOR IRRIG.	REL. FOR D.W.S.	REL. FOR RECH.	TOTAL RELEASES	TOTAL OUT	EST. INFLOW -SEEPAGE -OVERFLOW	MEASURED INFLOW
	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
JANUARY	9284000	6816000	31685	45700	196293	0	241993	273678	7089678	6441000
FEBRUARY	16100000	1000000	42369	80700	0	0	80700	123069	1123069	1565000
MARCH	17100000	0	64220	139400	0	0	139400	203620	203620	1406000
APRIL	17100000	-283000	135554	279300	558327	0	837627	973181	690181	717000
MAY	16817000	-903000	187683	372000	710218	0	1082218	1269901	366901	224000
JUNE	15914000	-1170000	181256	410300	776032	0	1186332	1367588	197588	46000
JULY	14744000	-1344000	183685	372300	866110	0	1238410	1422095	78095	6000
AUGUST	13400000	-1432000	154790	346000	946205	0	1292205	1446995	14995	2000
SEPTEMBER	11968000	-993000	108299	226700	595073	0	821773	930072		2000
OCTOBER	10975000	-343000	63705	172700	0	0	172700	236405		
NOVEMBER	10632000	-140000	37529	77390	0	0	77390	114919		
DECEMBER	10492000	-28000	24630	47800	0	0	47800	72430	44430	50000*
TOTALS		1180000	1215405	2570290	4648258	0	7218548	8433953	9808557	10459000
% to stor.capacity		7.1	15.0	27.2	42.2	49.3	57.4	61.2		

* Estimated

TABLE X-42
 DHYPOTAMOS DAM - HYDROLOGY 1989

STOR. CAPACITY 13.700 MCM

MONTH	STORAGE BEG. OF MONTH	VOL. CHANGE DURING MONTH	EVAPOR- ATION	REL. FOR IRRIGAT.	REL. FOR D.W.S.	REL. FOR RELEASES	TOTAL OUT	EST. INFLOW -SEEPAGE	MARONI INFLOW	MEASURED INFLOW U/S
	m3	m3	m3	m3	m3	m3	m3	m3	m3	
JANUARY	4560000	4660000	15906	60	354280	354340	370246	5030246	1389240	4186000
FEBRUARY	9220000	532000	25550	3620	441200	444820	470370	1002370	317710	645000
MARCH	9752000	228000	45676	8570	543510	552080	597756	825756	329100	373000
APRIL	9980000	-464000	79293	46730	666190	712920	792213	328213	166700	177000
MAY	9516000	-851000	96900	72270	730350	802620	899520	48520	3920	80000
JUNE	8665000	-849000	123247	92370	741540	833910	957157	108157	0	20000
JULY	7816000	-946000	160601	108330	784940	893270	1053871	107871	0	3000
AUGUST	6870000	-284000	103637	122690	42000	164690	268327	0	0	0
SEPTEMBER	6586000	-420000	73219	126520	135750	262270	335489	0	0	0
OCTOBER	6166000	-208000	42913	88120	60620	148740	191653	0	0	
NOVEMBER	5958000	-57000	27868	38350	5500	43850	71718	14718	0	15000*
DECEMBER	5901000	-11000	14746	6980	0	6980	21726	10726	0	11000*
TOTALS		1330000	809556	714610	4505880	5220490	6030046	7476577	2206670	5510000
% TO MAX. STORAGE			8.1	7.2	45.1	52.3	60.4	74.9	22.1	75.9
% TO STOR. CAPACITY			5.9	5.2	32.9	38.1	44.0	54.6	16.1	40.2

* Estimated inflow

TABLE X-43
LEFKARA DAM - HYDROLOGY 1989
STOR. CAPACITY 13.800 MCM

MONTH	STORAGE BEG. OF MONTH	VOL. CHANGE DURING MONTH	EVAPOR- ATION	REL. FOR IRRIGAT.	REL. FOR D.W.S.	TOTAL RELEASES	TOTAL OUT	EST. INFLOW MEASURED	-SEEPAGE LEAKAGES
	m3	m3	m3	m3	m3	m3	m3	m3	m3
JANUARY	2042000	3658000	7569	0	81820	81820	91800	3749800	2411
FEBRUARY	5700000	347000	12332	0	0	0	14509	361509	2177
MARCH	6047000	148000	19310	0	0	0	21721	169721	2411
APRIL	6195000	15000	39076	16470	0	16470	57879	72879	2333
MAY	6210000	-60000	49977	22011	0	22011	74399	14399	2411
JUNE	6150000	-100000	67181	26011	0	26011	95784	0	2592
JULY	6050000	-213000	93446	35670	47020	82690	178547	0	2411
AUGUST	5837000	-684000	59623	39671	662600	702271	764305	80305	2411
SEPTEMBER	5153000	-714000	39735	30593	593140	623733	665542	0	2074
OCTOBER	4439000	-696000	22022	22592	563610	586202	610099	0	1875
NOVEMBER	3743000	-618000	12000	8954	530950	539904	553978	0	2074
DECEMBER	3125000	-451000	8000	8260	533360	541620	551512	100512	1892
TOTALS		632000	430271	210232	3012500	3222732	3680075	4549125	27072
% to max. storage		6.9	3.4	48.4	51.8	59.1	73.1	0.4	
% to stor. capacity		3.1	1.5	21.8	23.3	26.6	32.8	0.2	

Water Utilization and Crops Irrigated

A total quantity of 15.456 MCM was utilized out of which 12.166 MCM for Domestic Water Supply. The rest 3.290 MCM were used irrigation of 689 hectares of land planted with various crops as shown on annex 1. Irrigation in the project area started in January and continued throughout the year until December 1989.

Water Sale, Income and Expenditure

A total quantity of 3.290 MCM was sold. Out of this 3.190 MCM were sold for irrigation at 4.5 cent/m³ to Maroni, Zygi and Skarinou areas 3.0 cent/m³ to Ayios Theodoros and Kalavassos areas and 4.0 cent/m³ for the water used in Lefkara area. The rest 0.100 MCM were sold for industrial use at 17.0 cent/m³. The gross income amounted to £161,224. The total expenditure including dam and distribution system maintenance, wages and purchase of materials amounted to £84,060. The net income to the project amounted to £77,164.

TABLE X-44

VASILIKOS-PENDASKINOS PROJECT - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m ³	Amount £
1	Water sold for irrigation	3 190 408	144 268
2	Water sold for industrial use	99 741	16 956
3	Total water sold and gross income	3 290 149	161 224
4	Operation cost	--	46 230
5	Maintenance cost	--	37 830
6	Total expenditure	--	84 060
7	Net income	--	77 164

Maintenance Details

During the year under review the following maintenance works were carried out:

- Painting of pipes and valves
- Cleaning of embankments
- Cleaning of drainage ditch channels
- Maintenance of the guard houses.
- Maintenance and cleaning of break pressure tanks.
- Maintenance and cleaning of hydrants.
- Maintenance and cleaning of Maroni diversion weir.

Project Performance for the last two years

Table X-45 shows project operation data for the last two years. Last column shows the percentage changes of data for the year under review over those of the previous year. The water available in storage was increased by 22.5%. The water sold, the gross income as well as the expenses were increased significantly.

TABLE X-45
VASILIKOS-PENDASKINOS PROJECT - DATA ON PROJECT FOR THE LAST
TWO YEARS

Ser. No.	Description	Unit	1988	1989	% change on 1988
1	Capacity	MCM	44.650	44.650	Nil
2	Water available	"	28.782	35.255	+ 22.5
3	Water sold	"	2.630	3.290	+25.1
4	Water used DWS	"	11.175	12.166	+ 8.9
5	Total water used	"	13.805	15.456	+12.0
6	Gross income	£	159 121	161 224	+ 1.3
7	Operation cost	"	40 940	46 230	+12.9
8	Maintenance cost	"	37 080	37 830	- 2.0
9	Total expenses	"	78 020	84 060	+ 7.0
10	Net income	"	81 101	77 164	-4.8
11	Area irrigated	Hectares	630	688.6	+ 9.3

XYLIATOS DAM

The Xyliatos dam was constructed within the Pitsilia Integrated Rural Development Project. The project consists of a rockfill type dam with a reservoir capacity at spillway crest. 1.220 MCM of water and a closed type distribution system commanding an area of 3,082 decars in Xyliatos and Ayia Marina village. The project commenced operation since the year 1983.

Project Operation

The project operation is with the Director of WDD. A dam attendant is responsible for the dam monitoring and collecting of water charges.

Project Hydrology

The project hydrologic data as recorded for 1989 are tabulated on table X-46. The dam reservoir was filled upto the spillway crest on the 1st January and overflow continued until the 9th April 1989. The minimum quantity in storage during the irrigation period was recorded on the 28th December 1989 with quantity 534,000 m³ of water.

Water Resources and System Efficiency

The water available for utilization was 1.342 MCM. A quantity of 808,600 m³ was released for irrigation, out of which 561,480 m³ were used and the rest 247,120 m³ were lost in the pipe system. The system efficiency is around 69%.

Water Utilization and Crops Irrigated

A total quantity of 561,480 m³ was utilized. Out of this quantity, 529,676 m³ were used for irrigation of 1,338 decars of land planted with various crops as shown on annex 1. The rest of 31,804 m³ was used for livestock consumption.

TABLE X-46
XYLIATOS DAM - HYDROLOGY 1989

MONTH	STORAGE		VOL. CHANGE		EVAPOR- REL. FOR		TOTAL		MONTHLY		TOTAL		MEASURED		EST. INFLOW	
	BEG. OF MONTH	m3	DURING MONTH	m3	ATION	IRRIGAT.	RELEASES	% OF	RELEASES	RELEASES	OUT	INFLOW	U/S	LEAKAGES	-SEEPAGE	-OVERFLOW
	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
JANUARY	1220000	0	1895	25690	25690	3.2	34885	2649000	7300	34885 *						
FEBRUARY	1220000	0	2920	11040	11040	1.4	21183	314000	7223	21183 *						
MARCH	1220000	0	5221	41750	41750	5.2	53995	360000	7024	53995 *						
APRIL	1220000	-33000	11153	110110	110110	13.6	128028	124000	6765	95028 *						
MAY	1187000	-107000	12449	108980	108980	13.5	128393	47000	6964	21393						
JUNE	1080000	-90000	15569	89410	89410	11.1	111459	15000	6480	21459						
JULY	990000	-129000	17156	113120	113120	14.0	137093	5000	6817	8093						
AUGUST	861000	-133000	12419	120930	120930	15.0	139311	4000	5962	6311						
SEPTEMBER	728000	-107000	8055	99100	99100	12.3	111786	0	4631	4786						
OCTOBER	621000	-60600	4267	50560	50560	6.3	58879	0	4052	-1721						
NOVEMBER	560400		2121	26160	26160	3.2	31651	28858	3370	9251						
DECEMBER	538000		1227	11750	11750	1.5	16874	46570	3897	12374						
TOTALS		-659600	94452	808600	808600		973537	3593428	70485	287037						
% to stor.capacity			7.7	66.3	66.3	100.0	79.8	294.5	5.8	23.5						

Water Sale, Income and Expenditure

The water used for irrigation was sold at 4 cent/m³ and that used for livestock consumption at 13 cent/m³. The gross income from the sale of 561,480 m³ of water, amounted to £25,322. Operation expenses including attendant wages and travelling costs amounted to £4,956 and the maintenance expenses spent on routine works amounted to £3,069 of the net income to the project was £17,297.

