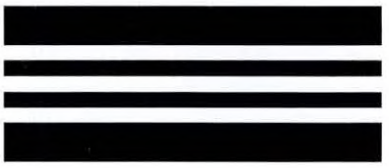

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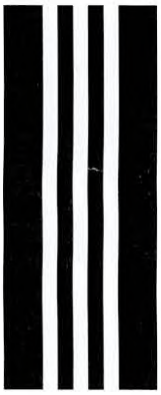

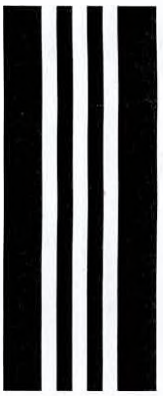

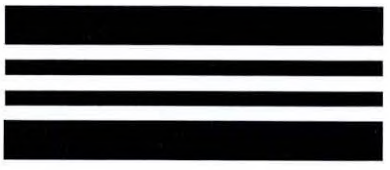

REPUBLIC OF CYPRUS

MINISTRY OF AGRICULTURE AND NATURAL RESOURCES

DEPARTMENT OF WATER DEVELOPMENT

ANNUAL REPORT
OF THE
DEPARTMENT
OF
WATER DEVELOPMENT
FOR THE YEAR
1971

By

C. A. C. KONTEATIS

Director of the Department of Water Development

NICOSIA — CYPRUS

September — 1972

REPUBLIC OF CYPRUS

MINISTRY OF AGRICULTURE AND NATURAL RESOURCES

A N N U A L R E P O R T

OF THE

DEPARTMENT OF WATER DEVELOPMENT

FOR THE YEAR

1971

By
C.A.C. KONTEATIS
Director
of the Department of Water Development

CONVERSION TABLE

One Meter	=	3.281 feet
One Kilometer	=	3281 feet or 0.621 Statute mile
One Millimeter	=	0.039 Inches
One Square Kilometer	=	0.386 Square Statute mile
One hectar	=	10000 Square meters (7.5 Donums)
One cubic meter per second	=	35.315 cubic feet per second
One Liter	=	0.224 gallon

ABBREVIATIONS USED

mm	=	Millimeter
MCM	=	Million cubic meter
m^3/s	=	cubic meter per second
m^3/h	=	cubic meter per hour
ha	=	hectar

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Current meter measurement of flood flow by wading in the Akaki river near Malounda

Diversion tunnel at Lefkara dam

I. GENERAL

1.1 Introduction

The Department of Water Development is one of the Departments of the Ministry of Agriculture and Natural Resources and is responsible for the Government's overall policy water resources, planning, design and construction including all engineering hydrological and geological aspects of all types of water development projects on the Island. It also contributes towards the management of water resources and water development projects together with other interested Ministries and Departments. Such 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. Soil Conservation and agricultural problems involved in the economic use of water are responsibilities of the Department of Agriculture. The Government institutional set up for water resources conservation and development and the role of the Department of Water Development is shown on page 12

1.2 Departmental Organization

The Departmental organization is shown on page 13 and is made up of :

1.2.1 Division of Water Resources

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

1.2.2 Division of Planning

This Division deals with the preparation of reconnaissance and feasibility studies prior to the detailed design of such 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.

1.2.3 Division of Design

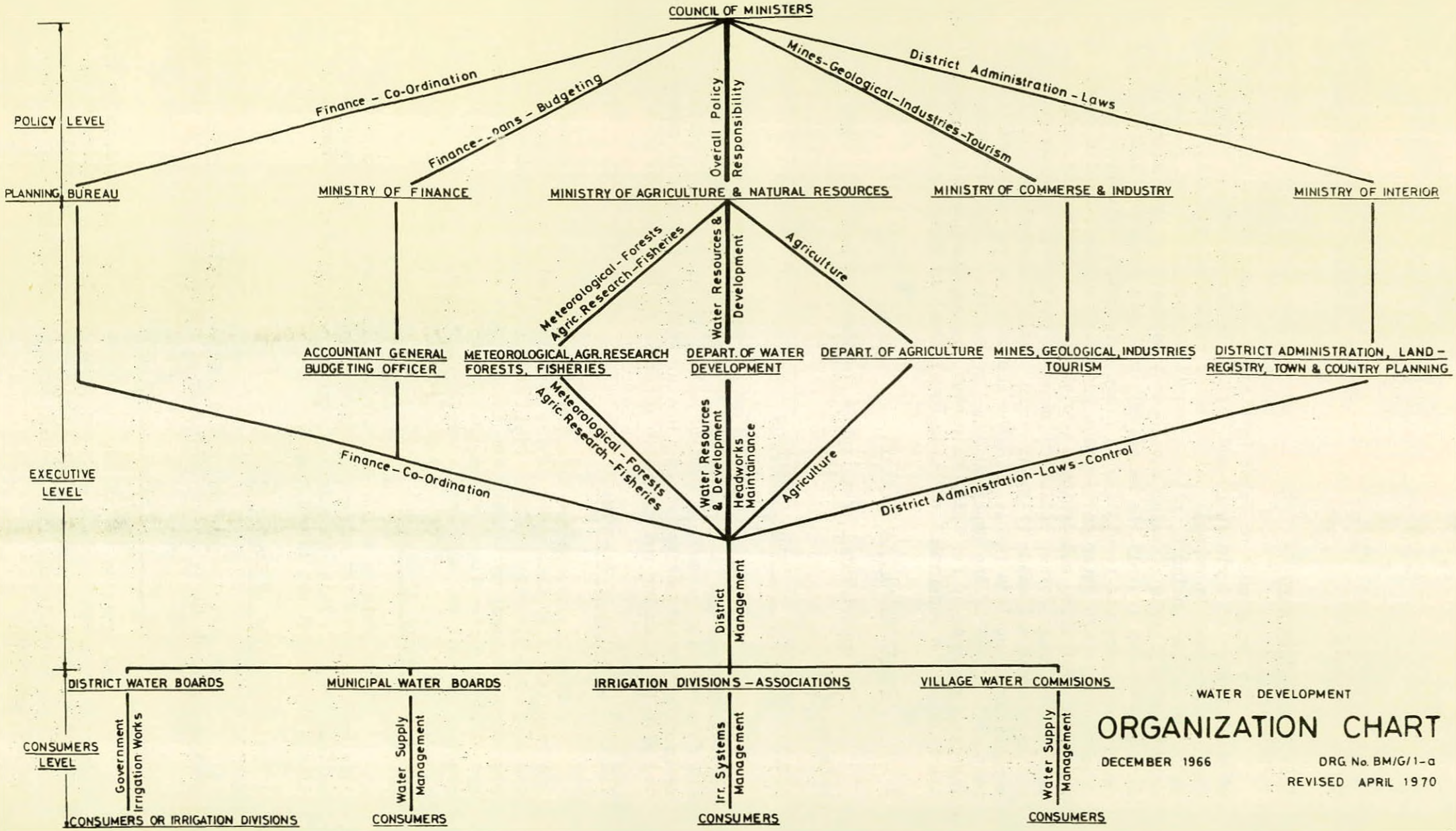
This Division deals with the detailed design and specification work required for major projects after they have been approved as feasible. In this Division the drawing and topographic functions of the Department are incorporated.

1.2.4 Division of Construction

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

1.2.5 Division of Operation and Maintenance

This Division assists in the operation and maintenance of the major projects such as dams and town water supplies. For every major project there is a Project Water Board in the case of Irrigation or a Town Water Board in the case of town domestic water supplies, to which we are a member.



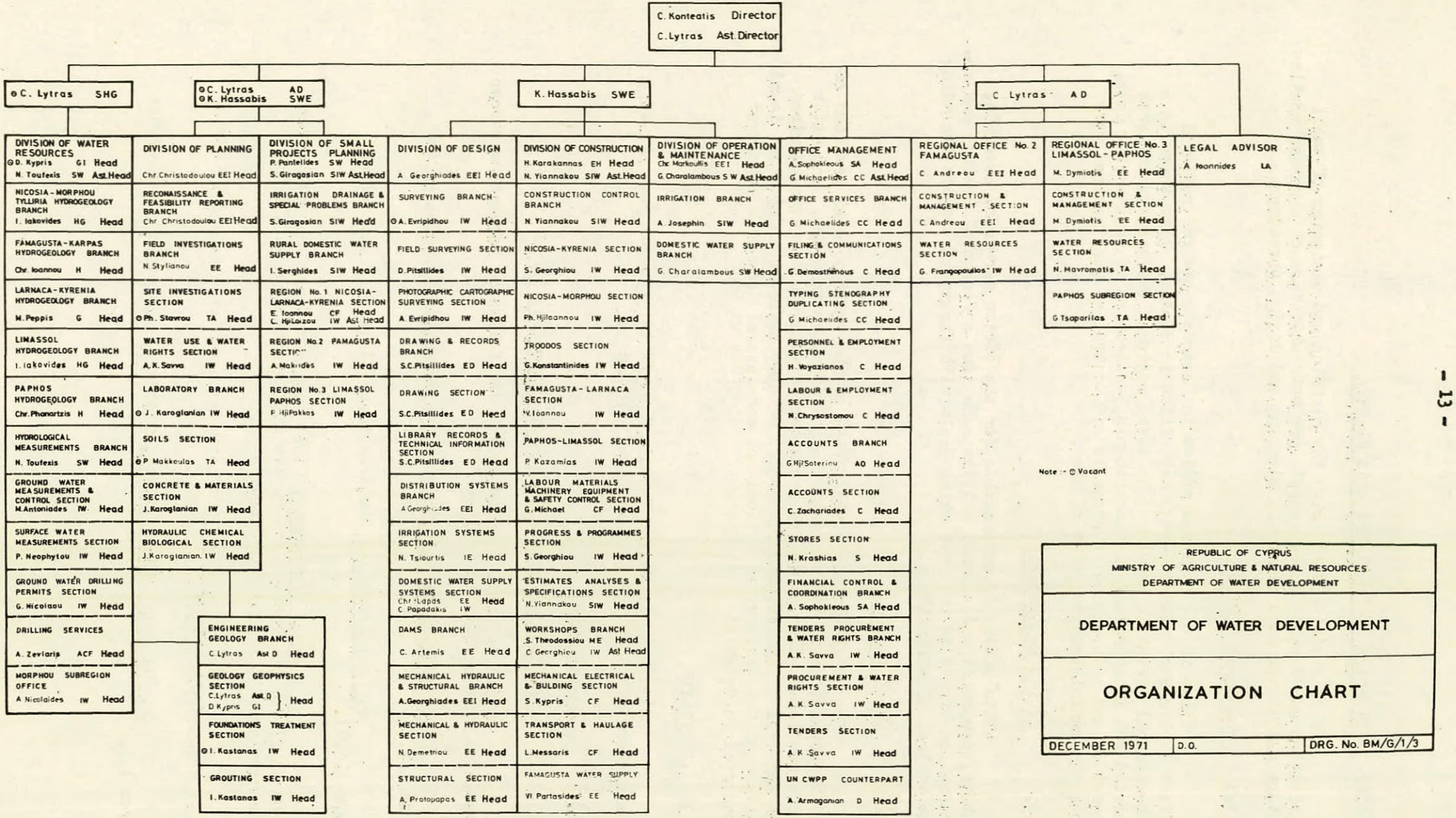
WATER DEVELOPMENT

ORGANIZATION CHART

DECEMBER 1966

DRG. No. BM/G/1-a

REVISED APRIL 1970


C. Konteatis Director
C. Lytras Ast. Director
⊙C. Lytras SHG
⊙C. Lytras AD
⊙K. Hassabis SWE
K. Hassabis SWE
C Lytras A D
DIVISION OF WATER RESOURCES
⊙D. Kypris GI Head
N. Toufexis SW Ast.Head
NICOSIA - MORPHOU TYLLIRIA HYDROGEOLOGY BRANCH
I. Iakovides HG Head
FAMAGUSTA - KARPAS HYDROGEOLOGY BRANCH
Chr. Ioannou H Head
LARNACA - KYRENIA HYDROGEOLOGY BRANCH
M. Peppis G Head
LIMASSOL HYDROGEOLOGY BRANCH
I. Iakovides HG Head
PAPHOS HYDROGEOLOGY BRANCH
Chr. Phanartzis H Head
HYDROLOGICAL MEASUREMENTS BRANCH
N. Toufexis SW Head
GROUND WATER MEASUREMENTS & CONTROL SECTION
M. Antoniades IW Head
SURFACE WATER MEASUREMENTS SECTION
P. Neophytou IW Head
GROUND WATER DRILLING PERMITS SECTION
G. Nicolaou IW Head
DRILLING SERVICES
A. Zevtaris ACF Head
MORPHOU SUBREGION OFFICE
A Nicolaides IW Head
DIVISION OF PLANNING
Chr Christodoulou EEI Head
RECONAISSANCE & FEASIBILITY REPORTING BRANCH
Chr. Christodoulou EEI Head
FIELD INVESTIGATIONS BRANCH
N. Stylianou EE Head
SITE INVESTIGATIONS SECTION
⊙Ph. Stavrou TA Head
WATER USE & WATER RIGHTS SECTION
A.K. Savva IW Head
LABORATORY BRANCH
⊙ J. Karoglanian IW Head
SOILS SECTION
⊙P Makkoulas TA Head
CONCRETE & MATERIALS SECTION
J. Karoglanian IW Head
HYDRAULIC CHEMICAL BIOLOGICAL SECTION
J. Karoglanian IW Head
ENGINEERING GEOLOGY BRANCH
C Lytras Ast D Head
GEOLOGY GEOPHYSICS SECTION
C.Lytras Ast.D
D.Kypris GI
Head
FOUNDATIONS TREATMENT SECTION
⊙I. Kastanas IW Head
GROUTING SECTION
I. Kastanas IW Head
DIVISION OF SMALL PROJECTS PLANNING
P. Pantelides SW Head
S. Giragosian SIW Ast.Head
IRRIGATION DRAINAGE & SPECIAL PROBLEMS BRANCH
S. Giragosian SIW Head
RURAL DOMESTIC WATER SUPPLY BRANCH
I. Serghides SIW Head
REGION No. 1 NICOSIA - LARNACA - KYRENIA SECTION
E. Ioannou CF Head
C. HjiLoizou IW Ast Head
REGION No.2 PAMAGUSTA SECTION
A. Makrides IW Head
REGION No.3 LIMASSOL PAPHOS SECTION
P. HjiPakkos IW Head
DIVISION OF DESIGN
A Georghiades EEI Head
SURVEYING BRANCH
⊙A. Evripidhou IW Head
FIELD SURVEYING SECTION
D. Pitsillides IW Head
PHOTOGRAPHIC CARTOGRAPHIC SURVEYING SECTION
A. Evripidhou IW Head
DRAWING & RECORDS BRANCH
S.C. Pitsillides ED Head
DRAWING SECTION
S.C. Pitsillides ED Head
LIBRARY RECORDS & TECHNICAL INFORMATION SECTION
S.C. Pitsillides ED Head
DISTRIBUTION SYSTEMS BRANCH
A Georghiades EEI Head
IRRIGATION SYSTEMS SECTION
N. Tsiourtis IE Head
DOMESTIC WATER SUPPLY SYSTEMS SECTION
Chr. Hapas EE Head
C. Papadakis IW
DAMS BRANCH
C. Artemis EE Head
MECHANICAL HYDRAULIC & STRUCTURAL BRANCH
A. Georghiades EEI Head
MECHANICAL & HYDRAULIC SECTION
N. Demetriou EE Head
STRUCTURAL SECTION
A. Protopapas EE Head
DIVISION OF CONSTRUCTION
H. Karakannas EH Head
N. Yiannakou SIW Ast.Head
CONSTRUCTION CONTROL BRANCH
N. Yiannakou SIW Head
NICOSIA - KYRENIA SECTION
S. Georghiou IW Head
NICOSIA - MORPHOU SECTION
Ph. Hjiloannou IW Head
TROODOS SECTION
G. Konstantinides IW Head
FAMAGUSTA - LARNACA SECTION
V. Ioannou IW Head
PAPHOS - LIMASSOL SECTION
P. Kazamias IW Head
LABOUR MATERIALS MACHINERY EQUIPMENT & SAFETY CONTROL SECTION
G. Michael CF Head
PROGRESS & PROGRAMMES SECTION
S. Georghiou IW Head
ESTIMATES ANALYSES & SPECIFICATIONS SECTION
N. Yiannakou SIW Head
WORKSHOPS BRANCH
S. Theodossiou ME Head
C. Georghiou IW Ast Head
MECHANICAL ELECTRICAL & BULDING SECTION
S. Kypris CF Head
TRANSPORT & HAULAGE SECTION
L. Messaris CF Head
FAMAGUSTA WATER SUPPLY
VI Partasides EE Head
DIVISION OF OPERATION & MAINTENANCE
Chr Markoullis EEI Head
G. Charalambous S W Ast.Head
IRRIGATION BRANCH
A. Josephin SIW Head
DOMESTIC WATER SUPPLY BRANCH
G. Charalambous SW Head
OFFICE MANAGEMENT
A. Sophokleous SA Head
G. Michaelides CC Ast.Head
OFFICE SERVICES BRANCH
G. Michaelides CC Head
FILING & COMMUNICATIONS SECTION
G. Demosthenous C Head
TYPING STENOGRAPHY DUPLICATING SECTION
G. Michaelides CC Head
PERSONNEL & EMPLOYMENT SECTION
H. Voyazianos C Head
LABOUR & EMPLOYMENT SECTION
N. Chrysostomou C Head
ACCOUNTS BRANCH
G.HjiSoteriou AO Head
ACCOUNTS SECTION
C. Zachariades C Head
STORES SECTION
N. Krashias S Head
FINANCIAL CONTROL & COORDINATION BRANCH
A. Sophokleous SA Head
TENDERS PROCUREMENT & WATER RIGHTS BRANCH
A.K. Savva IW Head
PROCUREMENT & WATER RIGHTS SECTION
A.K. Savva IW Head
TENDERS SECTION
A.K. Savva IW Head
UN CWPP COUNTERPART
A. Armaganian D Head
REGIONAL OFFICE No. 2 FAMAGUSTA
C Andreou EEI Head
CONSTRUCTION & MANAGEMENT SECTION
C Andreou EEI Head
WATER RESOURCES SECTION
G. Frangopoulos IW Head
REGIONAL OFFICE No. 3 LIMASSOL - PAPHOS
M. Dymiotis EE Head
CONSTRUCTION & MANAGEMENT SECTION
M Dymiotis EE Head
WATER RESOURCES SECTION
N. Mavromatis TA Head
PAPHOS SUBREGION SECTION
G Tsaparilas TA Head
LEGAL ADVISOR
A Ioannides LA
Note :- ⊙ Vacant
REPUBLIC OF CYPRUS
MINISTRY OF AGRICULTURE & NATURAL RESOURCES
DEPARTMENT OF WATER DEVELOPMENT
DEPARTMENT OF WATER DEVELOPMENT
ORGANIZATION CHART
DECEMBER 1971
D.O.
DRG. No. BM/G/1/3

1.2.6 Division of Small Projects Planning

This Division 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 procedures.

1.2.7 Regional Offices

There is one regional office in Famagusta and one regional office in Limassol with sub-regional office in Paphos. Also there is a sub-regional office in Morphou. In these regional offices the mainwork carried out is hydrological measurements, collection of engineering data, operation and maintenance of projects and control of construction work from the administrative point of view.

1.2.8 Office Management

This office is responsible for the office services, accounts, labour, personnel and stores. At the same time a financial control and co-ordination branch is included which deals with financial aspects including the control of expenditure.

1.2.9 Legal Advisor

The Legal Advisor gives advice on the various legal problems of the Department which include water legislation, contractors, and water right problems. Also he drafts new water legislation whenever required for approval by the Attorney General. He also deals with important legal matters of the Ministry of Agriculture and Natural Resources whenever requested to do so.

1.3 Staff

A list of the Senior Technical Staff is given on page 42 - 43. The numbers of staff by post are given on page 44.

1.3.1 Appointments

1.3.1.1 On a monthly (unestablished or Temporary) basis

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

Mr. Char. Palantzis, Civil Engineer Class II, with effect from 1.6.71.

Mr. Pan. Loucaides, Civil Engineer Class II, with effect from 1.6.71.

Mr. Andreas Protopapas, Civil Engineer Class II, with effect from 16.11.70, but assumed his duties with effect from 2.8.71 as he was serving in the National Guard.

Mr. St. Pitsillides, Officer in charge of the Drawing Office with effect from 1.6.71.

Mr. Christos Theocharides, Technical Assistant, with effect from 1.1.71.

Mr. Elefth. Phinikarides, Technical Assistant, with effect from 1.1.71.

Mr. Vassos Nicolaou, Technical Assistant, with effect from 1.1.71.

Mr. Ioannis Mouskoundis, Technical Assistant, with effect from 1.7.71.

Mr. Neophytos Nicolaou, Foreman 2nd Grade, with effect from 1.7.71.

Mr. Takis Kallis, Foreman 2nd Grade, with effect from 1.7.71.

Miss Par. Maratheftou, Draughtsman, with effect from 15.7.71.

Miss St. Papadopoullou, Draughtsman, with effect from 15.7.71.

Mr. Antonis Shellis, Technical Assistant, with effect from 15.7.71.

Mr. Kyr. Efstathiou, Technical Assistant, with effect from 15.7.71.

Mr. Vassos Vyras, Technical Assistant, with effect from 15.7.71.

Mr. Andreas Tsiakouris, Technical Assistant, with effect from 15.7.71.

Mr. Georghios Dicomits, Technical Assistant, with effect from 15.7.71.

Mr. Nicos Mavrommatis, Technical Assistant, with effect from 15.7.71.

Mr. Panos Antoniades, Technical Assistant, with effect from 15.7.71.

Mrs. Anna Ioannou, Clerical Assistant, with effect from 1.5.71.

Mrs. Androulla Kaspari, Clerical Assistant, with effect from 1.5.71.

Miss. Athina Koronellou, Clerical Assistant, with effect from 1.5.71.

1.3.1.2 On Permanent Basis

Mr. Nicos Stylianou, Executive Engineer, Class II, with effect from 15.12.71.

Mr. Marcos Dymiotis, Executive Engineer, Class II, with effect from 15.12.71.

Mr. Andreas Makis, Technical Assistant with effect from 1.1.71.

Mr. Chr. Georghiades, Technical Assistant, with effect from 1.1.71

Mr. Andreas Kourtellas, Technical Assistant, with effect from 1.1.71

Mr. Andreas Pengeros, Technical Assistant, with effect from 1.1.71

Mr. Georghios Pittas, Technical Assistant, with effect from 1.1.71

Mr. Petros Makkoulas, Technical Assistant, with effect from 1.1.71

1.3.1.3 On Daily Basis (Senior Staff)

Miss Niki Michael, Topographer, with effect from 29.3.71

Mr. Char. Kridiotis, Executive Engineer, with effect from 19.7.71

Mr. Petros Neophytides, Irrigation Engineer, with effect from 5.8.71

1.3.1.4 Renewal of Contract

Mr. Antonakis Ioannides, Legal Adviser, on contract, had his contract renewed for another year, with effect from 18.8.71

1.3.1.5 Promotions, Secondments

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

1.3.1.5.1 Promotions

Mr. Jacovos Jacovides, from Hydrologist, Class II, to Class I, with effect from 1.5.71

Mr. Michael Peppis, fromm Geologist Class II to Class I, with effect from 1.9.71

Mr. Andreas Zevlaris, from temporary Assistant Chief Foreman to permanent Assistant Chief Foremann with effect from 1.1.71

Mr. Andreas Vyras, from temporary Assistant Chief Foreman to permanent Assistant Chief Foreman with effect from 1.1.71

Mr. Demos Zoppos, from unestablished Foreman 1st Grade, to permanent Foreman 1st Grade with effect from 1.1.71

Mr. Antonios Zakheos, from unestablished Foreman 1st Grade to permanent Foreman 1st Grade with effect from 1.1.71

Mr. Neoklis Ioannou, from Foreman 2nd Grade to Foreman 1st Grade with effect from 1.10.71

Mr. Omeros Ioakim, from Foreman 2nd Grade to Foreman 1st Grade with effect from 1.10.71

1.3.1.5.2 Secondments

Mr. Pantelis Alexandrou, from Technical Assistant to Inspector of Works with effect from 1. 5.71

Mr. Georghios Koutis, from Foreman 1st Grade to Assistant Chief Foreman with effect from 1. 1.71

1.3.2 Resignations, terminations or engagements, transfers, retirements

1.3.2.1 Resignations

The following officers resigned from the Department during the year.

Mr. Polyvios Panayides, Executive Engineer, Class II, tendered his resignation with effect from 1. 4.71.

Mr. Neophytos Demetriou, Executive Engineer, Class II, tendered his resignation with effect from 15.9.71.

Miss Erini Kaimakki, Draughtsman, tendered her resignation with effect from 20.9.71.

Mrs. Aliki Kalathia, Draughtsman, tendered her resignation with effect from 14.9.71.

1.3.2.2 Termination of Engagement

Mr. Christod. Theocharides, Technical Assistant, was retired by the Council of Ministers on grounds of Public Interest with effect from 10.11.71.

1.3.2.3 Transfers

Mr. Marcos Dymiotis, Executive Engineer, was transferred from Nicosia to Limassol with effect from 1.7.71.

Mr. Elias Eliades, Inspector of Works, was transferred from Paphos to Nicosia with effect from 1.7.71.

Mr. Savvas Katsiannis, Technical Assistant, was transferred from Limassol to Nicosia with effect from 1.7.71.

Mr. Char. Hji Stavrou, Technical Assistant, was transferred from Nicosia to Limassol with effect from 1.1.71.

Mr. Antonis Nicola, Assistant Chief Foreman, was transferred from Famagusta to Nicosia with effect from 1.8.71.

Mr. Andreas Yiannakou, Administrative Officer, 1st Grade, was transferred from the Office of the District Officer Paphos to this Department on the 15th November 1971.

Miss Stella Ioannou, Clerk 2nd Grade, General Clerical Staff was transferred to the Office of the District Officer, Nicosia, with effect from 17.11.71.

Mr. George Hji Vassiliou, Permanent Clerical Assistant, General Clerical Staff was transferred to the Department of Personnel, with effect from 21. 9.71.

Mr. Georghios L. Teklos, Temporary Clerical Assistant, was transferred to this Department from the Inland Revenue Department on 20.12.71.

1.3.2.4 Retirements

Mr. Andreas Vyras, Assistant Chief Foreman, retired from the Government Service, due to age limit, on the 31. 5.71.

1.3.2.5 Deaths

V.C. Toundjian, Superintendent of Works, who worked in the Department from the 1947 to 1962 when he retired, passed away on 18. 2.71.

Ch. Theodosiades, Principal Clerk, who worked in the Department from 3.9.47 to 1.3.62 when he retired, passed away on 20.1.71.

1.3.3 Scholarships - Fellowships - Congresses - Duty Abroad

During 1971 a number of Officers were granted scholarships, others were sent on short courses or attended Congresses and/or Symposiums. All the Officers who has participated derived the maximum of benefit.

1.3.3.1 Scholarships - Fellowships

The Officers thus concerned are the following:

Mr. Christos Phanartzis, Hydrologist Class II, was awarded a scholarship by FAO in advanced hydrological studies and left Cyprus for Arizona University, U.S.A. on 31.1.71.

Mr. Nicos Tsiourtis, Topographer/Irr. Engineer, was awarded a scholarship from the Fulbright Programme and left Cyprus for Missouri University, U.S.A. on 16.8.71. His scholarship is mainly in advanced Irrigation and Water Supply Studies.

Mr. Christos Marcoullis, Executive Engineer, Class I, was awarded a scholarship in advanced irrigation and water management studies in the University of Utah and left Cyprus on 14.9.70.

Mr. Savvas Theodosiou, Mechanical Engineer, Class II, who had been awarded a scholarship in desalination completed successfully his scholarship and was awarded the M.Sc. (Eng.) He resumed his duties on 1.10.71. The scholarship was awarded by "CARRERAS" Ltd. and was tenable in the U.K.

1.3.3.2 Conferences Abroad

Mr. Nicos Tsiourtis, Topographer/Irr.Engineer attended the 8th European Meeting of the I.C.I.D., which was held in France from the 14th to the 19th June, 1971.

Mr. C.A.C. Konteatis, Director, attended two seminars one in Roumania on Water Resources Planning Techniques which was sponsored by FAO and lasted from the 5th to 14th September 1971 and the other in Zagreb, Yugoslavia, from the 4th to 11th October, where he participated in seminar of the Economic Commission for Europe on water problems in Southern Europe.

Mr. K.C. Hassabis, Senior Water Engineer, attended a meeting of the Economic Co-operation and Development Organization on Irrigation techniques held in Greece from the 11th to 16th October, 1971.

Mr. C. Lytras, Assistant Director, attended a seminar on Hydrogeology organized by FAO in Spain from the 18th to the 23rd October, 1971.

1.3.3.3 Duty abroad

Mr. J. Jacovides, Hydrologist, Class I, visited the FAO Projectin Lebanon between the 21st August and 5th September 1971 and attended the work done there in the use of a ground water model for hydrogeological studies to enable similar application in Cyprus.

Mr. C.A.C. Konteatis, Director, and Mr. C. Christodoulou Executive Engineer, Class I, visited the FAO Project in Lebanon between the 21st and the 26th November 1971 and observed the work and methods used there for application to similar studies in Cyprus.

Mr. C.A.C. Konteatis, Director, participated in the analysis of the Consultants proposals for the Morphou/Tylliria feasibility study in FAO Rome which lasted from the 10th to the 17th November, 1971.

1.4 Foreign Technical Assistance

During the year we received the following technical assistance:

1.4.1 United Nations

Under the United Nations the following works were provided.

1.4.1.1 Cyprus Water Planning Project

Under this project the main studies were the Paphos Feasibility Phase "B" done mostly by the Consultants Sir M. McDonald, Howard Humphreys and Huntings of the United Kingdom. This study is part of the CWPP plan of operation and is a continuation of the Paphos Phase "A". Feasibility studies done by the Consultants T. Igledow of Canada. The study which provides for the development of the Southeastern Paphos Coastal aquifer and the river flow of the Xeropotamos river for the irrigation of the Paphos Coastal Plains, is scheduled to be completed early in 1972.

1.4.1.2 Mr. A. McLaughlan continued his assignment through FAO both as the Resident Engineer for Paphos Feasibility and also carried out updating work for the CWPP studies.

1.4.1.3 Consultants Mr. Reid and Dr. Newbery visited Cyprus twice during the year and followed up the investigations and geotechnical work carried out on several damsites.

1.4.1.4 Dr. Sheeller visited Cyprus investigated and reported on the salinity problems of the Ovgos and Ezuza river in connection with the possibility of building dams on these two rivers.

1.4.1.5 Mr. M. Roger was appointed Resident Engineer for the Morphou Feasibility Study.

1.4.1.6 Dr. Dixon UNDP Expert on desalination visited Cyprus at the request of the Cyprus Government to provide advice on the possible use of desalination techniques here.

1.4.1.7 Several consultants from FAO including supervisory staff and IBRD/FAO teams visited Cyprus in connection with the progress of various projects.

1.4.2 British Technical Assistance

We received during the current year important British Technical Assistance in various fields as follows:

1.4.2.1 The Akrotiri Feasibility Study through the Consultants Howard Humphreys, Sir M. McDonald and Huntings continued its operations throughout the year and the final report is expected to be submitted early in 1972.

The study provides for the Development of the Kourris river flow, the further development of the Akrotiri aquifer and the conjunctive use for irrigation and domestic water supplies of the Kourris, Yermassoyia and Garyllis rivers as well as the aquifer supplies.

1.4.2.2 The Kyrenia range aquifer investigations were twice locally supervised for a period of about two months by Dr. Dixey. A number of boreholes were drilled on the range reading depth of the order of 1000ft. through the limestone and or Lapithos Chalks, Important quantities of water were revealed through testpumping. The progress is rather slow due to the difficulties of drilling through the hard and cavenous limestone and it is expected that the services of Dr. Dixey will also be required during 1972 when his final work may be awaited.

1.4.2.3 Assistance was provided in the field of desalination with emphasis on its conjunctive use with fresh water supplies. A team leaded by Dr. Mawyer Chief Economist of the Water Research Association visited us and discussed the initiation of such a study which has been already started. Dr. Mawyer is expected to pay another visit in 1972.

1.5 Cyprus National Inter-Departmental and Departmental Committees

1.5.1 International Hydrological Decade

This Committee was set up on 19th August, 1964 for U.N.E.S.C.O.'s Hydrological Decade (1965-1974) and is composed of the following persons:

Chairman — Mr. C.A.C. Konteatis,
Director, Water Development Department.

Secretary — Mr. N. Chr. Toufexis,
Asst. Head of Water Resources Division.

Members — Mr. Y. Hji Stavrinou,
Director, Geological Survey Department.

Mr. A. Papasolomontos,
Director, Agricultural Department.

Mr. Th. Christou,
Director, Agricultural Research Institute.

Mr. G. Seraphim,
Director, Forest Department.

Mr. Cl. Philaniotis,
Asst. Meteorologist, Meteorological Office.

The main activities during the year were the hydrometeorological observations taken in the Representative basin of Limnitis and Vasilikos rivers, as well as the evaporation observations taken at Athalassa. The results are reported to the Secretary, Co-ordinating Council for the I.H.D. Paris.

1.5.2 International Commission on Large Dams

The Cyprus National Committee on Large Dams (CNCOLD) was elected to full membership of the International Commission on Large Dams in 1962. During 1971 the National Committee was composed of the following members.

Chairman	Mr. C.A.C. Konteatis, Director, Water Development Department.
Secretary	Mr. C.C. Artemis, Executive Engineer, Division of Design.
Members	Mr. K.C. Hassabis, Senior Water Engineer.
	Mr. Y. Zambarloukos, Representative of the Association of Civil Engineers and Architects.
	Mr. G. Paraskevaides, Representative of the Association of Contractors.

The main activity of the year was the organization of a lecture delivered by the Chairman of CNCOLD on March 18th, 1971 with the title "Planning for Dams in Cyprus".

The lecture was a success in all respects.

The 39th Executive Meeting of ICOLD was held in Dubrovnik Yugoslavia on 4th - 7th October, 1971. Cyprus was not represented.

1.5.3 International Commission on Irrigation and Drainage

The International Commission on Irrigation and Drainage was set up in 1950 in order to meet the need for a non-governmental international organization for the stimulation and promotion of the development and application of the science and technique of irrigation, drainage, flood control and river training in the engineering, economic and social aspects. From 11 member countries at the beginning, the organization has grown to one that now has 62 member countries.

