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Republic of Cyprus
Ministry of Agriculture and
Natural Resources

WATER DEVELOPMENT DEPARTMENT

ANNUAL REPORT 1977

Nicosia, November 1978

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Republic of Cyprus
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Natural Resources

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ANNUAL REPORT 1977

C A C Konteatis B Sc (Eng.) FICE FIWE FGS — Director

Nicosia, November 1978

Published by the PIO
for the
Water Development Department
Ministry of Agriculture and Natural Resources.

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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	= 7.46	Donums
Acre	= 3.25	Donums

* The Cyprus pound was on par with £ sterling up to July, 1972. In 1977 the value of the Cyprus pound on average (daily basis) was:-

$.....	2.4504
£ st.	1.4030
DM	5.6768
Drachma ..	89.5392

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I GENERAL

Introduction

During 1977 the collection of hydrogeological data and other water resources design data has been confined to the southern part of the Island, as the northern part is still occupied by the Turkish troops. The occupation of the northern part of the Island prevents any personal or other contacts and it is impossible to know whether any such data is collected in the northern part of the Island.

It is believed however, that limited data are collected for essential water supply projects in the north. Also, we are not aware of the condition of the plantations and other crops in the occupied areas.

In the free zones of the Famagusta area intensive work has continued through the year to collect hydrogeological data which was lost in our Famagusta office during the invasion.

In 1977 the most important design work carried out was the finalization of the Vasilikos-Pendaskinos water supply and irrigation feasibility study, which provides for additional water supply to Nicosia-Famagusta-Larnaca and for the irrigation of about 1,000 ha in the Vasilikos-Pendaskinos area.

In the construction field, 1977 was a record year of expenditure and the Department has been very active with the Paphos Irrigation Project, which may cost in the end up to £25 million.

The Water Development Department

The Department of Water Development, Ministry of Agriculture and Natural Resources, is responsible for the Government's overall policy on water resources, planning, design and construction on the Island. It also cooperates in the management of water resources and water development projects together with other Ministries and Departments.

Water development projects include domestic water supplies, irrigation and drainage projects, flood protection works, protection works against pollution of water resources, groundwater recharge works and other relevant works.

The Government institutional set up for water resources conservation and development and the role of the Department of Water Development is shown on page 5.

DEPARTMENTAL ORGANIZATION

The Departmental Organization is shown on page 6 and is made up of:

The Division of Water Resources which groups together all services required for the collection, study and interpretation of hydrological and hydrogeological data both for ground and surface water, control of groundwater extraction and engineering geology problems as connected with the planning and execution of works projects.

The Division of Planning which deals with the preparation of reconnaissance and feasibility studies prior to the detailed design of major projects. The works for planning include field investigations for hydraulic structures, laboratory testing for these structures, water use studies, hydrological evaluations, evaluation of benefits, techno-economic studies, as well as engineering geology problems.

Systems analysis and mathematical modelling techniques with the help of electronic computers are widely used in these studies.

The Division of Design which deals with the datailed design and specification works required for major projects after feasibility stage. In this Division the drawing and topographic functions of the Department are incorporated.

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

The Division of Operation and Maintenance which assists in the operation and maintenance of the major projects such as dams and town water supplies. For every major irrigation project there is a Project Water Board for its management. In the case of town water supplies, Town Water Boards have been established to which we are a member, whilst in the case of rural water supplies, Village Water Commissions are set up according to relevant legislation.

The Division of Small Projects Planning deals with the planning and designing of small irrigation and domestic water supply projects which are of a rather routine nature and do not need elaborate planning and design procedure.

The Regional Offices after the 1974 Turkish invasion are confined to **Larnaca, Limassol** and **Paphos.**

In these Regional Offices the main works carried out are:-

Hydrological measurements, collection of engineering data, operation and maintenance of projects, investigations and planning for small projects and control of construction work.

The Office Management section is responsible for the office services, accounts, labour, personnel and stores. Also a financial control and coordination branch is included which deals with financial aspects and control of expenditure.

The Legal Adviser performs Legal and other relevant duties concerning the activities of the Department of Water Development or more generally the Ministry of Agriculture and Natural Resources.

His legal duties consist of legal opinions on matters deriving from contracts of work, contracts of sale, tenders, trespass to property, compulsory acquisition and requisition of immovable property.

In addition to the duties described above, the Legal Adviser attends the various meetings especially the meetings held by the Advisory Committee on applications for permits to sink or construct wells or boreholes, or to renew such permits, or to install machinery in order to use underground

or surface water. It is appropriate here to mention that during the year 1977 this Committee has dealt with over two thousand applications and gave its reasoned decision.

STAFF APPOINTMENTS

On a Monthly (Unestablished or Temporary) Basis

During the period under review the following persons have been appointed to the posts as indicated:

Elias Kambourides, Executive Engineer, Class II, with effect from 1.2.1977.

Andreas Artemis, Executive Engineer, Class II, with effect from 1.2.1977.

Andreas Kyriakides, Foreman 2nd Grade, with effect from 1.3.1977.

Charalambos Themistocleous, Foreman 2nd Grade, with effect from 1.3.1977.

Andreas Florides, Foreman 2nd Grade, with effect from 1.3.1977.

Phidias HjiXenophontos, Foreman 2nd Grade, with effect from 1.3.1977.

Phidias Metaxas, Foreman 2nd Grade, with effect from 1.3.1977.

Eleftherios Elia, Foreman 2nd Grade, with effect from 1.3.1977.

Ioannis Potamaris, Foreman 2nd Grade, with effect from 1.3.1977.

Maria Yiangou, Draughtsman, with effect from 15.3.1977.

Eleni Adamidou, Draughtsman. with effect from 15.3.1977.

Maroulla Spyrou, Clerical Assistant, GCS, with effect from 1.4.1977.

Andriana Christodoulou, Clerical Assistant, GCS, with effect from 1.4.1977.

Krinoulla Menikou, Clerical Assistant, GCS with effect from 1.4.1977.

Rita Moustaka, Clerical Assistant, GCS, with effect from 1.4.1977.

Aphrodite Christodoulou, Clerical Assistant, GCS, with effect from 1.4.1977.

Sophia Spyrou, Clerical Assistant, GCS, with effect from 1.4.1977.

Maria Papakyriakou, Clerical Assistant, GCS, with effect from 1.4.1977.

Georghios Theophilou, Clerical Assistant, GCS, with effect from 1.4.1977.

COSTAS ZACHARIADES
Accounting Clerk

VASSOS VYRAS
Technical Assistant

PANTELIS NICOLAOU
Technical Assistant

ANTONIOS KORELLIS
Technical Assistant

ANDREAS SEVLARIS
Driller

NICOS DEMETRIOU
Technical Assistant

NICOS HJI STAVROU
Electrician

ARTEMIS FRANGOPOULOS
Technical Assistant

GEORGHIOS HJI CHRIS/LOU
Builder

COSTAS ASHIOTIS
Builder

STILL MISSING

Since their capture by the invading Turkish troops in July — August 1974 the above pictured employees of WDD are still missing.

Philippos Ioannou, Clerical Assistant, GCS, with effect from 1.4.1977.

Andreas Ioannou, Clerical Assistant, GCS, with effect from 1.4.1977.

Andreas Aniftos, Technical Assistant, with effect from 1.7.1977.

Antonakis Hjiloannou, Technical Assistant, with effect from 1.7.1977.

Stavros Socratous, Technical Assistant, with effect from 1.7.1977.

Nicos Mavrommatis, Technical Assistant, with effect from 1.7.1977.

Xenophon Antoniades, Technical Assistant, with effect from 1.7.1977.

TECHNICAL STAFF OF W.D.D. ON 31.12.1977

DRG. No BM/G/44

	MONTHLY AND DAILY PAID TECHNICAL STAFF		D	AD	SWE	EH	EE	ME	Geo	H	Ch	TIE	LA	SW	SIW	EDR	IW	CF	ACF	TA	DR	F	TOTAL Nos
1	Permanent staff		1	2	1	1	15	1	2	3			3	6	1	18	4	8	48	2	40	156
2	Temporary staff				1		8			1		4	1		2		7	1	6	29	9	20	89
3	Daily paid staff						4				1	2								30	6		43
	TOTAL NUMBERS		1	2	2	1	27	1	2	4	1	6	1	3	8	1	25	5	14	107	17	60	288
	DISTRIBUTION OF STAFF																						
4	Divisions	i Water Resources					1			1	1						5			23		1	32
		ii Planning				1		2		1	1	2					2			4		1	14
		iii Design				1		4				2			1	1				8	9		26
		iv Construction						2	1						3		10	2	9	3		15	45
		v Small Projects Planning						2							2		4	1	1	4			14
		vi Operation & Maintenance									1			1	2		1		1			4	10
		vii Paphos Irrig. Project						7													9	2	18
5	Administration (Head Office)		1	2									1							32	2	30	4
6	Regional Offices (Limassol, L/ca & Paphos)							3									1	1					69
7	Turkish Officers absent from duty							1												9		2	12
8	On Scholarship										1												1
9	Vacancies							6			1	2		2			2	1	3	15	4	7	43
	TOTAL NUMBERS		1	2	2	1	27	1	2	4	1	6	1	3	8	1	25	5	14	107	17	60	288

REFERENCE	
D	Director
AD	Assistant Director
SWE	Senior Water Engineer
EH	Engineer Hydrologist
EE	Executive Engineer
ME	Mechanical Engineer
Geo	Geologist
H	Hydrologist
Ch	Chemist
TIE	Topographer/ Irrigation Engineer
LA	Legal Adviser (on contract)
SW	Superintendent of Works
SIW	Senior Inspector of Works
EDR	Engineering Draughtsman
IW	Inspector of Works
CF	Chief Foreman
ACF	Assistant Chief Foreman
TA	Technical Assistant
DR	Draughtsman
F	Foreman

On a Permanent Basis

Maroulla Petridou, Clerical Assistant, with effect from 1.1.1977.

Demosthenis Patsalides, Executive Engineer, Class II, with effect from 1.2.1977.

Georghios Ioardanou, Foreman 2nd Grade, with effect from 1.3.1977.

Cosmas Karayiannis, Foreman 2nd Grade, with effect from 1.3.1977.

Elias Neophytou, Foreman 2nd Grade, with effect from 1.3.1977.

Adonis Georghiou, Geologist 2nd Grade, with effect from 15.3.1977.

Christos Ioannou, Hydrologist Class I, with effect from 1.7.1977.

Joseph Karoglanian, Inspector of Works, with effect from 1.7.1977.

Andreas Eleftheriou, Inspector of Works. with effect from 1.7.1977.

Christodoulos Theocharides, Technical Assistant. with effect from 1.7.1977.

Eleni HjiKyriacou, Draughtsman, with effect from 1.7.1977.

Aphrodite Rodosthenous, Draughtsman, with effect from 1.7.1977.

On Contract

The contract of **Charalambos Kyriakides,** Legal Adviser, was renewed for one more year, with effect from 1.7.1977.

Promotions, Secondments

A number of Officers were promoted or seconded to the posts appearing opposite their names.

Promotions

Sophoclis Pitsillides, from Assistant Chief Foreman, to the permanent post of Chief Foreman, with effect from 1.1.1977.

Panayiotis Polycarpou, from Assistant Chief

Foreman, (on secondment), to the permanent post of Assistnat Chief Foreman, with effect from 1.1.1977.

Neophytos Nicolaou, from Foreman 2nd Grade, to the permanent post of Foreman 1st Grade, with effect from 1.1.1977.

Takis Kallis, from Foreman 2nd Grade, to the permanent post of Foreman 1st Grade, with effect from 1.1.1977.

Georghios Kostrikkis, from Foreman 2nd Grade, to the permanent post of Foreman 1st Grade with effect from 1.1.1977.

Alexandros Avgousti, from Foreman 2nd Grade, to the permanent post of Foreman 1st Grade, with effect from 1.1.1977.

Charalambos Kridiotis, from Executive Engineer Class II, to the permanent post of Executive Engineer Class I, with effect from 1.5.1977.

Georghios Iordanou, from Foreman 2nd Grade, to the permanent post of Foreman 1st Grade, with effect from 1.7.1977.

Georghios Kostrikkis, from Foreman 2nd Grade, to the permanent post of Foreman 1st Grade, with effect from 1.7.1977.

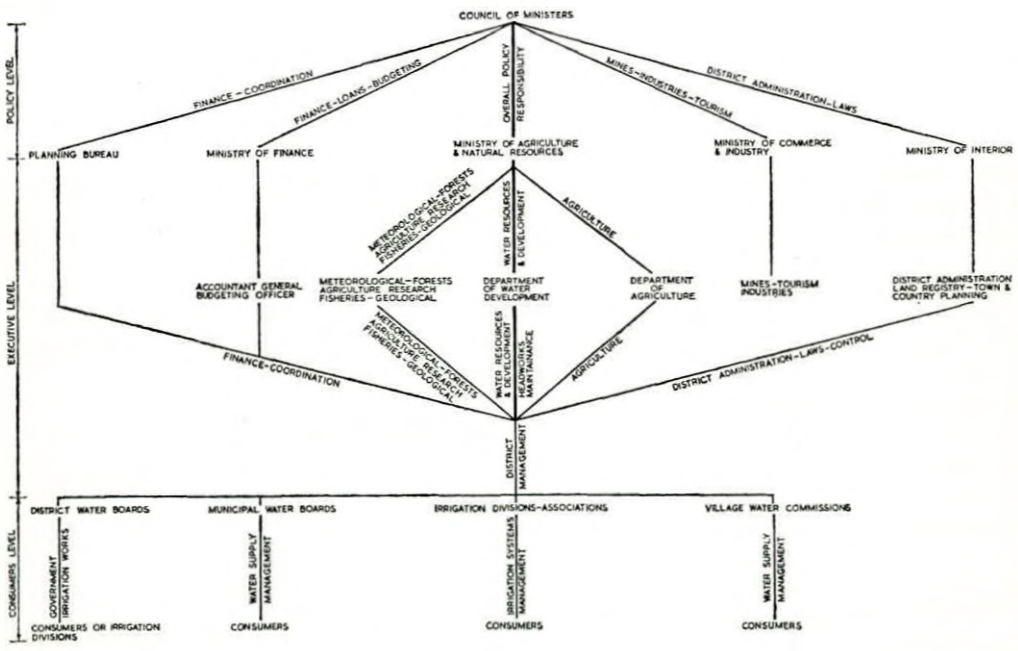
Elias Neophytou, from Foreman 2nd Grade, to the permanent post of Foreman 1st Grade with effect from 1.7.1977.

Secondments

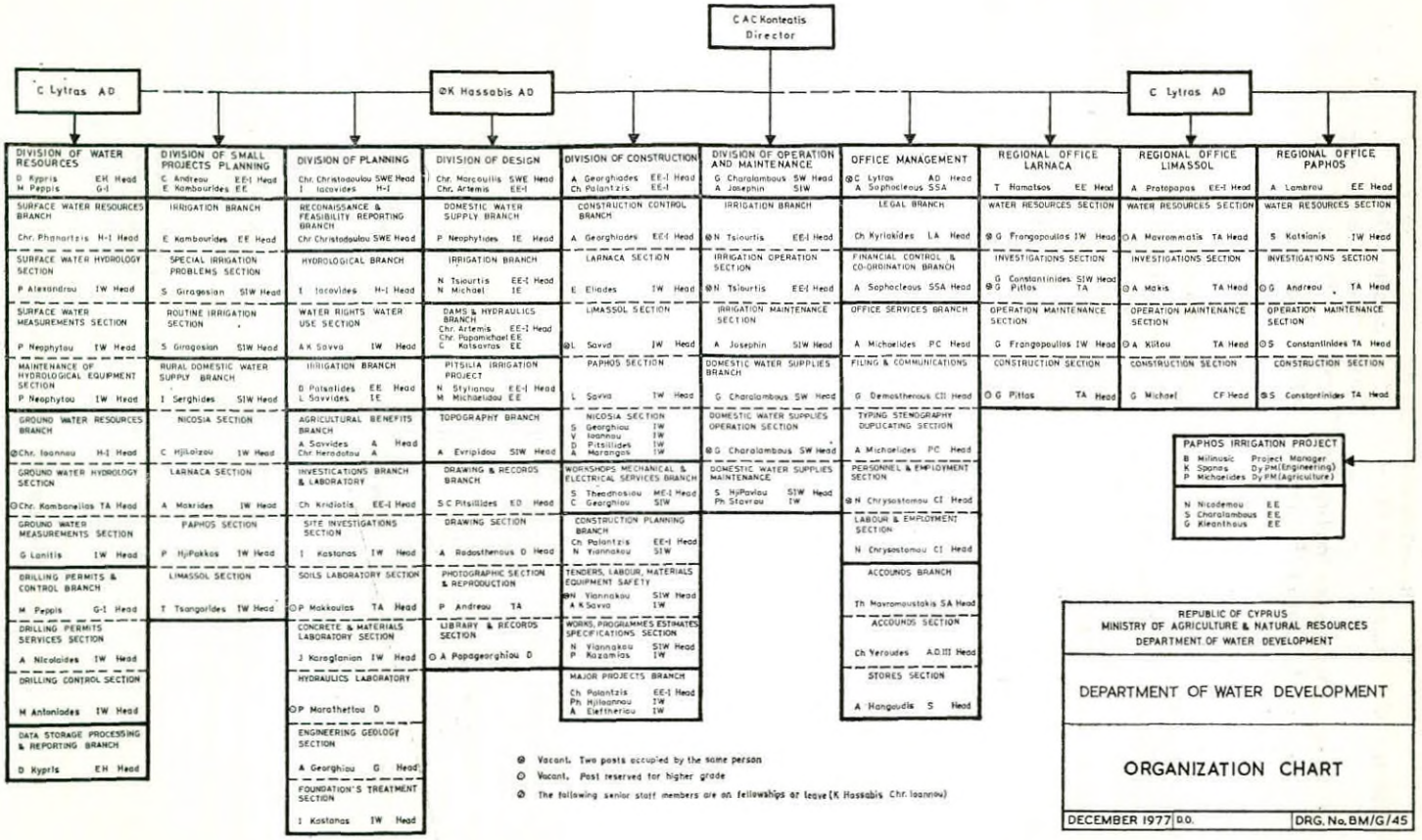
Phaedon Stavrou, from the permanent post of Technical Assistant, was seconded to the Temporary (Dev.) post of Inspector of Works, with effect from 1.7.1977.

Philippos Ioannou, from the permanent post of Foreman 1st Grade, was seconded to the Temporary (Dev.) post of Assistant Chief Foreman, with effect from 1.1.1977.

Christos Marcoullis, from the permanent post of Executive Engineer Class I to the Temporary (Dev.) post of Senior Water Engineer, with effect from 1.2.1977.



WATER DEVELOPMENT - ORGANIZATION CHART


C A C Konteatis
Director
C Lytras AD
⊘K Hassabis AD
C Lytras AD
DIVISION OF WATER RESOURCES
D Kypris EH Head
M Peppis G-I
SURFACE WATER RESOURCES BRANCH
Chr. Phanartzis H-I Head
SURFACE WATER HYDROLOGY SECTION
P Alexandrou IW Head
SURFACE WATER MEASUREMENTS SECTION
P Neophytou IW Head
MAINTENANCE OF HYDROLOGICAL EQUIPMENT SECTION
P Neophytou IW Head
GROUND WATER RESOURCES BRANCH
⊘Chr. Ioannou H-I Head
GROUND WATER HYDROLOGY SECTION
⊙Chr. Kambanellos TA Head
GROUND WATER MEASUREMENTS SECTION
G Lanitis IW Head
DRILLING PERMITS & CONTROL BRANCH
M Peppis G-I Head
DRILLING PERMITS SERVICES SECTION
A Nicolaides IW Head
DRILLING CONTROL SECTION
M Antoniades IW Head
DATA STORAGE PROCESSING & REPORTING BRANCH
D Kypris EH Head
DIVISION OF SMALL PROJECTS PLANNING
C Andreou EE-I Head
E Kambourides EE
IRRIGATION BRANCH
E Kambourides EE Head
SPECIAL IRRIGATION PROBLEMS SECTION
S Giragosian SIW Head
ROUTINE IRRIGATION SECTION
S Giragosian SIW Head
RURAL DOMESTIC WATER SUPPLY BRANCH
I Serghides SIW Head
NICOSIA SECTION
C Hjilolzou IW Head
LARNACA SECTION
A Makrides IW Head
PAPHOS SECTION
P HjiPakkos IW Head
LIMASSOL SECTION
T Tsangarides IW Head
DIVISION OF PLANNING
Chr. Christodoulou SWE Head
I Iacovides H-I
RECONAISSANCE & FEASIBILITY REPORTING BRANCH
Chr Christodoulou SWE Head
HYDROLOGICAL BRANCH
I Iacovides H-I Head
WATER RIGHTS WATER USE SECTION
A K Savva IW Head
IRRIGATION BRANCH
D Patsalides EE Head
L Savvides IE
AGRICULTURAL BENEFITS BRANCH
A Savvides A Head
Chr Herodotou A
INVESTIGATIONS BRANCH & LABORATORY
Ch Kridiotis EE-I Head
SITE INVESTIGATIONS SECTION
I Kastanas IW Head
SOILS LABORATORY SECTION
⊙P Makkoulas TA Head
CONCRETE & MATERIALS LABORATORY SECTION
J Karaglanian IW Head
HYDRAULICS LABORATORY
⊙P Marathettou D
ENGINEERING GEOLOGY SECTION
A Georghiou G Head
FOUNDATION'S TREATMENT SECTION
I Kastanas IW Head
DIVISION OF DESIGN
Chr. Marcoullis SWE Head
Chr. Artemis EE-I
DOMESTIC WATER SUPPLY BRANCH
P Neophytides IE Head
IRRIGATION BRANCH
N Tsiourtis EE-I Head
N Michael IE
DAMS & HYDRAULICS BRANCH
Chr. Artemis EE-I Head
Chr. Papamichael EE
C Katsavras EE
PITSILIA IRRIGATION PROJECT
N Stylianou EE-I Head
M Michaelidou EE
TOPOGRAPHY BRANCH
A Evripidou SIW Head
DRAWING & RECORDS BRANCH
S C Pitsillides ED Head
DRAWING SECTION
A Radosthenous D Head
PHOTOGRAPHIC SECTION & REPRODUCTION
P Andreou TA
LIBRARY & RECORDS SECTION
⊙A Papageorghiou D
DIVISION OF CONSTRUCTION
A Georghiades EE-I Head
Ch Polantzis EE-I
CONSTRUCTION CONTROL BRANCH
A Georghiades EE-I Head
LARNACA SECTION
E Eliades IW Head
LIMASSOL SECTION
⊘L Savva IW Head
PAPHOS SECTION
L Savva IW Head
NICOSIA SECTION
S Georghiou IW
V Ioannou IW
D Pitsillides IW
A Marangos IW
WORKSHOPS MECHANICAL & ELECTRICAL SERVICES BRANCH
S Theodhosiou ME-I Head
C Georghiou SIW
CONSTRUCTION PLANNING BRANCH
Ch Polantzis EE-I Head
N Yiannakou SIW
TENDERS, LABOUR, MATERIALS EQUIPMENT SAFETY
⊘N Yiannakou SIW Head
A K Savva IW
WORKS, PROGRAMMES ESTIMATES, SPECIFICATIONS SECTION
N Yiannakou SIW Head
P Nazamias IW
MAJOR PROJECTS BRANCH
Ch Polantzis EE-I Head
Ph Hjilaonnou IW
A Eleftheriou IW
DIVISION OF OPERATION AND MAINTENANCE
G Charalambous SW Head
A Josephin SIW
IRRIGATION BRANCH
⊘N Tsiourtis EE-I Head
IRRIGATION OPERATION SECTION
⊘N Tsiourtis EE-I Head
IRRIGATION MAINTENANCE SECTION
A Josephin SIW Head
DOMESTIC WATER SUPPLIES BRANCH
G Charalambous SW Head
DOMESTIC WATER SUPPLIES OPERATION SECTION
⊘G Charalambous SW Head
DOMESTIC WATER SUPPLIES MAINTENANCE
S HjiPavlou SIW Head
Ph Stavrou IW
OFFICE MANAGEMENT
⊘C Lytras AD Head
A Sophocleous SSA
LEGAL BRANCH
Ch Kyriakides LA Head
FINANCIAL CONTROL & CO-ORDINATION BRANCH
A Sophocleous SSA Head
OFFICE SERVICES BRANCH
A Michaelides PC Head
FILING & COMMUNICATIONS
G Demosthenous CII Head
TYPING STENOGRAPHY DUPLICATING SECTION
A Michaelides PC Head
PERSONNEL & EMPLOYMENT SECTION
⊘N Chrysostomou CI Head
LABOUR & EMPLOYMENT SECTION
N Chrysostomou CI Head
ACCOUNDS BRANCH
Th Mavromoustakis SA Head
ACCOUNDS SECTION
Ch Yeroudes A.O.III Head
STORES SECTION
A Hangoudis S Head
REGIONAL OFFICE LARNACA
T Hamatsos EE Head
WATER RESOURCES SECTION
⊘G Frangopoullos IW Head
INVESTIGATIONS SECTION
⊘G Constantinides SIW Head
⊘G Pittas TA
OPERATION MAINTENANCE SECTION
G Frangopoullos IW Head
CONSTRUCTION SECTION
⊙G Pittas TA Head
REGIONAL OFFICE LIMASSOL
A Protopapas EE-I Head
WATER RESOURCES SECTION
⊙A Mavrommatis TA Head
INVESTIGATIONS SECTION
⊘A Makis TA Head
OPERATION MAINTENANCE SECTION
⊙A Xilitou TA Head
CONSTRUCTION SECTION
G Michael CF Head
REGIONAL OFFICE PAPHOS
A Lambrou EE Head
WATER RESOURCES SECTION
S Katsianis IW Head
INVESTIGATIONS SECTION
⊙G Andreou TA Head
OPERATION MAINTENANCE SECTION
⊙S Constantinides TA Head
CONSTRUCTION SECTION
⊘S Constantinides TA Head
PAPHOS IRRIGATION PROJECT
B Milinusic Project Manager
K Sponas Dy PM (Engineering)
P Michaelides Dy PM (Agriculture)
N Nicodemou EE
S Charalambous EE
G Kleanthous EE
⊘ Vacant. Two posts occupied by the same person
⊙ Vacant. Post reserved for higher grade
Ø The following senior staff members are on fellowships or leave (K Hassabis Chr. Ioannou)
REPUBLIC OF CYPRUS
MINISTRY OF AGRICULTURE & NATURAL RESOURCES
DEPARTMENT OF WATER DEVELOPMENT
DEPARTMENT OF WATER DEVELOPMENT
ORGANIZATION CHART
DECEMBER 1977 D.O. DRG. No. BM/G/45

RESIGNATIONS, TRANSFERS, RETIREMENTS, DEATHS

Resignations

The following Officers resigned their posts during the year:

Maroulla Savvidou, Draughtsman, tendered her resignation, with effect from 1.2.1977.

Pantelis Loucaides, Executive Engineer Class I, with effect from 20.6.1977.

Georghia Lamprianidou, (nee Masouri), Technical Assistant, with effect from 10.11.1977.

Christos Papamichael, Executive Engineer, Class II, with effect from 25.11.1977.

Andreas Protopapas, Executive Engineer Class I, with effect from 1.12.1977.

Transfers

Costas Andreou, Executive Engineer Class I, was transferred from Larnaca to Nicosia, with effect from 17.1.1977.

Tassos Hamatsos, Executive Engineer Class II, was transferred from Nicosia to Larnaca, with effect from 17.1.1977.

Chariklia Phinikaridou, Clerical Assistant, GCS, was transferred from this Department to the Office of Public Service Commission, with effect from 13.1.1977.

Paraskevi Thrasyvoulou, Clerical Assistant, GCS, was transferred to this Department from the Office of Public Service Commission, with effect from 10.1.1977.

Theodoros Nicolaides, Executive Engineer Class II, was transferred from Limassol to Paphos, with effect from 31.1.1977.

Maria Evripidou, Clerical Assistant, GCS, was transferred from this Department to the Ministry of Commerce and Industry with effect from 26.4.1977.

Maroulla Petridou, Clerical Assistant, GCS, was transferred from this Department to the Public Works Department, with effect from 1.6.1977.

Chrystalla Papaevriviadou, Clerical Assistant, GCS, was transferred from Civil Defence to this Department, with effect from 1.6.1977.

Andreas Loizides, Clerical Assistant, GCS, was transferred from the Ministry of Foreign Affairs to this Department, with effect from 1.8.1977.

Theodoros Nicolaides, Executive Engineer Class II, was transfered from Paphos to Limassol with effect from 12.12.1977.

Retirements

Panos Pantelides, Superintendent of Works (who opted out at 58) retired from the Government Service, with effect from 1.3.1977.

Nicos Toufexis, Superintendent of Works with effect from 1.4.1977.

Georghios Orphanides, Foreman 1st Grade, with effect from 1.5.1977.

Harilaos Prokopiou, Foreman 1st Grade, with effect from 1.8.1977.

Erricos Ioannou, Chief Foreman, with effect from 1.11.1977.

Efstathios Panayi, Foreman 1st Grade, with effect from 16.10.1977.

Deaths

With deep sorrow we record here the death of two of our highly esteemed colleagues.

Panayiotis Polycarpou, Assistant Chief Foreman, who died on 20.1.1977. after a long illness and

Georghios Michaelides, Principal Clerk, who died on 3.7.1977 in a road accident.

SCHOLARSHIPS, STUDY LEAVES, DUTY ABROAD

Scholarships

Christos Ioannou, Hydrologist Class I, was awarded a scholarship by the Fulbright Programme in Cyprus, in Water Resources Management at the University of Idaho, USA, to obtain the MSc. He left Cyprus on the 29th August, 1977 and the duration of his scholarship is one year.

Dedalos Kypris, Engineer Hydrologist, was awarded a Postgraduate Training Course on Groundwater Tracing Techniques, by the UNESCO held in Graz, Austria, from the 29th August to 29th September, 1977.

Christodoulos Christodoulou, Senior Water Engineer, who had been granted a scholarship by the UK, Programme of Technical Assistance in Water Resources Planning and Economics at the Kings College of London, completed his studies and resumed his duties on the 11th July, 1977 having submitted a Ph. D. thesis on Systems Analysis for the Planning and Optimization of a Multibasin Water Resources System.

Elias Kambourides, Executive Engineer Class II, who had been granted a scholarship by the Netherlands Government in Water Management, completed his studies and was awarded the MSc in Water Management. He resumed his duties on the 11th July, 1977.

Panos Andreou, Technical Assistant, who had been granted a one year scholarship by the Netherlands Government in Photographic Technology in Aerial Photography, completed his studies and was awarded the Diploma in Photographic Tecnology. He resumed his duties on the 23td August, 1977.

Iacovos Iacovides, Hydrologist Class I, who had been granted a scholarship by the UK Programme of Technical Assistance in Hydrology at the Newcastle University and was awarded the MSc in Water Resources Management. He resumed his duties on the 17th September, 1977.

Study Leave

Paraskevoulla Maratheftou, Draughtsman, was awarded one year study leave to follow a cource of study in Civil Engineering at the City University of London, in order to enable her to obtain BSc Civil Engineering, commencing on the 26th September, 1977.

Christos Phanartzis, Hydrologist Class I, who had been granted 18 months' study leave without pay for attending advanced Hydrology courses at the University of Arizona, USA, resumed his duties on the 24th July, 1977.

Conferences and Duty Abroad

CAC Konteatis, Director of Water Development Department, visited Athens between the 14th —15th February, 1977, on a World Bank Mission.

CAC Konteatis, Director of Water Development Department, attended the United Nations Water Conference, Mar Del Plata, Argentina, 14—25 March, 1977.

CAC Konteatis, Director of Water Development, visited Washington, USA, to negotiate with officials of the International Bank, the issue of a loan for the Pitsilia Integrated Rural Development Project, between 3—12 July, 1977.

CAC Konteatis, Director of Water Development Department, visited the Main Offices of SOGREAH the Consulting Engineers for the Paphos Irrigation Distribution System in Grenoble, France, between 19—29 September 1977 for consultations.

CAC Konteatis, Director of Water Development Department and **Christos Marcoullis,** Senior Water Engineer, visited Moscow, for discussions on the financing of the Vasilikos — Pendaskinos Project, between 1—9 December, 1977.

Iacovos Iacovides, Hydrologist Class I, participated at the meeting of experts to advise the Executive Director of the United Nations Environment Programme on Pollution from land based sources in the Mediterranean, held in Geneva, 19—24 September, 1977.

Iacovos Iacovides, Hydrologist Class I, participated at the meeting of experts to formulate a Code of Practice of waste water discharge in the Mediterranean at a workshop under the auspices of the United Nations Environment Programme, held in Athens, Greece, on the 26th of June to 1st July, 1977.

Cristodoulos Artemis, Executive Engineer Class I, participated at the 45th Executive Meeting and Study Tours of the International Commission on Large Dams, held in Salzburg, Austria, between 10—22 September,

Nicos Tsiourtis, Executive Engineer Class II, participated at the 11th European Regional Conference on Irrigation and Drainage, held in Rome, between 5—12 May, 1977.

Savvas Theodosiou, Mechanical Engineer Class I, visited Messrs Dracos — Polemis factory in Greece, which specializes in the

manufacture of pumps from the 26th September to the 1st October, 1977.

Grant of Leave, without Pay, to Government Employees who have Secured Temporary Employment Overseas.

KC Hassabis, Assistant Director of the Department, has been granted another years leave without pay, not on grounds of public policy, with effect from 19.12.1977.

FOREIGN TECHNICAL ASSISTANCE

The following sections of work were dealt with during the year.

United Nations

Technical Assistance received from United Nations during 1977 was:

Experts

B Milinusic, FAO Senior Irrigation Engineer continued his services with us throughout the year as the Project Manager of the Paphos Irrigation Project.

British Technical Assistance

Studies undertaken under the British Technical Assistance have been the Southern Conveyor Project and Brackish Water Desalination.

Southern Conveyor Project

A detailed agro-economic study was initiated in September 1977, of the upper Dhiarizos valley for determining the upstream water uses and needs of this area. This investigation was postponed for 1978 in favour of the Lania Regional Irrigation Scheme which is also a part of the Southern Conveyor Project.

As regards the mathematical simulation-optimization model this was ready for preliminary runs by mid-1977. It was not, however, possible to test it due to the limited storage capabilities of the digital computer in Cyprus. The testing has been deferred to a later date — in 1978 — when the new IBM 370 computer model is expected to be installed in Nicosia.

Intensive detail field investigations and office work is planned to start by the beginning of 1978. The British Ministry of Overseas Development is augmenting our Division with four experts. They are expected to be in Cyprus by the beginning of April 1978.

The new Southern Conveyor Project offices will be ready very early in 1978.

Brackish Water Desalination

By the end of 1977 the second phase of reverse osmosis project which had commenced in 1975 was completed. The second phase involved the application of RO for the solution of specific water shortage problems as in the case of water shortage at the forest nursery at Athalassa. The tests at Athalassa proved that the application RO for the solution of such problems is feasible. The tests at Athalassa made possible the realisation of the actual costs and problems involved in the operation of such units.

CYPRUS NATIONAL, INTERDEPARTMENTAL AND DEPARTMENTAL COMMITTEES

International Hydrological Programme

The Cyprus National Committee for the IHP consists of the following:

Chairman
C A C Konteatis, Director,

REGISTRE DES BARRAGES EN CHYPRE — *REGISTER OF DAMS IN* CYPRUS

DRG. No. AG/IR/39

LIGNE / LINE No.	NOM DU BARRAGE / NAME OF DAM	ANNÉE D'ACHÈVEMENT / YEAR OF COMPLETION	SITUATION / LOCATION: COURS D'EAU / RIVER	SITUATION: VILLE LA PLUS PROCHE / NEAREST CITY	SITUATION: ETAT PROVINCE DU DEPARTEMENT / STATE PROVINCE OR COUNTY	TYPE	HAUTEUR AU-DESSUS DE LA PLUS BASSE FONDATION / HEIGHT ABOVE LOWEST FOUNDATION (m)	LONGUEUR DE CRÊTE / LENGTH OF CREST (m)	VOLUME DU BARRAGE / VOLUME CONTENT OF DAM (10^3 m^3)	CAPACITÉ TOTALE DU RÉSERVOIR / GROSS CAPACITY OF RESERVOIR (10^3 m^3)	DESTINATION	CAPACITÉ MAXIMALE DES ÉVACUATEURS / MAXIMUM DISCHARGE CAPACITY OF SPILLWAYS .. (m^3/s)	TYPE DES ÉVACUATEURS / TYPE OF SPILL WAYS	PROPRIÉTAIRE / OWNER	BUREAU D'ÉTUDES / ENGINEERING BY	CONSTRUCTEUR / CONSTRUCTION BY	LIGNE / LINE No.
1	KAFIZES	1953	Xeros (Morphou)	Nicosia	Nicosia	PG	23	27	4	113	I	54	L	Lefka Irrigation Division	Department of Water Development	Department of Water Development	1
2	KANDOU	1956	Kouris	Limassol	Limassol	PG	15	53	2	34	I	59	L	Kandou Irrigation Division	Department of Water Development	Department of Water Development	2
3	PERAPEDHI	1956	Kouris	Limassol	Limassol	PG	22	62	4	55	I	107	L	Perapedhi Irrigation Division	Department of Water Development	Department of Water Development	3
4	PYRGOS	1957	Katouris	Nicosia	Nicosia	PG	22	66	5	285	I	125	L	Pyrgos Irrigation Division	Department of Water Development	Department of Water Development	4
5	TRIMIKLINI	1958	Kouris	Limassol	Limassol	PG	33	76	6	340	I	59	L	Trimiklini Irrigation Division	Department of Water Development	Department of Water Development	5
6	ATHALASSA	1962	Pedhieos	Nicosia	Nicosia	TE	18	447	103	791	I	48	L	Government	Department of Water Development	Department of Water Development	6
7	GEUNYELI	1962	Pedhieos	Nicosia	Nicosia	TE	15	254	50	1 045	I	173	L	Geunyeli Irrigation Division	Department of Water Development	Department of Water Development	7
8	LEFKA	1962	Marathasa	Nicosia	Nicosia	PG	35	149	11	368	I	246	L	Lefka Irrigation Division	Department of Water Development	Department of Water Development	8
9	MORPHOU	1962	Serakhis	Nicosia	Nicosia	TE	13	1 436	206	1 879	I	764	L	Morphou Irrigation Division	Department of Water Development	Department of Water Development	9
10	PRODHROMOS	1962	off stream	Limassol	Limassol	TE	10	756	73	122	I	-	L	Prodromos Irrigation Division	Department of Water Development	Department of Water Development	10
11	KANLI KEUY	1963	Pedhieos	Nicosia	Nicosia	TE	19	511	47	1 113	I	116	L	Kanli Keuy Irrigation Division	Department of Water Development	Department of Water Development	11
12	AGROS	1964	Kouris	Limassol	Limassol	TE	26	180	61	99	I	6	L	Agros Irrigation Division	Department of Water Development	Department of Water Development	12
13	ARGAKA	1964	Magounda	Paphos	Paphos	ER	41	173	138	1 150	I	0,3	L	Government	Howard Humphreys & Sons of U.K.	Department of Water Development	13
14	KITI	1964	Tremithos	Larnaca	Larnaca	TE	22	990	183	1 614	I	602	L	Government	Il Nuovo Castoro of Italy	Department of Water Development	14
15	LIOPETRI	1964	Potamos	Famagusta	Famagusta	TE	18	579	50	340	R	150	L	Liopetri Irrigation Division	Department of Water Development	Department of Water Development	15
16	MIA MILEA	1964	Pedhieos	Nicosia	Nicosia	TE	22	140	54	355	I	24	L	Mia Milea Irrigation Division	Department of Water Development	Department of Water Development	16
17	OVGOS	1964	Serakhis	Nicosia	Nicosia	TE	16	745	130	845	I	786	L	Morphou Irrigation Division	Department of Water Development	Department of Water Development	17
18	AYIA MARINA	1965	Xeros (Tyllirias)	Paphos	Paphos	ER	33	142	61	311	I	161	L	Ayia Marina Irrigation Division	Energoprojekt of Yugoslavia	Mediterranean Constructors Greece - G.P.Zachariades Cyprus	18
19	POLEMIDHIA	1965	Garyllis	Limassol	Limassol	TE	45	196	215	3 864	I	581	L	Government	Energoprojekt of Yugoslavia	Mowlem & Ridgway of U.K.	19
20	KALOPANAYIOTIS	1966	Marathasa	Nicosia	Nicosia	TE	40	137	156	391	I	207	L	Government	Howard Humphreys & Sons of U.K.	Department of Water Development	20
21	MAVROKOLYMBOS	1966	Mavrokolym-bos	Paphos	Paphos	TE	45	528	267	2 180	I	340	L	Government	Energoprojekt of Yugoslavia	Cybarco of Cyprus	21
22	POMOS	1966	Livadhi	Paphos	Paphos	ER	38	302	153	859	I	300	L	Pomos Irrigation Division	Energoprojekt of Yugoslavia	Mediterranean Constructors Greece - G.P.Zachariades Cyprus	22
23	YERMASOYIA	1968	Yermasoyia	Limassol	Limassol	TE	49	409	539	13 600	I	850	V	Government	Energoprojekt of Yugoslavia	Cybarco of Cyprus	23
24	LEFKARA	1973	Pendaskinos	Larnaca	Larnaca	TE/ER	74	240	820	13 850	S/I	316	L	Famagusta Water Board & Lefkara Irrigation Division	Howard Humshreys & Sons of U.K.	L. Fairclough & Medcon Construction Ltd.	24
25	MASARI	1973	Serakhis	Nicosia	Nicosia	TE	15	929	245	2 273	I	622	V	Government	Department of Water Development	Department of Water Development	25
26	PALEKHORI-KAMBI	1973	Akaki	Nicosia	Nicosia	PG	33	131	27	620	I	65	L	Government & Palekhori Irrigation Division	Department of Water Development	Department of Water Development	26
27	ARAKAPAS	1975	Yermasoyia	Limassol	Limassol	PG	25	97	10	129	I	205	L	Arakapas Irrigation Division	Department of Water Development	Department of Water Development	27

Secretary
I Iacovides, Hydrologist,
Members
Dr V Krentos, Director, Agricultural Research Institute
A Louca, Director, Department of Agriculture
E Michaelides, Director, Department of Forests
Y HjiStavrinou, Director, Geological Survey Department
CI Philaniotis, Head, Meteorological Office

The IHP is sponsored by UNESCO and its purpose is to implement and carry on the findings and activities of International Hydrologic Decade which ended in 1975. The IHP officially started being operational in 1976 with the establishment of National Committees to act as focal points for IHP activities.

Several scientific and educational IHP projects have already been decided upon and questionnaires regarding local practice have been answered.

Data from the Cyprus Decade stations were continued to be provided.

The computer storage of hydrologic data initiated during the IHD is continuing.

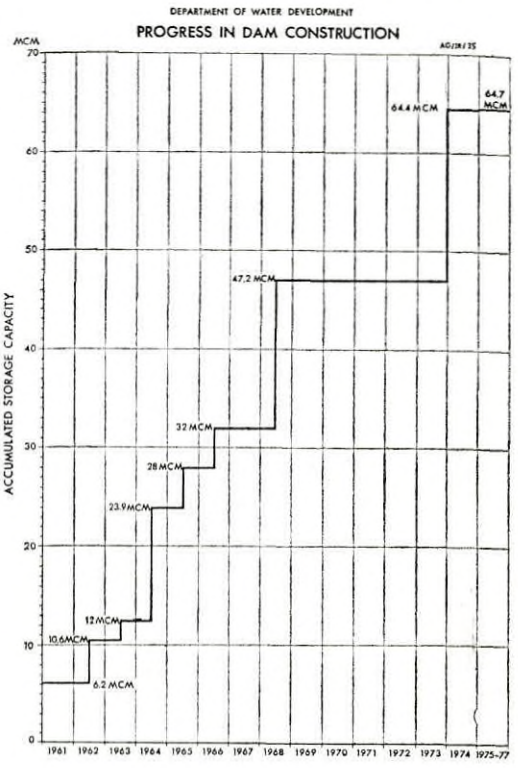
International Commission on Large Dams

The International Commission on Large Dams is a non-profit seeking organization with 74 member countries. As set out in its Constitution: "The objects of the Commission are to encourage improvements 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 (CYNCOLD) was elected to full membership of the International Commission in 1969. During 1976 the National Committee was composed of the following:

Chairman
C A C Konteatis, Director,

Secretary
C C Artemis, Executive Engineer I, WDD

Members
K C Hassabis, Assistant Director, WDD
A Papadopoulos, Representative of the Association of Civil Engineers and Architects



P Christophorou, Representative of the Association of Building Contractors.

The 45th Executive Meeting of the International Commission was held in

DAMS CONSTRUCTED UP TO 1960

No	DAM	TYPE	HT	1000m³	YEAR
1	Kouklia	Earth	6	4,545	1900
2	Lymbia *	Gravity	5	18	1945
3	Lythrodhonda	Gravity	11	32	1945
4	Kalokhorio (K1)	Gravity	9	82	1947
5	Akrounda	Gravity	7	23	1947
6	Galini	Gravity	11	23	1947
7	Petra	Gravity	9	32	1948
8	Petra	Gravity	9	23	1951
9	Lythrodhonda	Gravity	10	32	1952
10	Kafizes	Gravity	23	113	1953
11	Ayios Loucas	Earth	3	455	1955
12	Gypsos	Earth	3	100	1955
13	Kandou	Gravity	15	34	1956
14	Perapedhi	Gravity	22	55	1956
15	Pyrgos	Gravity	22	285	1957
16	Trimiklini	Gravity	33	340	1958

Total Storage Capacity $6.174\ m^3 \times 10^6$

MINOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT	1000m³	YEAR
47	Sotira	Earth	8	45	1962
48	Panayia (F)	Earth	7	45	1962
49	Paralimni (45)	Earth	5	115	1963
50	Ayia Napa (7)	Earth	8	55	1963
51	F'sta 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	Avgarou (7)	Earth	3	68	1966
56	Kandea (2)	Earth	5	82	1966
57	Xylophaghou (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. Epiktitos (6)	Earth	6	34	1968
62	Akanthou (6)	Earth	6	45	1968
63	Akhna (3)	Earth	4	40	1968
64	Xylotymbou (5)	Earth	5	50	1969

Total Storage Capacity $1,075\ m^3 \times 10^6$

MAJOR DAM PROJECTS FROM 1960-70

No	DAM	TYPE	HT	1000m³	YEAR
17	Prodhromos	Earth	10	122	1962
18	Morphou	Earth	13	1,879	1962
19	Letka	Gravity	35	368	1962
20	Geunyeli	Earth	15	1,045	1962
21	Athalassa	Earth	18	791	1962
22	Kanli Keuy	Earth	19	1,113	1963
23	Argaka	Rockfill	41	1,150	1964
24	Mia Milia	Earth	22	355	1964
25	Ovgos	Earth	16	845	1964
26	Kiti	Earth	22	1,614	1964
27	Agros	Earth	26	99	1964
28	Liopetri	Earth	18	340	1964
29	Polemidhia	Earth	45	3,864	1965
30	Ayia Marina	Rockfill	33	311	1965
31	Kalopanayiotis	Earth	40	391	1966
32	Mavrokolymbos	Earth	45	2,180	1966
33	Pomos	Rockfill	38	859	1966
34	Yermasoyia	Earth	49	13,600	1968
35	Syngrasis	Earth	7	1115	1968

Total Storage Capacity $32,041 m^3 \times 10^6$

MAJOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	HT	1000m³	YEAR
36	Ayios Yeoryios	Earth	6	90	1962
37	F'sta Antiflood	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	Makrasyka	Earth	8	195	1966
42	Akhna (Mesania)	Earth	4	90	1967
43	Morphou spreading grounds	Earth	5	130	1969
44	Ormidhia	Earth	5	100	1968
45	Vrysoules	Earth	7	140	1969
46	Protopapas	Earth	6	90	1970

Total Storage Capacity $8.275\ m^3 \times 10^6$

MAJOR DAM PROJECTS FROM 1971-77

No	DAM	TYPE	HT	1000m³	YEAR
65	Lefkara	Earth Rockfill	71	13,850	1973
66	Massari Recharge dam	Earth	15	2,273	1973
67	Palekhori-Kambi	Gravity	33	620	1973
68	Arakapas	Gravity	23	130	1975
69	New Lymbia	Gravity	12	220	1977

Total Storage Capacity $17,093 m^3 \times 10^6$

GRAND TOTAL UP TO END OF 1977: $64,7 m^3 \times 10^6$

(1) Dams constructed up to 1960

(17) Major dam projects from 1960-70

(69) Major dam projects from 1971-75

(36) Major recharge dams from 1960-70

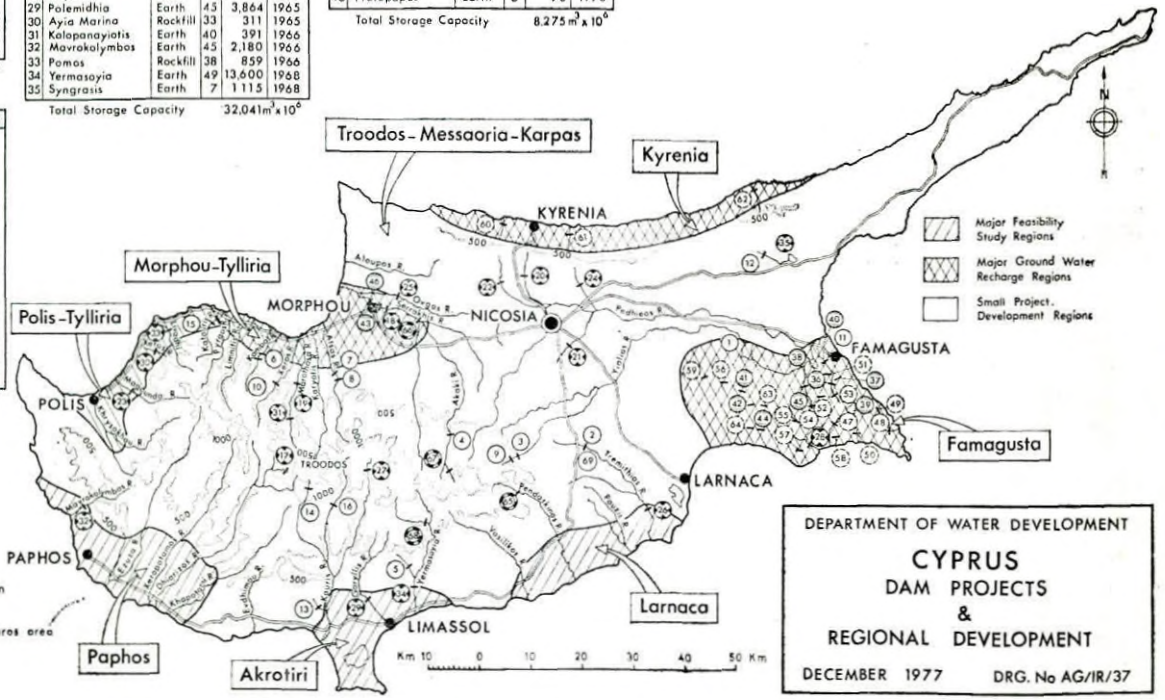
(47) Minor recharge dams from 1960-70

HT refers to height in meters from foundation

YEAR is the year of completion

Phrenaros (6) means six small dams in Phrenaros area

*Demolished 1976



DEPARTMENT OF WATER DEVELOPMENT

CYPRUS
DAM PROJECTS & REGIONAL DEVELOPMENT

DECEMBER 1977 DRG. No AG/IR/37

Salzburg, Austria on the 13th to the 16th September 1976. It was preceeded and followed by Study Tours to dams, construction sites and hydroelectric installations. CYNCOLD was represented by two delegates viz. Secretary CC Artemis and Member A Papadopoulos. Apart from the meetings of the various technical committees and the submission of their interim or final reports, the Exectutive Meeting chose the four subjects to be covered by the next Congress on Large Dams, which is to be held in New Delhi, INDIA in October — November, 1979.

The subjects chosen are:

- Interface Problems of Dams
- Deterioration or Failure of Dams
- Large Capacity Outlets and Spillways, and
- Seismicity and Aseismic Design of Dams

The 46th Executive Meeting will be held in Cape Town, South Africa from the 8th to the 12th October, 1978 and will be followed by organized Study Tours from the 13th to the 19th.

During the year under review CYNCOLD has continued the exchange of correspondence with the Central Office of the Commission in Paris and its Technical Committees and has both received and supplied technical information on dams and related subjects.

International Commission on Irrigation and Drainage

The International Commission on Irrigation and Drainage is a non-profit organization whose objectives are to stimulate and promote the development and application of the science and techniques of irrigation, drainage, flood control and river training in the engineering, economic and social aspects, The ICID was set up in 1950 with Central Office in New Delhi, India.

Cyprus is a member country of the International Commission on Irrigation and Drainage since 1954. The Cyprus Committee on Irrigation and Drainage was formed in 1964 and it is now composed of the following:

Chairman
C A C K o n t e a t i s, Director,

Secretary
N T s i o u r t i s, Executive Engineer, WDD

Ex-Officio Members
Director, Department of Forest
Director, Department of Agriculture
Director, Agricultural Research Institute

During the year 1977 the Cyprus National Committee on Irrigation and Drainage continued its correspondence and exchange of information with the Central Office of the ICID and other National Committees.

All publigations such as six-month bulletins, annual reports and other documents which were sent by the ICID or any other Member country of ICID were distributed to all members of the Cyprus National Committee.
In 1977 the following activities of the ICID took place.

The European Conference on Irrigation and Drainage was held in Rome Italy from May 5—12 1977.
The subjects of the conference were the following:

- Hydrological aspects of small watersheds

- Small watershed management
- Typical Technical aspects of small dams and their reservoirs
- Operational and socio-economic aspects.

The Cyprus National Committee was represented to the conference by N Tsiourtis, Secretary of the Committee.
The twenty eighth Meeting of the International Executive Council of the ICID was held in Teheran (Iran) on May 12th—15th 1977. The meeting discussed subjects such as membership, publications etc. The Cyprus National Committee was not represented.
The total number of member National Committees of the ICID has risen to 70.

International Water Supply Association

The Department of Water Development was an associate member of the IWSA until 1969. Late in 1969 a National Committee was established, made by:

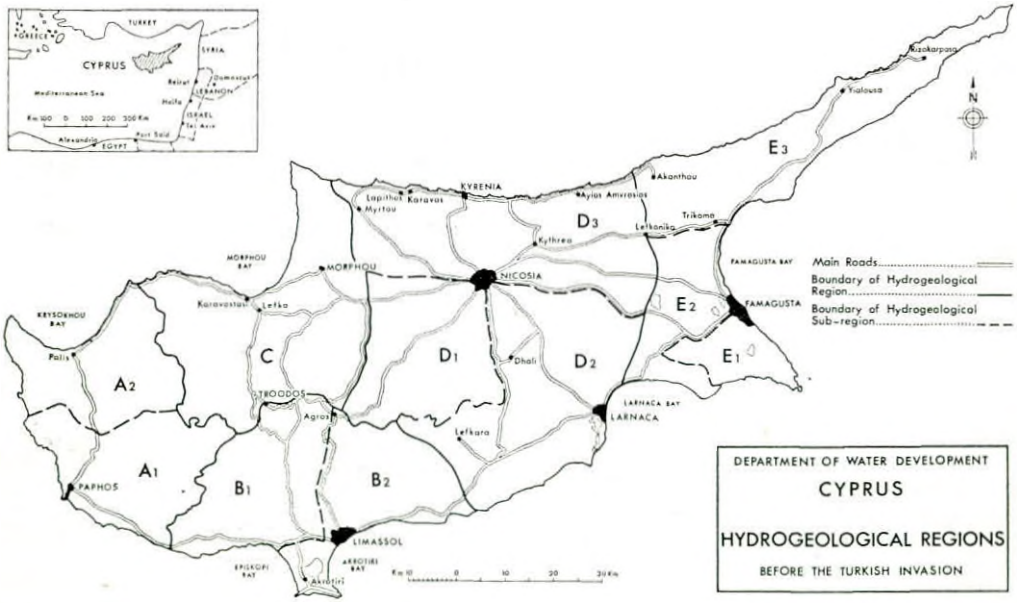
Chairman
C A C K o n t e a t i s, Director,

Secretary
G C h a r a l a m b o u s, Superintendent of Works, WDD ,

and the representatives of the Ministry of Interior and Water Boards of Nicosia, Limassol, Famagusta and Larnaca as members.
The Cyprus National Committee of the International Water Supply Association exchanged regular correspondence with the Head Office of the Association relative to the activities of his Organization.