TABLE X-47

XYLIATOS DAM-WATER SALE INCOME AND EXPENDITURE

Item No.	Description	Quantity m ³	Amount £
1	Water sold for irrigation	529 676	21 187
2	Water sold for livestock consumption	31 804	4 135
3	Total water sold and gross income	561 480	25 322
4	Operation cost	--	4 956
5	Maintenance cost	--	3 069
6	Total expenditure	--	8 025
7	Net income	--	17 297

Maintenance Details

The following works were carried out during the year under review:

- Repair of a washout
- Purchase of accessories for watermeters
- Replacement of sluice valves.
- Repairs of pipe breakages.
- Regrading of fields.

Project Performance for the last two year

Table X-48 shows the project operation data for the last two years. Last column shows the percentage variation of 1989 figures with respect to the previous year.

TABLE X-48

XYLIATOS DAM - DATA ON PROJECT FOR THE LAST TWO YEARS

Ser. No.	Description	Unit	1988	1989	% change on 1988
1	Capacity	MCM	1.220	1.220	Nil
2	Water available in storage	"	1.941	1.342	+30.9
3	Water sold	"	0.586	0.561	- 4.3
4	Gross income	£	24 602	25 322	+2.9
5	Operation cost	"	5 019	4 956	- 1.2
6	Maintenance cost	"	3 992	3 069	-23.1
7	Total expenditure	"	9 011	8 025	-10.9
8	Net income	"	15 591	17 297	+10.9
9	Area irrigated	Decars	2 059	1 338	-35.0

KALOPANAYIOTIS DAM

the Kalopanayiotis irrigation project consists of an earthfill type embankment dam reservoir of capacity 363,000 m³ and a distribution system made of closed conduits commanding an area of approximately 645 decars. The project commenced operation since the year 1967.

Project Operation

The project Management and Operation is carried out by the Waterworks Committee chaired by the Nicosia District Officer. A dam attendant is responsible for the dam monitoring and collecting of water charges.

Project Hydrology

The project hydrologic data as recorded during the year 1989 are shown on table X-49. Overflow started on the 7th May and continued until 16th June 1989. The minimum quantity in storage during the irrigation period occurred on the 1st December with quantity in storage around 27,000 m³.

Water Resources and System Efficiency

The water released from dam was not measured, so the system efficiency could not be calculated.

Water Utilization and Crops Irrigated

A total quantity of 247,586 m³ of water was used for irrigation of 562 decars of land planted with various crops as shown on annex 1. Irrigation in the project area started early in May and continued throughout the year until late in October 1989.

Water Sale, Income and Expenditure

A quantity of 247,586 m³ of water was sold at 4 cent/m³ and used for irrigation. The income from the sale of water amounted to £9,903. The operation expenses including attendant wages and travelling costs amounted to £4,045 whereas the maintenance expenses spent on routine works and emergency repairs amounted to £4,045. The net income to the project amounted to £1,813.

TABLE X-50 - KALOPANAYIOTIS DAM - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m ³	Amount £
1	Water sold and gross income ..	247 586	9 903
2	Operation cost	-	4 045
3	Maintenance cost	-	4 045
4	Total expenses	-	8 090
5	Net Income	-	1 813

Maintenance Details

The following maintenance works were carried out during the year under review.

- Repairs to pipe breakages
- Repair of main sluice valve
- Repair of a Float valve of one of the Break Pressure Tanks

TABLE X-49
KALOPANAYIOTIS DAM - HYDROLOGY 1989

MONTH	STORAGE BEG.OF MONTH	VOL.CHANGE DURING MONTH	EVAPOR- ATION	REL.FOR IRRIGAT.	TOTAL RELEASES	TOTAL OUT	ESTIMATED INFLOW -SEEPAGE -OVERFLOW
	m3	m3	m3	m3	m3	m3	m3
JANUARY	0	0	0	0	0	0	0
FEBRUARY	0	0	0	0	0	0	0
MARCH	0	0	0	0	0	0	0
APRIL	210000	140000	4400	0	0	4400	144400
MAY	350000	13000	6500	56800	56800	63300	76300
JUNE	363000	-61000	7500	56811	56811	64311	3311
JULY	302000	-102000	7600	45252	45252	52852	-49148
AUGUST	200000	-100000	5600	45252	45252	50852	-49148
SEPTEMBER	100000	-40000	3100	21771	21771	24871	-15129
OCTOBER	60000	-11000	1500	21700	21700	23200	12200
NOVEMBER	49000	-22000	600	0	0	600	-21400
DECEMBER	27000	-27000	230	0	0	230	-26770
TOTALS		-179000	37030	247586	247586	284616	
% to stor.capacity			10.2	68.2	68.2	78.4	

- Repair of a washout and replacement of a sluice valve.
- Disilting of the collector weir
- Painting of manhole covers

Project Performance for the last two years.

Table X-51 shows the project operation data for the last two years. Last column shows the percentage variation of the 1989's data over those of the previous year.

TABLE X-51 - KALOPANAYIOTIS DAM - DATA ON PROJECT FOR THE LAST TWO YEARS.

Item No.	Description	Unit	1988	1989	% change on 1988
1	Capacity	MCM	0.363	0.363	NIL
2	Water available in storage	"	0.861	0.363	-42.0
3	Water sold for irrigation	"	0.210	0.248	+18.0
4	Gross Income	£	8 391	9 903	+18.0
5	Operation cost	"	4 045	4 045	Nil
6	Maintenance cost	"	4 618	4 045	-12.4
7	Total expenses	"	8 663	8 090	-6.6
8	Net Income	"	-272	1 813	-
9	Area Irrigated	Decars	562	562	NIL

KITI DAM

The Kiti dam irrigation project consists of zoned earthfill type embankment dam reservoir of storage capacity 1.610MCM and a distribution system made of open canals commanding an area of approximately 830 hectares of land in the Kiti, Perivolia and Tersefanou villages. The project commenced operation since the year 1968.

Project Operation

Project Management and Operation is carried out by the waterworks Committee chaired by the Larnaca District Officer. A part time waterman is in charge for collecting of water charges.

Project Hydrology

The water in the dam reservoir reached the spillway crest on the 15th January and overflow continued until the 19th January 1989. On the 5th May the dam was dry.

Water Resources and System Efficiency

The quantity released for irrigation from Kiti dam could not be measured. The quantity used was 90,640 m³. To supplement irrigation during the months May-December a quantity of 398,111 m³ was released from Kouris dam. Out of this only 153,050 m³ were used where as the rest were lost in the canal system.

Water Utilization and Crops Irrigated

A total quantity of 243,690m³ were used for irrigation of 41 hectares of land planted with various crops as shown on Annex 1. Irrigation in the project area started in April and continued throughout the year until December, 1989.

Water Sale, Income and Expenditure

A quantity of 90,640 m³ was sold to the farmers at 3.0 cent/m³ and the income amounted to £2719. The income from the sale of the quantity of 153,050 m³ from Kouris dam is referred in the section on the SCP. This quantity was bought at 6 cent/m³ from SCP and sold to the farmers at 7 cent/m³. The difference of 1 cent/m³ was accounted to the gross income of Kiti dam. The operation cost including waterman wages amounted to £2816. The maintenance cost amounted to £2523. An annual deficit of £1090 was observed.

TABLE X-52 - KITI DAM - WATER SALE, INCOME AND EXPENDITURE

Item No.	Description	Quantity m ³	Amount £
1	Water sold from dam	90 640	2 719
2	Water sold from SCP	153 050	1 530(See SCP)
3	Total water used for irrigation and gross income ..	243 690	4 249
4	Operation cost	-	2 816
5	Maintenance cost	-	2 523
6	Total costs	-	5 339
7	Net income	-	- 1 090

Maintenance Details

The following works were carried out during the year under review:

- Replacement of the cylinder and the piston of the hydraulic system of the penstock.
- Cleaning of the canal system.

ATHALASSA PROJECT

The Athalassa Project consists of a storage dam built, to prevent flooding of the Athalassa Government Farm and for supplying water for the needs of the Government farm in the area. The dam at spillway crest has a capacity of 0.79 MCM and the distribution system commands an area of 415 decars belonging to the Agriculture Research Institute and the Department of Agriculture Farm. The distribution system is made of pipelines. The project is operated by the Department of Agriculture Farm in the area. During the year under review a total quantity of 72,000 m³ was collected in the dam reservoir.

KHA-POTAMI PROJECT

The Kha-Potami Irrigation project consists of a diversion Weir and a diversion pipeline capable of diverting a flow of 500 CM/Hour where the Kha-Potami river is flowing in the months January-June.

The Project is supplying water in bulk during the winter, spring and early summer months, to the Pissouri and Alekhtora Irrigation Divisions. The area commanded by both Irrigation Divisions is around 567 hectares, 402 hectares in the Pissouri Irrigation Division and 165 hectares in the Alekhtora Irrigation Division. In both cases the area to be irrigated is planted tottaly with vines.

Based on the existing water resources for each of the two irrigation divisions having in mind the area served by each irrigation division, the water is allocated as follows:

- If the works divert only 225m³/hr the water will be given in total to the Pissouri Irrigation Division.

- If the works divert more than 225m³/hr but less than 325m³/hr the 225m³/hr will be diverted to the Pissouri Irrigation Division and the remaining to the Alekhtora Irrigation Division.

- If the works divert a flow of more than 325m³/hr then the water will be allocated as follows:

- . 225m³/hr to Pissouri Irrigation Division
- . 200m³/hr to Alekhtora Irrigation Division
- . The remaining flow will be divided between the two irrigation divisions at a ratio of 3:1 (3 parts to the Pissouri irrigation division and 1 part to the Alekhtora irrigation division).