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 at present it is composed of the following:

Chairman	Mr. C.A.C. Konteatis, Director, Water Development Department.
Secretary	Mr. D.M. Patsalides Irrigation Engineer Water Development Department.

DAMS CONSTRUCTED UP TO 1960

No	DAM	TYPE	H.T.	1000 m³	YEAR
1	Kouklia	Earth	6.1	4,545	1900
2	Lymbia	Masonry	5.2	18	1945
3	Lythrodhonta	Masonry	10.7	32	1945
4	Kalochoria (K1)	Masonry	9.1	82	1947
5	Akrounda	Masonry	6.7	23	1947
6	Galini	Masonry	11	23	1947
7	Petra	Masonry	9.1	32	1948
8	Petra	Masonry	9.1	23	1951
9	Lythrodhonta	Masonry	10.4	32	1952
10	Kafizes	Masonry	23.5	115	1953
11	Ayios Loucas	Earth	34	455	1955
12	Gypsos	Earth	34	100	1955
13	Kandou	Masonry	14	35	1956
14	Perapedhi	Gravity	21.6	55	1956
15	Pyrgos	Gravity	22.3	280	1957
16	Trimiklini	Gravity	33.2	340	1958

Total Storage Capacity 6.190 $m^3 \times 10^6$

MINOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	H.T.	1000 m³	YEAR
47	Setira	Earth	7.6	45	1962
48	Panayia (F)	Earth	7	45	1962
49	Paralimni (45)	Earth	4.6	115	1963
50	Ayia Napa (7)	Earth	8.2	55	1963
51	F'sta Recharge	Earth	4.9	50	1963
52	Phrenaros (6)	Earth	5.5	115	1964
53	Dherynia	Earth	6.1	23	1964
54	Phrenaros (3)	Earth	6.7	45	1966
55	Avgorou (7)	Earth	3	68	1966
56	Kontea (2)	Earth	5.5	82	1966
57	Xylophagou (4)	Earth	6.7	86	1966
58	Setira (4)	Earth	4.6	32	1966
59	Lysi	Earth	6.7	77	1967
60	Ay Yeorgios (9)	Earth	3	68	1967
61	Ay Apiritos (6)	Earth	6.1	34	1968
62	Akanthou (8)	Earth	6.1	45	1968
63	Akhna (3)	Earth	4.3	40	1968
64	Xylotymbou (5)	Earth	5.5	50	1969

Total Storage Capacity 1.075 $m^3 \times 10^6$

MAJOR DAM PROJECTS FROM 1960-70

No	DAM	TYPE	H.T.	1000 m³	YEAR
17	Prodhromos	Earth	10.4	115	1962
18	Morphou	Earth	15.5	2,045	1962
19	Lefka	Gravity	34.4	365	1962
20	Geunyeli	Earth	18	1,050	1962
21	Athalassa	Earth	18.3	790	1962
22	Kanli Keyu	Earth	19.8	1,100	1963
23	Argaka	Rockfill	41.1	1,150	1964
24	Nia Milea	Earth	21.6	340	1964
25	Ovgos	Earth	15.8	850	1964
26	Tremithios	Earth	22.6	1,615	1964
27	Agros	Earth	26.2	100	1964
28	Liopetri	Earth	18.3	340	1964
29	Polemidhia	Earth	44.8	3,850	1965
30	Ayia Marina	Rockfill	32.9	310	1965
31	Kalopanayiotis	Earth	39.3	395	1966
32	Mavrokolymbos	Earth	46.6	2,180	1966
33	Pomos	Earth Rock	30.4	850	1966
34	Yermasoyia	Earth	48.4	13,600	1968
35	Syngrasis	Earth	7.3	1,115	1968

Total Storage Capacity 32.360 $m^3 \times 10^6$

MAJOR RECHARGE DAMS FROM 1960-70

No	DAM	TYPE	H.T.	1000 m³	YEAR
36	Ay. Yeorghios	Earth	6.1	90	1962
37	F'sta Antiflood	Earth	7.6	165	1963
38	Ay. Nicolaos	Earth	1.8	1,365	1964
39	Paralimni Lake	Earth	0.9	1,365	1964
40	Fresh Water Lake	Earth	3	4,545	1964
41	Makrasyka	Earth	7.9	195	1966
42	Akhna (Mesania)	Earth	3.7	90	1967
43	Morphou spreading grounds	Earth	4.6	130	1968
44	Ormidhia	Earth	5.5	100	1968
45	Vrysoules	Earth	6.7	140	1969
46	Protopapas	Earth	5.9	90	1970

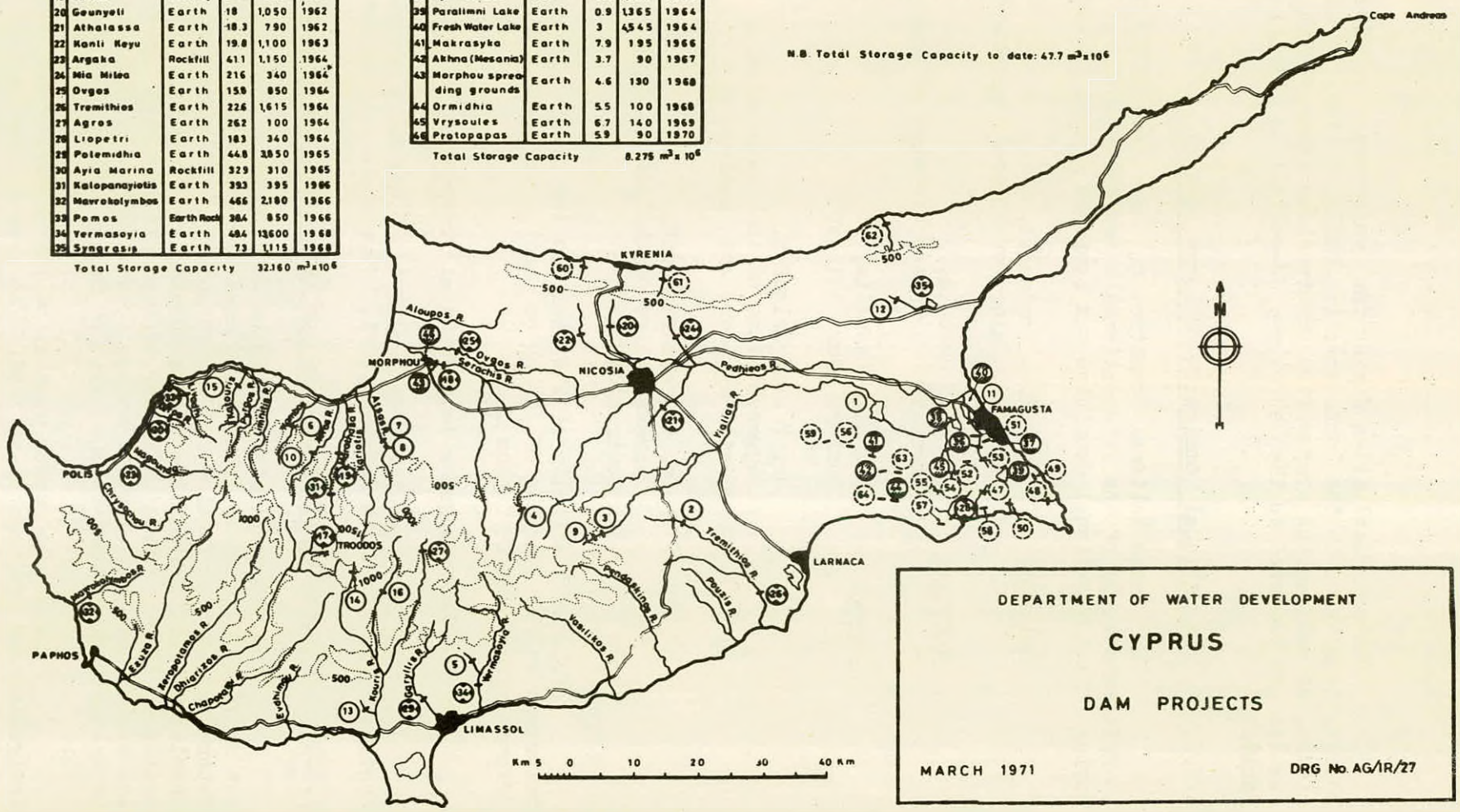
Total Storage Capacity 8.275 $m^3 \times 10^6$

H.T. refers to height in meters from foundation

YEAR is the year of completion

Phrenaros (6) means six small dams in Phrenaros area

N.B. Total Storage Capacity to date: 47.7 $m^3 \times 10^6$



(1) Dams constructed up to 1960

(17) Major dam projects from 1960-70

(36) Major recharge dams from 1960-70

(47) Minor recharge dams from 1960-70

DEPARTMENT OF WATER DEVELOPMENT

CYPRUS

DAM PROJECTS

MARCH 1971

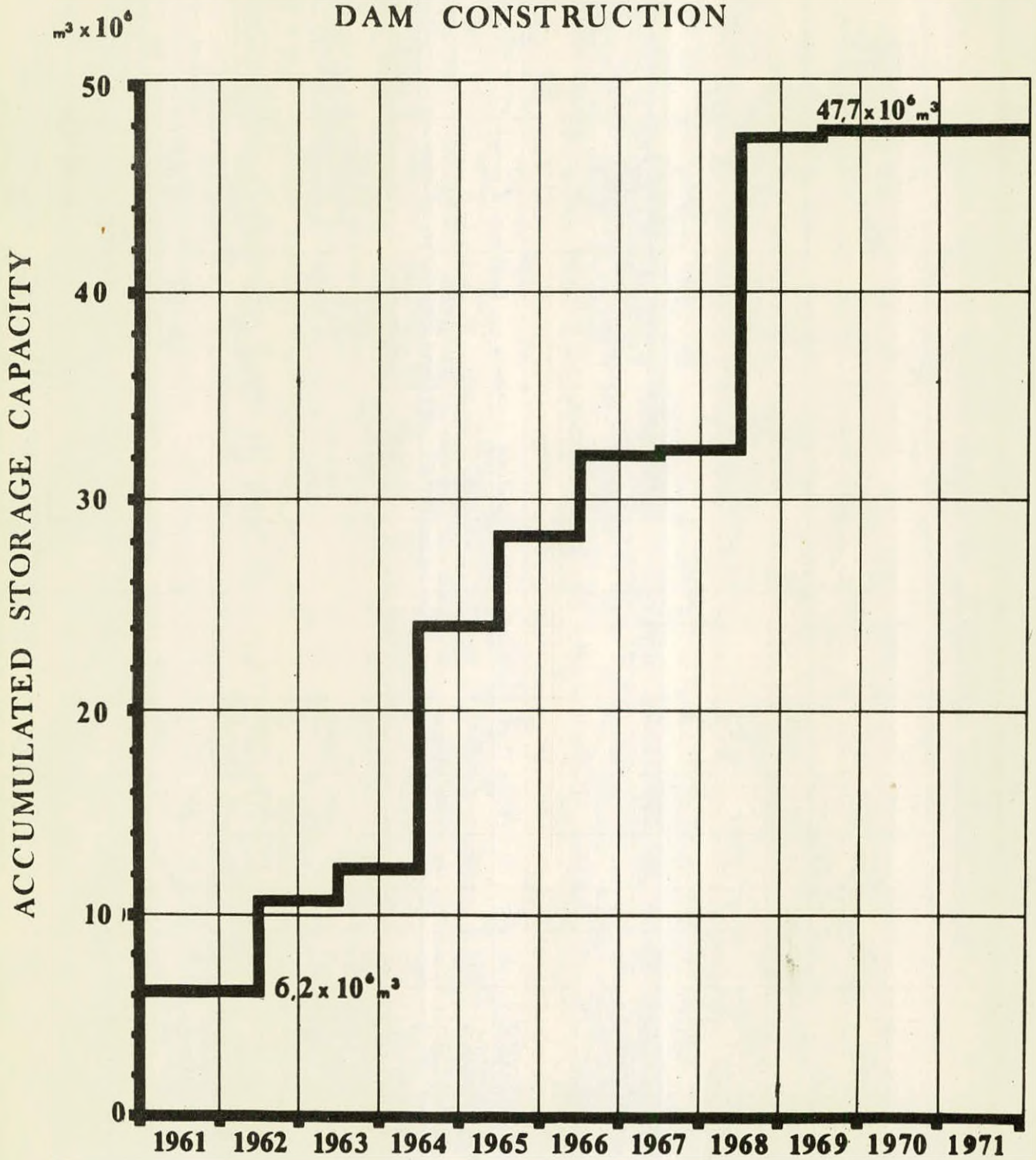
DRG No. AG/IR/27

International Commission on Large Dams
WORLD REGISTER OF DAMS
NATIONAL COMMITTEE OF . CYPRUS .....
Information on Dams supplied to National Committee
by
Director, Department of Water Development
Including Dams in Existence, under Construction or Proposed
1961

	(1) FILE NO.	(2) NAME OF DAM	(3) YEAR OF COMPLETION	(4) (5) LOCATION RIVER	(4) (5) LOCATION NEAREST CITY	(6) STATE COUNTY OR EQUIVALENT	(7) TYPE	(8) (9) (10) HEIGHT ABOVE LOWEST FOUNDATION	HEIGHT FOUNDATION TO CUT-OFF	HEIGHT ABOVE GROUND LEVEL	(11) LENGTH OF CREST	(12) VOLUME CONTENT OF DAM	(13) CAPACITY OF RESERVOIR	(14) PURPOSE	(15) INSTALLED POWER CAPACITY	(16) OWNER	(17) ENGINEERING BY	(18) CONSTRUCTION BY	(19) REMARKS	
			-: Delete units which are not being used :-					FEET	FEET	FEET	FEET	CUBIC YARDS	CUBIC FEET x 10^6		KW					
1		YERMASOYIA	1968	YERMASOYIA	LIMASSOL	LIMASSOL DISTRICT	E	162	51	110	965	650,000	480	I		GOVERNMENT	ENERGOPROJECT OF YUGOSLAVIA	CYBARCO OF CYPRUS		1
2		KALOPANAYIOTIS	1966	MARATHASA	NICOSIA	NICOSIA DISTRICT	E	129	44	85	450	200,000	14	I		GOVERNMENT	HOWARD HUMPHREYS & SONS OF U.K.	DEPARTMENT OF WATER DEVELOPMENT		2
3		MAVROKOLYMBOS	1966	MAVROKO-LYMBOS	KTIMA	PAPHOS DISTRICT	E	153		133	600	350,000	77	I		GOVERNMENT	ENERGOPROJECT OF YUGOSLAVIA	CYBARCO OF CYPRUS		3
4		POMOS	1966	LIVADHI	KTIMA	PAPHOS DISTRICT	ER	126		106	560	200,000	30	I		POMOS IRRIGATION DIVISION	ENERGOPROJECT OF YUGOSLAVIA	MEDITERRANEAN CONSTRUCTORS GREECE G. P ZACHARIADES CYPRUS		4
5		AYIA MARINA	1965	XEROS TYLLIRIAS	KTIMA	PAPHOS DISTRICT	R	108		100	380	80,000	11	I		AYIA MARINA IRRIGATION DIVISION	ENERGOPROJECT OF YUGOSLAVIA	MEDITERRANEAN CONSTRUCTORS GREECE G. P ZACHARIADES CYPRUS		5
6		POLEMIDHIA	1965	GARYLLIS	LIMASSOL	LIMASSOL DISTRICT	E	147		124	650	281,000	138	I		GOVERNMENT	ENERGOPROJECT OF YUGOSLAVIA	MOWLEM & RIDGWAY OF U.K.		6
7		AGROS	1964	KOURRIS	LIMASSOL	LIMASSOL DISTRICT	E	86		66	570	80,000	3.5	I		AGROS IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		7
8		ARGAKA	1964	MAGOUNDA	KTIMA	PAPHOS DISTRICT	R	135		100	560	180,000	40	I		GOVERNMENT	HOWARD HUMPHREYS & SONS OF U.K.	MOWLEM & RIDGWAY OF U.K.		8
9		LIOPETRI	1964	POTAMOS	FAMAGUSTA	FAMAGUSTA DISTRICT	E	60		48	1,800	65,000	12			LIOPETRI IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	GROUND WATER RECHARGE	9
10		MIA MILIA	1964	PEDIEOS	NICOSIA	NICOSIA DISTRICT	E	71		50	415	70,000	12	I		MIA MILIA IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		10
11		OVGOS	1964	SERAKHIS	NICOSIA	NICOSIA DISTRICT	E	52		46	2,400	170,000	30	I		MORPHOU IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		11
12		KITI	1964	TREMITHIOS	LARNACA	LARNACA DISTRICT	E	74		52	3 248	230 000	57	I		GOVERNMENT	IL NUOVO CASTORO OF ITALY	DEPARTMENT OF WATER DEVELOPMENT		12
13		KANLI KEUY	1963	PEDIEOS	NICOSIA	NICOSIA DISTRICT	E	65		40	700	62,000	39	I		KANLI KEUY IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		13
14		ATHALASSA	1962	PEDIEOS	NICOSIA	NICOSIA DISTRICT	E	60		42	1,370	135,000	28	F,I		GOVERNMENT	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		14
15		GEUNYELI	1962	PEDIEOS	NICOSIA	NICOSIA DISTRICT	E	59		53	655	66,000	37	I		GEUNYELI IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		15
16		LEFKA	1962	MARATHASA	NICOSIA	NICOSIA DISTRICT	G	113		89	490	15,000	13	I		LEFKA IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		16
17		MORPHOU	1962	SERAKHIS	NICOSIA	NICOSIA DISTRICT	E	51		39	4,500	197,000	61	I		MORPHOU IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	ALSO GROUND WATER RECHARGE	17
18		PRODHROMOS	1962	DHIARIZOS	LIMASSOL	LIMASSOL DISTRICT	E	34		20	1,400	96,000	4	I		PRODHROMOS IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	RECTANGULAR RESERVOIR	18
19		TRIMIKLINI	1958	KOURRIS	LIMASSOL	LIMASSOL DISTRICT	G	109		95	250	8,000	12	I		TRIMIKLINI IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		19
20		PYRGOS	1957	KATOURIS	NICOSIA	NICOSIA DISTRICT	G	73		67	215	10,000	10	I		PYRGOS IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		20
21		KANDOU	1956	KOURRIS	LIMASSOL	LIMASSOL DISTRICT	G	46		43	175	4,000	1.2	I		KANDOU IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	MASONRY	21
22		PERAPEDHI	1956	KOURRIS	LIMASSOL	LIMASSOL DISTRICT	G	71		64	215	6,000	2	I		PERAPEDHI IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT		22
23		KAFIZES	1953	XEROS MORPHOU	NICOSIA	NICOSIA DISTRICT	G	77		54	90	9,000	4	I		LEFKA IRRIGATION DIVISION	DEPARTMENT OF WATER DEVELOPMENT	DEPARTMENT OF WATER DEVELOPMENT	MASONRY	23

DEPARTMENT OF WATER DEVELOPMENT

DAM CONSTRUCTION



Ex-Officio Members

Director,
Department of Forest.

Director,
Department of Agriculture.

Director,
Agrioultural Research Institute.

The following activities were carried out by the Cyprus Committee during the year:

It continued to keep correspondance with the central office of the I.C.I.D. for the Interchange of information between its national committees.

All publications such as bulletins, Annual Reports and other documents which were sent by the I.C.I.D. or any member country of the I.C.I.D. were distributed to all members.

Mr. N. Tsiourts, former secretary of the C.C.I.D. has represented the Cyprus Committee at the 8th European Meeting on Irrigation and Drainage at Aix-En Provence, France, which took place between the 14th - 19th June 1971.

In July 1971 the constitution of the Cyprus Committee on Irrigation and Drainage was approved.

The constitution sets up the framework within which the committee acts in order to accomplish its own objectives.

1.5.4 International Water Supply Association

The Department of Water Development was an associate member of the I.W.S.A. until 1969. Late in 1969 a National Committee was established made by of:

Mr. C.A.C. Konteatis,
Director, Water Development Department,
as Chairman.

Mr. G. Charalambous,
Superintendent of Works of the Water Development Department, as Secretary.

and the representatives of the Ministry of Interior and Water Boards of Nicosia, Limassol, Famagusta and Larnaca as members.

1.5.5 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 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, A.R.I. the Geological Department, Meteorological Office, Fisheries Department and the District Administration were also held during the year.

1.6 Water Resources

1971 was a year of an average rainfall having reached 501 millimetres average throughout the island which is equivalent to 99.6% of the normal. Whereas, the winter months December and January were about 50% of the normal, yet February was 30% higher and April was 4 times that of the normal. Thus we had a wet spring, April being the wettest month ever recorded. This had a good effect on the irrigation requirements of crops and in particular it resulted to a high yield of wheat. The snow fall on Troodos was also considerable during the year and lasted until the end of April.

The flow in the rivers was well below average and the major dams were only about half filled with water. The small dams on the mountains were filled and over flowed as usual.

During the year 55 boreholes were drilled by the Department for prospective purposes such as domestic water supply and irrigation. The most important programme was that of the investigations on the Kyrenia range, which consisted of deep drilling exceeding 1000 ft. in hard limestone.

The ground water situation in the main aquifers of the upland continued to deteriorate during the year with a decline of the water table continuing. Over extraction in the main aquifers of Morphou Famagusta and Akrotiri increased during the year and especially in Morphou where the plantations are expanding by 7000 donums every year. The enforcement of the Special Measures Law in Morphou and Akrotiri where it was in force during the year was rather dissapointing. In Morphou only 55 water meters were installed during the year and in Akrotiri only 10, whereas in Famagusta where the Law was not in force only 3 water meters were installed. The application of efficient systems of irrigation in these regions has not been satisfactory either, and it can be said that wastage of water during the year was the most important contribution to the declining of the water table. There is no doubt that with the continuing of the over pumping, the wastage of water, and the extension of cultivation in the Morphou aquifer, this aquifer runs the risk to reach the same situation as that of Famagusta where pumping is only achieved from the annual recharge. In the Akrotiri peninsula the situation is more hopeful with the two dams having been built in the region and whose full utilization can now ensure the present requirements, and the equilibrium of the aquifer.

With the completion of the Akrotiri and Paphos Feasibility Studies it can now be said that certain parts of these aquifers still have some possibility for additional pumping whereas other parts show a decline. Even distribution of pumping is therefore necessary in order to maintain the proper balance of the aquifers. Regarding the Morphou aquifer apart from the Special Measures Law, our main objective now is to complete the study of the Morphou Feasibility Project whose main aim is to save this aquifer from devastation.

1.7. Planning and Design of Projects

The main works during the year were :

1.7.1 Paphos Feasibility Study - This study is a continuation of the CMPP and it is the part dealing with the Technoeconomic study for the development of the water resources of the Paphos coastal region and of the rivers discharging into it. This study is scheduled to be completed in early 1972.

1.7.2 The Akrotiri Feasibility Study has also been going on during the year using the same consultants and counterparts so that both these studies are to be produced using the same criteria, basic assumptions and considerations. This would enable a more realistic comparison of the results of these two projects.

1.7.3 Additional planning work and computerized studies undertaken by the Department been going on throughout the year for various parts of Cyprus.

1.7.4 Also planning and design works have been undertaken for the supply of additional water for Nicosia from Morphou and Pendayia.

Field and laboratory investigations have also been undertaken on several damsites such as the Asprokremmos damsite for the Paphos Project, the Kalavassos Khirokitia, Dhypotamos and Panayia tis Agapis damsites for the Larnaca regional project, the Kyra, Kalochorio and Ayios Theodoros damsites for the Morphou Project and the Ayios Nicolaos (Kakopetria) and Arakapas damsites for small local projects. In addition foundation investigations were carried out for other damsites. For other Departments works were carried out on the new Nicosia Morphou road for the Public Works and on the Forest Industries Project.

Grouting works for maintenance purposes were carried out by the Department on the Lythrodondas upper dam, on the Kalopanayiotis dam and at the Ayia Sophia mosque in Nicosia. This latter work is done under the supervision of the UNESCO and the Antiquities Department for the purpose of strengthening the foundations and Masonry structure of the mosque.

1.8 Construction of Projects

During the year about £980,400 were spent on the construction of various projects all over the island which include projects for 57 rural domestic water supplies, 48 minor irrigation, 14 major irrigation, 2 town water supplies and 8 river training and antiflood as well as a great number of smaller water supplies and irrigation schemes from funds deposited by the village water commissions or by the irrigation committees concerned. The total estimated cost of all the executed projects is about £1,600,000.

The largest works under construction during the year were:

1.8.1 Rural domestic water supplies

Important schemes were:

The Morphou domestic water supply scheme which included additional water supply and a new distribution system. A major regional water supply scheme was executed for Platanistasa and other 4 Pitsilia regional villages which included the supply of additional water from the Pikromiloudhi Spring at Troodos. Another major regional scheme for Lefkara Kato Drys and Vavla was also executed which provided for the pumping of water from the Khirokitia Famagusta Water Supply reservoir to these highland villages. Other Regional Water Supply Schemes in Famagusta and Larnaca Districts were also executed.

Of the small irrigation schemes, important irrigation schemes in Morphou Psymolophou and Saitas Moniatis were executed.

The Famagusta Water Supply Scheme continued during the year with the starting of the construction of the Lefkara dam of the Khirokitia treatment works and of the main conveyor from Lefkara to Khirokitia.

As regards Nicosia water supply the Tseri scheme with 2 boreholes was completed and is providing additional water to Nicosia. The Pendayia scheme to provide 1 million gallons of water per day additional to Nicosia using the existing pipeline from the Syrianokhori pumping station to Nicosia and additional pumping units will be started during the year.

During the year also important major irrigation works were started such as:

The Massari dam. Its construction was undertaken by the Department through direct labour. This dam with a series of spreading grounds downstream will contribute to the recharge of the aquifer using the Serakhis river water.

The Palekhori dam has been under consideration for some 15 years now and at last it was decided to build it. This is a concrete dam being built by a contractor. The site of the dam is situated on the Kambi tributary of the Maroullena stream just upstream of the confluent with the Maroulena main stream where originally it was contemplated to build a dam. The original site selected 15 years ago was at the confluent with the Maroullena stream and was now found to rest on a fault zone which might cause land slides in the reservoir. It was therefore decided to move the damsite into the Kambi tributary a little upstream of the confluent. As the flow may be rather limited there, a diversion weir with a conveyor pipeline from the Maroullena river to the dam has also to be constructed.

Of the 5 major projects mentioned in the 1970 annual report as not having been started due to administrative formalities, the Palekhori and Massari dams are the only 2 which have been started during 1971. It has therefore again to be noted with regret that schemes such as the Yermasoyia, the Argaka Magounda and the Mavrokolymbos dam distribution systems were not started during 1971, although considerable discussion had been going on about them especially regarding the former.

The average number of labourers employed by the Department during 1971 was 954 as compared with 1029 in 1970. 41.40% were classed as regulars whilst approximately 49.60% were skilled employees, 7.90% semi skilled and 42.50% unskilled. 4.19% of the labourers employed were Turks.

The approximate monthly average of labourers engaged was as follows:

January	806
February	888
March	927
April	918
May	934
June	973
July	1131
August	1173
September	1016
October	903
November	932
December	848
Monthly Average	954

1.9 Operation and Maintenance of Projects

With the present establishment set up the District Officers and district administration of the Ministry of Interior in general are primarily responsible for the management of the various domestic water supply and projects. In the case of the Government Projects the Department of Water Development is the technical advisor and actually responsible for the maintenance of these projects. The required funds for the maintenance of the major projects is included in the budget of the Water Development Department. In the case of the smaller irrigation projects and rural domestic water supplies the administration and maintenance is done through the Village Water Commissions or the Irrigation Divisions concerned. The Department of Water Development is called in for technical advice and maintenance works as may be required by the Divisions and Commissions. Regarding the town water supplies there are Town Water Boards headed by the District Officer with the Director of Water Development as a Member, for the administration of the town water distribution.

The Government policy now is that the Government remains responsible for the supply and conveyance of water up to the town's reservoir from where the distribution of water is the responsibility of the Water Board concerned.

1.9.1 Major Irrigation Works

During the year several routine maintenance works were carried out on the major dams and a total amount of about £3 340 were spent during the year, on Government built dams as well as an amount of £942 on contributory projects.

The water available in the dams excluding Yermasoyia dam, for which no distribution system has yet been built, was 5 352 000 cu.m. of water of which 2 467 000 that is to say 46% was sold for irrigation, as compared with 1,961,000 cu.m. sold in 1970. That is to say there was an increase of utilization of about 6% from 1970 to 1971. The gross increase from the sale of water was £26,891 compared with £22,594 in 1970 whilst the expenses were £15,861 in 1971 as compared with £11,417 in 1970.

1.9.2 Town Water Supplies

Two town domestic water supplies are administered partly as Government projects, these being Nicosia and Famagusta.

1.9.2.1 Nicosia Water Supply

During the year the distribution system of greater Nicosia was extended by 25,550 ft. of 4 to 6 in diameter asbestos cement pipes. The total amount of water conveyed from all sources during the year was 7,750,000 cu.m. whilst the highest daily consumption was 27,386 cm.m. which is equivalent to about 50 gallons per capita per day on a population of about 120,000. The revenue from the sale of water was £188,500 during the year.

1.9.2.2 Famagusta Water Supply

The Government supply to Famagusta during the year from the Khirokitia reservoir using the boreholes at Khirokitia and the Vasilikos river water was 1,390,000 cu.m. This quantity of water supplied from the Khirokitia reservoir during the year represented 71% of the total supply to Famagusta the remaining having been supplied from the Water Boards boreholes at Phrenaros. The revenue to the Government from the sale of this water to Famagusta reached £63,714,200 during 1971.

1.10 Finance and expenditure

During the year the total expenditure reached £1,476,000 including all administration costs. The largest item of expenditure was on major irrigation projects for which £385,000 were spent. The administration costs including hydrological observations, consultants fees and major projects investigations reached £371,000 during the year which represents 33.5% of the total departmental expenditure. This as can be seen from Table 3, is one of the highest over reached being however less by 4% than that of 1970. Obviously these overheads are very high and they can be attributed to the fact that considerable planning work and Feasibility Studies have been going on during the last few years. It must be assumed that full scale construction works will start as soon as the Feasibility Studies will be completed and in that case the overhead expenditure of the Department should be substantially reduced.

The monthly expenditure of the Department as can be seen from Table 2 is very unevenly distributed ranging from 1.2% in January and slowly increasing to 43.4% in December. This obviously is very unsatisfactory and it has to be attributed on the institutional set up of the Government in general, and of the 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.

Table 1 - 1971 Expenditure - Water Development Department

	Details	Government funds £	Contribution by Beneficiaries £	Total £
1.	Administration	262,523	-	262,523
2.	Irrigation, Drainage and Dams	424,095	60,228	484,323
3.	Town Water Supplies	72,258	5,120	77,378
4.	Village Water Supplies	179,579	193,446	373,025
5.	Drilling and Prospecting	50,388	-	50,388
6.	Hydr. Obs. Research and Weirs	19,359	-	19,359
7.	Workshops (Maintenance)	18,588	-	18,588
8.	Purchase of Machinery tools and equipment	4,889	-	4,889
9.	Consultants' Fees	26,299	-	26,299
10.	Govt. Water Supplies	5,754	-	5,754
11.	Major Projects Investigations and Surveys	33,349	-	33,349
12.	Greater Nicosia Scheme	112,375	-	112,375
13.	Water Supply. Special Measures Law	176	-	176
14.	Flood Damages	1,187	836	2,023
15.	Erection of Buildings	65	-	65
16.	Stores	5,612	-	5,612
	Includes Ordinary and Development Expenditure	1,216,496	259,630	1,476,126
	Breakdown of Administration			
1.	Personal Emoluments	154,249	-	154,249
2.	Casual Assistance	8,925	-	8,925
3.	Technical Assistance	34,364	-	34,364
4.	Travelling	21,408	-	21,408
5.	M'ce & Oper. of M. Transport	21,269	-	21,269
6.	Office Expenses	3,796	-	3,796
7.	Leave pay to R.E.	18,316	-	18,316
8.	Local Training of Staff	196	-	196
	Total	262,523	-	262,523

Table 2 - Monthly Statement of Development Expenditure for the year 1971

1971 Approved	£2,233,630
Add. S/Warrants 10, 34, 46,47,22 and 5/71	£ 62,810
Total	£2,296,440

Month	Monthly £	Expenditure up-do-date £	Balance £	% to date expended
January	28,430	28,430	2,268,010	1.2%
February	38,110	66,540	2,229,900	2.8%
March	53,186	119,726	2,176,714	5.2%
April	105,817	225,543	2,070,897	9.7%
May	65,439	290,982	2,005,458	12.6%
June	46,051	337,033	1,959,407	14.7%
July	30,848	367,881	1,928,559	16.2%
August	64,572	432,453	1,863,987	18.8%
September	120,259	552,712	1,743,728	24.7%
October	60,750	613,462	1,682,978	26.5%
November	167,097	780,559	1,515,881	33.8%
December	215,446	996,005	1,300,437	43.4%

Summary

Approved amount	£2,296,440 (100%)
Less Actual Expenditure	£ 996.005 (43.4%)
Unspent Balance	£1,300,435 (56.6%)

Table 3.