MEETINGS OF THE DIRECTOR WITH THE STAFF

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 Department, Meteorological Office, Fisheries Department and the District Administration were also held during the year.

WATER RESOURCES

The hydrological records, unfortunately, are still confined to the Government controlled areas and this report has to be viewed having in mind a complete absence of data from the northern occupied area.

The years precipitation averaged to 471mm i e 88% of the normal and varied from 80% to 95% in different areas.

December, January and February were drier than normal whilst October, November and April well above normal.

The maximum amount of rainfall reported in a 24 hour period was 105.9 mm at Kannaviou (Paphos) on the 3rd July.

The first snowfall occured at Olympus on the 24th November and the last fall on the 14th April. Snowfall occurred up to 450m elevations during the year.

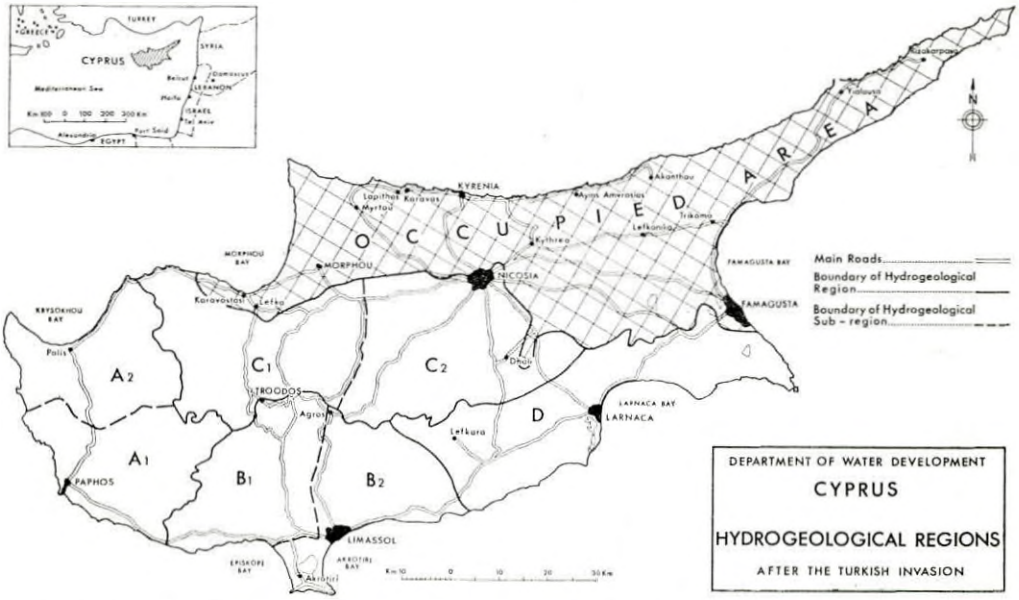
The temperature during the year as a whole was higher than normal by about 0.5^{0}C in coastal areas and 1^{0}C in inland areas.

Monthly mean temperatures were about normal in June, slightly above normal in October, November, February, May, July and August and below normal in January.

The extreme maximum and minimum temperatures occurred in Nicosia on the 11th July at 44.2^{0}C and at Prodhromos - 6.2^{0}C on the 5th January.

The measured evaporation from USWB class A pan was in Nicosia 1.852m and at Prodromos 1.419m during the year.

The surface flows were about 50% of the average during the year. The maximum recorded flow during the



year was 19 MCM on the Dhiarizos river at Kouklia. The maximum flood recorded was on the Tremithos river at 90m^3/s.
Out of 26 major dams under observation, 19 overflowed whilst Agros was 60% full, Athalassa was 5% full, Kiti 17% full, Lefkara 54% full, Polemidhia 35% full, Prodhromos 82% full and Liopetri zero. The biggest amount of water in storage was at Yermasoyia Dam with 14 MCM with Lefkara Dam second with 7.35 MCM.
Regarding the groundwater situation, this is observed through hydrological surveys of boreholes covering an area of about 2,500km^2 which is 2/3 of what it was before the 1974 Turkish invasion.
The groundwater levels have further declined in the Eastern Messaoria area, the worst case noticed was at Paralimni where the decline was 0.80m.
In the Kokkini Trimithia area the decline has been up to 1.1m.
During the year 2008 well applications were examined.

PLANNING AND DESIGN OF PROJECTS

During the year the main planning work on major projects concentrated on the finalization of the Feasibility Study for Vasilikos-Pendaskinos double purpose irrigation and domestic water supply project which was submitted in its printed form in July 1977.
This Feasibility Study, was presented in 11 volumes as mentioned under PLANNING DIVISION.
The study was entirely undertaken and completed by Departmental staff using high level sophisticated systems analysis and mathematical modelling techniques with extensive use of electronic computer.
Its high standard was praised by the World Bank specialists as being one of the best studies ever appraised by them and it represents a great achievement of those who participated and of the Department as a whole.
The Project which is estimated to cost £18 million provides for the irrigation of 8,000 donums of land between the Ayios Theodhoros and the Kalavasos villages and the supply of 7MCM of domestic water to Nicosia and partly to reinforce the Famagusta - Larnaca water supply at Khirokitia.
It is envisaged to start implementing in 1978 the groundwater phase of the project for irrigation and possibly to start on the Nicosia water supply with an emergency connection on Khirokitia treatment plant.

Preparatory work went ahead with collecting agroeconomic and water resources data for the Southern Conveyor Project for which a decision has already been taken to be undertaken through British Technical Assistance and starting early in 1978 for a 2 year period of Feasibility Studies.

A new study undertaken during the year is the Pitsilia Integrated Rural Development Project for which an agreement with the World Bank has been signed. The Project includes irrigation schemes, domestic water supply for rural communities soil conservation works for rainfed farming, roads, schools and hospital at Kyperounda. The WDD undertakes the irrigation and domestic water supply components which include one major dam at Xyliatos, upto 30 earth reservoirs, borehole schemes irrigation rehabilitation and village water supplies. The total cost is estimated at £9 million out of which £4 million is for the water works mentioned.

Planning and design for routine irrigation and domestic water supply projects continued also during the year. Some interesting projects undertaken were:

An extension of the Paphos town water supply distribution system at Mouttalos.

The Amathous Improvement Board Domestic water supply.

Tourist zones at Paralimni water supply.

An interesting irrigation scheme designed was the Pissouri scheme at a cost of £300,000 to provide water from Khapotami for the irrigation of the sultana vine plantations at the village.
Also a big irrigation scheme for the Khrysokhou valley using groundwater has been designed at an estimated cost of £211,000.
Finally, designs for irrigation of a number of schemes in the Solea valley have been produced.

CONSTRUCTION OF PROJECTS

The amount of expenditure during 1977 reached £3,258,000 on all construction projects and represents a new record of expenditure.

The main construction activities may be summarised as follows:-

Paphos Irrigation Project

The construction works for this Project were in the 2nd year works on the main canal, on the supply and installation of well pumps on the 25 boreholes of the project, on the wellfield conveyance system from the wellfield to the main canal and work on the Central Building Offices at Yeroskipos. The total expenditure on this project during the year was £871,000 whilst the up to date expenditure reached £1,340,000.

Other Major Irrigation Works

These included 25 different schemes at an expenditure of £786,000 most of them being extensions and repairs of existing projects.

The largest scheme under construction was the Yermasoyia-Polemidhia project Trakhoni pumping scheme using water from the Yermasoyia and Polemidhia Dams for which the expenditure reached £615,000.

The next important project executed was the Lymbia Dam the construction of which was completed during 1977.

Rural Domestic Water Supplies

The Department was very active in this field.

89 routine village water supply schemes were undertaken at an expenditure of £399,000 mainly for extensions, improvements additional sources etc. The most important was the lower Paphos villages regional water supply scheme.

101 water supply schemes for Refugee housing estates were undertaken during 1977 with an expenditure of £467,000.

128 rural domestic water supply schemes for maintenance purposes paid through village deposits were also executed at a total cost of £24,000.
In addition 136 small schemes mainly in the form of distribution pipes for

private developers was also carried out at a cost of £81,000.

Town Water Supplies

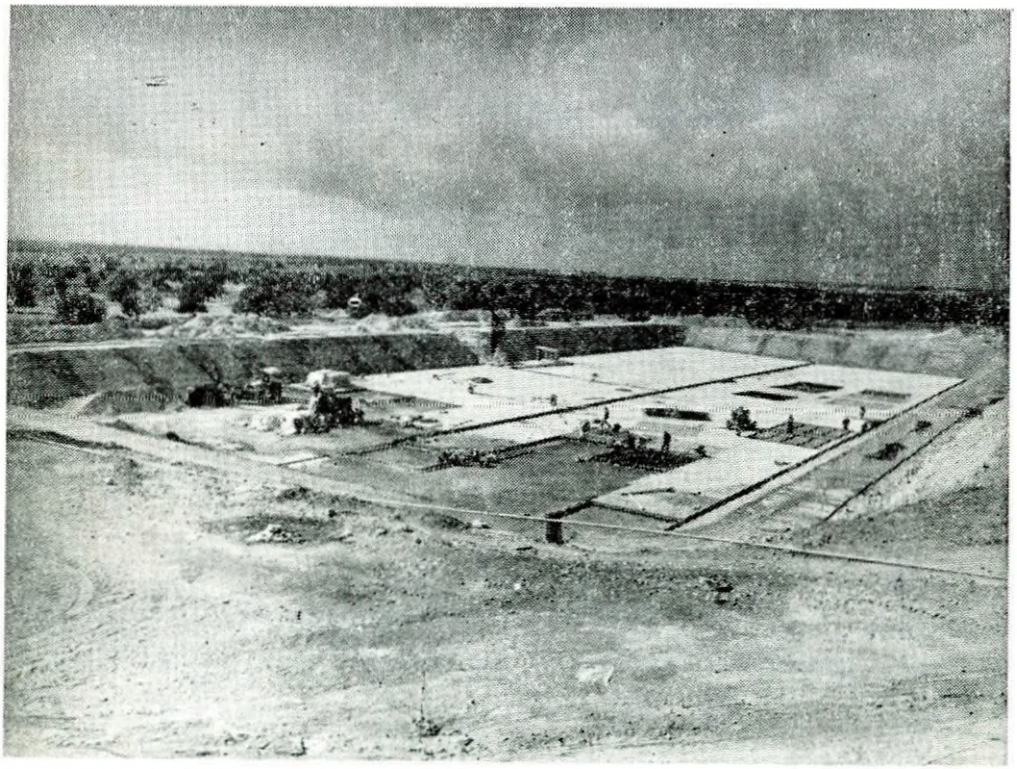
During 1977, 10 town water supply schemes were undertaken at £226,000 expenditure. The most important scheme was the continuation of the extensions and improvements on the Nicosia distribution system and the completion of the new Strovolos reservoir.

Minor Irrigation Works

110 routine irrigation schemes at an expenditure of £226,000 and 20 small schemes paid by village deposits at £9,000 were executed during the year. The most important of these schemes were for lining channels in concrete at Peristerona-Astromeritis at £17,000 and Akaki-Meniko at £16,000.

Works undertaken for other Government Departments

142 various schemes at an expenditure of £170,000 were carried out. Such schemes included water supplies for Agricultural Department Farms, Forest Department, Industrial Areas and other Schemes.



Concrete lined night storage reservoir 20,000 m³ capacity belonging to Trakhoni extension of the Yermasoyia-Polemidhia Project. It will be completed towards the end of 1978. The Trakhoni extension will finally irrigate 4,390 donums of citrus and vines. The whole Yermasoyia-Polemidhia Project including Akrounda, Phinikaria, Yermasoyia and Polemidhia Irrigation Divisions, Phasouri, Zakaki, Ayios Nikolaos and Trakhoni extensions will command an area of 16,000 donums permanent and annual crops. WDD photo A59-2.

LABOUR

The average number of labourers employed by the Department during 1977 was 937 as compared with 946 in 1976.
12.26% were classed as regulars and semiskilled and 8.43% unskilled.
The approximate daily average of labourers engaged per month was as follows:

January	945
February	903
March	878
April	859
May	916
June	929
July	1018
August	1061
September	980
October	954
November	902
December	897
Monthly average	937

OPERATION AND MAINTENANCE OF PROJECTS

The management of major irrigation works is done jointly with the District Administration, whilst small irrigation and village water supply schemes is done by the District Administration and local committees. For town water supplies, there are Water Boards set up.
In the year under review the total quantity of water stored in our dams reached 32MCM. Out of this quantity 15MCM was used as follows:- 2MCM for domestic purposes, 3.3MCM for recharge purposes and 9.7MCM for irrigation.

Irrigation Projects

The income from the water sold for irrigation from 10 dams reached £93,500 at a corresponding operation and maintenance costs of £42,500.
The water was used for the irrigation of 15,500 donums of land planted in citrus, vines, deciduous, bananas and vegetables.

Domestic Water Supply Projects

Water sold by the Department is in the case of Nicosia (Greater Nicosia Scheme) and in the case of the Famagusta Water Supply Project.
In Nicosia 3.7MCM were provided through the Greater Nicosia Scheme giving a revenue of £303,000 at £214,000 corresponding expenses.
The revenue would have been much larger if the Turkish population of Nicosia was not supplied free of charge.
The cost of supply of water from the Turkish occupied Morphou sources is 97% electricity which is also supplied free.
Also 4MCM were provided by the Water Board supply areas and 0.75 MCM by the Nicosia Water Commission area.
Efforts to unify the three Administrations as above and which started 10 years ago are still pending.
The Famagusta Domestic Water Supply Scheme supplies water to the Turkish occupied town of Famagusta, free of charge to Larnaca and to a number of villages. The total revenue from the sale of the water reached £50,000.

- Larnaca Water Board.... 31 193
- Villages 11 406
- Refugee estates 7 746
- Others 38

Total £50 383

REGIONAL OFFICES

Due to the occupation of northern Cyprus by Turkish troops, there are

only three regional offices, Famagusta/Larnaca, Limassol and Paphos.
The responsibility of the regional offices is largely on water resources and routine project planning and supervision of construction.

Larnaca - Famagusta Regional Office

Extensive hydrological surveys are carried out from this office mainly in the Kokkinokhoria area. A lot of work has to be done from the beginning due to the loss of records at Famagusta.

Limassol Office

The important hydrological work in this region is the groundwater measurements of the Akrotiri aquifer and the surface flows of Kouris, Yermasoyia and Garyllis.
The staff of this office has been largely occupied during the year with the supervision of the construction of the Trakhoni extension of Yermasoyia — Polemidhia Project.

Paphos Regional Office and Paphos Irrigation Project

The staff has been considerably strengthened due to the heavy resposibilities undertaken with the construction of the Paphos Irrigation Project. This office has been very active throughout the year.

FINANCE EXPENDITURE AND REVENUE

During the year 1977 the total expenditure (from WDD budgeted and non budgeted votes) was £4,272,795 including all administration costs.
This is by far the highest expenditure made since the creation of this Department.
The general picture is as follows:

Description	Budget £	Expenditure £
WDD development estimates including loans	2 907 587	4 965 942
WDD ordinary estimates	614 262	618 841
Non budgeted votes for Regufee housing estates, work for other Government departments and private developers and village deposits	750 946	931 473
Total	£4 272 795	£6 516 256

The level of construction works carried out during 1977 was a record £3,258,884.

The largest item of expenditure was for the Paphos Irrigation Project for which the sum of £870,936 was spent mainly on the main canal the construction of which started in September 1976 and continued throughout 1977.

During the year 1977 3 large contracts were in progress ie for the supply and installation of well pumps, the supply for well field conveyance system and eastern main pipeline.

The monthly development expenditure of the Department, as can be seen from Table 1—3 is again very unevenly distributed, ranging from 0.50% in January and increasing to 57.73% in December.

This obviously is very unsatisfactory and it has to be attributed on the institutional set up of the Government in general, and various Departments and Ministries dealing with water in particular.
The formalities to authorize projects obviously take a long time and the first few months of the year are almost wasted as far as construction works are involved.

Revenue

The sum of £405,486 was collected during the year (1976 was £468,016) as revenue, mainly from the sale of water for the Greater Nicosia and the Famagusta water supply schemes.

Loan Proceeds

(a) Two loans from the Federal Republic of Germany for the sum of £2,250,000 (approx) were approved for the construction of irrigation schemes in rural areas.
During the period 6th December 1976 — 18th July 1978 the sum of £1,468,509 was withdrawn from the loan.
(b) Loan from the International Bank of Reconstruction and Development for the Paphos Irrigation Project ($14,000,000).
During the period 22.1.1976 — 27.6.1978 the sum of £467,605 was withdrawn from the loan.
Tables 1-1 to 1-9 which follow refer to WDD budgeted votes only.

TABLE 1-1 **EXPENDITURE — WATER DEVELOPMENT DEPARTMENT VOTES**

Details	Govt	Village	Total
	£	£	£
1 Administration	606 793	—	606 793
2 Irrigation Drainage & Dams	1 792 616	118 416	1 911 032
3 Water Control	—	—	—
4 Town Water Supplies	440 583	70 006	510 589
5 Village Water Supplies	273 794	126 065	399 859
6 Drilling — Prospecting	13 080	—	13 080
7 Hydrology	33 824	—	33 824
8 Surveys and Investigation	29 672	—	29672
9 Construction of Formwork	3 690	—	3 690
10 Purchase of Machinery and Equipment	7 124	—	7 124
11 Stores	6 186	—	6 186
Total	£3 207 362	£314 487	£3 521 849

Breakdown of Administration

	£
1 Personal Emoluments	409 819
2 Casual Assistance	—
3 Technical Assistance	82 702
4 Travelling	34 755
5 M'ce and Operation of Motor Transport	38 365
6 Office Expenses	5 562
7 Leave pay to Regular Employees	33 205
8 Govt. Water Supply	2 375
Total	£606 793

Breakdown of "Irrigation, Drainage & Dams"

	£
1 Paphos Irrigation Project (including £101,985 for Consultants Fees)	870 936
2 Major Irrigation Works	786 193
3 Minor Irrigation Works	225 320
4 Major Projects Investigations	19 970
5 Dam Maintenance	8 613
Total	£1 911 032

TABLE 1-2 MONTHLY STATEMENT OF ORDINARY EXPENDITURE FOR THE YEAR 1977

Head 17A — Water Development

1977 Approved	£582 027
Add special Warrants	36 814
Total	618 841

Month	Monthly Expend. £	Expend. to date £	%
January	24 787	24 787	4.00
February	41 515	66 302	10.71
March	42 766	109 068	17.62
April	40 248	149 316	24.13
May	50 934	200 250	32.36
June	44 633	244 883	39.57
July	49 187	294 070	47.52
August	58 241	352 311	56.93
September	63 165	415 476	67.14
October	46 118	461 594	74.59
November	45 079	506 673	81.87
December	107 589	614 262	99.26

Summary

Amount approved	£618 841	100%
Less actual expend.	£614 262	99.26%
Balance	£ 4 579	0.74%

Repairs to trashrack at Perapedhi dam desilting tunnel inlet. WDD photo No. A82-2.

TABLE 1-3 MONTHLY STATEMENT OF DEVELOPMENT EXPENDITURE FOR THE YEAR 1977

1977 Approved	£4 481 482
Add special warrants	10 369
Total	£4 491 851

Month	Monthly Expend. £	Expend. to date £	%
January	22 247	22 747	0.50
February	95 124	117 371	2.61
March	96 570	213 941	4.76
April	155 416	369 357	8.22
May	531 861	901 218	20.06
June	157 017	1 058 235	23.56
July	144 203	1 202 438	26.77
August	115 027	1 317 465	29.33
September	230 446	1 547 911	34.46
October	141 571	1 689 482	37.61
November	190 131	1 879 613	41.84
December	713 486	2 593 099	57.73

Summary

Amount approved	£4 491 851	100%
Less actual expend.	£2 593 099	57.73%
Balance	£1 898 752	42.27%

TABLE 1-4 STATEMENT OF REVENUE COLLECTED DURING THE YEAR 1977

Description	£
Drilling Charges	748
Greater Nicosia Scheme	302 619
Famagusta WS Scheme	50 401
Village Water Supplies	5 293
Other Fees	46 425
Total	£405 486

TABLE 1-5 **PAPHOS IRRIGATION PROJECT — EXPENDITURE — YEAR 1977**

Scheme	Amount dedaggered	Expenditure	Balance
	£ mils	£ mils	£ mils
Furniture Equip. & Fittings	1 801 000	1 382 278	418 722
Purchase of Equip. & Cars	53 857 000	50 505 792	3 351 208
Irrig. Network Investigation	2 600 000	2 595 105	4 895
Wages of Drivers	10 400 000	9 781 832	618 168
Travelling	8 000 000	6 764 670	1 235 330
Advertisements	1 000 000	809 723	190 277
Western Conveyor	4 305 000	2 487 775	1 817 225
Overtime Fees	5 430 000	5 342 173	87 827
Surveys Work Eastern area	5 910 000	5 904 999	5 001
Main Canal — Contractor	446 465 000	446 461 383	3 617
Office Expenses	5 180 000	4 060 434	1 119 566
Asprokremmos Investigation	1 410 000	1 402 308	7 692
Buildings	8 787 000	8 266 180	520 820
Main Canal Investigations	3 950 000	3 876 541	73 459
Main Canal Diversion Services	9 280 000	9 239 009	40 991
Operation of Motor Transport	5 800 000	3 905 301	1 894 699
Model Testing	18 816 000	17 415 731	1 400 269
Establishment of New Agriculture Research Substation at Akhelia	26 350 000	11 059 611	15 290 389
Asprokremmos Dam Laboratory Triaxal Test	800 000	—	800 000
Training Programme	560 000	—	560 000
Main Canal — Compenstation for Damages Caused to Field Crops	500 000	219 500	280 500
Contractors for Supply and Installation of Well Pumps and Electrical Equipment	7 118 000	7 118 000	—
Supply of Pipes — ISASBET	74 963 000	74 962 416	0 584
Aspem Construction Co. Ltd.	13 357 000	13 357 000	—
Supply of Electrical Power	62 424 000	62 424 000	—
Drilling & Testing of Boreholes	327 000	—	327 000
Consultants Fees	101 964 000	99 964 429	1 999 571
Construction of Central Offices at Yeroskipos	18 404 000	18 401 369	2 631
Metering Units	7 000 000	—	7 000 000
Laboratory Testing Abroad	1 880 000	943 593	936 407
Messrs PAC (Consultants)	2 021 000	2 020 686	0314
M/ce of Project Vehicles	1 000 000	224 820	775 180
Purchase of Tools	1 440 000	—	1 440 000
Poster	300 000	39 375	260 625
Totals	£913 399 000	£870 936 033	£42 462 967

TABLE 1-6 **MAJOR WATER WORKS**

Scheme	Amount Dedaggered	Budget Village	Total	Actual Expenditure Government	Village	Balance Total	Government	Village	Total	Remarks
	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	
A. Dams and Distribution										
Mavrokolymbos Dam	446 000	—	446 000	69 920	—	**69 920**	376 080	—	376 080	
Yermasoyia Dam	1 234 000	—	1 234 000	37 376	—	**37 376**	1 196 624	—	1 196 624	
Kiti Dam—Leakages	8 153 000	—	8 153 000	5 511 199	—	**5 511 199**	2 641 801	—	2 641 801	
Lefkara Dam	7 578 000	—	7 578 000	1 469 184	—	**1 469 184**	6 108 816	—	6 108 816	
Lefkara—Khirokitia Pipeline	707 000	—	707 000	—	—	—	707 000	—	707 000	
Khirokitia Treatment Plant	1 770 000	—	1 770 000	846 496	—	**846 496**	923 504	—	923 504	
Pomos Distribution	39 000	—	39 000	6 000CH	—	CR **6 000**	45 000	—	45 000	
Mavrokolymbos Distribution	16 666 000	—	16 666 000	598 505	—	**598 505**	16 067 495	—	16 067 495	
Ay. Marina Distribution	3 620 000	—	3 620 000	—	—	—	3 620 000	—	3 620 000	
Kiti Distribution	234 000	—	234 000	28 992	—	**28 992**	205 008	—	205 008	
Lefkara Distribution	16 770 000	—	16 770 000	3 908 153	—	**3 908 153**	12 861 847	—	12 861 847	
Yermasoyia—Main Conveyor	6 319 000	—	6 319 000	4 675 808	—	**4 675 808**	1 643 192	—	1 643 192	
" Akrounda Phinikaria	2 154 000	—	2 154 000	141 000	—	**141 000**	2 013 000	—	2 013 000	
" Zakaki	3 600 000	—	3 600 000	3 061 735	—	**3 061 731**	538 265	—	538 265	
" Phasouri	17 040 000	—	17 040 000	13 940 461	—	**13 940 461**	3 099 539	—	3 099 539	
" Trakhoni	622 000 000	—	622 000 000	614 392 620	—	**614 392 620**	7 607 380	—	7 607 380	
Argaka—Magounda Dam	3 000 000	—	3 000 000	—		—	3 000 000	—	3 000 000	
B Contributory Schemes										
Arakapas Dam	659 000	220 000	879 000	165 375	55 125	**220 500**	493 625	164 875	658 500	1/4 PLF
Palekhori Dam	3 425 000	1 141 000	4 566 000	342 600	114 200	**456 800**	3 082 400	1 026 800	4 109 200	1/4 PLF
Lymbia Dam	60 384 000	30 192 000	90 576 000	60 377 211	30 188 607	**90 565 818**	6 789	3 393	10 182	1/3 PLF
Polemidhia Irrigation	20 000 000	10 000 000	30 000 000	1 567 721	783 861	**2 351 582**	18 432 279	9 216 139	27 648 418	1/3 PLF
Pakhyammos	7 600 000	3 800 000	11 400 000	7 454 543	3 727 271	**11 181 814**	145 457	72 729	218 186	1/3 PLF
Palekhori Sklydros	7 500 000	2 500 000	10 000 000	3 952 702	1 317 568	**5 270 270**	3 547 298	1 182 432	4 729 730	1/4 PLF
Palekhori Distribution	4 988 000	1 663 000	6 651 000	4 857 297	1 619 100	**6 476 397**	130 703	43 900	174 603	1/4 PLF
Yermasoyia Irrigation	20 000 000	10 00 000	30 000 000	13 996 622	6 998 310	**20 994 932**	6 003 378	3 001 690	9 005 068	1/3 PLF
Total	835 886 000	59 516 000	895 402 000	741 389 520	44 804 042	**786 193 562**	94 496 480	14 711 958	109 208 438	

TABLE 1-7 **MINOR IRRIGATION WORKS — YEAR 1977**

Scheme	Budget			Actual Expenditure			Balance			Remarks
	Government	Village	Total	Government	Village	**Total**	Government	Village	Total	
	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	
Ayii Trimithias	1 467 000	733 000	2 200 000	**1 467 000**	778 633	**2 245 633**	—	**-45 633**	-45 633	1/3
Amargeti	4 000 000	2 000 000	6 000 000	2 800 235	1 400 119	**4 200 354**	1 199 765	599 881	1 799 646	1/3
Alona	1 133 000	567 000	1 700 000	1 124 284	562 143	**1 686 427**	8 716	4 857	13 573	1/3
Anayia	1 161 897	580 949	1 742 846	1 113 050	556 525	**1 669 575**	48 847	24 424	73 271	1/3
Ay. Dhimitrios "Kryo Nero"	9 279 459	4 639 730	13 919 189	**8 637 100**	4 318 550	**12 955 650**	642 359	321 180	963 539	1/3
Astromeritis	909 809	909 810	1 819 619	567 515	567 515	**1 135 030**	342 295	342 294	684 589	1/2
Ay. Ioannis (Agros)	685 775	343 387	1 029 162	—	—	—	685 775	343 387	1 029 162	1/3
Ay. Dhimitrios "Kaloyiros"	1 052 216	525 607	1 577 823	799 869	399 935	**1 199 804**	252 347	125 672	378 019	1/3
Agros "Anastasia"	440 550	220 274	660 824	54 041	27 021	**81 062**	386 509	193 253	579 762	1/3
Agros "Kato Enetikos"	359 979	180 489	540 468	—	—	—	359 979	180 489	540 468	1/3
Agridhia "Panayia Irr. Div."	2 200 000	1 100 000	3 300 000	2 172 284	1 086 142	**3 258 426**	27 716	13 858	41 574	1/3
Ay. Yeoryios (Silikou)	900 000	450 000	1 350 000	890 911	445 457	**1 336 368**	9 089	**4 543**	13 632	1/3
Dhali—Yialias	14 400 000	—	14 400 000	10 928 376	—	**10 928 376**	3 471 624	—	3 471 624	Govt. only
Dhali "Ftelia"	3 755 995	1 049 229	5 634 991	984 288	274 863	**1 476 432**	2 771 707	774 366	4 158 559	1/3 } 55.95%
" "Katevas"		829 767			217 281			612 486		} 44.15%
Dhymes "Sykameri"	280 559	141 280	421 839	16 225	8 112	**24 337**	264 334	133 168	397 502	1/3
Evrykhou	159 551	80 274	239 825	159 551	82 490	**242 041**	—	-2 216	-2 216	1/3
Ergates	15 133 000	7 567 000	22 700 000	10 902 920	5 451 461	**16 354 381**	4 230 080	2 115 539	6 345 619	1/3
Episkopi (L/ssol)	4 323 716	2 161 859	6 485 575	2 916 821	1 458 411	**4 375 232**	1 406 895	703 448	2 110 343	1/3
Ergates "Fourkismenos"	2 100 064	1 214 000	3 314 064	2 066 706	1 196 170	**3 262 876**	33 358	17 830	51 188	36.66%
Gourri	533 000	267 000	800 000	520 433	260 217	**780 650**	12 567	6 783	19 350	1/3
Goudhi, Kholi, Skoulli	1880 515	939 757	2 820 272	1 592 082	796 041	**2 388 123**	288 433	143 716	432 149	1/3
Yialias Recharge	135 911	—	135 911	122 842	—	**122 842**	13 069	—	13 069	Govt. only
Kalokhorio (L/ssol)	433 000	217 000	650 000	433 000	246 372	**679 372**	—	-29 372	-29 372	1/3
Kalokhorio (Klirou)	266 000	134 000	400 000	265 880	132 939	**398 819**	0 120	1 061	1 181	1/3
Kambi (Pharmaka)	867 000	433 000	1 300 000	850 198	425 099	**1 275 297**	16 802	7 901	24 703	1/3
Korakou	433 652	217 325	650 977	407 619	203 809	**611 428**	26 033	13 516	39 549	1/3
Kouka	466 000	**234 000**	700 000	406 888	203 445	**610 333**	59 112	30 555	89 667	1/3
Khoulou	1 326 388	663 695	1 990 083	**456 854**	228 428	**685 282**	869 534	435 267	1 304 801	1/3

TABLE 1—7 **MINOR IRRIGATION WORKS —YEAR 1977 (Continued)**

Scheme	Budget			Actual Expenditure			Balance			Remarks
	Government	Village	Total	Government	Village	Total	Government	Village	Total	
	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	
Kaliana—Tembria	105 674	52 837	158 511	37 385	18 693	**56 078**	68 289	34 144	102 433	1/3
Kakopetria	65 425	34 713	100 138	64 160	32 080	**96 240**	1 265	2 633	3 898	1/3
Korakou, Phlasou, Linou "Seloshis"	191 488	96 243	287 731	167 859	83 930	**251 789**	23 629	12 313	35 942	1/3 1/3
Kyperounda "Halospities" — "Arkappis"	747 000	374 000	1 121 000	55 645	27 822	**83 467**	691 355	346 178	1 037 533	1/3
Kyperounda "Kardama Potitsou"	1 633 000	817 000	2 450 000	1 552 877	776 439	**2 329 316**	80 123	40 561	120 684	1/3
Kato Amiandos	918 057	459 528	1 377 585	889 876	449 939	**1 349 815**	18 181	9 589	27 770	1/3
Katydhata	407 004	203 501	610 505	399 351	199 676	**599 027**	7 653	3 825	11 478	1/3
Khoulou, Pumping scheme	2 555 865	1 278 931	3 834 796	2 080 667	1 041 333	**3 122 000**	475 198	237 598	712 796	1/3
Kato Platres	1 848 868	923 934	2 772 802	969 834	484 918	**1 454 752**	879 034	439 016	1 318 050	1/3
Kambos	213 865	107 432	321 297	—	—	—	213 865	107 432	321 297	1/3
Kolossi	2 959 207	1 480 604	4 439 811	2 618 832	1 309 417	**3 928 249**	340 375	171 187	511 562	1/3
Louvaras	520 000	410 000	930 000	295 289	232 768	**528 057**	224 711	177 232	401 943	44.08%
Linou "Linopsas"	599 703	300 852	900 555	84 610	42 306	**126 916**	515 093	258 546	773 639	1/3
Lemona	1 302 233	651 617	1 953 850	476 884	238 444	**715 328**	825 349	413 173	1 238 522	1/3
Mandria (L/ssol)	1 526 000	762 000	2 288 000	4 027	2 013	**6 040**	1 521 973	759 987	2 281 960	1/3
Meniko "Litharkies"	2 133 000	1 067 000	3 200 000	1 625 535	812 768	**2 438 303**	507 465	254 232	761 697	1/3
Mathikoloni	400 000	200 000	600 000	392 832	196 417	**589 249**	7 168	3 583	10 751	1/3
Mamonia	394 853	198 425	593 278	-44 614	-22 308	**-66 922**	439 467	220 733	660 200	1/3
Nikoklia	845 246	422 624	1 267 870	—	—	—	845 246	422 624	1 267 870	1/3
Orounda "Ornitharis"	4 967 000	2 483 000	7 450 000	1 842 327	921 163	**2 763 490**	3 124 673	1 561 837	4 686 510	1/3
Orounda	2 360 276	1 180 639	3 540 915	493 783	246 892	**740 675**	1 866 493	933 747	2 800 240	1/3
Prodhromos "Platania— Antonides"	1 333 000	667 000	2 000 000	1 065 521	532 761	**1 598 282**	267 479	134 239	401 718	1/3
Phini "Mylos & Vines"	5 541 227	2 771 112	8 312 339	5 541 227	2 771 112	**8 312 339**				1/3
Pano Platres	9 000 000	4 500 000	13 500 000	5 857 396	2 928 698	**8 786 094**	3 142 604	1 571 302	4 713 906	1/3
Peristerona	2 313 571	2 313 572	4 627 143	2 313 572	2 313 571	**4 627 143**				1/2
Pera (Orinis) "Vyzakia"	7 000 000	3 500 000	10 500 000	3 050 849	1 525 425	**4 576 274**	3 949 151	1 974 575	5 923 726	1/3

TABLE 1-7 **MINOR IRRIGATION WORKS — YEAR 1977 (Continued)**

Scheme	Budget			Actual Expenditure			Balance			Remarks
	Government	Village	Total	Government	Village	**Total**	Government	Village	Total	
	£ mils	£ mils	£ mils	£ mils	£ mils	**£ mils**	£ mils	£ mils	£ mils	
Paleometokho Recharge	1 629 000	—	1 629 000	341 883	—	**341 883**	1 287 117	—	1 287 117	Govt. only
Potami	1 389 857	695 430	2 085 287	443 992	221 997	**665 989**	945 865	473 433	1 419 298	1/3
Potamitissa	553 000	277 000	830 000	521 900	260 951	**782 851**	31 100	16 049	47 149	1/3
Pissouri	35 123	18 564	53 687	35 123	47 850	**82 973**	—	-29 286	-29 286	1/3
Pelendria "Vrysi tou Arkhangelou"	480 000	320 000	800 000	427 638	285 093	**712 731**	52 362	34 907	87 269	40%
Pelendria "Livadhia"	310 000	190 000	500 000	254 580	156 033	**410 613**	55 420	33 967	89 387	38%
Pharmakas	486 650	382 369	869 019	9 650	7 582	**17 232**	477 000	374 787	851 787	44%
Phlasou, Evrykhou, Korakou	244 233	123 616	367 849	239 666	119 833	**359 499**	4 567	3 783	8 350	1/3
Phlasou "Ay. Epiphanitis"	3 070 407	1 535 704	4 606 111	3 022 518	1 511 260	**4 533 778**	47 889	24 444	72 333	1/3
Palekhori "Milouris"	2 400 000	1900 000	4 300 000	1 974 222	1 563 176	**3 537 398**	425 778	336 824	762 602	44.19%
Potamiou	666 000	334 000	1 000 000	561 019	280 510	**841 529**	104 981	53 490	158 471	1/3
Peristerona	11 421 851	3 806 617	17 132 277	11 365 911	3 788 639	**17 048 868**	55 940	**17 978**	83 409	2/3
Astromeritis		1 903 809			1 894 318			9 491		1/3
Polis Pumping Scheme	7 333 000	3 667 000	11 000 000	4 886 845	2 443 422	**7 330 267**	2 446 155	1 223 578	3 669 733	1/3
Phini	287 225	143 612	430 837	275 087	137 044	**412 131**	12 138	6 568	18 706	1/3
Peristerona (Paphos)	342 481	171 240	513 721	184 112	92 057	**276 169**	158 369	79 183	237 552	1/3
Paleomylos	561 869	281 934	843 803	151 198	75 600	**226 798**	410 671	206 334	617 005	1/3
Polemi	5 661 260	2 831 629	8 492 889	4 087 837	2 043 918	**6 131 755**	1 573 423	787 711	2 361 134	1/3
Spilia "Kourdhali"	2 759 000	1 381 000	4 140 000	2 625 419	1 312 711	**3 938 130**	133 581	68 289	201 870	1/3
Steni	3 113 959	1 557 479	4 671 438	1 847 683	923 840	**2 771 523**	1 266 276	633 639	1 899 915	1/3
Skoulli	2 494 119	1 247 560	3 741 679	1 437 372	718 688	**2 156 060**	1 056 747	528 872	1 585 619	1/3
Ay. Theodhoros Phase "A"	513 504	257 252	770 756	513 504	257 252	**770 756**	—	—	—	1/3
Ay. Theodhoros Phase "B"	1 466 000	734 000	2 200 000	1 448 222	723 611	**2 171 833**	17 778	10 389	28 167	1/3

TABLE 1—7 **MINOR IRRIGATION WORKS —YEAR 1977 (Continued)**

Scheme	Budget			Actual Expenditure			Balance			Remarks
	Government £ mils	Village £ mils	Total £ mils	Government £ mils	Village £ mils	Total £ mils	Government £ mils	Village £ mils	Total £ mils	
Akaki } Phase "A" }	2 644 396	660 599	3 965 595	2 644 396	660 599	**3 965 595**	—	—	—	1/2
Meniko }		660 600			660 600					1/3 1/2
Akaki } Phase "B" }	11 000 000	3 667 000	16 500 000	10 366 327	3 456 110	**15 550 491**	633 673	210 890	949 509	1/3 2/3
Meniko }		1 833 000			1 728 054			104 946		1/3
Saittas—Moniatis	128 786	203 755	360 365	128 786	249 920	**406 530**	—	-46 165	-46 165	56.58%
		27 824			27 824			—		7.66%
Tembria }	193 583	78 957	290 875	129 850	52 720	**194 776**	63 733	26 237	96 099	1/3 } 81.20%
Korakou }		18 335			12 206			6 129		} 18.80%
Vyzakia	7 576 639	3 788 320	11 364 959	7 480 996	3 740 501	**11 221 497**	95 643	47 819	143 462	**1/3**
Yiolou	944 800	471 901	1 416 701	427 658	213 832	**641 490**	517 142	258 069	775 211	1/3
Xyliatos	11 333 000	5 667 000	17 000 000	9 881 938	4 940 970	**14 822 908**	1 451 062	726 030	2 177 092	1/3
Total	203 005 340	96 493 102	299 498 442	152 218 028	73 102 176	**225 320 204**	50 787 314	23 390 924	74 178 238	

TABLE 1-8 **IMPROVEMENT OF VILLAGE WATER SUPPLY — YEAR 1977 (Continued)**

Scheme	Budget			Actual Expenditure			Balance			Remarks
	Government	Village	Total	Government	Village	**Total**	Government	Village	Total	
	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	
Anayia	1 600 000	800 000	2 400 000	1 239 640	619 820	**1 859 460**	360 360	180 180	540 540	1/3
Arminou Reg. Scheme										
Kelokedhara	10 863 484	322 462	11 329 162	10 863 484	322 462	**11 329 162**	—	—	—	) 69.26%
Salamiou	—	97 910	—	—	97 910	—	—	—	—	4.11%) 21.04%
Mesana	—	**45 306**	—	—	45 306	—		—	—	) 9.70%
Ay. Marina — Kelokedhara	469 620	658 718	1 128 338	—	—	—	469 620	658 718	1 128 338	58.32%
Ayii Vavatsinias	133 559	133 559	267 118	—	—	—	133 559	133 559	267 118	1/2
Akhelia	144 968	144 969	289 937	—	—	—	144 968	144 969	289 937	1/2
Ay. Marina (Xyliatos)	3 653 208	2 164 957	5 818 165	3 164 793	1 874 686	**5 039 479**	488 415	290 271	778 686	37.20%
Askas	955 014	478 508	1 433 522	954 153	477 074	**1 431 227**	0 861	1 434	2 295	**1/3**
Asproyia	998 610	1 204 712	2 203 322	7 706	9 294	**17 000**	990 904	1 195 418	2 186 322	54.67%
Philousa } **Arminou**	1 940 000	115 000	2 580 000	4 620 020	29 627	**5 557 585**	13 319 980	85 373	16 022 416	
Pretori } **Reg. Scheme**	—	1 400 000	—	—	360 588	—	—	1 039 412	—	
Kedhares		2 125 000	—	—	547 350	—		1 577 650		
Ay. Napa	6 500 000	6 500 000	13 000 000	4 745 788	4 745 787	**9 491 575**	1 754 212	1 754 213	3 508 425	1/2
Avdhellero	2 583 000	661 000	3 244 000	2 402 050	614 844	**3 016 894**	180 950	46 156	227 106	20.38%
Armou	1 042 567	1 220 765	2 263 332	254 488	298 027	**552 515**	788 079	922 738	1 710 817	53.94%
Dhali	8 520 782	8 520 784	17 041 566	3 405 556	3 405 555	**6 811 111**	5 115 226	5 115 229	10 230 455	1/2
Episkopi	14 250 000	14 250 000	28 500 000	3 847 997	3 847 997	**7 695 994**	10 402 003	10 402 003	20 804 006	1/2
Galata	1 473 072	1 473 075	2 946 147	778 037	778 037	**1 556 074**	695 035	695 038	1 390 073	1/2
Galataria	2 350 000	3 475 000	5 825 000	1 612 432	2 384 675	**3 997 107**	737 568	1 090 325	1 827 893	59.66%
Kourdhali	64 954	85 110	150 064	1 912	2 509	**4 421**	63 042	82 601	145 643	56.77%
Kato Akourdhalia	227 609	274 552	502 161	64 063	77 324	**141 387**	163 546	197 228	360 774	54.69%
Kivisil — Mazotos	2 250 000	2 250 000	4 500 000	2 040 750	2 040 750	**4 081 500**	209 250	209 250	418 500	
Kyperounda	1 950 000	1 950 000	3 900 000	—	—	—	1 950 000	1 950 000	3 900 000	1/2
Kakopetria	471 411	270 310	942 822	188 667	108 163	**377 334**	282 744	162 147	565 488	1/2)57.33%
Galata	—	201 101	—	—	80 504			120 597		(42.67%
Kallepia		1 447 650			7 529			1 440 121		)50%
Letymbou	3 287 780	1 031 726	5 767 156	17 166	5 421	**30 116**	3 270 614	1 026 305	5 737 040	1/2)36%
Pitargou										(14% Govt.

TABLE 1—8 **IMPROVEMENT OF VILLAGE WATER SUPPLY — YEAR 1977 (Continued)**

Scheme	Budger		Actual Expenditure				Balance			Remarks
	Government	Village	Total	Government	Village	**Total**	Government	Village	Total	
	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	
Klirou	3 350 000	3 350 000	6 700 000	2 408 888	2 408 887	**4 817 775**	941 112	941 113	1 882 225	1/2
Kambi (Pharmakas)	842 000	878 000	1 720 000	562 938	585 914	**1 148 852**	279 062	292 086	571 148	51%
Ergates	1 404 152	842 491	2 808 303	568 451	341 072	**1 136 901**	835 701	501 419	1 671 402	) 60%
Episkopio	—	210 623			85 266			125 357		1/2) 15%
Kambia	—	210 622			85 267			125 355		) 15%
Analiondas		140 415			56 845			83 570		) 10%
Kato Moni	569 787	569 789	1 139 576	205 111	205 112	**410 223**	364 676	364 677	729 353	1/2
Kalokhorio (L/ssol)	930 332	930 333	1 860 665	181 470	181 470	**362 940**	748 862	748 863	1 497 725	1/2
Kiti	326 963	326 964	653 927	—	—		326 963	326 964	653 927	1/2
Kakopetria	13 650 000	19 050 000	32 700 000	6 239 390	8 708 836	**14 948 226**	7 410 610	10 341 164	17 751 714	58.26%
Kilinia	2 500 000	3 625 000	6 125 000	1 777 063	2 576 349	**4 353 412**	722 937	1 048 651	1 771 588	59.18%
Lymbia Emerg. Scheme	1 734 000	866 000	2 600 000	1 311 580	655 790	**1 967 370**	422 420	210 210	632 630	1/3
Laxia	2 025 500	1 051 261	4 051 001	952 452	495 276	**1 904 905**	1 073 048	555 985	2 146 096	1/2) 52%
Yeri		974 240			457 177			517 063		(48%
Lymbia Reg. Scheme	500 000	250 000	750 000	175 310	87 654	**262 964**	324 690	162 346	487 036	1/3
Lophou	1 600 000	4 460 000	6 060 000	1 600 000	5 591 997	**7 191 997**	—	-1 131 997	-1 131 997	73.60%
Linou	2 100 000	3 060 000	5 160 000	2 027 154	2 953 571	**4 980 725**	72 846	106 429	179 275	59.30%
Lefkara	3 011 380	—	3 011 380	—	—	—	3 011 380	—	3 011 380	Govt. only
Ay. Tykhonas		426 301			424 662			1 639		) 2.82%
Monagroulli		620 267			617 417			2 850		) 4.10%
Mouttayiaka Reg. Scheme										
Ay. Athanasios	15 965 238	3 696 918	3 077 606	15 913 794	3 684 925	**30 972 740**	51 444	11 993	104 866	48.62%) 24.47%
Ay. Phyla		4 335 870			4 321 818			13 952		) 28.70%
Paramitha		1 995 589			1 989 288			6 301		) 13.21%
Palodhia		1 583 788			1 576 671			7 117		) 10.47%
Spitali		1 445 998			1 439 653			6 363		) 9.56%
Parekklisha		1 007 637			1 004 430			3 207		) 6.67%
Malounda (N/sia)	170 545	342 483	513 028	77 063	154 704	**231 767**	93 482	187 779	281 261	66.75%

TABLE 1-8 **IMPROVEMENT OF VILLAGE WATER SUPPLY — YEAR 1977 (Continued)**

Scheme	Budget			Actual Expenditure			Balance			Remarks
	Government	Village	Total	Government	Village	**Total**	Government	Village	Total	
Mamonia	374 853	378 889	753 742	13 691CR	16 533CR	**30 224CR**	388 544	395 422	783 966	54.70%
Marathounda	723 065	863 888	1 586 953	4 430CR	5 291CR	**9 721CR**	727 495	869 179	1 596 674	54.42%
Odhou	3 500 000	4 340 000	7 840 000	1 867 754	2 316 284	**4 184 038**	1 632 246	2 023 716	3 655 962	55.36%
Ormidhia	419 250	419 251	838 501	21 000	21 000	**42 000**	398 250	398 251	796 501	1/2
Pano Platres	10 500 000	10 500 000	21 000 000	4 411 495	4 411 494	**8 822 989**	6 088 505	6 088 506	12 177 011	1/2
Pelendria	2 000 000	2 180 000	4 180 000	1 732 375	1 888 053	**3 620 428**	267 625	291 947	559 572	52.15%
Pano Arkhimandrita	2 400 000	3 400 000	5 800 000	1 435 390	2 033 413	**3 468 803**	964 610	1 366 587	2 331 197	58.62%
Perakhorio (Nisou)	11 800 000	11 800 000	23 600 000	9 787 924	9 787 923	**19 575 847**	2 012 076	2 012 077	4 024 153	1/2
Phterikoudhi	2 333 000	2 247 000	4 580 000	2 101 424	2 023 868	**4 125 292**	231 576	223 132	454 708	49.06%
Konia		216 899			216 899			—		
Anavargos		498 888			498 888			—		)
Khlorakas **Paphos Lower**	41 122 333	2 386 514	46 590 102	41 122 333	2 386 514	**46 590 102**	—	—	—	)
Emba **Villages Phase**		1 734 027			1 734 027			—		11.73%)
Lemba **"B"**		—			—			—		)
Kisseonerga		631 441			631 441			—		)
Armou		165 000			165 000			—		
Marathounda		784 000			784 000			—		
Episkopi **Paphos Lower**	41 280 000	4 781 000	54 560 000	41 280 000	4 781 000	**54 560 000**	—	—	—	
Mesa Khorion **Villages Phase**		955 000			955 000			—		
Mesoyi **"A"**		3 023 000			3 023 000			—		
Trimithousa		3 572 000			3 572 000			—		
Paliometokho	780 405	780 405	1 560 810	2 577	2 578	**5 155**	777 828	777 827	1 555 655	
Pera	1 057 083	1 057 082	2 114 165	941 261	941 261	**1 882 522**	115 822	115 821	231 643	1/2
Pentalia	877 824	1 266 488	2 144 312	66 335	95 736	**162 071**	811 489	1 170 752	1 982 241	1/2
Polemidhia										59.07%
Pano Kividhes	255 180	174 383	510 362	3 250	2 216	**6 500**	251 930	172 167	503 862	1/2)68.18%
Souni-Zanatzia		80 799			1 034			79 765		)31.82%
Piyenia	1 264 822	632 938	1 897 760	109 653	54 827	**164 480**	1 155 169	578 **111**	1 733 280	**1/3**

TABLE 1—8 **IMPROVEMENT OF VILLAGE WATER SUPPLY — YEAR 1977 (Continued)**

Scheme	Budget			Actual Expenditure			Balance			Remarks
	Government	Village	Total	Government	Village	**Total**	Government	Village	Total	
	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	£ mils	
Pissouri	1 450 000	1 450 000	2 900 000	—	—		1 450 000	1 450 000	2 900 000	1/2
Pitsilia B2										
Ay. Marina	1 561 442	661 789	2 342 288	435 740	184 848	**653 774**	1 125 702	476 941	1 688 514	33.35%) 84.78%
Xyliatos		119 057			33 186			85 871		)15.22%
Pitsilia B5	1 277 000	473 000	1 750 000	1 251 378	463 545	**1 714 923**	25 622	9 455	35 077	27.03%
Paralimni	18 500 000	15 355 000	37 00 000	2 155 140	1 788 766	**4 310 279**	16 344 860	13 566 234	32 689 721	1/2)83%
Ay. Napa		3 145 000			366 373			2 778 627		17%
Sykopetra	3 100 000	3 868 000	6 968 000	2 602 192	3 246 747	**5 848 939**	497 808	621 253	1 119 061	55.51%
Souni-Zanaja	2 824 795	3 264 796	6 089 591	984 402	1 137 611	**2 122 013**	1 840 393	2 127 185	3 967 578	53.61%
Sotira (L/ssol)	3 300 000	3 300 000	6 600 000	1 994 580	1 994 580	**3 989 160**	1 305 420	1 305 420	2 610 840	1/2
Stroumbi	3 942 140	1 499 329	7 884 280	108 665	24 354	**217 329**	3 833 475	1 474 975	7 666 951	1/2)38.03%
Polemi		2 442 811			84 310			2 358 501		)61.97%
Sotira (F/sta)	5 000 000	5 000 000	10 000 000	3 101 695	3 101 694	**6 203 389**	1 898 305	1 898 306	3 796 611	1/2
Sanidha	466 000	614 000	1 060 000	395 003	543 692	**938 695**	50 997	70 308	121 305	57.92%
Tala	902 458	1 171 068	2 073 526	119 822	155 378	**275 200**	782 636	1 015 690	1 798 326	56.46%
Voroklini	2 100 000	2 100 000	4 200 000	1 691 612	1 691 613	**3 383 225**	408 388	408 387	816 775	1/2
Vasa (Kilani)	2 800 000	2 800 000	5 600 000	1 034 826	1 034 826	**2 069 652**	1 765 174	1 765 174	3 530 348	1/2
Xylophagou	4 503 548	4 503 550	9 007 098	4 435 851	4 435 853	**8 871 704**	67 697	67 697	135 394	1/2
Xylotymbou	2 491 840	2 491 841	4 983 681	—	—	—	2 491 840	2 491 841	4 983 681	1/2
Paphos Lowe Villages	75 930 000	—	75 930 000	63 878 377	—	**63 878 377**	12 051 623	—	12 051 623	Govt. only
TOTALS	383 226 573	222 680 895	605 907 468	263 263 299	126 064 380	**389 327 679**	119 963 274	96 616 515	216 579 789	

Livadhia (Adj. No 186 March 1977)	3 091 000		For work executed by village authorities
Voroklini (Adj. No 186 March 1977)	1 545 000		
Khirokitia (Lefkara reg. scheme)	4 776 000		
		10 531 000	Running expenses for village regional water supply schemes (from Ordinary budget)
Timi (Paphos lower villages)	141 000		
Arminou (Arminou regional scheme)	38 000		
Paphos Lower Villages	940 000		
GRAND TOTAL	273 794 000	**399 858 679**	CR—Credit

TABLE 1-9 **STATEMENT OF EXPENDITURE AS FROM 1938**

Ser No	Details	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948
		£	£	£	£	£	£	£	£	£	£
1	Administration	4 716	5 652	4 322	4 111	5 157	8 586	9 245	15 974	15 974	19 033
2	W/shops & M'ce of Plant	467	587	500	398	254	284	414	—	350	—
3	Purchase of Machinery, tools etc.	1 970	224	199	—	184	105	196	—	420	—
4	Hydrological Observations	—	—	—	—	—	—	—	—	—	—
5	Consultants' Fees	—	—	—	—	—	—	—	—	—	—
6	Major Project Investigations	—	—	—	—	—	—	—	—	—	—
	Sub—total "A"	7 153	6 463	5 021	4 509	5 595	8 975	9 855	15 974	15 848	19 033
7	Drilling for Water	680	952	527	486	642	2 700	3 180	660	360	25 171
8	Water Meters for Wells & Boreholes	—	—	—	—	—	—	—	—	—	—
9	Town Water Supplies	1 169	925	908	1 043	1 169	1 827	2 448	—	—	—
10	Village Water Supplies	8 980	1 613	5 560	4 956	6 887	5 730	3 413	19 000	31 871	42 190
11	Small Irrigation Projects	2 770	7 979	10 252	35 809	74 134	116 334	100 470	166 493	177 144	120 278
12	Major Irrigation Projects	—	—	—	—	—	—	—	—	—	—
	Sub—total "B"	12 599	19 469	17 247	42 294	82 832	126 591	109 511	186 153	209 375	187 639
	Total	19 752	25 932	22 268	46 803	88 427	135 566	119 366	202 127	225 223	206 672
	%of A to Total	56.8	33.2	29.1	10.6	6.7	7.0	8.9	8.5	7.5	10.1

TABLE 1-9 **STATEMENT OF EXPENDITURE AS FROM 1939 (Continued)**

Ser No	Details	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
		£	£	£	£	£	£	£	£	£	£
1	Administration	18 156	19 146	26 270	29 991	38 050	52 950	54 350	61 699	80 790	95256
2	W/Shops & M'ce of Plant	—	—	39 111	10 826	14 150	13 000	13 000	15 688	25 960	20 995
3	Purchase of Machinery tools etc.	—	—	3 337	2 840	17 000	10 050	10 800	91 989	16 700	15 950
4	Hydrological Observations	—	—	—	1 066	1 000	1 500	3 500	19 626	13 000	4 450
5	Consultants' Fees	—	—	—	—	—	—	—	—	—	—
6	Major Projects Investigations	—	—	—	—	—	—	—	—	—	—
	Sub—total "A"	18 156	19 146	68 720	44 723	70 200	77 500	82 150	189 000	136 450	136 651
7	Drilling for Water	27 349	30 666	26 719	24 712	41 100	48 600	58 350	78 641	75 750	45 824
8	Water Meters for Wells and Boreholes	—	—	—	—	—	—	—	—	—	—
9	Town Water Supplies	—	—	155 116	119 481	235 000	303 900	93 200	152 476	417 600	648 350
10	Village Water Supplies	53 410	106 370	100 137	214 732	256 000	255 000	196 850	280 955	215 600	87 225
11	Small Irrigation Projects	111 352	150 980	172 154	166 493	154 500	116 900	150 850	116 100	168 600	81 075
12	Major Irrigation Projects	—	—	—	15 000	15 000	20 000	30 000	35 000	35 000	50 000
	Sub—total "B"	192 111	288 016	454 126	540 418	701 600	744 400	529 250	663 172	927 550	912 474
	Total	210 267	307 162	522 846	585 141	771 800	821 900	611 400	852 172	1 064 000	1 049 125
	% of A to Total	9.4	6.6	15.1	8.2	10.0	10.4	15.5	28.4	14.7	14.9

TABLE 1-9 **STATEMENT OF EXPENDITURE AS FROM 1939 (Continued)**

Ser No	Details	1959	1960	1961	1962	1963	1964	1965	1966	1967
		£	£	£	£	£	£	£	£	£
1	Administration	81 677	64 255	70 527	81 983	151 580	130 164	135 410	145 389	183 927
2	W/Shops & M'ce of Plant & Stores	20 441	28 979	30 238	31 789	14 000	16 150	15 500	14 147	14 848
3	Purchase of Machinery tools etc.	960	—	—	31 712	120 000	46 030	16 875	10 973	12 927
4	Hydrological Observations	7 090	6 059	10 640	40 520	40 500	43 223	28 200	18 863	20 538
5	Consultants' Fees	—	—	—	—	—	39 378	45 065	51 297	32 040
6	Major Projects Investigations	—	—	—	—	—	10 202	15 290	7 733	20 880
	Sub—total "A"	110 168	99 293	111 405	186 004	326 080	285 147	256 340	248 402	285 160
7	Drilling for Water	45 084	48 837	83 608	82 151	63 700	47 588	40 200	24 253	35 029
8	Water Meters for Wells & B/holes	—	—	—	—	—	—	—	983	2 672
9	Town Water Supplies	113 853	220 370	88 282	97 724	70 900	197 871	178 010	138 390	68 782
10	Village Water Supplies	113 493	137 825	602 436	602 537	486 600	507 679	404 600	108 926	130 340
11	Small Irrigation Projects	68 274	49 288	141 712	253 817	383 052	400 046	95 002	113 636	221 169
12	Major Irrigation Projects	50 000	50 000	120 000	150 000	414 948	369 420	691 349	689 010	941 131
	Sub—total "B"	390 704	506 320	1 036 037	1 204 229	1 418 600	1 522 604	1 409 160	1 075 198	1 399 123
	Total	500 872	605 613	1 147 442	1 390 233	1 744 680	1 807 751	1 665 500	1 323 600	1 648 283
	% of A to Total	28.2	19.6	10.7	15.4	22.9	18.7	18.1	23.1	80.3

TABLE 1-9 **STATEMENT OF EXPENDITURE AS FROM 1939 (Continued)**

Ser No	Details	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
		£	£	£	£	£	£	£	£	£	£
1	Administration	228 902	248 058	257 624	262 688	265 447	334 922	364 212	350 818	373 729	606 793
2	W/Shops & M'ce of Plant & Stores	25 594	38 268	24 896	24 200	29 415	28 512	29 589	19 656	16 388	9 876
3	Purchase of Machinery tools etc.	5 918	16 910	4 103	4 790	8 597	4 451	3 646	6 405	5 914	7 124
4	Hydrological Observations	19 768	22 365	42 393	19 359	21 816	19 984	21 478	26 642	28 750	33 824
5	Consultants' Fees	14 676	5 021	12 266	26 299	18 653	19 169	6 156	29 856	91 538	101 958
6	Major Projects Investigations	34 801	25 083	22 780	33 349	37 232	36 357	31 320	41 769	44 871	49 642
	Sub—total "A"	329 659	355 705	364 062	370 685	381 160	443 395	465 401	475 146	561 190	809 517
7	Drilling for Water	49 095	22 938	46 033	50 388	11 168	10 727	9 678	2 920	11 196	13 080
8	Water Meters for Wells & B/holes	86	116	—	—	418	20	143	242	250	—
9	Town Water Supplies	171 190	937 325	265 062	184 804	342 129	275 964	374 604	443 170	676 601	510 589
10	Village Water Supplies	232 253	251 805	229 746	374 943	320 436	472 448	393 781	244 737	382 287	399 859
11	Small Irrigation Projects	174 065	237 594	151 386	99 178	118 341	159 713	242 662	300 717	400 264	225 320
12	Major Irrigation Projects	493 045	263 209	283 499	378 882	1 116 023	1 081 463	695 378	696 327	587 712	1 563 784
	Sub—total "B"	1 119 734	1 717 987	975 726	1 088 195	1 908 515	2 000 335	1 716 246	1 688 113	2 058 310	2 712 632
	Total	1 449 393	2 073 692	1 339 788	1 458 880	2 289 675	2 443 730	2 172 647	2 163 259	2 619 500	3 521 849
	% of A to Total	20.3	17.2	37.3	25.0	20.0	22.0	26.0	22.0	21.42	

II DIVISION OF WATER RESOURCES

by
D C Kypris
Engineer Hydrologist
Head of Division

General

This is the fourth year during which we could not collect hydrological data in the Northern part of Cyprus, because this area amounting to 40% of the Cyprus land, is still under the occupation of the Turkish troops. So the behaviour of both surface runoff and groundwater bodies could not be followed or recorded there during the year under examination.