The project started operation in the year 1979.

Project Operation

The project management and operation is carried out by the Irrigation Division Committees chaired by the Limassol District Officer after an agreement has been made between the Government and the Committees according to which a rent of £2000 annually is paid to the Government.

Water Utilization and Crops Irrigated

A total quantity of 1.385 MCM was utilized for the supplementary irrigation of 567 hectares of land planted with vines. Out of the total quantity used 0.927 MCM m³ were used by the Pissouri irrigation Division and 0.458 MCM^M were used by the Alekhtora Irrigation Division.

EVDIMOU-PARAMALI PROJECT

The Evidimou-Paramali project includes three diversion weirs on Evidimou, Farkonias and Kryos rivers, conveyance pipelines and storage tanks. The Kryos diversion diverts the river flow to a point upstream of Farconias diversion weir. The conveyance pipelines of Evidimou and Farkonias diversion weirs are connected to each other so that water from Farkonias river is diverted to Evidimou. The project is supplying water in bulk during the winter, spring and early summer months, to Evidimou and Paramali irrigation Divisions. The area commanded by both Irrigation Divisions is around 530 hectares, 309 hectares in the Evidimou irrigation Division and 221 hectares in Paramali Irrigation Division. The project started operation in 1987.

Project Operation

The project management and operation is carried out by both the Water Development Department and the irrigation Division Committees. The responsibility of the WDD is for the Diversion weirs and parts of the conveyance pipelines while the responsibility of the Committees is the distribution systems.

A part time attendant/waterman is in charge for operating the Diversion Weirs and parts of the conveyance pipelines.

Water Utilization and Crops Irrigated.

A total quantity of 481,810 m³ of water was used for irrigation, 356,494 m³ by the Evdimou I/D and 125,316 m³ by the Paramali I/D. The water was used for the irrigation of land planted mainly with vines, citrus and cereals.

Water Sale, Income and Expenditure

A total quantity of 481,810 m³ of water was sold in bulk at 3 cent/m³ to both Irrigation Divisions. The gross income from the sale of water amounted to £14,454. The Operation and Maintenance expenses amounted to £4,000. The net income to the project amounted to £10,454.

XI LARNACA-FAMAGUSTA REGIONAL OFFICE

by
D.M. Patsalides
Senior Water Engineer
Head of the Regional Office

General

The Larnaca/Famagusta Regional Office is generally responsible, with certain exceptions, for the activities of the Department within the Districts of Larnaca and Famagusta. These activities are broadly classified as follows :

- Water Resources and Hydrology : Groups together all services for surface and groundwater data, measurements, studies and control of ground water extraction.
- Investigations and Design : Deals with the detail design of rural irrigation and domestic water supply projects.
- Construction of works : Deals with the construction of rural irrigation, domestic water supply and small dams.
- Operations and Maintenance : Deals with the control, operation and maintenance of rural water supply schemes and irrigation works.
- Special studies in connection with the implementation of major projects in the area i.e. Southern Conveyor Project etc.

The Larnaca/Famagusta Regional Office was manned by the following staff at the end of the year under review :

1 Senior Water Engineer, Head of the Regional Office
2 Executive Engineers I
1 Technical Superintendent
2 Senior Technicians
4 Technicians I
10 Technicians II
3 Foremen
3 Technicians (hourly)
1 Secretary-Typist

HYDROLOGY AND WATER RESOURCES

Ground Water Hydrology

The ground water conditions of the Larnaca and Famagusta Districts were observed by means of 516 wells/boreholes.

The water level (i.e. the distance from established bench marks on the top of the observation wells/boreholes to the ground water level) of 361 of them were taken twice this year i.e. in March before the irrigation period and in December after the irrigation period.

The water level of 87 of these observation boreholes was taken every month while for 9 additional boreholes the level was taken every two months.

The water level of 59 boreholes used for village water supplies was also taken once during the whole year.

Chemical Analyses

A total number of 242 samples were taken from Government, Communal or Private boreholes/wells or springs and were sent to the Government or Departmental Laboratories for chemical analysis.

Another 412 samples taken from wells and boreholes were analysed in the Regional Office for chloride content.

Test Pumping of Boreholes

During the year the test pumping of 7 boreholes/wells for private use were carried out.

Plotting of Boreholes

During the year the plotting of wells/boreholes in Larnaca/Famagusta Hydrological Area continued and the total number of wells/boreholes plotted was 595.

Questioning

the annual questionnaire was carried out in the area where the plotting was completed. A total number of 10 969 cases were carried out.

Village Water Supplies

The water supply of each village in both Districts was checked during the year (i.e. the flow of springs and boreholes used by each village was measured and samples were sent to the Government Laboratory for chemical analysis).

Quarries

A total number of 58 applications for quarries which were sent to the District Office by the Department of Mines were examined on the spot and returned to the above Department with the comments of this office.

Wells Sinking Permits

A total number of 567 applications for sinking, covering permits and the change

of conditions of permits of wells/boreholes were examined in the two Districts and were presented to the General Advisory Committee of wells/boreholes of the Ministry of Agriculture and Natural Resources. Some 405 applications are of cases lying in the water conservation areas and another 162 in the non-conservation area.

Apart from the above applications 334 cases dealing with wells/boreholes were also examined direct from the District Office of the WDD Larnaca/Famagusta and were submitted to the District Officers of the two Districts.

The above applications concerned cases for the renewal of leased agreements of wells/boreholes drilled on Government or Forest Land, or cases of cleaning or deepening of existing wells/boreholes. From the above 178 cases were approved, 3 were not and 153 were for the check of the conditions of permits or returned to the District Officers for further examination.

Water Supply (Special Measures) Law 32/64

The control of the aquifers or Ormidhia, Xylophaghos and Xylymbou under the Special Measures (Water Supply) Law 32/64 was continued and the District Officer in concurrence with the Water Development Department and the Department of Agriculture investigated a total number of 2 065 boreholes/wells.

In the above area, 60 applications for new boreholes/or covering permits were examined. Some 45 of them were approved and another 15 were rejected.

INVESTIGATION AND DESIGN

Investigations

During 1989 the following investigations were carried out.

LARNACA DISTRICT

Anglisidhes : (a) Investigation for the solution of water supply problems (b) Investigation for the solution of the temporary irrigation division problems.

Aradhippou : (a) Investigation for the irrigation of grass on the new highway Nicosia-Larnaca (b) Investigation for the solution of water supply problems. (c) Investigation for the expansion of part of the village water supply network.

Anaphotia : (a) Investigation for the solution of water supply problems (b) Investigation for the solution of the temporary irrigation division problems.

Athienou : (a) Investigation for the solution of water supply problems.

Alaminos : (a) Investigation for improvement of Government Borehole 151/83 for irrigation purposes (b) Investigation for the relocation of part of the village water supply pipeline which passes through private land (c) Investigation for the solution of water supply problems.

Alethrikō : (a) Investigation for the water supply of the proposed Stock Farming Area of the village (b) Investigation for the solution of water supply problems.

Ayios Theodoros : (a) Investigation for the solution of water supply problems. (b) Investigation for the relocation of part of the conveyance pipeline of Ayios Theodoros-Alaminos Water Supply.

Odhou "B" irrigation division (b) Investigation for the solution of irrigation division problems (c) Investigation for the inclusion of new plots in the irrigation division.

Oroklini : (a) Investigation for the solution of water supply problems (b) Investigation for the issue of certificates of approval for the division of building plots.

Ormidhia : (a) Improvement of the village water supply network (b) Investigation for the solution of water supply and stock farming problems.

Ora : (a) Investigation for the solution of water supply problems.

Pyrga : (a) Investigation for the solution of water supply problems (b) Investigation for improvement of the village water supply (c) Investigation for the relocation of part of the pipeline which passes through private land (d) Investigation for the water supply for the village division of plots (e) Investigation for the fencing of private land next to the river.

Pervolia : (a) Investigation for the solution of Faros village water supply problems (b) Investigation for the water supply to the new refugee self housing plots (Phase "E") (c) Investigation for the solution of water supply problems.

Pyla : (a) Investigation for the water supply for the village division of plots.

Pano Lefkara : (a) Investigation for the solution of water supply problems.

Psevdhas: (a) Investigation for the solution of water supply problems (b) Investigation for the fencing of private land next to the river.

Skarinou : (a) Investigation for the solution of water supply problems.

Troulli : (a) Investigation for the water supply for the village division of plots (b) Investigation for the construction of a new storage tank for the village water supply (c) Investigation for the solution of water supply problems.

Tersephanou : (a) Investigation for the solution of water supply problems.

Vavla : (a) Investigation for the solution of water supply problems.

Vavatsinia : (a) Investigation for the solution of water supply problems.

Xylophaghou: (a) Investigation for the water supply to the new refugee self housing plots (Phase "H") (b) Investigation for the solution of water supply problems (c) Investigation for relocation of part of the village water supply network scheme to the main road of the village.

Xylotymbou : (a) Investigation for the extension of part of the village water supply net work.

Zyyi : (a) Investigation for the water supply of new buildings (b) Investigation for the solution of water supply problems.

FAMAGUSTA DISTRICT

Avgorou : (a) Investigation for the water supply of the army camp guard house.

Ayia Anna : (a) Investigation for the solution of water supply problems.

Dhromolaxia : (a) Investigation for the extension of part of the village stock farming areas (b) Investigation for the solution of water supply problems (c) Investigation for the issue of certificates of approval for the division of building plots.

Delikipos : (a) Investigation for the solution of water supply problems.

Goshi : (a) Investigation for the water supply of the army camp guardhouse.

Kophinou : (a) Investigation for the solution of water supply problems (b) Study for the construction of the sewage scheme for the village self housing estate (c) Investigation for improvement of Government Borehole 52/83 for irrigation purposes (d) Investigation for the relocation of part of the village water supply net work scheme to the main road of the village.

Kiti : (a) Investigation for the relocation of R C C irrigation channel which passes through the main road Kiti-Pervolia (b) Investigation for the solution of water supply problems.

Kato Dhrys : (a) Investigation for the construction of a new storage tank for the village water supply (b) Investigation for the solution of water supply problems.

Kalavassos : (a) Investigation for the solution of water supply problems (b) Investigation for the extension of part of the village water supply net work.

Klavdhia : (a) Investigation for the solution of water supply problems.

Kornos : (a) Investigation for the water supply of the village division of plots. (b) Investigation for the solution of water supply problems.

Khirokitia : (a) Investigation for the solution of water supply problems (b) Investigation for the fencing of private land.

Kato Lefkara : (a) Investigation for the solution of water supply problems.