Statement of Expenditure

Serial No.	Details	1 9 7 1
1.	Administration	262,523
2.	W/shops' M'ce of Plant and Stores	24,200
3.	Purchase of Machinery tools etc.,	4,889
4.	Hydrological Observations	19,359
5.	Consultants' Fees	26,299
6.	Major Projects Investigations	33,349
	Sub-Total "A"	370,619
7.	Drilling of water	50,388
8.	Water meters for wells and Boreholes	176
9.	Town Water Supplies	195,602
10.	Village Water Supplies	373,025
11.	Small Irrig. Projects	101,543
12.	Major Irrig. Projects	384,773
	Sub-Total "B"	£1,105,507
	Grand Total	£1,476,126
	% of A to B	33.5

STATEMENT OF EXPENDITURE FOR THE YEAR 1971

Major Irrigation Works - (2D-11)

Scheme	Amount	Estimated Cost			Actual Expenditure		
	Dedaggered £	Government £	Village £	Total £	Government £	Village £	Total £
CONTRIBUTORY SCHEMES							
Syrianokhori-D. House	4,229,000	4,229,301	2,116,151	6,345,452	4,041,429	2,020,714	6,062,143
Syrianokhori "Kokkinogi"(i)	976,000	976,454	976,454	1,952,908	223,479	223,479	446,958
Syrianokhori "Kokkinogi"(ii)	3,000,000	3,000,000	3,000,000	6,000,000	2,919,529	2,919,530	5,839,059
Morphou-Rech"Protopapas"(1967)	1,758,000	1,760,177	1,172,194	2,932,371	279,286	180,714	460,000
Morphou-"Serrakhis" Spr.Grounds"	14,000	14,000	3,000	17,000	-	-	-
Morphou-"Serrakhis" Compens.	840,000	839,629	280,211	1,119,840	315,375	105,125	420,500
Morphou "Serrakhis" Spr.Grounds"	13,533,000	13,533,000	6,767,000	20,300,000	-	-	-
Ovgos - Compensations	339,000	4,176,238	1,392,079	5,568,317	3,360	1,120	4,480
Famagusta-Dherinia	24,000,000	24,000,000	12,000,000	36,000,000	8,573,562	4,286,781	12,860,343
Palekhori - Kambi	10,500,000	10,500,000	3,500,000	14,000,000	5,936,263	1,978,755	7,915,018
DAMS - GOVERNMENT ONLY							
Massari	40,000,000	40,000,000	-	40,000,000	36,000,976	-	36,000,976
Lefkara	197,472,000	197,472,000	-	197,472,000	153,251,499	-	153,251,499
Lefkara-Khirokitia-Pipeline	58,000,000	58,000,000	-	58,000,000	36,963,584	-	36,963,584
Lefkara-Khirokitia-Treatment	10,000,000	10,000,000	-	10,000,000	1,655,221	-	1,655,221
Pomos - Compensations	90,000	90,000	-	90,000	98,050	-	98,050
Kalopanayiotis-Compensations	6,072,000	6,072,000	-	6,072,000	888,100	-	888,100
Kalopanayiotis-Electricity	417,000	417,000	-	417,000	417,000	-	417,000
Kalopanayiotis-Grouting	1,240,000	1,240,000	-	1,240,000	1,179,389	-	1,179,389
Mavrokolymbos	8,275,000	8,275,000	-	8,275,000	229,048	-	229,048
Polemidhia-Compensations	400,000	400,000	-	400,000	-	-	-
Polemidhia-Promissory Notes	65,550,000	65,550,000	-	65,550,000	65,550,000	-	65,550,000
Agros Diversion	4,923,000	4,923,000	-	4,923,000	-	-	-
Agros Blanket	222,000	222,000	-	222,000	-	-	-
Athalassa-Spillway	430,000	430,000	-	430,000	179,485	-	179,485
Yermasoyia	29,389,000	29,389,000	-	29,389,000	18,200,149	-	18,200,149
Kiti Compensations	63,000	63,000	-	63,000	62,400	-	62,400
DISTRIBUTIONS-Govt.Only							
Kiti - Pervolia	13,308,000	13,308,000	-	13,308,000	11,246,859	-	11,246,859
Kiti-Phase III	27,000,000	27,000,000	-	27,000,000	750,000	-	750,000
Kiti-Improvements	457,000	457,000	-	457,000	457,000	-	457,000
C/F	522,497,000	526,336,799	31,207,089	557,543,888	349,421,043	11,716,218	361,137,261

Major Irrigation Works - (2D-11) Cont'

Scheme	Amount	Estimated Cost			Actual Expenditure		
	Dedaggered £	Government £	Village £	Total £	Government £	Village £	Total £
B/F	522,497,000	526,336,799	31,207,089	557,543,888	349,421,043	11,716,218	361,137,261
Mavrokolymbos	6,800,000	6,800,000	-	6,800,000	1,075,850	-	1,075,850
Mavrokolymbos Compensations	1,398,000	1,398,000	-	1,398,000	276,855	-	276,855
Polemidhia	203,000	203,000	-	203,000	1,500	-	1,500
Kalopanayiotis	1,381,000	1,381,000	-	1,381,000	-	-	-
Yermasoyia-Outlet Pipe	1,941,000	1,941,000	-	1,941,000	576,087	-	576,087
Pomos	15,968,000	15,968,000	-	15,968,000	15,814,740	-	15,814,740
Arghaka-Magounda	40,000,000	40,000,000	-	40,000,000	-	-	-
Total	590,188,000	594,027,799	31,207,089	625,234,888	367,166,075	11,716,218	378,882,293

MINOR IRRIGATION WORKS

STATEMENT OF EXPENDITURE FOR THE YEAR 1971

CONTRIBUTORY SCHEMES

Schemes	Estimated Cost			Actual Expenditure		
	Government £	Village £	Total £	Government £	Village £	Total £
Anglissides	161,488	80,242	241,730	151,228	75,614	226,842
Akhyritou-Vrysculles	1,045,502	523,248	1,568,750	60,130	30,064	90,194
Akhna (1968)	868,666	435,332	1,303,998	120,500	60,250	180,750
Athienou "Marmarika"	2,200,000	1,100,000	3,300,000	1,294,266	647,133	1,941,399
Akaki "Kamena"	1,800,000	450,000	2,250,000	1,795,858	448,963	2,244,821
Galini	666,740	334,371	1,001,111	655,132	327,566	982,698
Famagusta-Dherinia Rech.	3,762,776	1,882,388	5,645,164	976,198	488,098	1,464,296
Gaidhouras	733,000	367,000	1,100,000	403,477	201,738	605,215
Kyra	4,848,364	4,848,365	9,696,729	4,751,648	4,751,649	9,503,297
Kyperounda "Dheisis"	545,509	272,755	818,264	434,746	217,372	652,118
Kyperounda "Dhymes"	1,200,000	800,000	2,000,000	890,654	593,770	1,484,424
Kyperounda "Klima"	810,000	540,000	1,350,000	771,157	514,104	1,285,261
Katokopia	158,726	159,725	318,451	126,597	126,598	253,195
Kalopanayitos "Ay. Kyriakos"	134,102	128,453	262,555	126,687	121,719	248,406
Kato Pyrgos	2,400,000	1,200,000	3,600,000	2,230,136	1,115,066	3,345,202
K. Pyrgos "Tyllirias"	234,641	118,322	352,963	199,739	99,869	299,608
Kato Pyrgos M'ce of Dam	67,000	33,000	100,000	67,435	33,717	101,152
Kalo Khorio Klirou M'ce of Dam	100,000	50,000	150,000	66,667	33,333	100,000
Kato Moni-Antiflood	765,000	765,000	1,530,000	660,262	660,262	1,320,524
Kelokedhara "Ziripilli"	4,305,000	1,500,000	5,805,000	4,030,144	1,404,246	5,434,390
Koma-tou-Yialou Fish Ponds	1,500,000	-	1,500,000	4,000	-	4,000
Louvaras "K. Pervolia"	500,000	250,000	750,000	498,768	249,384	748,152
Kato Koutraphas-"Konizos"	4,667,000	2,333,000	7,000,000	3,167,227	1,583,613	4,750,840
Lythrodhontas M'ce of Dam	33,333	16,667	50,000	33,333	16,667	50,000
Maroni	1,959,106	980,053	2,939,159	1,288,312	644,156	1,932,468
Morphou "Teratsia"	13,876,640	13,876,641	27,753,281	13,476,173	13,476,175	26,952,348
Nikoklia "River Training"	5,425,000	6,075,000	11,500,000	3,880,036	4,343,864	8,223,900
Prodhromos M'ce of Dam	73,577	36,288	109,865	9,955	4,978	14,933
Potami	839,192	420,595	1,259,787	98,667	49,333	148,000
Pera-Pedi M'ce of Dam	66,650	33,350	100,000	62,953	31,477	94,430
Peristerona)		99,955			21,985	
Astromeritis)	150,436	50,478	300,869	32,978	10,992	65,955
C/F	55,897,448	39,760,228	95,657,676	42,365,063	32,383,755	74,748,818

MINOR IRRIGATION WORKS (Cont')

Scheme	Estimated Cost			Actual Expenditure		
	Government £	Village £	Total £	Government £	Village £	Total £
B/F	55,897.448	39,760,228	95,657,676	42,365,063	32,383,755	74,748,818
Peristerona	5,275,000	5,275,000	10,550,000	5,198,256	5,198,257	10,396,513
Peristerona)		767,000			656,783	
Astromeritis) £2,300.- Estimate	1,150,000	383,000	2,300,000	985,173	328,391	1,970,347
Peristerona)		133,000			42,357	
Astromerits)	250,000	67,000	500,000	74,124	21,179	148,249
Crounda)		50,000			10,589	
Trimiklini M'ce of Dam	102,753	51,877	154,630	31,723	15,862	47,585
Psimolophou	7,200,000	3,600,000	10,800,000	3,598,468	1,799,234	5,397,702
Trimiklini	3,333,000	1,667,000	5,000,000	3,267,669	1,633,834	4,901,503
Trimiklini Est. £906.-Rev.	604,900	301,951	906,851	320,927	160,464	481,391
Xylotymbou	1,507,449	753,236	2,260,685	47,379	23,689	71,068
Tris Elies "Diploma"	521,289	260,645	781,934	48,447	24,224	72,671
Xyliatos "Ayios Kyriacos"	480,000	120,000	600,000	465,135	116,283	581,418
Xyliatos Antiflood	555,000	185,000	740,000	526,814	175,604	702,418
Total	76,876,839	53,374,937	130,251,776	56,929,178	42,590,505	99,519,683

STATEMENT OF EXPENDITURE FOR THE YEAR 1971
CONTRIBUTORY SCHEMES

Village Water Supply Works

Scheme	Estimated Cost			Actual Expenditure		
	Government £	Village £	Total £	Government £	Village £	Total £
Aradhippou	502,234	703,461	1,205,695	317,659	444,663	762,322
Ay. Andronikos	3,600,000	3,600,000	7,200,000	3,557,934	3,557,936	7,115,870
Ay. Amvrosios)		42,331			41,888	
Hardja)	57,108	14,777	114,216	55,851	13,962	111,701
Alona)		4,350,000			4,315,598	
Platanistassa)		5,050,000			5,020,186	
Polystipos) Part I	14,800,000	2,025,000	29,600,000	14,678,904	1,996,330	29,357,808
Lagoudhera)		2,125,000			2,099,083	
Sarandi)		1,250,000			1,247,707	
Alona)		3,075,000			1,898,019	
Platanistassa) Part II	6,700,000	3,625,000	13,400,000	4,126,127	2,228,108	8,252,254
Alona	1,300,000	1,300,000	2,600,000	1,254,115	1,254,115	2,508,230
Platanistassa	1,700,000	1,700,000	3,400,000	1,699,483	1,699,484	3,398,967
Episkopi	2,900,000	3,600,000	6,500,000	2,369,867	2,941,354	5,311,221
Athienou	9,000,000	9,000,000	18,000,000	2,730,074	2,730,074	5,460,148
Kallepia)		1,080,000			7,119	
Letymbou) Ayia Scheme	3,000,000	1,500,000	6,000,000	19,774	9,887	39,548
Pittarkou)	420,000	-		2,768	-	
Karakoumi	143,053	117,552	260,605	77,198	62,653	139,851
Korphi	1,003,004	501,502	1,504,506	465,510	232,757	698,267
Kritou-Terra	300,000	2,000,000	2,300,000	226,562	1,509,546	1,736,108
Kato Polemidhia	4,247,582	7,888,366	12,135,948	4,176,773	7,756,866	11,933,639
Kalo Khorio Klirou	2,424,666	2,424,661	4,849,327	1,395,830	1,395,830	2,791,660
Kalogrea	8,650,000	8,650,000	17,300,000	7,509,825	7,509,827	15,019,652
Kolossi	4,000,000	4,000,000	8,000,000	1,577,734	1,577,734	3,155,468
Kontemenos	7,250,000	8,000,000	15,250,000	5,863,811	6,470,667	12,334,478
Kelokedhara "Vailas"	400,000	400,000	800,000	191,938	191,939	383,877
Kambi-Pharmakas	2,400,000	2,500,000	4,900,000	1,551,602	1,614,932	3,166,534
Khalassa	550,000	550,000	1,100,000	373,657	373,658	747,315
Kalo Khorio Limassol	600,512	600,510	1,201,022	271,675	271,675	543,350
Kedhares Paphos	1,550,000	2,150,000	3,700,000	71,178	98,294	169,472
Lymbia	667,539	1,033,109	1,700,648	11,248	17,424	28,672
C/F	78,165,698	84,856,269	163,021,967	54,577,097	60,589,315	115,166,412

Village Water Supply Works (Cont')

Scheme	Estimated Cost			Actual Expenditure		
	Government £	Village £	Total £	Government £	Village £	Total £
B/F	78,165,698	84,856,269	163,021,967	54,577,097	60,589,315	115,166,412
Lefkara Regional Scheme	30,000,000	-	30,000,000	17,504,292	-	17,504,292
Lefkara Phase 1 B 2	2,050,000	2,050,000	4,100,000	384,208	384,208	768,416
Morphou	9,528,765	14,510,502	24,039,267	9,158,501	13,945,688	23,104,189
Malounda	800,000	800,000	1,600,000	780,461	780,461	1,560,922
Kapouti	15,000,000	17,000,000	32,000,000	10,853,980	12,303,648	23,157,628
Motides	1,400,000	1,400,000	2,800,000	1,347,272	1,347,273	2,694,545
Mitsero	1,400,000	1,400,000	2,800,000	935,865	935,865	1,871,730
Melini	2,934,000	1,466,000	4,400,000	998,873	499,437	1,498,310
Mathiatis	2,092,743	697,579	2,790,322	402,311	134,104	536,415
Nata	201,750	201,750	403,500	187,959	187,960	375,919
Nikitari	931,005	1,164,168	2,095,173	48,491	60,601	109,092
Petra	988,559	988,558	1,977,117	820,028	820,028	1,640,056
Potamos Yermasoyias	4,418,177	18,383,566	22,801,743	3,913,059	18,257,243	22,170,302
Peristerona-Paphos	1,450,000	1,750,000	3,200,000	1,138,148	1,373,210	2,511,358
Pedhoulas	1,250,000	1,250,000	2,500,000	1,161,386	1,161,387	2,322,773
Pendakomo	8,000,000	9,800,000	17,800,000	5,176,862	6,340,071	11,516,933
Phinikaria	1,000,000	1,000,000	2,000,000	843,487	843,488	1,686,975
Pano Arodhes	2,250,000	3,250,000	5,500,000	2,218,783	3,206,114	5,424,897
Tembria)		195,760			36,317	
Sina Oros) Part I	543,777	87,004	1,087,554	100,880	16,140	201,760
Evrykhou)		261,013			48,423	
Tembria)		378,438			373,940	
Evrykhou) Phase II	901,043	522,605	1,802,086	890,333	516,394	1,780,667
Tembria	6,100,000	7,900,000	14,000,000	4,746,124	6,144,478	10,890,602
Sina Oros	1,750,000	2,250,000	4,000,000	1,461,920	1,879,611	3,341,531
Evrykhou Part III	660,327	660,327	1,320,654	498,184	498,185	996,369
Evrykhou New Scheme	1,500,000	1,500,000	3,000,000	656,442	656,442	1,312,884
Tseri	510,000	510,000	1,020,000	117,000	117,000	234,000
Tokhni	2,750,000	2,750,000	5,500,000	1, 313,216	1,313,217	2,626,433
Voroklini-Livadhia	650,000	-	650,000	494,762	-	494,762
Vitsadha Old Scheme	780,000	780,000	1,560,000	738,072	738,071	1,476,143
Vitsadha New Scheme	4,650,000	-	4,650,000	2, 094,215	-	2,094,215
C/F	184,655,844	179,763,539	364,419,383	125,360,451	135,306,559	260,667,010

Village Water Supply Works (Cont')

Scheme		Estimated Cost			Actual Expenditure		
		Government £	Village £	Total £	Government £	Village £	Total £
B/F		184,655,844	179,763,539	364,419,383	125,360,451	135,306,559	260,667,010
Vasilia			48,404			30,138	
Agridhaki			50,148			7,537	
Sysklipos			61,307			9,043	
Ay.Ermolaos			25,395			16,080	
Ay.Marina	Part I	228,644	14,185	461,955	194,925	9,043	289,368
Asomatos			18,915			12,056	
Panagra			1,773			1,503	
Orga			6,592			4,522	
Livera			6,592			4,521	
Ay. Marina Part VIII		934,848	311,617	1,246,465	454,618	151,541	606,159
Asomatos Part IX		699,768	349,885	1,049,653	25,333	12,667	38,000
Vasilia Part X		118,023	118,021	236,044	96,422	96,424	192,846
Meloushia		714,193			645,014	-	
Tremetoushia			1,666,450			1,505,037	
Arsos	A.I	12,345,385	1,547,418	23,806,431	11,072,735	1,397,529	21,500,461
Vatyli			6,818,792			6,235,133	
Strongylos			714,193			645,013	
Tremetoushia			442,000			15,362	
Arsos	A.II		413,000			14,338	
Vatyli		3,039,000	1,829,000	5,900,000	105,486	63,497	204,828
Strongylos			177,000			6,145	
Arsos			624,000			96,654	
Vatyli	A.III	4,043,000	2,847,000	7,800,000	626,234	440,982	1,208,169
Strongylos			286,000			44,299	
Vatyli			4,742,000			3,330,488	
Strongylos	A.IV	5,685,000	473,000	10,900,000	3,994,034	331,773	7,656,295
Tremetoushia	A.V	3,850,000	3,850,000	7,700,000	2,388,370	2,388,372	4,776,742
Arsos	A.VI	2,500,000	2,500,000	5,000,000	2,203,122	2,203,124	4,406,246
Vatyli	A.VII	14,000,000	14,000,000	28,000,000	11,044,062	11,044,061	22,088,123
Strongylos	A.VIII	4,333,000	2,167,000	6,500,000	4,317,204	2,158,603	6,475,807
Yerakies		56,021	65,191	121,212	41,529	48,168	89,697
C/F		237,202,726	225,938,417	463,141,143	162,569,539	167,630,212	330,199,751

Village Water Supply Works (Cont')

Scheme	Estimated Cost			Actual Expenditure		
	Government £	Village £	Total £	Government £	Village £	Total £
B/F	237,202,726	225,938,417	463,141,143	162,569,539	167,630,212	330,199,751
Ypsonas		4,613,000			4,519,789	
K. Polemidhia	11,250,000	6,075,000	22,500,000	11,023,851	5,952,882	22,047,705
P. Polemidhia	562,000	-		551,192	-	
Ypsonas	1,900,000	16,400,000	18,300,000	1,777,111	15,343,417	17,120,528
Total	250,914,726	253,026,417	503,941,143	175,921,693	193,446,291	369,367,984

List of Senior Technical Staff

Name	Post	Qualifications
Christos A. Konteatis	Director	B.Sc. (Civil Eng.) University of London, F.I.C.E., F.I.W.E.
Constantinos Lytras	Assistant Director	Dipl. (Natural Science) University of Athens, M.Sc. (Geology) University of London, D.I.C. Engineering Geology.
Kyprianos C. Hassabis	Senior Water Engineer	B.Sc. (Civil Eng.) University of London, M.E.,N.S.T.C., M.I.C.E., M.A.S.C.E.
Haralambos Karakannas	Engineer Hydrologist	M.A.S.C.E., F.I.P.H.E., F.R.S.H., (London) Registered Civil Engineer
Christodoulos Christodoulou	Executive Engineer Class I	Dipl. (Civil Eng.) National Technical University of Athens
Christos Marcoullis	Executive Engineer Class I	Dipl. (Civil Eng.) National Technical University of Athens
Andreas P. Georghiades	Executive Engineer Class I	Dipl. Tech. (Civil Eng.) University of London, M.Sc. University of Birmingham, M.I.C.E.
Costakis Andreou	Executive Engineer Class I	Dipl. (Civil Eng.) University of Dresden
Charis Lapas	Executive Engineer Class II	B.Sc. (Civil Eng.) University of Glasgow
Christodoulos Artemis	Executive Engineer Class II	B.Sc. (Civil Eng.) University of London, A.C.G.I., M.Sc. (Soil Mechanics) D.I.C., Assoc.Memb. I.C.E. - F.G.S.
Markos Dymiotis	Executive Enginner Class II	Dipl. (Civil Eng.) National Technical University of Athems
Nicos Stylianou	Executive Engineer Class II	Dipl. (Civil Eng.) The Polytechnic London, M.Sc. (Foundation Eng.) University of Birmingham, Assoc.Memb. I.C.E.
Vlasis Partassides	Executive Engineer Class II	Dipl. (Civil Eng.) University of Moscow, M.Cs. (Civil and Industrial Eng.) University of Moscow
Andreas Protopapas	Executive Engineer Class II	B.Sc. (Civil Engineering) University of Newcastle
Charalambos Palantzis	Executive Engineer Class II	B.Sc. (Civil Eng.) University of London, Assoc.Memb. I.C.E.
Pantelis Loucaides	Executive Engineer Class II	B.Sc. (Eng.) Civil. Eng. London University, M.Sc.(Foundations) Birmingham University
Maria Zachariou	Executive Engineer Class II	B.Sc. (Eng.) Civil Eng. London University, Member of Institute of Civil Engineers and Architects
Andreas Lambrou	Executive Engineer Class II	Dipl. (Civil Eng.) University of Budapest
Charalambos Kridiotis	Executive Engineer Class II	B.Sc. (Civil Eng.) University of London

Name	Post	Qualifications
Dedalos Kypris	Geologist Class I	Dipl. (Natural Science) University of Athens, D.I.C. Applied Geophysics
Michalakis Peppis	Geologist Class I	B.Sc. (Geology) American University of Beirut, M.Sc.(Geology) American University of Beirut
Iacovos Iacovides	Hydrologist Class I	B.Sc. (Hydrology) University of Arizona
Christos Phanartzis	Hydrologist Class II	B.Sc. (Hydrology) University of Arizona, A.M.A.G.U.
Christos Ioannou	Hydrologist Class II	Diploma (Natural Science) University of Salonica, Dipl. (Hydrogeology) University of London
Savvas Theodosiou	Mechanical Engineer Class II	B.Sc. (Mechanical Eng.) University of Manchester, M.Eng. in Desalination Technology University of Glasgow
Nicos Tsiourtis	Topographer/Irrigation Eng.	B.Sc. (Agricultural Eng.) Technion Israel Inst. of Technology, M.A.E.A.I.
Demosthenis Patsalides	Topographer/Irrigation Eng.	B.Sc. (Agricultural Eng.) Technion Israel Inst. of Technology M.A.E.A.I., Assoc. Memb. I.C.E.
Elias Kambourides	Topographer/Irrigation Eng.	B.Sc. (Agricultural Eng.) Technion Israel Inst. of Technology, M.A.E.A.I.
Panos Pantelides	Superintendent of Works	
Nicos Toufexis	Superintendent of Works	
George Charalambous	Superintendent of Works	
P. Neophytides	Topographer/Irrigation Eng.	Dipl. (Rural and Topography Engineering) National Technical University of Athens
Niki Michael	Topographer/Irrigation Eng.	Dipl. (Rural and Topography Engineering) National Technical University of Athens

TECHNICAL STAFF OF W.D.D. ON 31.12.71

DRG. No. BM/G/16

	MONTHLY AND DAILY PAID TECHNICAL STAFF			D	AD	SWE	SH	EH	EE	ME	Geo	H	TIE	LA	ADM	SW	SIW	IW	CF	EDR	ACF	TA	DR	F	Total Nos
1	Permanent staff			1	1	2	1	1	11		2	1			1	3	5	14	3		6	30		39	121
2	Temporary staff								7	1	1	2	5	1	1		1	8	1	1	6	73	7	17	132
	TOTAL NUMBERS			1	1	2	1	1	18	1	3	3	5	1	2	3	6	22	4	1	12	103	7	56	253
	DISTRIBUTION OF STAFF																								
3	Geological Dept (on loan)										1											3		1	5
4	Divisions	i	Water Resources								2	2				1		4			1	19		5	34
		ii	Planning						2									2				8		1	13
		iii	Design						4				3				1	2		1		28	5	2	46
		iv	Construction					1	3	1							2	8	3		8	1		40	67
		v	Small Projects Planning										1			1	2	3	1		1	4			13
		vi	Operation & Maintenance													1	1	1			1	3		3	10
5	Administration (Head Office)			1	1	1			1					1	2										7
6	Regional Offices (Limassol, Famagusta, Paphos & Morphou)								1									2				26		2	31
7	Turkish Officers absent from duty								1													9		2	12
8	On scholarship – or National Service								2			1	1												4
9	Vacancies					1	1		4												1	2	2		11
	TOTAL NUMBERS			1	1	2	1	1	18	1	3	3	5	1	2	3	6	22	4	1	12	103	7	56	253

REFERENCE

D	Director
AD	Assistant Director
SWE	Senior Water Engineer
SH	Senior Hydrogeologist
EH	Engineer Hydrologist
EE	Executive Engineer
ME	Mechanical Engineer
Geo	Geologist
H	Hydrologist
TIE	Topographer/Irrigation Engineer monthly & daily paid
LA	Legal Adviser (on contract)
ADM	Administrative Officer
SW	Superintendent of Works
SIW	Senior Inspector of Works
IW	Inspector of Works
CF	Chief Foreman
EDR	Engineering Draughtsman
ACF	Assistant Chief Foreman
TA	Technical Assistant monthly & daily paid
DR	Draughtsman
F	Foreman

I.II Publications of the Water Development Department During 1971

Library Reg.No.	Title	Author	Date
4877	Morphou Earth Dam Raising of Embankment Completion Report Report No. C/29.	Hji Ioannou Ph.	January 1971
4876	Khirokitia, Milianos Irrigation Scheme Completion Report Report No. C/28	Ioannou Vr.	January 1971
4874	Psevdhas, Irrigation Scheme. Completion Report. Report No. C/26	Hji Pakkos P.	January 1971
4873	Gypsou. "Vathys" Irrigation Division. Completion Report. Report No. C/25.	Hji Pakkos P.	January 1971
4859	Kato Amiandos. Kardhama Irrigation Scheme. Completion Report. Report No. C/10.	Macrides A.	January 1971
4875	Vitsadha Water Supply. House-to-House Scheme. Completion Report. Report No. C/27	Ioannou Vr.	January 1971
4872	Eastern Mesaoria Dry Villages. Water Supply Scheme. Additional Supply from B.H. 18a. Completion Report. Report No. C/24.	Hji Pakkos P.	January 1971
4871	Kornos Water Supply. House-to-House Scheme. Additional Source. Completion Report. Report No. C/22.	Hji Pakkos P.	January 1971
5078	Ayia Kebir Water Supply. House-to-House Scheme. Completion Report. Report No. C/23.	Hji Pakkos P.	January 1971
5413	Nicosia Sewerage Scheme Site Investigations Report. Report No. F/18	Stavrou Ph.	January 1971
4858	Kato Amiandos. Appis-Kardhaki Irrigation. Completion Report. Report No. C/9	Macrides A.	February 1971
4878	Komi Kebir Water Supply House-to-House Scheme. Completion Report. Report No. C/31.	Ioannou Vr.	February 1971

Library Reg.No.	Title	Author	Date
5118	Potamiou. Irrigation Scheme Completion Report. Report No. C/45	Macrides A.	February 1971
5141	Kissonerga. Apis Irrigation Scheme. Completion Report. Report No. C/46	Macrides A.	February 1971
5145	Prodhromos. Platania-Antonides Irrigation Scheme Completion Report.Report No. C/51	Macrides A.	February 1971
5146	Phiti (Paphos). Akritou Irrigation Scheme. Completion Report. Report No. C/52	Macrides A.	February 1971
5222 5224	Selected Water Problems in Southern Europe. Report No. L/7	Konteatis C.A.C.	February 1971
5189	Xylotymbou. Recharge Works. Completion Report. Report No. C/41	Hji Pakkos P.	February 1971
5190	Akanthou. Recharge Works. Completion Report. Report No. C/42	Hji Pakkos P.	February 1971
5181	Kato Amiandos-Pelendria Pano Phylagra Irrigation Scheme. Completion Report. Report No. C/32	Macrides A.	February 1971
5182	Agros. Kato Erimos Irrigation Scheme. Completion Report. Report No. C/33	Macrides A.	February 1971
5183	Agros. Dhikhalorotsos No.2 Irrigation Scheme. Completion Report. Report No. C/34	Macrides A.	February 1971
5184	Ayios Pavlos (LL) Dhimma-tou-Khoriou Irrigation Scheme. Completion Report.Report No. C/35	Macrides A.	February 1971
5185	Agros. Kaoukaris Irrigation Scheme. Completion Report. Report No. C/36	Macrides A.	February 1971
5186	Agros. Mylos Lambadha Irrigation Scheme.Completion Report. Report No. C/38	Macrides A.	February 1971
5187	Kato Amiantos-Pelendria Kato Phylagra Irrigation Scheme. Completion Report Report No. C/39	Macrides A.	February 1971
5178	Marathovounos Water Supply House-to-House Scheme. Completion Report. Report No. C/43	Ioannou Vr.	February 1971

Library Reg.No.	Title	Author	Date
5246	Kouka. Arnisfhord Irrigation Scheme. Completion Report.	Macrides A.	February 1971
4922 5077	Water Development Proposals for the Third Five Year Plan 1972-1976. Report No. L/3	Konteatis C.A.C.	March 1971
4926 4927	Hydrological Year-Book of Cyprus 1968-1969. Report No. H/11	Toufexis Chr. N., Phanartzis Chr.,& Jacovides J.,	March 1971
5149	Yermasoyia River. Minor Anti-Flood Works Completion Report. Report No. C/57	Macrides A.	March 1971
5117	Karavas. Mezeres Irrigation Scheme. Completion Report. Report No. C/44	Georghiou S.	March 1971
5142	Eptagonia. Pothos Irrigation Scheme. Completion Report. Report No. C/48	Macrides A.	March 1971
5143	Kilinia. Argaki tou Zisimou Irrigation Scheme. Completion Report. Report No. C/49	Macrides A.	March 1971
5144	Kilinia. Morris Irrigation Scheme. Completion Report. Report No. C/50	Macrides A.	March 1971
5147	Konia Irrigation Scheme Completion Report. Report No. C/53	Macrides A.	March 1971
5079	Karavas (Platani) Irrigation Scheme.Completion Report. Report No. C/54	Georghiou S.	March 1971
5119	Ay. Ioannis (Agros) Water Supply. House-to-House Scheme. Completion Report. Report No. C/47	Macrides A.	March 1971
5148	Polemi Water Supply.House-to-House Scheme. Completion Report. Report No. C/55	Macrides A.	March 1971
5225 5226	Planning of Dams in Cyprus. Report No. L/8	Konteatis C.A.C.	March 1971
5188	Tris Elies (LL). Dhiplomata Irrigation Scheme. Completion Report. Report No. C/40	Macrides A.	March 1971
5247	Korphi (LL) Water Supply. House-to-House Scheme. Completion Report. Report No. C356	Macrides A.	March 1971

Library Reg.No.	Title	Author	Date
5139 5140	Foundation Investigations for a Four Storey Building at Engomi Village.Report No. F/19	Artemis C.C.	April 1971
5114 5115	Design Division-Drawing Office Branch. Work Done During 1970.	Pitsillides S.C.	May 1971
5214	Maroni River. Khirokitia Dam	Hamatsos T.N.	May 1971
5179	Yenagra Water Supply House-to-House Scheme. Completion Report. Report No. C/59	Hji Pakkos P.	May 1971
5180	Pyrga (Famagusta) Water Supply. House-to-House Scheme. Completion Report. Report No. C/60	Hji Pakkos P.	May 1971
5249	Panayia. Sarka Irrigation Scheme. Completion Report. Report No. C/62	Macrides A.	May 1971
5252	Galataria. Phleva Irrigation Scheme. Completion Report. Report No. C/68	Macrides A.	May 1971
5248	Mousoulita Water Supply. House-to-House Scheme. Completion Report. Report No. C/58.	Hji Pakkos P.	May 1971
5250	Pano Kividhes Water Supply. House-to-House Scheme. Completion Report. Report No. C/65	Macrides A.	May 1971
5251	Tsadha Water Supply. House-to-House Scheme. Completion Report. Report No. C/66	Macrides A.	May 1971
5253	Anoyira Water Supply. House-to-House Scheme. Completion Report. Report No. C/70	Macrides A.	May 1971
5254	Kalokhorio (LL) Water Supply. House-to-House Scheme. Completion Report. Report No. C/71	Macrides A.	May 1971
5255	Louvaras Water Supply. House-to-House Scheme. Completion Report. Report No. C/72	Macrides A.	May 1971
5393	Trypimeni Irrigation. Pumping Scheme B/H No.19/66 Completion Report. Report No. C/61	Hji Pakkos P.	May 1971
5394	Arsos (LL). Irrigation Scheme. Completion Report. Report Report No. C/64	Macrides A.	May 1971

Library Reg.No.	Title	Author	Date
5397 5398	Phasoula (LL) Water Supply House-to-House Scheme. Completion Report. Report No. C/67	Macrides A.	May 1971
5399 5400	Arakapas (Perasma tis Koutsis) Irrigation Scheme. Completion Report. Report. No. C/69	Macrides A.	May 1971
5401 5402	Ayios Demetrios (LL) (Kaloyiros) Irrigation Scheme. Completion Report. Report No. C/73	Macrides A.	May 1971
5403 5404	Eptagonia. Pothos Irrigation Scheme. Completion Report. Report No. C/74	Macrides A.	May 1971
5405 5406	Arminou Water Supply. House-to-House Scheme. Completion Report. Report No. C/75	Macrides A.	May 1971
5414 5415	Polis and Prodhromi Water Supply. House-to House Scheme. Completion Report. Report No. C/63	Macrides A.	May 1971
5245	Milikouri Potamos Irrigation Scheme. Completion Report. Report No. C/30	Ioannou E.	June 1971
5213	Lythrodhondas Upper Dam. Report on the Site Investigations and Grouting Proposals. Report No. F/20	Kastanas I.	July 1971
5266 5267	Xeros River. Asprokremos Dam. Water Rights Report No. L/11	Savva K.A.	August 1971
5257	Eighth European Congress on Irrigation and Drainage Aix-en Provence 14-19th June, 1971. Report No. L/9	Tsiourtis N.	August 1971
5258 5259	Constitution. Cyprus Committee on Irrigation and Drainage of the International Commission on Irrigation and Drainage. Report No. L/10	Tsiourtis N.	August 1971
5339 5340	Akanthou Area. Three Proposed Small Dam Projects. Fill Material Investigations. Report No. F/22	Loucaides P.	August 1971
5411 5412	Kourris River. Kouris Dam. Water Rights. Report No. L/12	Savva A.K.	August 1971

Library Reg.No.	Title	Author	Date
5342 5343 5344	Site Investigation for Cyprus Forest Industries Ltd.Report No. F/21	Loucaides P. & Ioannou Chr.	September 1971
5333 5334	Annual Report of the Department of Water Development for the year 1970	Konteatis C.A.C	October 1971
5407 5408	Emba Water Supply. House-to House Scheme. Completion Report. Report No. C/76	Macrides A.	October 1971
5409 5410	Ayios Theodhoros (Agros) Water Supply. House-to House Scheme. Completion Report. Report No. C/77	Macrides A.	October 1971
5347 5348 5349	Asprokremmos Proposed Dam. Additional Site and Fill Material Investigations. Report No. F/23	Loucaides P.	November 1971

II. DIVISION OF WATER RESOURCES

By

D. Kypris
Head of Division

2.1 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 drilling operations for water and controls groundwater extraction and use.