During 1977, the effort for reconstructing our hydrological archives, destroyed during the events of July, 1974, or lost in the occupied area by the Turkish troops, continued and 2,274 wells boreholes were plotted again, in an area of 202 km^2, with their relative information recorded.

INTRODUCTION

The Division of Water Resources deals mainly with the collection and interpretation of Hydrological and Hydrogeological data, regarding both ground and surface water, engineering geology problems as connected with the planning and execution of water works projects, carries out ancillary drilling operations and controls groundwater extraction and use.

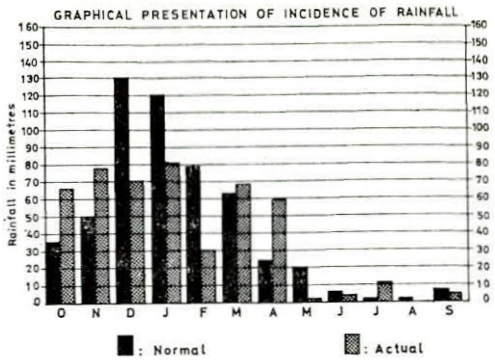
The original division of Cyprus into eleven hydrogeological regions based on both hydrogeological and administrative criteria, which has been followed in the past for reasons of better control on the collection of hydrogeological data and thorough hydrogeological studies, was not followed during the year under examination, since the Turkish troops are still occupying part of Cyprus. The new arrangement followed is seen on map page 15.

During 1977, D C Kypris, Engineer Hydrologist, was the Head of Division, M Peppis, Geologist, Class I, was the Assistant Head. He was also Head of the Drilling Permits and Water Control Branch. Mr Peppis acted also as the president of the specially formed advisory committee for the issue of well permits.

DRILLING OPERATIONS

Drilling operation 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 6 existing boreholes
- Drilling of 5 boreholes for domestic water supply and irrigation purposes. Penetrated depth 318m
- Removing of pumps stuck or broken in boreholes
- Enlarging, deepening and casing of 4 boreholes drilled for irrigation purposes. Penetrated depth 388m.



METEOROLOGICAL NOTES

The precipitation and other climatological elements recorded at the observing stations of the Cyprus Government Meteorological Service have been analysed. No metereological information was received from the northern part of the Island, which is under the occupation of the Turkish troops, thus the picture given refers to the southern part of the Island.

PRECIPITATION

The yearly total precipitation averaged over the southern part of the Island, during the hydrometeorological year October, 1976 to September, 1977 was 471mm which is 88% of normal (see diagram on page 39) Normal is considered as the average rainfall over the southern part of the Island during the period 1941—1970.

As regards the various parts in particular, the precipitation varied between 80% and 95% of normal (see Isohyetal map on page 40).

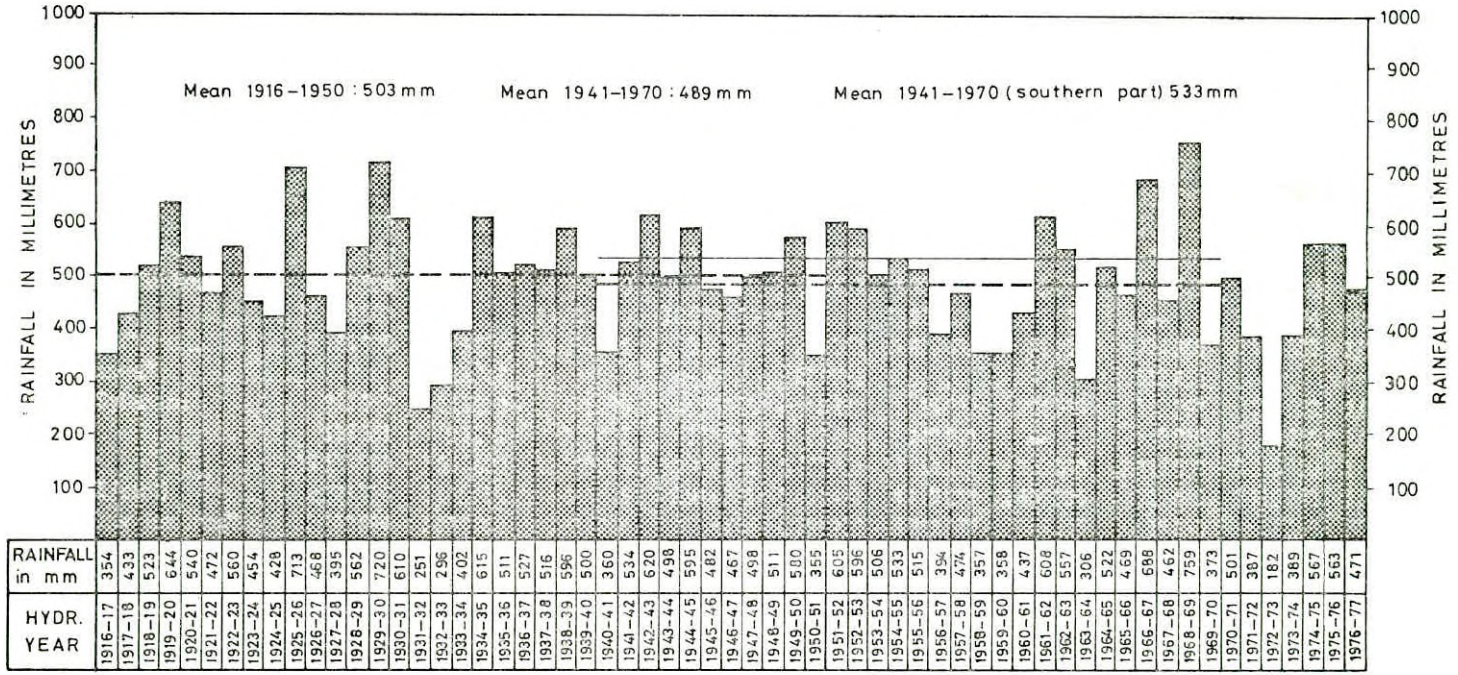
As far as the distribution of precipitation in time is regarded, great variations were experienced. December, January and February were much

TABLE II-1 **INCIDENCE OF RAINFALL**

The incidence of rainfall per month during the hydrometeorological year 1976—1977 was as follows:-

Month Rainfall	mm	inches	%
October	66.2	2.61	14.1
November	77.1	3.03	16.4
December	69.7	2.75	14.7
January	81.0	3.20	17.2
February	29.8	1.17	6.3
March	67.6	2.66	14.3
April	58.6	2.30	12.4
May	0.8	0.03	0.2
June	4.2	0.17	0.9
July	10.9	0.42	2.3
August	0.2	0.01	0.1
September	5.1	0.20	1.1
TOTALS	471.2	18.55	100%

ANNUAL AVERAGE RAINFALL OF CYPRUS
FROM 1916 – 1975



HYDR. YEAR	RAINFALL in mm
1916–17	354
1917–18	433
1918–19	523
1919–20	644
1920–21	540
1921–22	472
1922–23	560
1923–24	454
1924–25	428
1925–26	713
1926–27	468
1927–28	395
1928–29	562
1929–30	720
1930–31	610
1931–32	251
1932–33	296
1933–34	402
1934–35	615
1935–36	511
1936–37	527
1937–38	516
1938–39	596
1939–40	500
1940–41	360
1941–42	534
1942–43	620
1943–44	498
1944–45	595
1945–46	482
1946–47	467
1947–48	498
1948–49	511
1949–50	580
1950–51	355
1951–52	605
1952–53	596
1953–54	506
1954–55	533
1955–56	515
1956–57	394
1957–58	474
1958–59	357
1959–60	358
1960–61	437
1961–62	608
1962–63	557
1963–64	306
1964–65	522
1965–66	469
1966–67	688
1967–68	462
1968–69	759
1969–70	373
1970–71	501
1971–72	387
1972–73	182
1973–74	389
1974–75	567
1975–76	563
1976–77	471

Note: Annual average as from 1974–75 refers to southern part of Cyprus only

dryer than the average, while October, November and April were well above normal. The poor rainfall of winter months, could not give satisfactory replenishment to the groundwater resources (see diagram page 37).

The maximum amount of rainfall reported in a 24-hour period during the hydrometeorological year was 105.9mm reported by Kannaviou rainfall station, on 3rd July, 1977.

The first snowfall occurred on Olympus on the 24th November, 1976, about a week earlier than the mean date. It also occurred during the period from December, 1976 to April, 1977 and the last fall occurred on the 14th April, 1977, a few days later than the mean date. A noteworthy snowfall occurred on the 3rd March, 1977. Snow covered areas down to 450m in elevation.

TEMPERATURE

The temperature during the hydrological year 1976—1977 as a whole, was higher than normal by 0.5°C in coastal areas and by 1.0°C inland areas. In particular, monthly mean air temperature was around normal in June, slightly above normal in December, March, April and September, above normal in October, November, February, May, July and August and below normal in January.

The extreme maximum and extreme minimum temperatures recorded during the hydrological year under review at particular stations, were as follows:

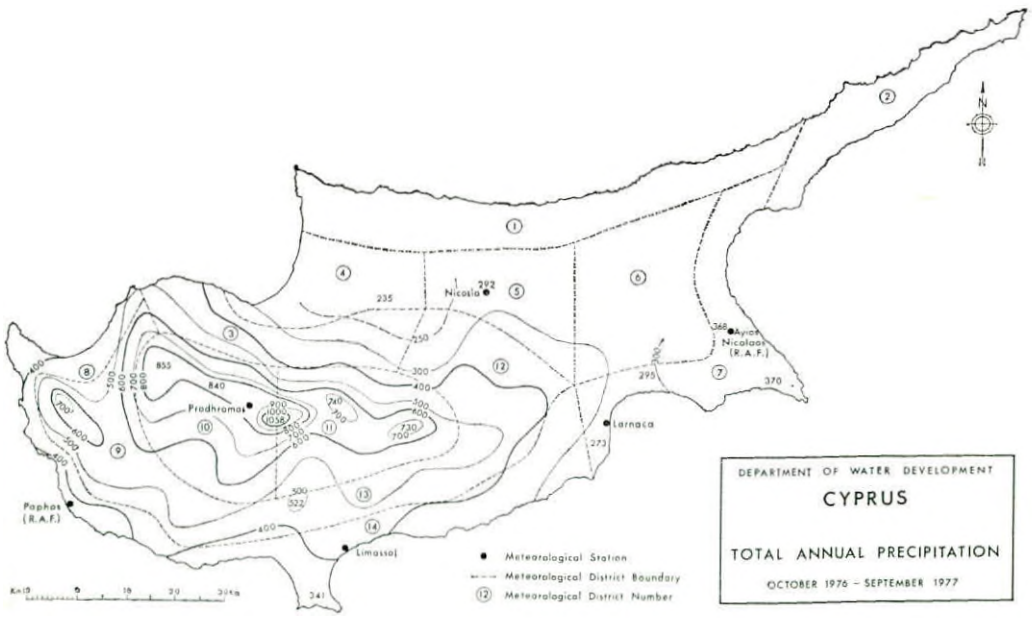
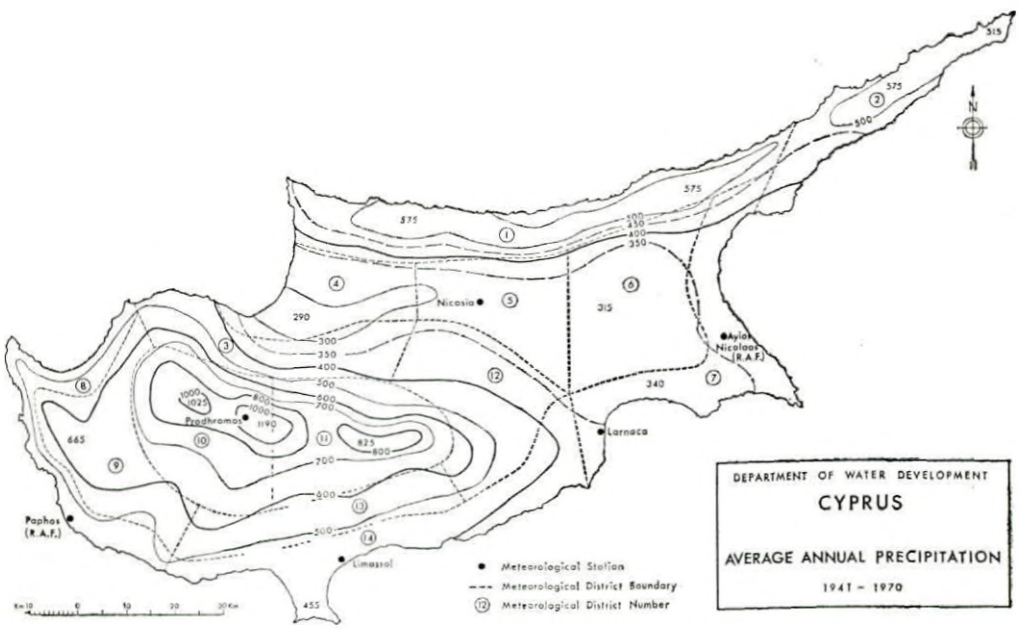


TABLE II-2 **INCIDENCE OF MAXIMUM AND MINIMUM TEMPERATURES 1976—1977**

Station	Extreme maximum temperature and date °C		Extreme minimum temperature and date °C	
Nicosia	44.2, 11th	July	0.2, 9th	January
Limassol	41.0, 17th	July	0.5, 6th	January
Larnaca Airport.	37.9, 17th	July	1.5, 5th	January
Ayios Nikolaos (F'sta)	40.5, 24th	August	—0.5, 9th	January
Paphos	35.5, 11th	July	3.5, 5th	January
Panayia Bridge	40.7, 11th	July	—5.5, 6th	January
Saittas	39.2, 17th	July	—2.0, 6th	January
Amiandos	33.0, 11th	July	—6.0, 5th	January
Prodhromos FC	33.5, 11th	July	—6.2, 5th	January
Stavros tis Psokas	38.6, 10th	July	—2.0, 5th+ 6th	January
Kornos	39.5, 16th		1.0, 8th	January
Platania	35.6, 11th	July	4th	March
Phasouri	40.0, 17th	July	—4.0, 5th	January
		July	—1.5, 6th	January

N.B. All maximum and minimum temperatures occurred in 1977.



EVAPORATION

Monthly total evaporation in mm measured from United States Weather Bureau (USWB) Class "A" pan during the hydrometeorological year 1976—1977 at selected places is given below:-

SURFACE WATER

Permanent Stream Gauging Stations

On important streams on selected places, permanent flow gauging stations equipped with automatic water lever recorders have been established, for the purpose of calculating the quantity of water flowing from each station. All these stations have to be inspected regularly ie 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 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.

In the northern part of the Island, we have not been able to attend any flow gauging stations, because of the presence of the Turkish invasion troops, so the condition of these stations is not known to us.

TABLE II-3 **TOTAL MONTHLY EVAPORATION FOR HYDROMETEOROLOGICAL YEAR 1976—77**

Station	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Yealy Total
Nicosia	128	77	44	46	58	84	139	232	263	323	275	183	1852
Athalassa	122	74	42	43	59	87	123	221	246	310	259	170	1756
Saittas	119	93	40	57	64	101	121	214	232	300	255	169	1765
Akhelia	132	110	83	71	75	112	137	189	206	248	228	183	1774
Yermasoyia	163	117	51	62	72	120	148	259	283	307	277	202	2061
Prodhromos	95	74	43	13	60	63	119	167	180	244	228	133	1419

TABLE II-4 **FLOW GAUGING STATIONS ON STREAMS**

Station No	Stream	Location	Co-ordinates
1-1-3-95	Khapotami	Kissousa	VD805513
1-1-7-95	Khapotami	Kouklia	VD627383
1-2-4-95	Dhiarizos	Philousa	VD754575
1-2-7-90	Dhiarizos	Kouklia	VD601411
1-3-5-05	Xeros	Lazaridhes	VD725652
1-3-8-60	Xeros	Phinikas	VD615470
1-4-4-50	Ezousas	Kannaviou	VD610633
1-4-9-80	Ezousas	Akhelia	VD524444
1-8-2-80	Avgas	Toxeftra (Akamas)	VD394644
2-2-3-95	Khrysokhou	Skoulli	VD497709

TABLE II-4 **FLOW GAUGING STATIONS (Continued)**

Station No	Stream	Location	Co-ordinates
2-2-6-90	Stavros tis Psokas	Evretou	VD520705
2-8-3-10	Limnitis	Limnitis Saw Mill	VD737822
2-9-3-40	Marathos *	Varisha	VD770872
2-9-4-90	Kambos *	Potamos tou Kambou	VD826892
3-1-3-95	Xeros *	Karavostasi	VD852889
3-2-4-95	Marathasa *	Karavostasi	VD863895
3-3-1-70	Ayios Nikolaos	Kakopetria	VD900707
3-3-2-60	Platania	Kakopetria	VD927698
3-3-3-95	Karyotis	Evrykhou	VD906773
3-3-5-95	Karyotis *	Pendayia	VD883902
3-4-2-90	Atsas	Evrykhou	VD931810
3-5-4-40	Elea	Vyzakia	WD018806
3-7-1-50	Peristerona	Panayia Br. FS	WD075754
3-7-3-90	Akaki	Malounda	WD163783
3-7-5-95	Merika *	Avlona	WD093924
3-7-7-85	Skylloura *	Ay. Vasilios	WD156969
3-7-8-60	Ovgos *	Kyra	WD050964
3-7-8-65	Ovgos *	Ovgos Dam	WD034973
3-7-8-90	Ovgos *	Morphou	VD973974
3-7-9-50	Serrakhis *	Morphou Dam	WD007948
3-8-6-50	Aloupos *	Aloupos Chiftlik	VE980018
4-2-3-70	Panagra *	Panagra	WE077119
4-4-2-50	Boghaz *	Kyrenia Road Forest	WE296077
5-2-3-50	Melini *	Ayia Trias	XE125337
5-9-4-90	Kharangas	Boghaz (F'sta)	WE883100
6-1-1-80	Ayios Onoufrios	Kambia	WD225735
6-1-185	Pedhieos	Kambia	WD224741
6-1-2-95	Pedhieos *	N'sia Railway Br	WD319941
6-1-3-84	Makedhonitissa Upper	Makedhonitissa	WD283908
6-1-3-85	Makedhonitissa Lower	Engomi	WD291915
6-1-4-20	Tengelis *	Kythrea	WE415010
6-1-4-50	Pedhieos *	Mia Milia	WD376958
6-1-5-50	Vathys	Athalassa	WD345867
6-1-7-15	Kephalovryso Spring	Kythrea	WE445030
6-1-7-40	Ak Sou *	Petra tou Dhigeni	WE499001
6-5-1-85	Yialias	Kochati	WD306727
6-5-3-15	Yialias	Nisou	WD360755
6-5-3-95	Yialias	Pyroi	WD446824
7-1-7-50	Kolopannes *	Kalopsidha	WD746842
7-2-3-50	Liopetri	U/S Liopetri Dam	WD806732
7-2-7-05	Paralimni Lake Outflow	Paralimni	WD892801
8-2-1-90	Aradhippou	N'sia — L'ca Road	WD517683
8-2-2-90	Aradhippou	Panayia Yematousa	WD516689

Station No.	Stream	Location	Co-ordinates
8-4-3-40	Tremithos	Ayia Anna	WD442668
8-4-5-30	Tremithos	Klavdhia	WD490615
8-4-5-40	Tremithos	Kiti Dam	WD510590
8-5-1-90	Pouzis	Mazotos	WD472518
8-7-3-60	Mylou	Kornos	WD332613
8-7-4-80	Syrkatis	Skarinou	WD343535
8-8-2-50	Maroni	Vavla	WD261558
8-8-3-30	Maroni	Khirokitia	WD317503
8-9-7-50	Vasilikos	Kalavasos	WD275472
8-9-7-95	Vasilikos	Vasiliko	WD292425
9-2-3-85	Yermasoyia	Phinikaria	WD093475
9-2-4-95	Akrounda	U/S Yermasoyia Dam	WD078460
9-4-3-80	Garyllis	U/S Polemidhia Dam	VD977450
9-6-2-90	Kryos	Khalassa	VD911474
9-6-4-95	Kouris	Khalassa	VD920470
9-6-5-10	Zavos	Khandria	VD994672
9-6-7-75	Zyghos	Khalassa	VD941471
9-6-9-05	Koyris & Kryos	Khalassa	VD921466
9-8-1-95	Evdhimou	Evdhimou	VD780397

* Situated in Turkish occupied areas.

The general conclusion, obtained from study of the records of the above said flow gauging stations, is the low runoff which has been estimated to be of the order of 50% the normal. This is due of course to the lower than normal rainfall, particularly during the winter season when most of the runoff occurs.

The yearly flow of some selected rivers, at selected flow gauging stations are presented in the following table.

TABLE II-5 **DISCHARGE OF SELECTED RIVERS AS MEASURED AT SELECTED FLOW GAUGING STATIONS FOR THE YEAR 1976—1977.**

Ser. No.	Station	Stream	Location	Flow for the year $m^3 \times 10^6$
1	3-7-1-50	Peristerona	Panayia Forest Station	8.8
2	3-7-3-90	Akaki	Malounda	8.1
3	6-1-1-80	Pedhieos (Ay. Onoufrios tributary)	Kambia	1.1
4	6-1-1-85	Pedhieos	Kambia	2.8
5	6-5-1-85	Yialias	Kochati	2.8
6	8-8-2-50	Maroni	Vavla	1.3
7	8-4-3-40	Tremithos	Ayia Anna	2.5
8	3-3-3-95	Karyotis	Evrykhou	8.8
9	2-8-3-15	Limnitis	Saw Mill	12.8
10	1-2-7-90	Dhiarizos	Kouklia	19.0

11	9-6-4-95	Kouris	Khalassa	11.5
12	9-6-2-90	Kouris (Kryos tributary)	Khalassa	2.9
13	9-6-7-75	Kouris (Zygas tributary)	Khalassa	10.5

Flow Gauging Stations on Irrigation Intakes

Besides the permanent stream gauging stations, which are established on streams, a number of flow gauging stations have been established on irrigation intakes for the purpose of calculating the water diverted from certain streams in a certain area for irrigation purposes.

TABLE II-6 **FLOW GAUGING STATIONS ON IRRIGATION INTAKES — 1977.**

Ser. No.	Intake	Location	Co-ordinates
1	Mylos	Peristerona	WD077856
2	Astromeridhiano	Peristerona	WD078855
3	Orounda	Orounda	WD083837
4	Riatiko	Meniko	WD144854
5	Afxenti	Meniko	WD152848
6	Naos *	Peristerona	WD075895
7	Vathys *	Masari Dam	WD077925
8	Avlona *	Avlona	WD091913
9	Masari *	Masari	WD071934
10	Kyra *	Kyra	WD057942
11	Katakrous *	Kyra	WD053945
12	Zavrazis *	Morphou Dam	WD023951
13	Elea	Koutraphas	WD978854
14	Asprallou — Linopsas	Kato Phlasou	VD897800
15	Polemios *	Pendayia	VD885888
16	Kritikos *	Pendayia	VD891881
17	Nikoklia	Nikoklia	VD618433
18	Kouklia	Kouklia	VD612419
19	Mandria	Mandria	VD589427
20	Akhelia	Akhelia	VD533449

* Situated within Turkish occupied areas

New Flow Gauging Stations

During the year under review, four new flow gauging stations were constructed for Pitsilia Integrated Rural Development Project.

L a g h o u d h e r a stream U/S of Xyliatos damsite. Construction of a half "V" shaped structure 4m wide, slope 1:10 under the bridge.

P l a t a n i s t a s a stream at Platanistasa. Construction of a "V" shaped structure 7m wide, slope 1:5.

A k a p n o u stream at Melini. Construction of a "V" shaped structure 8m wide, slope 1:10, on the old irrigation weir.

A g r o s stream at Agros. Construction of a "V" shaped structure 4m wide, slope 1:2.5.

Repairs and Improvements to the Existing Flow Gauging Stations.

During the year, minor improvements and repairs were carried out on the following stations:

A v g a s river Toxeftra. Repairs to the invert of the flume, which has suffered serious damages by floods of previous years, by casting a layer of 4" reinforced concrete.

A k a k i river at Malounda. Construction of a retaining wall and modifications to the floatwell and inflow system for the normal operation of the station.

Flood Discharges

The rainfall during the hydrologic year 1976—1977 was below normal. The most noteworthy floods recorded at the flow gauging stations during the same period were as follows:

T r e m i t h o s river near Ayia Anna about 90m^3 per second on 23rd October, 1976. Its catchment area is 90 km^2.

T r e m i t h o s river near Larnaca — Limassol road, about 70m^3 per second on 23rd October, 1976. Its catchment area is 142 km^2.

A r a d h i p o u river near Panayia Yematousa about 40m^3 per second on 23rd October, 1976. Its catchment area is 21 km^2.

P e r i s t e r o n a river near Panayia Forest Station, about 20m^3 per second on 18th January, 1977. Its catchment area is 79 km^2.

Inflow of Water in Dams

During 1977 out of 47 dams which were the most important in Cyprus and were in previous years under regular observation, only 27 could be attended, the rest remaining in the northern part of Cyprus, under occupation by the Turkish troops.

The water accumulated in the observed 27 dams was satisfactory, being in volume at its maximum 27.4MCM or 70% of the total capacity of these dams, being 38.4 MCM.

During this year, 19 dams overflowed, most of them during January. In one of them, no inflow has been recorded and in two others, the inflow was at its maximum less than 6% of its capacity.

Analytically, the situation is shown in the following table:

Spring Discharges

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

During the hydrological year 1976—1977, 2,483 spring discharges were taken on 182 springs: 1,236 discharges were taken on 103 springs which are under regular monthly observations and 1,247 discharges were taken on 79 springs for a certain period at various intervals.

As the precipitation during the hydrological year under review was below normal, all the springs had a rather low increase of flow during winter and spring time and maintained a slightly below normal flow during summer.

GROUND WATER

Ground Water Hydrological Works

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 infor-

TABLE II-7 **VOLUME OF WATER ACCUMULATED AND COMMENCING DATE OF INFLOW FOR VARIOUS DAMS DURING THE YEAR 1977**

Ser. No	Dam	Capacity $10^3 xm^3$	Inflow com/cing date (1977)	Volume of maximum accumulation $10^3 xm^3$	Date of maximum accumulation (1977)	Volume of minimum accumulation $10^3 xm^3$	Date of minimum accumulation (1977)	Remarks
1	Agros	72**	January	43	March	Empty	September	—
2	Akrounda	22	January	22	January	Empty	July	Overflowed
3	Arakapas	130	January	130	January	Empty	September	Overflowed
4	Argaka — Magounda	1 150	January	1 150	January	178	December	Overflowed
5	Athalassa	790	January	45	March	9	October	—
6	Ayia Marina	300**	January	300	January	57	December	Overflowed
7	Kalokhorio	81	January	81	January	Empty	September	Overflowed
8	Kalopanayiotis	390	January	390	January	88	October	Overflowed
9	Kandou	34	January	34	January	10	November	Overflowed
10	Kiti	1 500**	January	250	January	Empty	March	—
11	Kyperounda	60	January	60	January	4	November	Overflowed
12	Lefka — Marathasa	368	January	368	January	210	October	Overflowed
13	Lefkara	13 850	January	7 530	May	5 263	December	—
14	Liopetri	340	—	—	—	—	—	No inflow
15	Lythrodhonda Upper	32	January	32	February	Empty	October	Overflowed
16	Lythrodhonda Lower	32	January	32	January	Empty	November	Overflowed
17	Ormidhia (Vathys)	100	(Dec. 76)	1	January	Empty	February	—
18	Palekhori (Kambi)	620	January	620	February	Empty	September	Overflowed
19	Perapedhi	55	January	55	January	Empty	September	Overflowed
20	Petra Upper *	22	January	22	February	Empty	April	Overflowed
21	Petra Lower *	32	January	32	February	Empty	July	Overflowed
22	Pomos	860	January	860	January	173	November	Overflowed
23	Polemidhia	3 400**	January	1 200	March	373	December	—
24	Prodhromos	122	January	90	May	Empty	October	—
25	Pyrgos	270	January	270	January	18	October	Overflowed
26	Trimiklini	330**	January	330	April	90	September	Overflowed
27	Yermasoyia	13 500	January	13 500	February	7 430	December	Overflowed

* Dams in Turkish occupied territory ** Capacities taken from recent reservoir topographies

mation 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.

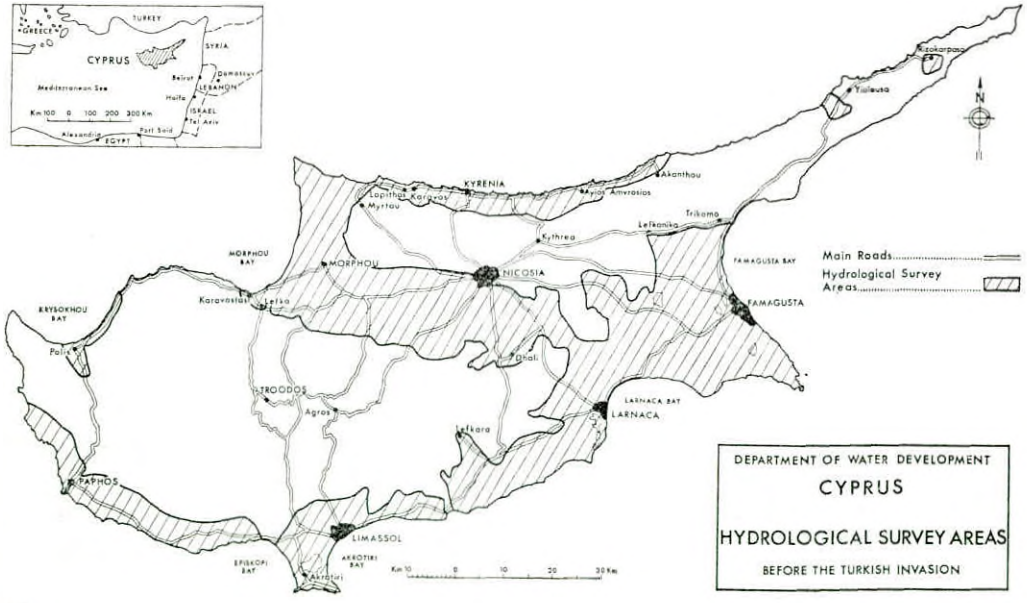
Through the Hydrological Surveys all wells/boreholes, springs and chain-of-wells are registered and plotted on maps. A dense network of observation boreholes, is being levelled.

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.

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. The extent of the areas which were covered before the Turkish invasion, by hydrological surveys was about 3,700 km^2, but now the free area where such work may be carried out is about 2/3 of that See maps on this and next page.

During 1977 the replotting of boreholes/wells, situated in free areas, the information about which was lost during the events of 1974, continued and new areas were also covered. A number of 2,274 boreholes, wells and springs have been plotted in an area 202 km^2.

As regards the groundwater situation, this was still very grave in the south-eastern part of the Island, since the extraction was much more in excess of the recharge. In the other aquifers the water table situation did not improve at all and the situation cannot be considered satisfactory. Details may be seen in the following table of



selected observation boreholes.

Control and Conservation of Ground Water

Advisory Committee for the issue of well permits established by the Ministry of Agriculture and Natural Resources, operated this year with M Peppis, as president 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 Dev. Department, on matters related to well sinking permits. At the meetings, the Legal Advisor of this Department, Ch Kyriakides and the District Engineer of the District where applications were to be examined. particlpated.

The Commitee performed during 1977, 58 meetings and examined 2,008 applications sent to the Director, W D D by the District Officers, as follows:

Water Supply (Special Measures) Law areas 107
Water Conservation areas 1 440
Non Water Conservation areas 461

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 map on page 51 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 on the following table.

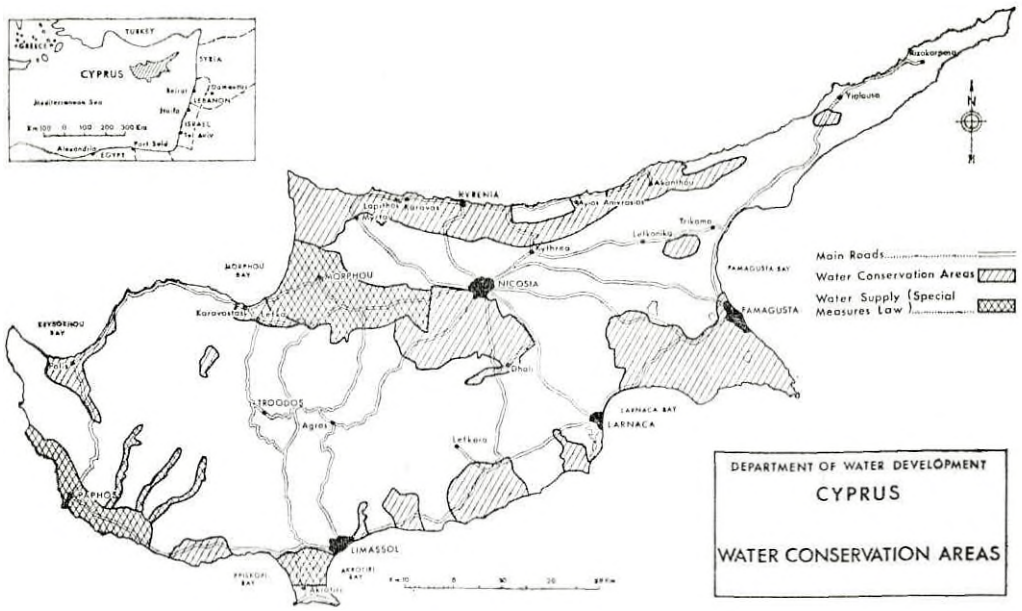
Applications for well permits falling within a Water Conservation Area, being sent by the District Officers to the Water Development Department, for technical advice and recommendations. These recommendations which are based on the Knowledge of the existing water situation of each aquifer, the development 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.

For TABLE II-8 OBSERVATION BOREHOLES see p. 184

TABLE II-9 **WATER CONSERVATION AREAS**

Ser No	Water Conservation Area	Order No	Date	Gazette No	Date
1	K/trimithia-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	374	18. 8.52	3639	27. 8.52
4	Laxia	374	18. 8.52	3639	27. 8.52
5	F'sta, Phenaros, 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	Makedhonitissa, 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, Dhromolaxia	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	14.11.65	444	14.10.65
22	Lakatamia, Dheftera, Anayia, Pera, etc.	744	11.11.65	453	25.11.63
23	Ayia Erini	280	19. 5.66	499	2. 6.66
24	Paramali, Evdhimou	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
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



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 been covered by that Law in 1974 and 1975.
For the above areas

- The District Officer, with the concurrence of the Director WDD 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.

The areas covered by this Law are shown on the above map and particulars given in the table below:

TABLE I-10 **WATER SUPPLY (SPECIAL MEASURES) LAW AREAS**

Ser No	Area	Order	Date	Date	Gazette No.
1	Western Mesaoria (Pendayia-Morphou-K/trimithia)	—	—	331	9.7.64
2	Akrotiri Peninsula	—	—	331	9.7.64
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
7	Ezousas 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	Mavrokolymbos 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

WCA = Water Conservation Area

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 without 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 is not available for western Mesaoria area, since this area is still under Turkish occupation. For Paphos area the Law has not yet been enforced. In Limassol -Akrotiri area 377 water meters have been installed of which 320 in continuous operation. The total volume of water recorded is 12 MCM. During the year 213 illegal pumpings have been reported to the District Officer, out of which 189 were presented 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 an 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 job. A fee is paid for the licence 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 1977, this Department issued 7 Drillers licences and renewed 34 others. Another 3 persons applied for a driller's licence but their application was turned down since they did not satisfy the examiners. The number of private drilling rigs which drilled

for water during 1977, was 68 and this Department has been notified about the drilling or cleaning of 206 boreholes. Information from private drillers have been received by this Department for 122 boreholes.

WATER QUALITY

Chemical Analyses

During the year, 1,689 samples of water were sent to the Government Analyst for Chemical Analysis. Of these, 677 samples were taken from springs, wells or boreholes, which are used or proposed as water supply sources. The remaining 1,012 samples derived from rivers, springs, observation boreholes and from other miscellaneous sources.

In addition to the above, about 2,000 samples of water taken from observation boreholes in the Hydrological Survey areas, were analysed by the Water Resources Division for Chloride content.

Bacteriological Analyses

During the year, 328 samples were sent to the Pathological Laboratory for bacteriological analysis with results as follows:

Water Supply	No of samples	No of unsatisfactory samples
Nicosia ...	34	10
Limassol	152	18
Larnaca ...	142	22
TOTAL ...	328	50

The unsatisfactory samples at Nicosia, Limassol and Larnaca were usually of unchlorinated water. All chlorinated samples at main reservoirs were Highly Satisfactory.

Suspended Sediment Analyses

In view of the future construction of large dams in Cyprus and the problem arising from Reservoirs Sedimentation, a sediment sampling programme was initiated. Though not very intensive, the programme provided for sampling during routine visits to the flow gauging stations and additional sampling during floods in as many rivers as possible.

During the year, approximately 40 samples of river water were taken for Suspended Sediment Analyses.

Cost of Hydrological Studies

Description	Approved Estimated Cost £	Actual Expenditure £
Hydrological Observation and Research	30 000	27 923
Construction and Maintenance of Measuring Weirs	6 000	5 901
TOTAL	£36 000	£33 824

Hydrological Instruments of a value of £300 ordered in 1977 and considered as expenditure of this year, did not arrived in time and they have to be paid from next year's vote.

SPECIAL STUDIES

Use of Computer Techniques for the Storage and Retrieval of Hydrological and Hydrogeological Data

Work was initiated in 1975 for storing and retrieving our hydrological and hydrogeological data in a computer readable form. The purpose and scope was given in the 1975 Annual Report of this Department.

This year, the work continued and the forms on which both permanent and

data information should be recorded to facilitate card punching have been prepared for all the types of information collected and for all types of hydrological stations.

The forms prepared have been classified into two main categories, those with the permanent or semi-permanent information, called the master cards and those with the information about the water sources, collected at regular intervals, called the data cards.

Considerable volume of non numerical hydrogeological information is not practical to be recorded on computer cards in the way it is provided or recorded in the manual archives, so codes have been prepared to cover all possible combinations of such information. These codes and the way the forms are to be used, as well as the classification of the hydrological and hydrogeological information to be recorded on them, are explained in an instructions manual, prepared by D C Kypris, most of which has been completed by the end of this year.

Environmental Isotope Survey of the Troodos Area

The improvement of understanding of the complicated hydrogeology of the Troodos area, has become quite necessary with the implementation of the Pitsilia Project. For this purpose and, among other conventional techiques employed, a survey of the environmental isotopes of the water in the area, has been undertaken in 1977. This survey has been made possible by the granting of an extension of a research contract by the International Atomic Energy Agency (IAEA) with I Iacovides, Hydrologist, as Chief Investigator.

During 1977, a total of 150 samples were collected and sent to the IAEA Laboratories (Vienna), for analysis for the radioisotope Tritium, and the stable isotopes of water Deuterium and Oxygen — 18. Of these samples, 70 are from springs, 60 from boreholes, 15 from streams, 2 from snow and 3 from rainfall.

From the study of the analytical results received so far, it has become apparent that the waters in the Troodos area may be differentiated both in terms of the location of their racharge zone, based on the stable isotope change with altitude, as well as the "age" or "transit time" since recharge occurred. The latter is based on the Tritium content of the water.

Thus, as a preliminary conclusion, it appears that the water masses may be classified in 4 groups.

- The high altitude springs and boreholes around the central core of Troodos including Amiandos, Prodhromos, Kakopetria and Kyperounda, where the water exhibits high Tritium (50 T U) indicating recent recharge and light water (-7.5‰ 0-18).
- The peripheral area covering the lower zone of Pitsilia, Saittas and Pedhoulas exhibiting relatively heavier water (-6.7‰ 0-18) and Tritium (25 T U) indicating components of old and recent recharge.
- The zone of Pelendria, Kato Mylos, Ayios Theodhoros which is distinguished by relatively heavier water (-6.‰ 0-18) indicating local recharge and Tritium (5 T U) suggesting a large old component recharge, and
- The Arakapas fault area where the oxygen — 18 content is about -5% indicating as source of recharge the local rainfall and a reservoir of "long transit time" suggesting a large reservoir or small compo-

nent of recent recharge.
The above preliminary conclusions are expected to be further verified and evaluated with the analysis of additional samples of water.

Research Carried out in Cooperation with the Institute of Geological Sciences (London)

Since the beginning of 1977 research on the aquifer recharge from rainfall is being carried out at a major lysimeter site at Paralimni and other minor lysimeters in the periphery.
This research is being carried out in cooperation with the IGS (London), which is funding the project and providing all the necessary instrumentation.

A large lysimeter (100m^2) has been prepared in situ and the percolating rainfall is continuously being monitored. A similar lysimeter is envisaged for 1978 which will be used for the study of "return flow" from irrigation by planting and irrigating crops with several irrigation methods. These studies which are expected to be continued for a number of years will help in the better evaluation of the recharge component, due to rainfall and irrigation, in the water balance studies of local aquifers and aquifers of similar conditions. I Iacovides, Hydrologist and L Savvides Topographer Engineer, are working on this project with Dr R Kitching of the IGS (London).

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 No 14694 - 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 plant 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 presided 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-Generals, Ministry of Finance, Ministry of the Interior, the 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 of 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 Offices of the Water Development Department, which displaced farmers could fill when applying to be granted a loan to purchase and install pumping plant 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 boreholes or group of boreholes accompanied by an irrigation scheme, where necessary, with the estimated cost, to the Committee which decides as to the kind of equipment to be installed, the amount of water to be pumped, the fields to be irrigated and the loan to be granted.

The decisions of the Committee are then notified to he Loan Commissioner, who releases the proper amount, so that it may be distributed by the local Cooperative Banks to the interested farmers. In case of groups of farmers, the loan remains in the hands of the local Cooperative Banks, which undertake to purchase, install and run the pumping plant and to deliver water for irrigation to the interested farmers who sign an agreement for the repayment of the loan and the running expenses as well.

The repayment period for the loans has been set to seven 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 substracting 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.

During the year under examination, the Committee had 9 meetings, during which it approved 91 applications from 158 farmers for the irrigation of 1,464 donums of land. The amount of loans granted is £46,366 and the value of pumping plant of Turkish Cypriot ownership was £4,075.

Details are given in the following table:

TABLE II-11 **APPLICATIONS EXAMINED AND LOANS ISSUED FOR THE REACTIVATION OF TURKISH CYPRIOT WELLS ABANDONED BY THEIR OWNERS**

Particulars	T/C = Turkish Cypriot N'sia	L'ssol	L'ca	Paphos	Totals
Applications approved (No)	16	18	22	35	91
Wells/boreholes allocated (No)	16	10	22	30	78
Farmers benefited (No)	28	62	25	43	158
Area to be irrigated (donums)	134	665	190	475	1 464
Loans granted (No)	13	18	20	30	81
Loans granted (Pounds £)	5 865	12 657	11 089	16 755	46 366
Loans issued (Pounds £)	5 865	13 487	10 089	16 755	46 196
T/C pumping plant allowed to be used (No)	—	9	3	7	19
Estimated value of T/C pumping plant (Pounds £)	—	2 375	330	1 370	4 075
Amortization rate (Pounds £/year)	—	300	48	159	507

III DIVISION OF PLANNING

by
C A Christodoulou
Senior Water Engineer
Head of Division

INTRODUCTION

The Planning Division of the Water Development Department consists of the following two branches:

- Reconnaissance and Feasibility Reporting
- Investigation and Testing

The activities of each are described below.

RECONNAISSANCE AND FEASIBILITY REPORTING BRANCH

VASILIKOS - PENDASKINOS PROJECT

The Vasilikos-Pendaskinos Project Feasibility Study is the first of its kind undertaken entirely by the Water Development Department. Our staff was assisted in its work by the Department of Agriculture, the Planning Bureau and the Department of Geological Surveys. It took 375 man-months for the completion of the study that was initiated in 1974 and finished in July of 1977. The distribution of the work by categories is shown below.

Distribution of labour force by categories in man-months

Category of Work	Man-Months	Percentage of Total
Engineering studies	126	33.6
Geologic investigations and soil mechanics	19	5.0
Hydrologic studies	21	5.6
Agricultural studies	89	23.7
Economic studies	10	2.7
Surveying	49	13.1
Draughting	54	14.4
Typing	7	1.9
Total	375	100.0

The Vasilikos-Pendaskinos Feasibility Study consists of the following volumes:

Volume I Main Report
Volume II Agriculture
Volume III Water Resources
Volume IV Development Planning and Simulation Studies
Volume V Engineering Components:
- V1 Kalavasos Dam
- V2 Dhypotamos Dam
- V3 Khirokitia-Dhypotamos Diversion
- V4 Groudwater Development
- V5 Irrigation Network and On-Farm Systems
- V6 Domestic Water Supply

Volume VI Economics

This multi-disciplinary, multi-objective, multi-basin and multi-component study is comprehensive in character. It uses tools and techniques from systems analysis and operations research for determining the spatial and temporal optimization of the integrated management of all the elements of the water supply and demand sectors. As such, modern sophisticated techniques have been used in its formulation and in particular computer simulation and optimization models.

The Project has been finalised into two Alternative Plans of development. The first alternative allocates almost half of its water resources for domestic uses, ie, 2.0 MCM/a from the Kalavasos dam to the Famagusta-Larnaca Water Supply Scheme, and 5.2 MCM/a from the Dhypotamos dam to the Nicosia Water Supply Scheme. The remaining surface water 7.6 MCM/a, as well as 1.3 MCM/a from both the Gypsum aquifer and the Pendaskinos valley groundwater, are used to irrigate 1160 ha. The second alternative places emphasis on irrigation. Only 13 percent of the water resources of the area, ie, 2.0 MCM/a, are allocated for domestic purposes (Famagusta-Larnaca Water Supply Scheme); the remaining 13.5 MCM/a, are used to irrigate 1805 ha.

In both alternative plans of development two dams (Kalavasos and Dhypotamos) with a combined capacity of 32.0 MCM are envisaged to be constructed as well as a diversion canal to divert about 60 percent of the Maroni river flow into the Dhypotamos dam. Other water structures proposed by the study are the extension of the Khirokitia Treatment Plant and the construction of a new treatment plant for Nicosia as well as pumping stations, conveyor canals and pipes and on-farm irrigation systems.

The initial capital costs are estimated to be £12.0 and £11.2 million for Alternative I and II respectively.

The degree of fidelity of the Vasilikos-Pendaskinos Project Feasibility Study is sufficiently accurate — considering the limitations of accuracy of the various inputs used — for appraisal by foreign institutions. Its high internal rates of return (11.91 and 12.21 per cent for Alternatives I and II respectively) are very favourable to act as a basis for an application for international finance.

Lania Regional Irrigation Scheme

In November of 1977 work had been initiated for the study of the engineering and economic feasibility of irrigation schemes for the Lania, Dhoros, Monagri, Sylikou and Ayios Yeoryios villages of the Limassol District.
Five alternative plans of development are to be analysed and evaluated. These are:

(a) Division on Kryos river, up stream of Perapedhi village and the construction of a pond to serve the irrigation water needs of Sylikou and Ayios Yeoryios villages.

(b) As in (a) above but instead of diversion pumping of water.

(c) Dam on Amiandos stream and the construction of a pond to serve the irrigation water needs of Lania, Dhoros and Monagri villages.

(d) Diversion on Amiandos stream and the construction of two ponds to serve the irrigation water needs of the villages mentioned in (c) above.

(e) As in (d) above but instead of diversion pumping of water.

Southern Conveyor Project

This project covers all the southern part of Cyprus, ie, from Paphos to Famagusta. It's the biggest project ever undertaken in the Island. Its main objective is the planning of the development and utilization of the surface and groundwater resources of this area. The optimal development and allocation of these resources both in space and time and in accordance with the socio - economic needs and goals is intended to be achieved through the use of a mathematical simulation-optimization model. The allocation of water will be done through the construction of a long conduit which will receive the excess water from the water rich areas and transfer it to the water deficient basins, The project is envisaged in supplying domestic water for both the municipal — including Nicosia — and rural needs as well as for the irrigation demands of the area.

After the completion of the Vasilikos-Pendaskinos Project Feasibility Study the Southern Coveyor Project became the main objective of this Division. A detailed agro-economic study was initiated in September 1977, of the upper Dhiarizos valley for determining the upstream water uses and needs of this area.

This investigation was postponed for 1978 in favour of the Lania Regional Irrigation Scheme which is also a part of the Southern Conveyor Project.

As regards the mathematical simulation-optimization model this was ready for preliminary runs by mid-1977. It was not, however, possible to test it due to the limited storage capabilities of the digital computer in Cyprus. The testing has been deferred to a later date — in 1978 — when the new IBM 370 computer model is expected to be installed in Nicosia.

Intensive detail field investigations and office work is planned to start by the beginning of 1978. The British Ministry of Overseas Development is augmenting our Division with four experts. They are expected to be in Cyprus by the beginning of April 1978. The new Southern Conveyor Project offices will be ready very early in 1978.

Pitsilia Integraded Rural Development Project

As stated in the 1976 annual report, a new study was undertaken late in 1976 by the Water Development Department with the view of providing data enough to further screen and select the proposed works, envisaged by the irrigation component of the project, according to the set economic criteria.

The new undertaking which included studies on a feasibility level for the Xyliatos dam, three ponds and three boreholes, was completed in time by the middle of February 1977. The study, which examined different cases of pond and borehole schemes provided useful cost data for the determination of the total costs both for 25-30 ponds and for an about equal number of boreholes. Various problems regarding the technical feasibility of the construction of the pond and borehole schemes were also examined. Finally the total costs of the Xyliatos scheme were determined.

In March 1977 a new World Bank Mission arrived in Cyprus for the project. This led to the signing of a loan agreement for financing the implementation of the project with a sum of $10 million (£4 million). This constitutes about 43 percent of the total costs of the project which is

£9.36 million. The total costs allocated to the water resources development and distribution are estimated to £3.34 million including the costs for the Xyliatos scheme. Although the loan became effective in October 1977 detail design of the irrigation works started much earlier.

SITE INVESTIGATION, LABORATORIES AND GROUTING SECTIONS

General

In 1977 the work of the Site Investigation, Laboratories and Grouting Sections of the Division of Planning, related to a numper of major and more minor projects undertaken by the Department. Furthermore at the request of other Government Departments and private organisations, a number of projects were undertaken and completed during the year.

The increased volume of work noted in the two previous years, persisted in 1977 and this led to the full utilization of available machinery and personnel throughout the year.

Site investigation work performed was mainly involved with subsurface geological, foundation and construction material investigations, at the feasibility study or design study stages of projects.