Kellia : (a) Investigation for the solution of water supply problems (b) Investigation for the water supply of the army camp guardhouse.

Livadhia : (a) Investigation for the solution of water supply problems.

Layia : (a) Investigation for the relocation of part of the village water supply conveyance pipeline to the main road Vavla-Layia (b) Investigation for improvement of the village water supply (installation of a new sluice valve).

Mazotos : (a) Investigation for the solution of water supply problems.

Mosphiloti : (a) Investigation for the solution of water supply problems (b) Investigation for the fencing of private land.

Maroni : Investigation for the solution of water supply problems.

Meneou : (a) Investigation for the solution of water supply problems (b) Investigation for the water supply of new buildings.

Odhou : (a) Investigation for improvement of Government Borehole 21/84/85 for

Ayia Napa : (a) Investigation for the expansion of part of the village water supply net work (b) Investigation for relocation of part of the village water supply pipelines (c) Investigation for the relocation of the river bed.

Akhna Forest : (a) Investigation for the water supply to the Commercial Centre.

Liopetri : (a) Investigation for relocation of part of the village water supply net work scheme to the main road of the village (b) Investigation for the solution of water supply problems.

Sotira : (a) Investigation for the solution of water supply problems.

Phrenaros : (a) Investigation for relocation of part of the village water supply net work scheme to the main road of the village (b) Investigation for the solution of water supply problems.

Paralimni : (a) Investigation for the solution of water supply problems (b) Investigation for replacing part of the village water supply scheme to the main road Paralimni-Protaras (c) Investigation for the expansion of part of the village water supply network.

TABLE XI - 1
DESIGNS SUBMITTED TO THE DIRECTOR FOR APPROVAL

Ser No.	Village and Scheme	Est. Cost £
VILLAGE WATER SUPPLY		
<u>Larnaca District</u>		
1	Aradhippou : Expansion of part of the village water supply net work scheme	90 000
2	Ayios Theodoros : Relocation of part of the conveyance pipeline of Ayios Theodoros-Alaminos water supply	17 000
3	Goshi : Water supply of the army camp guardhouse	35 000
4	Kiti : Relo ation of R C C irrigation channel which passes through the main road Kiti-Pervolia	9 000
5	Kalavassos : Expansion of part of the village water supply net work	3 600
6	Kornos : Water supply of new division of plots	8 000
7	Ormidhia : Improvement of the village water supply	50 000
8	Pyrga : Water supply of new division of plots	4 200
9	Pervolia : Refugee self housing house to house water supply scheme	3 500
10	Pyla : Water supply of new division of plots	2 200
11	Troulli : Water supply of new division of plots	4 600

TABLE XI-1

Ser. No.	Village and Scheme	Est. Cost £
VILLAGE WATER SUPPLY (cont.)		
	Troulli : Improvement of the village water supply	18 000
12	Xylophagou : Relocation of a pipeline of the village water supply	10 000
<u>Famagusta District</u>		
1	Ayia Napa : Expansion of part of the village water supply net work	1 300
	Expansion of part of the village water supply net work ..	2 800
	Relocation of part of the village water supply pipelines	10 000
2	Liopetri : Relocation of part of the village water supply pipelines	4 500
3	Paralimni : Replacing of part of the village water supply net work to the main road	26 000
	Expansion of part of the village water supply net work ...	3 500
4	Phrenaros : Relocation of part of the village water supply pipelines	19 000
STOCK FARMING AREAS WATER SUPPLY		
<u>Larnaca District</u>		
1	Dhromolaxia : Expansion of part of the village stock farming area	2 000
	Expansion of part of the village stock farming area	1 300
IRRIGATION WORKS		
<u>Larnaca District</u>		
1	Alaminos : Improvement of Government Borehole 151/83 for irrigation division	38 500
2	Odhou : Improvement of Government Borehole 21/84/85 for Odhou B irrigation division	3 800
VARIOUS MINOR SCHEMES		
<u>Larnaca District</u>		
1	Aradhippou : Irrigation of grass on the new highway Nicosia-Larnaca	2 000
2	Alaminos : Relocation of part of the village water supply pipeline	1 400

TABLE XI-1

Ser. No.	Village and Scheme	Est. Cost
VARIOUS MINOR SCHEMES (cont.)		
3	Kophinou : Improvement of the village sewage scheme	300
4	Layia : Relocation of part of the conveyance pipeline of the village water supply	3 300
	Installation of a new sluice valve	100
5	Pyrga : Improvement of the village water supply net work	3 000
6	Vavla : Improvement of the village water supply net work	600
7	Xylophaghou: Refugee self housing house to house water supply scheme	650
8	Zyyi : Water supply of new buildings	100
<u>Famagusta District</u>		
1	Akhna Forest : Water supply of the village Commercial Centre	250

OPERATION AND MAINTENANCE

General

The Operation and Maintenance Branch consists of two sections :

- The Domestic Water Supply Section dealing with matters concerning water supply schemes, and,
- The Irrigation Branch dealing with matters concerning irrigation projects.

Domestic Water Supply Branch

The main activities of this Branch during the year were the following :

- Controlling and adjusting the quantity of water given to villages and refugee housing estates connected to the Khirokitia-Famagusta main pipeline.
- The Branch offers technical advice and assistance to several Government, semi-Government and Communal Improvement Boards on water supply matters.
- The Branch is involved in the administration of the Larnaca and Famagusta Water Boards through the participation of the Regional Engineer in the Water Board meetings as a representative of the Director. Through its membership of Water Boards the Regional Engineer acts as their Technical Adviser.

Irrigation Branch

The main activities of this branch during the year were the following :

- Involvement in the administration and management of Government Waterwork Projects, through participation in the Committees of these Projects (Kiti Dam, Alaminos, Anaphotia, Anglisidhes and Alethriko Temporary Irrigation Schemes).
- Carried out the maintenance of these projects performing routine dam and pipeline maintenance, valves and water meter repairs or replacement, painting of metal or wood work components etc.
- Gave technical advice and technical assistance concerning the maintenance of contributory irrigation projects.
- Performed routine checks to 53 Government Recharge Waterworks (12 in Larnaca District and 41 in Famagusta District) and undertook the maintenance procedures where it was necessary.

SOUTHERN CONVEYOR PROJECT - KOKKINOKHORIA IRRIGATION SYSTEM - (Phase I)

Hydrological Investigations

During the year under review the following works were carried out of the Southern Conveyor Project :

- The groundwater level of 90 wells/boreholes was taken once a month in South-Eastern Mesaoria as well as the level of another 44 wells/boreholes in the area of Kiti.

Control of Wells/Boreholes round Akhna Dam Reservoir

90 private boreholes at Akhna Dam lying within a distance of 200 meters around the Dam Reservoir have been surveyed, studied and checked twice this year (July and October) and their yield was established.

The yield of the boreholes established by this study will constitute the basis for the control of water pumped from these boreholes for irrigation purposes.

Land Consolidation

The Regional Engineer as a member of the Land Consolidation Committees of Xylophaghou Xylotymbou and Ormidhia villages has participated in meetings for the promotion and establishment of Land Consolidation in the above villages.

Special Investigations and Reports on Communal Claims in the Kokkinokhoria Area

Within the frame of Kokkinokhoria Irrigation Project, special Investigations were carried out and reports were prepared and sent to the Director for the following cases :

Permanent Plantations (Citrus) not covered by the Kokkinokhoria Irrigation System

Detail investigations were carried out and reports were prepared for all the permanent plantations - mainly citrus - which are not covered by the Irrigation Blocks. The findings were transferred and put on maps and together with the report were sent to the Director.

The survey included an area of 120 hectares of permanent plantations, owned by 220 person scattered all over the Kokkinokhoria area as follows :

Village	Area in Hectares	Owners of Land
Xylotymbou	23.0	45
Xylophagou	11.5	29
Akhna	28.3	40
Liopetri	1.9	7
Phrenaros	6.0	15
Sotira	8.7	25
Avgorou	39.0	53
Dherynia	1.6	6
Total	120 0	220

Also the survey established the yield of 450 boreholes, used by the above 200 owners to irrigate the 120 hectares of permanent plantations.

Subtraction of Land From Irrigation Areas

Irrigation Block 17 (XVII) at Paralimni covering an Area of 112 hectares was excluded from the Kokkinokhoria Irrigation System:

Land to be Irrigated

The land to be irrigated by the Kokkinokhoria Irrigation Distribution System spreads all over the Kokkinokhoria Area and has an area of about 9030 hectares, owned by 7473 persons. This land is distributed as follows :

- 2142 hectares are within the Land Consolidation Scheme
- 5982 hectares are Private Land
- 483 hectares are Government Land
- 423 hectares are Forest Land

Establishment of Irrigation Divisions

The District Officer in coordination with the Regional Engineer of the Water Development Department and the District Agricultural Officer established the following Irrigation Divisions.

Irrigation Division	No.	Date established	Total Area Hectares
Sotira-Ayia Napa	10B	20/1/89	307
Sotira-Phrenaros	13B	27/1/89	475
Dherinia-Phrenaros-Sotira	13A	3/11/89	398

KITI-MAZOTOS IRRIGATION AREAS - PHASE II

Special Investigations and Reports on Communal Claims in the Kiti-Mazotos Area

Claims for temporary irrigation connections

Detail investigations for supplying irrigation water to farmers by temporary connections on the main Southern Conveyor Project were carried out and reports were prepared and sent to the Director for the following cases :

- Alaminos : Irrigation water was supplied through a temporary connection for the irrigation of about 50 hectares of Permanent Plantations (mainly citrus).
- Mazotos : A number of temporary connections supplied irrigation water to farmers for seasonal crops.

- Softadhes : A number of temporary connections supplied irrigation water to farmers for seasonal crops.
- Kiti-Pervolia-Meneou : A temporary connection supplied water direct to the main irrigation canal of the Kiti-Pervolia-Meneou Irrigation Divisions.

Claims for additional land to be irrigated

Detail investigations for the revision and expansion of Irrigation Areas were carried out and reports were prepared and sent to the Director for the following cases :

- Anaphotia : A total area of 50.7 hectares of land was approved and added to the existing Irrigation Area.
- Alaminos : Land of total Area of 48.0 hectares has been sent to the Director for approval.