2.1,2 For reasons of better control on the collection of hydrogeological data and thorough hydrogeological studies, Cyprus has been divided into eleven hydrogeological regions based on both hydrogeological and administrative criteria (See map.1.)

2.1.3 During 1971, the qualified personnel of the Division of Water Resources has been gradually reduced so that practically two geologists and one hydrologist were actually dealing with all the problems faced in all eleven hydrogeological regions, which the Division of Water Resources has been called upon to follow. This was the reason for the redistribution of responsibilities within the Division.

2.1.4 Mr. D.K. Kypris, Geologist Class I, was the Head of the Division. Mr. N. Toufexis, Superintendent of Works was the Assistant Head. Mr. M. Peppis, Geologist Class I, was the Head of the Hydrometry, Drilling and Geological Sections. Mr. Chr. Ioannou Hydrologist Class II, was the Head of Hydrology and Ground Water Control Sections.

2.1.5 Mr. Chr. Phanartzis, Hydrologist Class II, offered his services to this Division until the end of January 1971 and then proceeded abroad for further studies on scholarship.

Mr. J. Jacovides, Hydrologist Class I, offered his services to this Division until July, 1971, and then he undertook as Co-Manager to the Paphos and Akrotiri Feasibility Study Projects.

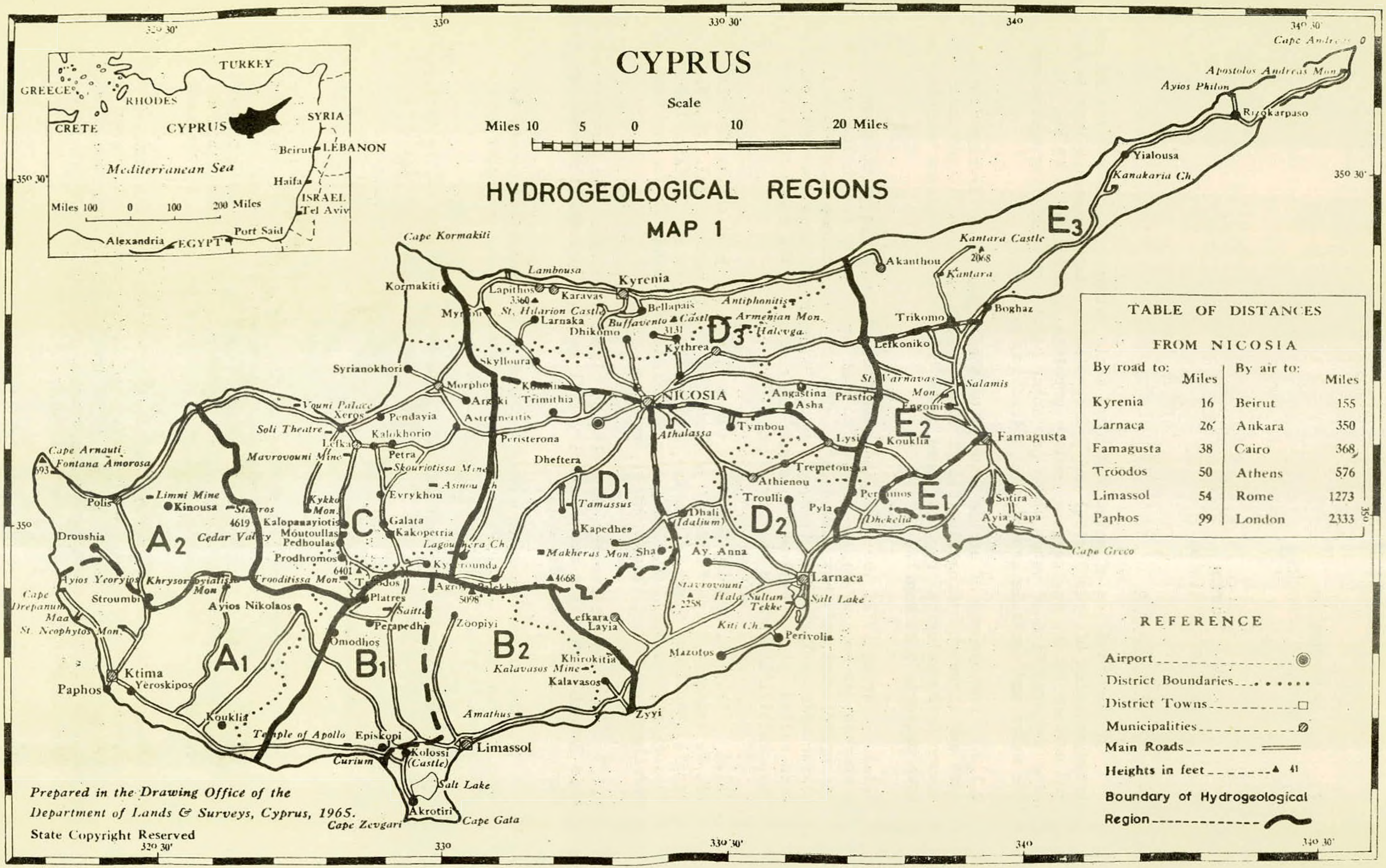
Mr. Kramvis, Geologist Class II, is still attached to the Geological Survey Department.

2.2 Prospecting Drilling

2.2.1 General

The programme of Prospecting Drilling was carried out under the full responsibility of the Water Development Department, with a crew of 10 drilling rigs. The rigs included two heavy duty Ruston Bucyrus 60 R.L. and eight Ruston Bucyrus 22W. Two additional Bucyrus, 22W, remained on loan with the Geological Survey Department. Three more rigs are still in the hands of the Turks.

2.2.2 As from the 5th November, 1971, when all the drilling rigs, as referred above, were transferred to the Geological Survey Department, except on Ruston Bucyrus 22W, the responsibility of drilling operations was in a way shared with the Geological Survey Department, until the end of the year, for all operations initiated by this Department.


CYPRUS
Scale
Miles 10 5 0 10 20 Miles
HYDROGEOLOGICAL REGIONS
MAP 1
TURKEY
GREECE
RHODES
CRETE
CYPRUS
SYRIA
Beirut
LEBANON
Mediterranean Sea
Haifa
ISRAEL
Tel Aviv
Miles 100 0 100 200 Miles
Port Said
Alexandria
EGYPT
A1
A2
B1
B2
C
D1
D2
D3
E1
E2
E3
NICOSIA
Kyrenia
Famagusta
Larnaca
Limassol
Paphos
Ktima
Cape Kormakiti
Cape Arnauti
Cape Greco
Cape Gata
Cape Zevgari
Akrotiri
Salt Lake
TABLE OF DISTANCES
FROM NICOSIA
By road to: Miles
Kyrenia 16
Larnaca 26
Famagusta 38
Troodos 50
Limassol 54
Paphos 99
By air to: Miles
Beirut 155
Ankara 350
Cairo 368
Athens 576
Rome 1273
London 2333
REFERENCE
Airport
District Boundaries
District Towns
Municipalities
Main Roads
Heights in feet ▲ 41
Boundary of Hydrogeological Region
Prepared in the Drawing Office of the
Department of Lands & Surveys, Cyprus, 1965.
State Copyright Reserved

2.2.3 During the year, 55 boreholes were drilled for water with an aggregate (penetrated depth) of 3,000 m with an average depth per borehole of 55 m. The drilling of five boreholes was still in progress by the end of 1970 and so drilling operations continued within three boreholes during 1971, with an aggregate (penetrated depth) of 703 m. Table 1 shows the results of our drilling operations at each village and District. Table 2 is a summary of table 1 and table 3 shows in general the drilling activities of the Department since 1946.

2.2.4 A total of 25 boreholes were subjected to lengthy pumping tests ranging from 3 hours 30 minutes to 234 hours of continuous duration. The total volume of water pumped was 170,104 m3 over a total pumping time of 1,836 hours 30 minutes.

2.2.5 Drilling Costs

During the year the total expenditure for the drilling was £36,275. The approximate average cost of drilling per borehole was £605 and £9.800 mils per meter drilled. This cost includes wages of drilling crews, cost of casing and other material and cost of test pumpings as well.

Table 1.

Boreholes Drilled for Water in 1971

District	Locality	Number Drilled	Number successful	Percentage successful	Hours Pumped	Total output in m3	Average Yield m^3/d
Nicosia	Ay. Sozomenos	1	-	-	-	-	-
	Dhali	1	1	100.0	-	-	-
	Ghaziveran	1	1	100.0	20	3,505	4,206
	Kato Moni	1	1	100.0	24	198	198
	Kato Pyrgos	1	1	100.0	-	-	-
	Mansura	1	1	100.0	47)	1,491	761
					24)	1,106	1,106
	Morphou	1	1	100.0	-	-	-
	Potamia	4	4	100.0	-	-	-
Famagusta	Kantara	1	1	100.0	7	156	446
	Phlamoudhi	1	Incomplete		-	-	-
Kyrenia	Ay. Amvrosios	1	Incomplete		-	-	-
	Bellapais	1	"		-	-	-
	Karavas	1	1	100.0	-	-	-
	Pendadhaktylos	1	Incomplete		-	-	-
Larnaca	Mari	1	1	100.0	5	93	446
	Psematismenos	1	-	-	-	-	-
	Pyla	1	1	100.0	8)	109	327
					49)	643	315
	Skarinou	1	1	100.0	62	6,300	2,440
	Voroklini	1	-	-	-	-	-
Limassol	Pissouri	2	Incomplete		-	-	-
	Yermasoyia	1	1	100.0	-	-	-

Table 2.
Boreholes Drilled in 1971 - Summary

Purpose	No.	Aggregate Depth m	Percentage Successful	Total Tested Yield m3	Hours Pumped
Irrigation	14	931	80.0	12,577	186
Domestic W.S.	9	818	84.0	4,611	108
Prospecting	3	166	Incomplete	-	-
Total for Water	26	1915			
Observation	22	1016			
Technical and Geological	7	69			
T o t a l	55	3000			

Table 3.
Drilling Activities 1946 - 1971

Purpose	1946 1963	1964	1965	1966	1967	1968	1969	1970	1971
Boreholes at full cost	2,173	11	2	8	11	6	30	4	10
For Government	1,091	86	215	83	44	62	45	39	45
For N.D.D.	865	14	16	7	-	2	2	-	-
T O T A L	4,129	111	233	98	55	70	77	43	55
Aggregate Depth Drilled (m)	221,300	6,850	8,350	5,150	4,580	5,620	5,250	3,140	3,000
Average Depth (m)		63	36	53	83	80	68	73	55

2.3 Boreholes of special Hydrological interest drilled during 1971

Most of the boreholes drilled during 1971, were put in already known aquifers as those drilled in the Akrotiri Peninsula or in the Pentayia area, or in river gravels and nothing special has been encountered with them. However there are two or three boreholes which present a certain hydrological interest and which they are worthwhile to mention.

2.3.1 Borehole 15/70

Drilled in Kantara area near borehole B.1 (Koronia). The reason for which this borehole has been drilled was the full penetration of the limestone aquifer, which was not attained by the Borehole B1 due to technical difficulties, which were met during its drilling. The total depth of this borehole is 122 m. The main aquifer of the borehole is expected to be the limestone penetrated from 63 m. to 95 m. The interesting feature that this borehole revealed is the existance of two limestone aquifers very near each other, either without any hydrological connection between them, or with one way connection only. This conclusion is inferred from the fact that there is a difference in the water table between the two boreholes of 30 m. Also during the test pumping of this borehole, no effect has been observed on the water level of borehole B.1 at a distance of only 15 m.

2.3.2 Borehole 47/71

This borehole has been drilled about 1 km west of Skarinou village. The drilling site has been selected to be on the fault zone running E-W through Skarinou village in the Lapithos chalks from which the artesian Borehole 35/70 draws its water. The total depth of this borehole is 122 m. and the main aquifer from which draws its water are horizons of hard chalks down to the depth of 81 meters. This borehole was test pumped with an output of 100 m3/h and it has been possible through the data obtained by this test to find the approximate storage capacity of the aquifer, which has been calculated at the order of 1700 cubic meters per meter.

3. Surface Hydrology Work

3.1 Meteorological Notes

The rainfall and climatological records of 170 observing stations of the Cyprus Government Meteorological Office have been analysed by the Division of Water Resources and the results of the principal features of the weather during the hydrological year - 1st October, 1970 to 30th September, 1971 - are given hereunder:-

(i) The average precipitation over the whole island was 501 mm which is 99.6% of normal (503 mm) this being the average for the period 1916-1950.

(ii) In November, February and particularly in April precipitation was above normal. In August heavy thunderstorms occurred in various parts of the island especially on the Troodos range and around Nicosia. On the 5th August, Nicosia town was flooded after a storm of unprecedented intensity.

(iii) The highest daily rainfall of the year was 123.2 mm and occurred at Troodos square on 9th August, 1971.

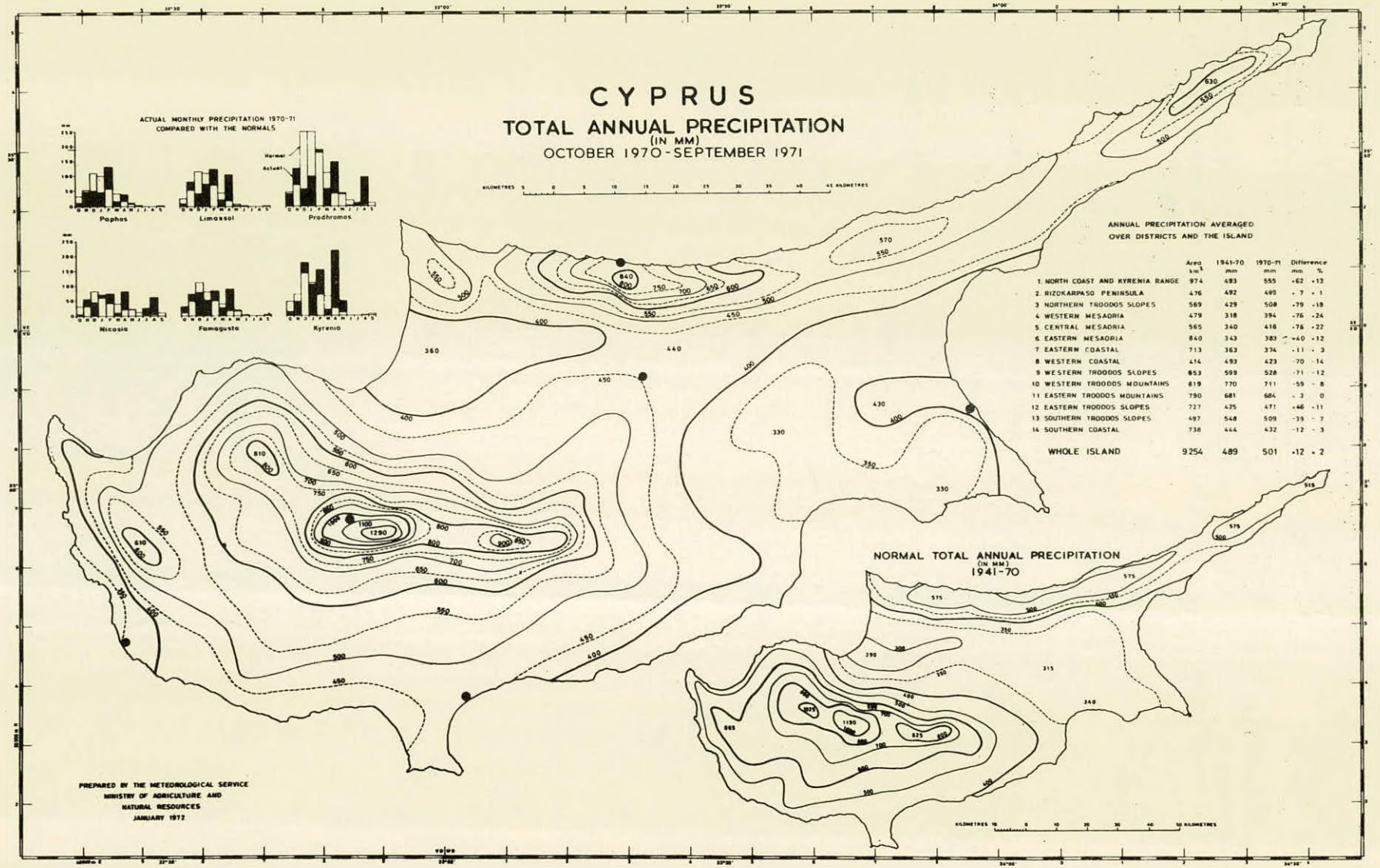
(iv) The first snowfall on the Troodos range occurred on 5th December, 1970 and the last on 16th April, 1971.

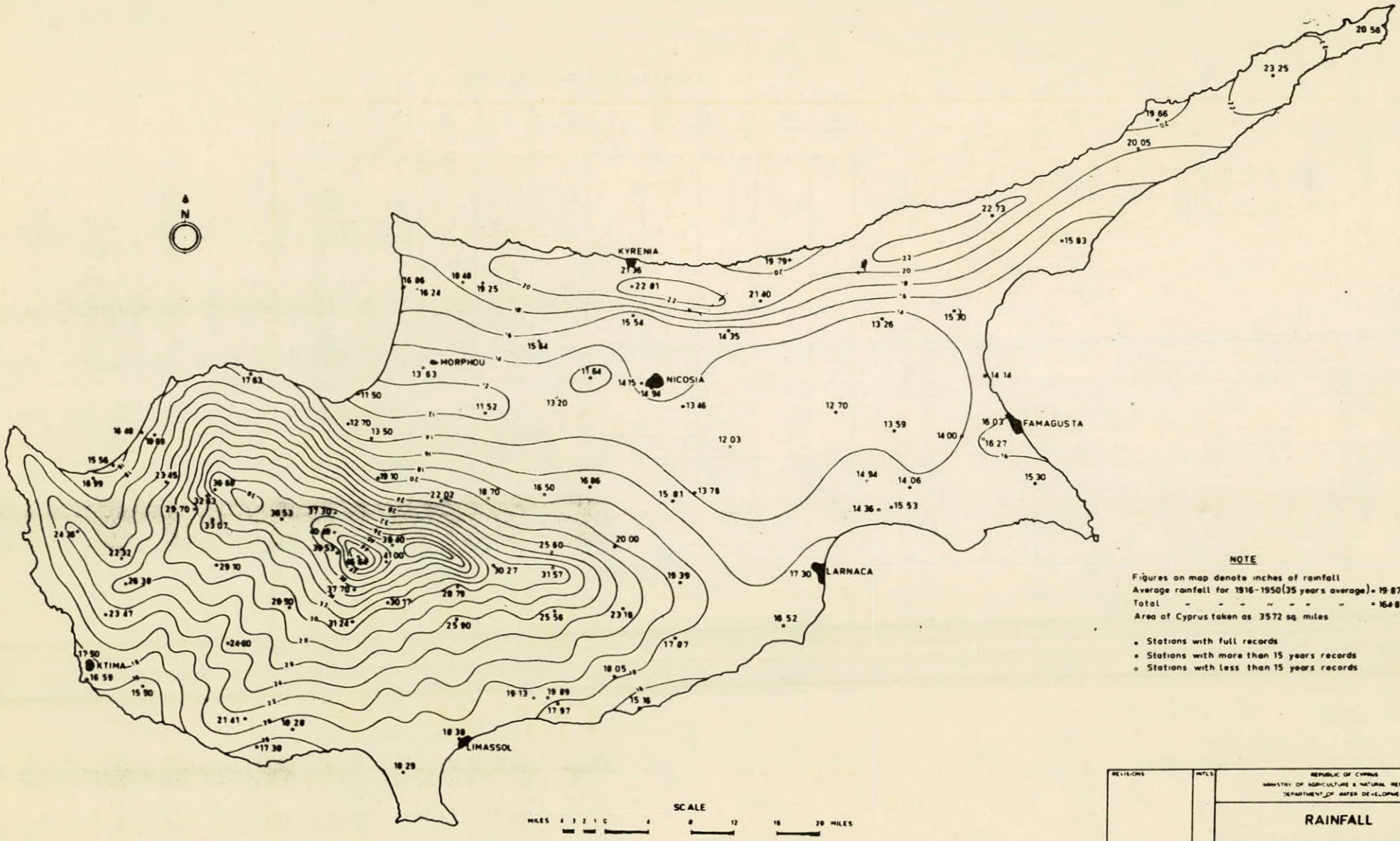
(v) On the average no significant departures from normal seasonal temperatures were experienced during the year under review. During the autumn and winter months temperature were around or a little below normal except for January, during which relatively warm conditions prevailed. In March temperatures oscillated around their normal values but in April they were below the average. May and June were warmer than usual while in July and August lower than normal temperatures prevailed. September was completely rainless and warmer that usual.

The extreme maximum and minimum temperatures recorded during the Hydrological year under consideration at various Meteorological Stations are quoted below:-

Station	Extreme maximum temperature and date	Extreme minimum temperature and date
	°C	°C
Nicosia	40.6 (on 19th June)	0.6 (on 17th January)
Limassol	40.0 (on 18th June)	0.0 (on 13th February)
Larnaca	39.8 (on 20th June)	2.4 (on 14th February)
Famagusta	38.0 (on 17th and 20th June)	0.6 (on 14th February)
Paphos	40.0 (on 18th June)	3.7 (on 13th February)
Kyrenia	37.2 (on 15th August)	3.3 (on 14th and 15th March)
Panayia Bridge, Forest Station (Between Platanistasa and Kato Moni).	36.7 (on 19th and 20th June)	-2.8 (on 13th February)
Morphou	40.6 (on 15th August)	-1.7 (on 13th February)
Halefka	35.6 (on 15th August)	-4.4 (on 13th February)
Saittas Nursery Garden	35.0 (on 16th July and 26th August)	-1.5 (on 13th and 14th February)
Pano Amiandos	30.6 (on 1st August).	-7.2 (on 13th February)
Prodromos Forestry College	31.0 (on 19th June)	-7.2 (on 13th February)

Station	Extreme maximum temperature and date	Extreme minimum temperature and date
	°C	°C
Stavros tis Psokas Forest Station	34.4 (on 19th June and on 14th and 15th August)	-2.8 (on 13th and 14th February and on 14th March)
Kornos	37.8 (on 20th June)	0.6 (on 13th February)
Platania (Kakopetria) Forest Station	31.7 (on 19th June)	-5.0 (on 13th February)
Phassouri	40.5 (on 18th June)	-2.2 (on 13th February)


CYPRUS
TOTAL ANNUAL PRECIPITATION
(IN MM)
OCTOBER 1970 - SEPTEMBER 1971
ACTUAL MONTHLY PRECIPITATION 1970-71
COMPARED WITH THE NORMALS
Normal
Actual
Paphos
Limassol
Prodhromos
Nicosia
Famagusta
Kyrenia
ANNUAL PRECIPITATION AVERAGED
OVER DISTRICTS AND THE ISLAND
Area km²
1941-70 mm
1970-71 mm
Difference mm
Difference %
1 NORTH COAST AND KYRENIA RANGE 974 483 555 +62 +13
2 RIZOKARPASO PENINSULA 476 492 485 - 7 - 1
3 NORTHERN TROODOS SLOPES 569 429 508 +79 +18
4 WESTERN MESAORIA 479 318 394 +76 +24
5 CENTRAL MESAORIA 565 340 418 +76 +22
6 EASTERN MESAORIA 840 343 383 +40 +12
7 EASTERN COASTAL 713 363 374 +11 + 3
8 WESTERN COASTAL 414 493 423 -70 -14
9 WESTERN TROODOS SLOPES 853 599 528 -71 -12
10 WESTERN TROODOS MOUNTAINS 819 770 711 -59 - 8
11 EASTERN TROODOS MOUNTAINS 790 681 684 + 3 0
12 EASTERN TROODOS SLOPES 727 425 471 +46 +11
13 SOUTHERN TROODOS SLOPES 497 548 509 -39 - 7
14 SOUTHERN COASTAL 738 444 432 -12 - 3
WHOLE ISLAND 9254 489 501 +12 + 2
NORMAL TOTAL ANNUAL PRECIPITATION
(IN MM)
1941-70
PREPARED BY THE METEOROLOGICAL SERVICE
MINISTRY OF AGRICULTURE AND
NATURAL RESOURCES
JANUARY 1972



NOTE

Figures on map denote inches of rainfall
Average rainfall for 1916-1950 (35 years average) = 19·87 inches
Total " " " " " " " = 16·89 × 10^9 ft^3
Area of Cyprus taken as 3572 sq. miles

• Stations with full records
• Stations with more than 15 years records
○ Stations with less than 15 years records

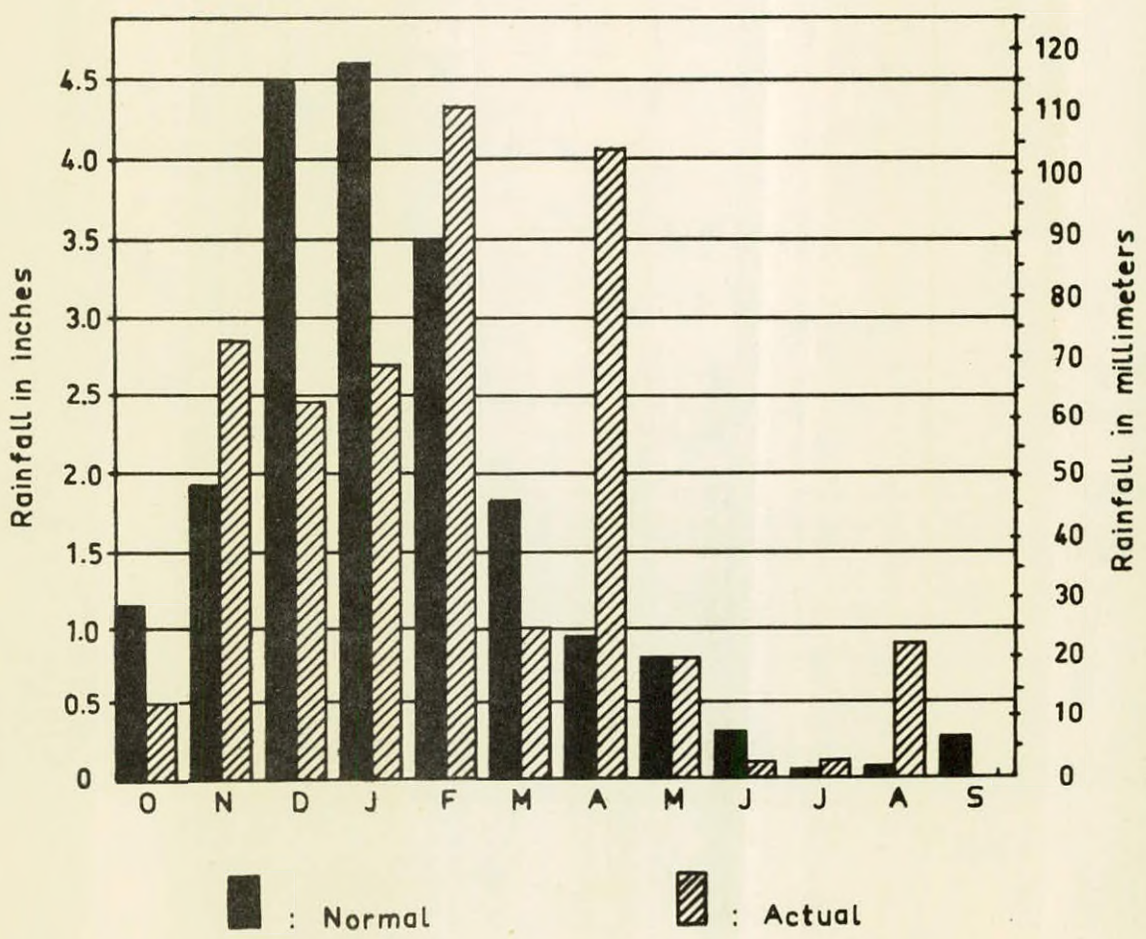
REVISIONS	INITLS	REPUBLIC OF CYPRUS MINISTRY OF AGRICULTURE & NATURAL RESOURCES DEPARTMENT OF WATER DEVELOPMENT
		RAINFALL
		ISOHYETAL MAP OF CYPRUS BASED ON RAINFALL FROM 1916 TO 1950 (35 YEARS AVERAGE)
		DRG No.
		SURVEYED BY / TRACED BY DESIGNED BY / CHECKED BY DRAWN BY / APPROVED BY

INCIDENCE OF RAINFALL

The incidence of rainfall per month as worked out from selected rainfall stations during the hydrological year 1970–1971 is given as under÷

Month	Rainfall in inches	Rainfall in millimeters	Percentage %
October	0.47	12	2.40
November	2.88	73	14.57
December	2.44	62	12.38
January	2.72	69	13.77
February	4.33	110	21.95
March	0.98	25	4.99
April	4.06	103	20.56
May	0.78	20	3.99
June	0.08	2	0.40
July	0.12	3	0.60
August	0.87	22	4.39
September	0.00	0	0.00
Totals	19.73	501	100.00

GRAPHICAL PRESENTATION
OF INCIDENCE OF RAINFALL



ANNUAL AVERAGE RAINFALL OF CYPRUS
FROM 1916–1971

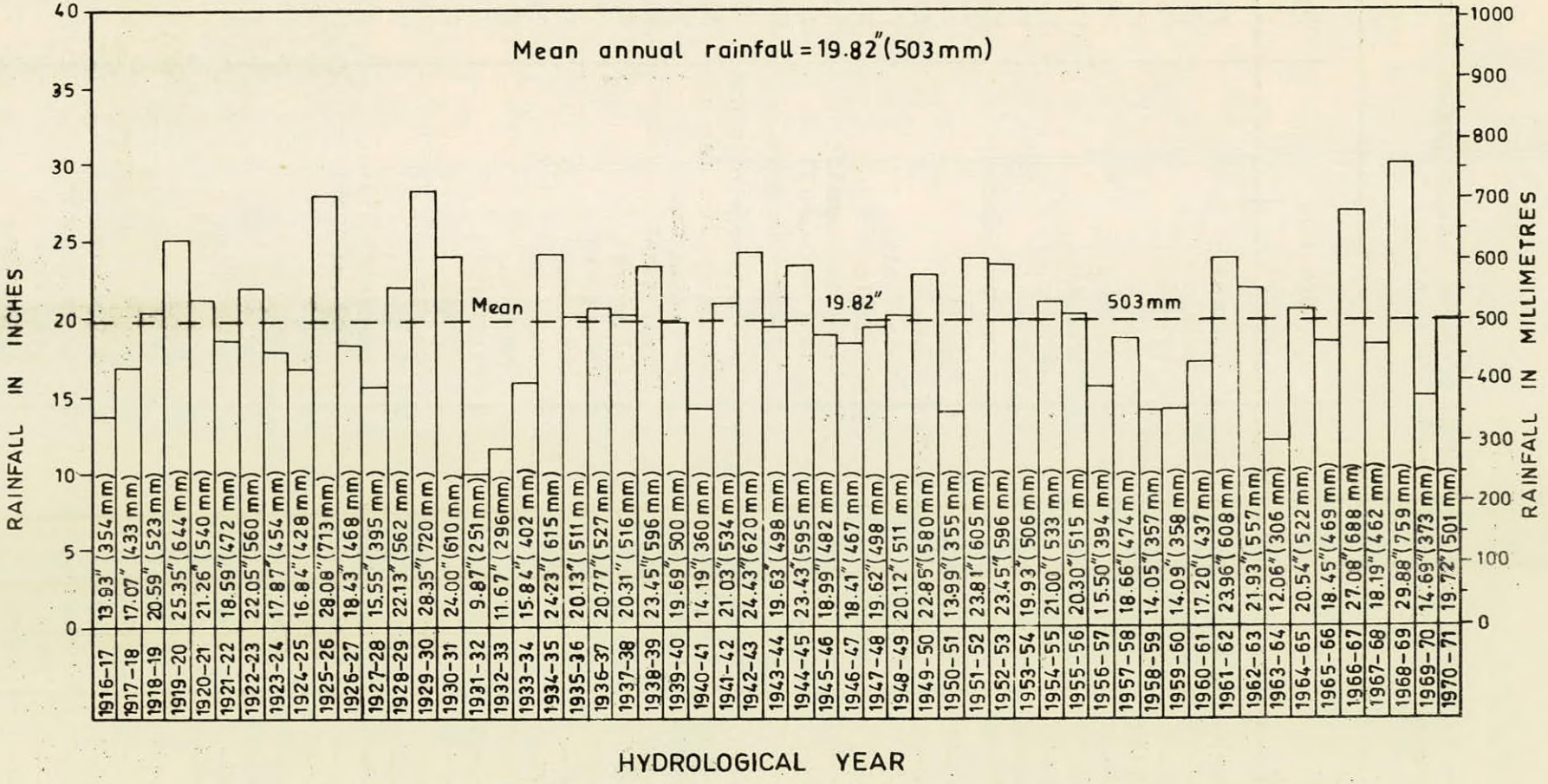


Table 4.