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

- **Paphos Irrigation Project:** Asprokremmos dam, main canal, storage reservoirs, elevated towers,
- **Pitsilia Rural Development Project:** Melini pond, Xyliatos dam, Ephtagonia pond, Pelendria pond, Kato Mylos pond, Akapnou pond,
- **Southern Conveyor Project:** Alaminos, Akhna, Klavdhia terminal storage eservoirs,
- Dhrousha pond,
- Lythrodhonda proposed new dam,

Site investigation or drilling work undertaken for other was of a very diverse nature and included:

- Foundation investigation for Refugee housing estates, at the request of the Department of Town Planning and Housing were carried out at Platy, Ayia Varvara, Ayios Nicolaos, Ayios Yeoryios and Ayios Mamas near Nicosia and Alyki at Larnaca.
- Bridge foundation and other investigations for the new Nicosia — Limassol road, at the request of the Public Works Department.
- Drilling at Armenokhori within a geological exploration for Limestone to be used for lime extraction, at the request of the Geological Survey Department.
- Drilling for electricity earthing purposes at Stavros tis Psokas, at the request of the Department of Forests,
- Subsurface foundation investigations for the National Bank of Greece new headquarters in Limassol.
- Subsurface foundation investigations for the Middle East Relay Station at Zakaki, at the request of Colakides and Associates,
- Subsurface foundation investigations for new tower at Moni, at the request of the Cyprus Cement Corporation,

Following the example of previous years and for site investigations, a very close collaboration was maintained with the Engineering Geology Section and in certain cases with the Geophysical Section of the Geological Survey Department.

The work of the Laboratories Section may be distiguished into that of the Main and Field Laboratories. In the Main (Soils/Concrete) Laboratories in Nicosia, tests were performed in connection to foundation and construction material investigations relating to Departmental projects. Tests were also performed at the request of other Government Departments, private organisations and the Nicosia Municipality.

Field laboratories set up at 3 construction sites aimed at the quality control of materials and workmanship during construction of the new Lymbia dam, the main canal for the Paphos Irrigation Project and the storage reservoir for the Trakhoni extension of the Yermasoyia — Polemidhia Project.
The work of the Grouting Section in 1977 included:

- Test grouting in conjuction with the site investigation work performed at the Asprokremmos damsite.
- Curtain grouting works at the new Lymbia dam.
- Foundation grouting for underpinning purposes for M Kouyoumjian's residence in Nicosia.

Site/Material Investigations, Grouting Works

Table III-1 gives relevant details of all site, construction material and grouting works performed during the year giving also duration of work for each project.

Laboratories

The work performed in the Soils Laboratory is analysed in Table III-2 with relevant details as to the type and number of tests performed for each project.

The work of the Conrete and Field Laboratories is presented in the same way on Table III-3.

Personnel

On the 31st of December 1977 the total number of personnel employed with the Section was 32. The number of, title or speciality and function of personnel employed are shown on the following table:

Title	Function Sup.	Lab.	Dril.	Other
Executive Engineer I	1	—	—	—
Geologist II	1	—	—	—
Inspector of Works	2	—	—	—
Technical Assistant	—	4	—	—
Laboratory Technician	—	6	—	—
Draughtsman ..	—	—	—	1
Foreman	—	—	2	—
Driller	—	—	5	—
Casual Labour ..	—	—	10	—

Machinery and equipment

Table III-4 sets out the drilling machinery and accessories which were available at the end of 1976 whilst Table III-5 refers to the Laboratory equipment available in 1976.
Tables III-6 and III-7 give details of laboratory equipment and drilling accessories purchased in 1977 at a cost of £1,600 and £6,000 respectively. Grouting machinery and equipment available in 1976 were as shown in Table III-8.

Through an agreement between the govt. of Cyprus and the IBRD £6,000 worth laboratory equipment was ordered for the Paphos Project soils/concrete field laboratory at Timi. The bulk of it was received by the end of 1977.

TABLE III-1 **1977 SITE/MATERIAL INVESTIGATIONS AND GROUTING (Continued)**

Ser No	Project		Fieldwork as Carried out	Machinery Used	Expenditure £
A.	DEPARTMENTAL PROJECTS				
1	Asprokremmos Dam (Continued from 1976 to 10.2.1977)	Subsurface geological investigations and test grouting	Drilling of 2 No coreholes with associated water pressure testing and test-grouting, depth 140 m	— 1 Core drill — 1 Grouting equipment — 1 Flush pump	900
2	Melini Pond (Continued from 1976 to 9.1.1977)	Subsurface geological investigations, permeability and excavation conditions	Drilling of 1 No corehole depth 20 m	— 1 Core drill — 1 Flush pump — 1 Traxcavator	300
3	Xyliatos Dam (Continued from 1976 to 7.9.1977)	Subsurface geological investigations, fill material investigations, permeability and excavation conditions	— 7 No coredrilled holes, total depth 220 m with water testing —2 No trenches, 70 m length — 70 No trial pits — blasting test (50 m3)	— 2 Coredrills — 2 Flush pumps — 1 Traxcavator — 1 Compressor — 1 Rock drill	5 500
4	New Lymbia Dam (Continued from 1976 to 30.4. 1977 and 1—9.7.1977)	Grout curtain cut-off	— 38 grout-holes, total depth 440 m — 3 No control holes with water testing, total depth 40 m	— 1 Core drill — 1 Overburden drill — 1 Wagon drill — 2 Flush pumps — 2 Compressors and grouting equipment	2 000
5	Ephtagonia Pond (3.1—11.1.1977)	Subsurface geological investigations for establishing excavation conditions	Excavation of 2 No trenches total length 50 m, with sampling	1 Traxcavator	300

TABLE III-1 **1977 SITE/MATERIAL INVESTIGATIONS AND GROUTING (Continued)**

Ser No	Project	Aim of Investigation	Fieldwork as Carried out	Machinery Used	Expenditure £
6	Kalokhorio Pond (14.1.—25.1.1977)	Subsurface geological investigations to establish depth to fresh rock and excavation conditions.	Excavation of 2 No trenches total length 75 m, with sampling.	1 Traxcavator	300
7	Pelendria Pond 25.1.—29.1.1977)	Subsurface geological investigations to establish excavation conditions.	Excavation of 3 No trenches. total length 120 m with sampling.	1 Traxcavator	300
8	Haphos Irrigation Project: Storage reservoir and tanks (8.2.—1.5.1977)	Subsurface geological investigations to establish excavation conditions, bearing capacities and quality of embankment materials.	27 boreholes, total depth 220 m with associated SPT testing and disturbed/undisturbed sampling.	— 1 Auger drill — 1 Core drill — 1 Flush pump — 1 Digger	2 600
9	Alaminos Terminal Reservoir (25.4—27.6.1977)	Subsurface geological investigations at damstite in order to establish permeability/foundation conditions.	4 No boreholes, coredrilled and pressure tested to a total depth of 220 m.	— 2 Core drills — 2 Flush pumps — 1 Bulldozer — 1 Backactor	2 600
10	Kato Mylos Pond (22—27.8.1977)	Subsurface geological investigations for establishing excavation conditions and depth to fresh rock.	Excavation of 2 No trenches, total length 70 m, with sampling.	— 1 Traxcavator	600
11	Akapnou Pond 9.8—15.9.1977)	Subsurface geological investigations for establishing excavation conditions and depth to fresh rock.	Excavation of 2 No trenches, total length 80 m and 8 No trial pits with sampling.	— 1 Traxcavator — 1 Backactor	750

TABLE III-1 **1977 SITE/MATERIAL INVESTIGATIONS AND GROUTING (Continued)**

Ser No	Project	Aim of Investigation	Fieldwork as Carried Out	Machinery Used	Expenditure £
12	Akhna Terminal Reservoir: (10.11.1977 continued in 1978)	Subsurface geological investigations for establishing permeability/foundation conditions.	4 No boreholes with undisturbed/disturbed sampling and pressure testing, total depth 110 m	— 1 Core drill — 1 Flush pump — 1 Mobil auger drill	1 750
13	Lythrodhonda New Dam (14—15.11.1977)	Subsurface geological investigations for establishing excavation/foundation conditions.	8 No trial pits with sampling.	1 Backactor	80
14	Klavdhia Terminal Reservoir: (23.11.1977 continued in 1978)	Subsurface geological investigations for establishing permeability/foundation conditions.	— 6 No boreholes, total depth 190 m with associated pressure testing and SPT/U4 sampling. — 8No trial pits, total depth 30 m	— 2 Core drills — 2 Flush pumps — 1 Light percussion drill — 1 Backactor	2 400
B.	OTHER GOVERNMENT PROJECTS				
1	Stavros tis Psokas (Forest Department) (Continued from 1976 to 6.2.1977)	Drilling for earthing purposes	8 No boreholes depth 120 m	— 1 No Overburden drill — 1 Flush pump — 1 Air compressor	640
2	Armenokhori (Geological Dept.) (20.4—2.11.1977 with a break of 4½ months)	Geological exploration/ Limestone for lime extraction.	— 14 No boreholes, total dept 60 m for sampling and blasting purposes. — 4 No boreholes, coredrilled and watertested to a total depth of 81 m	— 14 No Core drills — 1 Flush pump — 1 Wagon drill — 1 Compressor — 1 Tanker lorry	1 935
3	New Nicosia/Limassol Road—Vasilikos River (PWD) (18.5—30.6.1977)	Foundation investigations for bridge sites.	5 No boreholes, total depth 90 m with undisturbed sampling and SPT.	— 1 Overburden drill — 1 Flush pump — 1 Air compressor	1 400

TABLE III-1 **1977 SITE/MATERIAL INVESTIGATIONS AND GROUTING (Continued)**

Ser No	Project	Aim of Investigation	Fieldwork as Carried Out	Machinery Used	Expenditure £
4	Ay. Varvara Refugee Housing Scheme (15—20.6.1977)	Subsurface foundation investigations.	3 No boreholes, total depth 30 m with undistrurbed sampling and SPT.	1 Mobil auger drill	220
5	Ay. Nikolaos Refugee Housing Scheme (21—25.6.1977)	Subsurface foundation investigations.	2 No boreholes, total depth 25 m with undisturbed sampling and SPT.	1 Mobil auger drill	120
6	Ay. Yeoryios Refugee Housing Scheme (20.6—18.8.1977)	Subsurface foundation investigations.	6 No boreholes, total depth 80 m with undisturbed sampling and SPT.	1 Mobile auger drill	440
7	Ay. Mamas Housing Scheme (20.7—22.10.1977 with 1½ month break)	Subsurface foundation investigations.	12 No boreholes, total depth 250 m with undisturbed sampling and SPT.	— 1 Mobile auger drill — 1 Overburden drill	600
8	Platy Housing Scheme (20.7—18.8.1977)	Subsurface foundation investigations.	3 No coredrilled boreholes. total depth 40 m	— 1 Core drill — 1 Flush pump	50
9	Larnaca — Alyki Housing Scheme (18.8—23.9.1977)	Subsurface foundation investigations.	14 No boreholes, total depth 150 m with undisturbed sampling and STP.	— 1 Overburden drill — 1 Flush pump — 1 Compressor — 1 Mobile auger drill	700
C.	PRIVATE AND BOARD PROJECTS				
1.	Technodomiki—Nicosia (2—6.5.1977)	Subsurface foundation investigations.	5 No boreholes, total depth 40 m	1 Mobile auger drill	200

TABLE III-1 **1977 SITE/MATERIAL INVESTIGATIONS AND GROUTING (Continued)**

Ser No	Project	Aim of Investigation	Fieldwork as Carried Out	Machinery Used	Expenditure £
2	Moni—Cyprus Cement (9—15.5 and 20.10—2.11.1977)	Subsurface foundation investigations.	4 No boreholes, total depth 50 m including SPT and 4 sampling.	— 1 Mobile auger drill — 1 Overburden drill — 1 Compressor — 1 Flush pump	900
3	National Bank of Greece —Limassol New Headquarters (16.8—21.10.1977)	Subsurface foundation investigations.	3 No boreholes, total depth 90 m including SPT and U4 sampling.	— 1 Mobile auger drill — 1 Overburden drill — 1 Flush pump — 1 Heavy percussion drill	2 500
4	Zakaki—Middle East Relay Station (16.8—19.10.1977)	Subsurface foundation investigations.	8 No boreholes, total depth 115 m including SPT and U4 sampling.	— 1 Light percussion drill — 1 Mobile auger drill	2 283
5	Kalokhorio Aerial CBC (26.9—11.10.1977)	Drilling for Earthing purposes.	3 No boreholes, total depth 60 m	— 1 Overburden drill —1 Compressor — 1 Flush pump	450
6	A Skaliotis Building, Nicosia (27.9—30.9.1977)	Subsurface foundation investigations.	3 No boreholes, total depth 54 m with U4 sampling and SPT.	1 Mobile auger drill	271
7	KES Building, Nicosia (13—17.10.1977)	Subsurface foundation investigations.	2 No boreholes, total depth 34 m, with U4 sampling and SPT.	1 Mobile auger drill	100
8	M Zannettos Building, Paphos (25—27.10.1977)	Subsurface foundation investigations.	2 No boreholes, total depth 20 m.	1 Mobile auger drill	130
9	M Kouyoumjian Residence, Nicosia (27.10—1.11.1977)	Grouting for underpinning purposes.	7 No boreholes, total depth 100 m drilled and grouted with cement/sand mixture.	— 1 Wagon drill — 1 Compressor —1 Flush pump — 1 Grouting machinery	1 330
	Total Expenditure				34 649

TABLE III-2 **SOILS LABORATORY TESTS DURING 1977**

No	Type of Test	Paphos Irrigation Project: Aspro-kremmos Dam	Paphos Irrigation Project: Main canal	Xyliatos Dam	itsilia Rural evelopment Project: Pelendria Pond	Ephtagonia Pond	Akapnou Pond	Other Governmental Departments: GSC	Productivity center	Private Firms	Miscellaneous	Total of each kind
1	Sieve analysis (Wet or dry)	—	28	3	—	2	—	—	—	6	—	39
2	Hydrometer analysis	18	50	33	2	—	7	17	11	15	19	172
3	Atterberg limits	20	44	33	2	2	7	—	13	14	—	135
4	Specific gravity	22	42	33	2	—	7	17	13	14	19	169
5	Bulk density	—	548	—	—	—	—	—	10	18	—	576
6	Moisture content	22	254	30	—	—	7	—	10	16	—	339
7	Compaction	22	153	34	2	2	7	—	—	5	—	225
8	Permeability	18	—	33	2	2	7	—	—	6	—	68
9	Unconfined test	—	2	—	—	—	—	—	—	—	—	2
10	Undrained triaxial	—	3	—	—	—	—	—	10	11	—	24
11	Drained triaxial	—	—	—	1	—	—	—	—	—	—	1
12	Large shear box	1	—	—	1	—	—	—	—	—	—	2
13	Consolidation	10	8	—	—	—	—	—	5	5	—	28
14	Swelling pressure test	—	5	—	—	—	—	—	—	—	—	5
15	Suspended sediment	—	—	—	—	—	—	—	—	—	49	49
	Total	133	11 37	199	12	8	42	34	72	110	87	1 834

TABLE III-3 **CONCRETE AND FIELD LABORATORIES TESTS DURING 1977**

No	Type of Test	Concrete Laboratory: Paphos project Main Canal	Tenders For Conc. Aggregate	For Private Sector	Miscellaneous	Field Laboratories: Paphos Project Main Canal	Trakhoni Reservoir	Lymbia Dam	Total
1	Mix design	4	—	—	—	—	2	—	6
2	Density of aggregates	12	—	—	—	6	2	—	20
3	Sieve analysis	20	78	—	14	148	94	78	432
4	Silt content	15	46	—	8	120	56	50	295
5	Organic impurities	15	46	—	8	120	56	45	290
6	Specific gravity	8	—	—	4	—	2	10	24
7	Water absorption	8	—	—	—	4	2	10	24
8	Moisture content	16	—	—	7	249	2	48	322
9	Aggregate crushing value	4	10	—	—	—	7	13	34
10	Aggregate impact value	—	—	—	6	—	—	—	6
11	Bulking of sand	—	—	—	2	—	2	2	6
12	Cube crushing	52	—	33	24	2 681	370	548	3 708
13	Slump	12	—	—	—	1 094	92	160	1 358
14	Core crushing strength	—	—	—	53	—	—	—	53
	Total	166	180	33	126	4 422	687	964	6 578

TABLE III-4 **SITE INVESTIGATION MACHINERY AND EQUIPMENT**

(i) DRILLING AND BORING RIGS

No	Description	Make	No of	WDD Ref Nos
1	Rotary percussion (Overburden)	Atlas	3	294 455 477
2	Core drill	Craelius	2	354 497
3	Core drill	Boyles	4	459 460 555 557
4	Mobile auger/core drill	Atlas	1	560
5	Wagon drill	Atlas	1	423
6	Mini wagon drill	Atlas	1	587
7	Shell and auger boring machine	Edeco	1	553

(ii) AIR COMPRESSORS

No	Description	Make	No of	WDD Ref Nos
1	Compressor	Atlas	2	280 362
2	Compressor	Gardner	1	495
3	Compressor	Cumming	1	668

(iii) FLUSH PUMPS

No	Capacity HP	Make	No of	WDD Ref Nos
1	4.75	Lister	1	354A
2	5.5	Petter	2	102 103
3	6.5	Lister	2	460A 554
4	6.5	Craelius	1	564
5	9.5	Simplex	3	499 628 629
6	10.0	Petter	2	484 600
7	11.75	Ruston	1	586
8	19.5	Lister	3	556 558 563

(iv) ASSOCIATED EQUIPMENT FOR USE ON SITE

No Description

1 Core drilling equipment: to fit available coredrills and for boreholes of variable diameter and to depths greater than 100 m, including:

(i) Casing tubes,
(ii) Casing show bits (diamond, diaborit, TC),
(iii) Double tube core barrels,
(iv) Core bits (diamond, diaborit, TC, rockbit),
(v) Contral drill rods,
(vi) Reaming shells etc.

2 Auger drilling equipment: to fit mobile auger drill and for 0.20 m dia drilling to 30.0 m or for 0.25 m dia drilling to 12.0 m, including:

(i) Hollow stem auger flights of 1.5 m length,
(ii) Hard or soft formation cutters,
(iii) Central boring rods,
(iv) Head assembly.

3 Shell and auger boring machine equipment: for 0.15 m or 0.20 m dia boring to 25 m depth in clayey or sandy formations.

4 2 Sets standard penetration test equipment complete with:

(i) 140 lb automatic trip hammer,
(ii) 30 m/set square connecting rods,
(iii) Open ended raymond (split spoon) sampler,
(iv) 60° cone ended sampler.

5 Undisturbed sampling aquipment complete with:

(i) 10 cm dia head assembly,
(ii) 10 cm dia open drive (U4) tubes,
(iii) 10cm dia cutting shoes,
(iv) 8 cm dia and 7 cm dia thin walled (shellby) tube sampler.

TABLE III-5 **LABORATORY EQUIPMENT**

(i) SOILS LABORATORY EQUIPMENT

No	Description	Year acquired
1	5 No Liquid limit apparatus	2 prior to 1967 1 in 1971 2 in 1974
2	Normal and rapid moisture apparatus	prior to 1967
3	2 No shrinkage limit apparatus	prior to 1970
4	Standard and modified proctor apparatus	prior to 1967
5	Sand replacement apparatus	prior to 1967
6	Sieve analysis and hydrometer apparatus	prior to 1967 and 1973
7	Falling and constant head permeameters	prior to 1967
8	Unconfined compression apparatus	prior to 1967
9	Triaxial shear strength test apparatus (1½" diameter specimen)	prior to 1967
10	Small shear box machine (6x6 cm specimen)	1 prior to 1967
11	3 No consolidation apparatus	2 in 1971
12	1 No 17 inch diameter by 10 inch high constant head permeameter	prior to 1967 1967
13	2 No sample extruder	1967 & 1974
14	1 No high capacity triaxial machine for up to 4 inch dia soil and rock specimens	1968
15	1 No Norwegian type pore pressure apparatus	1968
16	1 No Torsion dial balance	1969
17	2 No Proctor penetrometer sets	1969
18	Universal hydraulic extruder	1970
19	Large shear box machine (12"x12" samples)	1970
20	Platform beam scale	1971
21	2 No multispeed, bench mounted, 1 ton, Triaxial compression machines	1972
22	1 No multispeed, 5 ton, Triaxial machine	1972
23	2 No Bishop type pore pressure apparatus and 1 No volume change indicator	1972
24	6 No Bishop type constant pressure systems	1972
25	1 No Infra red drying cabinet	1972
26	2 No Kango vibrating hammers	1972 & 1975
27	2 No Blader type pressure cylinders	1972
28	1 No Constant head permeameter for sands	1972
29	Water de-airing unit complete	1973
30	Automatic proctor and modified proctor compactor	1973
31	Automatic (hydraulic-electric) extruder	1973
32	Soil pocket penetrometer	1973
33	2 No stop clocks	1973
34	2 No Geological hammers	1973
35	Paschall ball mill complete	1975
36	Andreassen pipette apparatus	1975
37	Electrical resistivity geological equipment	1975
38	15 kg semi automatic weighing balance	1976

39 Consoilidation testing accessories:
(i) 2 No 3 in. dia s/s ring cutters 1976
(ii) 1 set 4 in. dia cell complete 1976
40 1 set 200 mm dia Test sieves1976
41 4 No falling head permeameters 1976

(ii) CONCRETE LABORATORY EQUIPMENT

No	Description	Year Acquired
1	Aggregate crushing test apparatus	1960
2	Balance capacity 700 lbs	1961
3	Compacting factor apparatus concrete	1961
4	Oven for drying sands and aggregates	1965
5	Concrete cube crushing machine (hand operated)	1957
6	Sieve shaker	1964
7	Vicant needle for cement test	1966
8	150 ton concrete cube crashing machine (electrically operated)	1966
9	Laboratory concrete mixer	1968
10	Distillation apparatus	1969
11	Large riffle box for coarse for concrete	1969
12	Air entraintment meter	1971
13	Electric concrete vibrator	1971
14	Core cutting machine	1972
15	Portable coring machine	1972
16	3 in. dia drill bit for portable coring machine	1973
17	4 in. dia drill bit for portable coring machine	1973
18	Schmidt concrete test hammer (type N)	1975
19	Profometer, reinforcement detector	1976
20	Crack width meassuring unit	1976
21	Concrete temperature measuring instrument	1976

(iii) IN SITU TESTING EQUIPMENT

No	Description	Year Acquired
1	Vane shear test unit	1970
2	2 No plate bearing test units	1970 and 1973
3	Well permeability test unit	1972
4	Point load tester unit	1974

TABLE III-6 **DRILLING ACCESSORIES PURCHASED IN 1977**

No	Quantity	Description
1	1	Pixie diamond bit 3"
2	7	Rock roller bits 3 7/8"
3	2	TC core bits T76
4	5	Diamond casing shoes NX
5	5	Double tube core barrels
6	6	Impregnated core bits T76
7	1	Impregnated core bit T66
8	2	Impregnated casing shoes NX
9	1	Impregnated casing shoe BX
10	1	Diamond casing shoe BX
11	9	Diamond core bits T76
12	4	Impregnated reaming shells T76
13	9	Diamond core bits T76
14	1	Non coring diamond bit 66 m
15	14	Core lifter springs
16	6	Core lifter cases
17	1	Batton bit 63 mm
18	1	Adaptor sleeve 3 1/2"
19	2	Casing tubes 5"x3 m

TABLE III-7 **LABORATORY EQUIPMENT PURCHASED IN 1977**

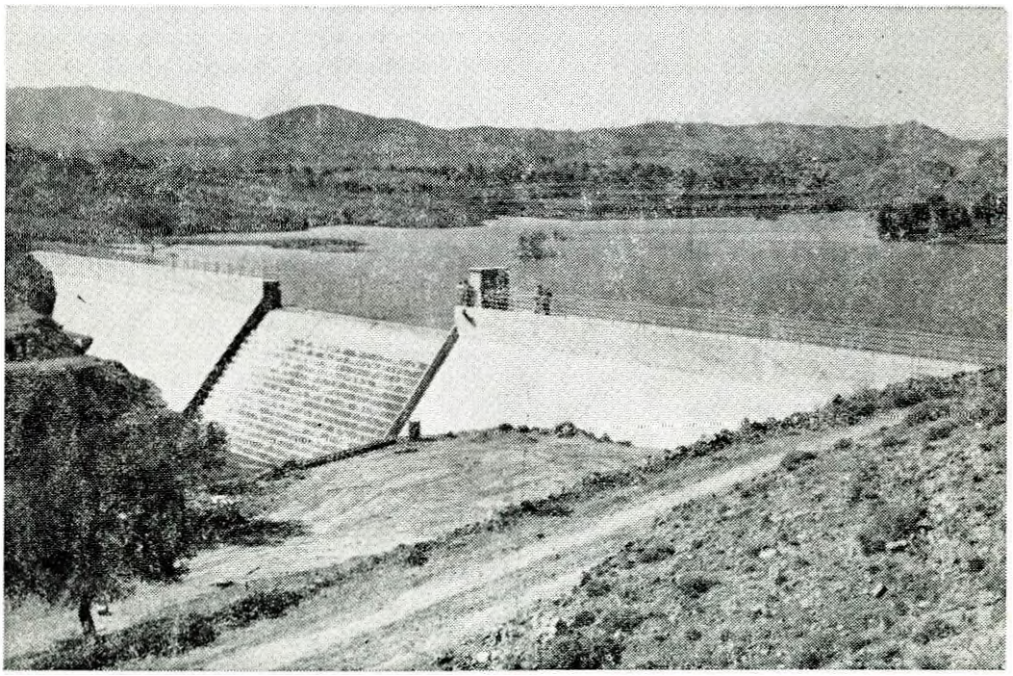
No	Quantity	Description
1	1	Endecotts test sieve shaker
2	1	1 litre stainless steel ball mill pot
3	4	Alkali reaction container

TABLE III-8 **GROUTING MACHINERY AND EQUIPMENT**

No	Description
1	1 "Moyno" grout pump (pneumatic) Capacity ..... = 50 psi/min Pumping pressure ..... = 200 psi
2	2 No "Craelius" grout pumps reciprocating with diesel engine Capacity ..... = 11 gal/m Pumping pressure ..... = 1000 psi
3	2 No ZA 300 high speed mixers (pneumatic), "Craelius" Capacity ..... = 66 imp. gallons
4	2 No ZA 600 grout agitators (pneumatic), "Craelius" Capacity ..... = 132 imp. gallons
5	1 No colloidal grout mixer "semix" 175" type "Craelius"
6	1 No grout agitator "Concrete" type Capacity ..... = 77 imp. gallons

Reports

Relevant technical reports were prepared on completion of projects. These are included in the list of Departmental publications under DIVISION OF DESIGN.



New Lymbia dam with a reservoir capacity of 220,000 m³ of water is a mass concrete gravity type dam built on the site of the old masonry dam which had silted up altogether. It was completed in September 1977 at a cost of £85,287 up to the end of 1977. Expenditure is expected to rise up to approx. £92,000 due to continuing payments on land acquisition compensation. WDD photo No. A77-4.

IV DIVISION OF DESIGN

by
Chr. Marcoullis
Senior Water Engineer
Head of Division

Introduction

The Design Division of the Water Development Department deals mainly with the preparation of detailed designs of all major projects undertaken by the Department. These projects involve the design of dams and other hydraulic structures, irrigation networks or domestic water supply schemes. In case such works are to be constructed by contract the designs are supplemented with specifications, conditions of contract and other documents.

Further to the Branches particular to the above mentioned types of design, this Division incorporates the Topography and the Drawing and Records Branches of the Department. The first undertakes all topographical works, surveys, etc. of the whole Department, whereas the second carries out all drawing work of all the major and minor projects, keeps the technical records and looks after the library of the Department and carries out the photo-process lab, photographic and reproduction work.

During the first few months of 1977 most of the qualified personnel of the Division were kept busy with planning work related to the preparation of the feasibility studies of the Vasilikos — Pendaskinos and Pitsilia projects.
The actual detailed design work carried out during the year under concern, by each Branch of the Division, is described below:

DAMS BRANCH

The detailed design of the Xyliatos dam and of the Pelendria and Ephtagonia ponds envisaged by the Pitsilia Project, kept this Branch busy since after the feasibility study of the project was completed in March 1977. The Xyliatos Dam is the only dam included in the project whereas the ponds are the first two out of a number of 20 to 30, planned to be constructed within the project.

Xyliatos Dam

This is a rockfill dam with a storage capacity of about 1.3 million cubic metres, which is intended to provide water for the irrigation of a gross area of about 2200 donums in the Xyliatos village vicinity.

The damsite is located on the Lagoudhera tributary of Elea river.

A rockfill type of dam with a central

clay core was finally adopted after ruling out the concrete gravity type which was found unsuitable on geologic and economic grounds. The dam crest elevation will be 541.75 m, its normal water level 537.5 m and the crest length about 145 m. The height of the dam will be 41 m with upstream and downstream slopes of 1:1.6.

The spillway, which is located on the left abutment, will be of the free overflow type with a concrete lined chute that will end in a deflector bucket. Its width at the weir crest will be 15 m.

A straight 150 m long, 2.0 m dia concrete lined tunnel is to be provided in the left abutment to be used for flood diversion during construction and later as a scour outlet. A 0.45 m dia irrigation pipe cast in concrete beneath the tunnel invert, will be controlled by sluice valves housed in a small control chamber located at the downstream end of the tunnel. This chamber will also house the controls of a 0.75 m square, hydraulically operated gate that will be installed at the tunnel inlet. A transition is used to change the circular section of the tunnel at its end to a rectangular one, followed by a concrete lined chute which discharges into a stilling basin.

Most of the time spent on this work during 1977 was used to fix the ultimate location of the various components of the dam, based on the available surface geology of the damsite, the topography and the foundation and material investigations which were concurrently carried out. By the end of the year the design work was directed toward the finalization of the hydraulics of the tunnel during and after the diversion stage.

Pelendria Pond

This pond, similar to that already constructed by the Department at Kyperounda, will be one of the largest ponds which are planned to be built within the Pitsilia Project. The pond is located south of Pelendria village just below the road which leads to Potamitissa.

The storage capacity of the pond will be about 123,000 m^3. The pond will be impounded with water diverted through a 200 mm dia pipeline, from a stream which flows at the western end of the village. Its operation, however, will be combined with the use of a nearby drilled successful borehole, which can supplement the ponds storage with additional water pumped during the critical last three months of the irrigation period. Through this combined operation the pond will enable the irrigation of a net area of 290 donums whereas the borehole will be able to cover an additional net area of 190 donums by itself.

Geologically the pond will be located in a valley of weathered gabbro, which is easy to excavate but which requires lining to prevent excessive leakage. The total volume of earthworks, that is excavation and fills will be about 110.000 m^3. The area of the lining membrane will be about 25,000 m^2.

By the end of 1977 the detailed design of the pond had been advanced to such a point, requiring only for its completion the reinforcement details of the diversion works.

Due to the fact that the construction of all the ponds included in the Pitsilia Project will be done through the employment of contractors, a full set of contract documents, specifications etc. were under preparation during 1977. These documents will be ready during the first few months of the new year to enable the invitation of tenders.

Ephtagonia Pond

This pond is located about half a kilometer east of Ephtagonia village. It is the first of three ponds planned for this village within the framework of the Pitsilia Project.

The storage capacity of the pond is about 92,000 m^3. The pond will draw water for storage through a 200 mm dia pipeline from a tributary of Vasilikos river which passes inbetween the pond and the village. The stored water will be used for the irrigation of an area of 135 net donums of new land located just below the pond.

The selected pondsite is situated in a small valley topographically very favourable for the construction of a pond. The site, which is located in a diabase formation, offers relatively easy conditions of excavation whereas again lining of the pond's surface will be required to prevent excessive leakage. The total volume of earthworks will be of the order of 97,000 m^3 whilst the area of the lining membrane will be about 21,000 m^2.

The progress of the work on Ephtagonia pond was similar to that of Pelendria since the design work on both ponds was concurrently carried out.

IRRIGATION BRANCH

The main works dealt with by this branch were also associated with Pitsilia Project. However the actual design work for the schemes proposed for execution during 1978 was very limited due to the fact that for most of these schemes the prior completion of land consolidation prevented the preparation of the final designs of distribution systems. A great deal, however, of administrative matters associated mostly with the selection of and fixing the irrigated area of each scheme and the preparation for the establishment of the legal bodies which would be involved in the financing and operation of the schemes kept this Branch busy throughout the year.

In particular this Branch has dealt with the following:

Xyliatos Dam

This scheme will be constructed under the Government Waterworks Law, that is the beneficiaries are not to contribute directly towards the construction costs but will have to buy the water at a rate per unit volume.

The selection of the area to be irrigated, which is about 2200 gross donums, became a matter of controversy between several villages which own this land. This resulted mainly from the existence of an extensive commanded area of good land which objective criteria such as land suitability could not rule out. Several changes were proposed during 1977 which along with new data regarding the ownership of the land and its suitability involved new work for three Departments resposible for this work, that is the Departments of Water Development and of Agriculture and the Land Consolidation Authority. Until the end of 1977 no final decision could be reached on the definite boundaries of the irrigated area.

Ephtagonia Pond

The distribution network for this pond was almost completed pending some final touches which may be necessary after the establishment of the Irrigation Division which will undertake the management of the scheme. The total

gross irrigated area will be about 150 donums.

Other Schemes

The distribution systems of all other schemes planned to be implemented during 1978, such as the Pelendria, Potamitissa, Kalokhorio, Agros etc. were not proceeded for a detailed design, pending either the prior completion of land consolidation or administrative difficulties requiring a prior solution. However the collection of the required data and the preparation of topographic and land suitability maps needed for the studies continued throughout the year.

DOMESTIC WATER SUPPLIES

As mentioned earlier, the feasibility study of the Vasilikos — Pendaskinos Project was completed in August 1977. One of the most important features of the selected alternative of this Project is the reinforcement of the Nicosia water supply through the construction of Dhypotamos Dam on the Pendaskinos river, and the pumping of a great quantity of the stored water to Nicosia.

The high capital costs, however, involved in the implementation of this scheme will most probably call for foreign financing, whereas its construction will take quite a considerable time to be completed. Therefore due to the fact that the acute problem of the Nicosia water supply shortage ought to be urgently faced, a decision was taken in October 1977, to proceed with the construction of the pipeline to Nicosia, which will convey to Nicosia the unutilized by the Famagusta — Larnaca Water Supply Scheme water of Lefkara dam, until the Vasilikos — Pendaskinos Project is implemented.

The pipeline will be connected at a suitable point with the existing Famagusta — Larnaca pipeline and will draw water treated by the Khirokitia Treatment Plant.

Due to the urgent nature of the work and to the observed personnel shortage of the Water Development Department, it was decided a foreign consulting firm to be employed for the preparation of the final design of this scheme which is considered as the first phase of the Vasilikos — Pendaskinos Project.

The preparation, however, of detailed topographical maps along the already selected route of pipeline and the preparation of all necessary documents for the invitation of tenders for the selection of consultants kept this Branch busy until the end of 1977.

Another feature of the Nicosia Water Supply which was dealt with in cooperation with the Construction Division was the finalization of the design of the new Lakatamia Reservoir.

This is a 40,000 m^3 capacity reinforced concrete reservoir, located at the eastern side of the existing smaller Lakatamia reservoir. It is the third reservoir, after the construction of Engomi and Strovolos ones, which is planned for the amelioration of the distribution proplem of the Nicosia water supply, and will receive mostly water from the above mentioned Vasilikos — Pendaskinos Project. The construction of the new reservoir is expected to begin in 1978 and its estimated cost will reach about £670, 000.

TOPOGRAPHY BRANCH

This Branch of the Design Division is assigned to conduct all the Engineering Survey Work required by the Department. It is not a closed branch with specialized surveyors but nevertheless the staff is properly trained

inter-departmentally and is well acquainted with the methods and procedures of the engineering surveys such as:

- Cross-Sectioning
- Profile-levelling
- Tacheometry for Contour Surveys
- Setting-out of project outlines
- Instrumental observations for movement detection and the computations involved.

All kinds of modern surveying instruments and equipment are available in the Department and these are replenished annually according to the existing necessities. Adjustments and minor repairs of these instruments are done within the Branch.

The staff during the year 1977 numbered twenty-four persons classified as follows:

One Senior Inspector of Works — in charge of the Branch
Eleven monthly paid Technical Assistants
Seven hourly paid Technical Assistants
Six regular hourly paid employees engaged as Rod-men

The Pitsilia Rural Development Project and the Paphos Irrigation Project were again, among other routine surveys, the main areas of operations during the year under review. For the Pitsilia Rural Development Project a number of final surveys of selected sites were conducted, for the construction of storage ponds and longitudinal sections of routes of proposed pipelines were surveyed for the conveyor and distribution systems. For the Paphos Irrigation Project the western pipeline route (22 km long) was surveyed as well as several site surveys were conducted for pumping stations or reservoirs. A detail list of the projects dealt with this year by this Branch is given below:

SURVEY WORK CARRIED OUT DURING 1977

PROJECT	TYPE OF SURVEY
Pitsilia Project	
(i) 15 pond sites	Contour survey
(ii) 7 conveyor pipeline routes	Setting-out, levelling
Paphos Project	
(i) Western pipeline route	Setting-out, levelling
(ii) 8 site surveys	Contour survey
Southern Conveyor	
(i) Klavdhia terminal reservoir	Damsite contour
(ii) Alaminos terminal reservoir	Surveys
(iii) Athna terminal reservoir	Surveys
Other Projects	
Ayia Napa existing dam	Contour survey
Khirokitia — Nicosia pipeline	
(Alternative route)	Setting-out, levelling
Lythrodhonda damsite	
Akapnou diversion site	
Paleometokho recharge scheme	Contour survey
Pharmakas reservoir	
Ground reservoir	
Klirou damsite	
Vyzakia pond	
Pedhieos river training	
Kokkini Trimithia pipeline	Levelling
Kiti dam	Sedimentation
Arakapas dam	Sedimentation
Lymbia dam	Sedimentation
Sklidhros dam	Sedimentation studies
Pissouri pond, Paralimni river training	Contour survey

Akapnou pond	
Kalopanayiotis dam	Movement observations
Lefkara dam	
(i) Kakopetria pond	Solea Valley
(ii) Evrykhou pond	
(iii) Tembria pond	
(iv) Phlassou pond	Contour survey

DRAWING AND RECORDS BRANCH

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

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

The staff of the Drawing Branch during 1977 numbered 16 i.e. 5 Draughtsmen scale 5, 1 Technical Assistant scale 5, 6 daily paid Technical Assistants and 3 hourly paid Technical Assistants.

In addition, during the summer, six students of the Higher Technical Institute were employed, within their training programme, at the Drawing Branch for varying periods of up to 5 weeks each.

The work done by the Drawing and Records Branch can be listed as follows:

WORK CARRIED OUT BY THE DRAWING BRANCH

Ref.	Description	Time Spent in hours	Man mon.	% of total
a	Existing Dams (completion plans sedimentation maps, control monuments etc)	580	3.6	2.2
b	Irrigation Distribution Systems for Dams	401	2.5	1.5
c	Routine Irrigation Schemes	1 144	7.2	4.4
d	Domestic Water Supplies	2 035	12.8	7.7
e	Recharge Schemes	—	—	—
f	Antiflood Schemes	46	0.3	0.2
g	River Training Works	85	0.5	0.3
h	Hydrological	97	0.6	0.4
i	Pitsilia Integrated Rural Development Project	3 950	25.0	15.0
j	Vasilikos - Pendaskinos Project	3 450	21.9	13.0
k	Paphos Irrigation Project	2 360	14.9	9.0
l	Solea Valley Development	520	3.3	2.0
m	Southern Conveyor Project	449	2.8	1.7
n	Kouris Dhelta Project	46	0.3	0.2
o	Completion Plans & Reports	1 339	8.6	5.0
p	Programmes and Organization	164	1.0.	0.6
q	Odd jobs	730	4.6	2.8
r	Training staff and HTI students	1 245	8.0	4.8
s	Auxilliary Services			
	(i) Library	1 046	6.6	4.0
	(ii) Photographic & Photo Process	719	4.5	2.7
	(iii) Plan Registry & Plan Reproduction	2 376	15.0	8.9
	(iv) Drawing Materials store	129	0.8	0.5
	Services Total	4 260	26.9	16.1
t	Leave etc.			
	(i) Leave Paid	1 278	8.1	4.8
	(ii) Leave without pay	159	1.0	0.6
	(iii) Sick Leave	1 039	6.5	4.0
	(iv) Maternity Leave	794	5.0	3.0
	(v) D C	382	2.4	1.4
	Leave etc. Total	3 652	23.0	13.8
	Grand Total	26 552	168.0	100%

Drawing and Cartography Section

As can be seen from the above table nearly 40% of the work done was for the projects Vasilikos — Pentaskinos, Pitsilia and Paphos.

The Land Use Map, prepared by the Drawing Branch in 1976, was reprinted at Couvas & Sons of Limassol at a cost of £290 for 1000 copies. A number of the maps are on sale at the Department of Lands and Surveys and 200 maps in the pocket of the relevant book "Land Use in Cyprus" by L. Savvides are on sale at this Department.

Plan Reproduction and Plan Registry Section

Plan reproduction continued during 1977 with one continuous process and one still machines. Some 2100 orders were issued for 36,500 prints of various types and sizes. The plan registry work is shared by the Drawing Section Staff but it is planned to get plan reproduction and plan registry under one roof to avoid using Drawing Section Staff on this job.

The Photographic Section and Photo Process Laboratory

With the return of the Photographer of the Department in August 1977 from his scholarship in Holeand the photography as well as colour 16 mm again and coverage continued of construction works of the Department in black and white and colour still photography as well as colou 16 mm cine filming.

The Photo Process Laboratory during 1977 was equipped with 2 additional pieces of equipment, namely a Contact Vacuum printing frame 110 x 132 cm and one 2 point film punch through the use of which 'register' of maps is attained. The Laboratory is equipped also with a process camera for enlargement, reduction and reproduction of maps.

Technical Library and Technical Information Section

1977 was a year of an all out effort to rebuild the Technical Library of the Department which was totally destroyed by fire in 1974. An amount of £581 was expended on the purchase of 60 new volumes of books through Governmental votes. In addition a sum of £618 was spent by UNDP for the purchese of 80 volumes of books requested by the Library. The Library is indeed grateful to UNDP and to UNDP Representative in Cyprus Mr Jeager who saw to it personally that this project was carried out successfully. More books through UNDP are expected in 1978. The Library is also grateful to various international organizations that have supplied the Library free of charge with material, as follows:

The Argonne National Laboratory for 6 volumes of the Water Quality Management Programme of the state of Illinois, USA.
The US Texas Water Development Board for 3 series of reports (17 volumes) on Water Resources.
The US Army. Corps of Engineers, North Atlantic Division for 25 volumes of the North Atlantic Regional Water Resources Study.
The US Department of Agriculture, Soil Conservation Service for 3 sections of the National Engineering Handbooks.
The US Department of the Interior, Bureau of Recla-

mation for 3 volumes of Earth and Dam Manuals.

The US Army Hydrologic Engineering Centre for their Technical Papers series (46 volumes).

The UK Central Water Planning Unit for 12 technical notes.

The Library continued to issue monthly notes on material received and of articles of special interest in periodicals. Following are lists of books purchased, and of WDD reports.

Books Purchased during 1977

Mc GRAW — HILL BOOK CO. Encyclopaedia of science and technology. Vol. 1 — Vol. 15 (including Index). New York, 1971. Price £151,000 mils.

Mc GRAW — HILL BOOK CO. Encyclopaedia of science and technology. Yearbook for 1972. New York, 1972. Book No. 7817. Price £9,000 mils.

THE TIMES. Atlas of the world. Great Britain, 1975. Book No. 7818. Price £26,000 mils.

D M CONSIDINE Encyclopaedia of instrumentation and control. New York, 1971. Book No. 7846. Price £21,300 mils.

ROBERT H PERRY. Engineering manual. New York, 1967. Book No. 7821. Price £9,350 mils.

CONSTRUCTIONAL STEEL RESEARCH DEV. ORG. Steel designer's manual. London, 1975. Book No. 7853. Price £7,000 mils.

W H KING & D R ESSON. A metric manual of specifications and quantities for Civil Engineers. London. 1975. Book No. 7836. Price £3,250 mils.

F S MERRITT. Structural steel designers' handbook. New York, 1972. Book No. 7845. Price £18,250 mils.

E H GAYLORD & C N GAYLORD. Structural engineering handbook. New York, 1968. Book No. 7843. Price £21,300 mils.

C V DAVIS & K E SORENSEN. Handbook of applied hydraulics. New York, 1969. Book No. 7848. Price £12.150 mils.

J A HAVERS & F W STUBBS. Handbook of heavy construction. New York, 1971. Book No. 7852. Price £22,250 mils.

L C URQUHART. Civil engineering handbook. New York, 1962. Book No. 7841. Price £18,350 mils.

R C KING & S CROCKER. Piping handbook. New York, 1967. Book No. 7822. Price £23,600 mils.

K IMHOFF & G M FAIR. Sewage treatment. New York, 1956. Book No. 7827. Price £6,650 mils.

L B ESCRITT. Water supply and building sanitation. Vol. 1. London, 1972. Book No. 7828. Price £6,000 mils.

L B ESCRITT. Sewerage and sewage disposal. Vol II. London, 1972. Book No. 7837. Price £8,500 mils.

H E BABBITT. Plumbing. New York, 1960. Book No. 7833. Price £14,750 mils.

CEMENT & CONCRETE ASSOCCIATION. International recommendations for the design and construction of concrete structures. London, 1970. Book No. 7856. Price £4,000 mils.

S W CRAWLEY & R M DILLON. Steel buildings analysis and design. New York, 1970. Book No. 7829. Price £12,450 mils.

CHAS E REYNOLDS. Basic reinforced concrete design. Vol. 1. London, 1968. Book No. 7838. Price £2.000 mils.

CHAS E REYNOLDS. Basic reinforced concrete design. Vol. II. London, 1973. Book No. 7840. Price £2,000 mils.

C DAVIS. Steel — concrete composite beams for buildings. London, 1975. Book No. 7834. Price £5,600 mils.

A L L BAKER. Limit — state design of reinforced concrete. London, 1970. Book No. 7826. Price £5,000 mils.

J FABER & F MEAD. Reinforced concrete. London, 1967. Book No. 7825. Price £5,000 mils.

C W DUNHAM. The theory and practice of reinforced concrete. New York, 1966. Book No. 7824. Price £10,950 mils.

L J MURDOCK & G F BLACKLEDGE. Concrete materials and practice. London, 1968. Book No. 7835. Price £7,000 mils.

CHAS E REYNOLDS. Concrete construction. London, 1967. Book No. 7842. Price £4.000 mils.

E LITTON. Automatic computational techniques in civil and structural engineering. London, 1973. Book No. 7832. Price £7,000 mils.

R M PHELAN. Fundamentals of mechanical design. New York, 1970. Book No. 7850. Price £10,750 mils.

C W DUNHAM. Foundations of structures. New York, 1962. Book No. 7851. Price £11,500 mils.

G A LEONARDS. Foundation engineering. New York, 1962. Book No. 7844. Price £19.750 mils.

A S WEST. Piling techniques, 1975. London, 1975. Book No. 7830. Price £1,500 mils.

A BANNISTER & S RAYMOND. Surveying. London, 1972. Book No. 7839. Price £4,500 mils.

A W FRICS & C W FRICS. Elements of qouantity surveying. London, 1974. Price £4,250 mils.

FR HILTON. Advanced carpentry & joinery. Metric edition. London, 1969. Book No. 7831. Price £3,200 mils.

J H CALLENDER. Time — saver standards for a chitectural design data. New York, 1974. Book No. 7847. Price £19.750 mils.

I H SELEY. Building economics. London, 1974. Book No. 7855. Price £5,750 mils.

J E BOWLES. Analytical and computer methods in foundation engineering. Tokyo, 1974. Book No. 7820. Price £5,150 mils.

V L STREETER & E B WYLIE. Fluid mechanics. Tokyo, 1975. Book No. 7849. Price £5,250 mils.

D F TURNER. Building contracts. A practical guide. London, 1975. Book No. 7854. Price £5,250 mils.

PETER KING — SCOTT. Production control for supervisors. London, 1971. Book No. 7819. Price £1,500 mils.

IWRA. Water for Human Needs. Five volumes. New Delhi, 1976. Price $70.

Volume I.
Energy and food. Book No. 7894.

Volume II.
Health and planning. Book No. 7895

Volume III.
Development and meteorology. Book No. 7896

Volume IV.
Management and education. Book No. 7897

Volume V.
Technology and ecology. Book No. 7898

BY BANAYIOTIS KALLIS. Index to Cyprus law reports and judgments of the supreme court. civil and criminal 1956—1976 Nicosia, 1977. Book No. 8217 £10,000 mils.

BSI. British standard code of practice. CP 110: Part 1:1972. The structural use of concrete. Design materials and work—manship. London, November, 1972. Book No. 8190 £11, 000 mils.

Books Purchased by UNDP for WDD Library

ELWYN SEELYE. Data book for civil engineers. Field practice. Vol. 3 U.S.A., 1954 Book No. 8008 $27.05.

BEVER — SELBY. Standard mathematical tables. Ohio, 1976. Book No. 8006.

FAIR — GEYER — OKUN. Water and wastewater engineering Vol. I Water supply and westewater removal. USA, 1966. Book No. 8009. $32.70.

FAIR — GEYER — OKUN. Water and wastewater engineering Vol. 2. Water purification and wastewater treatment and disposal. USA, 1968. Book No. 8010. $37.90.

ISRAELSEN — HANSEN. Irrigation principles and practices U.S.A. 1962. Book No. 7984. $24.30.

DAVIS — De WIEST. Hydrogeology. U.S.A., 1966. Book No. 8007. $24.85.

De WIEST. Geohydrology. U.S.A., 1965. Book No. 8011. $23.00.

R. COBPTON. Manual of field geology. U.S.A. 1962. Book No. 8012 $17.85.

ZARUBA — MENCL. Engineering geology developments in geotechnical engineering. Vol. 10 Gzechoslavakia, 1976. Book No. 7985. $38.95.

SHERARD — WOODWARD — GIZIEŃSKI — CLEVENGER. Earth and earth rock dams. U.S.A., 1963. Book No. 8013. $48.70.

STAGG — ZIENKIEWICZ. Rock mechanicics in engineering practice. London, 1975. Book No. 8014. $16.50.

PECK — HANSON — THORNBURN. Foundation engineering. U.S.A., 1974. Book No. 8015. $27.10.

VENNARD — STREET. Elementary fluid mechanics. U.S.A., 1976. Book No. 8016. $24.10.

HUNTER ROUSE. Engineering hydraulics, U.S.A., 1950. Book No. 8017. $48.70.

LONGLEY. Elements of Meteorology. U.S.A., 1970. Book No. 8018. $22.30.

WILLIAM FELLER. An introduction to probability theory and its applications U.S.A., 1971. Book No. 8019. $21.95.

ELWYN SEELYE. Design Vol. 1, U.S.A., 1960. Book No. 8020. £23,300.

F WALEY — S C C BATE. A guide to B.S. code of practice for prestressed concrete. No. 115: 1969. London, 1971. Book No. 8024. £2,128 mils.

ABELES — BARDHAN — TURNER. Prestressed concrete designers handbook. London, 1976. Book No. 8025. £8,513 mils.

SCOTT — GLANVILLE — THOMAS. Explanatory handbook on the B.S. code of practice for reinforced concrete CP 114: 1957 with metric appendix. London, 1973. Book No. 8026. £2,128 mils.

GRAY — MANNING. Concrete water towers bunkers silos and other elevated structures. London, 1973. Book No. 8027. £3,547 mils.

C E REYNOLDS. Concrete construction. London, 1967. Book No. 8028. £2.837 mils.

C W DUNHAM. The theory and practice of reinforced concrete. USA, 1966. Book No. 8029. £11,041 mils.

H L CHILDE. Everyman's guide to concrete work. London, 1969. Book No. 8030. £0,709 mils.

J G RICHARDSON. Concrete notebook. London, 1974. Book No. 8031. £2,483 mils.

THE CONCRETE SOCIETY. Standard reinforced concrete details. London, 1973. Book No. 8032. £0.851 mils.

THE CONCRETE SOCIETY. Technical report — Underwater concreting. London, 1971. Book. No. 8033. £1,064 mils.

THE CONCRETE SOCIETY. Technical report — Model for the presentation of calculations. London, 1975. Book No. 8034. £0,851 mils.

CEMENT AND CONCRETE ASSOCIATION — MCINTOSH & ERNTROY. The workability of concrete mixes with 3/8 in. aggregates. London, 1955. Book No. 8035. £0,709 mils.

CEMENT AND CONCRETE ASSOCIATION — ROWE, JAROSZ & BATCHELOR. The analysis and design of rectangular concrete slabs with various boundary conditions. London, 1963. Book No. 8036. £0,709 mils.

CEMENT AND CONCRETE ASSOCIATION — CRANSTON. Analysis and design of reinforced concrete columns. London, 1972. Book No. 8037. £,418 mils.

CEMENT AND CONCRETE ASSOCIATION — POMERO. Technical report. The effect of curring conditions and cube size on the crushing strength of concrete. London, 1972. Book No. 8038. £0,709 mils.

CEMENT AND CONCRETE ASSOCIATION — MONKS. The performance of waterstops in movement joints. London, 1972. Book No. 8039. £0,354 mils.

CEMENT AND CONCRETE ASSOCIATION — ROBERTS. Technical report. The crazing of concrete. London, 1973. Book No. 8040. £0,709 mils.

CEMENT AND CONCRETE ASSOCIATION — SHIRLEY. Introduction to concrete. London, 1975. Book No. 8041. £0,532 mils.

CEMENT AND CONCRETE ASSOCIATION — RUSSEL. The curring of concrete. London, 1976. Book No. 8042. £0,354 mils.

CEMENT AND CONCRETE ASSOCIATION — BLACKLEDGE. The concrete cube test. London, 1973. Book No. 8043. £0.177 mils.

CEMENT AND CONCRETE ASSOCIATION — DEACON. Watertight concrete construction. London, 1974. Book No. 8044. £0,709 mils.

CEMENT AND CONCRETE ASSOCIATION — KEEN. Advisory note — Impurities in aggregates for concrete. London, 1970. Book No. 8045. £0,177 mils.

CEMENT AND CONCRETE ASSOCIATION. Advisory note — Test facilities and equipment for quality control of concrete on site. London, 1972. Book No. 8046. £0,177 mils.

CEMENT AND CONCRETE ASSOCIATION. Advisory note — Introduction to statistical methods for quality control of concrete. London, 1972. Book No. 8047. £0,070 mils.

CEMENT AND CONCRETE ASSOCIATION. Advisory note. The determination of the

proportions of aggregates approximating to any required grading. London, 1971. Book No. 8048. £0,177 mils.

CEMENT AND CONCRETE ASSOCIATION — Advisory note — Hot weather concreting. London, 1970. Book No. 8049. £0,177 mils.

CEMENT AND CONCRETE ASSOCIATION. Wall chart for winter concreting. London, 1970. Book No. 8050. £0,070 mils.

CEMENT AND CONCRETE ASSOCIATION. Concrete practice. London, 1976. Book No. 8051. £1,064 mils.

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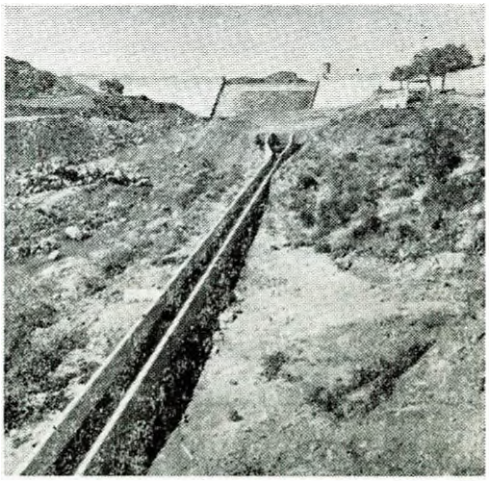


The main concrete channel from new Lymbia dam to the area to be irrigated some 5 km away from the dam. The dam seen in the background and the main channel are completed and constitute phase A of the work, phase B being the secondary and tertiary distribution system which will commence as soon as land consolidation, being carried out now, is completed. The area to be commanded finally is 700 donums to be planted in spring crops. The cost of construction of the main channel was £43,480 to the end of 1977. WDD photo No. A77-11.

V DIVISION OF CONSTRUCTION

by
A P Georghiades
Executive Engineer I
Head of the Division.

Introduction

The Division of contruction which deals with the planning, supervision and control of all construction works of the Department (Not including Paphos Project) either by direct labour or by contract, is one of the major Divisions of the Department and is sub-divided into four main branches:

- The Planning and Control Branch
- The Major Projects Branch
- The Minor Projects Branch, and
- The Workshop

All the above functions necessitate adequate, highly experienced and able technical staff in order to cope with the demand for the execution of so many different and complicated schemes.