Subtraction of land from Irrigation Areas

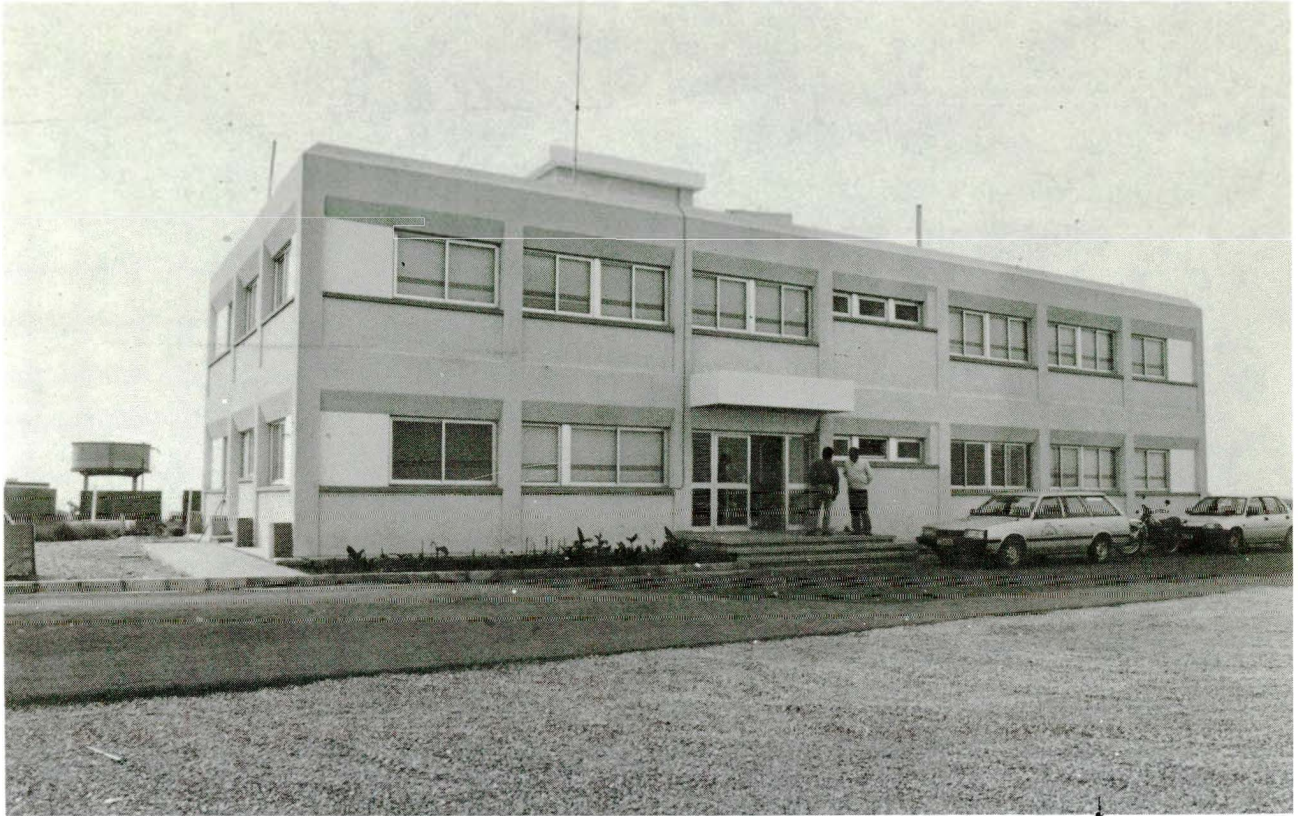
A total number of 181.0 hectares of land was excluded from the following irrigation Areas :

- Kiti Irrigation Area : 22.5 hectares because this area has been included in Housing and Tourist Areas.
- Pervolia Irrigation Area : 108.5 hectares because this area has been included in Housing and Tourist Areas.
- Softadhes Irrigation Area : 49 hectares included in Tourist area.
- Meneou Irrigation Area : 1 hectare included in Tourist Area.

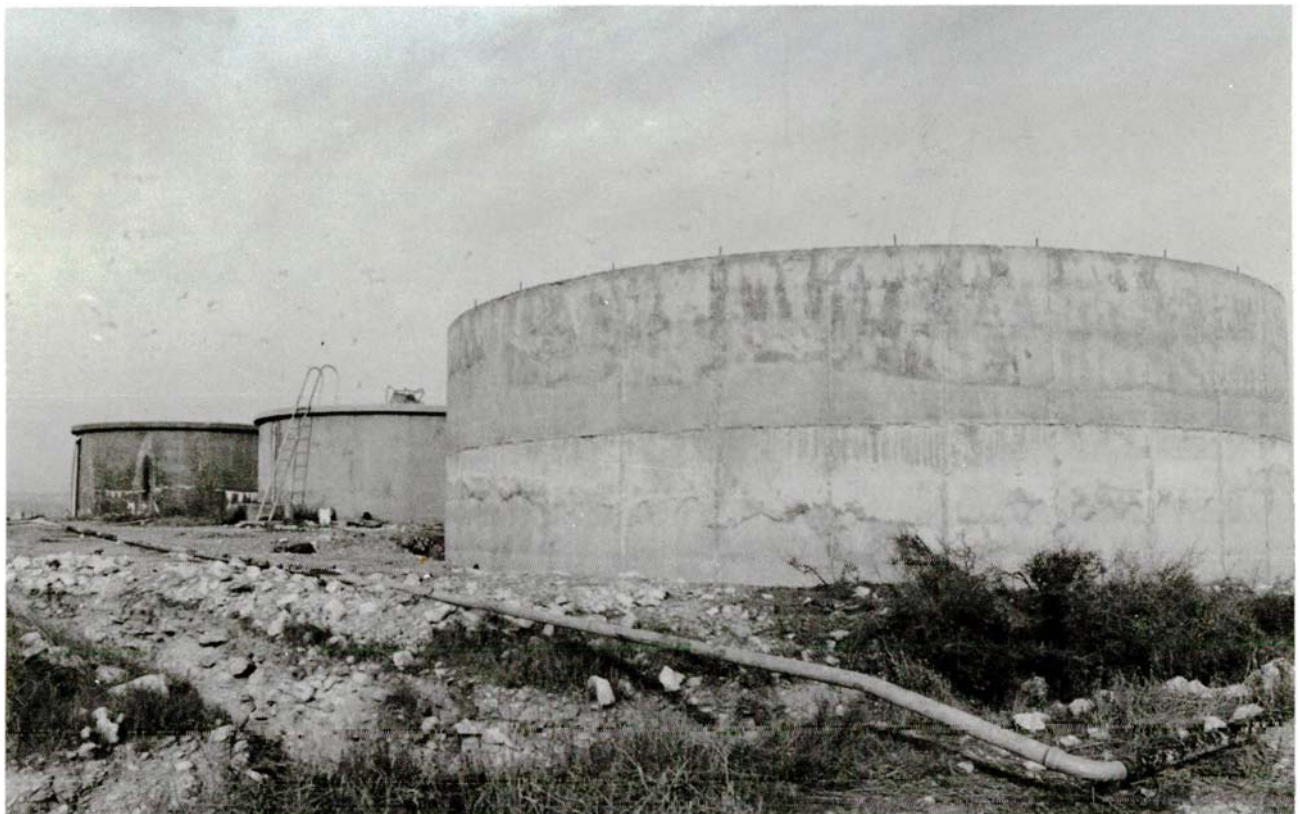
CONSTRUCTION WORKS

During the year under review a considerable number of village water supply schemes, stock farming water supply, water supply for refugee housing estates, irrigation schemes, relocation of pipes and a number of other works were carried out by the Larnaca-Famagusta Regional Office. The Larnaca-Famagusta Regional Office during 1989 undertook the construction of 36 various schemes of a total cost of £1 327 632.

More detailed information regarding the construction of works undertaken by the Larnaca-Famagusta Regional Office is listed under CONSTRUCTION DIVISION chapter VII.



Southern Conveyor Project. Kokkinokhoria Irrigation Area. New offices at Ormidhia. WDD Photo G14EN-8 (27.10.89).



Livadhia Water Supply Scheme. Construction of 500 m³ new storage tank in the foreground.
WDD Photo G14EN-3 (27.10.89)

XII LIMASSOL DISTRICT OFFICE

by
E Kambourides
Senior Water Engineer
Head

GENERAL

Limassol District Office is responsible for the activities of the Department within the District of Limassol. The office is divided into five main sections as follows:

- Water Resources
- Planning and Design
- Construction
- Operation and Maintenance
- Internal Auditing

Following the decision for decentralization of the Water Development Department and the upgrading of the District Offices, a Senior Water Engineer was appointed as District Engineer on 1st July 1989. Furthermore the number of Executive Engineers was increased to two.

At the end of 1989 the District Office consisted of the following staff:

- 1 Senior Water Engineer - Head
- 2 Executive Engineers I
- 5 Senior Technicians
- 8 Technicians I
- 2 Chief Foremen
- 3 Assist. Chief Foremen
- 14 Technicians II

1 Accounting Officer
2 Clerks II
11 Foremen (monthly paid)
6 Foremen (weekly paid)
150 Labourers

205 Total Staff

WATER RESOURCES

Hydrological measurements were carried out in the prescribed areas which are under the Special Measures or Conservation Law as listed under DIVISION OF WATER RESOURCES.

Surface Water hydrology

Rivers

The flow of the rivers is gauged by means of automatic water level recorders and the results are calibrated by means of current meter measurements.

Seven gauging stations equipped with automatic water level recorders are established on main rivers of Limassol District. The recorder at Evdimou River was removed during the year.

The total discharges calculated for each river are given at the end of the Hydrological Year.

Kouris river, at Monagri gauging station and Amathos river at Phinikaria had a continuous flow throughout the year.

Current meter measurements were taken at weekly intervals except at times of flood, when additional measurements were taken (total number of measurements 86).

Springs and Streams

The discharge of 28 springs and streams was measured at monthly intervals for the benefit of the design of minor irrigation and water supply schemes and the collection of hydrological data.

A total of 303 spring discharges were taken either volumetrically or by means of a current meter.

Water samples from the above springs and streams were taken once during the year for chemical analysis.

Groundwater Hydrology

Hydrological investigations and measurements were carried out in the Special Measures Law area of Akrotiri and the water conservation areas of Yermasoyia, Moni-Pyrgos, Paramali-Evdhimou, Pissouri-Evdhimou, Parekklisha and other areas of Limassol District.

Special measures Law - Akrotiri Phasouri Area

Hydrological observation and control were exercised by means of 195 wells/boreholes in the area.

Water level measurements are taken twice a year at 47 of the above wells/boreholes. For the remaining 248 wells/boreholes water levels are observed monthly so that the behaviour of the water table in the aquifer is observed more closely. A contour map showing the ground water situation in the aquifer, is drawn monthly.