Permanent stream gauging stations

The following measuring weirs equipped with automatic Water Level Recorders were in operation during the year:-

Gauging Station No.	Stream	Location	Co-ordinates
1-1-3-95	Khapotami	Kissousa	VD 805513
1-1-7-95	Khapotami	Kouklia	VD 627383
1-2-4-95	Dhiarizos	Philousa	VD 754575
1-2-7-90	Dhiarizos	Kouklia	VD 601411
1-3-8-60	Xeros	Phinikas	VD 615470
1-4-4-50	Ezouza	Kannaviou	VD 610633
1-4-9-80	Ezouza	Akhelia	VD 524444
1-6-2-80	Mavrokolymbos	Potima	VD 446567
1-8-2-80	Avgas	Toxeftra (Akamas)	VD 394644
2-2-3-95	Khrysokhou	Skoulli	VD 497709
2-2-6-90	Stavros-tis-Psokas	Evretou	VD 520705
2-3-8-95	Yialia	Kato Yialia	VD 549848
2-7-2-75	Pyrgos	Phileyia	VD 717857
2-8-3-10	Limnitis	Limnitis Sawmill	VD 737822
2-8-3-15	Limnitis	Limnitis Sawmill	VD 739830
2-9-4-90	Kambos	Potamos-tou-Kambou	VD 826892
3-2-1-85	Marathasa	U/S Kalopanayiotis Dam	VD 842733
3-2-1-95	Marathasa	Kalopanayiotis Dam	VD 841739
3-2-2-90	Marathasa	U/S Lefka Dam	VD 852795
3-2-4-95	Marathasa	Karavostasi	VD 863895
3-3-1-70	Ayios Nicolaos	Kakopetria	VD 900707
3-3-2-60	Platania	Kakopetria	VD 927698
3-3-3-95	Karyotis	Evrykhou	VD 906773
3-3-5-95	Karyotis	Pendayia	VD 883902
3-4-2-90	Atsas	Evrykhou	VD 931810
3-5-3-90	Asinou	Nikitari	VD 997820
3-5-4-40	Elea	Vyzakia	WD 018806
3-7-1-50	Peristerona	Panayia F.S.	WD 075754
3-7-3-90	Akaki	Malounda	WD 163783
3-7-5-85	Kokkinotrimithia	Kokkinotrimithia	WD 150906
3-7-7-85	Skylloura	Ayios Vasilios	WD 156969
3-7-8-60	Ovgos	Kyra	WD 050964
3-7-8-65	Ovgos	Ovgos Dam	WD 034973
3-7-8-90	Ovgos	Morphou	VD 973974
3-7-9-50	Serakhis	Morphou Dam	WD 007948
3-8-6-50	Aloupos	Aloupos Chiftlik	VE 980018
4-2-3-70	Panagra	Nicosia-Kyrenia Road	WE 077119
4-4-2-50	Boghazi	Kyrenia Road Forest	WE 296077
4-5-5-90	Alakati	Platymatis	WE 455105
4-7-1-75	Yerokolymbos	Boghaz (Akanthou)	WE 636142
5-2-3-50	Melini	Ayia Trias	XE 125337
5-3-4-85	Laris	Rizokarpaso	XE 218405
5-9-4-90	Kharangas	Boghaz (Famagusta)	WE 883100
6-1-1-80	Ayios Onoufrios	Kambia	WD 225735
6-1-1-85	Pedhieos	Kambia	WD 224741
6-1-4-50	Pedhieos	Mia-Milia	WD 376958
6-1-5-50	Vathis	Athalassa	WD 345867

Gauging Station No.	Stream	Location	Co-ordinates
6-5-2-95	Alikos	Ayios Sozomenos	WD 413808
6-5-3-15	Yialias	Nisou	WD 359756
6-5-3-95	Yialias	Pyroi	WD 446824
7-1-7-50	Kalopannes	Kalopsidha	WD 746842
7-1-2-80	Ayios Yeorghios	Akhna P.S.	WD 750814
7-1-3-80	Avgorou	Avgorou	WD 765800
7-1-4-50	Phrenaros	Phrenaros	WD 804800
7-1-6-80	Ayios Loucas	Ayios Loucas Lake	WD 827871
7-2-3-50	Liopetri	U/S Liopetri Dam	WD 806732
7-2-7-05	Paralimni Lake out Flow	Paralimni	WD 892801
8-2-1-90	Aradhippou	Nicosia-Larnaca Road	WD 517683
8-2-2-90	Aradhippou	Panayia Yematousa	WD 516689
8-4-3-40	Tremithos	Ayia Anna	WD 442668
8-4-5-30	Tremithos	Larnaca-Limassol Road	WD 490615
8-4-5-40	Tremithos	Kiti Dam	WD 510590
8-5-1-90	Bouzis	Mazotos	WD 472518
8-6-3-50	Xeropotamos	Alaminos	WD 398519
8-7-3-60	Mylou	Kornos	WD 332613
8-7-4-80	Syrgatis	Skarinou Station	WD 343535
8-8-2-50	Maroni	Vavla	WD 261558
8-8-3-30	Maroni	Khirokitia Station	WD 317503
8-9-5-95	Vasilikos	Kalavasos Mine	WD 256503
8-9-7-50	Vasilikos	Kalavasos	WD 257472
8-9-7-95	Vasilikos	Vasiliko	WD 292425
9-2-3-85	Yermasoyia	Phinikaria	WD 093475
9-2-4-90	Akrounda	D/S Akrounda Dam	WD 070477
9-2-5-95	Yermasoyia	Yermasoyia P.S.	WD 081397
9-4-3-80	Garyllis	U/S Polemidhia Dam	VD 977450
9-4-3-90	Garyllis (Mersina Tr.)	U/S Polemidhia Dam	VD 990435
9-4-4-50	Garyllis	Polemidhia	WD 009396
9-6-4-95	Kourris	Khalassa	VD 920470
9-6-7-75	Zyghos	Khalassa	VD 941471
9-6-9-05	Kouris and Kryos	Khalassa	VD 921466
9-8-1-95	Evdhimou	Evdhimou	VD 780397
4-3-3-32	Kephalovriso Spring	Karavas	WE 174098
6-1-7-15	Kephalovriso Spring	Kythrea	WE 445030

Stream discharge measurements from the above Permanent Gauging Stations are given in the Hydrological Year Book issued by the Public Information Office.

3.2 Flood Discharges

The most remarkable floods during the year under review occurred mainly in Autumn, spring and summer time; the highest floods reported were in Aradhippou River on 14.11.70 near Panayia Yematousa 30 cubic meters per second and near the main road 20 cubic meters per second, on 10.1.71 in Alikos River near Ayios Sozomenos 60 cubic meters per second and on 3.6.71 in Akaki River near Malounda 100 cubic meters per second.

Table showing maximum volume of water accumulated and commencing date of inflow for the various dams during the year 1971

No.	D a m	Capacity $m^3 \times 10^3$	Inflow Commencing Date (1971)	Maximum volume Accumulated $m^3 \times 10^3$	Date at Maximum Accumulation 1 9 7 1	R e m a r k s
1	Agros	100	October	13	May	
2	Akrounda	22	January	1	January	Reservoir is almost totally silted up (Overflowed)
3	Argaka	1,150	November	1,150	March	Overflowed
4	Athalassa	790	February	54	August	
5	Ay.Loucas	450				No inflow
6	Ay.Marina	300		80	March	No inflow in 1971
7	Famagusta District Recharge Dams					No inflow
8	Galini	22	January	22	March	Overflowed
9	Geunyeli	1,000	February	559	May	
10	Gypsos	113				No inflow
11	Kalo Khorio(Klirou)	81	November	81	March	Overflowed
12	Kalopanayiotis	390		390	February	River runs throughout the year. Overflowed
13	Kandou	36		36	February	Overflowed
14	Kanli	1,100	February	259	June	
15	Kiti	1,600	January	222	April	
16	Kouklia	4,800				No inflow
17	Kyrenia Range Recharge Dams		For most of them February		For most of them August	Most of them overflowed
18	Lefka-Marathasa	360		360	February	River runs throughout the year. Overflowed
19	Lefka-Kafizes	110	January	110	March	Overflowed
20	Liopetri	340				No inflow
21	Lythrodontas Upper	32	December	32	February	Overflowed
22	Lythrodontas Lower	32	December	32	February	Overflowed
23	Makrasyka	196				No inflow
24	Mavrokolymbos	2,200		1,250	March	
25	Mia Milia	330	February	250	August	
26	Morphou Serrachis	2,000	January	1,200	April	
27	Ovgos	850	January	135	April	
28	Paralimni	65				No inflow
29	Pera Pedhi	55		55	February	River runs throughout the year. Overflowed
30	Petra (Upper)	22	February	22	February	Overflowed
31	Petra (Lower)	32	February	32	February	Overflowed
32	Pomos	860	November	860	April	Overflowed
33	Polemidhia	3,400	December	670	May	
34	Prodromos	110	February	63	March	
35	Pyrgos	270	February	270	March	Overflowed
36	Syngrasis	1,100				No inflow
37	Trimiklini	330		330	April	Continuous inflow. Gate closed in April overflowed
38	Yermasoyia	14,000	January	6,300	May	

3.3. Spring Discharges

The majority of the observed springs are gauged on a routine basis at different frequencies, while a small number of springs are gauged only for a temporary period after the request of another interested Departmental Division.

During the Hydrological Year, 2,634 spring discharges were gauged, averaging 218 gaugings every month; the output of 145 springs is being regularly gauged once a month while 140 springs were gauged at various frequencies for a certain period during the year.

In addition to the above gaugings, this year, all water supply sources which were not under regular observations, were gauged once, during the summer months. The output of 450 springs was gauged during the above period.

The precipitation of the current hydrological year was slightly above normal; the highest precipitation occurred in February and April while in December and January it was below normal. As a result of the above distribution of rainfall, all springs all over the island experienced an increase of flow during late spring and early summer time; most springs maintained a high flow during the whole summer.

3.4 Chemical Analyses

During the year, 5899 samples of water were sent to the Government Analyst for Ionic Chemical Analysis. Of these, 1829 samples were taken from springs, wells or boreholes which are used or proposed as water supplies sources. The remaining 4070 samples derived from springs, observation boreholes and from other miscellaneous sources. In addition, 20 samples taken from boreholes and rivers were sent to the Analyst of the Agricultural Department for full analyses including boron.

Also, 3,258 samples of water taken from observation boreholes in the Hydrological Survey areas were analysed by the Water Resources Division for Chloride content.

3.5 Bacteriological Analyses

Water Supply	No. of samples	No. of unsatisfactory samples
Nicosia	40	2
Famagusta	200	14
Limassol	152	21
Larnaca	168	10
Paphos	-	-
Kyrenia	18	-
Total	578	47

The unsatisfactory samples at Limassol, Famagusta, Larnaca and Kyrenia, were usually of unchlorinated water. All chlorinated samples at main reservoirs were satisfactory.

3.6 Suspended Sediment Analyses

In view of the future construction of large dams in Cyprus and the problem arising from reservoir 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 222 samples of rivers water were taken for suspended sediment analysis.

3.7 New stream gauging sites

During the year under review, 3 new stream gauging sites were completed and automatic water level recorders were installed.

1. Tengelis River near Kythrea: Construction of a broad crested weir "V" shaped (slope 1:15) 30 ft. wide.
2. Merika River near Avlona: Construction of a "V" shaped structure (slope 1:12) on the stabilized river bed under the bridge on Avlona Philia road.
3. Marathos River near Varisha: Construction of a Broad crested weir "V" shaped (slope 1:15) 10 ft. wide.

3.8 Repairs and improvements, to Existing Stream gauging stations

1. Alikos River near Ayios Sozomenos: Due to the repeated overflowing of the weir and the erosion of the banks, the flow gauging stations was widened by 30 ft. The present opening of the weir is now 60 ft. with a notch 4' x 1' ft.
2. Tremithos River near Klavdhia: Construction of a "V" shaped structure (slope 1:15) on the stabilized bed under the bridge on Larnaca-Limassol main road.

3.9 Kouris Feasibility study - Irrigation intakes

At the beginning of the year, 7 new flow gauging stations were put in operation on 7 irrigation intakes on Lower Kouris River; the above work comprises of a small structure for the stabilization of the section of the irrigation channels and the installation of water level recorders.

In addition to the above, a water level recorder was installed in Akrotiri Salt Lake for the continuous recording of the water level of the Lake.

3.10 Cost of Hydrological Observations and Research and Construction and Maintenance of Measuring Weirs

	Approved Estimated Cost	Actual Expenditure
(i) Hydrological Observations and Research	£ 15.000	£ 14.500
(ii) Construction and Maintenance of Measuring Weirs	£ 5.000	4.900
	£ 20.000	£ 19.400

4. Groundwater Hydrological Work

Hydrological Surveys of the ground water bearing systems were carried out on small scale by this Department before 1960. Since then, they were rapidly amounting in scale until the most important known aquifer systems were brought in a few years time under Hydrological Observation.

The last addition to the Hydrological Survey areas was made during 1969, with Ay. Amvrosios-Kalogrea-Akanthou aquifers.

Through the Hydrological Surveys all wells boreholes, springs and chain-of-wells have been registered and plotted on maps. A dense network of observation boreholes, has also been leveled. 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.

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 covered by Hydrological Surveys is 3.600 km2 and they are shown on map. No.3.

Analytically the observation network was distributed throughout the Island during 1971 as shown in table No. 5 below.

Table 5.

Groundwater Observation Net Work

Hydrological Area	Number of observation wells/boreholes for water level	Number of observation wells/boreholes for water samples
1. Western Mesaoria	715	294
2. Central Mesaoria	786	273
3. S.E.Mesaoria (Famagusta)	746	284
4. S.W.Mesaoria (Larnaca)	491	260
5. Kyrenia Region	348	70
6. Akrotiri-Phassouri	305	138
7. Yermasoyia-Moni-Pyrgos	160	50
8. Zygi-Maroni-Kalavasos-Ay. Theodhoros	161	79
9. S.W.Paphos	378	96
10. Polis Chrysochou	103	64
11. Lapathos-Ay.Andronikos-Rizokarpaso-Akanthou	270	87
T o t a l	4.463	1.695

From the above observations, groundwater table contour maps and isosalinity maps have been prepared for each aquifer for March and November 1971.

The annual questionnaire was also carried out for the determination of the Groundwater extraction for the year under review. The accuracy for the extraction was greatly improved this year, by the water-meter readings, in the areas where such meters have been installed.

From Table 6 it will be seen that, except in one borehole at Phrenaros, one at Kolossi and one at Yermasoyia, all the others show a drop of water Table indicating that the situation created by the overpumping of the aquifers of the Island is continuously worsening.

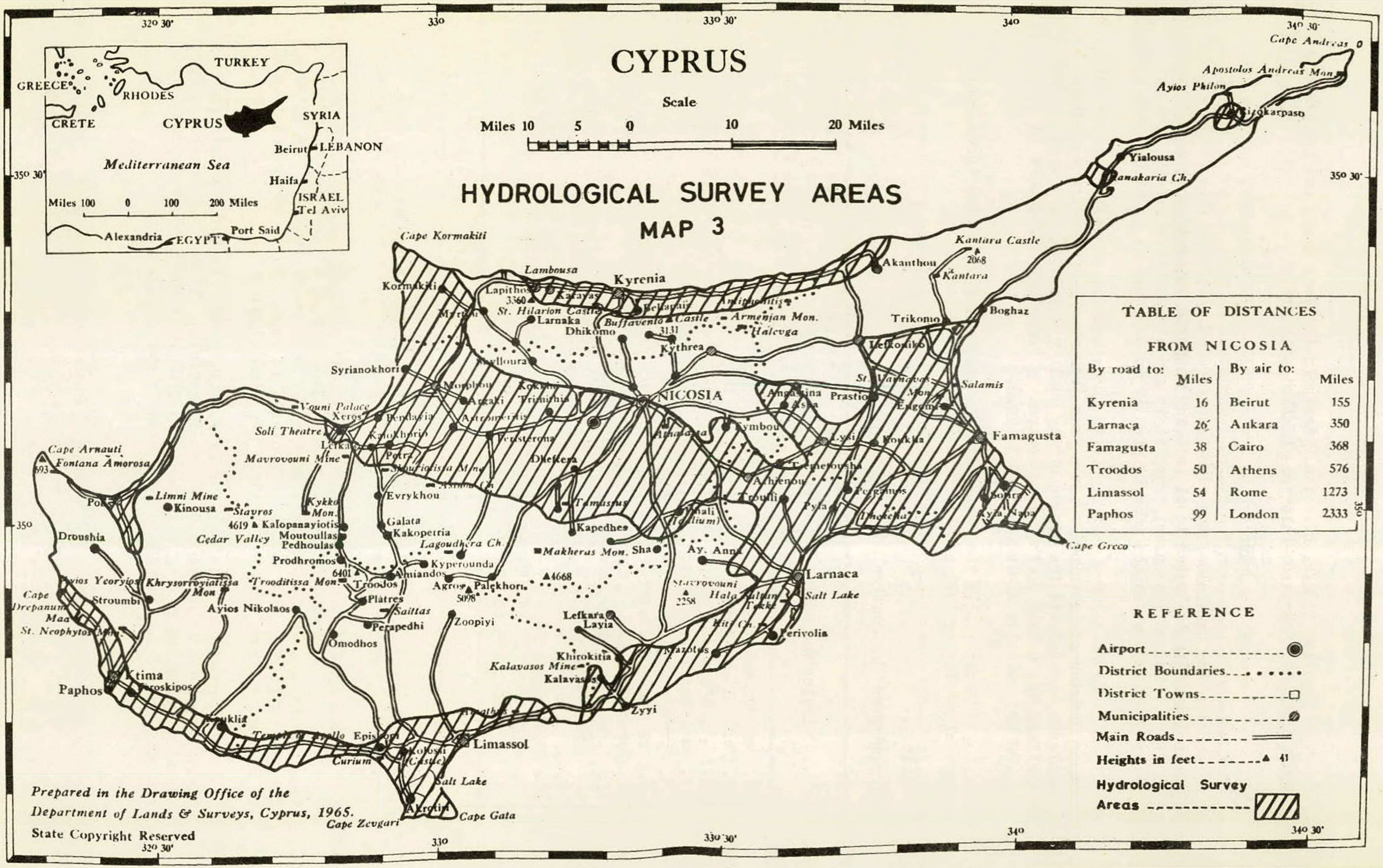

CYPRUS
Scale
Miles 10 5 0 10 20 Miles
HYDROLOGICAL SURVEY AREAS
MAP 3
TURKEY
GREECE
RHODES
CRETE
CYPRUS
SYRIA
Beirut
LEBANON
Mediterranean Sea
Haifa
ISRAEL
Tel Aviv
Miles 100 0 100 200 Miles
Alexandria
EGYPT
Port Said
TABLE OF DISTANCES
FROM NICOSIA
By road to: Miles
Kyrenia 16
Larnaca 26
Famagusta 38
Troodos 50
Limassol 54
Paphos 99
By air to: Miles
Beirut 155
Ankara 350
Cairo 368
Athens 576
Rome 1273
London 2333
REFERENCE
Airport
District Boundaries
District Towns
Municipalities
Main Roads
Heights in feet ▲ 41
Hydrological Survey Areas
Cape Andreas
Apostolos Andreas Mon.
Ayios Philon
Rizokarpaso
Yialousa
Kantara Castle
2068
Kantara
Akanthou
Trikomo
Boghaz
Lefkoniko
Salamis
Famagusta
Cape Greco
Cape Kormakiti
Kormakiti
Lambousa
Kyrenia
Lapithos
3360
St. Hilarion Castle
Larnaka
Dhikomo
Buffavento Castle
3131
Armenian Mon.
Halevga
Kythrea
Syrianokhori
NICOSIA
Vouni Palace
Xeros
Soli Theatre
Lefka
Mavrovouni Mine
Evrykhou
Galata
Kakopetria
Lagoudhera Ch.
Kyperounda
Makheras Mon.
Kapedhes
Athienou
Troulli
Pyla
Ay. Anna
Larnaca
Salt Lake
Perivolia
Stavrovouni
2258
Cape Arnauti
Fontana Amorosa
1693
Polis
Limni Mine
Kinousa
Stavros
4619 Kalopanayiotis
Cedar Valley
Moutoullas
Pedhoulas
Prodhromos
6401
Troodos
Amiandos
Platres
Saittas
Agros
Palekhori
5098
4668
Droushia
Ayios Yeoryios
Khrysorroyiatissa Mon
Trooditissa Mon.
Stroumbi
Cape Drepanum
St. Neophytos Mon.
Ayios Nikolaos
Perapedhi
Zoopiyi
Omodhos
Lefkara
Layia
Khirokitia
Kalavasos Mine
Kalavasos
Zyyi
Ktima
Paphos
Yeroskipos
Kouklia
Temple of Apollo
Episkopi
Curium
Kolossi Castle
Limassol
Salt Lake
Akrotiri
Cape Gata
Cape Zevgari
32° 30'
33°
33° 30'
34°
34° 30'
35°
35° 30'
Prepared in the Drawing Office of the
Department of Lands & Surveys, Cyprus, 1965.
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Table 6

Serial No.	Hydr. No.	Village	Water level a.m.s.l. in meters				Water level Increase (+) or Decrease (-)	
			1970		1971			
			March	Novem.	March	Novem.	March 70-71	Novem. 70-71
168/50	309	Morphou	+24.85	DRY	DRY	DRY	-	-
44/62	1695	"	+18.22	+ 6.79	+ 9.72	+ 1.12	- 8.50	- 5.67
150/54	15	Syrianochori	+ 0.97	- 0.18	+ 0.22	- 0.70	- 0.75	- 0.52
1/55	61	"	- 0.59	- 2.88	- 2.57	- 5.37	- 1.98	- 2.49
113/56	76	"	- 1.52	- 3.31	- 2.81	- 4.76	- 1.29	- 1.45
209/56	117	"	- 1.78	- 4.46	- 2.88	- 4.76	- 1.10	- 0.30
15/62	875	K.Varoshia	- 5.09	- 5.37	- 5.54	- 5.38	- 0.45	- 0.01
18/62	228	Ay.Memmon	- 0.71	- 2.13	- 1.81	- 2.53	- 1.10	- 0.40
27/62	285	Ay.Loucas	- 2.51	- 3.73	- 3.05	- 3.91	- 0.54	- 0.18
50/53	558	Dherynia	- 0.94	- 0.52	- 0.20	- 0.96	+ 0.74	- 0.44
56/56	192	Liopetri	+ 3.22	+ 2.58	+ 2.49	+ 1.72	- 0.73	- 0.86
49/54	134	Makrasyka	+36.21	+36.08	+36.30	+35.97	+ 0.09	- 0.11
20/63	1516	Paralimni	+21.24	+20.31	+19.86	+19.71	- 1.38	- 0.60
22/63	1518	"	+ 6.08	+ 5.83	+ 5.82	- 0.26	- 0.26	- 0.11
51/31	774	Phrenaros	+ 9.10	+ 8.39	+ 8.11	+ 8.20	- 0.99	- 0.19
76/56	972	"	- 0.49	- 2.49	- 2.94	- 4.65	- 2.45	- 2.16
79/56	975	"	+ 8.24	+ 7.56	+ 8.06	+ 7.95	- 0.18	+ 0.39
246/57	D438	Xylophagou	- 0.72	-	-	-	-	-
70/51	D 66	Ormidhia	- 1.31	DRY	DRY	DRY	-	-
12/63	806	Cherkes Chiftlik	+ 1.38	+ 0.93	+ 1.09	+ 0.52	- 0.29	- 0.41
88/54	24	Kolossi	+ 4.41	+ 0.68	+ 2.16	+ 0.75	- 2.25	+ 0.07
51/63	813	Limassol	+ 2.03	+ 1.25	+ 1.33	+ 0.97	- 0.70	- 0.28
13/63	807	Zakaki	+ 0.51	-	-	-	-	-
107/61	17	Yermasoyia	+14.03	+ 1.18	+ 2.00	+ 2.78	-12.03	+ 1.60

5. Control and Conservation of Groundwater

5.1 Water Conservation Areas (Wells Law cap. 351)

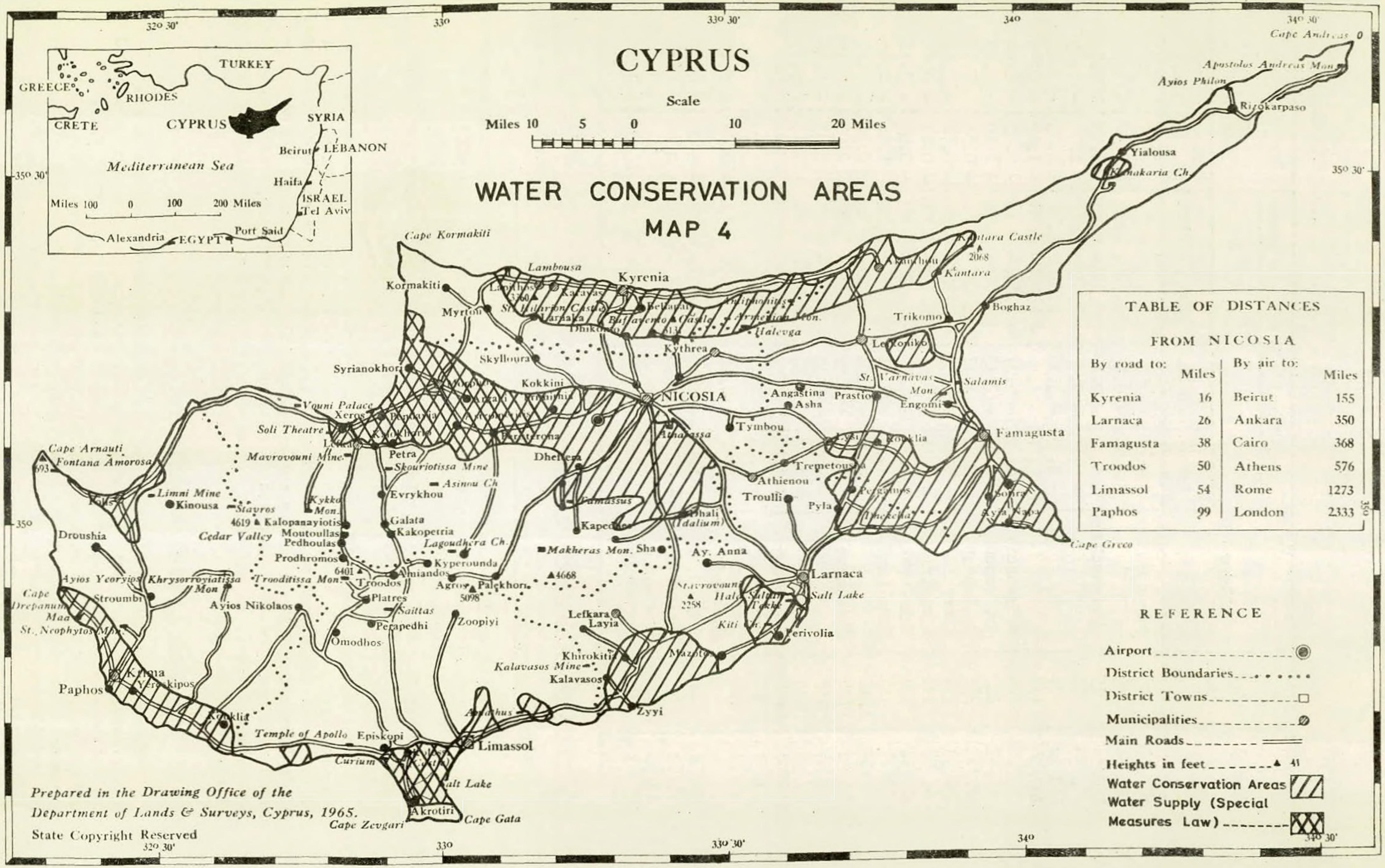
An area is declared as a Water Conservation Area when its water resources are being overexploited or the pumping trends are such that will affect the quantity or quality of the water of that area.

On map No. 4 it is shown the areas which have been declared as "Water Conservation Areas" under the Well's Law cap. 351.

Applications for well permits falling within a water conservation area are being sent by the District Officers to the Water Development Department for technical advice and recommendation. 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, chains-of-wells and springs as well as any other Government water-works, are mandatory to the District Officer.

5.2 Water Supply (Special Measures) Law. 32/64

The major aquifers of South-Eastern Mesaoria, Western-Mesaoria and Akrotiri aquifer, 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 provisions of the water supply (Special Measures) Law 32/64 have been withdrawn from the area of South-Eastern Mesaoria on the 23/4/70. (See map No.3).



CYPRUS
Scale
Miles 10 5 0 10 20 Miles
WATER CONSERVATION AREAS
MAP 4
TURKEY
GREECE
RHODES
CRETE
CYPRUS
SYRIA
Beirut
LEBANON
Mediterranean Sea
Haifa
ISRAEL
Tel Aviv
Miles 100 0 100 200 Miles
Alexandria
EGYPT
Port Said
Cape Kormakiti
Kormakiti
Myrtou
Lambousa
Kyrenia
Kythrea
Skylloura
Syrianokhori
Kokkini
NICOSIA
Vouni Palace
Xeros
Soli Theatre
Lefka
Petra
Mavrovouni Mine
Skouriotissa Mine
Asinou Ch.
Evrykhou
Dheftera
Cape Arnauti
Fontana Amorosa
Limni Mine
Kinousa
Stavros
Kykko Mon.
Galata
Kakopetria
Kalopanayiotis
Moutoullas
Pedhoulas
Cedar Valley
Prodhromos
Droushia
Lagoudhera Ch.
Kyperounda
Makheras Mon.
Kapedhes
Tamassus
Dhali
(Idalium)
Troodos
Amiandos
Agros
Palekhori
Trooditissa Mon.
Platres
Saittas
Perapedhi
Zoopiyi
Omodhos
Ayios Yeoryios
Khrysorroyiatissa Mon
Stroumbi
Ayios Nikolaos
Cape Drepanum
Maa
St. Neophytos Mon.
Ktima
Yeroskipos
Paphos
Kouklia
Temple of Apollo
Episkopi
Curium
Limassol
Amathus
Salt Lake
Akrotiri
Cape Zevgari
Cape Gata
Lefkara
Layia
Khirokitia
Kalavasos Mine
Kalavasos
Zyyi
Mazotos
Kiti
Perivolia
Larnaca
Salt Lake
Ay. Anna
Sha
Troulli
Athienou
Pyla
Tremetousha
Tymbou
Angastina
Asha
Prastio
Engomi
Salamis
Famagusta
Trikomo
Boghaz
Kantara
Kantara Castle
2068
Halevga
Armenian Mon.
Yialousa
Rizokarpaso
Ayios Philon
Apostolos Andreas Mon.
Cape Andreas
Cape Greco
Ayia Napa
Paralimni
TABLE OF DISTANCES
FROM NICOSIA
By road to: Miles
Kyrenia 16
Larnaca 26
Famagusta 38
Troodos 50
Limassol 54
Paphos 99
By air to: Miles
Beirut 155
Ankara 350
Cairo 368
Athens 576
Rome 1273
London 2333
REFERENCE
Airport
District Boundaries
District Towns
Municipalities
Main Roads
Heights in feet
Water Conservation Areas
Water Supply (Special Measures Law)
Prepared in the Drawing Office of the
Department of Lands & Surveys, Cyprus, 1965.
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(i) The District Officer, with the concurrence of the Director of Water Development can withdraw any permit for any well or can apply any modifications on the extraction of water as required.

(ii) 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.

5.3 Drilling permits

According to the law as stated above, the Director of the Water Development Department, has to give his concurrence so that the District Officer may issue a well permit, when the application falls within a Water Conservation or Special Measures Law area.

Such applications have been examined by the Division of Water Resources and our views expressed to the District Officer. A number of other applications not falling within the above referred areas have also been examined.

Analytically the number of applications during 1971 received for permits of drilling and enlarging existing boreholes are as follows:-

(i) Water Supply (Special Measures)	992
(ii) Water Conservation areas	2.784
(iii) Non-Conservation areas	476
T o t a l	4.252

5.4 Water Meters

The fulfillment of the objective of the water supply (Special Measures) Law, that is the close control of the extraction of Water from the aquifer under such Law, can not be attained without difining the quantity of water allowed to be pumped from each borehole and metering the water extracted.

According to the above referred law the following number of Water Meters have been installed.

A r e a	Number of Water Meters installed	Number of Water Meters in operation	Number of Water Meters in operation without any breakdowns	Volume of water Recorded	Number of illegal pumping (excess water extracted)
Western Messaoria	570	565	387	31.767.000m^3	55
Limassol-Akrotiri	388	382	320	-	142

Frequent checks of the Water Meters installed are carried out and the results for 1971, are shown in the Table above.

5.5 Private Drillers (Wells Law, Section 30)

According to the above Law no one is allowed to operate a drilling rig without a Driller's Licence issued every year by the Director of the Water Development Department. 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 penentrated and send to the Director of the Water Development Department, a technical report on each borehole drilled.

During the year 1971, the number of licenced private drillers were 88 in number. The number of private drilling rigs drilling for water were 60 in number.

During the year the private drillers transmitted to the Director of the W.D.D. information about 191 boreholes drilled by them.

6. Special Hydrological Studies

6.1 Hydrogeological Investigations of the Kyrenia Range Limestone

The special hydrogeological study of the Kyrenia Range was continued throughout the year, with geological observations, hydrological measurements, drilling of boreholes and pumping tests. The study started towards the end of 1969 and its objective is to examine and evaluate the water resources of the Kyrenia Range, from Vasilia to Kantara.

Dr. F. Dixey, the consultant to the study, spent two months in Cyprus, in two separate visits one in June and the other in December.

Mr. M. Peppis, Geologist, acted as the Counterpart of Dr. F. Dixey and was responsible for the drilling, test pumping and all the geological work on the Range.

There are in all 32 boreholes on the Range of which the water table level in measured monthly. For each of the borehole there is a graph showing the various characteristics and details. Out of the 32 boreholes, 16 are in operation and are used mainly for domestic supplies. Records of the extractions by means of water meters, are kept. Apart from the boreholes, 12 springs are also measured monthly, the records being kept in graph forms.

During the year an extensive programme of levelling was carried out. A total of 17 boreholes and 12 springs were accurately levelled.

For most of the year there were five drilling rigs operating on the Range in the areas of Trypimeni, Ayios Amvrosios, Klepini, Phlamoudhi and Bellapais.

The most important borehole was drilled on the limestone to the North of Trypimeni village. This borehole had commenced in 1970 and was completed in 1971 to a final depth of 495 meters. It is by far the deepest borehole on the Range. A pumping test was carried out for 168 hours with an hourly output of 40 cubic meters. The drilling of the rest of the boreholes, that started in 1971, are expected to be completed during 1972.

6.2 Akrotiri Feasibility Study (Water Resources)

In the course of the feasibility study undertaken by Messrs. H. Humphreys and Sons in co-operation with Sir M. MacDonald and Partners and Hunting Technical Services Ltd., under British Technical Assistance and made for the Development of the water resources in the Akrotiri Aquifer as well as the water resources of Kouris, Garyllis and Yermasoyia rivers, 12 testing sites involving one test well and at least two observation wells were set up and pumping tests of one week duration each were undertaken and analysed for aquifer characteristics.

The Kouris river was monitored for its flow once a week at six different locations whilst 5 intake-channels were equipped with automatic water level recorders for continuous monitoring of the diverted amounts of water; the whole effort leading to an accurate appraisal of the water balance of the Kouris flow regime.