During 1977 the Division consited of the following staff:

1 Executive Engineer Class I, Head of the Division
1 Executive Engineer Class I,
1 Mechanical Engineer Class I, Head of the Workshop
3 Senior Inspectors of Works
9 Inspectors of Works
2 Chief Foremen
7 Assistant Chief Foremen
6 Technical Assistants (monthly and daily)
50 Monthly paid Foremen
35 Weekly paid Foremen

115 Total Staff

Over and above the above technical staff, the Division engaged 396 regular employees of various trades and a number of casual employees for the execution of all the schemes.

Another important function of the Division is the collection of data regarding actual rates, standard of materials and equipment, the results of which are upraised and utilized for future planning and cost estimating.
The execution of the new schemes included in the 1977 Development Budget, commenced in April—May, soon after the Estimates were approved by the House of Representatives.

CONTRUCTION PROGRAMME AND PROGRESS

As alseady stated some of the new schemes included in the 1977 Construction Programme were put in hand in April or May, soon after the approval of the Budget by the House

of Representatives and the issue of the respective loans which represented the village contributions towards the total estimated cost of the schemes. It is worth mentioning that contrary to the previous years the recruitment of casual labour force became more acute than ever before even worse than what it was before the Turkish Invasion period. In spite of all these difficulties, great efforts were made by all the staff of the Division, and great zeal was shown by everybody so as to cover the target set and complete the construction programme satisfactorily.

The 1977 Development Budget of the Department included 234 schemes of various types, estimated at £2,330,418 for construction.

These schemes are divided into four main categories, as shown hereunder in Table V—1.

TABLE V-1

LIST OF SCHEMES INCLUDED IN THE 1977 CONSTRUCTION PROGRAMME

Ser No	Description	No of Schemes	Amount allocated for 1977 in £
1	Rural Domestic WS Schemes	89	719 920
2	Minor Irrigation Works	110	448 083
3	Major Irrigation Works (Not including Paphos Project)	25	895 402
4	Town Water Supply Schemes	10	267 013
	Totals	234	2 330 418

Here, it should be stated that the volume of work undertaken by the Division during 1977, exceeded the amount of £2,330,418 allocated through the Department's Development Budget. In addition to the above main categories of schemes usually undertaken by the Division, we had to respond to the execution of a great number of other schemes of vital importance, which were not included in the Division's Construction Programme. Such schemes were the Refugee housing and self housing estates, schemes undertaken on behalf of Village Water Commissions, Irrigation Committees or Associations, other Government Departments and even Private Developers. It is the usual practice for the Division to undertake such schemes, over and above the usual construction works of the Department, as all these Authorities or individuals do not have the means and experience to undertake by themselves the construction of so big and so important water works.

The additional schemes undertaken by the Division are of course related to water works. Eventually the total volume of works undertaken during 1977 reached the amount of £3,261,891 The expenditure incurred on all these schemes during 1977 reached the amount of £2,377,416.

As already stated, in order to cope with the demand for the construction of all these schemes the staff of the Division had to work hard and with the utmost zeal, so as to attend to all the urgent needs for all the types of the works.

PLANNING BRANCH

This is a new branch which has been created within the Division the past few years, and is considered of vital importance for the implementation and the satisfactory progress of the Construction Programme. Although this Branch has not yet been adequately staffed its activities contributed greatly towards the execution of all

schemes, in spite of the fact that they are greatly limited due to the lack of qualified personnel to lead this Branch.

The main activities of this Branch are:

—The Programming and cost control of all schemes under construction.

—The invitation of tenders regarding the supply of materials ie pipes and pipe-fittings, pumping-units, building materials and the hiring of machinery.

—The acquisition of immovable property which is affected by the construction of the schemes.

—The distribution of resources, such as labour force, plant and materials to the various schemes in all Districts.

—The supply of services towards the installation of electricity supply or telephone to various works.

The checking of the schemes designed by the Small Projects Planning Division, with regard to operation rates and final estimate.

CONTROL BRANCH

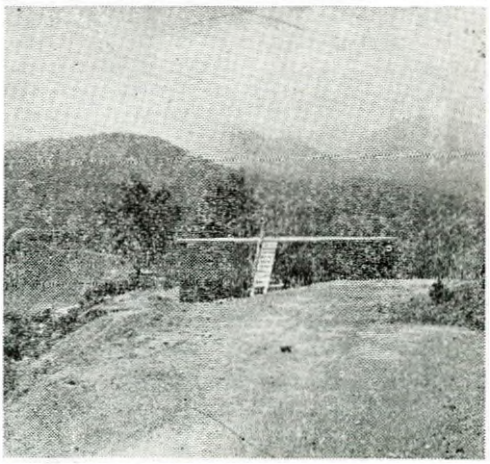
The main objective of this Branch is to advise the Supervising Technical Officers on any problem that might arise, regarding the execution of schemes or on any modifications that become inevitable, in the light of actual local conditions with the least repercussions on the cost of the schemes.

During the year the staff of this Branch consisted of one Executive Engineer, Class I, one Senior Inspector of Works and one Inspector of Works, with a wide experience in supervision and control techniques. The same staff with the Head of the Division was also dealing with the planning of the various works.

Another activity of this Branch is to exercise control over the execution of all schemes. It follows up and sees that all construction programmes are adhered to, by the supervising officers, that the progress of the works is attained at reasonable standards, and as planned, and that the estimated cost of the schemes is not exceeded.

The supervision of schemes under construction in Limassol, Larnaca, Paphos and Famagusta Districts was undertaken this year as well, by the respective regional offices of the Department, however, periodic supervision by the Staff of the Division in the Head Quarters at Nicosia was also carried out, The Head of the Division is also kept informed continuously on the progress of the works by relative reports from the Engineers in charge of the regional offices and by personal site supervision.

Table V—2 below shows the volume of works undertaken by the Division during the year. During this year the Division had to respond urgently, giving top priority for the execution



Kakopetria water supply storage tank, 500 m³ capacity storing water from Papaphilipou springs which are shared with Galata village. WDD photo No. A81-11.

of 101 water supply schemes for Refugee housing and self housing Estates for the 200,000 Greek Cypriot Refugees. Only on this item the expenditure incurred on all schemes all over the free area of the Country reached the amount of £466,985.

TABLE V-2

SCHEMES UNDERTAKEN FOR CONSTRUTION DURING 1977

Ser No	Nature of Scheme	No of Schemes	Amount allocat. for 1977 £	Expend. 1977 £
1	Rural domestic water supply schemes	89	719 920	399 859
2	Minor irrigation works	110	448 083	225 320
3	Major irrigation works	25	895 402	786 193
4	Town water supply schemes including Water Boards	10	267 013	225 630
5	Water supply to Refugee housing and self housing Estates	101	647 512	466 985
6	Schemes undertaken for other Government Departments	142	169 480	169 480
7	Rural domestic Water supply schemes from village deposits	128	23 807	23 807
8	Minor irrigation schemes from village deposits	20	9 272	9 272
9	Works carried out for private developers (mainly laying of distribution mains for new building sites)	136	81 402	81 402
	Totals	761	3 261 891	2 389 948

N B Paphos Project is not included above.

LABOUR FORCE

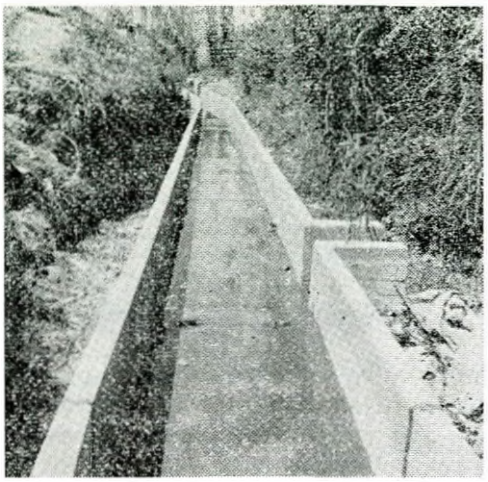
For the execution of one scheme the Division usually engaged a gang consisting of a Foreman (monthly or weekly paid) Regular Artisans of the Department of various trades ie builders, carpenters, pipelayers, etc. and casual unskilled labour who are recruited locally through the Government Labour offices.

The average daily labour force engaged by the Division during 1977, all over the Island was 937 persons, out of which 396 were regular employees of various trades of the Department and 541 casual labour. The total expenditure incurred on wages alone during the year reached the amount of £769,035, which is also another record figure.

It is worth mentioning here that enormous difficulties were encountered in recruiting casual unskilled labourers for the execution of the schemes. The shortage of Labour Force is experienced mostly in the big towns where other construction works compete with the Government in securing unskilled labour. The difficulties encountered in this field were greater than ever before and this is attributed to the following two main reasons:

—The great demand for construction of works of all types, especially for the Housing of Refugees, as a result of the Turkish invasion, and
—The low wages paid by Government in comparison with the wages paid by the private sector.

In order to cover the urgent needs of the works in labour force the Division had to carry labourers from various areas to the sites of the works using Government or hired Land Rovers.



Systematic lining of earth channels in reinforced cement concrete is in progress in Solea valley. The photograph shows Linou-Linopsas main irrigation channel serving Linou village and conveying also water to Petra village now under Turkish occupation. WDD photo No. A81-5.

TABLE V-3 **PIPES LAID DURING 1977**

GALVANISED IRON PIPES — CLASS B

Dia inches	Length m	Value £
½	18 366	3 932
¾	2 550	684
1	15 120	6 034
1¼	10 200	4 977
1½	32 226	19 100
2	20 274	16 580
2½	6 384	6 098
3	21 414	28 112
4	26 748	48 368
Total	153 282	133 885

STEEL PIPES — CLASS B

Dia inches	Length m	Value £
6	3 100	9 103
8	3 714	18 144
12	1 488	12 849
16	18	261
18	24	392
34	12	445
Total	8 356	41 194

ASBESTOS CEMENT PIPES — CLASS B

3	10 936	6 975
4	29 032	25 500
6	15 252	23 194
8	6 100	13 435
10	1 300	3 288
12	1 030	3 758
16	830	7 155
18	1 230	10 500
32	1 680	31 574
Total	67 390	125 379

ASBESTOS CEMENT PIPES — CLASS C

3	1 140	700
4	5 656	4 957
6	1 224	1 989
8	800	2 205
10	445	1 551
12	2 495	12 311
Total	11 760	23 713

P V C PIPES — 6 ATMS

Dia mm	Length m	Value £
90	2 088	986
160	2 100	3 079
Total	4 188	4 065

SUMMARY OF ALL PIPES LAID DURING 1977

Ser No	Type of pipes	Length m	Value £
1	Galvanized iron pipes— Class B	153 282	133 885
2	Steel Pipes — Class B	8 356	41 194
3	Asbestos cement pipes— Class B	67 390	125 379
4	Asbestos cement pipes— Class C	11 760	23 713
5	P V C pipes — 6 ATMS	4 188	4 065
	Total	244 976	328 236

CONSTRUCTION PLANT

If machinery is essential for the execution of one scheme, the Division has to apply primarily to the E M S for the hiring of Government machinery. If, however, Government machinery is not available at the time, the Division hires machinery from the private sector through open tenders. During 1977, for the execution of all the schemes the Division hired machi nery of all types from the E M S at an expendititure of £46,485 and from the private sector through open tenders at an expenditure of £123,859.

The types of machinery hired by the Division of Construction from the E M S as well as from the private sector, showing also the expenditure incurred during 1977, is given in Table V—4 that follows:

TABYE V-4 **MACHINERY HIRED DURING 1977**

MACHINERY FROM THE E M E

Ser No	Description	Working days	Value in £
1	Heavy machinery	946	8 394
2	Excavators — Diggers	420	2 812
3	Compressors	653	5 497
4	Concrete mixers	3 181	4 915
5	Land Rovers (48)	—	22 732
6	Others	980	2 135
	Total	—	£46 485

MACHINERY HIRED FROM PRIVATE SECTOR SECTOR

1	Compressors	19 229	19 689
2	Diggers	20 989	43 832
3	Tractors	8 784	12 576
4	Tipper lories	5 459	6 335
5	Traxcavators	2 996	14 491
6	Bulldozers	61	305
7	Cranes	1 513	4 573
8	Electrowelding machines	3 947	2 997
9	Buses	1 100	4 526
10	Land Rovers	4 904	13 495
11	Dumpers	121	482
12	Concrete mixers	162	358
	Total	—	£123 859
	Excavation and filling in of trenches for pipe—laying	68 925 metres/run	36 658
	Total		£160 517

PIPES AND PIPE FITTINGS

The practice followed for many years is to purchase pipes of all types and pipe-fittings for the schemes undertaken by the Construction Division from the Government Central Stores.

During the year shortage of such materials as pipes and water meters was observed in the Government Central Stores as a result of the great damand for schemes not included in the original construction programme, especially water supply schemes for the Refugee Housing Projects.

In order to have all pipes and fittings in stock, and in time for the early and uninterrupted execution of the schemes, the Division puts an order for all its needs, early, prior to the approval of the Budget, as soon as the schemes proposed for execution are known.

During 1977 a length of 244,976 metres of pipes of various types were laid all over the Island at an expenditure of £328,236. As it will be observed from the Tables that follow the type of pipes mostly used in Cyprus are galvanized iron class B and this of course is attributed to the formation of the ground.

BUILDING MATERIALS

All building materials, such as cement shingle, sand, etc. are purchased by the Division from the private sector

through open tenders. Cement is purchased from the two local Cyprus Cement Factories and during the year 71,664 bags of cement were purchased at a value of £39,972. For all the other materials purpchased by the Division during 1977 the expenditure reached the amount of £64,462 and in total for all materials the expenditure was £144,434.

All materials purchased during the year by the Division are given on Table V—5.

RURAL DOMESTIC WATER SUPPLY SCHEMES

The construction programme for 1977 included 89 Rural Domestic Water Supply schemes at an estimated cost of £719,920. These 89 schemes were split all over the island in the five free districts. 29 schemes of an estimated cost of £151,620 were in the Nicosia district, 21 at an estimated cost of £192,529 were in the Limassol district, 22 at an estimated cost of £262,263 were in the Paphos district, 12 at an estimated cost of £51,646 were in the Larnaca district and 5 schemes of an estimated cost of £61,862 were in the Famagusta district.

The overall expenditure on all 89 Rural domestic water supply schemes during 1977 reached the amount of £389,407. The biggest expenditure incurred in any one district was £195,169 for the Paphos district.

Lists showing in detail all schemes undertaken by the Division, by district are shown on the Table V—6 that follows.

TABLE V-5 **BUILDING MATERIALS PURCHASED DURING 1977**

Ser No	Description	Quantities	Value £
1	Cement	71 664 bags	39 972
2	Sand	18 415 m	24 410
3	Shingle	13 508 m	18 310
4	Aggregate	10 895 m	11 689
5	Sand for pipe bedding	12 129 m	10 053
	Total	—	£104 053

WATER METERS INSTALLED DURING 1977

Ser No	Dia inches	Number	Value £
1	½	7 825	28 692
2	¾—6	111	6 540
	Total	7 936	£35 232

TABLE V—6 **RURAL DOMESTIC WATER SUPPLY SCHEMES UNDERTAKEN IN 1977**

Ser No	Name of scheme and short description	Amount allocated for 1977 £	Expenditure incurred in 1977 £	Remarks
	NICOSIA DISTRICT			
	(a) Carry Over Schemes			
1	Argates — Episkopio — Kambia —Analiondas — Supplementary Supply	2 808	1 137	Completed
2	Pera — Supplementary supply	2 114	1 883	— do —
3	Galata — Extension of distr. system	2 946	1 556	— do —

TABLE V—6 **RURAL DOMESTIC WATER SUPPLY SCHEMES UNDERTAKEN IN 1977 (Continued)**

4	Kourdhali — Storage tank and house-to-house scheme ...	150	5	— do —
5	Dhali — distribution system ...	17 042	6 811	In progress
6	Linou — St. tank, pumping unit and water meters	5 160	4 981	Completed
7	Kato Moni — supplementary supply	1 140	410	— do —
8	Galata — Kokopetria — improvement of spring	943	377	— do —
9	Laxia — Yeri — supplementary supply	4 051	1 905	In progress
10	Malounda — supplementary supply	513	232	Completed
11	Kambi (Pharmakas) — supplementary supply from spring ...	1 720	1 149	— do —
12	Lymbia — Reg. Scheme for minor improvements	750	263	— do —
13	Paleometokho — Add. st. tank	1 561	5	— do —
14	Piyenia — Pumping unit	1 898	164	— do —
15	Kakopetria — St. tank and new distr. system with water meters	32 700	14 948	In progress
	Pitsilia Regional Scheme			
16	Part I — Combined for Lagoudhera — Sarandi — Polystipos — Alona — Platanistasa — Askas ..... Livadhia — Xyliatos & Ayia Marina — Supplementary supply from Kannoures spring	8 920	—	Scheme is being revised.
17	Part 2 — Combined for Xyliatos — Ayia Marina — Distr. Box & main conveyor	2 342	654	Completed
18	Part 5 — For Livadhia — main conveyor	1 750	1 715	— do —
19	Askas — St. tanks and distr. mains ?.....	1 434	1 431	— do —
20	Phterykoudhi — Distr. system	4 580	4 125	— do —
21	Ayia Marina (Xyliatos) — Distr. system	5 818	5 039	— do —
	(b) New Schemes			
22	Kambos — Improvements	4 500	—	Pending issue of loan scheme is being revised

TABLE V—6 **RURAL DOMESTIC WATER SUPPLY SCHEMES UNDERTAKEN IN 1977 (Continued)**

23	Perakhorio (Nisou) — St. tank & distr. system	23 600	19 576	In progress
24	Dhali — Improvement to distr. system	1 500	—	Pending issue of loan
25	Kannavia — Supplementary Supply	4 200	—	Scheme is being revised
26	Pedhoulas — St. tank, pumping unit, supplementary supply combined with Irr. Scheme	5 700	—	Pending issue of loans
27	Klirou — Improvements to main conveyors & pumping unit	6 700	4 818	In progress
28	Anayia — New pumping unit and supply of electricity	2 400	1 859	— do —
29	Lymbia — Emergency scheme Supplementary supply from B/H	2 600	1 967	Completed
	Total for Nicosia District	£151 620	£76 930	

LIMASSOL DISTRICT

(a) Carry Over Schemes

1	Pyrgos — St. tank & supplementary supply	1 745	—	Completed
2	Pissouri — Supplementary supply from spring	2 900	—	Pending acquisition of spring
3	Kalokhorio — Installation of chlorinator and extensions	1 861	363	In progress
4	Moutayaka Reg. Scheme — St. tank, main conveyors	31 078	30 973	In progress
5	Souni — Zanaja — St. tanks & house-to-house scheme	6 090	2 122	— do —
6	Pano Kividhes — Souni — Zanaja Supplementary supply from spring st. tank and pumping unit	510	7	Completed
7	Ypsonas — Polemidhia	32	—	— do —
8	Prastio — Kellaki	1 425	—	— do —
9	Trakhoni	332		— do —
10	Ayios Theodhoros — Supplementary supply from spring ...	1 600	—	Scheme to be revised
11	Kellaki	1 088	—	Completed

TABLE V—6 RURAL DOMESTIC WATER SUPPLY SCHEMES UNDERTAKEN IN 1977 (Continued)

(b) New Schemes

12	Vasa (Kilani) — St. tank, pumping unit & house-to-house scheme	5 600	2 070	In progress
13	Sykopetra — St. tank supplementary supply and house-to-house scheme	6 968	5 849	— do —
14	Pelendria — Extensions to distribution system	4 180	3 620	— do —
15	Lophos — House-to-house distribution system	6 060	7 192	Completed
16	Sanidha — House-to-house distribution system	1 060	939	— do —
17	Sotira — Supplementary supply from B/H and distribution system	6 600	3 989	In progress
18	Kyperounda — Supplementary supply	3 900		Included in the Pitsilia Development project Will commence later
19	Episkopi — St. tank and distribution system	28 500	7 696	In progress
20	Pano Platres — St. tank supplementary supply & distribution system	21 000	8 823	— do —
21	Amathus Area — New scheme for the development of the area	60 000		B/Hs are
	Total for Limassol District	£192 529	£73 643	being drilled

PAPHOS DISTRICT

(a) Carry Over Schemes

1	Arminou Reg. Scheme Kelokedhara — Salamiou — Mesana — Supplementary supply from B/Hs	11 329	11 329	Completed
2	Kato Akourdhalia — House-to-house distribution system	502	141	— do —
3	Pendalia — House-to-house distribution system	2 144	162	Completed
4	Paphos Lower Villages Phase B Konia — Anavargos — Khlorakas — Emba — Lemba — Kissonerga — Supplementary supply from B/Hs	46 590	46 590	— do —

TABLE V—6 **RURAL DOMESTIC WATER SUPPLY SCHEMES UNDERTAKEN IN 1977 (Continued)**

5	Stroumbi — Polemi — Supplementary supply from B/H	7 884	217	— do —
6	Tala — Supplementary supply from spring	2 074	275	— do —
7	Armou — House-to-house distribution system	2 263	553	— do —
8	Ayia Marina Kelokedhara — Supplementary supply	1 128	—	— do —
9	Akhelia — House-to-house distribution system	290	—	— do —
10	Kallepia — Letymbou — Pitargou — Supplementary supply ...	5 767	30	— do —
11	Mamonia — Supplementary supply from B/H	754	30	— do —
12	Arminou — Reg. Scheme Philousa — Pretori — Kedhares — Supplementary supply from B/Hs	21 580	5 558	In progress
13	Marathounda — House-to-house distribution system	1 587	10	Completed
14	Psathi — Supplemntary supply	1 278		— do —
15	Panayia — House-to-house distribution system	1 692		— do —
16	Tsadha — Supplementary supply and House-to-house	2 363		— do —
17	Asproyia — House-to-house distribution system	2 203	17	— do —
	(b) New Schemes			
18	Kilinia — House-to-house distribution system	6 125	4 353	In progress
19	Galataria — House-to-house distribution system	5 825	3 997	— do —
20	Arkhimandrita — House-to-house distribution system	5 800	3 469	— do —
21	Ayia Marinoudha — House-to-house distribution system	2 595	—	Pending issue of loan
22	Paphos Lower Villages Phase "C" Armou — Marathounda — Episkopi — Mesa Khorio — Mesoyi — Trimithousa — Supplementary supply from new B/Hs	75 930	63 878	In progress to be completed in 1978
	Total for Paphos District	£262 263	£195 169	

TABLE V—6 **RURAL DOMESTIC WATER SUPPLY SCHEMES UNDERTAKEN IN 1977 (Continued)**

LARNACA DISTRICT

(a) Carry Over Schemes

1	Lefkara Reg. Scheme — For minor works	3 011	—	Completed
2	Ayii Vavatsinias — For minor works	267	—	— do —
3	Kiti — For improvements	654	—	— do —
4	Xylotymbou — Supplementary supply	4 984	—	— do —
5	Avdhellero — St. tank & house-to-house scheme	3 244	3 017	— do —
6	Ormidhia — Supplementary supply	839	42	— do —
7	Xylophagou — St. tank & house-to-house scheme	9 007	8 872	— do —

(b) New schemes

8	Khirokitia	1 500	—	
9	Odhou — Improvement of spring and house-to-house scheme	7 840	4 184	In progress
10	Anaphotia — Supplementary supply	11 600	—	
11	Mazotos — Kivisil — Add. supply & house-to-house scheme...	4 500	4 082	In progress
12	Voroklini — Extension of distr. system & house-to-house scheme	4 200	3 383	Completed
	Total for Larnaca District	£51 646	£23 580	

FAMAGUSTA DISTRICT

(a) Carry Over Schemes

1	Avgorou	1 106	—	Completed
2	Ayia Napa	13 000	9 492	— do —
3	Phrenaros	756	—	— do —

(b) New schemes

4	Paralimni — Ayia Napa — Supplementary supply	37 000	4 310	In progress
5	Sotira — Supplementary supply	10 000	6 203	— do —
	Total for Famagusta District ...	£61 862	£20 005	

RURAL DEMESTIC WATER SUPPLY SCHEMES UNDERTAKEN FOR EXECUTION IN 1977

Summary for all Districts

Ser No	District	No of schemes	Amount allocated for 1977 in £	Expenditure incurred 1977 £
1	Nicosia	29	151 620	76 930
2	Limassol	21	192 529	73 643
3	Paphos	22	262 263	195 169
4	Larnaca	12	51 646	23 580
5	Famagusta	5	61 862	20 005
	T o t a l.....	89	£719 920	£389 327
	Add expenditure from ordinary budget etc (See bottom of table I—8)		.....	10 531
	Grand Total		.....	£399 858

MINOR IRRIGATION WORKS

The 1977 construction programme included 110 Minor Irrigation Schemes of an estimated cost of £448,083 in all districts.

47 of these schemes of an estimated cost of £253,278 were for the Nicosia District, 28 schemes of an estimated cost of £98,408 were in the Limassol District, and 15 schemes of an estimated cost of £96,397 were in the Paphos District.

On all Minor Irrigation schemes the expenditure incurred during the year reached the amount of £225,448. By district the expenditure incurred on Minor Irrigation Schemes was £137,604 for Nicosia, £57,360 for Limassol and £30,484 for Paphos.

As it will be observed from the lists that follow most of the schemes included in the construction programme were completed by the end of the year, some other schemes were put in hand late in the year and could not be completed by the end of the year and were carried over for completion in 1978. Some schemes could not be put in hand during the year for various administrative difficulties and were carried over for execution in 1978.

All the schemes that were included in the construction programme for execution in 1977 are shown in detail on Table V—7 that follows:

TABLE V—7 **MINOR IRRIGATION WORKS UNDERTAKEN FOR EXECUTION IN 1977**

Ser No	Name of scheme and short description	Amount allocated for 1977 £	Expenditure incurred in 1977 £	Remarks
NICOSIA DISTRICT				
(a) Carry Over Schemes				
1	Anayia — Lining of channels ...	1 743	1 670	Completed
2	Akaki — Meniko Phase "A" — Lining of channels	3 966	3 966	— do —
3	Ayios Theodhoros (Solea) — Phase "A" R. C. C. channels ...	771	771	— do —
4	Vyzakia — Lining of canals ...	11 365	11 221	— do —
5	Yerakies — Pumping scheme, st. tanks and piped distribution system	40 000	—	Scheme to be revised B/Hs under drilling
6	Dhali — Ftalia & Katevas — Pumping scheme & piped distr. system	5 635	1 476	Completed
7	Argates — Fourkismenos — Pumping scheme and district system	3 314	3 263	— do —
8	Dhali — Yialia River Recharge works	136	123	— do —
9	Orounda — Pumping scheme and distribution system	3 541	741	Completed
10	Potami — Pumping scheme and piped distr. system	2 085	666	— do —
11	Peristerona — Astromeritis — Lining of channels	17 132	17 049	— do —
12	Paleometokho — Recharge works	1 629	342	— do —
13	Palekhori — Maroullena — Intake	391	—	— do —
14	Peristerona — Lining of channels	4 627	4 627	— do —
15	Pharmakas 'Koskinas' — Piped distr. system	869	17	— do —
16	Kambos — Extension of piped distr. system	321	—	— do —
17	Astromeritis — Lining of channels	1 820	1 135	— do —
18	Akaki — Meniko Phase "B" — Lining of channels	16 500	15 550	In progress
19	Tembria — Korakou R C C channels	291	195	Completed

20	Evrykhou R C C channels	242	242	— do —
21	Korakou R C C channels	651	611	— do —
22	Kakopetria R C C channels	100	96	— do —
23	Evrykhou — Phlasou — Korakou R C C channels	368	359	— do —
24	Kaliana — Tembria R C C channels -.....	159	56	— do —
25	Korakou — Phlasou — Linou Seloshis R C C channels	288	252	— do —
26	Phlasou 'Ayios Epiphanitis' R C C channels	4 606	4 534	— do —
27	Katydhata R C C channels	611	599	— do —
28	Linou 'Linopsas' R C C channels	901	127	— do —
	(b) New schemes			
29	Pera Orinis 'Vyzakia' — Pumping scheme & distr. system	10 500	4 576	In progress
30	Pedhoulas — Pumping scheme with st. tank & piped distr. system combined with W S scheme	14 900	—	Pending issue of loan
31	Mosphili — New pumping unit	5 500	—	Pending issue of loan funds
32	Alona — :Arkakoudhia — Papamichael' — Lining of channels	1 700	1 686	Completed
33	Ayii Trimithias — Intake & Improvements to existing earth channel	2 246	2 246	— do —
34	Argates — Lining of channels	22 700	16 354	In progress
35	Spilia — Kourdhali 'Mosphili' — intakes, st. tanks and piped distr. system	4 140	3 938	**Completed**
36	Spilia — Kourdhali 'Arkondou' —intakes, st. tanks and piped distr. system			
37	Kambi (Pharmakas) — Piped distr. system	1 300	1 275	— do —
38	Xyliatos — Irr. tank, piped distr. system & lining of channels	17 000	14 823	In progress
39	Galata — Sina Oros — Irr. tank	10 000	—	Scheme to be revised
40	Gourri — Improvements to intake and R C C channels	800	781	Completed
41	Ayios Theodhoros (Solea) Phase "B" R C C channels	2 200	2 172	— do —
42	Palekhori 'Mylavris' — Piped distr. system	4 300	3 537	— do —

TABLE V—7 **MINOR IRRIGATION WORKS UNDERTAKEN FOR EXECUTION IN 1977 (Continued)**

43	Kalokhorio (Klirou) — Minor works — culverts	400	399	— do —
44	Dhali Yialias River Recharge works	14 400	10 928	In progress
45	Orounda — Peristerona 'Ornitharis' — Lining of channels ...	7 450	2 763	— do —
46	Linou 'Linopsas' R C C channels	6 500	—	Pending issue of loan funds
47	Meniko 'Litharkies' — New diversion	3 200	2 438	In progress
	Total for Nicosia District	£253 278	£137 604	

LIMASSOL DISTRICT
(a) Carry Over Schemes

1	Phini 'Vines' — Piped distr. system	431	412	Completed
2	Phini 'Mylos' — Intake, st. tank & piped distr. system	8 312	8 312	— do —
3	Episkopi — Pumping scheme st. tank. & piped distr. system ...	6 486	4 375	In progress
4	Kato Platres — St. tank and piped distr. system	2 773	1 456	Completed
5	Kolossi — Pumping scheme and piped distr. system	4 440	3 928	— do —
6	Kato Amiandos — Pelendria — Piped, distr. system	1 378	1 350	— do —
7	Agros 'K Enetikos' — Piped distr. system	540	—	— do —
8	Agros 'Anastasia' — Piped distr. system	661	81	Completed
9	Ayios Demetrios 'Kryo Nero' — St. tank & spring & piped distr. system	13 919	12 956	In progress
10	Ayios Demetrios 'Kaloyiros' — Springs & piped distr. system	1 578	1 200	Completed
11	Ayios Ioannis (Agros) 'Teratsia' — Piped distr. system	1 029	—	Pending completion of road
12	Saittas — Moniatis — Piped distr. system	406	406	Completed
13	Paleomylos 'Khardji' — St. tank & piped distr. system	844	227	— do —
14	Lemythou 'Tsangaroudhia' — Piped distr. system	526	—	— do —

15	Pelendria 'Englisis Psilou' — Piped distr. system	899	—	— do —
16	Pelendria 'Kato Englisis' — Piped distr. system	1 214	—	— do —
17	Kyperounda 'Arkappis — Halospities' — St. tank and piped distr. system	1 121	83	— do —
18	Kyperounda 'Appis' — Piped distr. system	270	—	— do —
19	Trimiklini — Piped distr. system	1 300	—	Scheme rejected
20	Tris Elies — St. tank and piped distr. system	880	—	Completed
21	Mandria 'Mylavris' — Piped distr. system	1 837	—	— do —
22	Pelendria 'Phylagra' — Piped distr. system	646	—	— do —
23	Mandria — Pumping scheme and piped distr. system	2 288	6	— do —
24	Agridhia — Piped distr. system	857	—	— do —
25	Kyperounda 'Vasilikos' — Piped distr. system	705	—	— do —
26	Dhymes 'Sykameni' — Piped distr. system	422	24	— do —
27	Ayios Pavlos — Piped distr. system	694	—	— do —
28	Pissouri — Pumping scheme and piped distr. system	83	83	— do —

(b) New schemes

29	Louvaras 'P Pervolia' — Spring & piped distr. system	930	528	In progress
30	Dhymes — Piped distr. system	1 470	—	Pending issue of loan
31	Pano Platres R C C Channels and piped distr. system	13 500	8 786	In progress
32	Potamitissa— Piped distr. system	830	783	Completed
33	Kalokhorio — Improvement of spring	679	679	— do —
34	Agridhia — Piped distr. system	3 300	3 258	— do —
35	Prodhromos 'Platania — Antonides' — St. tank & piped distr. system	2 000	1 598	— do —
36	Pelendria 'Arkhangelos' — Piped distr. system	800	713	— do —
37	Pelendria 'Livadhia' — Piped distr. system	500	411	— do —

TABLE V—7 **MINOR IRRIGATION WORKS UNDERTAKEN FOR EXECUTION IN 1977 (Continued)**

38	Louvaras	420	—	Sheme rejected
39	Ayios Yeorghios (Sylikou) — St. tank & piped distr. system ...	1 350	1 336	Completed
40	Ayios Ioannis 'K. Mylos' — Piped distr. system	7 800	—	Included in the Pitsilia Development Project
41	Kyperounda 'Kardama' — Piped distr. system	2 450	2 329	Completed
42	Agros 'Vournes' — Piped distr. system	1 000	—	Pending issue of loan
43	Trimiklini	1 100	—	
44	Potamiou — Piped distr. system	1 000	842	Completed
45	Mathikoloni — Piped distr. system	600	589	— do —
46	Kouka — Piped distr. system and repairs to st. tank	700	610	— do —
47	Mandria 'Mylavris' — Construction of new st. tank	600	–	Pending issue of loan
48	Arsos 'Athkies' — Spring & piped distr. system	840	—	— do —
	Total for Limassol District	£98 408	£57 360	

PAPHOS DISTRICT
(a) Carry Over Schemes

1	Yiolou — Pumping scheme & piped distr. system	1 417	641	Completed
2	Lemona — Pumping scheme & piped distr. system	1 954	715	— do —
3	Khoulou — Pumping scheme & piped distr. system	1 990	685	— do —
4	Khoulou — Pumping scheme & distr. system	3 835	3 122	Completed
5	Steni — Pumping scheme & piped distr. system	4 671	2 772	— do —
6	Polis (Khyrokhou) — Pumping scheme & piped distr. system...	11 00	7 330	In progress
7	Polemi — Pumping scheme & piped distr. system	8 493	6 132	— do —
8	Skoulli — Pumping scheme & piped distr. system	3 742	2 156	Completed

9	Goudhi — Skoulli — Kholi — Pumping scheme & piped distr. system	2 820	2 388	— do —
10	Nikoklia — Pumping scheme ...	1 268	—	Balance for minor works
11	Peristerona — Pumping schemes & piped distr. system	514	276	Completed
12	Amargeti — Pumping scheme & piped distr. system	6 000	4 200	In progress
13	Goudhi — Pumping scheme ...	22 600	—	Pending issue of loan
14	Manonia — Pumping scheme ...	593	67	Completed
	(b) New schemes			
15	Yialia — Ayia Marina — Extension of distr. system	5 500	—	Pending issue of loan
	Total for Paphos District	£96 397	£30 484	

MINOR IRRIGATION WORKS UNDERTAKEN FOR EXECUTION IN 1977
SUMMARY OF ALL DISTRICTS

Ser No	District	No of schemes	Amount allocated for 1977 £	Expenditure incurred in 1977 £
1	Nicosia	47	253 278	137 604
2	Limassol	48	98 408	57 360
3	Paphos	15	96 397	30 484
	T o t a l.....	110	£448 083	£225 320

MAJOR IRRIGATION WORKS

The 1977 construction programme included 25 major irrigation schemes of a total estimated cost of £895,402. These 25 schemes represented carry over and new schemes and involved dam works, distribution networks maintenance and other structures and the overall expenditure incurred on all of them during the year reached the amount of £786,206 (Not including Paphos Irrigation Project).

The biggest expenditure incurred on one single project was on the Yermasoyia, Trakhoni distribution system reaching the amount of £614,393.

A detailed report on some of the Major Irrigation Schemes executed during 1977 is given elsewhere further on, in this report.

A list showing in detail all the 25 major irrigation schemes included in the 1977 construction programme is given on Table V-8 that follows:

TABLE V-8 **MAJOR IRRIGATION WORKS UNDERTAKEN FOR EXECUTION IN 1977**

Ser No	Name of scheme	Amount allocated for 1977 £	Expenditure incurred in 1977 £	Remarks
1	Mavrokolymbos Dam	446	69	Minor works
2	Yermasoyia Dam	1 234	37	Maintenance
3	Kiti Dam (Leakages)	8 153	5 511	
4	Lefkara Dam	7 578	1 469	
5	Lefkara — Khirokitia pipeline ...	707	—	
6	Khirokitia Treatment Plant	1 770	846	
7	Pomos Dam distrubution system	39	6	Maintenance
8	Mavrokolymbos Dam Distr. system	16 666	598	Extensions
9	Ayia Marina Dam Distr. system	3 620	—	For extensions
10	Kiti Dam Distr. system	234	28	Maintenance
11	Lefkara Dam Distr. system — Extensions	16 770	3 908	In progress
12	Yermasoyia Main Conveyor ...	6 319	4 675	Completed
13	Yermasoyia — Akrounda — Phinikaria	2 154	141	Maintenance
14	Yermasoyia — Zakaki	3 600	3 062	Extensions & maintenance
15	Yermasoyia — Phasouri	17 040	13 940	— do —
16	Yermasoyia — Trakhoni — Pumping unit, st. tank & A C piped distr. system	622 000	614 392	New piped distr. system work in progress
17	Argaka — Magounda Dam	3 000	—	For extensions
18	Arakapas Dam	879	220	Maintenance
19	Palekhori (Kambi) Dam	4 566	456	
20	Lymbia Dam	90 576	90 565	Completed
21	Polemidhia Dam Irrigation piped distr. system	30 000	2 352	In progress
22	Pakhyammos Irrigation Scheme	11 400	11 182	— do —
23	Palekhori — Sklidhros	10 000	5 270	
24	Palekhori (Kambi) Dam — distr. system	6 651	6 476	
25	Yermasoyia Irrig. Scheme A C piped distr. system	30 000	20 995	In progress
	T o t a l.....	£895 402	£786 193	

Description of Major Irrigation Schemes

YERMASOYIA — TRAKHONI DISTRI BUTION SYSTEM

This major distribution system constitutes part of the Yermasoyia Dam Distribution system which extends west of Limassol town and covers Trakhoni and Ypsonas village areas. The main objective of this project is to provide adequate water from the Yermasoyia and Polemidhia dams for the irrigation of 4,390 donums of land planted with vineyard and citrus for Trakhoni and Ypsonas villages. In actual figures the area to be commanded by the implementation of this scheme will be

3,890 donums for Trakhoni village, and
500 donums for Ypsonas village.

The total estimated cost of the project is £840,000 and it involves the boosting of the water from the Yermasoyia—Polemidhia Main Conveyor Pipeline into a 20,000 m^3 capacity irrigation tank, and thence distribute the water through Asbestos Cement pressure pipes all over the area to be irrigated.

700 mm dia, 4 km long steel pumping main conveying water from Yermasoyia Polemidhia main pipeline to Trakhoni night storage reservoir. This is the first pipeline laid in Cyprus by electrowelding of 250 m lengths in situ and lowering them in the trench jointing them finally with slip on type joints. WDD photo No. A59-11.

The whole scheme includes the construction of a pump-house, the installation of a pumping unit, the laying of a pumping main 4,000 m long and 700 mm in diameter, the construction of a 20,000 m^3 irrigation Tank and laying of the following pipelines.

(a) **Steel pipes** for Pumping main
(i) 4 000 meters/run of 700 mm dia

(b) **Asbestos Cement Pressure Pipes — Class 15 ATMS**

(i)	990	meters/run of	900 mm dia
(ii)	2 820	"	600 "
(iii)	620	"	500 "
(iv)	422	"	450 "
(v)	4 120	"	400 "
(vi)	600	"	350 "
(vii)	3 200	"	300 "
(viii)	1 120	"	250 "
(ix)	2 670	"	200 "
(x)	35 000	"	150 "
	51 562	Total length of pipes to be laid	

During 1977 an amount of £622,000 was allocated for this scheme and the total expenditure incurred reached the amount of £614,393. Enormous progress has been achieved on the whole construction programme of the scheme and it is expected that the work will be completed in summer of 1978. The whole project was put in hand very early in January 1977, and the steel pumping main, the irrigation tank and most of the distribution system have been completed during the year.

YERMASOYIA IRRIGATION SCHEME
This Major project estimated at

£100,000 has been split into two phases. Phase I estimated at £30,000 has been approved for execution during 1977 and Phase II estimated at £70,000 is earmarked for execution in 1978.

The whole scheme involves the installation of an asbestos Cement Pressure Pipes distribution system in the Yermasoyia village area so as to cover 1,045 donums of land, mostly covered with citrus plantations and also used for seasonal crops. This new distribution network has been connected onto the Yermasoyia. Dam Main Conveyor pipeline and during the year out of the £30,000 allocated for this purpose an amount of £20,995 has been spent on the laying of the main distribution pipeline consisting of 1,380 meters of A C pipes of 250 mm diameter and 3,210 meters of A C pipes of 200 mm in diameter.

Most part of the work scheduled for construction in 1977 was completed by the end of the year and the remaining work as well as Phase II of the scheme are expected to be completed during 1978.

LYMBIA DAM

The construction of this Project started in the autumn of 1976 and the whole scheme constitutes

(a) The construction of a concrete gravity dam situated about 5 km southwest of Lymbia village, and
(b) The construction of a main irrigation channel 5 km in length.

The estimated cost of the schemes was £125,000 and this amount represented £86,000 for dam works and £39,000 for the construction of the main R C C channel.

Work on dam structures was put in hand in June 1976 and was continued until September 1977 when all dam structures were completed. This dam is a mass concrete gravity type and its maximum length of the crest is 121 m and it consists of 15 vertical blocks extending all over the entire height of the dam. The capacity of the dam is 220,000 m^3.

The excavation of the foundations of a total volum of 4,600 m^3 was done in the early stages in the summer of 1976, by means of heavy machinery and limited blasting.

The concreting of the dam started in September 1976 and was completed in July 1977. The total volume of concrete was 5,030 m^3 and the average cube crushing strength for each mix design was as follows:

1:2 :4 - 3 250	ibs/in²	(228	kg/cm²)	after 28 days
1:2½:5 - 2 800	"	(197	"	) after 28 days
1:1½:3 - 4 200	"	(295	"	) after 28 days

Drilling and grouting was put in hand in September 1976 and was completed by July 1977.

The main R C C channel will be of a length of 5 km and of dimensions 60 cm wide and 40 cm height. Along the route of the channel there will be a number of outlets from which water will be distributed later through a piped distribution system; work on the construction of this channel was put in hand in May 1977 and by the end of the year 4,000 meters of channels were completed. Their construction will be continued and is expected to be completed early in 1978.

The overall expenditure incurred during 1977 on both dam works and irrigation channel reached the amount of £90,576.

TABLE V—9 **TOWN WATER SUPPLY SCHEMES UNDERTAKEN FOR EXECUTION IN 1977**

Ser No	Name of scheme	Amount allocated for 1977 £	Expenditure incurred in 1977 £	Remarks
(a)	**Greater Nicosia Scheme — Improvement of Distr Mains**			
1	Athinas Ave — Stadiou Str. Strovolos	20 000	14 812	In progress
2	Lakatamia Reservoir — Pendadaktylos str.	50 000	47 118	
3	New Engomi Reservoir — Kalypso str.	56 576	48 296	
(b)	**Greater Nicosia Scheme — Supplementary Supply**			
4	Tseri — Paleometokho Emergency Scheme	4 730	3 263	Completed
5	Nicosia — Kokkini Trimithia Emergency Scheme	56 000	34 018	In progress
(c)	**Nicosia Water Board — Improvement of Distr. Mains ...**			
6	Distribution system within the Old City Walls	812	812	In progress
7	Strovolos Reservoir — Old Mental Hospital			
8	Kalypso str. — Solomos Square Continuation of scheme No. 3 above	8 110	8 110	— do —
9	Minor works	39 557	39 557	Completed
		1 891	307	— do —
(d)	**Larnaca Water Board**			
10	Tremithos Reservoir	29 337	29 337	
	T o t a l.....	£267 013	£225 630	

TOWN WATER SUPPLY SCHEMES

During the year the Division had to deal with 10 town water supply schemes of an estimated cost of £267,013.

Five of these schemes were included in the Department's Development Budget and were related to the Greater Nicosia Scheme and the remaining five were related to the Nicosia and Larnaca water Boards. The overall expenditure incurred on all these

schemes during the year reached the amount of £225,630.
A detailed report on some of the most important schemes is given elsewhere, further on in this report. A list showing the 10 Town Water Supply Schemes that were undertaken for construction by the Division during the year is given on Table V—9 on the previous page

Description of Town Water Supply Schemes

Main Pipeline from Athinas Avenue to Stadiou Street, Strovolos

This project estimated at £60,000 involves the laying of a new Asbestos Cement Trunk Main class 15 ATMS 1,920 meters in length and of a composite diameter ranging between 450 mm and 250 mm, from Pendadaktylos street, along Athinas Avenue to Stadiou Street. The main objective of the scheme is to provide sufficient capacity of water for areas 7 and 8.

Work on this project was put in hand in November and by the end of the year the expenditure reached the amount of £14,812. Work will continue in 1978 and is expected to be completed by the end of summer 1978.

Main Pipeline from Lakatamia Reservoir to Pendadaktylos Street, Strovolos

This scheme, at an estimated cost of £82,000 involved the laying of a new Asbestos Cement class 15 ATMS Pipeline 1,680 meters in length and 800 mm in diameter, from the Lakatamia Reservoir through the Strovolos No. 2 Refugee Housing Estate, to Pendadaktylos street.

The objective of this new main pipeline is to provide adequate quantity of water to existing areas 7 and 8 and to reinforce the new Strovolos Reservoir in future.

Work on the project was put in hand early, in March 1977 and it was scheduled for completion before the end of the year, however, the original scheme had to be revised so as to by pass the Refugee Housing Estate of Strovolos No. 2. By this revision the new route of the pipeline was extended from 1,680 meters to 1,780 meters. A new order for the additional pipes had to be put and this alteration made necessary the interruption of the whole project.

During the year the expenditure incurred on this project reached the amount of £47,118. Work will commence as soon as the additional A C pipes arrive in Cyprus and it is expected that the scheme will be completed before the end of 1978.

Main Pipeline from New Engomi Reservoir to Kalypso street and Solomos Square

The objective of this project is to reinforce the existing network of the Nicosia Water Supply and provide sufficient capacity of water to areas 9 and 5 and to the old Nicosia City within the walls.

The scheme estimated at £274,000 was financed by the Government £190,000 and the Nicosia Water Board £84,000. The part of the scheme financed by the Government includes the pipeline between the New Engomi Reservoir and Kalypso street whilst the remaining part is financed by the Water Board.

Work on the whole project was put in hand in August 1976 and was continued in 1977 until September when it was completed. During this

period a total length of 5,165 meters of Asbestos Cement Pressure Pipes Class 20 ATMS were laid as follows:-

(a) From the New Engomi Reservoir through Grigori Afxentiou Avenue until Kalypso street:

1 885 meters of 700 mm dia class 20 ATMS
1 491 meters of 500 mm dia class 20 ATMS

3 376 total length

(b) From Kalypso street through Omirou Avenue to Solomos Square:

501 meters of 500 mm dia class 20 ATMS
873 meters of 400 mm dia class 20 ATMS
415 meters of 250 mm dia class 20 ATMS

1 789 total length

All constructional works for the implementation of this scheme were undertaken by the Division. The excavation of trenches was mostly carried out by machinery (diggers), except in cases where utility lines such as electricity and telephones would be affected, hand excavation was carried out with the use of compressors and pneumatic drills. All pipes were thoroughly bedded and tested at 120 lbs/in^2 in sections not exceeding 500 meters in length. The backfilling was made in layers of 150 mm and pipes were well compacted with the use of a Soil Compactor.

The expenditure incurred on the above scheme during the year reached the amount of £87,853 as follows:-
(a) Engomi Res — Kalypso street £48, 296.
(b) Kalypso Street — Solomos Sq. £39,557.

The overall expenditure incurred during 1976 and 1977 for the completion of the project reached the amount of £198,000 thus leaving a saving £76,000 from the original estimated cost. This final cost of £198,000 was shared between Government and the Water Board as under:

(a) Government £145 000
(b) Nicosia Water Board £ 53 000

Pipeline from the Strovolos Reservoir to the Old Mental Hospital

This project estimated at £174,000 is financed by the Nicosia Water Board and involves the laying of an Asbestos Cement Pressure Pipeline class 20 ATMS, between the Strovolos Reservoir and the old Mental Hospital. The main objective of the whole project is to reinforce the existing network of the Nicosia Water Supply and provide sufficient capacity of water to areas 2 and 3.
In details this project involve the laying of 24,000 meters in length Asbestos Cement pressure pipeline class 20 ATMS 700 mm in diameter as far as the Limassol Road — Eylendjia Sunction, and thence 600 mm in diameter until the old Mental Hospital.
Work on this scheme was put in hand on the 28.11.1977 and by the end of the year a length of about 800 meters of pipeline was completed. The expenditure incurred during 1977 reached the amount of £8,110. Work will be continued in 1978 and the whole project is expected to be completed in the autumn of 1978.

Greater Nicosia Scheme — Kokkini Trimithia — Emergency Scheme

This project estimated at £56,000 is financed by the Government and Kokkini Trimithia village and involves the installation of a pumping unit of B/H 2/76, the laying of an 8 inch diameter steel pumping main from the borehole to the Kokkini Trimithia Town Balancing Tank from where it flows

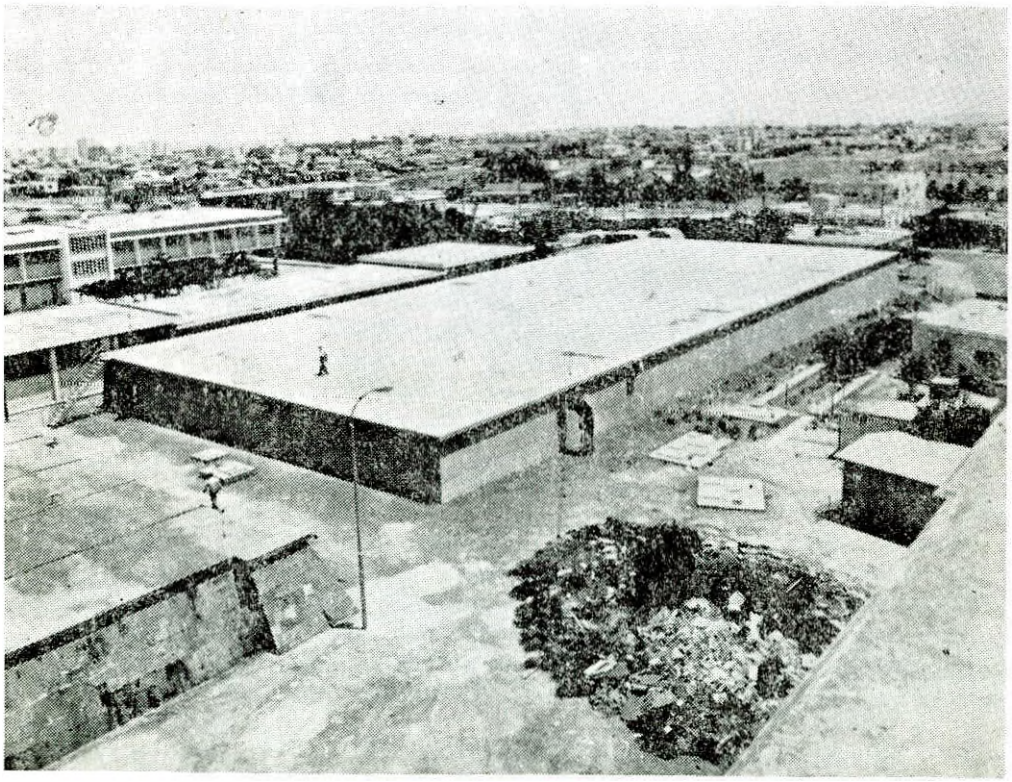
to Nicosia and the laying of a 4 inch diameter steel pumping main to the Kokkini Trimithia village storage tank. Work on the above project was put in hand in May 1977 and after great efforts by the staff of the Division it was made, possible to supply Nicosia town and Kokkini Trimithia village with an additional quantity of 700 m^3 of water per day.

In total a length of 3,798 meters of 8 inch in diameter steel victaulic pipes were laid on the surface of the ground between the borehole and the existing balancing town tank near Kokkini Trimithia from where water flows by gravity to Nicosia, and 1,262 meters of 4 inch diameter galvanized steel pipeline from the 8" dia. steel pumping main onto the existing village storage tank of Kokkini Trimithia. Eventually all the pumping main for Kokkini Trimithia village was laid in trenches and about half of the main 8" dia. pumping main will be laid in trenches.

The expenditure incurred during the year on this project reached the amount of £34,018. Work will be continued in 1978 and is expected to be completed by spring of 1978.

Larnaca Water Board — Tremithos Reservoir

The total estimated cost of this pro-



New Strovolos reservoir, Nicosia Water Supply, 7,600 m^3 capacity, completed at the beginning of 1977. On the left the Nicosia Water Board offices can be seen as well as part of the old 3,725 m^3 capacity reservoir. WDD photo No. A63-3 taken from the tower tank supplying high areas.

ject was £180,000 and it was financed entirely by the Larnaca Water Board. The objective of this scheme was to provide an additional storage of 7,700 m^3 for Larnaca town, by the construction of a reservoir by the side of the existing storage tanks which are situated near the 6th mile post of the Larnaca — Limassol road.

Both the design and the construction of the project were undertaken by the Department of Water Development. Work on the scheme was put in hand in August 1975 it was continued in 1976 and was finally completed by the end of 1977. The expenditure incurred during 1977 was £29,337 and the overall expenditure for the whole project reached the amount of £182,370.

During 1977, time was spent equally on the completion of the original scheme and on extra structures relating to the project. The entire operation and maintenance of this scheme will be handed over to the Larnaca Water Board as from the beginning of 1978.

Earthworks

The excavation of the foundation was carried out by machinery (16,800 m^3) and only a small proportion (1,355 m^3) was carried out by pneumatic drills. The work was executed in 1975 and 1976.

Placing of Filter

A quantity of 500 m^3 of filter was placed in 1975 and another quantity of 600 m^3 was placed in 1976.

Concrete

Site concreting 1:3:6 commenced in October 1975 and is expected to be completed very early in 1978 (1,300 m^3). Structural concrete 1:1½:3 commenced in October 1975 and is expected to be completed very early in 1978 (2,285 m^3).

Formwork

Formwork being used for the new Engomi Reservoir has also been used for the new Larnaca Reservoir as they are both of the same capacity. Such formkork of an extent of 6,500 m^2 was used in 1977 and rent was paid for its use. A small quantity of timber of a value of £1,000 has been purchased for this purpose.

Reinforcement

For the whole project a quantity of 247 tons of mild steel reinforcement has been used. The average cost per ton was £135.

Pipe work

All internal piping for drainage system etc were completed in 1976. External pipes for connections fittings and manholes were completed during 1977.

Finishing works

The whole reservoir was painted internally and externally with suitable bitumenous paint to increase the durability of structure.

Water proof sealer has been applied during 1977 as follows:

(a) Silygutt 200 m r for external joints
(b) Vertiseal 150 m r for internal vertical joints
(c) Paraseal 690 m r for internal horizontal joints

An amount of £3,500 has been spent for the insulation of the roof slab (2,052 m^2).

Chlorination house

A new chlorination house has been designed and constructed during 1977

for the existing and future needs of the town.

Extra works

During 1977 the following extra works were executed for the Larnaca Water Board:

- Maintenance of old reservoirs and chlorination house
- Diversion of water from old to new chlorination
- Design and construction of a guard--room
- Design and construction of a work-shop
- Supply of pumps, compressor and other fittings for the operation of testing equipment
- Construction of a small storage tank (10 m^3) for the operation of testing equipment
- Construction of stores
- Supply of electricity
- Construction of toilets
- Purchasing and fixing of four points for lighting the area

WATER SUPPLY SCHEMES TO REFUGEE HOUSING AND SELF HOUSING SCHEMES

As already mentioned, in addition to the usual activities of the Department the Division during the year had to respond to the urgent demand for the supply of water to all the Housing Estates and the Self — Help Housing schemes for the displaced people. During the year the Division had to respond to 101 such schemes of an estimated cost of £647,512. 82 of these schemes of an estimated cost of £332,576 were related to Self — Help Housing projects and 20 to Government Housing Estates at an estimated cost of £314,936.