Sea water intrusion in the aquifer was observed and studied by means of 67 wells/boreholes at Zakaki-Asomatos area and 23 wells/boreholes at Akrotiri area. Water samples were taken from the above wells/boreholes 3-4 times a year. Additionally the salinity of the water of 25 wells/boreholes in Episkopi-Akrotiri area was checked once a week during the months July-September.

Water pumped from the aquifer for irrigation, domestic and industrial purposes was recorded monthly for each individual licenced well, by means of water meters, (total 421) attached to each pumping unit in order to ensure that the quantity pumped does not exceed the quantity allocated.

Water for irrigation was also supplied in the area, from Yermasoyia and Polemidhia Dams through the distribution system of the Dams. A quantity of 11.77 M.C.M. was also released from Kouris Dam into the river bed d/s of the Dam, both for recharge purposes and direct irrigation through the irrigation intakes.

Water extracted from Akrotiri Aquifer.

Purpose:	1988 M.C.M.	1989 M.C.M.
Irrigation	8.4	10.18
Domestic	5.64	6.42
Industrial	0.82	0.80
Total	14.86	17.40
	=====	=====
Water supplied from Dams	1.78	3.77
Total supplied for irrigation from the aquifer and from the Dams	10.18	13.95

Water Conservation Areas

The ground water situation within the Water Conservation Areas is observed by means of a number of wells/boreholes the water level of which is measured twice a year and the total of water extracted is estimated by the method of the questioning.

Salinity is also observed by taking water samples for analysis, twice a year, from a number of wells/boreholes.

The total number of observation wells/boreholes in the Water Conservation Areas, which are measured twice a year, is 211.

The aquifer of Yermasoyia river is observed more closely, by means of 42 wells/boreholes, the water level of which is measured weekly. During 1989, a quantity of 5.31 M.C.M. was released from Yermasoyia Dam for recharging purposes. A significant recharge of the aquifer has occurred due to the overflow of Yermasoyia Dam.

Well Sinking Permits

484 applications for well sinking permits and applications to transfer water to other plots, pump installations or Adjustment of pumping permits were studied and submitted to the District Officer.

Limassol Water Supply

The water supply to Limassol, for domestic use is quaged monthly. A Quantity of 9.95 M.C.M. was supplied as follow.

From Yermasoyia aquifer	5.53 M.C.M.
From Episkopi - Akrotiri - Phasouri aquifer	3.74 "
From Garyllis aquifer	1.80 "
From Kandou Borehole	-

Total	11.07 M.C.M.

Village Water Supply

The water supply of 106 villages was measured during the period September-November, when springs and boreholes are at their minimum output or maximum drawdown.

The quality of the water is being examined at regular intervals by the Medical Department.

Metereological Observations

Daily records were kept for rainfall (Max. 56.2mm on 8.1.89) water evaporation (Max. 11.3 mm on 17.5.89) temperature (Max. 39.7°C on 16.5.89), wind velocity and sun reflection, at Yermasoyia Dam.

Records were also kept for rainfall (Max. 70.2 mm on 9.1.89) and water evaporation (Max. 11.5 mm on 15.5.89), at Polemidhia Dam.

Quarry and Gravel Pits Permits

28 applications for quarries and gravel pits licences, were examined and submitted to the Senior Mines Officer.

Dams and Reservoirs

In the District of Limassol there are 21 Dams and Reservoir. The water elevation of these was measured once a month. Maximum water stored during 1989 and other data are recorded under OPERATION AND MAINTENANCE DIVISION.

PLANNING AND DESIGN

The section deals with the planning and preparation of detailed designs for Irrigation and Domestic Water Supply Schemes including rehabilitation works within the Limassol District.

Irrigation

During 1989 a total of 56 studies were prepared including detailed designs and cost estimates for the following irrigation schemes.

TABLE XII - 1
IRRIGATION SCHEMES PREPARED IN 1989.

Ser. No.	Village and Description	Est. Cost £
1	Kaminaria: Rehabilitation of "Potaminiaes" Irrigation Association	7 000
2	K. Polemidhia: Relocation of pipelines of "Polemidhia" Irrigation Division	1 720
3	Pissouri: Construction of a new storage tank for "Pissouri" Irrigation Division ..	22 900
4	Kolossi: Improvement of the distribution system of Yermasoyia-Polemidhia Scheme at Kolossi area.	19 000
5	Akrounda: Extension of the distribution system to plot 283 sh/pl 54/IEE	1 040
6	Trakhoni: Extension of the distribution system of Yermasoyia-Polemidhia scheme ...	3 050
7	Ayios Ioannis (Agros): Rehabilitation of "Ayia Marina" Irrigation Division	58 000
8	Pera-Pedhi: Construction of a new storage tank near the borehole of "Pera-Pedhi" Irrigation Division	5 880
9	Yerasa: Improvement of the distribution system of "Yerasa" Irrigation Division ...	4 100
10	Kato Amiantos: Rehabilitation of "Phournia" Irrigation Association	1 850
11	Yerasa: Improvement of "Vrysi" spring of "Yerasa" Irrigation Division	3 200
12	Zakaki: Extension of Yermasoyia-Polemidhia distribution system to plots 146, 147, 148, sh/pl 56/16.6.11	690
13	Kolossi: Extension of Yermasoyia-Polemidhia distribution system to plot 227/12 sh/pl 56/6	4 320
14	Zakaki: Extension of Yermasoyia-Polemidhia distribution system to plots 52.6, 52.3 sh/pl 59/9	1 240
15	Ypsonas: Extension of Yermasoyia-Polemidhia distribution system near Mavropoullos Farm.	1 500
16	Vasa Kellakiou: Relocation of pipelines near plot 265/1 sh/pl 48/64	745

17	Dhieronas: Rehabilitation of "Mylos" Irrigation Division	40 000
18	Zakaki: Extension of Yermasoyia-Polemidhia distribution system near Lanitis Farm	3 050
19	Armenokhori: Extension of Yermasoyia distribution system to "Xenofontos Farm ..	1 600
20	Ayios Theodoros (Agros): Improvement of the distribution system of "Phintoukia" Irrigation Division	900
21	Mallia: Construction of a storage tank for "Mallia" Irrigation Association ..	13 000
23	Kaminaria: Rehabilitation of "Livadhi- Apokofto" Irrigation Division	9 350
23	Limassol-Platres: Relocation of pipelines along the road between Polemidhia and Khalassa.....	11 000
24	Pelendri-Potamitissa: Relocation of pipelines along the road between Pelendri and Potamitissa	7 700
25	Akrotiri: Extension of Akrotiri distribution system to Municipal garden of Akrotiri	570
26	Asgata: Relocation of pipelines in land consolidation area of Asgata	5 880
27	Asgata: Rehabilitation of "Asgata" Irrigation Division	64 700
28	Trimiklini: Extension of the distribution system to plots 242/1, 242/2 sh/pl 47/37 ..	540
29	Akrounda: Extension of Yermasoyia distribution system to plots 221/ 230/1, 252, 253, 254, 255, 256 sh/pl 54/3	720
30	Kilani: Improvement of the distribution system of "Kilani" Irrigation Division at Iacovidhes locality	1 450
31	Zakaki: Extension of Yermasoyia-Polemidhia distribution system to plot 109/1/1 sh/pl 56/16	7 280
32	Phinikaria: Extension of Yermasoyia distribution system to plots 137/ 171.1, 178, 167/1, 179, 132, 155 sh/pl 54/21 and to plots 176, 175/1, 175/2 sh/pl 54/13 ...	700
33	Phinikaria: Extension of Yermasoyia distribution system to plots 735/1, 735/2, 746 sh/pl 54/20	700
34	Akrounda: Extension of Yermasoyia distribution system to plots 194, 199/1, 244 sh/pl 54/3 and to plot 388/1/2 sh/pl 54/11	1 800
35	Phinikaria: Extension of Yermasoyia distribution system to plots 386/2/1, 389/2/1, 598/1 sh/pl 54/20	700
36	Phinikaria: Extension of Yermasoyia distribution system to plots 47/1, 60, 52, 53, 59, 48, 143 sh/pl 54/13 and to plots 142/1, 121, 171/1, 171, 158, 149 sh/pl 54/21	1 650
37	Akrounda: Extension of Yermasoyia	

	distribution system to plots 345, 71/2, 72, 73, 71/3, 71/2, 76/4, 138/1/2, 138/3, 76/2, 75, 76/1, sh/pl 54/12 and to plot 606.2	
	sh/pl 54/11	1 980
38	Pera-Pedhi-Kilani: Relocation of pipelines along the road between Pera-Pedhi and Kilani	23 000
39	Mallia-Arsos: Relocation of pipelines along the road between Mallia and Arsos	16 300
40	Dhymes: Rehabilitation of "Kardama" Irrigation Division	5 000
41	Prodhromos: Improvement of "Hartji" Irrigation Division	1 600
42	Phinikaria: Extension of Yermasoyia distribution system to plots 393, 410, 411/1 411/2, 412, 405, 408 sh/pl 54/12 and to plot 788 sh/pl 54/20	1 170
43	Asgata: Relocation of water supply pipelines from land consolidation area	4 200
44	Limassol: Study for the conveyance of industrial effluent of the Limassol Industrial Estate to Episkopi	350 000
45	Zakaki: Extension of Yermasoyia-Polemidhia distribution system to plot 103/2/1 sh/pl 56/16	550
46	Limassol-Paphos: Relocation of pipelines along the road near Polemidhia	8 000
47	Kato Polemidhia: Relocation of sluice valve near plot 138 sh/pl 58/8 of "Kato Polemidhia Irrigation Division	650
48	Limassol-Paphos: Relocation of pipelines along the road between Kato Polemidhia and Ypsonas	4 300
49	Kyperounda-Agros: Relocation of pipelines along the road between Kyperounda and Khandria	65 000
50-56	Seven minor irrigation schemes in seven villages were studied, of total cost	2 585
		793 860

Domestic Water Supply

For the development of water supply systems of Limassol District 80 cases were examined studied and the relevant designs were prepared at a total estimated cost of £3,318,866 as follows:

TABLE XII-2

DOMESTIC WATER SUPPLY SCHEMES PREPARED IN 1989

Ser. No.	Village and Description	Est. Cost £
1	Apsiou: Water Supply scheme from "Loutsiaes" spring and replacement of distribution system	92 500