A special 40 boreholes observation network was selected throughout the Akrotiri aquifer for monthly observations on the water-table fluctuation and trends of water quality.

A detailed compilation and elaboration on existing information regarding groundwater abstraction, geometry of the aquifer, land use, trends of water levels and quality were undertaken leading to an assessment of the ground-water balance for the needs of the Feasibility study.

6.3 Akrotiri Mathematical Model

The same data were utilized in the formulation of the input data and the preparation of the Akrotiri Mathematical Model undertaken by the Department in association with the Institute of Geological Science of London the latter being again sponsored by the British Technical Assistance. The model is expected to be calibrated in London during the early part of 1972.

6.4 Environmental Isotope Survey

The International Atomic Agency has awarded an one-year Research Contract on Environmental Isotope Survey in Cyprus under their Research Contracts programme effective as of the 1st of September, 1971. This research contract amounts to the analysis of about 100 samples for oxygen-18, 50 samples for Tritium and 20 samples for Carbon-14 worth of about £3000 in the IAEA's Laboratories. An extensive sampling network was prepared covering the whole island and 50% of the samples were collected and despatched by the end of 1971.

The research programme aims to verify the applicability of radioisotope-techniques in the Hydrology of Cyprus and to assist in the better understanding of the Hydrologic regime in respect to the location of recharge, transit time of water in the groundwater reservoirs as well as the differentiation of the water masses from each other by the natural labelling of them by the stable isotopes and tritium.

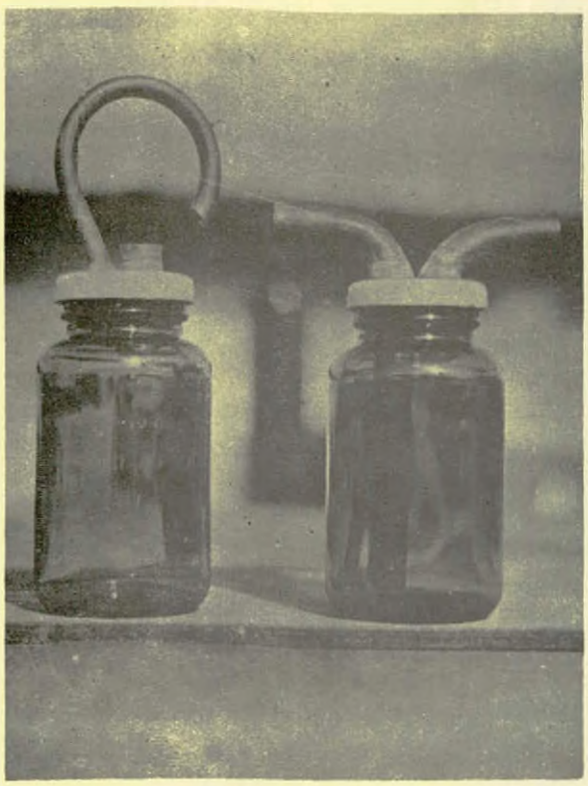
A smaller programme on Radioisotopes concerned only with the tritium content of the water of the Kyrenia limestone range was initiated earlier in 1971 with the Institute of Geological Sciences. The First Preliminary Information that was obtained from interpolating the results of the Tritium Analysis, (0 to 10 T.U) of 12 samples taken from springs and/boreholes indicated pre-1952 recharge or a quite extensive underground reservoir diluting recent recharge with older stored water, giving a low tritium content of water issuing from the major springs.

The results of the oxygen-18 content of the water of 12 samples from different locations of the Kyrenia range being quite similar to each other (δ = - 6‰ to - 7‰) indicate similar origin and conditions of recharge for all the water in the limestone aquifer.

6.5 Automatic River water Samplers

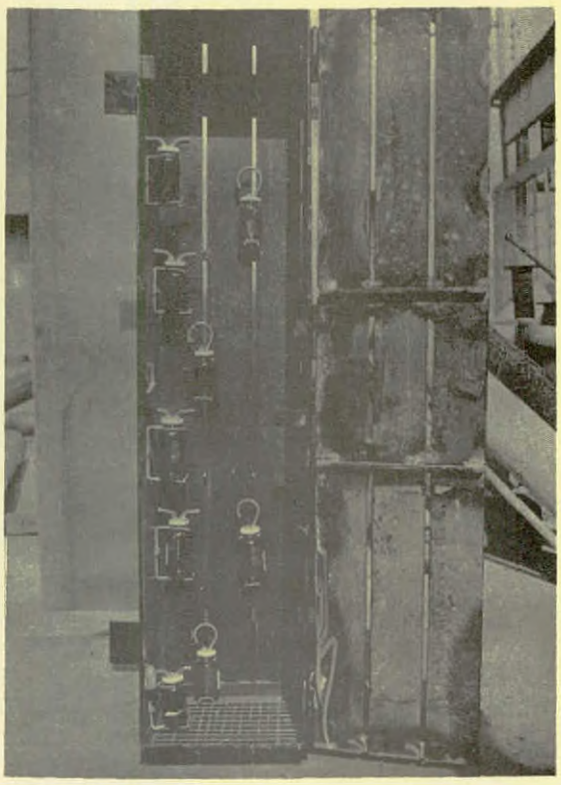
The quality of the water for most rivers in Cyprus is changing with the flow, the time of the year, the mode of rainfall and a number of other factors. The forecasting of the water quality of these rivers with a reasonable accuracy, if impounded in reservoirs, is at present for most of them impossible, since there were never enough samples from their water analysed.

The main reason of their insufficient sampling, is that the duration of their flow is short after the rain, so it is very difficult and rare to sample their water during high flows or, in some of them, at any flow at all.

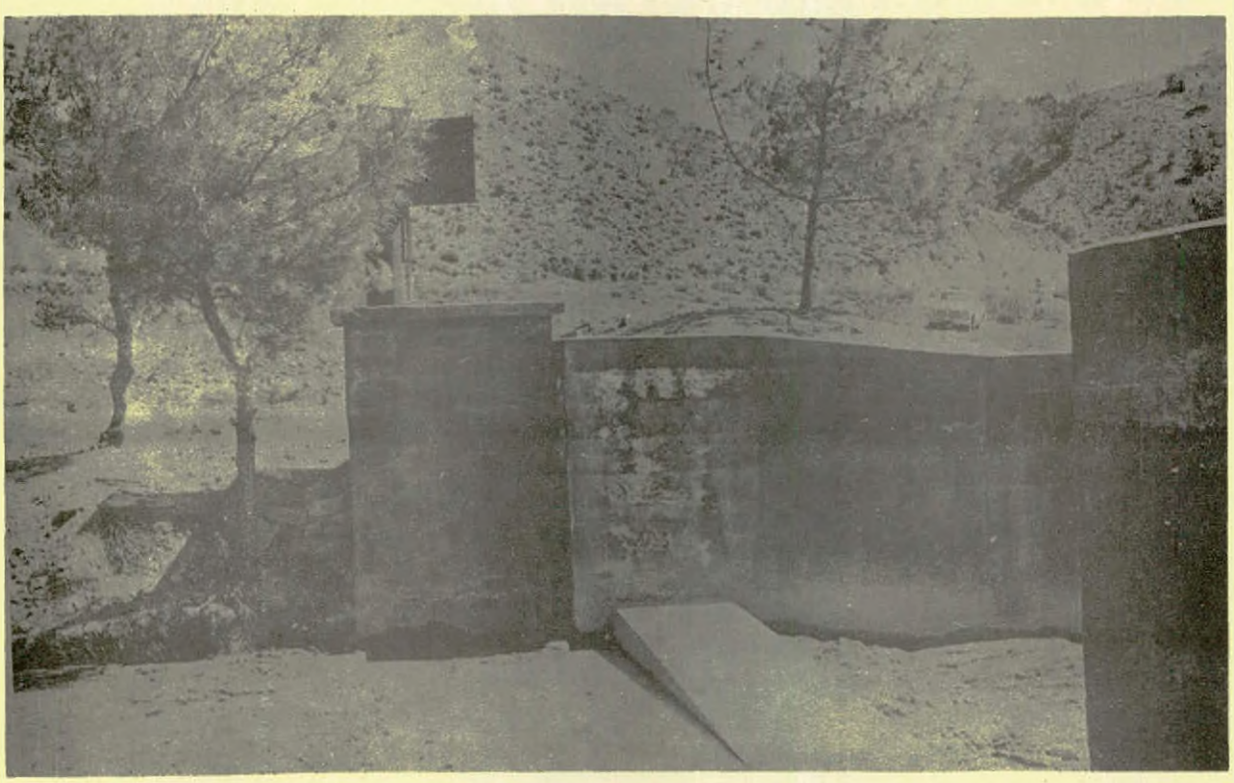


Automatic Riverwater Samplers

Left : Rising stage
Right : Falling stage



Automatic Riverwater Samplers in place at various levels in the iron case, ready to be installed in river.



Tengelis River Measuring Weir equipped with Automatic Riverwater Samplers. Samplers are installed for protection within the iron case fastened on the concrete wall.

This difficulty applies in the same way for silt sampling as well.

Since full information about the quality of the water in our rivers is of utmost importance for the planned use of it and information about the silt content of their water is very useful, when designing reservoirs for storing this water, a study has been undertaken for the solution of this problem.

Two types of automatic riverwater samplers have been devised. One type to sample the river during its rising stage and the other to sample the river during its falling stage. Both types are sampling during the stage of the river for which they have been installed. So by installing a number of these samplers at various elevations in the river, we will be able to get after every flood, samples for chemical and silt content analysis of the river water at the stages for which samplers have been installed and as amany as the number of samplers covered with the river water.

The rising stage automatic riverwater sampler is a hermetically closed bottle with two short pipes, which connect the inside with the outside of the bottle. The one of these pipes has its lower end, in the bottle, bent upwards and this is the water pipe through which the river water enters the sampler bottle. The other pipe has its upper end bent downwards and this is the air pipe through which the air escapes while the water is filling the bottle. The bottle is filled within a few seconds up to the level of the lower end of the air pipe, when the level of the river water reaches the upper end of the water pipe and a small volume of air is trapped then in the bottle. The lower bent end of the water pipe is within this trapped bubble of air and so no direct contact of the water within the sampler is allowed with the water flowing in the river any more and so no mixing of the two waters is possible. If the river water level rise above the air pipe of the sampler, then an air bubble is again formed in that pipe which will not allow the mixing of the inside with the outside water through this path either, even if the level of the river water rises a few meters above the sampler. So the quality of the water within the sampler, is for sure the same as the quality of the river water flowing at that rising stage, for which the sampler has been installed.

The falling stage automatic riverwater sampler is much simpler in operation and it is a bottle with two pipes bent so that when installed and opening of the one the "in pipe" faces upstream and the opening of the other the "out pipe" is looking downstream. Both pipes are open and when the sampler is immersed in the flowing river water, there is a continuous circulation of the water. When the level of the river water drops below the level of the sampler, then what is left in the sampler, is water with the same quality as the water flowing in the river during that falling stage for which the sampler has been installed.

Both samplers have been tested in flowing water and proved to operate satisfactorily.

During 1971, such samplers have been installed on a Measuring Weir in Ovgos River near Kyra village and on a measuring weir in Tengelis river near Kythrea village, on experimental basis.

III. DIVISION OF PLANNING

By

C. Christodoulou
Executive Engineer

3.1 Planning

3.1.1 Masterplan

During 1971 a study has been undertaken by the Department the objective of which was to draw up a dynamic master plan regarding the development of the water resources of the whole Island. Most of the basic data for the said study have been taken from the reports of the Cyprus Water Planning Project.

The study of the Master Plan which will be continued during 1972 as well, includes reservoir operations analyses diversion schemes and economic analyses of various alternative development schemes. Almost all the above analyses are carried out by means of an electronic computer the use of which is of vital importance for such studies, since many alternatives of every proposed project can be analysed and compared in a very short time.

The main task of the study is to indicate, and suggest ways of achieving, the optimum utilization of the water resources of the Island as a whole.

All the important watersheds of the Island have been divided for the sake of the study into two major groups. The first group includes all the watersheds between Paphos and Famagusta and the second all the watersheds between Polis and Morphou.

The study of the first group includes the Paphos and Akrotiri Projects while the second includes the Morphou Tylliria Project. The results of all the said projects are taken into consideration in the progress of the study.

3.1.2 Feasibility Studies

As a continuation of the Cyprus Water Planning Project the following Feasibility Studies were undertaken:

3.1.2.1 Akrotiri Feasibility Study

In October 1970, agreement was reached between the Government of Cyprus and the British Government for the provision of technical assistance in a study of the feasibility of further irrigation development of the Akrotiri Area in Limassol District. The Overseas Development Administration in London appointed Howard Humphreys and Sons to undertake the study in association with Sir M. MacDonald and Partners and Hunting Technical Services Ltd.

The Project is intended to recommend development of the Water Resources of the Kouris, Garyllis and Yermasoyia rivers, together with the groundwater resources of the area, for use in the main irrigable lands between Episkopi and Limassol as well as for the growing urban water requirements of Limassol.

With the Project nearing completion by the end of 1971 a tentative development plan has been suggested. The synthesis of the studies made in 1971 and the final formulation of a development plan of the water resources of the region will be made during the early 1972 with the final report being submitted in the middle of 1972. This report will be International Bank standards as may be required for international financing if needed.

The development of water resources includes:

The fullest possible development of the available supplies from the present Garyllis and Yermasoyia dams, and development of the remaining groundwater potential, the raising of Yermasoyia dam and the construction of Kouris dam being of the optimum size to develop the runoff of the Kouris river.

Limassol and other rural domestic water supplies has been made in the studies.

3.1.2.2 Paphos Feasibility Study Phase "B"

The consulting firms of Sir M. MacDonald and Partners in association with Hunting Technical Services, Jean Saliba and Howards Humphreys and Sons acting as sub-contractors employed by the Food and Agriculture Organization of the United Nations under contract No. SF/CYP 6 - 3/LA embarked on the Paphos Feasibility Study phase "B" on the 1st of March 1971.

The project envisages a development plan of the water resources of the Xeropotamos river together with the groundwater resources of the Dhiarizos, and Ezouza river bed aquifers as well as the calcarenite aquifer of the coastal plain of the South Eastern Paphos area. These water resources are to be used in the main irrigable lands between Ha-Potami and Mavrokolymbos river along the coastal plain.

The project also, further to making recommendations on the engineering solutions (Asprokremos dam, distribution systems, well construction and irrigation techniques etc.) examines the agricultural development considering cropping patterns land consolidation, marketting and analyses, the financial and economic justification of the Project preparing thus a comprehensive bankable report.

The final recommended development programme and the results of this feasibility study will be presented in the middle of 1972.

With the project being in an advanced stage by the end of 1971 the following provisions can be outlined.

The proposed project will include a groundwater development of additional groundwater from the river gravels of the Dhiarizos and Ezouza rivers, as well as a surface water development by the construction of the proposed Asprokremmos Damon the Xeropotamos river.

3.2 Site Investigations - Soils and Concrete Laboratories - Grouting

3.2.1 General

Because of the expansion of the site investigations programme during 1971, four new drilling rigs were purchased, as shown on Table 1. Three of the new rigs are Core Drills and the other Auger/Core Drill. Additions were also made to the Laboratory equipment, including two new consolidation apparatus as shown on Table 3.

Site investigation work was done on sixteen different projects, nine of which were completed in 1971. The following are usually included - when applicable - in a site investigation :

(i) Preparation of detailed geological maps of the dam and reservoir sites
(ii) Foundation Investigations, - i.e. subsurface exploration.
(iii) Material Investigations
(iv) Laboratory Testing
(v) Interpretation of results for design
(vi) Reports on the investigations

3.2.2 Schemes Investigated During 1971

3.2.2.1 Kouris Dam Investigations

In addition to the foundation investigations completed in 1970, material investigations and test grouting were carried out in early 1971 as follows:

3.2.2.1.1 The core material investigations were carried out in the Night Storage Reservoir Sites and included the opening of six Trial Pits having a maximum depth of 9.10 m., drilling of fifty five boreholes ranging in depth from 1.0 m. to 5.5. m. using a hand operated powerhead Auger, sampling and Laboratory testing. Samples were also taken from the Kandou Santstone, probable rockfill material, and relevant Laboratory tests were carried out.

The test grouting was carried out to investigate the groutability and effects of grouting on the calcarenite beds outcropping at the dam site. This test was performed according to the specifications of the Consultants. Ten boreholes were drilled, four primaries, four secondaries and two check holes one of which was used as a tertiary grout hole. The depth of each hole was 6.5 m. A pit was also opened to a depth of 6.0 m. for visual examination of the grouting effect.

A report on all site investigation work is being prepared and will be issued early in 1972.

3.2.2.2 Asprokremmos Dam Additional Investigations

Additional site investigations were carried out in 1971, according to instructions given by Sir MacDonald and Partners, Consultants of the Project, as follows:

(i) Twelve boreholes in all were put down by core-drilling, overburden drilling and percussion boring, totalling a depth of 271 m.
(ii) Water pressure tests were performed in the core-drilled boreholes.

(iii) Perforated stand pipes were installed into six of the boreholes drilled.
(iv) A pumping out test was also carried out in the gravelly deposits.
(v) Ten trial pits were dug in the river gravels upstream and downstream of the proposed dam axis and samples taken and tested as possible shell material for the dam.
(vi) Ten trial pits were excavated at the borrow area for core material and representative samples were obtained and tested.
(vii) For filter material three beach areas were investigated by sampling and laboratory testing.
(viii) For suitable "bentonitic" clay four probable areas were investigated by sampling and testing.
(ix) Geophysical investigations were also carried out by the Geological Survey Department.
(x) A report on the investigations was prepared.

3.2.2.3 Kalavassos Dam Investigations

Four boreholes were drilled during the investigations totalling a depth of 200 m.

Water pressure tests were carried out in all boreholes at 3 metres stages.

Perforated stand pipes (one inch diameter) were installed in all boreholes drilled, for water table measurements.

Trial pits were excavated in the river gravels downstream of the proposed dam axis for probable materials of filter and shell. Representative samples were obtained and tested.

Six trial pits were excavated at the proposed core material borrow area and samples were obtained and tested.

Detailed geological maps of dam and reservoir sites were prepared.

A report on the investigations will be prepared in 1972.

3.2.2.4 Khirokitia Dam - Additional Investigations

At the recommendations of the Consultants the following investigations were carried out in 1971 in addition to the 1968 investigations.

(i) Three boreholes were drilled during the investigations totalling a depth of 210 m.
(ii) Water pressure tests were carried out in all boreholes at 3 metres stages.
(iii) Perforated stand pipes were installed in the three boreholes for water table measurements.
(iv) A report on the investigations will be prepared in 1972.

3.2.2.5 Dhypotamos Dam Investigations

The following investigations were carried out after the recommendations of the Consultants.

(i) Eight boreholes were drilled having a total depth of 296 m.

(ii) Water pressure tests were performed in all boreholes at 3 metres stages.
(iii) Perforated stand pipes were installed in all boreholes for water table measurements.
(iv) A seismic survey was carried out at the dam site.
(v) Eleven trial pits were excavated in the river gravels downstream of the dam axis for probable shell material. Samples were obtained and tested.
(vi) Samples for filter material were obtained from Ayios Theodhoros beach area and tested.
(vii) Seven trial pits were excavated at the proposed core material borrow area and samples were obtained and tested.
(viii) A report on the investigations will be prepared in 1972.

3.2.2.6 Ayios Nicolaos Dam Investigations

Four boreholes were drilled during the investigations to a total depth of 134 m.

Water pressure tests were carried out in three of the boreholes at 3 metres stages.

Perforated stand pipes were installed in the three boreholes for water table measurements.

A report on the investigations will be prepared in 1972.

3.2.2.7 Kyra Dam Investigations

These investigations were carried out at the request of the Consultants.

Ten boreholes were drilled of a total depth of 338 m.

Water pressure tests were carried out in six of the ten boreholes at 3 metres stages.

Standard penetration tests were performed and undisturbed samples taken in four of the boreholes drilled in the alluvium deposits.

Perforated stand pipes were installed in five of the boreholes for water table measurements.

Seven boreholes were drilled with the Auger Drill in the proposed core material borrow area and samples were taken and tested.

Fifteen boreholes were drilled with the Auger Drill in the catchment area and samples were sulphate tested.

A report on the investigations will be prepared in 1972.

3.2.2.8 Kalochorio Diversion

The following investigations were carried out at the request of the Consultants:

(i) Five boreholes were drilled to a total depth of 131 meters.
(ii) Water pressure tests were performed in one of the boreholes at 3 m. stages.

(iii) Perforated stand pipes were installed in four boreholes for water table measurements.
(iv) Three trenches were excavated in the river gravels and samples taken and tested.
(v) Samples of core material were also obtained from the reservoir area and tested.
(vi) Additional investigations in the gravels will be carried out early in 1972.

3.2.2.9 Ayios Theodhoros Dam Investigations

These investigations were started in late December 1971 at the recommendations of the Consultants and it is hoped that they will be completed by April 1972.

During 1971, one borehole was almost completed to depth of 60 m. and water tests were performed at 3 m. stages. A standpipe was also installed for water level measurements.

3.2.2.10 Panayia tis Agapis Dam Investigations

They were started in late December 1971 at the recommendations of the Consultants and it is hoped to complete them by the end of February 1972.

3.2.2.11 Arakapas Dam Site Investigations

These were started in late 1971 and it is hoped to have them completed by the end of March , 1972.

3.2.2.12 Paphos Main Conveyor Route Site Investigations

These were carried out at the request of Sir MacDonald & Partners, as follows:

(i) Thirteen trial pits were excavated using a J.C.B. digger.
(ii) Seven boreholes were drilled using the Department's Mobile Auger Drill.
(iii) Standard penetration tests were performed in all boreholes and in three of the trial pits at one metre intervals.
(iv) Samples were taken and tested in the Laboratory, from all the boreholes and trial pits.
(v) A report will be prepared in early 1972.

3.2.2.13 Investigations for Other Departments

Due to the additional volume of work and the lack of extra equipment and personel many of the requests for site investigations, received from other Government Departments and private firms had to be turned down. Investigations undertaken in 1971 were that of the Forest Industries Project and the new Nicosia-Morphou Road.

3.2.2.131 Forest Industries Project

The site investigated for the proposed Industrial Complex, is located just outside Kokkinotrimithia village. Very briefly the following work was carried out:

(i) Eleven boreholes were drilled, using the Mobile Auger Drill, three to a depth of 13 metres the others having depths ranging between 4.5 and 6 metres.

(ii) Six Trial Pits were hand excavated to a depth of 1.53 m.
(iii) Samples were taken and tested in the Laboratory.
(iv) Standard penetration tests and in-situ density tests were performed.
(v) A report on the investigations has been prepared.

3.2.2.13.2 New Nicosia-Morphou Road

These investigations were started in November 1971, at the request of the Director of the Public Works Department and it is hoped to have them completed in early 1972. The sites to be investigated are at the points of road interchanges and river bridges. Sampling and in-situ and laboratory testing are carried out during the investigations.

3.2.3 Field Investigations Equipment

Table 1 shows a list of the equipment available during 1971, for field investigations.

3.2.4 Grouting Section

The only grouting work carried out for W.D.D. was the Kouris Test Grouting and that at Lythrodhondas Dam. The Kouris grouting was briefly described above, under section 2.1. Other work carried out by the grouting section may be summarised as follows:

3.2.4.1 Lythrodhondas Upper Dam Grouting Investigations.

This investigation was carried out to investigate the leakages of the dam and to enable us to make an estimate of the grouting necessary to stop or minimise the leakages.
Two boreholes were drilled through the dam and into the rock in the left abutment and water pressure tests carried out in order to check the rock permeability. Their depths were 12.5 and 11 metres penetrating into rock 7.3 and 9.5 metres respectively. Both boreholes were cement grouted and water tested. This grouting reduced the leakages through the left abutment by about 43%.

3.2.4.2 Kalopanayiotis Dam Grouting Investigations

In order to investigate the leakages of the dam six inclined boreholes of a total depth of 189 metres were drilled and water tested. Based on the permeability results, a grouting programme will be recommended by the Consultants.

3.2.4.3 Grouting Works at Ayia Sophia Mosque

This work was carried out at the request of the Department of Antiquities, in connection with the restoration work now being performed under the direction of UNESCO experts.
Masonry foundations of the columns were strengthened by cement grouting. Grouting was also carried out on the masonry structure, that is on columns, walls and arches in order to fill up the voids formed in the lime mortar. During 1971, the total number of holes grouted was 352. Grouting work will continue in 1972.

3.2.4.4. Grouting Equipment

A list of the grouting equipment available during 1972 is shown in Table 2.

3.2.5 Laboratory Branch

During 1971, the volume of work carried out by the Soils Laboratory increased compared to the previous years. This may be attributed mainly to the following reasons:

(i) The number of material investigations carried out increased.
(ii) A number of time consuming tests were carried out, such as large and small drained Triaxial Tests and large shear box tests on gravels and crushed rock.
(iii) Construction control was started at Lefkara and Massari Dams.

The volume of work carried out by the Concrete Laboratory shows a decrease over the previous years.

The testing facilities available during 1971 in the soils and concrete Laboratories are shown in Tables 3 and 4 respectively. Tables 5 and 6 show the type and number of tests carried out during the year.

Table 1 - W.D.D. Field Investigation Equipment

(i) Drilling Rigs

Drill rig Number	Type	Make	Year Acquired
WDD 294	Overburden	Atlas	1963
WDD 354	Coredrill	Craelius	1963
WDD 423	Wagon Drill	Atlas	1965
WDD 455	Overburden	Atlas	1966
WDD 460	Coredrill	Boyles	1966
WDD 477	Overburden	Atlas	1967
WDD 497	Coredrill	Craelius	1968
WDD 555	Coredrill	Boyles	1971
WDD 559	Coredrill	Boyles	1971
WDD 557	Coredrill	Boyles	1971
WDD 560	Auger drill	Atlas	1971
WDD 553	Light percussion drill	Edeco	1970

(ii) Other Equipment for Use on Site

Serial Number	Apparatus	Year Acquired
1	Vane shear test apparatus	1970
2	Portable powerhead auger	1970
3	Plate bearing test apparatus	1970
4	Clean-out auger with sludge barrel	1970
5	Stationary piston sampler	1970
6	Thinwall samplers (Shelby tubes	1970
7	U4 sampling tubes	1970

Table 2 - W.D.D. Grouting Machinery in 1971

1.	One "Moyno" Grout pump (Pneumatic) Capacity = 50 gal./min. Pumping Pressure = 200 psi.
2.	One "Craelius" Grout pump Reciprocating with Diesel Engine Capacity = 11 gal./min Pumping Pressure = 1000 psi.
3.	Two Z-M-300 High Speed Mixers (Pneumatic) Capacity = 66 Imp. gallons
4.	Two ZA-600 Grout Agitators (Pneumatic) Capacity = 132 Imp. gallons

Table 3 - Soils Laboratory Equipment

Serial Number	Apparatus	Year Acquired
1	3 No. Liquid Limit apparatus	2 prior to 1967 1 in 1971
2	Normal and rapid moisture content apparatus	prior to 1967
3	2 No. Shrinkage Limit apparatus	" 1970
4	Standard and modified proctor apparatus	prior to 1967
5	Sand replacement apparatus	" 1967
6	Sieve analysis, hydrometer and pipette apparatus	" 1967
7	Falling and Constant Head permeameters	" 1967
8	Unconfined Compression apparatus	" 1967
9	Triaxial apparatus ($1\frac{1}{2}$" diameter specimens)	" 1967
10	Small shear box machine (6 x 6 cm specimens)	" 1967
11	3 No. consolidation apparatus	1 prior to 1967 2 in 1971
12	1 No. 17 inch diameter by 10 inch high constant head permeameter	1967
13	1 No. sample extruder	1967
14	1 No. High capacity triaxial machine for up to 4 inch diam. soil and rock specimens	1968
15		

Table 3 - Soil Laboratory Equipment (Cont')

Serial Number	Apparatus	Year Acquired
15	1 No. Norwegian type Porepressure apparatus	1968
16	1 No. Torsion dial balance	1969
17	2 No. Proctor penetrometer sets	1969
18	Universal Hydraulic extructed	1970
19	Large Shear Box machine (12 x 12 inch samples)	1970
20	Platform beam scale	1971

Table 4 - Concrete Laboratory Equipment

Serial Number	Apparatus	Year Acquired
1	Aggregate crushing test apparatus (Local)	1960
2	Balance capacity 700 lbs (local)	1961
3	Compacting factor apparatus for concrete (Local)	1961
4	Oven for drying sands and aggregates	1965
5	Concrete testing machine hand operated 100 ton capacity	1957
6	Sieve shaker	1964
7	Vicat neddle for cement test	1966
8	Concrete testing machine electrically operated 150 ton capacity	1966
9	Laboratory concrete mixer	1968
10	Distillation apparatus	1969
11	Sample spitter for aggregates	1969
12	Air Entraintment meter	1971
13	Electric concrete vibrator	1971

Table 5 - Tests carried out in M.D.D. Soils Laboratory in 1971

TESTS	Akrotiri	Kouris	Asprokremmos	Dhypotamos	Ovgos Dam	Lefkara Dam	Khirokitia Dam	Kalo Khorion Lefkas	Kalavassos	Paphos Canal	Angulos Dam	Stalos Dam	Yerokolymbos Dam	New Pendayia Boosting Station	Kokkinotrimithia Forest Industries	P.W.D.	Miscellaneous	Massari Dam	Total of each kind of test
Atterberg Limits		14	26	22	37	5	2	16	11	8	1	1	2	4	10	10	20	20	209
Moisture Content	72									11				6		5		304	398
Standard Proctor		12	2		18	6					2	1	2			4		11	58
Sand Replacement																		153	153
Core Cutters																		253	253
Hydrometer	157	14	10	22	39	5	2	16	11	10	1	1	2	4	10	10	10		324
Permeability	72	19	2		18	5										7			123
Undrained Triaxial		12									1	1	2	3		6			25
Drained Triaxial		4	3																7
Shear box (Large)		2	4	1															7
Consolidation																			
Silt Content																	200		200
Specific Gravity	157	37	10	22	39	5	2	16	11	10	1	1	2	4	10	10	11		348
Field Density	72															5			77
Wet Analysis		12	40	19					7		1	1			3				83
Dry Analysis		8														10		33	51
Crushing Strength		64	7	8			4		3								1		87
Total	530	198	104	94	151	26	10	48	43	39	7	6	10	21	33	61	248	774	2403

Table 6 - Test carried out in the W.D.D. Concrete Laboratory in 1971

T E S T S	Massari Dam	Tenders for Concrete aggregate	Miscellaneous	Tests for Private firms	Kokkinotrimithia Channel - Control	Phrenaros Reservoir	Total of each kind of test
Sieve Analysis	41	150	30		6		227
Silt Content	41	87	30		6		164
Organic Impurities	41	87	30		6		164
Specific Gravity	10		18		6		34
Aggregate crushing test		13	50		6		69
Acid Test			10				10
Fineness Modulus			12				12
Cubes prepared and crushed	80			980	16	12	1088
Slump Test	20				4	3	27
Water Absorption	10		20				30
T o t a l	243	337	200	980	50	15	1825

IV. DIVISION OF DESIGN AND CONSTRUCTION OF MAJOR PROJECTS

By

K.C. Hassabis
Senior Water Engineer

4.1 The Design Division which is one of the Major Divisions of the Department is Sub-divided into three main branches.

The Design Branch whose functions are :

(i) the detailed design of major projects undertaken by the Department.
(ii) the preparation of specification and conditions of contract for Major Projects.
(iii) the planning and supervision of construction of Major Projects.

The Topography Branch which carries out all the surveying work of the Department.

The Drawing Office Branch which does most of the drawing work of the Department.

4.1.2 Design Branch

The Design Branch is manned with qualified Civil, Irrigation and Topography Engineers and one Senior Inspector of Works.

The Permanent and Temporary personnel of the Design Branch during 1971 consisted of:

1 No. Executive Engineer I - Head
7 No. " " II
2 No. Irrigation Engineers
2 No. Topography Engineers
1 No. Senior Inspector of Works

During the year work was done on the design of Dams, Irrigation Works, preparation of specification and conditions of Contract for Major Projects, construction planning and control of Major Projects and other minor miscellaneous works. A brief description of the most important works undertaken by the design branch, during the year is given below:

4.2 Report on Design of Major Projects

4.2.1 Palekhori-Kambi Dam

The preliminary design of this Dam started in 1969, but its final design was carried out and completed during 1971.

The work involved also the preparation of specification, Bills of Quantities and conditions of Contract in view of the Project being subject to International Tender.

The Project involves a Concrete Gravity Dam of max. height of 32 m. and of total crest length of about 190 m. with a total volume of concrete of 35,000 m3.

The reservoir will have a capacity of about 600,000 m3, of water for irrigation purposes.

The access road leading to the Dam site including the R.C. Bridge were also designed and executed during the year.

The contract for the construction of the Dam was awarded to Messrs Joannou & Paraskevaides, in September 1971, for the Contract Price of £271,000. Construction of the Dam started in October 1971, and it is scheduled for completion in May 1973.

4.2.2 Ayios Nicolaos Dam - Kakopetria

The Design of this Dam commenced during the second half of 1971 and is nearing completion. Considerable work has been done on the preparation of drawings, Bills of Quantities and Cost Estimating. Additional detailing of the foundation may however be required after the completion of the geological report regarding the nature of rock encountered at the site.

The dam is of the concrete gravity type with a max. height of 33 m. with a total crest length of 110 m and total volume of concrete of 27,000 m3.

The dam with a capacity of about 265.000 m3 to be used mainly for irrigation has a step type spillway 40 m. wide with a 1.52 x 1.83 m. desilting outlet.

The cost of the dam is estimated to be about £240,000.

4.2.3 Arakapas Dam

The Design of this Dam commenced during the year and is still continuing.

Two alternative sides were investigated, but the upper damsite has been found more suitable from geological point of view.

The Dam is of the concrete gravity type with a max. height of 21 m. total crest length of about 110 m., a step type spillway of total width 57 m. and a 1.5 x 1.5 m. desilting outlet. It is estimated that 200 donums of citrus will be irrigated from this dam.

The capacity of the reservoir will be about 200,000 m3. The concrete volume of the dam will be about 14 000 m3.

4.2.4 Kalokhorio-Klirou Dam

A reasonable amount of design work has been done throughout the year on the raising of existing masonry dams.