The overall expenditure incurred on the execution of all these schemes during the year reached the amount of £466,985 which far exceeds the expenditure incurred on all the Rural Domestic Water Supply schemes, which was only £389,000. It should be noted that the Division always dealt with these schemes with the atmost urgency giving them top priority over the execution of all other types of water works and this of course caused enormous difficulties having in mind the shortage of skilled and unskilled labour force.

Some of these housing estate schemes can easily be classified as Major projects. Such a scheme is the Pano Lakatamia housing estate which is stimated at £113,000 and the expenditure incurred during 1977 was £89,231. This scheme has as sources of supply two boreholes and is entirely an independent scheme. Among other things it involves the installation of two electrosubmersible pumps, the installation of a 6 inch diameter sbestos cement pumping main of a length of 3,500 meters, the construction of two reservoirs of capacity 500 m^3 each, the installation of a distribution system of a length of 16,000 meters of Asbestos cement pipes of diameter 8—4 inches and the installation of 1,000 house connections.

Other major schemes are those of the housing estate of Strovolos II estimated at £42,900. Strovolos III, estimated at £43,307, Platy estimated at £28,600 and a number of others of the same vital importance.

Most of the 101 schemes were completed by the end of the year, but some others could not be completed for various difficulties and were carried over for completion in 1978.

Table V—10 that follows shows in detail all 101 self—help housing projects and Government housing estates that were undertaken for execution during 1977.

TABLE V—10 **WATER SUPPLY SCHEMES TO REFUGEE HOUSING AND SELF HOUSING ESTATES**

Ser No	Name of scheme	Amount allocated for 1977 £	Expenditure incurred in 1977 £	Remarks
	(a) Self Housing Estates			
1	Laxia "A"	1 400	1 467	Completed
2	" 'B'	6 800	952	In progress
3	Aredhiou 'A'	1 760	1 733	Completed
4	Anayia 'A'	4 200	4 120	— do —
5	Malounda 'A'	1 000	1 000	— do —
6	Pera 'A'	1 500	1 500	— do —
7	Perakhorio (Nisou) 'A'	1 200	829	— do —
8	" 'B'	1 250	1 149	— do —
9	Tseri 'A'	4 430	4 223	— do —
10	" 'B'	3 300	2 461	— do —
11	Ayii Trimithias 'A'	800	744	— do —
12	Paleometokho 'A'	1 900	1 644	— do —
13	Dhali 'A'	1 400	819	— do —
14	Peristerona 'A'	930	1 027	— do —
15	" 'B'	1 570	1 482	— do —
16	" 'C'	2 920	2 941	— do —
17	Akaki 'A'	560	553	— do —
18	" 'B'	1 400	1 397	— do —
19	Nikitari 'A'	1 600	1 649	— do —
20	Astromeritis 'A'	2 600	2 695	— do —
21	Ergates 'A'	2 350	2 335	— do —
22	Analiondas 'A'	2 066	2 017	— do —
23	Kokkini Trimithia 'A'	18 500	13 642	In progress
24	" " 'B'	15 000	7 736	— do —
25	Yeri 'A'	2 400	309	— do —
26	Nisou 'A'	1 400	1 076	Completed
27	" 'B'	1 350	943	— do —
28	Orounda 'A'	1 100	912	— do —
29	Xylophagou 'A'	2 300	2 114	— do —
30	" 'B'	10 300	7 102	In progress
31	" 'C'	2 250	1 481	— do —
32	Anglisidhes 'A'	1 250	770	— do —
33	Kalokhorio (L'ca) 'A'	1 900	1 903	Completed
34	" 'B'	4 000	3 114	In progress
35	" 'C'	3 100	2 170	— do —
36	Kophinou 'A'	1 550	1 316	Completed
37	Psevdhas 'A'	1 300	1 152	In progress
38	Kiti 'A'	5 500	4 040	— do —

TABLE V—10 **WATER SUPPLY SCHEMES TO REFUGEE HOUSING AND SELF HOUSING ESTATES (Continued)**

Ser No	Name of scheme	Amount allocated for 1977 £	Expenditure incurred in 1977 £	Remarks
39	Kiti 'B'	1 900	1 152	— do —
40	Tersephanou 'A'	4 100	3 074	Completed
41	" 'B'	1 500	970	— do —
42	Ormidhia 'A'	10 300	6 457	— do —
43	" 'B'	2 500	2 324	— do —
44	" 'C'	900	923	— do —
45	Alethriko 'A'	4 600	3 945	— do —
46	Pyla 'A'	1 000	520	— do —
47	Mosphiloti 'A'	2 550	2 134	In progress
48	Oroklini 'A'	1 500	1 733	Completed
49	Livadhia 'A'	2 500	2 275	— do —
50	" 'B'	2 200	1 877	— do —
51	Dhromolaxia 'A'	5 940	5 991	— do —
52	" 'B'	2 500	2 188	— do —
53	Xylotymbou 'A'	6 500	—	— do —
54	Athienou 'A'	2 000	1 553	— do —
55	Pervolia 'A'	1 600	1 484	— do —
56	Kornos 'A'	1 800	1 277	In progress
57	Vrysoulles 'A'	39 300	31 053	Completed
58	" 'B'	3 000	2 988	— do —
59	Liopetri 'A'	3 200	2 201	— do —
60	" 'B'	1 200	748	— do —
61	" 'C'	10 700	10 472	— do —
62	Phrenaros 'A'	2 000	1 554	— do —
63	" 'B'	5 500	5 420	— do —
64	" 'C'	3 100	2 034	— do —
65	Sotira 'A'	2 300	2 268	— do —
66	" 'B'	1 600	1 595	— do —
67	Avgorou 'B'	2 750	2 754	— do —
68	" 'C'	7 850	4 605	— do —
69	" 'D'	1 150	1 002	— do —
70	Paralimni 'B'	3 800	3 795	— do —
71	" 'C'	4 400	3 369	— do —
72	Dherynia 'A'	3 300	3 300	— do —
73	" 'B'	6 700	6 512	— do —
74	Kolossi 'A'	9 000	7 205	— do —
75	" 'B'	14 000	—	Pending formation of roads
76	Trakhoni 'A'	5 400	4 277	Completed
77	Pano Polemidhia 'A'	10 300	8 636	— do —

78	Pano Polemidhia	8 200	4 530	In progress
79	Episkopi 'A'	2 200	2 428	Completed
80	Evdhimou 'A'	2 300	1 235	In progress
81	Armenokhori 'A'	3 300	—	Pending formation of roads
	(b) Housing Estates			
82	Pano Lakatamia (Anthoupolis)	113 000	89 231	In progress
83	Laxia — Phase I	39 406	36 127	— do —
84	Laxia — Phase II	900	—	— do —
85	Strovolos II 'A'	42 900	42 176	Completed
86	Strovolos III 'B'	43 407	31 291	In progress
87	Ayios Athanasios	8 000	7 568	Completed
88	Ayii Anargyri — Larnaca	10 293	6 429	In progress
89	Vrysoulles — Single Persons Housing Estate	1 200	1 145	Completed
90	Platy (Investigations)	500	513	— do —
91	Platy	28 600	2 634	In progress
92	Ayios Mamas — K. Lakatamia Investigations	600	981	Completed
93	Ayios Mamas — K. Lakatamia Temprorary W S	1 600	911	— do —
94	Ayios Nicolaos — Pallouriotissa Investigations	120	153	— do —
95	Ayios Nicolaos — Pallouriotissa	2 800	2 225	In progress
96	Ayios Yeoryios — Pallouriotissa Investigation	440	425	Completed
97	Ayios Yeoryios — Pallouriotissa	13 200	—	In progress
98	" " "	2 100	1 062	— do —
99	Ayia Varvara — Pallouriotissa Investigation	170	177	Completed
100	Ayia Varvara — Pallouriotissa	4 200	281	In progress
101	Alyki — Larnaca Investigations	1 500	1 281	Completed
	Total	£647 512	£466 985	

SCHEMES UNDERTAKEN FOR CONSTRUCTION FOR OTHER DEPARTMENTS, VILLAGES, PRIVATE DEVELOPERS ETC

(a) Schemes undertaken for construction for other Government Departments.

During the year the Division undertook 142 schemes for construction on behalf of other Government Departments which do not have the means and experience for the execution of these schemes. Most of these schemes were related to water supplies, to Turkish villages, industrial areas, Animal Husbandry Areas, etc. and the funds were allocated by the Ministry of the Interior, the District Officers, the Ministry of Commerce and Industry, the Departments of Agriculture and Forests, etc.

Some of the most important of these schemes were:

1 Water supply to Animal Husbandry Station at Aradhippou, for the Agriculture Dept estimated at £21,000.

2 Water supply to Animal Husbandry Station at Paralimni for the Agriculture Dept estimated at £12,000.
3 New water supply scheme for the Forest Nursery at Athalassa, estimated at £10,300.
4 Water supply to the new industrial area at Strovolos, estimated at £22,600.
5 Water supply to the new industrial area at Paphos, estimated at £22, 300.
6 Improvement of the water supply of Margi estimated at £2,100.
7 Improvement of the Stavrokonnou village water supply estimated at £11,600.
8 Improvement of the Kochati water supply estimated at £4,535.
9 Improvement of the Mouttalos (Paphos Turkish Quarter) water supply estimated at £7,000.
10 Service for the protection of Turkish property £5,000.

In total on all 142 schemes executed for other Departments the expenditure incurred during 1977 reached the amount of £169,480.

(b) Schemes undertaken for villages from village deposits

During the year 128 such schemes were undertaken by the Division for the execution of minor water supply schemes for various villages, from funds deposited direct by the Village Water Commissions. These schemes were related to extensions of distribution mains, installation of water meters, maintenance of pumping units etc. On all these schemes the expenditure incurred during 1977 reached the amount of £23,807.

(c) Minor irrigation schemes undertaken for villages from funds deposited by the Irrigation Committees

During the year 20 such schemes were undertaken for execution by the Division. Mostly they were related to maintenance of pumping units, minor extension, etc. The overall expenditure incurred during the year reached the amount of £9,272.

(d) Schemes undertaken for Private Developers

During the year 136 such schemes were undertaken by the Division for execution for private developers. These schemes were related mostly to division of land. Expenditure during the year reached the amount of £81, 402.

MECHANICAL, ELECTRICAL SERVICES BRANCH AND WORKSHOP

The MES branch keeps on emergency standby the following equipment which are used to prime pumping units when existing facilities are temporarily out of order or utilization of certain water source is urgently needed.

Power Generators	10
Diesel Engines	17
Turbine Pumps	12
Electrosubmersible Pumps	9
Centrifugal Pumps	12

This branch in order to fulfil its task employs 61 persons and uses two mobile cranes and five vehicles.
In 1977 the branch carried out the following works amounting to £62,586.

1 Instalation of 36 new pumping units for Water Supply and Irrigation	£25 655
2 Repair and maintenance of 75 pumping units	£ 9 015
3 Mechanical fabrication carpentry and masonry works	£20 916
4 Despatch of materials and stores	£ 7 000

V/I PAPHOS IRRIGATION PROJECT

by
K Spanos
Executive Engineer II
Deputy Project Manager

General

The year 1977 was the second year of the Project's implementation during which the following main activities took place:

- The completion of the tender documents for 8 contracts by the Consulting Engineers SOGREAH and the Asprokremmos Dam by Sir M MacDonald and Partners.
- The prequalification of the contructors for 5 tenders has been carried out.
- The tendering procedure for 4 contracts has been completed with their award to an equal number of contractors for a total amount of £620,926. The same procedure was still in progress by the end of the year for another 3 Contracts.
- The construction of the Main Canal was continued from the year 1976 and also works for the following new contracts were started by the selected contractors.

Central Offices at Yeroskipos
Construction of Wellfield Conveyance System
Supply of AC pipes and valves for the Wellfields
Supply and Installation of Well Pumps

The technical staff of the Project at the end of the year 1977 consisted of:

1 Executive Engineer I
Project Manager
1 Executive Engineer II
Deputy Project Manager
3 Executive Engineers II (daily)
1 Technical Assistant
8 Technical Assistants (daily)
4 Surveyors (daily)
2 Laboratory Technicians (hourly)
4 Draughtsmen
3 Foremen

An out line of the project organization was given in the annual report 1976. The whole structure on which the pro ject organization is based is shown again by the chart on page 119.

PROGRESS OF WORKS

A ENGINEERING DESIGN AND CONTRACT DOCUMENTS

Work on the preparation of the work ing drawing and specifications for the various contracts of the Project was started by the two foreign Consulting Engineering Firms in the year 1976

and was completed by the end of the year 1977.

During that year the work performed by them was as follows:

1 SOGREAH Consulting Engineers, Grenoble, France. Tender documents for 8 contracts have been completed and submitted to WDD by SOGREAH during 1977 as follows:

Tender No 2 — Supply and Installation of Well Pumps and Electrical Equipment. Contract No S1 39/76/28 (January 1977). This contract includes the construction of the well head structures of the 24 project boreholes in the rivers of Ezusas Xeropotamos and Dhiarizos and the supply and installation of their electrical submersible pumps and equipment,

Tender No 3 — Consisting of 3 Lots (January 1977)

Lot 3S1 — Supply of canaletti
Lot 3S2 — Supply of pipes and fittings
Lot 3S3 — Supply of valves

All above supplies consisting of about 8 km of canaletti R45 to R80 and 13 km of AC pipes dia 200—800 mm will be needed for the construction of the Well Conveyance System and Main Eastern Pipeline.

Tender No 4 — Installation of Wellfield Conveyance System and Main Eastern Pipeline. Contract No C1 39/76/27 (March 1977). This contract includes the installation of a canaletti line about 8 km long and the construction of 2 km rectangular concrete canal for the conveyance system from the upper boreholes of Ezusas and Dhiarizos and the installation of about 10 km pipeline for the conveyance system from the lower boreholes and the Main Eastern Pipeline.

Tender No 5 — Consisting of 3 lots contract No 39/77/31—2—3 (July 77).

Lot 5S1 — Supply of pipes and fittings
Lot 5S2 — Supply of valves
Lot 5S3 — Supply of hydrants

The above supplies which include about 480,000 m of AC pipes dia. 80 - 700 mm 7,280 No of Valves and 665 No of Hydrants will be used for the construction of the Irrigation Networks of the Eastern Area of the Project.

Tender No 7 —Installation of Irrigation Network of Eastern Area and Construction of Reservoirs. Contract No C7 39/77/38—9 (July 77). This contract includes the construction of the Pipe Distribution System of 6 Irrigation Sub-divisions of the Eastern Project covering about 3,500 ha together with their balancing reservoirs.

Tender No 6 — Main contract No C6 39/77/37 (October 77). This contract includes the supply and installation of 16 Pumping Units and the construction of their houses, the supply and installation of the Eastern Main Pipeline 23 km long and 400 to 900 diameter and the Remote Monitoring Equipment.

Tenders No 8 and No 9 — Contract No S8 39/77/34—5—6 (December 77) — Contract No C9 39/77/40 They are similar to those of No 5 and No 7 respectively and concern the Irrigation Network of the Western Project Area covering about 1,200 ha.

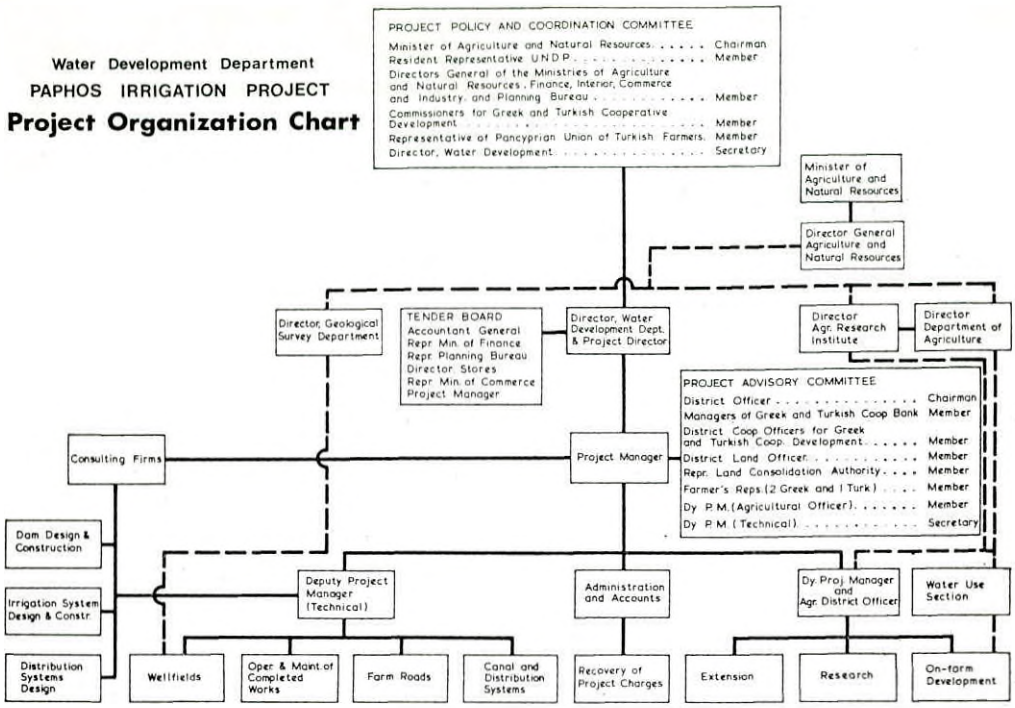
Invitations for Tendering

For the above Tender Nos 4, 7, 6 and 9 prequalification of the contractors was carried out in order to restrict the participation in the tendering only to those contractors who are technically and financially capable to cope with

Water Development Department

PAPHOS IRRIGATION PROJECT

Project Organization Chart



the work.

Invitation for tenders was announced for tender Nos 2, 3, 4, 5 and 7 during the year 1977. After the opening of the Tenders evaluation of the bids was carried out by the Consultants and WDD in order to make recommendations for the award to the Tender Board as given below:

Tender No 2 — Tenders were opened on the 30th April 1977. The contract was awarded to Karamondani Bros Ltd for the sum of £142,372, and the agreement was signed on the 21st September 1977. Completion period for the contract was fixed as 9 months starting from that date.

Tender No 3 — Lot 3S1 — This lot was given to J & P after direct negotiations as this firm is the only manufacturer of canaletti in Cyprus. Contract agreement was signed on the 14th April 1977 for the sum of £66,850.

Lot 3S2 and 3S3 — Tenders were opened on the 30th April 1977. Both lots were awarded to K & G Stephanou Bros and Isasbest of Israel for the sum of £208,402.

The agreement was signed on the 27th July 1977 and the completion period was fixed as 6 months from that date.

Tender No 4 —Tenders were opened on the 8th July 1977. The contract was awarded to ASPEM Construction Ltd for the sum of £162,889. The agreement was signed on the 26th October 1977 and the period for completion was fixed as one year from that date.

Tender No 5 — Tenders were opened on the 12th December 1977 and were still under consideration at the end of the month.

Tender No 7 — Tenders were opened on the 7th October 1977. The evaluation report was prepared by WDD and was submitted to the Tender Board for consideration.

2 Sir M MacDonald and Partners

The Consultants continued from 1976 their work on the preparation of the Contract Documents for the Asprokremmos dam. On the 26th August 1977 the Main Contract Documents and Album of Drawings was submitted to WDD and soon after they were issued to the 16 Contractors who were already prequalified for the dam construction from the beginning of the year 1977. Sub-contract documents for the water Control Gates, Pipework and Instrumentation were also completed and dispatched to the Main Contract Tenderers. In all 5 Tenders were submitted and opened on the 16th December 1977 by the following contractors:

- J & P with MEDCON (Cyprus) .....£ 6 743 837
- G C C with Scapaneus (Cyprus & Greece) ...£ 7 872 627
- Entrecanales Y Tavora (Spain) £10 848 708
- Pomgrad (Yugoslavia) £11 441 855
- Strabag (West Germany) £14 202 239

The Consultants have undertaken to prepare the Evaluation of the Bids and make recommendations for the award. It is planned that the selection of the contractor will be done by the end of March 1978 so that construction works will start with the beginning of the summer season of the same year and be completed by the year 1981.

B EXECUTION OF SUPPLY AND CONSTRUCTION CONTRACTS

1 Main Canal — Contract No C3—S9 39/76/23

Works on this contract were started in October 1976 by the General Construction Co Ltd and were continued throughout the year 1977 at a satisfactory progress rate. The 11.8 km of open trapezoidal concrete lined canal will be able with its head capacity of 4.2 m^3/sec to meet the water requirements of the whole project area. The use of three regulating hydraulic gates of AVIO type will ensure an automatic control of the canal flow by maintaining constant downstream water level. From one regulator to the next one the invert of the canal has a slope of 0.00016 while its top level line is horizontal. Apart from the canal itself quite a large number of auxiliary concrete structures had to be constructed also, like 17 bridges, 22 culverts, 3 crossings of thalwegs, the Ezusas siphon, 6 intakes, 4 watering places etc which carry about 50% of the total cost of the canal contract sum of £992,826.

The various stages of the construction works involved:

Earthworks

The earthworks were started in October 1976 and were nearly completed by the end of the year 1977. The quantities excavated and filled were:

Normal excavation	122 000 m^3	95%
Rip excavation	10 000 m^3	
Rock excavation	6 000 m^3	
Compacted fill	150 000 m^3	

For each canal section the necessary earthworks (mass excavation or filling) depending on the ground levels were first carried out in order to bring the level to that of the top line of the canal.

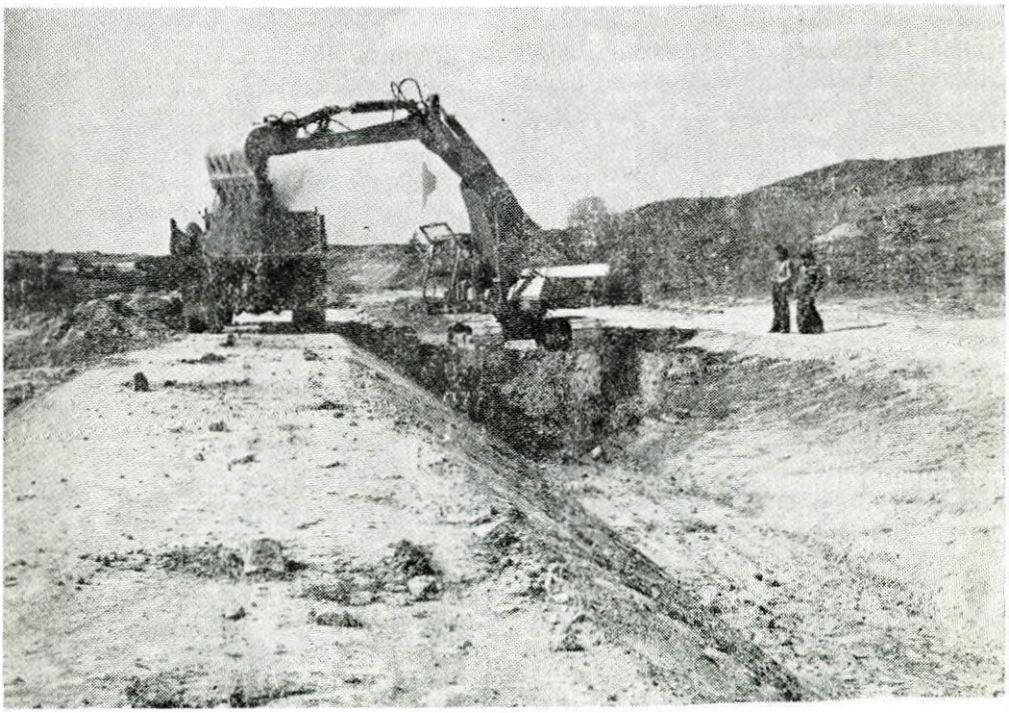
For the mass excavation a bulldozer D8 was used plus some blasting or pneumatic drilling in the cases of hard rock. The fill materials for the compacted fillings were coming either from the nearby canal excavation if proved to be suitable or from the nearest borrow areas. Such borrow area was the Xeropotamos river bed from which about 30,000 m^3 of shingle were extracted. The fill materials were compacted in layers of 20 cm until their dry density was 95% of the Laboratory Proctor test max density, by the use of two rollers, one vibrating and one pneumatic.

The canal itself was then excavated and trimmed by two powerul diggers, Schwing, 120 HP (see photo below) which could produce the final shape of the canal with an acouracy of 1 to 2 cm.

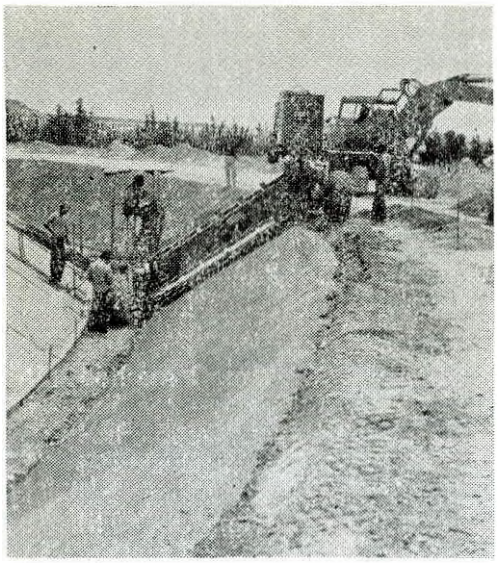
Concrete Lining

The canal lining was made by concrete of 10 cm thickness.

The concreting operation was carried out on the slopes by RAHCO slipform paving machine brought to the site in August 1977 from USA (see photo on p. 122). This machine had the capacity of concreting about 50 m^3 per hour. By the end of the year 1977 42,000 m^2 of lining was completed or about 40% of the whole work.



Excavation of main canal was carried out by 2 powerful SCHWING, 120 HP diggers which can excavate and trim to the final shape of the canal with an accuracy of 1-2 cm. WDD photo No. A58-2 shows one of them at work.



RAHCO slipform paving machine especially imported from the USA by the Contractors General Construction Co. to pave the 11.8 km long main conveyor canal. WDD photo No A55-5.

Concrete Structures

By the end of the year the following were completed: 14 bridges, 17 culverts, 2 regulators, 2 crossing of thalweges, 2 safety siphons and 1 aqueduct. The total volume of concrete poured of class 350/25 was 1650 m^3, 300/25 was 1700 m^3 and 250/25 600 m^3. The quality of the concreting work was quite satifactory and the cubes taken were having crushing strengths above specifications.

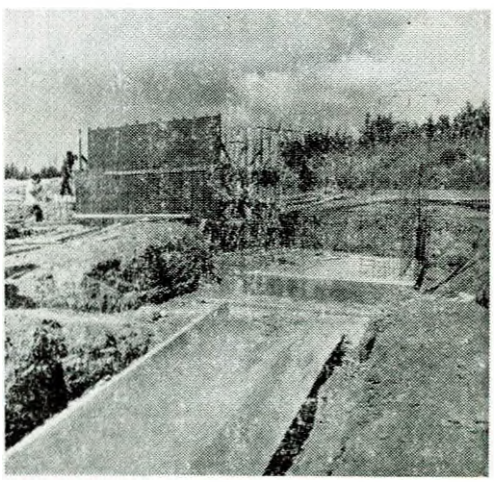
Ezusas Siphon

One of the main activities during the summer season was the construction of the Ezuza siphon which consisted of the Ezusas siphon which consisted 3 main structures, the blow off, the inlet and the outlet. In all 224 m of AC pipes of dia 1 200 mm from HELLENIT were installed. (See photo A56 - 1 on p. 124).

General remarks

The only unexpected difficulty met in the work was the appearance of small longitudinal cracks on the face of the canal concrete lining soon after its placing by the RAHCO. To prevent this a formwork line was put along the bottom end of the lining immediately after concrete comes out of the machine and by changing the use of Vasilikos Cement Type V to Moni OP Cement because the former was found by the Consultants as having high insoluble content which produced more bleeding in fresh concrete.

The Main Canal is expected to be completed by the middle of the year 1978, 3 months behind schedule.



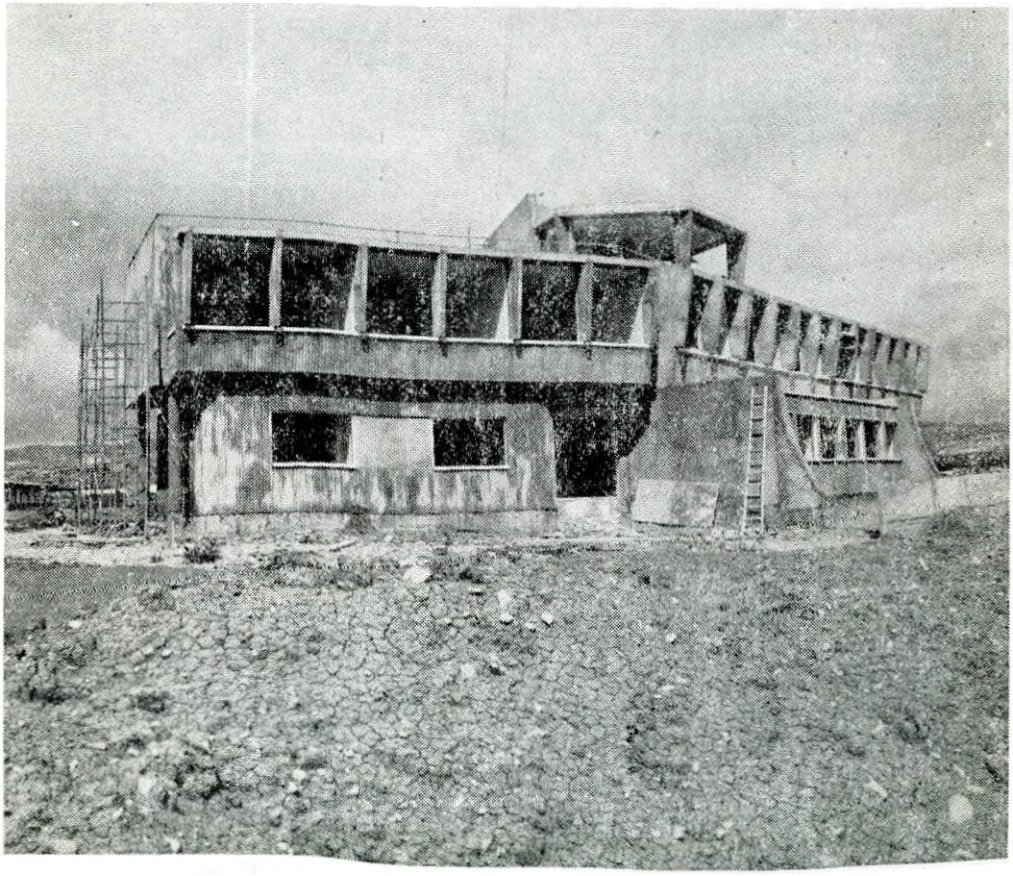
The Ezusas siphon outlet structure under construction. The siphon is to discharge into an outlet chamber and from there through a transition from rectangular to the trapezoidal canal. WDD photo No. A54-7.

2. Central offices at Yeroskipos contract No C7 39/77/22

Work on the construction of the Project Central Offices at Yeroskipos started in March 1977 by the local contractor HjiDemosthenous. Progress rate was quite satisfactory and about 70% of the work was completed by the end of the year. The building consists of a ground floor and two storeys of a total covered area 750 m^2. (See photo below). Work is expected to be completed by the middle of the year 1978, 2 months behind schedule.

3. Supply and Installation of Well Pumps Contract No S1 39/76/28

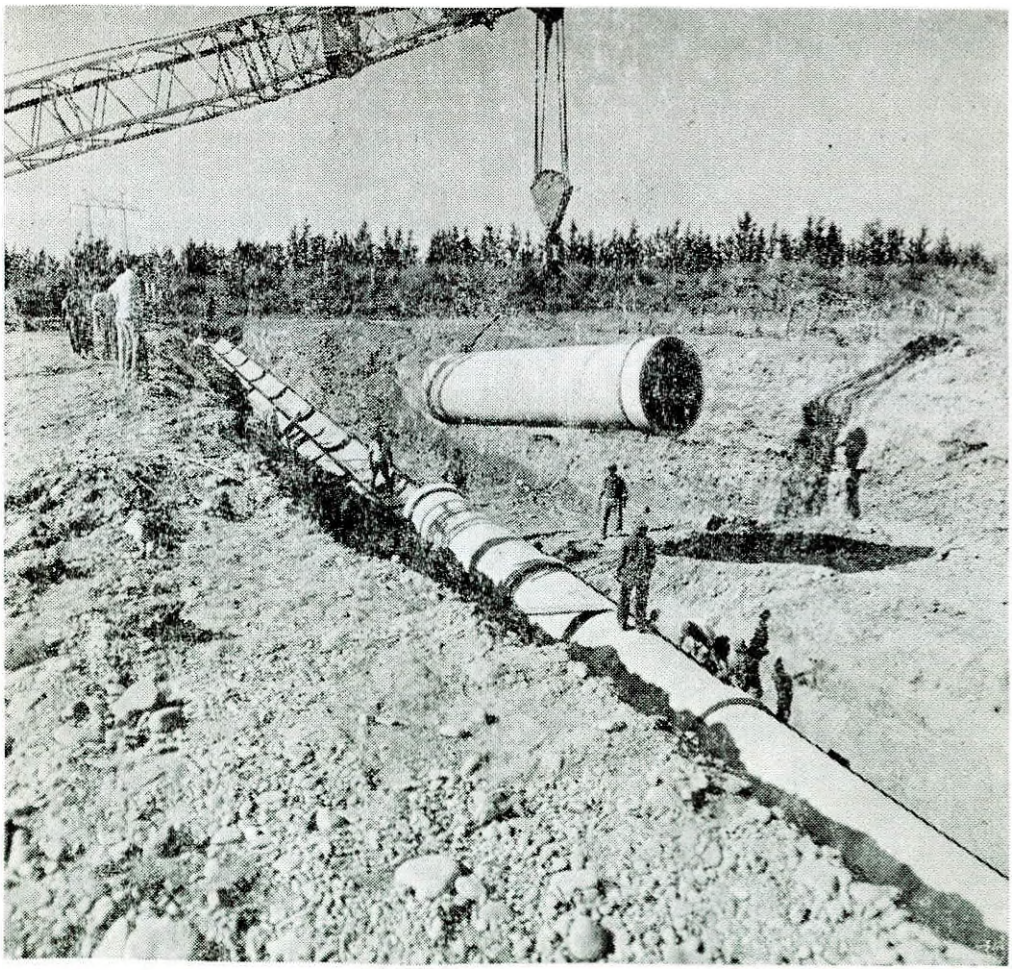
The Contractor, Karamondani Bros Ltd commenced works in October 1977 on the construction of some well head structures. The 24 submersible pumps were ordered from the manufacturers EMV and RITZ and they are expected to arrive in April 1978, and be installed during the following summer season.



Paphos Project central offices at Yeroskipos during construction. WDD photo No. A80-11.

4. Wellfield Conveyance System Contract No C1 39/76/27

The ASPEM Construction Ltd started work with the installation of the pipelines from the lower boreholes in November 1977. The AC pipes were supplied by ISASBEST of Israel in October. Due to the start of the winter season the progress of the works during the last two months of the year was quite low. Works are scheduled to be completed by the end of the year 1978.



Installation of siphon (1,200 mm AC HELLENIT pipe 224 m long) across the Ezusas river. The pipe was laid on a mass concrete platform and braced with steel braces on the sloping down and sloping up sections of the siphon. At the lowest point the blow-off structure was constructed with washout valve and air valve up to flood water level. WDD photo No. A56-1.

C FINANCIAL INFORMATION

The table below shows the actual expenditure incurred during 1977 for the various project works.

The total expenditure of the Project up to the end of the year 1977 amounts to £1,339,850 representing about 9% of the total estimated costs.

PAPHOS PROJECT. — ACTUAL EXPENDITURE INCURRED — YEAR 1977

Scheme - item	Actual expenditure during 1977 £	Remarks
Engineering and administration:		
1 Consulting Firms	101 987	continued
2 Project Organization and Management	32 301	"
Contract Works:		
1 Main Canal	446 462	continued
2 Central Offices	18 402	"
3 Supply and Installation of Well Pumps	7 118	
4 Supply of AC Pipes and Valves	74 963	continued
5 Construction of Wellfield Conveyance System	13 357	continued
6 Dam Model Testing	17 415	"
Works by WDD		
1 Construction of Premises	8 267	completed
2 Akhelia ARI Station	11 060	continued
3 Purchase of Equipment	50 506	"
4 Investigations, Surveys and Laboratory Works	17 213	"
5 Diversion of Services and Compensations	9 460	"
By EAC		
1 Power Supply	62 424	completed
T o t a l	£870 936	

Note. For breakdown of the above expenditure with amount dedaggered, expenditure during 1977 and balance see Table 1—5 on page 23.

VI DIVISION OF OPERATION AND MAINTENANCE

By
N Tsiourtis
Executive Engineer I
and
G Charalambous
Superintendent of Works

Introduction

This Division includes the Branches dealing with:

- The Management, Operation and Maintenance of Major Irrigation Works (mainly dams)
- The maintenance of contributory irrigation projects, and
- The operation and maintenance of Town Water Supplies.

MANAGEMENT, OPERATION AND MAINTENANCE OF MAJOR IRRIGATION WORKS

The management and operation of the major irrigation works constructed under the Government Water Works Law is carried out by Waterworks Committees, established according to the provisions of the relevant law (Government Waterworks Law Cap. 341) where in cases of contributory works (Palekhori) these are run by the Irrigation Division Committees according to the law Cap. 342.

The Waterworks Committees for Government Waterworks are usually composed of the following:

Chairman

District Officer of the District in which the project is situated:

Members

Director of the Water Development Department or his representative:
Director of the Agricultural Department or his representative:
Land and Surveys Department,
Two or more farmers elected by District Officer.
the beneficiary farmers.

The Committee is responsible for the overall administration and management of the project such as:

- to make recommendations 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
  (a) improve the standard of agriculture practices,
  (b) improve the methods of irrigation,
  (c) increase the revenue from land and water utilization to the full economic value

The Irrigation Division Committees have the same responsibilities and duties as above and they may request the help of technical Departments if they desire so.

The maintenance of the Government Waterworks is the responsibility of the Water Development Department, being the Government's Executive Agency. The maintenance of the contributory projects is undertaken again by WDD and the cost of such works is borne by the Government (2/3) and the Irrigation Division (1/3).

SUMMARY OF MANAGEMENT OPERATION AND MAINTENANCE DATA OF MAJOR IRRIGATION WORKS FOR 1977

General

The overall average rainfall during the year under review, was 477 mm or 88% of the long period average of the Island. However, the distribution and time of rainfall was such that only three dams were affected or did not fill to spillway crest namely Mavrokolymbos, Polemidhia and Kiti Dams. Lefkara collected much less quantity than in the year before.

Table VI—1 shows in tabular form, the project reservoir capacities, the area commanded, the water utilized and the areas irrigated during the year under review. It also indicates the evaporation and leakages losses.

Water Availability and Its Use

In the year under review, the total quantity of water available from the ten major dams reached the figure of 32,003,000 m^3 which is a record high. From this total, a quantity of 15,085,000 m^3 representing 47.1% of the total was used for irrigation, domestic water supply and recharge purposes. From the total quantity of 15,085,000 m^3 utilized 9,704,000 m^3 or 64.3% was used for irrigation purposes, 2,058,000 m^3 or 13.64% was used for domestic water supply and 3,323,000 m^3 or 22.0% was used for recharge purposes.

The irrigation water was used to irrigate either fully or partly 15,459 donums of irrigable land planted with citrus, bananas, vines, deciduous, vegetables and other crops, as follows:-

TABLE VI—2
CROPS AND AREAS IRRIGATED

Ser No	Crop	Area Donums
1	Citrus	5 533
2	Bananas	701
3	Vines	1 784
4	Deciduous ...	793
5	Vegetables ...	5 502
6	Potatoes	260
7	Gereals	766
8	Olives	20
	Total	15 459

TABLE VI—3
APPROVED WATER CHARGES IN MILS/m^3

Ser No	Project	Overflow	Vegetables	Vines	Deciduous	Citrus	Flat rate
1	Argaka — Magounda	Free	—	—	—	—	10
2	Ayia Marina	5	—	—	—	—	10
3	Kalopanayiotis	—	—	—	—	—	18
4	Kiti	3	—	—	—	—	10
5	Lefkara	—	—	—	—	—	10
6	Mavrokolymbos	—	10	15	15	15	—
7	Pomos	5	—	—	—	—	10
8	Polemidhia	3	10	15	15	15	—
9	Yermasoyia						

TABLE VI—1 **MAJOR IRRIGATION PROJECTS — DATA FOR 1977**

No	Project	Capac. m^3X10^3	Area Comm. Don.	Water Avail.* for Utiliz m^3x10^3	Water used for irrig. m^3x10^3	Water used for D.W.S. m^3x10^3	Water used for rech. m^3x10^3	Total Quant. used m^3x10^3	Evapor. Losses m^3x10^3	Seepage Losses m^3x10^3	Area Irrigated Don.	Water Utiliz. index %	Land Utiliz. index %
1	Argaka — Magounda	1 150	2 340	1 749	1 422	Nil	150	1 572	81	5	2 102	89.9	89.8
2	Ayia Marina	300	1 500	471	364	Nil	50	414	30	48	415	87.9	27.7
3	Kalopanayiotis	390	435	390	164	Nil	Nil	164	40	106	435	42.0	100.
4	Kiti	1 610	6 200	258	72	Nil	169	241	17	Nil	170	93.4	2.7
5	Lefkara **	13 850	615	7 961	65	2 058	Nil	2 123	533	40	200	26.6	32.5
6	Mavrokolymbos	2 180	3 355	586	486	Nil	Nil	486	86	Nil	520	82.9	15.5
7	Palekhori	620	1 000	620	620	Nil	Nil	620	50	N.A.	1 000	100.	100.
8	Pomos	860	2 850	1 188	1 016	Nil	Nil	1 016	79	160	567	85.	19.9
9	Polemidhia	3 430	11 050	18 780	5 495	Nil	2 954	8 449	1 746	Nil	10 050	45.0	90.9
10	Yermasoyia	13 500											
	Total	37 890	29 345	32 003	9 704	2 058	3 323	15 085	2 662	359	15 459	47.13	52.7

* This is the water that possibly may be utilized: storage + overflow or seepage that may be utilized after deducting evaporation and seepage losses.

** Water allocated mainly for domestic water supply.

TABLE VI—4 **DATA ON WATER USE FOR THE LAST 9 YEARS FOR MAJOR PROJECTS**

No	Description	Unit	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	Capacity	m^3x10^3	23 420	23 420	23 420	23 420	2 340	37 890	37 890	37 890	37 890
2	Water available	"	NA	6 160	5 352	3 777	1 858	6 367	27 612	28 000	32 003
3	Water utilized for irrigation	"	NA	NA	NA	NA	NA	NA	7 776	8 388	9 704
4	Water used for DWS	"	Nil	Nil	Nil	Nil	Nil	Nil	1 000	1 365	2 058
5	Water used for recharge	"	NA	NA	NA	NA	NA	NA	NA	6 016	3 323
6	Total Water used	"	NA	NA	NA	NA	NA	NA	8 776	15 769	15 085
7	Evaporation Losses ...	"	NA	NA	NA	NA	NA	NA	2 854	2 570	2 662
8	Seepage Losses	"	NA	NA	NA	NA	NA	NA	NA	428	359
9	Water sold	"	1 038	1 961	2 467	2 757	11 137	26 138	60 600	73 747	93 485
10	Gross Income	£	21 241	22 594	26 891	29 391	971	2 544	5 522	6 624	7 999
11	Operation Cost	£	5 911	5 849	7 688	7 282	6 450	11 048	12 619	18 627	34 500
12.	Maintenance Cost ...	£	7 582	5 328	3 342	4 849	4 278	4 603	3 174	4 496	8 059
13	Total Expenditure	£	13 493	11 177	11 030	12 131	10 728	15 651	15 793	23 123	42 559
14	Net Income	£	7 748	11 417	15 861	17 260	409	10 487	44 808	50 264	50 926
15	Area Irrigated	Donums	NA	NA	NA	NA	NA	NA	12 458	17 376	15 459

NA: Not available

TABLE VI—5 **DATA ON MANAGEMENT, OPERATION AND MAINTENANCE OF MAJOR IRRIGATION PROJECTS**

No	Project Name	Dam Reservoir Capacity m^3x10^3	Area Command Don	Water Available * m^3x10^3	Water used m^3x10^3	Water sold m^3x10^3	Area Irrigated Don	Gross Income £	Expenditure Operat. £	Expenditure Maint. £	Expenditure Total £	Income Net £
1	Argaka — Magounda	1 150	2 340	1 749	1 572	781	2 102	781	1 633	752	2 385	5 425
2	Ayia Marina ...	300	1 500	471	414	364	415	3 335	1 459	340	1 799	1 536
3	Kalopanayiotis	390	435	390	164	164	435	2 954	1 503	1 075	2 578	376
4	Kiti	1 614	6 200	258	241	72	170	725	100	842	942	-217
5	Lefkara	13 850	615	7 961	2 123	65	200	650	Nil	1 045	1 045	-395
6	Mayrokolymbos	2 180	3 355	386	486	529	520	8 919	6 224	1 184	7 408	1 511
7	Palekhori	620	1 000	620	620	Nil	1 000	Nil	Nil	Nil	Nil	Nil
8	Pomos	860	2 850	1 188	1 016	1 017	567	9 081	2 813	1 087	3 900	5 181
9	Polemidhia	3 864	11 050	18 780	8 449	5 007	10 050	60 011	20 767	1 734	22 501	37 510
10	Yermasoyia	13 500										
	Total	37 890	29 345	32 003	15 085	7 999	15 459	93 485	34 500	8 059	42 559	50 926

* Including storage + overflow or seepage that may be utilized after deducting evaporation and seepage losses.

Evaporation losses from the ten major dams amounted to 2,662,000 m^3 representing 7% of the total available storage. The seepage losses were estimated at 359,000 m^3 or around 1% of the total available storage. Details regarding the water availability and its use for each of the ten major dams, is shown on Table VI—1. The overall water utilization index is around 47% i e the water used is around 47% of the total quantity available. Of the water utilized for irrigation purposes 7,999,000 m^3 or 82.4% was sold to the farmers at the nominal rates where the rest was given free of charge as water rights.

The gross income from the sale of water amounted to £93,485 being the income from irrigation water only. The management and operational costs amounted to £34,500 being the cost for the payment of the waterguards etc. The maintenance costs were at £8,059 and were paid for routine and emergency maintenance works on main structures and the distribution systems. Tables VI—4 and VI—5 give details for the management and maintenance cost of the major irrigation projects together and separately.

Projects performance for the last two years

Table VI—4 gives data on the operation and maintenance of the ten major irrigation projects. Generally, the water development and water utilization through the years 1968—1977 is visualized in figures of Table VI—4.

Table VI—6 shows data on management, operation and maintenance for the last two years and also shows the change in these data compared with 1976. The last column of the table shows the change expressed in percentage and it is either positive (increase) or negative (decrease).

TABLE VI—6 **DATA ON MANAGEMENT AND OPERATION OF MAJOR IRRIGATION PROJECTS FOR THE LAST 2 YEARS**

Item No	Data	Unit	1976	1977	% change on 1976
1	Capacity	10^3xm^3	37 890	37 890	Nil
2	Water available	"	28 000	32 003	+14.29
3	Water utilized for irrigation	"	8 388	9 704	+15.69
4	Water utilized for DWS	"	1 365	2 058	+50.76
5	Water utilized for recharge	"	6 016	3 323	—44.76
6	Total water used	"	15 769	15 085	— 4.34
7	Evaporation losses	"	2 570	2 662	+ 3.58
8	Seepage Losses	"	428	359	—16.12
9	Water sold	"	6 624	7 999	+20.76
10	Gross Income	£	73 749	93 485	+26.76
11	Operation Cost	£	18 629	34 500	+85.19
12	Maintenance Cost	£	4 496	8 059	+72.25
13	Total Expenses	£	23 123	42 559	+84.05
14	Net Income	£	50 264	50 926	+ 1.31
15	Area commanded	Donums	17 376	15 459	—11.03
16	Area Irrigated	Donums	29 345	29 345	Nil

Although the storage capacity has remained the same, the water available for utilization was up by 14%. This was the result of fairly good weather conditions and the good management of the projects. The water utilized for irrigation was up by 15% (1.4 MCM) being the result of completion of the Zakaki and Phasouri extensions and the increased water utilization in other project areas. Water for domestic uses from the Lefkara dam was given in much larger quantities and the increase compared with that of 1976 is up by 50.76%.

The water sold was up by 20% where the gross income was 27% higher than that of 1976. However, the operation and maintenance costs were up by 85 and 72 per cent respectively. This is the result of higher rates of wages, the increased number of personnel and the expenses of energy for pumping water in the Akrounda — Phinikaria Scheme.

The area under irrigation was less than that of 1976. This was partly due to the irrigation of crops with higher water demand and to the pumpage restrictions applied in the Phasouri and Zakaki areas according to the special measures Law.

ARGAKA MAGOUNDA PROJECT

General

The Argaka Magounda Irrigation Project consists of a dam reservoir of maximum capacity at spillway crest 1.150 MCM and a distribution system made of closed conduits commanding an area of 2,340 donums (312 Ha). Irrigation in the Project area started early in January, 1977 and continued throughout the year until late in December, 1977. An area of 2,102 donums was irrigated by utilizing about 1.42 MCM of water. The area irrigated was planted with citrus, bananas, vines, deciduous, vegetables and cereals.

Out of the 1.42 MCM of water utilized, 781,086 m^3 was sold to the farmers at the nominal rates where the remaining 640,589 m^3 was taken from the overflow, free of charge. The gross income from the sale of water was £7,810. The expenditure of management was £1,633 where that of maintenance amounted to £752. Net income to the Project was £5,425.

Project Hydrology

The project hydrologic data, as recorded during the year, are tabulated on Table VI—7. The dam reservoir was filled to spillway crest on January 22nd and overflow continued until May 21st, 1977. During this period a total quantity of 3,297,000 m^3 had overspilled. The minimum level of

TABLE VI—7
ARGAKA MAGOUNDA DAM — HYDROLOGY FOR 1977

Item No	Description	Quantity m^3	% of Storage capacity
1	Initial amount in storage	684 000	59.4
2	Inflow during the year	3 810 000	331.3
3	Total release ...	783 000	68
4	Leakages	5 000	0.4
5	Evaporation ...	81 000	7.0
6	Overflow	3 297 000	286.7
7	Final amount in storage	328 000	28.5
8	Minimum quantity in storage (Nov. 1977) ...	178 000	15.48
9	Storage capacity	1 150 000	100

water in storage ever reached was in November with total quantity in storage around 178,000 m^3.

Water Utilization and Crops Irrigated

The project is built for irrigation purposes and as such, a quantity of 1.42 MCM of water was utilized for the irrigation of 2,102 donums of land planted with various crops as indicated in Table VI—8.

Further to this quantity of water used for irrigation, an additional quantity of 150,000 m^3 of water overflowing

TABLE VI—8
ARGAKA MAGOUNDA DAM — WATER UTILIZATION

Item No	Description	Quantity m^3	% of Storage capacity
1	Water used for irrigation	1 421 675	124
2	Water used for Recharge	150 000*	13
3	Total water ...	1 571 675	137
	Water lost in pipe bursting ...	2 197	0.20

* This is a rough estimate

the spillway crest had recharged the aquifer downstream the dam. Water from this aquifer is pumped by the Limni Mines and the local farmers to satisfy their demand in the mines operation and in agriculture not within the Argaka Magounda Project area.

Table VI—8 shows the utilization of the project water and Table VI—9 shows the crops irrigated.

Water Sale, Income, Operation and Maintenance Cost

The water released for irrigation was 783,000 m^3 out of which 2,197 m^3 was lost in pipe bursting. The total quantity utilized for irrigation, water released from the dam reservoir and overflow amounted to 1,571,675 m^3. Out of this, only 781,086 m^3 was sold to the farmers at the nominal rates where the rest was given free of charge, because of water rights. From the sale of water a total of £7,810 was collected for the operation of the project an amount of £1,633 was paid

TABLE VI—9
ARGAKA MAGOUNDA DAM — CROPS IRRIGATER

Ser No	Crop	1st period donums	2nd period donums	Total Area donums
1	Citrus	1	194	194
2	Bananas	250	250	250
3	Vines	30	—	30
4	Deciduous	16	16	16
5	Vegetables	590	272	862
6	Potatoes	—	—	—
7	Cereals	750		750
	Total	1 637	732	2 102

TABLE VI—10
ARGAKA MAGOUNDA DAM — INCOME AND EXPENDITURE DATA

Item No	Description	Quantity m^3	Amount in £
1	Water sold at nominal rates	781 086	7 810
2	Water sold at reduced rates	NIL	NIL
3	Water given free of charge	640 589	NIL
4	Total quantity utilized and gross income	1 421 675	7 810
5	Operation cost		1 633
6	Maintenance cost		752
7	Net Income		5 425

to the water men and bill collectors where for the maintenance of the project another £752 was spent.

Net income for the benefit of the project is £5,426. All the data concerning water sale, operation and management costs are shown on Table VI—10.

Project Performance for Last two Years

Table VI—11 shows the performance of the project for the last two years. As shown, there was an increase in the total volume of water used for irrigation by 18.4% where the area irrigated was reduced by 5%. The reduction was due to the increase of of the area under permanent crops (citrus and bananas).

Generally, the water utilization could be considered as satisfactory, although certain increase may be achieved.

TABLE VI—11

ARGAKA MAGOUNDA DAM — DATA ON PROJECT FOR THE LAST TWO YEARS

Item No	Unit	1976	1977	% change on 1976
1 Capacity	10^3m^3	1 150	1 150	
2 Water available	"	1 150	1 749	
3 Water utilized for irrigation ..	"	1 200	1 421	18.4
4 Water sold	"	583	781	34.0
5 Water given free	"	617	640	3.8
6 Water used for recharge	"	150	150	—
7 Gross income	£	5 830	7 810	34.0
8 Operation cost	£	868	1 633	88
9 Maintenance cost	£	277	752	171.5
10 Total expenses	£	1 145	2 385	108.3
11 Net income	£	4 685	5 426	15.8

AYIA MARINA PROJECT

General

The Ayia Marina Irrigation Project consists of a dam reservoir of capacity at spillway crest of 300,000 m^3 and a distribution system Commanding an area of 1,500 donums. The distribution system consists of a main canal at the terminal of which tertiary pipes branch-off to distribute water to each individual plot.

Irrigation in the project area started late in February, 1977 and continued throughout the year, until early in December. An area of 415 donums was irrigated by utilizing about 364,000 m^3.

The area irrigated was planted with bananas, vines, deciduous, vegetables and cereals. The water utilized was sold to the farmers at the approved rates. Out of the 364,000 m^3 utilized, 303,000 m^3 were released from the dam and sold to the farmers at nominal rates, whereas the remaining 61,000 m^3 were taken from the overflow and were paid at reduced rates. The total gross income from the sale of water amounted to £3,335. The expenditure for the operation was £1,459 and that for maintenance £340. Net income to the project was £1,536.-

Project Hydrology

The project hydrologic data as recorded during the year, are tabulated on Table VI—12.

The dam was overflowing from January 19th 1977 to May 11th 1977. Minimum quantity of water ever stored during the year under review, was 57,000 m^3 and this occurred in December, 1977.

Water Utilization and Crops Irrigated

During the year under review, a total quantity of 364,000 m^3 of water was

TABLE VI—12 **AYIA MARINA DAM — HYDROLOGY FOR 1977**

Item No	Description	Quantity m³	% of storage capacity
1	Initial amount in storage	209 000	69.6
2	Inflow during the year	710 000	236.7
3	Total release	303 000	101.0
4	Leakages	48 000	16.0
5	Evaporation	30 000	10.0
6	Overflow	456 000	152.0
7	Final amount in storage	82 000	27.3
8	Minimum quantity in storage (Dec. '77)	57 000	19.0
9	Storage capacity	300 000	100.0

utilized for the irrigation of approximately 415 donums planted with various crops. Details about the water utilization and the crops irrigated and their extent are shown on Tables VI—13 and VI—14.

Further to the water utilized for irrigation, a small quantity from the overspilled water recharged the small aquifer downstream the dam. Water is pumped from this aquifer for irrigation of areas not within the project area.