2	Yermasoyia: Improvement of Mouttayiaka water supply scheme	15 000
3	Pakhna: Water supply to Pakhna cemetery	860
4	Kyperounda: Construction of a new storage tank and extension of the distribution system to "Kannoures" area	157 000
5	Ypsonas-Polemidhia: Improvement of Ypsonas-Polemidhia water supply scheme	1 750
6	Armenokhori: Refugee self-housing scheme	25 700
7	Paleomylos: Replacement of the distribution system	31 000
8	Kandou: Replacement of the distribution system	38 500
9	Prastio Kellaki: Replacement of the distribution system	21 800
10	Prastio Kellaki: Improvement of water supply from B/H 16/88 and replacement of the distribution system	39 200
11	Prastio Kellaki: Improvement of water supply from B/H 16.88	19 000
12	Trimiklini: Water supply to land division (File No. D101/78)	7 150
13	Ayios Pavlos: Replacement of the main pipeline from "Vrysi tou Taouti" spring .	6 700
14	Paramytha-Palodhia-Spitali: Replacement of main pipeline from the spring "Maramenos" to the bridge	10 200
15	Ypsonas (Vounaros): Water supply to "Vounaros" locality	36 300
16	Kouris Dam: Water supply scheme to Kouris dam Guard house.....	20 800
17	Amathus: Water supply to plot 183/1 sh/pl 54/45	15 100
18	Polemidhia-Trimiklini-Potamitissa: Relocation of pipelines along the new road between Trimiklini and Pelendria ...	1 800
19	Kolossi: Utilization of B/H 40/69 for live stock area	13 000
20	Mouttayiaka scheme (Ayios Athanasios): Replacement of main pipeline from Yermasoyia pumping station to Ayios Athanasios	108 000
21	Amathus: Water supply to plot 60 sh/pl 54/47	1 160
22	Ayios Athanasios: Water supply to land division (plot 539, sh/pl 54/43)	8 600
23	Kouris Dam: Water supply scheme for Guard house and for Metereological station	1 650
24	Kato Polemidhia: Water supply to land division plot 351 sh/pl 53/56	2 720
25	Yermasoyia: Replacement of pipeline near Anna Court	1 800
26	Kolossi: Water supply to land division (File No. D53/80)	1 270
27	Polemidhia. Replacement of the distribution system of National Guard camp	21 600

28	Omodhos: Utilization of "Kramviotis" spring for a public fountain	14 000
29	Paramali: Utilization of B/H 70/88 for the improvement of water supply	38 000
30	Kato Polemidhia: Relocation of pipelines in self-housing estate	2 400
31	Mouttayiaka: Refugee self-housing scheme	8 400
32	Kato Polemidhia: Refugee self-housing scheme phase "H"	3 950
33	Yermasoyia: Water supply to plots 188/2, 189/3/2, 190/2/1/3 sh/pl 541/52	2 316
34	Amathus: Water supply to plots 275/2/1, 68.1, 274/2 sh/pl 54/46 & 47 ...	2 160
35	Amathus: Re-evaluation of water supply to land division (File No. B170/84)	1 510
36	Limassol area: Limassol water treatment works water supply to villages west of Limassol	2 200 000
37	Paramytha: Water supply to land division (File no. D158/87)	2 700
38	Amathus: Water supply to land division (File No. D57/89)	18 400
39	Paramali: Utilization of B/H 70/88 for the improvement of water supply	5 000
40	Sykopetra (Profitis Elias locality): Re-evaluation of water supply scheme. ...	40 300
41	Kato Polemidhia: Water supply to plot 440/2, sh/pl 53/55 & 56	2 300
42	Amathus: water supply to plots 24/2/1, 25/1, 24/1/1, 25/2, sh/pl 54/46	4 980
43	Eptagonia: Relocation of pipelines near plot 561 sh/pl 48/30	1 980
44	Kato Polemidhia: Refugee self-housing scheme	6 500
45	Pera-Pedhi: Water supply to plot 642 sh/pl 47/28	3 600
46	Asgata: Improvement of the distribution system	660
47	Apesha: Supervision of the construction of a storage tank	2 300
48	Pera-Pedhi: Water supply to plot 230/1, sh/pl 47/27	840
49	Omodhos: Improvement of water supply distribution system	6 000
50	Yermasoyia: Installation of chlorination systems to B/Hs 107/61 and 63/64	1 700
51	Trozena: Water supply scheme from "Titsilia" spring	15 000
52	Ayios Theodoros: Re-evaluation of water supply scheme	9 300
53	Kato Polemidhia: Refugee self-housing scheme	12 000
54	Spitali: Replacement of pipelines of the distribution system	2 000
55	Arakapas: Relocation of pipelines near plot 26 sh/pl 48/37	1 090

56	Kato Polemidhia: Water supply to land division (plot 399/1 sh/pl 54/49)	670
57	Parekklisha: Water supply to plot 10 sh/pl 54/47	1 900
58	Sotira: Water supply to plot 90/1/1, sh/pl 53/43	2 200
59	Phinikaria: Water supply to land division (plots 650, 664 sh/pl 54/20)	2 700
60	Dhymes: Relocation of pipelines near plot 434 sh/pl 37/64	580
61	Amathus: Water supply to plots 247/2, 248/1/1 sh/pl 54/45	2 000
62	Ayios Athanasios: Water supply to land division (plots 256/4, 270/5 sh/pl 54/42)	2 900
63	Ayios Therapon: Water supply to plots 736, 860, 727/1, sh/pl 47/58	5 000
64	Episkopi: Water supply to land division for building plots of the community (Phase "B")	17 000
65	Ayios Athanasios: Water supply to land division (plot 48 sh/pl 54/43)	5 000
66	Dhierona: Water supply to land division for building plots of the community (plot 379/1 sh/pl 48/45)	4 100
67	Kato Polemidhia: Water supply to land division (plot 564 sh/pl 53/56)	1 000
68	Ayios Tykhonas: Water supply to land division (File No. D409/86)	2 500
69	Kolossi: Water supply to land division (File No. D351/89)	770
70	Ayios Yeoryios Silikou: Improvement of water supply scheme	32 400
71	Yermasoyia: Water supply to plot 36 sh/pl 54/44	1 600
72	Mouttayiaka: Replacement of pumping main of water supply scheme (B/H 64/64)	1 700
73	Amathus: Water supply to plots 172/1/1/1/1, 172/2/2/1 sh/pl 54/45	2 500
74	Pano Polemidhia: Improvement of distribution system	1 900
75	Omodhos: Improvement of water supply from Arkolakhania spring	68 900
76	Yermasoyia: Water supply to land division (File No. D67/85)	3 270
77	Kato Polemidhia: Water supply to land division (File No. D389/85)	23 200
78	Akrounda: Replacement of the distribution system (part).....	12 800
79	Palodhia: Re-evaluation of water supply to land division (File No. D88/85)	2 100
80	Palodhia: Water supply to land division (File No. D468/87)	3 400
81-125	Forty five minor schemes in forty five villages were studied of total cost	5 380
	Total	3 318 866

In addition to the above another 140 cases were examined and advice was given to the applicants.

CONSTRUCTION

Irrigation and Domestic Water Supply Schemes

Several schemes were constructed by the Limassol District Office for major and minor irrigation schemes, village water supply, water supply for refugee housing estates and other schemes. These are listed under Construction Division VII.

Major Projects

The Construction Division of Limassol District Office was involved in the construction of the following Major Projects.

Vasilikos-Pendaskinos Project

Following a break of 1 1/2 years, during which land consolidation was finalized, construction of the Vasilikos Irrigation network restarted late 1988 and was completed by December 1989. The total cost reached £1,154,000 which is 90% of the original estimate although the area covered was extended to 707 hectares.

Maroni Irrigation Network (Pumping scheme) was also completed during 1989. The three pump houses were completed and the pumps were installed. The main pipeline connecting the boreholes to Maroni storage tank was laid and the irrigation network was completed. The expenditure for 1989 was £22,612.

Southern Conveyor Project - 1st Phase

The construction of Kouris pumping station continued during the year.

Southern Conveyor Project - 2nd Phase

Akrotiri Irrigation Network covers an area of 1883 hectares. The estimated cost including the purchase of pipes and fittings is £6,000,000. construction started in January 1988 and it is expected to be completed mid 1992. By the end of 1989 14.2 km of main pipelines were laid (200-1000 mm dia DI and AC pipes). The expenditure incurred in 1989 was £276,168.

Materials and Machinery

During 1989 the cost for materials and machinery used for the construction of the water supply and irrigation schemes reached the amount of £133,083 as follows:

TABLE XII - 3

MACHINERY USED BY LIMASSOL DISTRICT OFFICE

Machinery Employed	Unit	Quantity	Value £
Tipper lorries	agreed	-	3 090.00
Tipper lorries	W/hours	2 520	7 787.00
Buses	W/days	447	7 191.00
Electrowelding machines	W/hours	440	318.00
Electrowelding machines WDD	W/hours	1 993	-
Electrowelding machines	agreed(w/days)	207	1 668.00
Caterpillars	agreed	-	1 120.00
Cutting machines	W/hours	2 224	-
Bulldozer	W/hours	397	2 345.00
Bulldozer	W/days	175	5 425.00
Land rovers	W/days	4 573	36 147.00
Diggers	W/hours	12 778	51 031.00
Diggers	agreed(w/hours)	1 070	4 693.00
Compressors	W/days	102	1 224.00
Compressors	agreed(w/days)	5	75.00
Concrete mixers	W/days	627	1 766.00
Concrete mixers	agreed(w/days)	14	127.00
Braker	agreed(w/hours)	32	320.00
Braker	W/hours	244	1 905.00
Testing machines	W/hours	175	-
Drainage pump	W/hours	130	-
Drainage pump	agreed(w/days)	15	225.00
Electric Generator	W/hours	965	-
Hydraulic Excavator	W/hours	432	3 460.00
Hydraulic Excavator	agreed	-	100.00
Mobile Concrete Mixer	W/days	34	850.00
Mobile Concrete Mixer	agreed	-	631.00
Vibrator	W/hours	184	-
Vibrator	agreed(w/days)	3	39.00
Crane	W/hours	160	1 280.00
Crane	agreed	-	256.00
Total			133 083.00

TABLE XII - 4

MATERIALS USED BY LIMASSOL DISTRICT OFFICE

Materials used	Unit	Quantity	Value £
Galvanized iron pipes	m	33 570	105 166.00
Steel pipes (coated or uncoated)	m	4 826	51 874.00
Ductile iron pipes	m	504	46 719.00
Asbestos cement pipes			
Class 15	m	5 284	35 603.00
Class 20	m	979	3 660.00
Class 25	m	1 118	8 467.00

Class 30	m	-	-
uP.V.C. and polythene pipes .	m	27 618	16 376.00
Cement	tons	671	15 978.00
Sand	m ³	702	3 468.00
Fine and coarse sand	m ³	607	2 465.00
Aggregates	m ³	457	1 100.00
Reinforcement (Mild steel)..	tons	61.8	8 936.00
Sand for pipe bedding	m ³	8 943	12 958.00
Ready mixed concrete	m ³	332	2 231.00
Fittings	No.	17 200	42 200.00
Sluice valves	No.	2 300	31 100.00
Water meters	No.	106	3 774.00
Shingle	m ³	1 428	5 592.00
Total			----- 397 667.00

OPERATION AND MAINTENANCE

The Limassol District Office was responsible for the operation and maintenance of all water works in the District of Limassol.