The Klirou Dam with an existing capacity of 33,000 m3 is to be raised by 2 m. in order to accomodate an additional capacity of 32,000 m3. As a result of the increased capacity an additional area of 64 donums of Spring Crops will be irrigated. The max. height of the Dam will now be 13 m.

4.2.18 Palekhori Dam

Although this Dam is being constructed by a contracting firm, quite some time was spent, late in the year, in preparing a construction programme for the works by the Critical Path Analysis for Tender purposes. In addition a minor amount of modified design work has been done on the contract drawings in view of new requirements, in the light of new data available.

The preparation of minutes of meetings held on the site with the Contractor and the monthly progress reports which again form a part of the whole planning and control of the works, as well as the administration of the whole contract has constituted during the year one of the major functions of the design division.

4.3 Hydraulics Laboratory

The Hydraulics Laboratory was built during 1971, for performing various scaled hydraulic model tests of dams and other hydraulic structures. The spillway of the Lefkara Dam, was the first model constructed. The construction of the topographical and structural part of the model was completed late in 1971 to a scale of 1:50. The mechanical part of the model (pipe work, water tanks, etc) will be completed in the first months of 1972 and it is hoped that the model will be used for testing as soon as this is done.

The main purposes of the model tests on the Lefkara Spillway are two:

(i) to study the flow pattern and the effect and extend of errosion caused by the spillway discharge for various floods, and
(ii) to study the effect of the surge waves developed by the discharge of the spillway, on the downstream face of the dam structure.

4.4 Construction Reports on Major Projects

4.4.1 An account is given below on the progress of construction of Major Projects during the year 1971.

During 1971 the construction of several important projects has been put in hand.

The most important of these works are:

Famagusta Water Supply Project Stage III Works:

(i) Lefkara Dam
(ii) Lefkara-Khirokitia Pipeline and
(iii) Khirokitia Treatment Works
(iv) Massari Dam
(v) Palekhori Dam

At the same time work continued on minor outstanding works of the 2nd Stage of the Famagusta Water Supply Project.

It is estimated that the raising of the Dam will cost around £7.000.

4.2.5 Lythrodhondas Dam (Lower Site)

This is again an existing masonry dam with a present capacity of 33,000 m3, which is to be raised by 1.30 m. giving additional capacity of 24,000 m3. As a result of the increased capacity an additional area of 48 donums of spring crops will be irrigated. The max. height of the dam will now be 9.8 m.

4.2.6 W.D.D. Hydraulics Laboratory

During this year the structural and hydraulic design of the laboratory was completed. The construction of the lab. was completed under the supervision of the design division by the end of the year.

The work involved a 42 ft. x 44 ft. industrial type shed including pipework from a constant head tank and return channels.

The laboratory is mainly to be used for hydraulic models.

4.2.7 Argaka Magounda Distribution System

Quite an amount of design work has also be done during the year on irrigation net-works.

The final design of Argaka Distribution scheme started in March, and was completed by the end of the year.

Detailed working drawings and a cost estimate have been prepared showing all items to be installed. The system will cover an area of about 2300 donums of irrigated land. The total network in A.C. pipes is estimated to cost around £128.000.

4.2.8 Ayia Marina Diversion Scheme

This scheme is proposed for the diversion of water from the upper ridges of the Livadhi river to the Ayia Marina Dam catchment. Design work started and was completed in the same year. The estimated cost of the proposed scheme which is to be in steel pipes is valued to £28,000.

The daily maximum capacity of the scheme will be 1590 m3.

4.2.9 Kiti Distribution System - Stage III

During the year design work was done and completed on stage III of the Kiti distribution system which constitutes the third phase of the entire network.

Stage III of the scheme which is to be of prefabricated reinforced concrete channels is estimated to cost about £27,000 and will command an area of 1110 donums.

4.2.10 Lefkara Distribution System

More design works was done during the year on the Distribution scheme of Lefkara Dam. At present the scheme which is to be in steel pipes was restricted on the main conveyor pipe lines as the tertiary lines will have to be decided after land consolidation.

It is estimated that the scheme will command an area of about 615 donums out of which a net area of about 430 dons. will be irrigated.

The cost of the scheme is provisionally estimated at about £45,000.

4.2.11 Yermasoyia Distribution System

Several alternative proposals have been studied, and more design work has been done throughout the year concerning mainly the route which should be followed to convey the water to the areas to be irrigated.

4.2.12 Mavrokolymbos Distribution System

A study for possible extension of the system has started late in 1971.

The purpose of the extension is to irrigate an additional land of about 226 donums, mostly vegetables in the Khloraka-Ktima Area.

The extension, as well as the previous network consist of A.C. and steel pipes with some sections in concrete channels.

It is estimated that an additional cost of £7,200 will be required to cover the new extension.

4.2.13 Polemidhia Distribution System

A study for extension of Polemidhia distribution system started very late in the year.

The new extension is to cover 400 donums of citrus of Lanitis Plantations.

The extension which is to be of A.C. pipes is estimated to cost about £7,800.

4.2.14 Nicosia Water Supply - Morphou Bay Scheme

A scheme was prepared for bringing an additional quantity of about 10 000 cu. meters per day from new boreholes in the Pendayia area. The scheme involves:

(i) the use of five new boreholes, and a new 18" A.C. pipeline about from the boreholes to the main Prastio Pumping Station.

(ii) The provision of two additional electrically driven centrifugal pumps with ancillary equipment at the Prastio Station.

(iii) A booster station near Philia Village which will enable the existing Morphou-Nicosia pipeline to convey the additional quantity of water. The alternative of providing a second pipeline from Morphou to Nicosia was found to be more expensive and would take a considerable time to implement, while it was imperative that additional quantity of water had to be provided during 1972, in order to avoid serious shortage of water during the summer months.

Orders for materials and equipment for this scheme were placed during 1971, and it is expected that it will be possible to provide at least an additional quantity of 5000 cu.m. per day by July 1972, while the whole scheme is expected to be fully operational in 1973.

4.2.15 Famagusta Water Supply Scheme Stage III

This stage is the final stage of the new scheme for meeting the water supply requirements of the town of Famagusta until 1985 and includes Lefkara Dam, the Khirokitia Treatment Works and the Lefkara-Khirokitia pipeline.

The first two parts were designed by Consultants, while the pipeline was designed by the Department. More details about these works are given in the respective construction reports.

Work on all parts of this stage commenced during 1971 and it is expected that it will be possible to put the scheme into operation in 1973.

4.2.16 Planning Construction of Major Projects

The year 1971 has not only been a fairly busy year both for Design and for the Construction of Major Projects.

As a result quite an amount of Construction planning and Control of Major Projects has been carried out by the Design Division during the year.

In addition four Executive Engineers of the Design Division have undertaken the supervision of these Projects. Specific report on each particular project, prepared by the Engineer in charge appears elsewhere.

4.2.17 Massari Dam

Planning

In view of the fact that this dam is being constructed by the Department quite an amount of construction planning has been done in the office.

A programme of works has been prepared by the critical path analysis, after breaking down the various activities involved in the project and determining the critical path. The network was also presented on a bar chart.

A cost control chart indicating the budgeted cost as compared to the actual cost has been prepared and applied to this project. This was achieved by following closely the actual rates obtained and applying a method study to operations in excess.

Another aspect within the control of the works is the preparation of the Monthly Progress Reports by the Engineer in Charge with an expenditure record upto date.

In the case of Massari Dam, in parallel to the Construction Works, a reasonable amount of design work was done occasionally throughout the year in modifying the existing design, in view of new requirements, preparing bar bending schedules, designing form work etc.

4.5 Famagusta Water Supply Project - Stage II

This stage includes the boreholes and pumping schemes in the Khirokitia Vassilikos area, the Collecting Reservoir at Khirokitia, the Pipeline from Khirokitia to Phrenaros. The above works have been constructed at Government expense and are operated by Government.

In the same stage are included the concrete reservoir at Phrenaros and the pipeline from Phrenaros to Stavros reservoirs in Famagusta.

Work during 1971 was confined to finishing the pumping station near Vassilikos, since all other works have already been completed and were put into operation during 1970.

Pumping from the Vassilikos River and Cutting, which was completed in December 1970, commenced on the 12th March 1971, and continued into June 1971.

A summary of expenditure incurred is given below:

(Note: The main item of expenditure in 1971 was the payment for the acquisition of land used for the works)

Year	Government Works		Famagusta W.B. Works		Total Cumulative
	Partial	Cumulative	Partial	Cumulative	
1968	100 055	100 055	—	—	100 055
1969	837 738	937 793	26 482	26 482	964 275
1970	95 258	1033 051	194 016	220 498	1253 549
1971	53 655	1086 706	14 719	235 217	1321 923

4.5.1 Famagusta Water Supply - Stage III - Lefkara Dam

The Lefkara Dam forms part of the third stage of the Famagusta Water Supply Project. The design of the dam was carried out by Messrs. Pietrangeli ed Humphreys, an associated firm of Howard Humphreys and Sons, Consulting Engineers, in 1970.

International Tenders for the construction of the dam were invited on the 18th December, 1970, the closing date for submission of Tenders being the 27th February, 1971. Ten Tenders were received from eight different countries. The Tender was finally awarded to "Joint Venture Leonard Fairclough (U.K.)Ltd., and Medcon Construction Ltd." The Letter of Acceptance of the Tender was dated 29th April, 1971. The contract was signed on 29th May, 1971 and the Engineer's Order to Commence was issued on the same date. The Contract Price is £1,125,148.990 mils and the duration of the Contract is 910 days from the Engineer's Order to commence.

The dam will be of the rockfill type with a central clay core. It will be 70 metres high, crest elevation being at 361.0 metres above sea level, with a total fill volume of about 800 000 cu.m. and storage capacity of 13.85 million cu.m. The mean annual inflow was estimated at 8.2×10^6 cu.m., from a catchment area of 36.30 km2. It is estimated that about 5.3×10^6 cu.m. of water will be made available annually from the dam for the Water Supply of Famagusta.

4.5.1.1 Expenditure

The total expenditure incurred upto the end of December 1971 was £153 929.- of which £144 051.- was for work done by the Contractor and the balance of £9 878, represents direct expenditure by the Department.

A detailed chronological account of event after the signing of the Contract is given below:

4.5.1.2 Lefkara Dam Construction - Progress Report for 1971

During June, 1971, the first month of the contract period, progress was slow and a start was made on various temporary works. The excavation of the site office platform on the left abutment upstream of the dam and just above crest elevatiom including access roads to link the platform with the existing access road system started using light excavators. The first lift of a Temporary Concrete Arch Dam in a rock gorge upstream of the main damsite to impound some water for construction during the dry season was placed. Surveying by the Department's surveying team to establish the original ground levels and setting out points was in progress since the middle of May.

In July the Contractor's efforts were also mainly concentrated on Temporary Works. The excavation of the site office platform and associated access roads was completed and construction of the site offices started. Several other access roads were cut by bulldozer such as one leading to the site of the tunnel exit and another one along the riverbed upstream of the main dam leading to the site of the proposed Drinking Water Supply underground concrete cut-off. Also access roads to Quarry No. 1 upstream of the dam and Quarry No.2 downstream were cut. Another two lifts were placed in the Temporary Arch Dam and some water was impounded. Construction of the arch was temporarily abandoned after July 20th to be resumed and completed at the beginning of the 1971-72 rainy season.

Some Quarry Development started at Quarry No. 1 by bulldozer. This quarry, however, was later abandoned mainly because the amount of clearing required in order to reach sound rock was prohibitive. Open cut excavation at the upstream and downstream ends of the tunnel started in mid-July and reached the entry and exit portals by the end of the month. The downstream portal was formed 9.65 metres further into the hillside from the point where it had been envisaged due to the poor quality of the rock. The upstream portal was formed more or less where it had been envisaged.

During August the tunnel excavation continued at both faces and a total of 55 cut of 252 metres had been excavated by the end of the month. Some temporary timber supports were installed over the first 10 metres or so at either end. No further work was carried out on the quarries as the Contractor was awaiting the quarry permits for which he had applied. The Contractor investigated an Alternative Borrow Area for core material within the reservoir area near the damsite and permission was granted to use this area for the core material. The site offices were almost completed by the end of the month. Stripping of the abutments by bulldozer started during the month and about 1/3 of the right flank had been stripped down to rock by the end of the month. During August an access road was constructed to reach the higher part of the proposed spillway cutting. Some work was carried out on the Drinking Water Supply System for the site.

During the month of September 12 - hour shifts were worked on the tunnel excavation and from 18th September work continued through the weekends as well. No supports were required in the tunnel other than those near the portals. The total length of tunnel excavated by the end of the month was 147 m. Mucking out was done by traxcavator whose driver used an "Aqualung" under-water breathing apparatus as ventilation in the tunnel was bad. Stripping of the abutments by bulldozer continued and about 2/3 of the total area had been cleared by the end of the month. Spillway excavation by drilling, blasting and dozing started about mid-September after access had been improved. Work on the arch dam was resumed and shuttering was ready for placing the last 2m. Lift at the beginning of October. The subsurface concrete dam for the site Drinking Water Supply was concreted and a slotted steel pipe intake grid was set in position upstream of the dam and surrounded with crushed gravels of various gradings. A pump-well which will serve as a sump for pumping the water to a rapid gravity filter above the site offices was almost completed. The drainage system for the site-offices and the electrical wiring were completed.

During the month of October work on the tunnel continued at full speed. On 29th October, the Minister of Agriculture and Natural Resources, the Director-General of the Ministry, the Director of Water Development and other visitors attended the firing of the last charges to join the two sections of the tunnel. The Minister fired the charges and the tunnel was through. The alignment and levels of the two sections of the tunnels proved to be remarkably good. Some additional stripping of the abutments was carried out by bulldozer and the areas which could be reached by bulldozer were completed by the end of the month. Removal of spoil which had collected in the riverbed was in progress. The spoil was dumped in the river just upstream of the tunnel exit over a low concrete wall founded on rock outcrops to form temporary dam 3 which is to be used to conserve water during construction as well as to provide vehicular access across the river. Spillway excavation continued during October, the floor of the excavation having reached a level of 384 m.a.s.l.

The excavation started from a level of about 404 m.a.s.l. which is the highest point on the cutting. The designed elevation of the spillway cutting is 361 m.a.s.l. below which the actual spillway channel will be cut. Five metre wide berms are to be formed at elevations 380 and 361 m.a.s.l. on the cutting and batter is to be 1.5 V : 1H. Cut-off excavation on the left abutment at an approximate elevation of 350 m.a.s.l. started on 15th October. The subsurface riverflow ceased during September. The pump-well for the Drinking Water Supply was completed and work started on the rapid gravity filter above the offices.

The temporary arch dam was completed at an elevation of 307.33 m.a.s.l., riverbed elevation being about 297 m. Telephones were installed and connected to the public system on 15th October.

During November work on the tunnel consisted of washing down the walls and roof with a mixture of compressed air and water and the removal of loose material from the floor in preparation for concreting the invert. Trial runs using a concrete pump proved unsuccessful. Removal of spoil from the valley floor was almost completed, dam 3 was completed and for most of the month spoil was dumped and compacted in the river below quarry No. 2 to form temporary dam 4 to be used for impounding water as well as access to quarry No. 2. Some minor clearing at the site of the cofferdam was carried out during the month. The spillway excavation continued reaching a level of 380 m.a.s.l. by the end of the month. Cut-off excavation on the left abutment continued throughout November. Technoexportsroy of Bulgaria having been approved as grouting Sub-contractor sent out a team of 8 men but their equipment had not yet arrived by the end of the month. At quarry No. 2 drilling started in preparation for blasting. The Alternative Borrow Area was cleared by bulldozer. The site laboratory equipment arrived and was put to use. Electricity supply was connected to the site offices on 24th November. The drinking Water Supply sand filter was completed.

On 1st and 2nd December, 12 m. of tunnel invert were concreted using ready-mixed concrete imported from the Contractor's ready-mixed concrete plant at Stavrovouni. The results were substandard and concreting was stopped. River flow started on 14th December and the arch dam was full and overflowing by 24th December. The spillway excavation continued and had reached a general level of about 365 m.a.s.l. by the end of the month. The spoil from the excavation was bulldozed down the slopes on either side. On the upstream side the spoil masked the entrance to the tunnel but was pervious enough to allow the streamflow to pass freely through the tunnel. Most of the excavated material from the abutments had been removed from the valley floor and clearing continued in the vicinity of the cofferdam. Excavation of the left abutment cut-off area of the main dam continued. The spoil removed from the river was dumped and compacted at temporary dam 4. The drilling and grouting sub-contract started on 28th December with drilling and water testing on the left abutment. The subcontract is programmed to last eight months. A preliminary clearing blast took place at Quarry No. 2 and drilling was resumed. Despite a good flow in the river, in the absence of a supply of electricity to the pump-well the site water supply continued to be delivered by tanker.

4.5.1.3 Lefkara Khirokitia Pipeline

The Lefkara Khirokitia pipeline forms part of the third Stage of the new Famagusta Water Supply Project.

Its purpose is to convey raw water from the Lefkara Dam on Syrgatis river to the Khirokitia Water Treatment Works, where the water will be treated and then conveyed to Famagusta by the Khirokitia-Phrenaros-Famagusta pipeline which has already been constructed as part of the Stage II Works of the same scheme.

The pipeline is about 49 000 ft. long and is composed of 22" outside dia steel pipes of which 44 000 ft. are 0.250" thick and about 5 000 ft. are 0.312" thick. The pipes are spirally welded and they are internally lined and externally protected with coal tar enamel.

An electrical resistivity of the pipeline route has indicated that the soil adjacent to the pipes is aggressive and for this reason additional measures will be taken for protecting the pipeline against corrosion by providing cathodic protection.

The contract for the supply of the pipes was awarded in July 1971 to Corinth Pipeworks of Greece for the total price of £161 814 and the contract for the supply of most of the valves in July 1971, to Messrs Glenfield and Kennedy of U.K. for the total of £17 540.

Delivery of the pipes was expected to be effected in April 1972 and of the valves in June 1972.

Construction work started in March 1971 and was concerned mainly with the opening and preparation of access roads to the pipeline (whose route was over very difficult and inaccessible terrain) and with the initial levelling of the pipeline route.

The expenditure incurred up to the end of 1971 was £37 852.

More details on the work carried out are given below:

4.5.1.4 Access Roads

Work on the construction of the access roads to the Lefkara-Khirokitia Pipeline was put in hand on the 1st March 1971, and was completed by the end of the year.

The work carried out consists of :

(i) Construction of 19,630 ft. of new road 20 ft. wide
(ii) Widening and regrading 21,000 ft. of existing road from 10 ft. to 20 ft.
(iii) Widening and regrading 5,280 ft. of existing path from 3 ft. to 20 ft.
(iv) For a length of about 15,000 ft. where the road coincides with the route of the pipeline a considerable amount of work was carried out for easing the steepness of the road with a view to making it passable by heavy traffic, work which otherwise was unnecessary for the mere initial levelling of the route of the pipeline. The expenditure incurred for this length was equally shared between the access roads and the initial levelling.
(v) Construction 1 No. culvert 20 ft. wide using 5 ft. ∅ precast concrete pipes.
(vi) Construction 2 Nos. culverts 20 ft. wide using 4 ft. ∅ precast concrete pipes.
(vii) Construction of 5 Nos. Irish bridges.

The expenditure incurred for the above works was £4,476.

It is anticipated that an amount of £1,000 will be required in 1972 for carrying out major repairs to all river and stream crossings as well as maintaining all roads in a good condition.

4.5.1.5 Initial Levelling

Work on the initial levelling was put in hand on the 29th July 1971. By the end of the year, a length of 42,000 ft. out of the total length of 48,910 ft. of the pipeline, was levelled.

The expenditure incurred was £1,961.

The remaining length of 6,910 ft. is the worst part of the project. It involves the levelling of very steep river and stream crossings in solid rock where explosives and compressors should be used. Besides, a considerable amount of work should be carried out in 1972 at all river and stream crossings already levelled. The anticipated expenditure in 1972, is of the order of £2,500.

4.5.1.6 Break Pressure Tank

Some work was carried out for the levelling of the new site of the Break Pressure Tank, in December 1971 at a cost of £118.

4.5.1.7 Summary of Expenditure in 1971

The total expenditure incurred for the project upto the end of 1971, was £37,852 as shown below:

(i)	Pipes and Fittings	£ 28,916
(ii)	Access Roads	4,476
(iii)	Initial Levelling	1,961
(iv)	Break Pressure Tank	118
(v)	Transport	83
(vi)	Supervision	666
(vii)	Land Aquisition and Compensation	1,632
	Total	£ 37,852

4.5.1.8 Khirokitia Water Treatment Works

The Khirokitia Water Treatment Works are part of third Stage of the Famagusta Water Supply Project which includes the construction of Lefkara Dam and the pipeline to convey the water from the dam to the Treatment Works.

A reservoir at the Treatment Works site and a pipeline to convey the treated water to Famagusta have already been constructed under Stage II, and they also form part of this Project.

The Khirokitia Treatment Works comprise of three main components. The Sedimentation Tanks, the filters and the Administration Building. The design was carried out by Howard Humphreys and Sons, Consulting Engineers and the Department of Water Development undertook the construction of the Civil Engineering part of the Works. United filters and Engineering Ltd., are responsible for the supply and erection of the plant.

Tenders for the supply and erection of the water treatment plant and equipment were invited on the September 1970, and the date fixed for receiving the tenders was the 14th November 1970. Twelve tenders were received and the Contract was finally awarded to the United Filters and Engineering Ltd., of United Kingdom, on the 12th March 1971 for the total of £97,833. In accordance with the Contract the plant will be delivered by the 8th December 1972, and the works are scheduled for commissioning by the 8th June 1973.

An outline of the Treatment Works is as folows

Coagulants and Chlorine are injected into the raw water from Lefkara Dam before it enters through a flash mixing chamber into the Sedimentation Tanks.

The raw water is equally distributed into each of the six tanks and it enters vertically downwards at the bottom of each of them, losing velocity as it moves upwards. At some level in the Sedimentation Tanks the weight of the suspended particles is equal to the upthrust caused by the flowing water and a concentration of floc causing a sludge blanket is formed. The coagulant, aluminium sulphate, assists in the formation of the sludge blanket which traps lighter particles that would otherwise pass through the tanks. The depth of this sludge blanket can be controlled by bleeding through a sludge pocket provided. Heavier particles settle at the bottom of the tanks from where they can be dischanged periodically. The water is collected at the top of the Sedimentation Tanks through glass fibre perforated collecting tubes and passes on to the filters.

In the event of low concentration of suspended solids in the raw water, provision has been made to by-pass the Sedimentation Tanks through a weir penstock and pass the water directly to the filters.

In the filters, the final filtering out of suspended matter takes place and their action is also effective in removing bacteria.

Four rapid gravity type filters are provided through which the flow is controlled by varying the outlet valve opening. The depth of the fine media is 800 mm supported by a layer of coarser material 300 mm thick. The water passes through the filtering media into perforated PVC laterals on the filter floor and is collected through various channels into the wash water storage tanks.

Filter cleaning is carried out in rotation by air scoring the media though the filter laterals of the particular filter, which has the effect of loosening the media and releasing particles trapped. This is followed by wash water pumping, at a carefully adjusted rate, sufficient to fluidise the bed and so clear it of impurities.

The criteria for clearing the filters are the head loss in the filters and the quality of the filtrate. Turbidity tests for this reason are carried out periodically.

The Administration Building comprises of a workshop, a chlorine drum store, a chemical store, a wash water tank, a part where the machinery for washing the filters is housed along with the chemical mixing tanks and a part on the upper floor which houses the Central Control Panel and the switchboard for the electrical machinery as well as a laboratory, an office, a dormitory and mess room.

A weir wall ensures that an adequate supply of wash water is stored in the wash water tank for washing the filters. A pipeline past the weir wall conveys the treated water to the reservoir and chlorine and lime are injected into it to disinfect and correct its acidity.

The Khirokitia Treatment Works are designed to produce 20,300 m3/day of potable water and provision is made for extending the works to produce an ultimate output of 31, 800 m3/day.

Hydraulically the Sedimentation Tanks and filters are designed to pass a 50% overload of flow and depending on the characteristics of the raw water it would be possible to treat 30,450% m3/day without constructing further units. Full scale experiments will show the extent of overload feasible.

The construction of the Civil Engineering part of the Treatment Works has started on the lst of December, 1971 and it is programmed to be completed by November 1972. The plant should then be installed and the works are expected to be operational in June 1973. The expenditure incurred up the end of 1971 was £1,655.

4.6 Massari Dam

4.6.1 General Information

4.6.1.1 Location

The dam is located at the junction of the three main tributaries of Serakhis river, i.e. the Akaki, Peristerona and Mericas rivers.

4.6.1.2 Purpose

The purpose of the scheme is to recharge the Morphou acquifer downstream of the dam, as it was established beyond any doubt that even with the existing Morphou dam and other recharge works, a considerable amount of water during floods is lost to the sea. Geological investigations made it possible to estimate the storage capacity of this acquifer to be approximately 64 x 10^6 ft^3/sq. mile.

4.6.1.3 Description

The whole project is to be completed in two stages (i) the construction of the detention dam and (ii) the construction of the main recharge works which will consist of the canalization of the river and the construction of basins on either side of the central canal, within the existing river bed between Massari and Morphou Dam.

The dam-already under construction is an earth-rockfill dam of max. reservoir capacity 2.3 million m3 and is being constructed from river sandy gravels with an impervious thin clay central core, an impervious upstream blanket with a cut-off trench at its upstream end, and a downstream toe drain. The upstream slope will be covered with dumped rip-rap obtained from the river banks.

The max. structural height of the dam will be about 47 ft. above river bed with a max. crest length of 3,050 ft. A free flow ogee crest spillway 200 ft. wide, in reinforced and mass concrete, is under construction at the right abutment of the dam. A reinforced concrete tunnel of 11 ft. internal diameter will be incorporated below the max. section of the dam with a hydraulically operated gate at its entrance.

4.6.1.4 Progress of Work

The construction of Massari Dam was undertaken by the W.D.D. with sub-contractors for the provision of fill materials.

Work at the site commenced on the 21st of July 1971 Excavation of the Spillway started on the 15th of August and by the end of December a total of 32000 yd^3 were executed out of an estimated total of 40100 yd^3. During the same period concreting in the stilling basin was completed and a total of 740 yd^3 of reinforced concrete were placed.

In order to avoid the danger of flooding because of the river flow only the left stretch of the embankment 1800 ft in length was under construction during this period, the rest 1200 ft. of the embankment being left for next summer.

By the end of December a total of 83000 yd^3 of compacted fill materials were placed on the embankment at a cost of £14 650. On the 29th of December when the reduced levels of the bank were recorded, the highest point reached was 5 ft. below crest elevation.

The rates obtained for fill and excavated materials are generally below the estimated as is shown in the table below.

Description	Quantity (yd^3)		Cost (£'s)		Rate (£'s/yd^3)	
	Actual Exeduted	Estimated Total	Actual	Estimated	Actual	Estimated
Dam						
Corefill	25 381	83 000	4 327	6 350	0.169	0.250
Filters	11 914	39 000	2 880	3 000	0.240	0.250
shell-fill	41 525	135 000	6 400	10 400	0.152	0.250
Toe drain	4 000	5 500	1 042	3 200	0.260	0.400
Spillway						
Open common Mass excavation	6 000	5 100	660	960	0.110	0.160
Open Rock Excavation						
By ripping	18 000	23 000	2 160	4 500	0.120	0.250
By Blasting	8 000	12 000	1 030	3 200	0.130	0.400

The total expenditure incurred upto the end of December 1971 is summarised below :

Description	Total Estimated Cost £	Actual cost to date (£)
General	112 162	8 094
Dam total	64 838	14 218
Spillway total	37 000	13 689
Outlet total	12 000	—
Grand Total	226 000	36 001

4.7 Palekhori - Kambi Dam

4.7.1 Description

The Palekhori-Kambi Dam is located on the Kambi river, at a distance of approximately 26 miles from Nicosia.

The main purpose of the dam is irrigation.

The dam is a mass concrete gravity dam type. It will have a max. height of 107 ft. (32,6 m) from river bed level to the crest of the dam, and 100 ft. (30,5 m) to spillway crest level. The capacity of the dam will be 136 x 10^6 gallons (620.000 m3) with normal irrigation outlet flow 120 l/sec.

The dam and spillway will be founded on sound rock and will consist of 13 vertical blocks extending over the entire height of the dam. A continuous grout curtain extending over the entire length of the dam, will be provided in the dam foundation, injection being done through a concrete cap.

The fifth block from the left abutment of the dam will be constructed as a spillway section, 34 ft. wide, discharging overflow water into a flip bucket.

A drainage and inspection gallery having a cross section 5' x 7' will extend through the entire length of the dam. A valve chamber formed partly within the gallery will accomodate the sluice valves.

A sluice way channel (cross section 5' x 6') which will be constructed at the deepest section of the dam will be acting as an disilting outlet, discharging into a stilling basin.

4.7.1.1 Progress of Work

The construction of the dam was subject to international tenders. Five Contractors have submitted a tender out of which "Joannou and Paraskevaides Ltd" were awarded the contract for an amount of "270.976.842 on September 1971.

The WDD have constructed the access road including a reinforce concrete bridge, to the dam site.

The Contractor started the work on the 15th October 1971.

The first operation was the stripping of the foundation of the Dam which was completed during the second week in November. A total area of 3 883 sq.yds. has been stripped part of which was done mannually in view of the steep slopes encountered.

At the meantime the Contractor proceeded in the erection of the Site Offices and laboratory, manufactured of standard prefabricated Units. This operation was completed by the end of November.

Paralled to the erection of the Site Offices the Contractor commenced on the excavation of the foundation using a 977 and 955 traxcavators, starting from both abutments and moving towards the river bed. By the end of December the excavation was mainly restricted in removing the soft material at the upper section and exposing the foundation rock.

Very little has been done during the year as regards the installation of Electricity and telephone services and the construction of the concrete structure for Water Supply.

No interim certificate for payment has been submitted by the Contractor during the year as the cost of work done could not reach the minimum amount of £8.000 as provided in the Form of Tender. The Water Development expenditure by 31st December 1971 was £7 915.

4.8 Drawing Branch

The staff of this Branch numbered 26 i.e. 16 daily paid Technical Assistants, 5 draughtsmen scale 8, 2 Foremen scale 5 and 7, one hourly paid employee and the Head of the Branch who was appointed to the post Engineering draughtsman.

4.8.1 Drawing Section

For the first six months of the year, in addition to normal Departmental work, the Drawing Branch was engaged in the execution of all drawing work needed for the Paphos Project of the CWPP as well as the work needed for the Akrotiri. Project.

Work done can be listed as follows giving also the time spent in each category of drawings and maps.

		Time spent in hours		Man months	
(i)	Existing and Proposed Dams	8 100		49.0	
(ii)	Irrigation Distribution Systems for Dams	885		5.4	
(iii)	Routine Irrigation Schemes	2 475		15.0	
(iv)	Domestic Water Supplies	5 060		30.6	
(v)	Recharge Schemes	335		2.0	
(vi)	Antiflood Schemes	50		0.3	
(vii)	River Training Works	620		3.8	
(viii)	Hydrological	635		3.9	
(ix)	Hydraulic Tables	Nil		Nil	
(x)	Programmes & Organization.....	450		2.7	
(xi)	Completion Plans	2 700		16.3	
(xii)	Completion Reports	1 375		8.3	
(xiii)	Akrotiri Project	2 740		16.6	
(xiv)	Reports	640		3.9	
(xv)	General	1 525		9.2	
(xvi)	Odd Jobs	100		0.6	
(xvii)	Watershed surveys	1 862		11.3	
(xviii)	Paphos Project	2 850		17.5	
(xix)	Auxiliary Services:				
	Library	1 665		10.0	
	Plan Registry	545		3.3	
	Plan Reproduction.....	245		1.5	
	Registry Work	215		1.3	
	Drawing Materials/Store	95		0.6	
(xx)	Training of Staff	Nil		Nil	
(xxi)	Leave etc :				
	Leave paid	1 960	12.0		
	Leave without pay	720	4.2		
	Sick Leave	2 985	18.0	40.0	
	Maternity	690	4.2		
	D.C.	260	1.6		
	Totals		41 785		253

The above time spent on various jobs does not include any time spent by the Head of the Drawing Branch, the 2 Foremen and one hourly paid employee of the working photo process lab. Also the work of the Storeman (T.A.) of drawing instruments and surveying instruments is not included.

4.8.2 Library & Technical Information Section

During 1971 26 new books at a total cost of approx. £124 were purchased by the Department and subscription was continued on 7 Technical Periodicals at a total cost of £33. In addition 75 reports were prepared by Officers of the Department and numerous other books and periodicals were received free of charge.

The Library continued to issue regular reports of material received and of articles from periodicals of special interest.

4.8.3 Reproduction Section

Plan reproduction cintinued during 1971 with the automatic continuous process dyeline paper printing machine with the old machine as stand-by. Some 3,700 orders were issued to the Reproduction Section and 37,000 prints were made of various sizes and of all types.

4.8.4 Photo Process Lab.

The Photo Process Lab. continued functioning on reproduction, enlargement and reduction of drawings and maps. Both Paphos and Akrotiri Projects made extensive use of this service. Some work has been done for other Departments.

4.9 Topography Branch

Topography Branch was headed by Mr. Andreas Evripidhou, Inspector of Works and has carried out all the Survey Work required by the Design and Planning Divisions of the Department and the Cyprus Water Planning Project (Akrotiri and Paphos Projects).

These Surveys consisted of Contour Surveys, Profile-levelling, Cross-Sectioning and Setting-out for Dam Reservoirs, Irrigation Distribution Systems and Major pipelines for domestic Water Supply Schemes. Another assignment of this Branch was to take precise observations at the site of constructed dams for the detection of any horizontal or vertical movements of the structure or the neighbouring slopes and the re-survey of dam-reservoirs for sedimentation studies.