TABLE VI—13 **WATER UTILIZATION**

Item No	Water utilization	Quantity m³	% of storage capacity
1	Water used for irrigation	364 000	121.0
2	Water used for recharge	50 000	16.7
3	Total water utilized	414 000	138.0

TABLE VI—14 **CROPS IRRIGATED**

Ser No	Crop	1st period donums	2nd period donums	Total Area donums
1	Citrus	20	20	20
2	Bananas	16	16	16
3	Vines	14		14
4	Deciduous	4	4	4
5	Vegetables	213	135	345
6	Potatoes	—	—	—
7	Gereals	16	—	16
	Total	283	175	415

Water Sale, Income, Operation and Maintenance costs

From the sale of 364,000 m³ of water, the gross income to the project, amounted to £3,335. Management and operation expenses being the wages of the water man and that of the dam attendant, amounted to £1,459. Maintenance costs on the dam and the distribution system was £340. Net income to the project is £1,536. Details regarding sale of water income and costs are given on Table VI—15.

TABLE VI—15 **INCOME AND EXPENDITURE DATA**

Item No	Item description	Quantity m³	Amount in £
1	Water sold at nominal rates	303 000	3 030
2	Water sold at reduced rates	61 000	304
3	Water given free of charge	50 000	—
4	Total quantity utilized and gross income	414 000	3 335
5	Operation cost		1 459
6	Maintenance cost		340
7	Net income		1 536

Project Operation Data for The Last Two Years

Table VI—16 shows data on the operation of the project for the last two years. The water utilization shows an increase by 12.3% where the income showed an increase by 11.9%. The operation expenditure showed a reduction by 5.2%.

The area under irrigation was reduced by 155 don or by 27.2% while the water utilized increase by 12.3%. This is an indication of the trend in the area, where the farmers irrigate more profitable crops. In this case the farmers have irrigated less cereals compared with 1976 (100 don in 1976 and 16 don in 1977)
Generally, the utilization of water in the project area is satisfactory.

TABLE VI—18 **DATA ON PROJECT FOR THE LAST TWO YEARS**

Item No	Unit	1976	1977	% change on 1976
	m^3x10^3			
1 Capacity		300	300	Nil
2 Water available in storage	"	300	364	Nil
3 Water utilized for irrigation	"	324	364	+12.3
4 Water sold	"	324	364	+12.3
5 Water given free	"	Nil	Nil	Nil
6 Water used for recharge	"	50	50	Nil
7 Gross income	£	2 805	3 335	+18.9
8 Operation cost	£	1 539	1 459	— 5.2
9 Maintenance cost	£	183	340	+85.8
10 Total expenses	£	1 722	1 799	+ 4.5
11 Net income	£	1 033	1 536	+41.8
12 Area irrigated	Donums	570	415	—27.2

KALOPANAYIOTIS PROJECT

General

The Kalopanayiotis irrigation project consists of a dam reservoir of capacity 390,000 m^3 and a distibution system of closed conduits commanding an area of approximately 435 donums. Irrigation in the project area, started early in May, 1977 and continued throughout the year, until mid October, 1977. During this period, a total quantity of 164,096 m^3 of water was used for the irrigation of an area of approx. 435 donums planted mainly with deciduous. All the water was sold to the farmers at a fixed rate of 18 mils/m^3, and the gross income was £2,954. The operation expenses were £1,503 where the maintenance cost spent on routine works and emergency repairs, was £1,075. Net income to the project was £376.

Project Hydrology

The project hydrologic data, as recorded during the year under review, are tabulated in Table VI—17. The dam scouring gate was opened in December 27th 1976 and the reservoir emptied by January 31st 1977. The scouring gate was closed in February 23rd 1977 and by March 14th the reservoir was filled to spillway crest. Overflow over the spillway crest lasted from March 14th to June 23rd 1977. Irrigation releases lowered the water level in the dam, but increased inflow raised the water level again to spillway crest. Overflow continued from July 6th July - 9th 1977.

TABLE VI—17 **HYDROLOGY FOR 1977**

Item No	Description	Quantity m^3	% of storage capacity
1	Initial amount in storage	Empty	—
2	Inflow during the year	3 016 000	773
3	Total release	120 000	30.77
4	Leakages	106 000	27.18
5	Evaporation	40 000	10.26
6	Overflow	360 000*	92.31
7	Final amount in storage	Empty	—
8	Minimum quantity in storage (October 1977)	88 000	22.56

9	Storage capacity	390 000	100.00
10	Flow through scouring gate **	2 000 000	512.82

* The dam scouring gate was open in the period January to February 23rd 1977.

** Estimated

The smallest quantity ever remained in the reservoir during the irrigation season, was 88,000 m^3 and occurred in October 13th 1977. The scouring gate of the dam was opened again in December 29th 1977.

Water Utilization

During the year under review, a total quantity of 164,096 m^3 of water was utilized for the irrigation of 435 donums of deciduous plantations in the project area. The plantations are mainly apple trees, pear trees and peach trees. Part of the water utilized was taken from the seepages collected downstream in a collection weir. See Table VI—18 for water utilization.

TABLE VI—18 **WATER UTILIZATION**

Item No	Water Utilization	Quantity m^3	% of storage capacity
1	Water used for irrigation	164 096	42.08
2	Water used for recharge	NIL	NIL
3	Total water utilized	164 096	42.08

Water Sale, Income, Operation and Maintenance costs

From the sale of water the gross income during the year under review, was £2,953. Operation expenses, including attendant and water man wages and travelling claims, amounted to £1,503. Maintenance expenses, including the erection of a new ware house, were £1,075. Net income to the project amounted to £376. Details on these are shown on Tables VI—19 and VI—20.

TABLE VI—19 **CROP IRRIGATED**

Ser No	Crop	1st period donums	2nd period donums	Total Area donums
1	Citrus	—	—	—
2	Bananas	—	—	—
3	Vines	—	—	—
4	Deciduous	435	435	435
5	Vegetables	—	—	—
6	Potatoes	—	—	—
7	Cereals	—	—	—
	Total	435	435	435

TABLE VI—20
INCOME AND EXPENDITURE DATA

Item No	Item Description	Quantity m^3	Amount £
1	Water sold at nominal rates	164 096	2 953
2	Water sold at reduced rates	NIL	NIL
3	Water given free of charge	NIL	NIL
4	Total quantity utilized and gross income	164 096	2 953
5	Operation cost		1 503
6	Maintenance cost		1 075
7	Net income		376

Project Operation Data for the Last two Years

Table VI—21 shows the operation data for the last two years. The amount of water utilized for irrigation, has increased by 23.3% where the area irrigated has remained the same. The increase was mainly due to the plantations grown in age and increase in water requirements.

The increase in the maintenance cost was due largely to the erection of a ware house. The operational costs were up by 31.84%. The water utilization in the project area seems satisfactory although further increase of the quantity utilized may be expected.

TABLE VI—21 **DATA ON PROJECT FOR THE LAST TWO YEARS**

Item No	Description	Unit	1976	1977	% charge on 1976
1	Capacity	100 m^3	390	390	Nil
2	Water in storage	"	390	390	Nil
3	Water utilized for irrigation	"	133	164	+23.3
4	Water sold	"	133	164	+23.3
5	Water given free	"	Nil	Nil	Nil
6	Water used for recharge	"	Nil	Nil	Nil
7	Gross income	£	2 398	2 954	+23.18
8	Operation cost	£	1 140	1 503	+31.84
9	Maintenance cost	£	433	1 075	+48.27
10	Total expenses	£	1 573	2 578	+63.89
11	Net income	£	825	376	—54.42
12	Area irrigated	Donums	435	435	Nil

KITI DAM

General

The Kiti dam irrigation project consists of a dam reservoir of storage capacity 1,610,000 m^3 and a distribution system, made of open canals commanding an area of approximately 6,200 donums in the Kiti, Perivolia and Tersephanou villages. Irrigation in the project area started in mid February and ended in March 24th, when all water available was utilized. A total of 72,460 cubic meters of water were sold at a rate of 10 mils/m^3 for the irrigation of approximately 170 donums of seasonal crops, mainly potatoes, carrots and ladies fingers. The gross income amounted to £724 whereas the operation expenses were £100.

The maintenance expenses of the dam and distribution system were of the order of £842. The project presents a negative income of £218.

The dam was empty by the end of March and was completely dry until December 1977, when inflow started again. A total quantity of 70,000 m^3 was collected, out of which 51,000 m^3 were released for recharge downstream where the rest 19,000 m^3 seeped under the dam embankment and recharged the gravel aquifer.

Project Hydrology

The project hydrologic data as recorded during the year under review are shown in Table VI—22. ,

Inflow to the reservoir occurred in January, February and March in intermitent periods. Maximum amount in storage ever reached was 250,000 m^3 in January.

Water from the reservoir was lost, either in the form of evaporation or seeped through the Meneou and Bekir Pasha chains of wells to recharge the aquifers south and east of the reservoir.

Late in December, the water collected in the reservoir, was released to recharge the aquifer downstream. The water was released in small quantities in the recharge works to allow proper recharging.

TABLE VI—22
KITI DAM — HYDROLOGY FOR 1977

Item No	Description	Quantity m^3	% of storage capacity
1	Initial amount in storage	NIL	—
2	Inflow during the year	258 479	22.28
3	Total release	72 460	6.25
4	Leakages	169 019	14.57
5	Evaporation	17 000	1.46

6	Overflow	NIL	—
7	Final amount in storage	NIL	—
8	Minimum quantity in storage (March — December 1977)	NIL	—
9	Storage capacity	1 160	100.00

Water Utilization and Crops Irrigated

Irrigation in the project area, lasted for 40 days and during this period, a total quantity of 72,400 m^3 of water was utilized. This quantity irrigated approximately 170 donums of seasonal early crops as shown on Tables VI—23 and VI—24.

TABLE VI—23
KITI DAM — WATER UTILIZATION

Item No	Description	Quantity m^3	% of storage capacity
1	Water used for irrigation	72 460	6.25
2	Water used for recharge	169 019	14.57
3	Total water utilized	241 479	20.82

TABLE VI-24 KITI DAM - CROPS IRRIGATED

Ser No	Description	1st period donums	2nd period donums	Total Area donums
1	Citrus	NIL	NIL	NIL
2	Bananas	NIL	NIL	NIL
3	Vines	NIL	NIL	NIL
4	Deciduous	NIL	NIL	NIL
5	Vegetables	110	—	110
6	Potatoes	60	—	60
7	Cereals			
	Total	170	—	170

Water Sale, Income, Operation and Maintenance Cost

From the sale of water, the gross income amounted to £742 where the operation cost was £100. The maintenance cost was £842. Net income amounted to a loss of £218. Details regarding water sale and cost, are shown on Table VI—25.

TABLE VI—25 **KITI DAM — INCOME AND EXPENDITURE DATA**

Item No	Item Description	Quantity m^3	Amount £
1	Water sold at nominal rates	72 460	724
2	Water sold at reduced rates	NIL	NIL
3	Water given free of charge	NIL	NIL
4	Total quantity utilized and gross income	72 460	724
5	Operation cost	—	100
6	Maintenance cost	—	842
7	Net income	—	-218

Project Operation Data for the Last two Years

Table VI—26 shows data on the operation of the project for the last two years. There can be no comparison of the data since the water inflow to the reservoir is not steady and dependable. However, comparison of the figures for the last two years, show that the amount of water in storage, the water sold or utilized and the area irrigated, have reduced tremendously. The operation cost showed a decrease by 79% where the maintenance costs were down by £1,887 or 69%.

Generally, the picture does not seem very promising. However, with the new method of operation introduced later in December, 1977, the aquifer downstream the dam is expected to recover with beneficial effects on the project area as a whole.

TABLE VI—26 **KITI DAM — DATA ON PROJECT FOR THE LAST TWO YEARS**

Item No	Description	Unit	1976	1977	% charge on 1976
1	Capacity	1000m³	1 160	1 160	NIL
2	Water available	"	212	258	—17.3
3	Water utilized for irrigation	"	212	72	—66
4	Water sold	"	212	72	—66
5	Water given free	"	NIL	NIL	NIL
6	Water used for recharge	"	100	169	+69
7	Gross income	£	2 116	720	—66
8	Operation cost	£	486	100	—79
9	Maintenance cost	£	2 729	842	—69
10	Total expenses	£	3 215	942	—70
11	Net income	£	—1 099	—218	—80
12	Area irrigated	Donums	500	170	—66

PROJECT HYDROLOGY

General

The Lefkara dam project is a dual purpose project, mainly for the supply of Domestic Water to the Famagusta town and partly for the irrigation for agricultural land downstrem the dam. The dam consists of (a) a dam reservoir whose capacity is 13.85 MCM (the largest in Cyprus), (b) a distribution system (piped) for the supply of irrigation water to an area of approximately 615 donums, (c) a feeder pipeline and (d) a domestic water treatment plant near Khirokitia and the pipeline to Famagusta town.

As a result of the Turkish invasion and the occupation of the Famagusta town, the reserved water for Famagusta has been utilized to supply water to the Larnaca and Famagusta towns, other villages and refugee camps en route to Famagusta, whose population has been greatly increased or created from the regugees who were expelled by the occupation army.

This part of the report will deal only with the dam reservoir and water utilization for irrigation and water supply in general where details, regarding domestic water supply will be given in the section dealing with domestic water supply.

From the sale of irrigation water, the gross income for 1977 amounted to £650. Maintenance works were carried out at a total cost of £1,045.

PROJECT HYDROLOGY

The project hydrologic data as recorded during the year under review, are tabulated in Table VI—27.
The water in dam reservoir did not reach spillway crest but remained much lower with quantity in storage around 7,530 000m³ or 54.37% of the total capacity. The average inflow to the dam reservoir during the year, was estimated to be 1,593,177 m³. The minimum water level reached, occurred in December with minimum quantity in storage, estimated at 5,263,419 m³.

TABLE VI—27 **LEFKARA DAM — HYDROLOGY DATA FOR 1977**

Item No	Description	Quantity m³	% of storage capacity
1	Initial amount in storage	6 367 721	45.98
2	Inflow during the year	1 593 177	11.50
3	Total release	2 123 852	15.33
4	Leakages	40 423	0.29
5	Evaporation	533 204	3.85
6	Overflow	NIL	NIL
7	Final amount in storage	5 304 780	38.30
8	Minimum quantity in storage (December 1977)	5 263 419	38.00
9	Storage capacity	13 850 000	100.00

Water Utilization

As stated before the Project was built mainly for the supply of domestic water and in less extent to provide irrigation water for an area of 615 donums downstream the dam structure. The water utilization for the two main categories of use is as shown on Table VI—28.

TABLE VI—28 **WATER UTILIZATION**

Serial No	Description	Quantity m^3	storage capacity
1	Domestic water use	2 057 680	14.86
2	Irrigation use	65 023	0.47
3	Losses in pipe breakage	1 149	
	Total	2 123 852	15.33

Crops Irrigated

The distribution system of the Lefkara irrigation project is still under construction. However, there has been a relative agricultural activity in the area and during the year under review, a total of 200 donums of land has been irrigated by using 65 023 m^3 of water. The area was planted with citrus, potatoes and vegetables as shown in Table VI—29.

TABLE VI—29 **LEFKARA DAM PROJECT IRRIGATED CROPS**

Serial No	Crop	Area in donums
1	Citrus	85
2	Vegetables	115
	Total	200

There has been intercropping in the citrus plantation since the trees are very young.

Water Sale Income

The water was sold either for irrigation or domestic use at the fixed rates. Details on water sale for domestic purposes are given in the section on Domestic water supply.
The irrigation water was sold at rate of 10 mils/m^3 and the total income from the sale of irrigation water amounted to £650.

Project Operation Data for the Last Two Years

Table VI—30 shows some important data concerning the hydrology and operation of the Lefkara dam project.

TABLE VI—30 **PROJECT OPERATION DATA FOR THE LAST TWO YEARS**

Serial No	Description	Unit	1976	1977	% change on 1976
1	Capacity	1000m^3	13 850	13 850	Nil
2	Water available *	"	8 295	7 961	— 4.0
3	Water utilized for irrigation	"	16	65	+306.0
4	Water utilized for domestic WS	"	1 365	2 058	+50.8
5	Total water utilized	"	1 381	2 123	+53.7
6	Inflow (estimated)	"	4 660	1 593	—65.8
7	Area irrigated	Donums	30	200	+566.6

* This is the gross quantity available.

From the table it is shown that the quantity of water both for irrigation and domestic water supply has increased by 30% in the first case and 50.8% in the second case. In total the increase has been up by 53.7%. Also the area under irrigation has been increased which indicates the interest of the land holder in the area. The decrease in the inflow of water was

due mainly to the weather conditions which were not favourable.

MAVROKOLYMBOS PROJECT

General

The Mavrokolymbos dam irrigation project consists of a dam reservoir of capacity 2,180 MCM at spillway crest and a distribution system of canal and pipes commanding an area of approximately 3,355 donums. Further to the dam, four boreholes in the Potima area were drilled and equipped with diesel engines and turbine pumps for supplying water to the project area, in case of water shortage. These boreholes were drilled in 1977 and they were put into operation in the period August — December 1977.

Irrigation in the project area commenced early in January 1977 and continued throughout the year and was terminated late in December.

During this period a total quantity of 619,268 m^3 (released from the dam and pumped from the boreholes) of water was utilized for the irrigation of 520 donums of bananas, vines and vegetables under cover and in the open. Of the 619,268 m^3 utilized 529, 079^3 was sold at nominal rates where the rest 90,173 m^3 was given free of charge to the Potima Chiftlik farmers as water rights.

The total gross income from the sale of water amounted to £8,919 where the operation cost, including turbine pump power cost, amounted to £6,224. The maintenance expenses were £1, 184 thus reducing net project income to £1,511.

Project Hydrology

The project hydrologic data including borehole data as recorded during the year under review are tabulated on Table VI—31.

Inflow to the dam in the year 1977 was very limited only 15.68% of the reservoir capacity and this called for the implementation of the emergency pumping scheme in the Potima Chiftlik area. Part of the irrigation water was supplied from the boreholes emergency pumping scheme.

TABLE VI—31
MAVROKOLYMBOS — HYDROLOGY FOR 1977

Item No	Description	Quantity m^3	% of storage capacity
1	Initial amount in storage	312 000	14.31
2	Inflow during the year	342 000	15.68
3	Total release	486 000	22.29
4	Leakages	—	—
5	Evaporation	68 000	3.11
6	Overflow	NIL	NIL
7	Final amount in storage	100 000	4.59
8	Minimum quantity in storage (December 1977)	100 000	
9	Storage capacity	2 180 000	100.00
10	Water pumped from boreholes	161 268	7.38

Water Utilization and Crops Irrigated

During the irrigation season a total of 619,268 m^3 of water was utilized for the irrigation of 520 donums of various crops as shown on Table VI—32 and Table VI—33.

TABLE VI—32 — **WATER UTILIZATION**

Item No	Water utilization	Quantity m^3	% of storage capacity
1	Water used for irrigation	619 268	28.40
2	Water used for recharge	NIL	

3	Total water utilized	619 268	28.40

TABLE VI—33 **CROPS IRRIGATED**

Ser No	Crop	1st period donums	2nd period donums	Total Area donums
1	Citrus	—	—	
2	Bananas	150	150	150
3	Vines	40	40	40
4	Deciduous	—	—	
5	Vegetables	120	120	330
6	Potatoes	—	—	—
7	Cereals	—	—	—
	Total	310	400	520

Water Sale, Income, Operation and Maintenance costs

From the sale of water both from the dam and the boreholes the gross income amounted to £8,919. The water sold from the dam reservoir was at nominal rates 10 and 15 mils/m^3 where the pumped water was sold at 25 mils/m^3. The operation expenses including the operation costs for the four boreholes amounted to £6,224 where the maintenance works costs were £1,184. Net income to the project was only £1,511. Details regarding the income, expenditure and operational costs are shown on Table VI—34 and Table VI—35.

TABLE VI—34
INCOME AND EXPENDITURE DATA

Item No	Item description	Quantity m^3	Amount £
1	Water sold at nominal rates	529 075	8 919
2	Water sold at reduced rates	NIL	NIL
3	Water given free of charge	90 193	NIL
4	Total quantity utilized and gross income	619 268	8 919
5	Operation cost		6 224
6	Maintenance cost		1 184
7	Net income		1 511

TABLE VI—35
OPERATION COST BREAKDOWN

Item No	Description	Amount £
1	Water men	2 223
2	Pump attendants	928
3	Diesel and lubricating	1 756
4	Pump installation	1 114
5	Miscellaneous	200

Generally there was a decrease in the amount of water utilized due to water shortage. The area irrigated was also reduced where the operation costs have gone up by 139%. This was due to the operational costs of the pumps as given in Table VI—35.

The problem of water shortage for the project is expected to be solved after the completion of the Paphos project.

TABLE VI—36 **DATA ON PROJECT FOR THE LAST TWO YEARS**

Item No		Unit	1976	1977	% change on 1976
1	Capacity	1000m^3	2 180	2 180	Nil
2	Water available	"	1 294	586	
3	Water utilized for irrigation	"	1 462	619	—57.66
4	Water sold	"	1 275	529	—58.51
5	Water given free	"	186	90	—51.61
6	Water used for recharge		Nil	Nil	
7	Gross income	£	15 364	8 919	—41.95
8	Operation cost	£	2 595	6 224	+139.84
9	Maintenance cost	£	73	1 184	+1522.00
10	Total expenses	£	2 668	7 408	+177.66
11	Net income	£	12 696	1 511	—88.09
12	Area irrigated	Donums	1 983	520	—73.77

PALEKHORI DAM PROJECT

The Palekhori irrigation project is a contributory project and consists of a concrete gravity dam whose reservoir capacity is 620,000 m^3 and the distribution system made of canals and pipes commands an area of approximately 1,000 donums.

Irrigation in the project area started early in March and continued through the year until the end of November 1977 when the water in the reservoir was exhausted. A total of 620,000 m^3 of water was utilized for the irrigation of approximately 1,000 donums of deciduous fruit trees, potatoes and vegetables.

Evaporation losses amounted to 50, 000 m^3.

Since the project is a contributory one the water was given free of charge and the management and operation costs were paid by the farmers through their Irrigation Division Committee. No maintenance works were carried on the project since works on the construction of the distribution system are still going on.

POMOS PROJECT

General

The Pomos irrigation project is composed of a dam reservoir of maximum capacity at spillway crest of 860,000 m^3 of water and a distribution system made of a main canal and a closed type distribution system commanding an area of 2,850 donums.

Irrigation in the project area started early in January 1977 and continued throughout the year until early in December 1977. An area of 567 donums, of land planted with citrus, bananas and vegetables was irrigated by utilizing 1,016,635 m^3 of water.
From the total water utilized, 804,000 m^3 were taken directly from the dam reservoir where the remaining 212,000 m^3 were taken from the overflow occurring in the period January the 6th — May the 21st 1977.

The total gross income from the sale of water amounted to £9,081. The expenditure for the maintenance was £1,087 where the operation and management costs were £2,813. Net income to the project for the year under review was £5,181.

Project Hydrology

The project hydrologic data as recorded during the year are tabulated in

TABLE VI—37

POMOS DAM — HYDROLOGY FOR 1977

Item No	Description	Quantity m^3	% of storage capacity
1	Initial amount in storage	751 000	87.32
2	Inflow during the year	2 530 000	294.29
3	Total release	804 000	93.49
4	Leakages	160 000	18.60
5	Evaporation	79 000	9.19
6	Ouerflow	1 907 000	221.74
7	Final amount in storage	331 000	38.49
8	Minimum quantity in storage (November 1977)	172 000	19.99
9	Storage capacity	860 000	100.

The reservoir was filled to spillway crest in January the 6th and overflow occurred during the period January the 6th to May 21st 1977. Minimum water level in the reservoir occurred in November with water in storage in the order of 172,000 m^3.

Water Utilization and Crops Irrigated

The 1,016,635 m^3 of water were utilized for the irrigation of 567 donums

within the project area. Details about the water utilized and the crops irrigated are shown on Tables VI-38 and Table VI-39.

TABLE VI—38
POMOS DAM — WATER UTILIZATION

Item No	Description	Quantity m³	% of storage capacity
1	Water used for irrigation	1 016 635	118.21
2	Water used for recharge	—	—
3	Total water utilized	1 016 635	118.21

TABLE VI—39
POMOS DAM — CROPS IRRIGATED

Serial No	Crop	1st period donums	2nd period donums	Total Area donums
1	Citrus	134	134	134
2	Bananas	285	285	285
3	Vines	—	—	—
4	Deciduous	8	8	8
5	Vegetables	120	20	140
6	Potatoes	—		—
7	Cereals	—		—
	Total	547	447	567

Water Sale, Income, Operation and Maintenance Costs

From the sale of water (see details on Table VI—40) the total gross income amounted to £9,081 whereas the operation and management costs were £2,813. Maintenance works on the dam and distribution system were £1,087. Net income to the project for the year under review amounted to £5,181.

TABLE VI—40 **POMOS DAM — INCOME AND EXPENDITURE DATA**

Item No	Description	Quantity m³	Amount £
1	Water sold at nominal rates	803 693	8 019
2	Water sold at reduced rates	212 942	1 062
3	Water given free of charge	NIL	
4	Total quantity utilized and gross income	1 016 638	9 081
5	Operation cost	—	2 813
6	Maintenance cost	—	1 087
7	Net income	—	5 181

Project Performance Data for the Last Two Years

Table VI—41 shows data regarding hydrologic, water utilization, water sales, gross income, operation, maintenance costs, net income and areas irrigated for the last two years.

The last column of the table shows the change in percentages of the quantities of 1977 over the previous years.

The quantity of water utilized for irrigation has increased by 7.5% where the gross income has risen by 14.4%. However the area irrigated was reduced by 5.1% and this was mainly due to the increase of the area under permanent crops ie bananas from 228 donums to 285 donums and citrus from 81 donums to 134 donums. The area under vegetables reduced tremendously (almost half that of the previous year) where no cereals were irrigated as was the practice in the past.

The operational costs were reduced by 12.6% where the maintenance cost increased by almost £800 or by 269%. Total expenses were up by £400 or by 11%. However the total net income increased by £745 or by 17%.

Generally the project water has been utilized satisfactorily.

TABLE VI—41 **POMOS DAM — DATA ON PROJECT FOR THE LAST TWO YEARS**

Item No		Unit	1976	1977	% change on 1976
1	Capacity	.....	860	860	
2	Water in storage		860	1 188	
3	Water utilized		946	1 017	+7.5
4	Water sold	.....	946	1 017	+7.5
5	Water given free		—	NIL	—
6	Water used for recharge	.....	NIL	NIL	—
7	Gross income	....	7 939	9 081	+14.4
8	Operation cost		3 218	1 813	—12.6
9	Maintenance cost		294	1 087	+269.0
10	Total expenses		3 512	3 900	+11.0
11	Net income	.....	4 427	5 181	+17.0
12	Area irrigated		597	567	—5.1

YERMASOYIA — POLEMIDHIA PROJECT

General

The Yermasoyia — Polemidhia Irrigation Project consists of the Yermasoyia dam, the reservoir of which has a capacity of 13.5 MCM and the Polemidhia dam with reservoir capacity in the order 3.43 MCM. Total storage capacity of the combined project is 16.93 MCM. The distribution system of the project consists of closed conduits now commanding an area of about 11,050 donums but further extensions now under construction in the areas Trakhoni and Ypsonas are to add another 4,390 donums within the project perimetry.

Irrigation in the project area started early in January 1977 and continued throughout the year until late in December 1977. A total quantity of 5,494,827 m^3 of water was utilized from both dams (5,168,457 m^3 from Yermasoyia dam and 326,370 m^3 from the Polemidhia dam) for the irrigation of 10,050 donums (partial or full) in the Zakaki, Phasouri, Akrounda — Phinikaria areas and Yermasoyia and Polemidhia Irrigation Divisions Of the 5,494,000 m^3 of water 488,040 m^3 was given free of charge as water rights to the Yermasoyia and Polemidhia Irrigation Division (101,000 m^3 for Kato Polemidhia Irrigation Division and 387,040 m^3 for the Yermasoyia Irrigation Division) and 672,414 m^3 was given at reduced rates as overflow.

Overflow occurred only from the Yermasoyia dam in the period February 5th to April 9th and from April 13th to May 15th 1977 and the total quantity was 2,632,500 m^3 of water. All of this water recharged the Yermasoyia aquifer downstream the dam structure. This aquifer is pumped for the supply of domestic water to the Limassol town.

Total gross income from the sale of water amounted to £60,011 where the operating costs including power expenses amounted to £20,767. The maintenance works carried out by the WDD were of the order of £1,190 details on which are given in the next part of this chapter.

Project Hydrology

The project hydrologic data as recorded during the year under review are tabulated in the following tables. The data for each dam reservoir is given separately.

Polemidhia Dam

The inflow to the Polemidhia dam during the year under review totalled 955,920 m^3 representing 27.87% of the reservoir capacity. The reservoir did not fill to spillway crest. Leakages occurred through the dam and part of these were intercepted down-

stream for irrigation purposes. Releases from the dam reservoir were only 186,370 m^3 where the total water utilized for irrigation and recharge amounted to 647,753 m^3. As is seen most of the leakage water was intercepted for irrigation (See Table below).

TABLE VI—42
POLEMIDHIA DAM — HYDROLOGY FOR 1977

Item No	Description	Quantity	% of storage
1	Initial amount in storage	521 000	15.18
2	Inflow during the year	955 920	27.87
3	Total release	186 370	5.43
4	Leakages	461 383	13.45
5	Evaporation	149 846	4.37
6	Overflow	NIL	
7	Final amount in storage	536 000	15.63
8	Minimum quantity in storage (November 1977)	379 000	1.10
9	Storage capacity	3 430 000	100

Yermasoyia Dam

The inflow to the dam during the year under review was estimated at 8,424,000 m^3 mostly occurring in the months of January to July and in December. Out of this inflow 2,632,500 m^3 overspilled and recharged the aquifer downstream. Overflow took place over a period of four months February to May 1977 (see Table VI—43).

TABLE VI—43
YERMASOYIA DAM — HYDROLOGY FOR 1977

Item No	Description	Quantity m^3	% of storage capacity
1	Initial amount in storage	10 625 000	78.70
2	Inflow during the year	8 424 000	62.40
3	Total release	5 168 500	38.28
4	Leakages	—	NIL
5	Evaporation	1 596 000	11.82
6	Overflow	2 632 500	19.50
7	Final amount in storage	8 440 000	62.52
8	Minimum quantity in storage (November 1977)	7 430 000	55.04
9	Storage capacity	13 500 000	100

Water Utilization from Both Dams

Details regarding water utilization from both dams separately and in combine are shown on Tables VI—44 and VI—45. In summary during the year under review a total quantity of 8,448,710 m^3 of water was utilized for irrigation and recharge purposes. Out of this quantity 5,494,827 m^3 was utilized for the irrigation (fully or in part) of 10,050 donums as indicated in Table VI—46. The rest 2,953,673 m^3 was utilized to recharge the Garyllis and Yermasoyia aquifers downstream both dams.

TABLE VI—44
POLEMIDHIA DAM — WATER UTILIZATION

Item No	Water utilization	Quantity m^3	% of storage capacity
1	Water used for irrigation	326 370	9.51
2	Water used for recharge	321 383	9.37
3	Total water utilized	647 753	18.88

TABLE VI—45
YERMASOYIA DAM — WATER UTILIZATION

Item No	Water utilization	Quantity m^3	% of storage capacity
1	Water used for irrigation	5 168 457	38.28

2	Water used for recharge (Overspilled and recharged D/S aquifer)		
3	Total water utilized	7 800 957	57.78

TABLE VI—46 **YERMASOYIA — POLEMIDHIA PROJECT — IRRIGATED CROPS**

Ser No	Crop	Area donums
1	Citrus	5 100
2	Vines	1 700
3	Desiduous	130
4	Vegetables	3 100
5	Olive trees	20
	Total	10 050

Water Sale, Income, Operation and Maintenance Costs

Details about the quantity sold at the nominal rates, water given free of charge as water rights and the water given at reduced rates are given in Table VI—47.

TABLE VI—47 **YERMASOYIA — POLEMIDHIA PROJECT — WATER UTILIZATION**

Ser No	Description	Quantity m³	% of storage capacity
1	Water used for irrigation (Y & P)	5 494 827	32.46
2	Water used for recharge of Garyllis aquifer	321 383	1.90
3	Water used for recharge of Yermasoyia aquifer	2 632 500	15.55
4	Total water utilized	8 448 710	49.90

From the sale of water the total gross income was £60,011. The operation cost, including power cost for the Akrounda — Phinikaria pumping station totalled £20,767 where the maintenance costs spent on routine works was £1,734. Details regarding income and expenditure data are shown on Table VI—48.

TABLE VI—48 **YERMASOYIA — POLEMIDHIA PROJECT — INCOME & EXPENDITURE DATA**

Ser No	Description	Quantity m³	Amount £
1	Water sold at nominal rates	4 334 373	57.994
2	Water sold at reduced rates	672 414	2 017
3	Water given free of charge as water rights to:		
	—Yermasoyia Irr Division	387 040	—
	—Polemidhia Irr Division	101 000	—
4	Total quantity and income	5 494 827	60 011
5	Operational cost	—	14 817
6	Power cost (Akrounda-Phinikaria)	—	5 950
7	Maintenance cost		
	—Yermasoyia £1 190	—	1 734
	—Polemidhia £ 544		
8	Total cost	—	22 501
9	Net income	—	37 510

Project Operation Data for the Last Two Years

Table VI—49 shows data on the operation of the project (Yermasoyia — Polemidhia) for the last two years. The last column indicates the changes of data (in percentage) with respect to the year 1976.

Of major importance to be noted are the following:

There has been an increase of the quantity of water utilized for irrigation. Compared with 1976 figures the increase has been up by 48.67%. The gross income has been increased by 61.62%. However there has been an

increase of the operation cost by 127.60% and that of the power cost by 61.88%.

The increase of the quantity of water utilized for irrigation was due mainly to the completion of the Zakaki and Phasouri extensions. The increase of cost in power was a result of the increase of quantity being pumped (last year was only 46,903 m^3 where this year this quantity increase to 172,264 m^3 (Cost of pumped, water 34.5 mils/m^3) for 1977 and 48.4 mils/m^3 for 1976). Obviously the cost per meter cube of water pumped has reduced by 28.7% and this will be reduced even further with the change of the contract conditions of the Power Supply.

The increase in cost of the operating costs was a result of an appointment of Director of the Project and the necessary personnel, fully paid by the Management Committee.

TABLE VI—49 **YERMASOYIA — POLEMIDHIA PROJECT — DATA ON PROJECT FOR THE LAST TWO YEARS**

Ser No	Description	Unit	1976	1977	% change on 1976
1	Capacity	1000m^3	16 930	16 930	—
2	Water available	"	15 230	18 780	—1.67
3	Water utilized for irrigation	"	3 696	5 495	+48.67
4	Water sold	"	3 135	5 007	59.71
5	Water givenfree	"	562	488	—13.16
6	Water used for recharge	"	816	2 954	—
7	Total quantity used	"	4 512	8 449	+87.26
8	Gross income	£	37 131	60 011	+61.62
9	Operation cost	"	6 510	14 817	+127.60
10	Power cost	"	2 272	5 950	+161.88
11	Maintenance cost	"	966	1 734	+79.50
12	Total expenditure	"	9 748	22 501	+130.83
13	Net income	"	27 383	37 510	+36.98
14	Area irrigated	Donums	10 050	10 050	NIL

DETAILS OF MAINTENANCE WORKS ON GOVERNMENT IRRIGATION PROJECTS

Argaka Magounda: Cleaning of enbankment from wild vegetation and spillway from stones and driftwood. Painting of all metal structures. Treating of bridge woodworks with solignum. Removing of avalanched rocks from access road of guard house. Painting of 250 manhole covers and maintaining distribution system sluice valves and water meters.

Expenditure for Dam	£502
" " Distribution	£250
Total	£752

Athalassa: No works carried out.

Polemidhia: Painting and maintaining of winch and diesel engine of penstock. Painting of bridge and railings. Painting and maintaining of all manhole covers sluice valves and air valves.

Expenditure for Dam	£175
" " Distribution	£369
Total	£544

Pomos: Cleaning of embankment and drains from wild vegetation. Painting of all metal structures. Treating of woodwork of bridge with solignum.

Maintaining and painting of winch. Slabbing of 150 m. length of RCC channels. Filling up of joints with guttaterna. Replacing of 10 sluice valves and maintaining of all valves of the systems.

Expenditure for Dam	£ 351
" " Distribution	£ 736
Total	£1 087

Yermasoyia: Painting of radial gates, bouyancy tanks and all other metal structures. Maintenance of the Phinikaria booster pump. Maintaining and painting of all sluice valves air valves and manhole covers.

Expenditure for Dam	£ 946
" " Distribution	£ 244
Total	£1 190

MAINTENANCE OF GOVERNMENT IRRIGATION PROJECTS

General

During the year under review routine maintenance works were carried out in all major and minor government irrigation project structures. Routine works included the following:

—painting of metal structures
—removing of wild vegetation from embankment
—maintenance of access roads
—cleaning of channels and their structures
—cleaning and repairing of sluice valves
—maintenance and repair of water meters

A total of £5,346 was spent for the maintenance of the dam structures and £2,713 was spent for the maintenance of the distribution systems. A summary of the cost for each individual project is shown in Table VI—50. Details of the maintenance works is presented in the next section.

MAINTENANCE OF CONTRIBUTORY IRRIGATION PROJECTS

The maintenance of contributory irrigation projects constructed under the Irrigation Division Law is the responsibility of the Water Development which provides the skilled and qualified personnel. The Government carries two thirds of the costs where the irrigation division, pay the rest one third.

During the year under review, a total of £1,523 were spent for maintenance works of contributory schemes out of which £1,016 were paid by the Government and the rest £507 paid by the respective irrigation divisions. A summary of the maintenance cost is shown on Table VI—51 where details of the maintenance works carried out on each individual project are given below:

TABLE VI—50 **MAINTENANCE EXPENSES FOR GOVERNMENT IRRIGATION PROJECTS**

Ser No	Project	Dam	Distr. system	Total	Remarks
1	Argaka — Magounda	502	250	752	
2	Athalassa	—	—	—	No works
3	Ayia Marina	200	140	340	
4	Kalopanayiotis	993	83	1 075	
5	Kiti	391	451	842	
6	Lefka	—	—	—	No works
7	Lefkara	1 045	NIL	1 045	
8	Masari	—	—	—	Under Turkish occupation
9	Mavrokolymbos	743	441	1 184	
10	Polemidhia	175	369	544	
11	Pomos	351	736	1 087	
12	Syngrasi	—	—	—	Under Turkish occupation
13	Yermasoyia	946	244	1 190	
	Total	£5 346	£2 713	£8 059	

TABLE VI—51 **MAINTENANCE EXPENSES** OF CONTRIBUTORY PROJECTS

No	Project	Expenditure Govt.	Contr.	Total
1	Agros dam	141	71	212
2	Arakapas dam	39	19	58
3	Kalokhorio (Klirou) dam	89	44	133
4	Kyperounda pond	186	93	279
5	Palekhori dam	36	18	54
6	Prodhromos reservoir	337	168	505
7	Pyrgos dam	188	94	282
Total		1 016	507	1 523

Contributory Irrigation Projects Maintenance Expenses

Agros dam: Repairing of float switch and cleaning of collector reservoir of pumping unit. Repairing of main irrigation meter. Constructing of a 15m X 2.75m X 0.46m concrete protective wall.

Government contribution	£141
Village contribution	£ 71
Total	£212

Arakapas dam: Treating of all underwater metal structures with Evode.

Government contribution	£39
Village contribution	£19
Total	£58

Kalokhorio (Klirou) Dam: Repairing of broken axle — Boring of the dam structure and installing of a permanent 6" dia. sluice valve drain.

Government contribution	£ 89
Village contribution	£ 44
Total	£133

Kyperounda pond: Repairing of eroded embankment — Placing of damped rip-rap.

Government contribution	£186
Village contribution	£ 93
Total	£279

Palekhori dam: Treating of all underwater metal structure with Evode.

Government contribution	£36
Village contribution	£18
Total	£54

Prodhromos reservoir: Cleaning of reservoir from dumped stores and debris. Repairing of rip-rap. Installing of a 6" dia. and 4" dia sluice valves on main outlet and washout respectively. Installing of a metric water level indicator. Painting of all manhole covers and valves. Installing of an air valve housed in concrete manhole, on the "Cemetery" main irrigation line.

Government contribution	£337
Village contribution	£168
Total	505

Pyrgos dam: Emergency repairs to outlet system. Constructing of 4 irrigation ports. Replacing of 75 irrigation gates. Painting of all manhole covers. Repairing of breakages of RCC channels.

Goverrntment contribution	£188
Village contribution	£ 94
Total	£282

OPERATION AND MAINTENANCE OF TOWN WATER SUPPLY

INTERNATIONAL WATER SUPPLY ASSOCIATION

During the year under review the activities of the Cyprus National Committee were mainly the exchange of correspondence with the IWSA.

Management of Water Supplies

The Management, Operation and Mainntenance of schemes supplying water to Nicosia, Famagusta, Larnaca Towns and to several Communities

and Refugee Camps, mainly situated in Famagusta and Larnaca Districts, compose the activities of this Branch of the Operation and Maintenance Division of the Department.

Other than Nicosia, where restrictions in the supply of water were imposed during summer months, demands were met satisfactorily, thanks to Famagusta Water Supply Project and a regular supply could be maintained. More details are given in the following chapters.

Greater Nicosia Scheme

A scheme designed to serve the suburban area of Nicosia Town has since its execution — in 1958 — been administered by Water Development Department on behalf of Cyprus Government. For some years now efforts are made to the direction of this Scheme be amalgamated with that under the administration of the Nicosia Water Board. Such amalgamation has not been materialized yet.

Though this scheme is an independant one, yet its sources were pumped in full in order to suffice both its consumers and provide at the same time water in "bulk" to the Nicosia Water Board with a view to minimizing as much as possible the shortage of water experienced in this Board's "area of supply". It should be stated, therefore, that water supply for the whole Nicosia and Suburbs is faced commonly and in this respect more particulars are given below.

The highest daily consumption in 1977 for Greater Nicosia Scheme "area of supply" was 16,400 m^3 on 11th July 1977 (under restrictions).
During the year under review, the distribution system of Greater Nicosia Scheme was extended by 975 m of 8" dia, 2,194 m of 6" dia and 556 m of 4" dia of asbestos pipes, laid mostly in Government Housing Estates around Nicosia. In addition 1,471 house connections were made bringing the total number of consumers to 14,929 by the 31st December 1977.
A statement showing expenditure and revenue for 1977 is given on Table VI—52.

Nicosia Town and Suburbs Water Supply

The ever increasing demand in water due to the inhabitation of Nicosia area by Greek Refugees and the increased consumption observed in the Turkish Sector of the Town, existing sources could not suffice requirements and restrictions to the supply were imposed on 27th April, 1977. The restrictions applied, provided a supply of 20 hours in every 48 hours to all consumers.

Though no exact records on population can be given, yet, it is believed that the number of people now residing in the area of Nicosia or otherwise supplied with water by the Authorities concerned amounts to 180—200 thousands, requiring 37,000—40,000 m^3 of water daily during summer months. The capacity of existing sources is only 25,000 m^3 daily under continuous pumping.

Apart from Morphou sources, all other existing ones are low yielding and considering the great difference between availability and requirements of water restrictions in the supply can only be avoided if a new reliable scheme were executed which could at least double the present available quantity.

The total quantity of water conveyed from all sources during the year 1977 reached the fiqure of 8,558,530 m^3 and

was distributed as follows:

Greater Nicosia Scheme "area of supply"	3 686 439 m³
Nicosia Water Board "area of supply"	3 979 083 m³
Nicosia Water Commission "Town within walls"	753 315 m³
Total	8 418 837 m³

The highest daily consumption for all "areas of supply" as detailed above, was 39,400 m³ (supply under restrictions) on 19th September, 1977.
Government had continued its efforts towards the supplementation of water supply to Nicosia and Suburbs as much as possible and a scheme providing the use of borehole No 2/76 near Kokkinotrimithia village was carried out. The yield of this borehole is conveyed to Strovolos Reservoir through an existing main pipeline, property of the Nicosia Water Board. Definitely, such schemes of comparatively small capacity do not solve the problem of Nicosia and Suburbs water supply and at last Government has adopted the planning of a major scheme which will provide water by damming of rivers in the Lefkara — Skarinou area. As a matter of fact a feasibility study for necessary securement of the services of Consulting Engineers to supervise designing and execution of the scheme.

Water Supply to Government Residences and Institutions

The supply of water for domestic use and irrigation to all Government Residences and Institutions was regular throughout the year.

Famagusta Water Supply

Water to Famagusta and Larnaca towns, several village authorities and refugee camps in both the Famagusta and Larnaca. District was supplied by the "Famagusta Water Supply Project"

Pumping "Vasilikos" source and boreholes in the area could meet demands until 31st May 1977 when the Khirokitia Treatment Plant was put in operation. By that time the water impounded into Lefkara Dam was 7,530,000 m³ representing 54% of the dam's capacity.

The total amount of water pumped and/or treated by this Project was 3,179,034 m³ including losses and was distributed as follows:

	Consumption by	m³
(a)	Famagusta	1 051 610
(b)	Larnaca Water Board	800 680
(c)	Regional Village Water Supplies	552 487
(d)	Local Irrigators	68 346
(e)	Refugee Camps	258 310
	Total	2 731 456

A statement showing expenditure and revenue of the Famagusta Water Supply Project for the year 1977 is given on Table VI—53,

Technical Advice

This branch offers technical advice to several Government and semi — Government Organizations, mainly to Water Boards, attending regularly respective meetings.

FACTS ABOUT EACH OF THE EXISTING WATER BOARDS AND BRIEF DESCRIPTION OF THEIR WATER SUPPLIES ARE OUTLINED BELOW:

Nicosia Water Board

Shortage of water is experienced and restrictions to the supply were imposed. Improvements to the distribution

system as recommended by the Consultants were in progress. Additional data are given below:

—The total quantity of water supplied was 2,521,414 m^3.
—The total quantity of water consumed as registered by area meters was 4,732,398 m^3 (including Nicosia Water Commission).
—The total maximum consumption per day (including Nicosia Water Commission) was 23,610 m^3 on 19. 9.77 (with restrictions).
—The total number of consumers on 31.12.77 was 15,986.
—Extension of distribution system was by:

16 m length of 6" dia
647 m length of 4" dia

—Total length of distribution system including extensions for 1977.

3 688 m of 12" dia
7 620 m of 10" dia
3 940 m of 8" dia
25 213 m of 6" dia
195 374 m of 4" dia

—The total number of hydrants installed in 1977 was 6.
—The total number of hydrants installed up to 31.12.77 was 885.

Limassol Water Board

Regular supply could be maintained through existing sources all over the year. Other useful information is:

—Total quantity of water supplied from all sources ..... 6 013 864 m^3
—Total quantity of water consumed as registered by area meters ..... 5 935 146 m^3
—Total maximum summer consumption in one day ..... 22 608 m^3
—Total number of consumers as at 31.12.77 ..... 20 989
—Extension of distribution system during 1977 was:

4 466 m of 4" dia
1 153 m of 6" dia
10 m of 8" dia

—Total length of distribution system (including extensions in 1977) 300 278
—Number of hydrants installed in 1977 26
—Total number of hydrants installed within "area of supply" 1 075

Famagusta Water Board

Since the Turkish occupation of this town, Cyprus Government has been supplying water, free of charge, to meet requirements of the Turkish people and the troops in the area. The sources of supply from the system and the quantities actually delivered in bulk are given in the following tables:

FAMAGUSTA WATER SUPPLY
SOURCES OF SUPPLY — 1977

	m^3
Treatment Plant	1 914 097
Vasilikos Cut-off	752 990
Government Boreholes ...	511 947
Total	3 179 034

BULK SUPPLY 1977 TO:

	m^3
Famagusta	1 051 610
Larnaca	800 680
Reg. villages W S (West)	156 679
Reg villages W S (East) ...	395 808
Irrigation	68 346
Refugees	258 310
Total	2 731 433

Water produced : 3 179 034

Water delivered : 2 731 433
Difference : 447 601 or 14.07%

Larnaca Water Board

Through pumping of its own sources and the supplementation made from the Famagusta Water Supply Project, a regular and undisturbed water supply was possible. Further details are also given as under:-

—Water supplied during the year 1977: as shown on the attached statement. ..... 2 411 240 m³

—Water consumed during the year 1977 registered by area meters: 2 315 590 m³

—Maximum summer consumption in one day ..... 9 370 m³

—Total number of consumers at 31.12.77 ..... 8 133

—Extension of distribution system during the year 1977:

6 141 m of 6" dia
9 055 m of 4" dia

The total length of distribution system is not available.

—Hydrants installed during the year 1977 45

—Total number of hydrants installed within water supply area 434

Paphos Water Supply

The water supply of Paphos is administered by the Town Municipality. Existing sources could suffice requirements and regular supply was maintained throughout the year. The maximum daily consumption was 3,360 m³. During the year the total amount of amount of 808,772 m³ was pumped, supplying 2,706 consumers by 31.12. 1977.

TABLE VI—52 **GREATER NICOSIA SCHEME (INCLUDING MORPHOU BAY SCHEME)**

Revenue and Expenditure Account for 1977

Expenditure		**Revenue**	
	£		£
Pumping and Maintenance charges		Sale of water	38 524
(i) Wages	32 468	(a) in bulk	254 766
(ii) Electricity	12 534	(b) to consumers	3 228
(iii) Materials	11 581	Connection fees	2 950
Total	£56 583	Usage of pipeline	2 950
Morphou Running Expenses		Other revenue	3 150
(i) Wages	1 218	Total	£302 619
(ii) Electricity	84 772		
(iii) Materials	891		
Total	£86 881		
Tseri Running Expenses			
(i) Wages	4 552		
(ii) Electricity	12 080		
(iii) Materials	2 283		
Total	18 915		
Purchase of water	12 959		
Collection fees	38 699		
Total	£51 658		
Grand Total	£214 037		

Note:
This statement does not include for the amortization of the installations and equipment of the scheme. The cost of the existing installations was approximately £1,976,000 and the amortization was calculated to be £169,000 per year. Thus there is in fact a deficit between revenue and actual annual cost amounting to £80,418 for 1977.

TABLE VI—53 **FAMAGUSTA WATER SUPPLY PROJECT**
Expenditure and Revenue Account for 1977

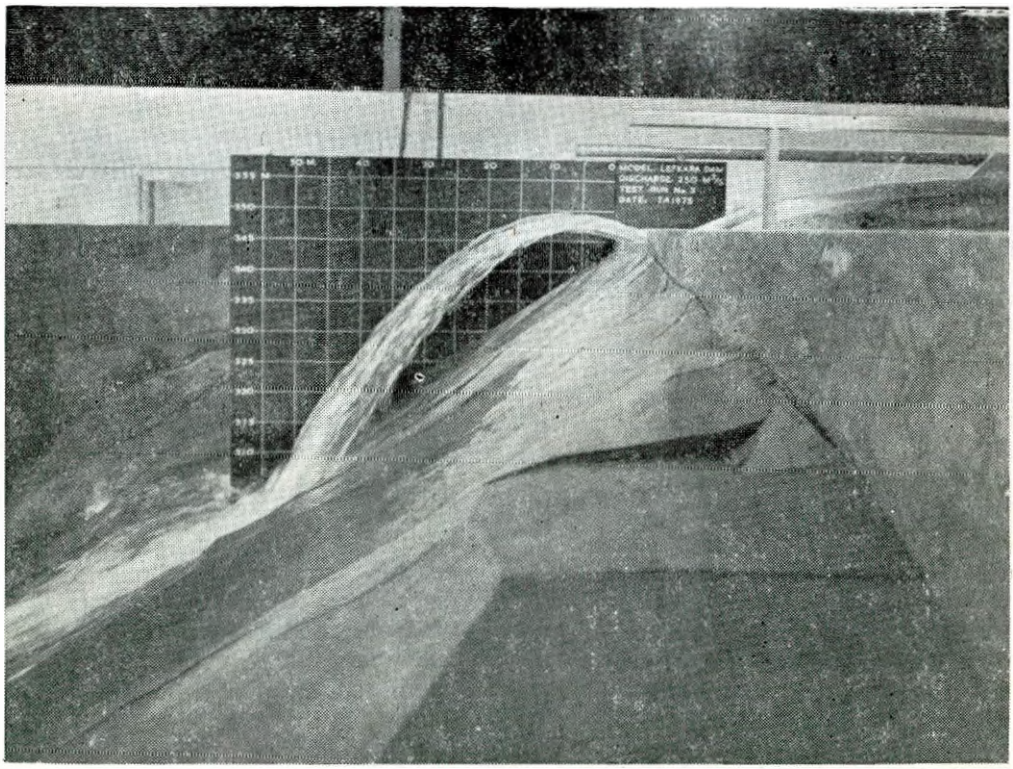
Expenditure

	£
Pumping and Maintenance charges	
(i) Wages	16 964
(ii) Electricity	24 916
(iii) Materials	15 138
Total	£57 018
Running Expenses Khirokitia and Lefkara Installations	
(i) Wages	10 022
(ii) Electricity	93
(iii) Materials	7 593
Total	£17 708
Regional Scheme, Water Supply Running Expenses Khirokitia Area	
(i) Wages	3 076
(ii) Electricity	1 700
Total	£4 776
Grand Total	£79 502

Revenue

	£
Sale of water	50 401
Oustanding payments by 31.12.1977	148 547
Total	£198 948

Note:
The cost of the Government financed "Famagusta Project" upto the end of 1977 amounted to £2,971,721. Roughly, the amortization for this capital investment is £249,210 annually (at 8% for 40 years). Thus the deficit for the year 1977 amounts to £129,764.



Lefkara Dam spillway model testing at the WDD hydraulic laboratory. WDD photo No. A4-6

VII DIVISION OF SMALL PROJECTS PLANNING

by
C Andreou
Executive Engineer I
Head of the Division

Introduction

By the end of the year 1977, the staff of the Division consisted of one Executive Engineer, Class I, one Executive Engineer, Class II, two Senior Inspectors of works, four Inspector of works, four Technical Assistants and one Clerical Assistant. The main activities of the Division during the year under review, were the planning and design of:

- Village Water Supplies
- Routine Irrigation Schemes

VILLAGE WATER SUPPLIES

The general village water supply situation during 1977 is described in Tables VII—1 and VII—2. There are no villages in Cyprus without piped water.

With the completion of 8 house-to-house supply systems in 1977 only 68 out of a total number of 619 villages still remain with public fountains ie 10.96% of the total village population.

Out of 551 villages with house-to-house systems 497 enjoyed a per capita daily rate of over 90 litres.

Water supply schemes prepared in 1977

A total number of 35 new schemes were prepared and submitted to the District Officers, during 1977 at a total estimated cost of £853,118 as shown on Table VII—3.

Another 48 schemes were in the course of preparation at the end of the year, as per Table VII—4.

Apart from the above mentioned work carried out by this Division, a certain number of schemes for the supply of domestic water to housing estates of displaced persons have been prepared and submitted to the Department of Town Planning and Housing.

Brief description of important village water supply schemes prepared in 1977

Kokkini Trimithia: Scheme for providing additional supply to Nicosia Town and Kokkini Trimithia village from borehole 2/76 at a total estimated cost of £56,000.

Psomolophou: A scheme for the implementation of a new house-to-house supply including the construction of a new storage tank at a total estimated cost of £41,000.

Paleometokho: A scheme for providing additional supply to the village from borehole 116/76 drilled in the area at a total estimated cost of £13,000.

Vrysoulles (Akhyritou village area): A scheme for the installation of a house-to-house supply at a total estimated cost of £10,900.

Aradhipou: A scheme for piping water to the village livestock unit at a total estimated cost of £21,000.

Kiti — Meneou — Pervolia — Dhromolaxia and Tersephanou: A scheme for providing additional supply to the village from a new borehole drilled in the area at a total estimated cost of £14,000.

Paphos Higher Villages: A regional scheme for providing additional supply to 44 villages from a filter system at "Lazarides" locality in Paphos State Forest, at a total estimated cost of £399,000.

Amathous Improvement Board: A scheme for piping water to the tourist development zone stretched along the coastal area from Moni Electric power station up to the main Limassol — Moutayiaka road from two boreholes drilled in Yermasoyia river bed at a total estimated cost of £175,000.

Pelendria: A scheme for providing additional supply from a new borehole drilled in the area at a total estimated cost of £22,000.