Yermasoyia-Polemidhia Project

Akrotiri, Avdimou-Paramali Irrigation Schemes

A sum of £27,000 was spent on Yermasoyia-Polemidhia Dams and Distribution network for repairing and maintenance of water meters, valves general maintenance and painting of metal structures, etc.

An amount of £2,000 was spent on Akrotiri irrigation scheme and the sum of £4,000 was spent on Evdimou-Paramali irrigation scheme.

Amathus Water Supply

The scheme operates with automatic control equipment. The operation and maintenance are carried out by the District Office of the Department in Co-operation with Limassol District Administration Office. The sum spent for the supervision, repairs and maintenance of water meters, valves general maintenance and painting of metal structures etc. was £7,000.

Village Water Supply Schemes

A total of 220 cases of breakdowns at water supply schemes were dealt with and the expenditure reached £16,868.

INTERNAL AUDITING

The main activities of the Internal Auditing Section of Limassol District Office were:

- a. Technical control of all constructional works undertaken.
- b. Check of all payment vouchers for the purchases of goods and services.
- c. Check of Time-Book and Store (raw materials and spare parts stocks).

MEETINGS

During the year under review, the District Engineer and staff members of the Office attended several meetings representing the Director of the Department.

XIII PAPHOS REGIONAL OFFICE

By
K. Spanos, SWE
District Engineer

GENERAL

The Paphos Regional Office is responsible for the activities of the Department within the Paphos District. With the appointment of a Senior Water Engineer as a District Engineer early 1989, the activities of this office were extended to include the implementation of Major Projects-Khrysookhou Irrigation Project and a branch for Dam Monitoring and Laboratory. The main divisions of the office with their corresponding staff were as follows at the end of the year.

<u>Division Head</u>	<u>Division</u>	<u>Supporting Staff</u>
1 Senior Water Eng.	District Engineer	
1 Exec. Eng I	(-Water Resources and (Hydrology	1 Sen.Techn,5 Techn I, 6 Techn. II
	(-Operation and (Maintenance D.W.S. (1 Sen.Techn,3 Techn. I, 1 Techn.II
1 Exec. Eng. I	-Planning and Design (i)Rural Projects	1 Sen.Techn, 2 Techn I, 1 Techn. II
	(ii)Khrysookhou Irrig.Project	1 Exec.Eng.I,2 Techn.I, 3 Techn. II.
1 Exec.Eng. I	-Construction	1 Sen.Techn, 1 Techn.I, 4 Techn. II, 2 Ass.Ch.Foremen, 6 Foremen.
1 Exec.Eng.I	-Operation and Maintenance (Irr.) (i)Paphos Irr.Project	2 Techn.I, 4 Techn. II, 1 Ass.C.Foreman,3 Foremen.
	(ii)Khrysookhou Irr.Project	5 Techn. II.
1 Mech. Eng. II	-Mechanical and Electrical Services	2 Techn.II, 1 Foreman
1 Exec.Eng.I	-Dam Monitoring and Laboratory	2 Techn.I, 3 Techn. II
1 Clerical and 1 Accounting Officer	-Accounts and Administr.	1 Clerk I, 6 Clerk II, 1 Telephonist, 1 Messenger.

WATER RESOURCES AND HYDROLOGY

Surface Hydrology

During the year 12 permanent stream gauging stations equipped with automatic water level recorders were in operation and weekly visits were made for observation, maintenance and calibration purposes by the use of current meter.

A total number of 286 current meter measurements were taken during the year for calibration purposes. Also samples for suspended sediment load and boron analysis were taken regularly.

Springs

During the year 23 springs were under observation and a total number of 423 spring discharges were gauged, 22 by current meter and 401 volumetrically.

Water Supply

The water supply of 132 villages was gauged during the months of July and August and samples for Ionic & Nitrates analysis were taken.

Rainfall observing stations

Five rainfall observing stations equipped with automatic raingauge recorders were in operation during the year, under weekly and monthly visits for operation.

Ground Water Hydrology

Ground water conditions in South Western Paphos were observed by means of 127 wells/boreholes.

The water level, i.e. the distance from established bench marks on top of every observation well/borehole to the ground water level, was measured twice a year at the end of wet season (March) when it is expected to be at the highest level and at the end of the dry season (November-December) when it is expected to be at the lowest level.

In addition monthly or weekly measurements of the ground water level were taken from 156 wells/boreholes during the year for special studies.

During the year a total number of 3217 measurements were taken from wells/boreholes under observation as follows:

2941 Water levels from S.W. Paphos Hydrological Area.
276 " " " Polis Project Area.

Chemical Analyses

A total number of 686 samples were taken from wells/boreholes, springs and streams, 30 of which were sent to the Government laboratory for full chemical analysis, 11 to the Departmental laboratory for silt content analysis, 134 to Khirokitia laboratory for Nitrates & Ionic analysis and 511 for the determination of the Chloride content.

Questioning

The annual questioning was carried out in South Western Paphos Hydrological Area in Dhiarizos-Xeros-Ezousa river beds on 2088 owners of wells during summer for determining the ground water extraction, area irrigated and kind of crop planted.

Well sinking permits

A total number of 250 applications for sinking or covering permits for wells/boreholes were examined and submitted to the Advisory Committee of the Ministry of Agriculture and Natural Resources for recommendations to the District Officer.

The final responses to the applications were as follows:

APPROVED			NOT APPROVED		
S.M.L. Area	W.C.A.	Non W.C.A.	S.M.L. Area	W.C.A.	Non W.C.A.
36	124	29	11	45	5

Encroachments in Rivers and Streams

Twenty three cases for land encroachments in rivers and streams were examined and the Director of Land and Survey Department was advised accordingly.

Quarry Permits

A total number of 78 applications for quarry permits were examined by this office and comments were given to the Department of Mines.

Plotting

During 1989, 13 new wells/boreholes were plotted on LRO plans at Kannaviou and Kallepia area covering a total area of 5km².

Pumping Tests

During the year one pumping test for Tourist Development was carried out and relevant report was submitted to the Director of the Department.

<u>B. Khrysokhou Irrigation Project</u>		<u>Est.cost £</u>
<u>Phase I</u>		
1. Sarama-Peristerona Irrigation Network		250,000
2. Farm Roads in Khrysokhou Valley		100,000
<u>Phase II</u>		
1. Replacement of Pomos open canal with pipeline (continued from 1988)		370,000
2. Temporary connection of Ayia Marina Distr. Network with Evretou Main Conveyor		74,000
<u>Extensions of Project Irrigated area as requested by some Communities.</u>		
1. Pumping scheme from Evretou dam for the irrigation of areas in Simou and Yiolou villages		552,000
	TOTAL	1,346,000

C. Village Water Supply Schemes.

<u>Village</u>	<u>Nature of Scheme</u>	<u>Est.cost £</u>
1. Paphos Higher villages	Replacement of part of the main conveyor pipelines	67,340
2. Lyso	Replacement of distribution system	76,000
3. Mandria	Replacement of distribution system	88,000
4. Ayia Marinouda	Replacement of distribution system	16,000
5. Ayios Yeoryios	" "	15,000
6. Kinousa	New house to house system	33,200
7. Pakhyammos	Additional supply from "Avgousta" Spring	14,700
8. Argaka	Replacement of distribution system	146,000
9. Amargeti	New water supply scheme from B/H 127/87.	126,000
	TOTAL	£582,240

CONSTRUCTION

The construction programme of Paphos District Office for 1989 included 32 water supply and irrigations schemes of a total cost of £849,480. Also another £51,265 was expended for several otherworks, mainly coming from Public Works Departments and the District Officer Paphos. A table for all constructions works, has been submitted to the Director. See tables under CONSTRUCTION DIVISION Chapter VII.

PLANNING AND DESIGN

The Planning and design division deals with the preparation of studies and detailed designs of rural domestic water supply schemes, the contributory irrigation schemes and of all outstanding works in relation with Khrysokhou Irrigation Project Phase I and II.

During the year 1989 the following schemes were prepared and submitted to the Director of WDD for approval and further action if necessary.

TABLE XIII- 1 IRRIGATION SCHEMES PREPARED IN 1989.

<u>Village</u>	<u>Nature of proposed scheme</u>	<u>Est. Cost £</u>
1. Amargeti	Extension of existing Glyphoudhi Irrigation Division with development of B/H 127/87	77,500
2. Amargeti	Replacement of existing open canals with Pipelines of Ziripillis Irr.Division.	62,000
3. Pretori	New Pumping scheme for irrigation from B/H 21/88	108,500
4. Lemona	New Pumping scheme from B/H 134/84 for irrigation and domestic water supply.	106,500
5. Polemi	Additional water supply from B/H 17/89 to existing Irrigation Division "Proodos".	38,000
	TOTAL	392,000

OPERATION AND MAINTENANCE

Domestic Water Supply Schemes

The main activities of this Division during the year were:

-To ensure the proper operation and maintenance of the two Government Regional Water Supply Schemes in Paphos, namely: (i) The Paphos Lower Villages, which supplies water to 22 communities, Industrial Estates and Paphos Airport (ii) The Arminou Regional Scheme which supplies water to 9 communities. Details of the components of these schemes, the quantities of water supplied during 1989 and the corresponding expenditures and revenues generated are reported under Chapter IX.

-To give technical advice and assistance concerning the operation and maintenance of all the community water supply systems in the District of Paphos.

-To participate in the administration of the water supply schemes to the Tourist Development areas of Khlorakas, Kissonerga and Peyia which have been established under the Government Water Works Law.

Irrigation Schemes

This Division includes the branches dealing with management, operation and maintenance of

- Paphos Irrigation Project

- Khrysokhou Irrigation Project

- All other Government WaterWorks Projects in Paphos District (Argaka, Ayia Marina and Pomos) which are administered by Waterworks Committees through the participation of the WDD District Engineer.

All the details regarding the various components of the above Projects, and all the necessary procedures and data on their management, operation, maintenance, water utilization, crops irrigated, incomes and expenditures are reported in detail in Chapter X .