Paphos town (Mouttalos area): A scheme for improving the area distribution system at a total estimated cost of £27,500. This is the Turkish quarter of Paphos town abondoned by their inhabitants after the Turkish invation of Cyprus in July — August 1974. The area is now inhabited by Greek Cypriot refugees from the North part of Cyprus. New distribution mains have to be laid in the whole of Mouttalos area.

TABLE VII-2 **WATER SUPPLY SITUATION AT THE END OF 1977**

	Satisfactory piped supply (Supply rate 90 litres/Head/Day & Over)								Unsatisfactory piped supply (Supply rate below 90 litres/Head/Day)								Total No of villages	Population 1969
	Villages with house-to-house			Villages with fountains			Villages with H to H			Villages with fountains								
	No.	%	Pop.	%	No.	%	Pop.	%	No.	%	Pop.	%	No.	%	Pop.	%		
Nicosia	138	81.66	112 121	90.20	10	5.92	1 318	1.06	14	8.28	10 314	8.30	7	4.14	543	0.44	169	124 296
Kyrenia	39	82.98	30 869	93.76	2	4.25	55	0.16	1	2.13	540	1.64	5	10.64	1 463	4.44	47	32 927
Famagusta	81	82.66	82 990	92.50	3	3.06	100	0.11	7	7.14	5 693	6.35	7	7.14	934	1.04	98	89 717
Limassol	99	86.84	71 308	96.22	4	3.51	50	.07	8	7.02	2 630	3.55	3	2.63	120	0.16	114	74 108
Paphos	87	65.91	40 556	78.45	14	10.61	1 898	3.67	23	17.42	8 313	16.08	8	6.06	928	1.80	132	51 695
Larnaca	53	89.83	39 388	97.17	3	5.09	482	1.19	1	1.69	474	1.17	2	3.39	190	0.47	59	40 543
Total	497	80.29	377 232	91.28	36	5.82	3 903	0.94	54	8.72	27 964	6.77	32	5.17	4 178	1.01	619	413 277

TABLE VII-1 **VILLAGE WATER SUPPLIES**

Year	Villages with House-to-house distribution system				Villages with Public Fountains			Villages without a piped supply			
	Schemes completed	Total No of Villages	Village %	Population %	Total No of Villages	Villages %	Population %	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	68.86	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	44.90	24.28	—	—	—	628
1969	14	360	57.32	78.60	268	42.68	21.40	—	—	—	628
1970	32	392	62.42	83.23	236	37.58	16.77	—	—	—	628
1971	16	408	64.95	85.42	220	35.05	14.58	—	—	—	628
1972	29	437	69.60	88.70	191	30.40	11.30	—	—	—	628
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	543	87.72	97.60	76	12.28	2.40	—	—	—	619
1977	8	551	89.02	98.04	68	10.98	1.96	—	—	—	619

TABLE VII—3 **VILLAGE WATER SUPLLY SCHEMES PREPARED IN 1977 AND SUBMITTED TO DISTRICT OFFICERS**

Ser No	Village	Nature of scheme	Estimated cost £
Nicosia District			
1	Phikardhou	House-to-house scheme and new storage tank	4 530
2	Kokkini Trimithia — Nicosia	Additional supply from borehole 2/76	56 000
3	Argates - Episkopio - Kambia - Analiondas	Construction of two new storage tanks	5 000
4	Lythrodhonta	Improvements	500
5	Makheras camp	Supplying water from well	3 500
6	Ayii Trimithias	Extension of the distribution system ...	1 600
7	Lazania	House-to-house scheme	1 608
8	Meniko	Supplying water to farm units	2 500
9	Yeri	Supplying water to the National Guard	650
10	Meniko	Extension of distr. system	4 800
11	Paleometokho	Additional supply from B/H116/76	13 000
12	Dhali	Supplying water to veterinary clinic ...	300
13	Phomolophou	New house-to-house scheme and storage tank	41 000
14	Kambi	Additional supply from new spring	1 000
15	Lymbia	Emergency supply from private borehole	2 600
16	Kalokhorio (Klirou) ...	New storage tank	3 500
	Total	.....	£142 088

TABLE VII—3 **VILLAGE WATER SUPPLY SCHEMES PREPARED IN 1977 AND SUBMITTED TO DISTRICT OFFICERS (Continued)**

Ser No	Village	Nature of scheme	Estimated cost £
Famagusta District			
1	Vrysoulles	House-to-house scheme	10 900
2	Liopetri	Improvements to the distr. system	4 500
3	Phrenaros	Extensions	7 000
	Total		£22 400
Larnaca District			
1	Aradhippou	Supplying water to Aradhipou livestock unit	21 000
2	Athienou	Additional supply from new B/H	7 000
3	Klavdhia	Additional supply from B/H	6 600
4	Kiti	Additional supply from B/H	14 000
5	Xylophagou	Additional supply from B/H	4 000
	Total		£52 600
Paphos District			
1	Eledhiou	House-to-house scheme	4 585
2	Philousa - Kelokedhara	New storage tank and house-to-house	5 445
3	Paphos Higher Villages	Supplementary supply	399 000
	Total		£409 030
Limassol District			
1	Agros	Additional supply from B/H 63/76	21 200
2	Ayios Tykhonas	Additional storage	2 400
3	Amathous Impr. Board	New scheme from boreholes	175 000
4	Dhierona	Extensions	2 000
5	Pelendria	Additional supply from new B/H	22 000
6	Parekklishia	Improvements	3 400
7	Zoopiyi	Extensions	1 000
	Total		£227 000

SUMMARY OF TABLE VII—3

District	No of schemes	Estimated Cost £
Nicosia	17	142 088
Limassol	7	227 000
Paphos	3	409 030
Famagusta	3	22 400
Larnaca	5	52 600
Total	35	£853 118

TABLE VII—4 **SCHEMES UNDER PREPARATION**

Ser No	Village	Nature of scheme
	Nicosia District	
1	Pitsilia scheme Palekhori, Apliki, Kannavia	Add. supply from Kannoures Gallery
2	Xeri	Storage tank and improvements
3	Lythrodhonda	Extensions
4	Ayios Mamas	Refugee housing estate WS
5	Astromeritis	Additional supply
6	Pano Lakatamia	from new B/H
7	Peristerona	New storage tank
8	Ayios Theodoros (Solea)	New storage tank New spring
9	Malounda	Extensions
10	Ayia Varvara	Extensions
11	Moutoullas	House-to-house
12	Laxia	Storage tank
13	Ayii Trimithias	Suppl. supply from new B/H
	Larnaca District	
1	Ormidhia	Additional supply
2	Aradhippou	Extensions
3	Kellia	Additional supply
4	Kalavasos	Additional supply
5	Layia	Additional supply
6	Ayii Vavatsinias	Improvements
7	Alaminos	Improvements and storage tank
8	Stavrovouni	Additional supply
9	Troulli	New source
	Famagusta District	
1	Paralimni — Ayia Napa	WS to tourist zones
2	Paralimni	WS to livestock area
3	Phrenaros	Additional supply
4	Ayia Napa	Additional supply
	Limassol District	
1	Moniatis - Saittas	Additional supply
2	Dhoros	"
3	Phasoula	"
4	Ayios Thomas	"
5	Plataniskia	"
6	Ayios Therapon	"
7	Pendakomo	Additional supply
8	Vouni	Domestic WS surplus
9	Anoyira	New borehole
10	Pelendria	Extensions
11	Lambousa	Water supply to school
12	Linopetra	Refugee housing estate W S
13	Limassol W B	Improvements to Ayia Phyla
	Paphos District	
1	Miliou	Additional supply
2	Neon Khorio	Additional supply
3	Kholi	Additional supply
4	Theletra	New house-to-house scheme
5	Peristerona	Additional supply
6	Peyia	Replacement of main pipeline
7	Nata	Additional supply
8	Peyia (Coral Bay).	New BH
9	Paphos Higher Villages	New scheme from BHs
10	Paphos	Improvements to system

ROUTINE IRRIGATION SCHEMES

The main objective of this programme is to increase the irrigated area near the sources for self employed farming organizations such as village irrigation divisions or associations.

The main target which is being pursued is to extend permanent irrigation by 1,000 to 1,500 donums annually, by planning small irrigation projects which can be implemented with financial participation by the farmers.
As the main principles underlying the programme is the quick and effective use of water at or near the source combined with intensive agricultural methods, design, considerations are usully based on land and water use data furnished by the District or Regional Agricultural Officers. Project evaluation is undertaken by a Joint Interdepartmental Committee.

The advantages of the Small Projects Programme, whose beginning 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 agricultural and agronomic background of the contry.

Planning for this particular programme 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; nevertheless a lot depends on the personal drive, dedication and a certain measure of imagination by the planner himself.

The main types of schemes included in this programme postulate water conservation either by the improvement of the old established obsolete intake and distribution system, the construction of small reservoirs for higher or seasonal storage, the exploitation of new boreholes and the artificial recharge of depleted aquifers.

Capital aid from the Federal Republic of Germany

During the year under review 77 major and minor irrigation schemes were financed from the loan of 8 million D. Marks provided by the Federal Republic of Germany. The total amount withdrawn from the loan was £1,305,398 as shown on Table VII—9.

An agreement was signed in May 1977 for a further loan amounting to 5 million D. Marks for the same purpose.

A list of the schemes financed from the loan appears on Table VII—8.
Schemes prepared in 1977

The schemes which were ready for implementation at the end of the year appear on Table VII—5 and were estimated at a total cost of £223,980.

The schemes which have been budgeted for implementation in 1978 are at a total cost of £246,980.

Some more important schemes prepared in 1977 and submitted to the District Officers, or which are in the course of preparation are briefly described herebelow:-

Pumping schemes
Two pumping schemes from mountain streams have been prepared for Kambos and Chakistra villages.

Kambos irrigation scheme Involving two stage pumping, is estimated at £43,000 and will bring under irrigation 200 donums of new land with deciduous.

Chakistra irrigation scheme involving two stage pumping, is estimated at £56,000 and will irrigate 330 donums new land with deciduous.

TABLE VII-5 **LIST OF SMALL IRRIGATION SCHEMES**
(Ready for Construction at the end of 1977)

Nicosia District

No	W D D Reference	Village	Division or Assoc.	Locality	Nature of Proposed Works	Estimat. Cost £	Village Contr. %	Irrigation Perm. don.	Irrigation Seas. don.
1	83/52	Orounda	Division	Maoutsos	Pumping & Distribut.	17 580	45	77	126
2	127/40/151	Tsakistra	Division	Yephiri	Pumping & Distribut. Phase "A"	20 000	1/3	330	—
3	127/40/127	Kambos	Division	Kameno Pedhi	Pumping & Distribut. Phase "A"	20 000	1/3	200	—
4	127/40/97	Moutoullas	Division	Maratho - Ay. Constantinos-Chrisomilies	Reservoir & Distr.	4 800	1/3	370	—
5	127/40/25	Kakopetria	Division	—	Lining of channels	4 800	1/3	260	—
6	127/40/174	Linou	Division	—	Lining of channels	6 500	1/3	50	400
7	42/50/II	Evrykhou	Division	Kato Atsas	Lining of channels	19 000	1/3	300	800
8	127/40/118	Kaliana	Division	Neron Tsappas	Lining of channels & Distr. pipes	4 200	1/3	150	—
9	57/41	Dhali	Division	—	Lining of channels	7 200	1/3	—	—
10	51/54	Peristerona	Division	—	Lining of channels	10 000	1/2	—	—
11	31/46	Astromeritis	Division	—	Lining of channels	10 000	1/2	—	—
12	34/45	Anayia	Division	—	Lining of channels	10 000	1/3	100	250
13	105/63/II	Pera-Politiko	Division	Moulos	Improvement works	4 500	1/3	—	—

TABLE VII—5 **LIST OF SMALL IRRIGATION SCHEMES (Continued)**

No	W D D Reference	Village	Division or Assoc.	Locality	Nature of Proposed Works	Estimated Cost £	Village Contr. %	Irrigation Perm. don.	Irrigation Seas. don.
Limossol District.									
1	116/51	Prodhromos	Division	Kyparissi	Pumping & Distribut.	3 300	38	12.5	—
2	31/45/H	Prodhromos	Division	Skledhros	Distribution pipes	500	1/3	27	—
3	127/40/134	Pelendria	Division	K. Eglisis	Distribution pipes	1 800	1/3	14	—
4	127/40/47	Khandria	Division	Arkadjin	Distribution pipes	1 750	1/3	6	2
5	127/40/47	Khandria	Division	Avlakou	Distribution pipes	800	1/2	22.25	—
6	127/40/99	Agros	Division	K. Taliou	Distribution pipes	4 100	1/3	18	—
7	127/40/99	Agros	Division	P. Lambadha	Distribution pipes	980	1/3	7	—
8	127/40/99	Agros	Division	Kaouros	Distribution pipes	1 600	1/3	13	—
9	53/53/III	Perapedhi	Division	—	Distr. pipes & lining of channels	8 600	1/3	90	—
10	127/40/49II	Kyperounda	Division	P. Stremmata	Distribution pipes	1 800	40	2	4
11	**127/40/52**	Ay. Ioannis (Agr)	Division	Yerambela	Distribution pipes	670	1/3	20	—
12	127/40/95	Potamitissa	Division	Yeradjia	Distribution pipes	2 900	40	30	19
13	42/43/III	Phini	Division	Mylos & Vines	Distribution pipes	12 400	1/3	500	—
Larnaca District									
1	96/39/IV	Khirokitia	Division	Anephantis	Pumping & Distribut.	11 000	1/3	120	—
2	127/40/14	Odhou	Division	No. 1	Distribution pipes	10 000	1/3	57	—
3	127/40/14	Odhou	Division	No. 2	Distribution pipes	3 600	1/3	55	—
Paphos District									
1	98/53	Pissouri	Division	—	River Diversion schemes stage I	140 000	—	3000	—
2	88/61	Anarita	Division	B/H No. 78/61	Pumping & Distr. (Phase "A")	20 000	1/3	120	120

Note: All above are included in the 1978 stimades.

Orounda (Maoutsos) irrigation scheme has been prepared by which water will be pumped from a newly drilled borehole and conveyed by pipeline to an area presently irrigated from an obsolete chain of wells system. Some 77 donums of existing permanent crops will be saved from destruction by the construction of this scheme which is estimated at £13,300.

Anarita borehole pumping scheme in two phases, at a total cost of £50,000 consists of a pumping set, pumping main, balancing tank and piped distribution network for the irrigation of 120 donums permanent and 120 donums seasonal crops. Only phase A at a cost of £20,000 has been budgeted for 1978.

Khirokitia "Anephantis" irrigation scheme at a cost of £11,000. This pumping scheme from a new borehole is to replace the present borehole, supplying the irrigated land of the division, whose output has failed.

Pissouri irrigation scheme at a total cost of £280,000 consists of a diversion weir of the Khapotami river, a conveyor pipeline and an earth reservoir of 380,000 m^3 capacity will enable some 5,000 donums of sultana grapes at Pissouri and Alektora villages now under irrigation from boreholes with low output to receive supplementary irrigation. Only the 1st phase of the scheme is budgeted for 1978 and consists of the construction of the diversion weir and laying of the conveyor pipeline at a cost of £140,000.

A small storage reservoir has been designed for Pissouri which is the 2nd phase of the scheme as mentioned above. It has a capacity of 380,000 m^3 and will serve for the supplementary irrigation of about 5,000 donums of sultana vineyards.

Khrysokhou valley. In continuation of the works already carried out in the valley, pumping schemes have been prepared from five boreholes for the irrigation of 1,800 donums of new permanent and seasonal crops in the villages of Khrysokhou, Polis and Prodhromi. These works are estimated to cost £211,000. The first phase at a cost of £50,000 is included in the 1978 Development Estimates.

Solea valley. Four schemes have been prepared for lining of canals and laying of pipes for the villages of Kakopetria, Linou, Evrykhou and Kaliana. The object of these schemes is to save water now lost through the existing earth canals so that more land can be irrigated. Parallel to this policy a scheme is under study where by water will be stored in earth reservoirs during the night for more efficient control in irrigation and the increase of irrigated land.

Inter - departmental committee for small irrigation projects

The Committee is functioning in conformity with directions by the Director - General of the Ministry of Agriculture and Natural Resources for the purpose of assessing project viability for budgeting purposes and co-ordinates the activities of the District

Agricultural Services for the supply of agro-economic data in the preparatory stages of the projects. Some 35 schemes were considered by the Committee as per Tables VII-6 and VII-6a.

A list of schemes which were in the course of preparation or under investigation is given on Table VII—7.

TABLE VII—6 **SMALL IRRIGATION SCHEMES APPROVED BY THE INTERDEPARTMENTAL COMMITTEE IN 1977**

No	Village	Scheme
1	Odhou	I D No 1
2	Odhou	I D No 2
3	Ayia Marina	—
4	Pelendria	K. Englisis
5	Khandria	Arkadjin
6	Kyperounda	P. Stremmata
7	Prodhromos	Kyparissi
8	Perapedhi	—
9	Agros	K Taliou
10	Agros	P Lambadha
11	Prodhromos	Sklidros
12	Moutoullas	—
13	Agros	Kaouros
14	Ayios Ioannis	Yerambelos
15	Potamitissa	Yeradjia
16	Dhali	—
17	Kakopetria	—
18	Linou	—
19	Anarita	—
20	Kaliana	Neron tis Tsappas
21	Evrykhou	—
22	Chakistra	Yephiri
23	Kambos	Kameno Pedhi
24	Khandria	Avlakou
25	Khandria	Panayia
26	Tris Elies	Kaminoudhi
27	Kyperounda	Appis — Avlaki tous Palazidhes
28	Phini	—

TABLE VII—6a **SCHEMES NOT APPROVED**

1	Psomolophou	—
2	Episkopio	—
3	Yerasa	—
4	Agros	P Taliou
5	Potamitissa	Arkadhin tou Pyrou
6	Louvaras	—
7	Orounda	Limni

TABLE VII—7 **SCHEMES IN THE COURSE OF PREPARATION OR UNDER INVESTIGATION AT THE END OF 1977**

Nicosia District

1	Orounda	Limni
2	Psomolophou	—
3	Episkopio	—
4	Pedhieos River	—
5	Pera	Phassera
6	Ayios Yeoryios (Kafkalou)	—
7	Ayios Epiphanios	—
8	Potamia	Alikos
9	Ayii Trimithias	—
10	Ayios Ioannis (Malounda)	Katsimata — Asprokremmos — Malakka — Petra Aspri
11	Dhali	—
12	Pera - Politiko	—
13	Argates	Kounnappis

Limassol District

1	Agridhia	Pano & Kato Leftina
2	Zoopiyi	Zoodhochos Piyi
3	Agros	Pano Taliou
4	Louvaras	Monastirka Kyra
5	Zoopiyi	Petrakouras
6	Potamitissa	Argaki tou Pirou
7	Kapilio	Mylos
8	Mathikoloni	Esso Pervolia — Paleomylos
9	Dhymes	Hji Pelendros
10	Ayios Ioannis	Pera Akros
11	Kyperounda	Zonismenos — Dhialas
12	Phini	Khrisomilies
13	Pelendri	K Koutlos
14	Kyperounda	Kardhama tous Allayiotes
15	Kyperounda	Kardhama tous Solomidhes
16	Paramali	—
17	Evdhimou	—

Paphos District

1	Dhrousha	Pitharolakkos —
2	Miliou -	Lishiarin
3	K. Akourdhalia	Kremmidhi
4	Amargeti	Ziripillis
5	Yiolou	—
6	Tala	Milari
7	Miliou	Kolokouris
8	Kholi	—
9	Kholetria	—

10	Nata	Xeros Potamos
11	Mamonia	Dhiarizos
12	Kritou Terra	Kephalovrisos
13	Kritou Terra	Kremmiotis
14	Philousa	Yerondas
15	Kedhares	Plistra
16	Kathikas	—
17	Kallepia	Myli

Larnaca District

1	Ayii Vavatsinias	Palimbela
2	Ayii Vavatsinias	Kephalovrisos
3	Melini	Mallouris
4	Melini	Vamvakeri
5	Kivisil	—

TABLE VII—8 CAPITAL AID FROM THE FEDERAL REPUBLIC OF GERMANY

Amount Withdrawn for Individual Projects of upto £15,000 in 1977

Ser No	Project	Amount £
1	Kambos	1 679
2	Anayia	7 577
3	Peristerona	10 000
4	Astromeritis	9 979
5	Ayios Theodhoros (Solea)	2 900
6	Kato Amiandos — Pelendria	2 996
7	Agros "K Enetikos"	1 309
8	Agros "Anastasia"	5 420
9	Ayios Dimitrios	3 022
10	Pelendria "Koundourides"	733
11	Pelendria "Avlakou"	522
12	Pelendria "K Englisis"	3 185
13	Pelendria "P Englisis"	3 551
14	Kyperounda "Appis"	1 430
15	Kyperounda "Khalospities"	2 579
16	Dhymes	2 402
17	Ayios Pavlos	1 606
18	Ayios Ioannis "Agros"	1 871
19	Lemythou	1 724
20	Louvaras	1 274
21	Khoulou	10 787
22	Polemi	12 148
23	Potami	11 915
24	Korakou — Phlasou	14 702
25	Pharmakas	4 210
26	Paleometokho	8 646
27	Dhali "Ftelia"	3 698
28	Dhali "Katevas"	2 924
29	Argates	563
30	Yialias	4 194
31	Kalopanayiotis	592
32	Tembria	5 055
33	Evrykou	3 963
34	Korakou	8 030
35	Kaliana — Tembria	4 404
36	Palekhori	310
37	Pissouri	1 300
38	Nikoklia	206
39	Khandria	145
40	Mandria	163
41	Kyperounda	362
42	Saittas — Moniatis	3 300
43	Pano Platres	6 521
44	Agridhia "Panayia"	2 917
45	Ayios Yeorgios (Silikou) "Syrkas"	1 310
46	Mathikoloni "Paleomylos & Esso Pervolia"	558
47	Kouka "Arniades"	558
	Total	£178 356

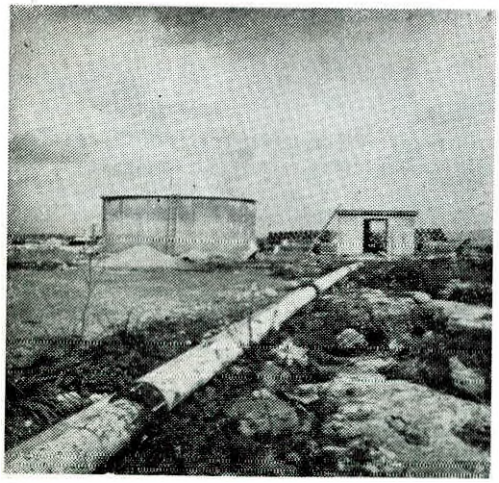
Amount Withdrawn for Individual Projects over £15,000 in 1977

		£
1	Akaki — Meniko	11 762
2	Paleomylos	15 964
3	Phini	20 689
4	Vyzakia	23 825
5	Phlasou	20 960
6	Linou	15 553
7	Steni	17 791
8	Episkopi (L'ssol)	24 667
9	Argates	16 664
10	Kato Platres	8 897
11	Lemona	12 480
12	Orounda	13 658
13	Katydhata	10 114
14	Khoulou	16 873
15	Kakopetria	8 949
16	Peristerona	882
17	Yiolou	2 342

18	Ayios Dhimitrios	15 630
19	Kolossi	11 685
20	Goudhi — Skoulli — Kholi	4 066
21	Skoulli	16 733
22	Peyia	700
23	Peristerona — Astromeritis	4 178
	Total	£295 062

Amount Withdrawn for Major Projects

1	Yermasoyia — Polemidhia Project, Trakhoni — Ypsonas extension	525 585
2	Yermasoyia Gravity main	21 005
3	Akrounda — Phinikaria Scheme	33 966
4	Phasouri Extension	102 859
5	Zakaki Extension	33 877
6	Yermasoyia Irrigation Division	10 539
7	Lymbia Dam and Distribution System	104 149
	Total	£831 980



270 m3 capacity storage tank connected to Khirokitia-Famagusta pipeline near Phrenaros reservoir. A booster pump station (on the right) pumps water through an 8" dia steel pipeline to Paralimni and Ayia Napa villages to be used for their domestic water needs. WDD photo No. A72-6.

TABLE VII—9 **CAPITAL AID FROM FEDERAL REPUBLIC OF GERMANY**

Summary of Withdrawls in 1977

Individual Projects upto £15,000	178 356
Individual Projects over £15,000	295 062
Major Projects	831 980
Total	£1 305 398

Quarrying in River Beds

In order to coordinate the activities of the Departments concerned, ie the District Offices, the Department of Mines and this Department and in order to bring about effective supervision and the enforcement of conditions included in the quarry licences issued by the Department of Mines, an advisory committee was set up in 1976.

During 1977 this committee examined 146 cases and advised the Senior Mines Officer accordingly.

Encroachment in Rivers and Streams

Some 48 cases for land encroachment in rivers and streams were examined and the Director of Lands and Surveys was advised accordingly.

VIII LARNACA REGIONAL OFFICE

By
T N Hamatsos
Executive Engineer II
Regional Engineer

General

By the end of the year the staff of the Regional Office was composed of the following officers:

1 No Executive Engineer II, Head of the Office
1 No Inspector of Works
3 No Monthly Paid Technical Assistants
1 No Daily paid Technical Assistant
1 No Foreman Grade I
3 No Regular Employees
3 No Casual Employees
1 No Secretary — Typist
1 No Driver

The Senior Inspector of Works G Constantinides who was transferred to Nicosia Headquarters in 1976 has been working with us one or two days a week after an arrangement with the Director of the Water Development Department and especially in the Construction Section. One regular employee was transferred in April 1977 to the Paphos Regional Office. One regular employee was appointed as from April, 1977.

The Technical staff of the office was engaged in Hydrology, Investigations and Designs, Construction and Maintenance.

Apart from the above functions one officer Mr Hjiloannou has been working for 3 months (September — November 1977) with the Semi — Arid Zones Project of the South — Eastern Mesaoria Area under Dr Kitching and Mr Iacovides. He will work also partly on this project in the future.

Meetings

During the year under review, the Regional Engineer attended the following meetings as the representative of the Director of the Department:

Larnaca Water Board	10
Famagusta Water Board	4
Famagusta Coordination Committee	2
Larnaca Coordination Committee	2
Kiti Dam	7
Self Housing of Refugees and Displaced persons (Famagusta — Larnaca)	16
Joint Water Committee	4
Tersephanou Soil Consolidation	3
Sewage Treatment Larnaca	3
Borehole Permits	19
Others (Director, District Officers etc.)	33
Total	103

HYDROLOGY AND WATER RESOURCES

Stream Gauging

During the year two permanent stream gauging observations (Paralimni Lake and Liopetri Dam) equipped with automatic water level recorders were in operation and weekly or monthly visits were paid for observation and maintenance.

Groundwater Hydrology

The groundwater conditions of the two Districts, Famagusta and Larnaca, were observed by means of 487 wells/boreholes. The water levels ie the distance from established bench mark on top of the observation wells/ boreholes to the groundwater level of 364 of them were taken twice this year ie in March before the irrigation period and in November after the irrigation period.

The water levels of 65 of them were taken every month and another 10 of them were taken every two months. The water levels of 21 boreholes round Larnaca Salt Lake were taken eight times during the whole year. The water levels of 27 boreholes used for village water supplies were also taken once in the whole year.

Chemical Analyses

A total number of 229 samples were taken from Government communal or private boreholes and sent to the Government Laboratory for Chemical Analysis. Also a large number of samples were taken from wells and boreholes and were analysed in the Regional Office for chloride content.

Plotting of boreholes

During the year the plotting of the boreholes in the Hydrological Area at Famagusta — Larnaca was continued. Up to the end of the year 1,143 boreholes were plotted in Dherynia, Phrenaros, Sotira, Liopetri, Akhyritou, Akhna, Xylophaghou, Ormidhia, Xylotymbou and Anaphotia.

Questioning

The annual questionnaire was carried in the area where the plotting was completed. A total number of 3,511 cases were carried out.

Well sinking permits

A total number of 832 applications for sinking and covering permits of well/ boreholes were examined in the two Districts, Famagusta and Larnaca, and were presented to the Central Advisory Committee for wells/boreholes of the Ministry of Agriculture and Natural Resources. 760 applications are for cases lying in the conservation areas and the other 72 in the non-conservation areas.

Analytically the applications examined per district and area are given on the table below.

District	Conservation Area		Non-conservation Area	
	Approved	Not approved	Approved	Not approved
Famagusta	260	318	—	—
Larnaca	73	109	50	22
Total	333	427	50	22

Apart from the above applications, 598 cases dealing with boreholes/ wells were also examined direct by the Regional Office of the WDD Larnaca — Famagusta and were submitted to the District Officers of Larnaca and Famagusta. These applications concerned cases for the renewal of Lease — Agreements of boreholes drilled on Government or Hali land, or cases effecting interests of third persons. Of these, 200 were approved and 398 were not.

Applications to Install Pumping Units on T/C Wells

A total number of 18 applications were submitted to the Larnaca Regional Office for installing pumping units on Turkish Cypriot wells/boreholes, thus raising the total number for 1976 and 1977 to 120. These applications after being examined on the spot were submitted to the Central Committee for approval.

INVESTIGATIONS AND DESIGN

Investigations

During 1977 the following investigations were carried out:

LARNACA DISTRICT

Kato-Dhrys: Investigations for the water supply of the village from Lefkara complex.

Kiti: Investigations for the water supply of the village.

Mari: Investigations for the improvement of the water supply from a spring. No design was carried out because it was found very uneconomical.

Anaphotia - Menoyia - Aplanda: Investigations for the cost estimating of excess water used by the Aplanda camp.

Troulli: Investigations for the water supply of the village.

Kornos - Mospiloti - Psevdhas - Pyrga: Investigations for the water supply of the villages.

Mazotos: Investigations for the insufficient water supply of the village from Alethriko reservoir.

Kalavasos village: Investigations for the insufficient water supply of the village, in coordination with the Geological Survey Department.

Melini: Investigations for the improvement of the Malloyris irrigation association.

Ayii Vavatsinias: Investigations for the creation of irrigation association from the surplus water of the village water supply.

Aradhippou: Investigations for the construction of antiflood works.

Skarinou: Investigations for the water supply of the village complex Skarinou - Ayios Theodhoros - Alaminos.

Kellia: Investigations for the insufficient village water supply.

Voroklini: Investigations for the improvement of water resources of the Loures irrigation association in Voroklini.

Stavrovouni: Investigations for the creation of irrigation association in the Stavrovouni area.

Kivisil: Investigations for the re-use of the old local irrigation division.

Kophinou: Investigations for the village water supply.

FAMAGUSTA DISTRICT

Paralimni village: Investigations for the improvement and other problems of the village water supply.

Paralimni village: Investigations for the improvement of the river embankments, of the river flowing in the village.

Paralimni area: Investigations for the water supply for touristic purposes of the Touristic area of Protaras.

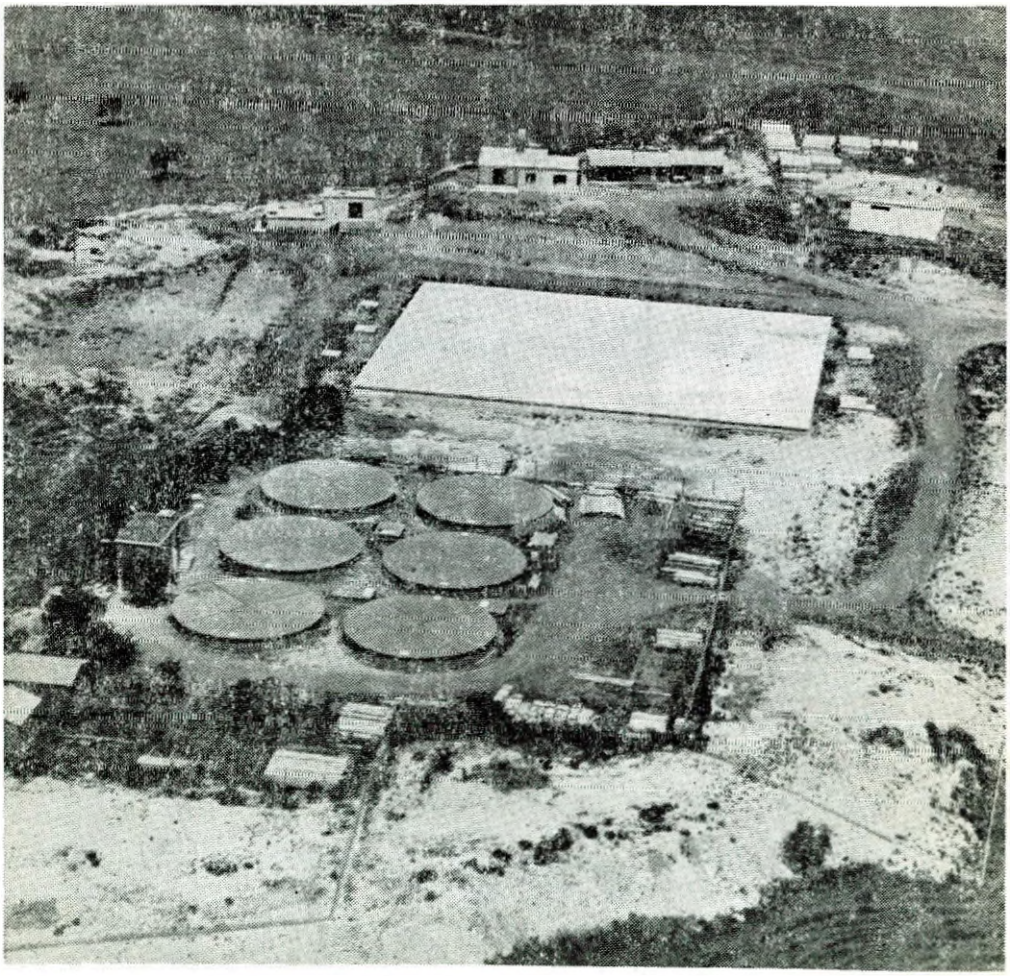
Dherinia village: Investigations for the improvement of the village water supply in connection with the local refugee camp.

Ayia Napa village: Investigations for the improvement of the village water supply, and the illegal boreholes of the Diosmis (Latomia Polonon) area.

Phrenaros village: Investigations for settlements or deformations of the Famagusta water supply reservoir. These investigations are done every three months.

CONSTRUCTION

During the year the regional office undertook the construction of various domestic water supply schemes for



New Larnaca water supply reinforced concrete reservoir, 7,700 m³ capacity. In the foreground are 6 circular storage tanks of Larnaca town with a total capacity of 2,700 m³ WDD photo No. A85-2 taken from the air.

villages, regugee camps and refugee housing estates as well as the construction of various routine irrigation schemes. For all construction work see tables under CONSTRUCTION DIVISION.

Labour force involved

Due to the large number of projects to be carried out during the year a regular employee was temporororily assigned as foreman. An hourly foreman resigned. The total number of staff employed for the execution of the work was as follows:

Monthly paid foremen	3
Hourly paid foremen	2
Temprorary foremen	4
Regular employees	15

TOWN WATER SUPPLIES

New Tremithos Reservoir

The Tremithos reservoir, whose construction started in 1976 was by the end of 1977 fully constructed and given to the Larnaca Water Board. See description of construction under CONSTRUCTION DIVISION.

Designs for Village Water Supplies

During 1977 the following designs for water supply schemes were prepared and submitted to the Director for approval.

VILLAGE WATER SUPPLY DESIGNS SUBMITTED TO DIRECTOR FOR APPROVAL

Ser No	Village	Scheme	Estimated Cost £
LARNACA DISTRICT			
1	Kiti - Dhromolaxia - Meneou - Tersephanou - Pervolia ...	Supplementary water supply	14 000
2	Mari	Improvement of WS	1 700
3	EAC Refugee Camp	Water Supply	19 000
4	Menoyia - Anaphotia - Aplanda	Supplementary WS	23 000
5	Ora	Supplementary WS	8 500
6	Layia	Supplementary WS from Lefkara complex	3 500
7	Klavdhia	Supplementary WS	6 600
8	Xylophaghou	Improvement of WS	4 000
9	Vavatsinia	Cost-estimate of water meter installation	900
10	Kophinou	Connection of the two storage tanks	1 300
FAMAGUSTA DISTRICT			
1	Liopetri	Extension of WS	4 500
2	Phrenaros - Industrial area	WS for the industrial area	7 000
3	Phrenaros	Supplementary WS from the Famagusta pipeline	5 000
4	Paralimni Livestock area ...	WS for the Paralimni Livestock area	9 000
5	Akhna	Supplementary WS for Akhna camp	8 320

VILLAGE WATER SUPPLY DESIGNS (Continued)

Designs of Irrigation Schemes etc.

LARNACA DISTRICT

Ser No	Village	Scheme	Estimated Cost £
1	Maroni Lakkoi - Xalona ...	Installation of electric switch board and replacement part of the irrigation pipeline	2 500
2	Anaphotia	Diversion of Xeropouzis river	9 000
3	Larnaca salt lake	Pumping of sea water to the lake ...	13 000

Other Village Water Supplies

The following designs for water supply schemes were submitted in 1977 to the District Officers for approval.

Ser No	Village	Scheme	Estimated Cost £
LARNACA/FAM. DISTRICT			
1	Ormidhia	Supplementary WS from a Government borehole	9 200
2	Alaminos	Supplementary WS and installation of water meters	304
3	Lefkara	Installation of water meters for the T/C houses	480
4	Liopetri	Repairs to WS pump	360

IX LIMASSOL REGIONAL OFFICE

by
T N Nicolaides
Executive Engineer II
Regional Engineer

General

This Office is responsible for the activities of the Department in the District of Limassol. Its functions are divided into three main categories as follows:

Hydrology. Surface and groundwater hydrological measurements and studies.

Design of Major Water Works Projects, Minor Irrigation and Water Supply Schemes.

Construction of Major Water Works Projects, Minor Irrigation and Water Supply Schames.

This Office is also responsible for the maintenance of all existing irrigation and water supply schemes. The Office is manned by twenty five officers and draughtsmen who serve in the three functions as follows:

—Hydrology	10;No
—Design	7 No
—Construction	8 No
—Secretaries	3 No

Hydrology

Hydrological measurements were carried out in the prescribed areas which are under the Special Measures or Conservation Law as listed under WATER RESOURCES DIVISION.

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.

Twelve Gauging Stations equipped with Automatic Water Level Recorders are established on main rivers of Limassol District, including two on Vasilikos river. See Flow Gauging Stations Table under WATER RESOURCES DIVISION.

Current meter measurements were taken at weekly intervals except at times of flood when additional measurements were taken and at the same time water samples were taken for suspended sediment analysis. Water samples were also taken periodically

for chemical analysis. The total discharges calculated for each river are given in the "Hydrological Year Book" of the Department.

Springs

The discharges of 104 springs were measured at monthly or weekly intervals for the benefit of Village Water Supply, Limassol Water Supply, the Design of Minor Irrigation Projects and Hydrological purposes. A total of 914 spring discharges were taken either volumetrically or by means of the current meter. Water samples from all springs were taken once during the year for chemical analysis.

Groundwater Hydrology

Akrotiri Aquifer

Hydrological observation and control is exercised by means of 190 wells/ boreholes strategically situated in the area.

Water level measurements are taken twice a year from the above wells or boreholes except from 39 wells or boreholes where water levels are observed monthly, so that the behaviour of the water table in the aquifer is observed more closely. Contour map drawn for the years water levels in boreholes compared with a map drawn at the same period last year it was observed that the water situation of the aquifer has not been improved. Sea intrusion in the aquifer is observed and studied by means of 85 No wells or boreholes at Zakaki - Phasouri and 23 wells or boreholes at Akrotiri.

Water pumped from the Aquifer for irrigation, domestic and industrial purposes is noted monthly for each individual licenced well by means of water meters (total 377) attached to each pumping unit in order to ensure that the quantity pumped does not exceed the quantity allocated.

It is thus ensured that pumping is kept at the minimum necessary to preserve the existing plantations in good and productive condition and at the same time ensuring that the aquifer is not extensively damaged.

Water for irrigation was also supplied in this area from Yermasoyia and Polemidhia Dams through the distribution system of the Dams which had already been completed at Zakaki - Phasouri.

Water extracted from Akrotiri Aquifer

Purpose	Quantity MCM
Irrigation	9.80
Domestic	1.70
Industrial	0.93
Total	12.43
Water supplied from Dams	4.30
Total supplied for irrigation	13.10

Water for irrigation was also obtained from Kouris River up to June 1976.

Water Conservation Areas

The water situation within the Water Conservations Areas is also observed by means of a number of wells and boreholes, the water level of which is measured twice a year and the total extraction is estimated by the method of questioning. Especially for Yermasoyia Aquifer the water situation is observed, by means of 20 wells/ boreholes, the water level of which is measured every fortnight. Salinity is also observed taking samples for analysis twice a year.

The number of observation wells/ boreholes in the Hydrological Areas is distributed as follows:

Area	No of wells/ boreholes
Yermasoyia	55
Moni - Pyrgos	73
Parekklisha	22
Kalavasos - Zyyi - Tokhni	68
Paramali - Evdhimou	37
Pissouri - Evdhimou	28
Total	283

Applications for well sinking

Applications for well sinking, transfer of water to other plots for irrigation, installation of engines and turbines or adjustment of pumping permits were investigated as follows:

Special Measures Law Areas

	No investigated	No of granted
Akrotiri Aquifer	29	6
Conservation Areas		
Yermasoyia	—	—
Moni - Pyrgos	2	1
Parekklisha	28	24
Paramali - Evdhimou	17	8
Pissouri - Evdhimou	2	1
Rest of Limassol District	201	172
Total	269	212

DOMESTIC WATER SUPPLIES

Limassol Water Supply

Water supplied to Limassol from the springs and boreholes is gauged and frequent samples are taken both at the water source and at the two reservoirs for chemical and bacteriological analyses. The total quantity of water supplied to Limassol Town was 6 MCM. See also information under OPERATION & MAINTENANCE DIVISION.

Village Water Supplies

The water supply of 108 villages was checked during the period September - November when springs and boreholes are at their minimum output or maximum draw down respectively.

All villages in the District of Limassol had adequate water supply throughout the year. Ninety one water samples were taken from the village water supply springs and boreholes for chemical analysis.

Meteorological Observations

Daily records were kept for rainfall (Max 40 mm on 8/12/77) wind velocity, temperature (Max 40.2° on 17/7/77) humidity, sun reflection and water evaporation (Max 15 mm on 17/7/77), at Yermasoyia Dam.

Daily records were kept for rainfall (Max 56 mm on 8/12/77) and water evaporation (Max average for 10 days period 8.5 mm from 1/6 — 10/6/77) at Polemidhia Dam.

Quarry and Gravel Pits Permits

Fifty five applications for quarries and gravel pits were examined. Also ten applications for land encroachment in rivers and streams were examined.

CONSTRUCTION WORKS

In the construction works 30 foremen, 243 skilled and 137 uskilled workers were engaged.

Construction of Major Water Works

Yermasoyia - Polemidhia Project Trakhoni Extension

An extension of Polemidhia - Yermasoyia Project for the irrigation of 4, 930 donums of citrus and vines. The Project was scheduled to be completed by the end of July 1978, but due to various difficulties, such as non-availability of unskilled workers, the

installation of electric power etc. delay the completion date for about 2—3 months.

Trakhoni Extension is divided into the following four main sub-schemes:

Pumping Plant. It consists of Break Pressure Tank, Pump House and Guard House. Its purpose is to boost water from the Yermasoyia - Polemidhia main conveyor. The cost of the works up to the end of 1977 amounted to £9,060. The works have not been completed yet and it is estimated to cost £100,000 on completion.

Pumping Main. Its purpose is to convey the boosted water from the pumping plant to the night storage reservoir. The pipeline consists of "Solinourgia Korinthou" steel pipes 700 mm dia and the total piping was 4,158 m. The cost of the works up to the end of 1977 amounted to £146,820. The korks are in progress. Estimated cost £172,000.

Night Storage Reservoir. The Trakhoni Night Storage Reservoir will have a storage capacity of 20,000 cubic meters and its cost is estimated at £110,000. The cost of the works up to the end of 1977 amounted to £63, 591. The works are in progress.

Distribution System. This is to convey and distribute water from the night storage reservoir to each holding within the area commanded. Pipe network consisted of "HELLENIT" A.C. Pipes 150—900 mm dia and the total piping layed was 32,394 m. The cost of the works up to the end of 1977 amounted to £383,460. The works are in progress. Estimated cost £463,000.

Construction of Routine Works

Several schemes were constructed by the Limassol Regional Office for minor irrigation schemes, village water supplies and refugee housing projects. These are listed under CONSTRUCTION DIVISION.

DESIGN OF VARIOUS MINOR IRRIGATION AND WATER SUPPLY SCHEMES

Minor Irrigation Projects Design

For the development of irrigation systems 29 applications were examined and designs were prepared for 16 of them as follows:

Ser No	Village	Scheme	Estimated Cost £
1	Potamitissa	Yerajia Irr. Assoc.	2 900
2	Potamitissa	Argakin tou Pirou Irr. Works	1 400
3	Khandria	Panayia Irr. Works	870
4	Phini	Mylos Irr. Div.	12 400
5	Tris Elies	Kaminoudhi Irr. Div.	5 400
6	Tris Elies	Milarka Irr. Div.	270
7	Pelendria	Koripi Irr. Div.	2 250
8	Pelendria	Dhimma Irr. Div.	3 700
9	Pelendria	Potamoulia Irr. Div.	2 500
10	Kato Amiandos - Pelendria	Hji Fisouni - Kardama Irr. Div.	4 000
11	Kato Amiandos - Pelendria	Kato Amiandos - Pelendria Irr. Div.	330

DESIGN OF VARIOUS SCHEMES (Continued)

Ser No	Village	Scheme	Estimated Cost £
12	Kyperounda	Klima Irr. Assoc.	760
13	Kyperounda	Appis - Avlaci tous Palazidhes Irr. Div.	1 600
14	Kato Platres	Kato Platres Irr. Div.	300
15	Arsos	Improvement of Spring	800
16	Arakapas	Improvement of Govt. B/H 107/76	6 400
	Total		£45 880

Water Supply Schemes Design

Eighteen applications were examined and designs were prepared as follows:

1	Moniatis	Water Supply from Kaminoudhi A, B springs	12 800
2	Parekklisha	Extension of distribution system ...	2 400
3	Limnatis	Substitution of water tank (G.I. type)	100
4	Yerasa	Extension of distribution system ...	400
5	Mallia	Improvement of water supply for substitution of central pipe from the spring	140
6	Yermasoyia	Domestic water supply of Anna Court	1 600
7	Yermasoyia	Domestic water supply of Miramare locality	1 200
8	Ayios Tykhonas	Construction of new water tank ...	2 400
9	Kouka	Improvement of water supply	1 749
10	Kouka	Installation of water meters	351
11	Phinikaria	Extension of distribution system ...	190
12	Kellaki	Domestic water supply of Panayia tou Glossa Monastery	2 500
13	Zoopiyi	Extension of distribution system ...	740
14	Spitali	Extension of distribution system ...	142
15	Dhierona	Extension of distribution system ...	1 370
16	Ayios Thomas	Improvement of Nappi spring	1 600
17	Kolossi	Livestock farm water supply	8 500
18	Apesha	Construction of water tank	150
	Total		£38 332

Refugee Emergency Irrigation Schemes

Eighteen applications for develompent of irrigation systems were examined as follows:

Ser No	Village	B/H No	Description	Estimated Cost £
1	Kandou	8	Purchase and installation of turbine, engine, pipes and water meter	6 100
2	Evdhimou	50	Purchase of engine, pipes etc.	860
3	Kato Polemidhia	581	Purchase and installation of water meter	60
4	Evdhimou	94	Extension of irrigation system	193
5	Kato Polemidhia	879	Extension of irrigation system	135
6	Evdhimou	50	Extension of irrigation system	616
7	Evdhimou	67	Purchase and installation of water meter	50
8	Evdhimou	189	Extension of irrigation system	148
9	Tsiflikoudhia	715	Purchase and installation of water meters	50
10	Kato Polemidhia	941	Purchase and installation of water meter	50
11	Tsiflikoudhia	716	Purchase and installation of water meter	50
12	Episkopi	16	Purchase and installation of pipes and water meter	2 145
13	Evdhimou	202	Purchase and installation of turbine, engine and water meter	1 360
14	Tsiflikoudhia	628	Installation of machineries	147
15	Evdhimou	63	Extension of irrigation system	473
16	Armenokhori	2	Purchase of water meter	50
17	Evdhimou	50	Extension of irrigation system	110
18	Kato Polemidhia	885	Purchase of water meter	60
	Total			£12 657

Materials and Machinery

By the end of the year 1977, the following materials and machinery for minor and major projects have been used.

Materials Used	Major Projects	Minor Projects	Total
Asbestos cement pipes km	32.4	5.4	37.8
Concrete aggregates m^3	17 534	3 170	20 704
Cement Tonnes	603	396	999
Steel reinforcing bars Tonnes	81	22.7	103.7
Cast iron specials & joints No	2 396	20 383	22 779
C I flanged sluice valves No	240	2 223	2 463
Water meters No	35	857	892
C I double air valves No	4	—	4
Galvanised iron pipes km	0.200	36.7	36.9
Victaulic pipes km	—	1.2	1.2

Machinery Employed in hours

	Minor Projects	Major Projects	Total
Concrete mixers	4 029	1 132	5 161
Digger M/F	5 398	2 284	7 682
Excavators	2 567	—	2 567
Trascavators	2 336	288	2 624
Wheel loaders	5 645	85	5 730
Dumper trucks	4 947	58	5 005
Compressors	4 157	3 429	7 586
Welding machines	3 965	127	4 092
Mobile cranes	884	17	901
Land rovers	4 824	2 707	7 531
Vibrator	85	—	85
Steam roller	94	—	94
Dumper	646	—	646
Centrifugal Pump	43	—	43
Bus	1 980	—	1 980

Dams and Reservoirs

In the district of Limassol there are ten reservoirs. For details see under OPERATION AND MAINTENANCE.

Committee meetings

In the following committee meetings the District Engineer expresses the policy of the Department and gives his advice on matters concerned.

1 Limassol Water Board
2 Joint Water Committee
3 Waterworks (Special Measures) Law Committee
4 Land Consolidation Committee
5 District Coordination Committee
6 Polemidhia - Yermasoyia Government Water Project Committee
7 Advisory Committee for sinking new wells/boreholes
8 Protection of Turkish Property Committee
9 Interdepartmental Committee meetings on Design of Small Projects
10 Kouris Delta Project Committee
11 Quarries Committee
12 Committee for Rubbish Desposal of Limassol District

X PAPHOS REGIONAL OFFICE

by
A Lambrou
Executive Engineer II
Regional Engineer

General

By the end of the year the staff of the Paphos Regional office was composed of the following:

1 No Executive Engineer II, Head of the Regional Office
5 No Monthly paid Technical Assistants
5 No Daily paid Technical Assistants
2 No Regular Employees
1 No Secretary - Typist

The Technical staff of the office was engaged in **Water Resources, Construction, Design and Investigation.**

WATER RESOURCES BRANCH

The staff of the Water Resources Branch was engaged on the collection of Hydrological and Hydrogeological data as follows.

Surface Hydrology

Stream gauging

During the year 14 permanent stream gauging stations equipped with automatic water level recorders were in operation and weekly visits were made for observation and calibration purposes by the use of current meter. A total number of 620 current meter measurements were taken during the year for calibration purposes. Also samples for suspended sediment and boron analysis were taken regularly. During the year 38 springs were under observation and a total number of 420 spring discharges were gauged by current meter or volumetrically.

The water supply of 132 villages was checked during the months of September, October and November and samples for Ionic and Nitrates were taken.

One rainfall observing station, (near Philousa) equipped with automatic raingauge recorder was in operation during the year, under weekly visits for observation.

Groundwater Hydrology

Groundwater conditions in South Western Paphos and Polis (Khrysokhou) areas, were observed with the help of 192 wells/boreholes.

The distance from the established bench marks on topof every observation Well/Borehole to the groundwater level was measured twice a year, at the end of the wet season

(March) when it is expected to be at highest and at the end of the dry season (December) when it is expected to be at the lowest level.

In addition, monthly or weekly measurements of the groundwater level were taken from 135 wells/boreholes during the year for special studies.

9 observations boreholes equipped with automatic water level recorders were also under observation and regular visits were made during the year. Six of the above automatic water level recorders were taken off during November because construction work started on the boreholes.

Chemical analyses

A total number of 510 samples for analysis were taken from Wells/boreholes, springs and streams, 100 of which for Ionic and Nitrates, 26 for Boron, 24 for suspended sediment and 360 were analysed in the Regional Office for Chloride content.

Questioning

The annual questioning was carried out in South Western Paphos and Polis (Khrysokhou) Hydrological areas during summer for determinating the groundwater extracted, area irrigated and Kind of crops planted.

Water supply (special measures) Law

The survey in the S M L area continued during the year and a total area of 75 km^2 was covered.

Well sinking permits

A total number of 152 applications for sinking and covering permits of Wells/boreholes were examined and submitted to the District Office of Paphos.

These applications were finally examined and approved or not by the Advisory Committe of the Ministry of Agriculture and Natural Resources. The applications examined are as follows:

Approved

S M L area	W C A area	Non W C A
18	14	66

Not Approved

S M L area	W C A area	Non W C A
13	16	25

S M L = Special Measures Law
W C A = Water Conservation area

Encroachements on Government Land and Quarries

34 applications regarding encroachments on government land were investigated and reports were submitted to the Director of the Department.

Also 31 cases for Quarry license were examined.

CONSTRUCTION, INVESTIGATIONS AND DESIGN

The staff of the above branch were engaged on the following works.

Investigations

53 applications and complaints regarding small water supply and irrigation problems were investigated and reports submitted to the District Office Paphos. Also 9 applications for removing water supply and irrigation pipelines from certain fields that might be levelled were investigated and relevant action was taken by the staff of this office.

Small Projects Investigations and Designs

During 1977 5 new schemes were designed and with estimated costs submitted to the headquarters for approval and inclusion in the budget of next year.

Pumping schemes on T/C boreholes 35 applications regarding improvement of Turkish Cypriot boreholes were received by this Office and relevant investigations were carried out, where necessary pumping schemes were prepared and reports were submitted to Central Committee for approval.

Plotting and Levelling

70 new wells/boreholes were plotted and the settlement marks levelled every month of Mavrokolymbos, Pomos, Ayia Marina and Argaka — Magounda dams.

Operation and Maintenance of Paphos Dams

The operation and maintenance of Paphos Dams was carried out by the Staff of this office and routine visits were carried out for this purpose. Detailed reports were prepared separately and submitted to the Director of the Water Development. Department.

Construction Works

The construction of works carried out by the Paphos Regional Office are shown under CONSTRUCTION DIVISION.

Note: This table to be read under chapter II DIVISION OF WATER RESOURCES

TABLE II-8 **SELECTED OBSERVATION BOREHOLES**

Ser No	Hydr. No	Village	Water level amsl in m				Water level increase (+) or decrease (-)	
			March 1976	Nov 1976	March 1977	Nov 1977	March 76-77	Nov 76-77
55/56	192	Liopetri ...	+0.22	+0.07	+1.15	-0.24	+0.93	-0.31
20/63	1516	Paralimni	+21.70	+20.76	+20.88	+20.18	-0.82	-0.58
22/63	1518	" ...	+6.08	+6.03	+6.12	+5.98	+0.04	-0.05
51/51	774	Phrenaros	+5.42	+4.72	+5.03	+4.42	-0.39	-0.30
79/56	975	"	+7.98	+8.06	+7.72	+7.79	-0.26	-0.27
88/54	24	Kolossi ...	+3.00	+1.25	+3.05	-0.20	+0.05	-1.45
51/63	813	Limassol	+1.18	+0.88	+1.08	+0.48	-0.10	-0.40
13/63	807	Zakaki ...	+0.17	—	Blocked	Blocked	—	—
107/61	17	Yermasoyia	+17.23	Working	+8.95	+1.43	-8.28	—
180/59	8	"	+35.95	+19.42	+30.83	+18.13	-5.12	-1.29
7/60	22	"	—	+1.98	+3.38	+1.55	—	-0.43
134/59	27	"	+13.99	+3.16	+10.86	+7.40	-.3.13	+4.24
161/50	559	K. Trimithia	+187.34	+187.41	+187.41	+187.52	+0.07	+0.11
160/50	150	"	+196.28	+194.96	+195.14	+194.07	-1.14	-0.89