The staff of this Branch during the year was as follows:

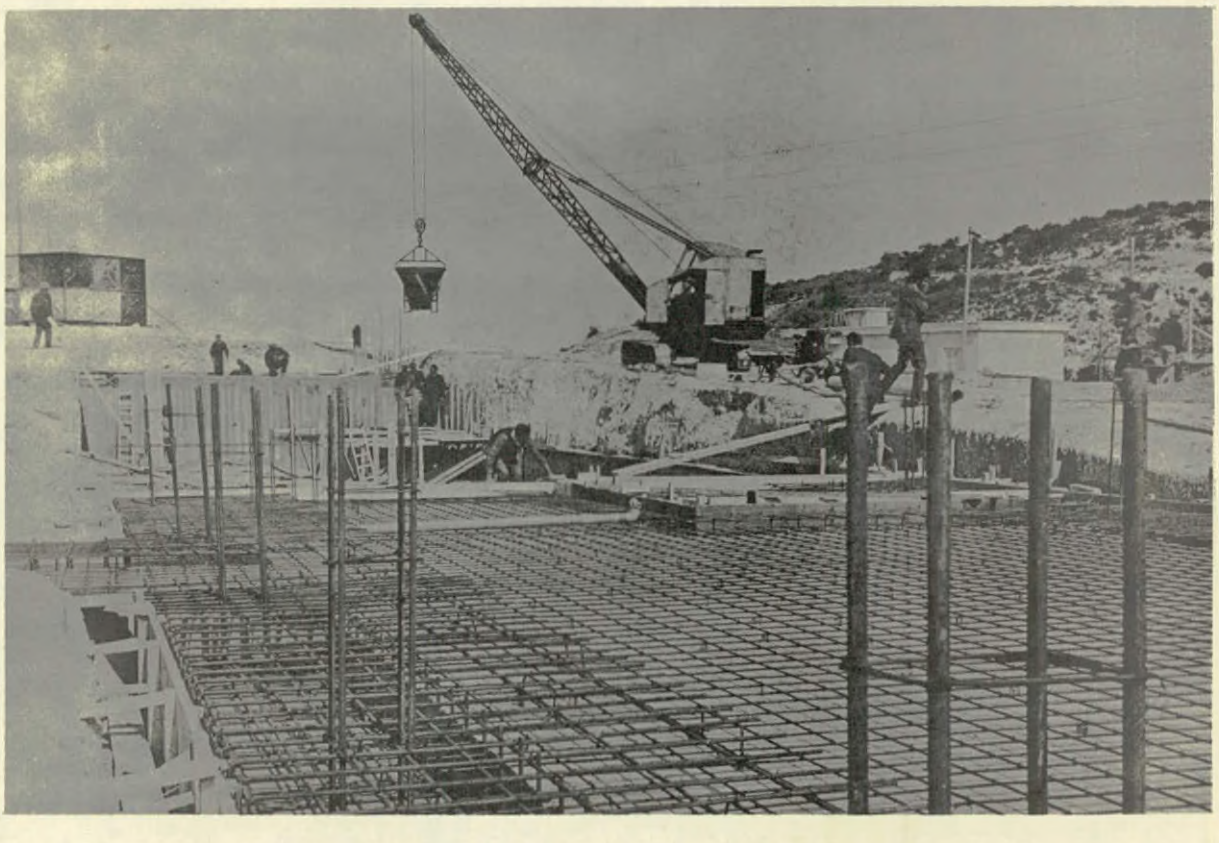
Post	No.	Remarks
Inspector of Works	2	One I/C of Branch
Technical Assistants	9	Monthly paid
Technical Assistants	4	Daily paid

This Branch has dealt with the following Projects:

Project	Type of Survey	Remarks
Kapsala Dam	Contour	C.W.P.P. - Paphos
Akrotiri Lake	Contour	C.W.P.P. - Akrotiri
Kambi Dam	Sectioning	Departmental
Kalo-Khorio-Klirou	Contour	Sedimentation purposes
Massari Dam	Setting-out	Departmental
Ayios Nicolaos-Kakopetria	Contour	-do-
Pendayia pipeline	Profile-levelling	-do-
Arakapas reservoir	Contour	-do-
Skarinou pipeline	Profile-levelling	F/sta WS - Departmental
Kannaviou Dam	Contour	Photogrammetric methods
Omodhos dam	Contour	-do-
Yermasoyia dam	Contour	Akrotiri Project
Lefkara dam	Setting-out	Departmental
Kouris canals	Contour and Sectioning	Akrotiri Project
Ayia Marina-Paphos	Profile-levelling	Departmental
Argaka-Magounda-Paphos	-do-	-do-
Forest Industries	Levelling-setting out	Private
Dhipotamos Dam Site	Contouring	Departmental
Galini Dam	Contour	Departmental
Pedhoulas reservoir	Contour	Departmental-minor
Ayios Dam Site	Contour	Photogrammetric methods
Myrmigoph	Contour	-do-

Project	Type of Survey	R e m a r k s
Lythrodhondas Dam	Contour	Raising-Departmental
Paphos canals	Profile-levelling setting-out	CWPP-Paphos Project
Phlassou Dam Site	Contour	CWPP-Tylliria Project
Lefkara pipeline	Profile-levelling	F/sta W.S.
Engomi reservoir	Contour	N/sia W.S.
Khirokitia	Setting-out and Contour	Treatment Plant, F/sta W.S.
Kalokhorio Lefka	Contour	CWPP-Tylliria Project
Ovgos-Kyra	Contour	CWPP-Tylliria Project
Pareklisha Dam Site	Contour	Minor Projects (continued in 1972)
Angastina Dam Site	Contour	-do-
Kalopanayiotis Dam	Observations for movements	Departmental

Spillway construction at Massari dam



Administration Building - Khirokitia
Treatment Plant

DIVISION OF
CONSTRUCTION

By

H.P. Karakannas
Head of Division

5.1 This Division embraces all the constructional activities of the Department in the field of Domestic Water Supply and Irrigation Projects, all civil engineering departmental contracts, the use of constructional plant and the Departmental Workshop.

The staff of the Division during 1971 consisted of:

1 No. Engineer Hydrologist - Head
1 No. Mechanical Engineer
2 Nos. Senior Inspectors of Works
7 Nos. Inspectors of Works
3 Nos. Chief Foremen
8 Nos. Assistant Chief Foremen
1 No. Technical Assistant
84 Nos. Monthly paid & weekly paid Foremen
395 Nos. Weekly paid regular artisans

502 Nos. Total

In addition to the above permanent staff other Executive Engineers, are working jointly with this Division on the Dam Construction.

The Construction programme for 1971 included 57 Rural Domestic Water Supply Schemes of an estimated cost £573,061, 48 Small Irrigation Schemes of an estimated cost of £166,594, 14 Major Irrigation Schemes of an estimated cost of £486,087, 2 Town Water Supply Schemes of an estimated cost of £256,426 and 8 other schemes for River Training, Antiflood and Landslides Works of an estimated cost of £38,757. In Total the Construction programme included.

129 schemes of an estimated cost of £1,520.925, as shown hereunder:

Ser. No.	No. of schemes	Nature of scheme	Amount approved for 1971 £
1	57	Rural Domestic Water Supply Schemes	573,061
2	48	Small Irrigation Works	166,594
3	14	Major Irrigation Works	486,087
4	2	Town Water Supply Schemes	256,426
5	8	River Training, Antiflood and Landslide Works	38,757
	129	T o t a l	1,520,925

Over and above these projects the Division has carried out minor works on a number of Village Domestic Water Supplies and Irrigation schemes from funds deposited by the Village Water Commissions or by the Irrigation Committees

On these minor Works the expenditure during 1971 reached the amount of £62,653.

During the year the Division also undertook the construction of the Margo Farm Water Supply scheme for the Department of Agriculture. This scheme estimated at £55,000 involves the construction of two wells in the Yialias River aquifer, the laying of 8,500 meters of 8" ø A.C. pumping main, the construction of one R.C.C. reservoir of capacity 455 m3, and the construction of an earthern reservoir of capacity 5,000 m3. The expenditure during 1971 on this scheme reached the amount of £32,450.

The overall expenditure on all schemes incurred during 1971 reached the amount of £984,402.-. This amount was spent on carry over and new schemes included in the 1971 Development Estimates of the Department, as well as on schemes executed for other Departments or from deposits. Out of this amount £394,146 were spent on 51 Village Water Supply Schemes, £83,444 on 33 Small Irrigation Works, £312,986 on 14 Major Irrigation Works, £80,169 on 2 Town Water Supply Schemes, £18,554 on 8 River Training and Antiflood Works, £32,450 on the Margo Farm Water Supply Scheme and £62,653.- on a number of minor works for Rural Water Supply and Small Irrigation Works.

In detail the expenditure incurred for the construction of all the above works is shown hereunder.

Ser. No.	Nature of scheme	Nos. of schemes	Expenditure incurred during 1971 (£)
1.	Rural Domestic Water Supply	51	394,146
2.	Small Irrigation Works	33	83,444
3.	Major Irrigation	14	312,986
4.	Town Water Supplies	2	80,169
5.	River Training, Landslides and Antiflood Works	8	18,554
6.	Margo Farm Water Supply	1	32,450
7.	Minor Works and Maintenance on Rural Water Supplies from Deposits made by Villages	-	34,079
8.	Work carried out for private Developers, such as laying of distribution mains etc.	-	24,904
9.	Minor works and Maintenance of Irrigation schemes from deposits	-	3,670
	T o t a l	109	984,402

5.1.1 Labour Force

For the execution of a scheme, the labour force consists of the regular employees of the Department and the casual employees recruited from the area where the work is executed. During 1971 the average number of regular employees engaged by the Department for the construction of all schemes was 395, and a monthly average of 559 casual employees were employeed through the Labour Exchange. In total during 1971 a monthly average of 8954 regular and casual employees were engaged by the Department and the overall expenditure on wages for the whole year was £425,719.

5.1.2 Constructional Plant

As usually Government machinery is used primarily for the construction of the projects that are included in the Department's Development Budget.

As however the Departmental heavy machinery is quite limited, it was necessary to hire machinery from private owners through tenders. In total during 1971 machinery was hired for 23,140 working hours at an expenditure of £18,897. Machinery was also hired for the excavation of 137,815 feet of trenches for the laying of pipes at a cost of £3,160.

5.1.3 Materials

As it is the usual practice all the materials for the construction of the projects, such as pipes, pipe fittings, steel, etc. are requisitioned through the Government Central Stores. Building materials, however, such as sand, gravel, aggregate, etc. were purchased through tenders. During 1971 the Division awarded 94 tenders for the purchase of 40,620 cubic meters of such materials at a cost of 12,058. The needs of the Division in cement were purchased through a Government contract from the Vassiliko Cement Factory. During 1971 3,374 tons of cement were used for the construction of all the projects, at a cost of £22,247.

During 1971 a total length of 297,144 meters of pipes of all types were laid by the Division for Domestic Water Supply and Irrigation schemes.

Tables showing in detail the pipes and other materials used by the Division during 1971 are given hereunder:

(i) Galvanized mild steel pipes laid during 1971

Nominal diameter in inches	4"	3"	2½"	2"	1½"	1¼"	1"	¾"	½"	Total length in meters
Length of pipes laid in meters	40,314	23,292	12,0[illegible]	28,728	14,766	29,166	10,026	312	20,070	Total 178,704

(ii) Steel Victaulic pipes laid during 1971

Nominal size in inches	10"	8"	6"	Total length in inches
Length of pipes laid in meters	373	310	2,094	2,777

(c) Asbestos cement pressure pipes laid during 1971

Nominal size in inches	18"	15"	12"	10"	8"	6"	4"	3"	Total length in meters
Length of pipes laid in meters	120	1,485	788	5,270	40,120	20,285	25,812	21,783	115,663

(d) Materials and machinery used during 1971

Ser. No.	Description	Quantity	Expenditure
1.	Cement	3,374 tons	£ 22,247
2.	Gravel, sand and aggregate	40,620 m3	12,058
3.	Heavy machinery	23,140 working hours	18,897
4.	Excavation of trenches	42,870 running meters	3,160
	Total		£ 56,362

5.1.4 Rural Domestic Water Supply Schemes

As already stated the construction programme for 1971 included 57 Domestic Water Supply Schemes of an estimated cost of £573,061. Out of these schemes 21 were completed during the year, 31 were put in hand but could not be completed by the end of the year and were carried over for completion in 1972, and 6 schemes could not be put in hand for various administrative and other difficulties and were also carried over for execution in 1972.

The expenditure incurred during the year on all Domestic Water Supply Schemes reached the amount of £394,146.

The 57 Domestic Water Supply Schemes which were included in the 1971 construction programme are shown in the three lists that follow. These schemes have been split into three categories as under:

(i) Schemes completed during 1971
(ii) Schemes put in hand during 1971, but not completed by the end of the year, and carried over for completion in 1972, and
(iii) Schemes not put in hand during 1971 and carried over for construction in 1972.

5.1.5 Rural Domestic Water Supply Schemes completed during 1971

Out of the 57 schemes that were included in the 1971 construction programme, 21 schemes, of an estimated cost of £65,142 were completed during the year. For these 21 schemes the expenditure for 1971 reached the amount of £55,266. Two of these schemes, namely Ayios Andronikos in the Karpas peninsula and Motidhes in the Kyrenia District were completely new schemes and the other 19 were improvements and modernization to old schemes, especially modifications to their distribution systems and storage tanks. For all these schemes 14 new reinforced cement concrete circular storage tanks of a capacity of 1765 m3 were constructed, and 900 water meters of ½ inch in diameter were installed to control the water consumption.

In all cases where a distribution system was executed, the house-to-house service with water meters was implemented. These 21 schemes that were completed during 1971 are shown in the list hereunder:

Rural Domestic Water Supplies
Schemes completed during 1971

Ser. No.	Name of scheme	Amount Approved for 1971 £	Expenditure incurred during 1971 £	Type of Scheme	Nature of work
	Nicosia District				
1.	Malounda	1,600	1,561	Pumping	XH
2.	Pedhoulas	2,500	2,323	Gravity	X
3.	Sina Oros) Tembria) Evrykhou)	4,210	2,979	Gravity	X
4.	Sina Oros	4,000	3,342	Gravity	XH
5.	Tembria	14,000	10,891	Gravity	XH
6.	Mitsero	2,800	1,872	Gravity	X
7.					
	Limassol District				
7.	Alassa	1,100	747	Gravity	X
8.	Phinikaria	2,000	1,687	"	XH
9.	Arkolahania Spring	1,000	979	"	X
	Famagusta District				
10.	Ayios Andronikos	7,200	7,116	Pumping	≠ H
11.	Vitsadha	1,560	1,476	"	X
	Larnaca District				
12.	Aradhippou	1,205	762	Pumping	X
13.	Voroklini-Livadhia	650	495	"	X
	Paphos District				
14.	Kritou-Terra	2,300	1,736	Gravity	XH
15.	Nata	403	376	Pumping	X
16.	Kelokedhara	800	384	Gravity	X
17.	Peristerona	3,200	2,511	"	XH
18.	Pano Arodhes	5,500	5,425	"	XH
	Kyrenia District				
19.	Ayios Amvrosios) Khardjia)	114	112	Pumping	X
20.	Motidhes	3,000	2,695	Gravity	≠ H
21.	Karavas	6,000	5,797	"	X
	T o t a l s	65,142	55,266		

LEGEND:

≠ means new scheme
X means improvements to an existing scheme
H means house-to-house service

Some of the most important schemes that were completed during 1971 are:

1) The combined scheme for Sina Oros, Tembria and Evrykhou
2) Ayios Andronikos scheme
3) Aradhippou scheme
4) Pano Arodhes scheme and
5) Karavas scheme

A short description of each scheme separately is given below:

5.1.5.1 Sina Oros - Tembria - Evrykhou combined water supply scheme

All three villages had independent sources of supply prior to the implementation of this combined scheme, which however decreased considerably during the summer months and the people faced difficulties in obtaining their drinking water. Lately the small spring of Sina-Oros became contaminated and Sina Oros was temporarily connected into the Galata Water Supply. The new source of supply for the three villages is Hantares spring in the Troodos Range, which has a flow of 70,000 - 90,000 gallons per day. A 3" ϕ galvanized main approximately 8 miles in length has been laid to convey the water to the three villages. Six new additional storage tanks of capacity 86,000 gallons, or 400 m3, have been constructed for the three villages, and new house-to-house distribution systems have been implemented for Sina Oros and Tembria where water meters have been installed in all houses to control the water consumption.

5.1.5.2 Ayios Andronikos Water Supply Scheme

This scheme of an estimated cost of £7,200 was entirely a new and its objective was to serve the Turkish Quarter of Ayios Andronikos which remained without piped water as a result of the suspension of the execution of the Water Supply Scheme for the whole village in 1964 due to the then prevailing political situation. By the implementation of this scheme 116 Turkish houses were connected onto a new distribution system for their quarter consisting of 9,000 meters of galvanized steel pipes. The source of supply is a borehole and is the same that has been serving the Greek population of the village for about 8 years.

5.1.5.3 Aradhippou Water Supply Scheme

This scheme at an estimated cost of £5,400 included the construction of a new additional reservoir of capacity 455 m3 for the high quarter of the village, and the laying of 700 meters of distributions mains. Before the implementation of this scheme a number of houses were facing great difficulties in obtaining their water supply.

5.1.5.4 Pano Arodhes Water Supply Scheme

Prior to the implementation of this scheme at an estimated cost of £5,500, the villagers of Pano Arodhes were obtaining their domestic water supply from street fountains. Now a new storage tank of capacity 95 m3 has been constructed at a high place to command the whole village, and a completely new house-to-house service distribution system has been executed. All 150 houses of the village are now enjoying a metered supply from "Appidhes" spring.

5.1.5.5 Karavas Water Supply Scheme

Karavas with its famous Kephalovrysos spring, was facing great domestic water difficulties in the summer months as a result of its old and obsolete distribution system. The scheme executed in 1971 at a cost of £6,000 consists part of a major Water Supply Scheme earmarked for

1972 and 1973. This scheme involved the construction of a reinforced cement concrete circular reservoir of capacity 455 m3 to provide sufficient storage for the additional water hired by the Municipality from private owners of the Kephalovrysos spring. The source of Water Supply for Karavas is 1/15th of Kephalovrysos spring and this flow together with the additional water hired from the same spring flow into the new reservoir through a 8" Ø A.C. new pipeline. It can be said that this emergency scheme together with the installation of water meters in all houses, saved the Karavas Municipality from great water problems for the summer of 1971.

5.2 Rural Domestic Water Supply Schemes put in hand during 1971 but not completed by the end of the year and carried over for completion in 1972

As it has been mentioned, out of the 57 Domestic Water Supply Schemes included in the 1971 construction programme, 31 schemes were put in hand during the year but were not completed, and were carried over for completion in 1972. Some of these schemes are major schemes and were split for construction into two phases, other schemes were put in hand late in the year as a result of the delay for the completion of the loan formalities, Nevertheless considerable work was carried out on these 31 schemes estimated at £469,049. The expenditure on these schemes during 1971 reached the amount of £338,880. These schemes include the major water supply schemes for Morphou, Potamos-tis-Yermasoyias, Vatyli-Strongylos, Lapithos, Polemidhia Pano and Kato and Ypsonas, the Lefkara Regional scheme, and the Regional scheme for Alona-Platanistassa Laghoudhera - Sarandi and Polystipos. It should be noted that most of these major schemes were split into two phases for construction in 1971 and 1972. For these 31 schemes 28 No. R.C.C. circular storage tanks of capacity 6,436 m3 were constructed, in addition to the 14 storage tanks constructed for the schemes described in para 5.5 on pages 116-117. Moreover, 3,900 water meters of ½ inch in diameter were installed during the year for these 31 schemes. A list showing these 31 water supply schemes as well as the amount spent for each scheme separately during 1971 is given hereunder:

Rural Domestic Water Supplies - Schemes put in hand during 1971 but not completed and carried over for completion in 1972

Ser. No.	Name of scheme	Amount Approved for 1971	Expenditure incurred during 1971
		£	£
	Nicosia District		
1.	Morphou	24,039	23,104
2.	Mathiatis	2,790	536
3.	Petra	1,977	1,640
4.	Kalo Khorio (Klirou)	4,850	2,792
5,	Alona)		
	Platanistassa)		
	Laghoudhera)	49,000	43,518
	Sarandi)		
	Polystipos)		
6.	Kapouti	32,000	23,158
7.	Kambi-tou-Pharmaka	4,900	3,167
8.	Evrykhou	3,000	1,313
9.	Tseri	1,020	234
	C/F	93,476	99,462

Ser. No.	Name of scheme	Amount Approved for 1971	Expenditure incurred during 1971
		£	£
	B/F	93,476	99,462
	Limassol District		
10.	Kalo Khorio	1,201	543
11.	Potamos-tis-Yermasoyias	22,802	22,170
12.	Polemidhia Pano) Polemidhia Kato) Ypsonas)	52,910	51,102
13.	Korphi	1,504	698
14.	Kolossi	8,000	3,155
15.	Pendakomo	17,800	11,517
	Famagusta District		
16.	Vatyli) Strongylos)	71,005	51,090
17.	Vitsadha	4,650	2,094
	Larnaca District		
18.	Arsos) Tremetoushia) Meloushia)	24,601	17,247
19.	Athienou	18,000	5,460
20.	Melini	4,400	1,498
21.	Lefkara Pano) Lefkara Kato) Kato Drys) Vavla)	30,000	17,504
22.	Tokhni	5,500	2,626
23.	Pano Lefkara	4,100	768
	Paphos District		
24.	Ayia Pipeline (Kallepia) Letymbou, Pitarkou)	6,000	40
25.	Episkopi	6,500	5,311
26.	Kedhares	3,700	169
27.	Kholetria	12,700	8,015
28.	Statos	2,550	1,900
	Kyrenia District		
29.	Kalogrea	17,300	15,020
30.	Kondemenos	15,250	12,334
31.	Lapithos	15,000	9,157
	T o t a l s	469,049	338,880

5.3 Rural Domestic Water Supply Schemes not put in hand during 1971 and carried over for construction in 1972

Out of the 57 Rural Domestic Water Supply Schemes that were included in the 1971 construction programme 6 such schemes of an estimated cost of £38,870 could not be put in hand for various administrative or legal difficulties and were carried over for execution in 1972. Two of these schemes Kalopanayiotis, and Nikitari are delayed as the case for the acquisition of the water is pending before the court. The Mathikoloni scheme could not be proceeded with because the roads of the new resited village were not constructed, while the remaining three schemes namely Kakopetria, Piyenia and Pano Pyrgos could not be put in hand as the villagers requested revision of these schemes. A list showing these 6 schemes and the money allocated for each one separately is given below:

Rural Domestic Water Supplies - Schemes approved for execution in 1971 but not put in hand during the year and carried over for execution in 1972

Ser. No.	Name of scheme	Amount Approved for 1971 £	Remarks
	Nicosia District		
1.	Kalopanayiotis	4,635	Acquisition of water pending before the Supreme Court
2.	Kakopetria (Palea)	3,200	New revised scheme to cover the whole village prepared.
3.	Nikitari	2,095	Acquisition of spring not completed.
4.	Piyenia) combined	27,200	New revised separate pumping schemes requested by the two villages.
5.	Pano Pyrgos) scheme		
	Limassol District		
6.	Mathikoloni	1,740	Balance for completion of scheme after construction of roads for new resited village.
	Total	38,870	

5.4 Small Irrigation Works

The construction programme for 1971 included 48 Small Irrigation Schemes of an estimated cost of £166,594. Out of these schemes 19 were completed during the year, 14 were put in hand but could not be completed by the end of the year and were carried over for completion in 1972, and 15 schemes could not be put in hand for various administrative or other difficulties and were also carried over for execution in 1972.

The expenditure incurred during 1971 on all the Small Irrigation Schemes reached the amount of £83,444.

The 48 Small Irrigation Works include various types of schemes such as Recharge Works, pumping schemes, lining of canals or minor irrigation works. They are shown in detail in the three lists that follow. These 48 schemes have been split into three categories as under:

(i) Schemes completed during 1971
(ii) Schemes put in hand during 1971, but not completed by the end of the year, and carried over for completion in 1972, and
(iii) Schemes not put in hand during 1971 and carried over for construction in 1972.

5.4.1 Small Irrigation Schemes completed during 1971

Out of 48 schemes included in the 1971 construction programme, 19 of an estimated cost of £69,799 were completed. The overall expenditure on these 19 schemes reached the amount of £63,427, leaving a saving of £6,372. Out of these 19 schemes, 6 involved the construction of R.C. canals, 2 were pumping schemes, 2 were recharge schemes, and the remaining 9 were minor irrigation works including the laying of distribution pipes and the construction of intakes or storage irrigation tanks. A list showing these 19 schemes, as well as the amount spent on each one separately is given on next page:

Small Irrigation Works - Schemes completed during 1971

Ser. No.	Name of scheme	Amount Approved for 1971 £	Expenditure incurred during 1971 £	Nature of works
	Nicosia District			
1.	Kyra	9,697	9,503	Lining of canals
2.	Kalokopia	318	253	-do-
3.	Morphou-Teratsia	27,753	26,952	-do-
4.	Peristerona	10,550	10,397	-do-
5.	Galini	1,001	983	-do-
6.	Pyrgos - Tyllirias	353	300	Distribution pipes
7.	Kalopanayiotis	263	248	-do-
8.	Akaki	2,250	2,245	Intake and R.C. canals
9.	Kato Pyrgos	3,600	3,345	Pumping scheme
10.	Xyliatos	600	581	Lining of canals
	Limassol District			
11.	Kypercunda-Dheisis	818	652	St.tank and distribution pipes
12.	Tris Elies - Diplomata	782	73	Intakes and distribution pipes
13.	Trimiklini	907	481	Improvements to distribution system
14.	Kyperounda - Khima	1,350	1,285	Intake, St. tank and distribution system
15.	Louvaras	750	748	St.tank and distribution pipes
16.	Trimiklini	5,000	4,902	Distribution pipes
	Famagusta District			
17.	Akhna (1968 scheme)	1,304	181	Recharge works
	Larnaca District			
18.	Anglissidhes	242	227	Pumping scheme
19.	Xylotymbou	2,261	71	Recharge works
	T o t a l	69,799	63,427	

5.4.2 Small Irrigation Schemes put in hand during 1971, but not completed by the end of the year and carried over for completion in 1972

Out of the 48 small irrigation schemes that were included in the 1971 construction programme 14 were put in hand during the year but were not completed, and were carried over for completion in 1972. On these 14 schemes of an estimated cost of £41,264, the actual expenditure reached the amount of £20,017. Two of these schemes involved the construction of R.C. canals, five were pumping schemes. These 14 schemes included the construction of reinforced concrete canals, the installation of pumping units for the use of boreholes for irrigation, and the laying of irrigation mains and storage tanks. A scheme for improving the seashore at Koma-tou-Yialou by filling one lagoon was also completed.

Small Irrigation Works - Schemes put in hand during 1971 but not completed and carried over for completion in 1972

Ser. No.	Name of scheme	Amount Approved for 1971 £	Expenditure incurred during 1971 £	Nature of work
	Nicosia District			
1.	Peristerona-Astromeritis	300	66	Compensations
2.	Peristerona-Astromerits Orounda	2,800	2,119	Projective walls & lining of canals
3.	Kato Koutraphas	7,000	4,751	Pumping scheme
4.	Potami	1,260	148	-do-
5.	Psimolophou	10,800	5,398	Lining of canals
	Limassol District			
6.	Kyperounda (Piyi Dhimou)	2,000	1,484	Intake, St.tank and distribution pipes
	Famagusta District			
7.	Akheritou	1,569	90	Compensations
8.	Famagusta-Dherynia	5,645	1,464	Recharge works
9.	Phrenaros	220	-	Compensations
10.	Gaidhouras	1,100	605	Drainage works
11.	Koma-tou-Yialou Fish Ponds	1,500	4	Filling of one lagoon near the sea
	Larnaca District			
12.	Maroni	2,939	1,932	Pumping scheme
13.	Zygi - Tokhni	831	15	-do-
14.	Athienou - Marmarika	3,300	1,941	-do-
	Totals	41,264	20,017	

5.4.3 Small Irrigation schemes not put in hand during 1971 and carried over for construction in 1972

Out of the 48 Small Irrigation Schemes that were included in the 1971 construction programme 15 such schemes of an estimated cost of £55,531 could not be put in hand for various administrative or other difficulties and were carried over for execution in 1972. Six of the 15 schemes are recharge works in the Kyrenia District and the reason for having not been able to put them in hand was the delay for the completion of the land acquisition formalities. Five schemes are distribution systems and the reason for their having not been put in hand was mostly the delay in the completion of the loan formalities. The scheme for Esso Galata was not put in hand as the funds became available very late in the year and the work could not be carried out in Winter time.

The scheme for Tries Elies could not be put in hand for the same reason. The scheme for Marathovounos & Pyrka was delayed due to objections from the villagers, and the pumping scheme for Athienou could not be put in hand due to the request of the beneficiaries for a higher Government contribution towards its cost. A list showing all these 15 schemes with the amount allocated for each one separately is given hereunder:

Small Irrigation Works - Schemes approved for execution in 1971, but not put in hand during the year and carried over for execution in 1972

Ser. No.	Name of scheme	Amount Approved for 1971 £	Nature of work and Remarks
	Nicosia District		
1.	Massari	3,300	Distribution system
2.	Esso Galata	1,300	Pumping scheme
	Limassol District		
3.	Saittas - Moniatis	11,215	Distribution system
4.	Tris Elies - Mylarka	3,750	Intakes and distribution pipes
5.	Pelendria - (Nikomitis)	800	Distribution pipes
	Famagusta District		
6.	Marathovounos - Pyrka	3,000	Intake and earthnorn channels
	Larnaca District		
7.	Athienou - Athanasis	5,500	Pumping scheme
	Paphos District		
8.	Kato Akourdalia	3,600	Distribution system
9.	Statos	1,200	-do-
	Kyrenia District		
10.	Elia	1,491	Recharge works
11.	Ayios Epiktitos	4,000	-do-
12.	Ayios Yeorghios	4,675	-do-
13.	Karakoumi	1,900	-do-
14.	Kazaphani	7,400	-do-
15.	Thermia	2,400	-do-
	T o t a l s	55,531	

5.5 **Major Irrigation Schemes**

The construction programme for 1971 included 14 Major Irrigation schemes for which the expenditure was estimated at £486,087. The actual expenditure for these 14 schemes reached the amount of £312,986. Out of the 14 schemes, 6 were involving works on Dams, 4 were distribution schemes and the remaining 4 were recharge works. The biggest expenditure incurred was on Lefkara Dam whereby on Dam works the expenditure was £153,217 and on the Lefkara-Khirokitia pipeline £36,964. Considerable work was also carried out on the Massari Dam where the expenditure during 1971 was £36,036. Another major scheme which was put in hand during 1971 was the Palekhori Dam. All these three Dams were put in hand during 1971. Work was also carried out on the other three existing Dams, namely Yermasoyia, Kalopanayiotis and Mavrokolymbos.

On the four distribution schemes included in the programme of construction of the year considerable work was carried out on the Kiti distribution system and on the Pomos distribution system. These distribution schemes involve the distribution of the water of the dams by means of R.C. channels or A.C. or galvanized steel pipes to the fields in order to effect the maximum economy in water and to improve the irrigation system for the benefits of the farmer.

The four Recharge Schemes included in the construction programme were the Famagusta-Dherynia scheme where water will be pumped from the Famagusta Ayios Loukas reservoir to recharge the wells in the Ayios Memnon area, the Syrianokhori pumping schemes and irrigation R.C. channels and the Morphou-Serrakhis scheme.

A list showing all 14 Major Irrigation Works is shown hereunder:

Major Irrigation Works

Ser. No.	Name of scheme	Amounts Approved for 1971 £	Expenditure incurred during 1971 £	Remarks
	Dams			
1.	Lefkara			
	(i) Dam Works	197,472	153,217	
	(ii) Lefkara-Khirokitia Pipeline	58,000	36,964	
	(iii) Khirokitia Treatment plant	10,000	1,655	
2.	Massari	40,000	36,036	
3.	Palekhori	14,000	7,915	
4.	Yermasoyia	29,389	18,200	
5.	Kalopanayiotis			
	(i) Compensations	6,072	888	
	(ii) Electricity	417	417	
	(iii) Grouting	1,240	1,179	
6.	Mavrokolymbos	8,275	229	
	Distribution Systems			
7.	Kiti	40,765	12,454	
8.	Mavrokolymbos	8,198	1,353	
9.	Yermasoyia-Outlet Pipe	1,941	576	
10.	Pomos	15,968	15,815	
	C/F	431,737	286,898	

Ser. No.	Name of scheme	Amount Approved for 1971 £	Expenditure incurred during 1971 £	Remarks
	B/F	431,737	286,898	
	Recharge Works			
11.	Famagusta - Dherynia	36,000	12,860	
12.	Syrianokhori Pump-houses etc.,	6,345	6,062	
13.	Syrianokhori-Kokkinoyi	7,953	6,286	
14.	Morphou - Serrakhis			
	(i) Protopapas	2,932	460	
	(ii) Compensations	1,120	420	
	T o t a l s	486,087	312,986	

5.6 Town Water Supplies

For the two Town Water Supply schemes that were included in the 1971 construction programme the expenditure reached the amount of £80,169. The scheme was completed and additional water was pumped to relieve Nicosia Town from two boreholes. The Pendayia scheme for which a provision of £100,000 was made in the 1971 Development Estimates could not be put in hand due to the delay in the completion of various formalities. For Famagusta Town an expenditure of £59,436 was incurred on Government and Water Board funds. The list below shows the schemes and the expenditure incurred on each one separately:

Town Water Supplies

Ser. No.	Town	Amount Approved for 1971 £	Expenditure incurred during 1971 £	Remarks
1.	Nicosia Town			
	(i) Tseri scheme	25,020	20,733	
	(iii) Pendayia scheme	100,000	-	
2.	Famagusta Town			
	(i) Government Funds	125,625	53,655	
	(ii) Water Board Funds	5,781	5,781	
	T o t a l	256,426	80,169	

5.7 River Training, Landslides and Antiflood Works

The 1971 construction programme included 8 such schemes, three of which were antiflood, three river training works and the other two landslides works.

The expenditure incurred on all these schemes during 1971 was £18,554, and some of them, i.e. Monagri, Kilani and Ormidhia were carried out on behalf of the District Officers. The 8 schemes, and the expenditure incurred on each one of them are shown in the list hereunder:

River Training, Antiflood and Landslides Works - Schemes included in the 1971 construction programme

Ser. No.	Name of scheme	Nature of work	Amount Approved for 1971 £	Expenditure incurred during 1971 £	Remarks
	Nicosia District				
1.	Kato Moni	Antiflood	1,539	1,321	
2.	Syrianokhori	River Training	15,000	-	
3.	Xyliatos	Antiflood	740	702	
	Limassol District				
4.	Monagri	Landslides	1,850	1,091	
5.	Kilani	-do-	550	-	
	Larnaca District				
6.	Ormidhia	Antiflood	1,782	1,782	
	Paphos District				
7.	Nikoklia	River Training	11,500	8,224	
8.	Kelokedhara-Ziripillis	-do-	5,805	5,434	
	T o t a l		38,757	18,554	

5.8 Margo Farm Water Supply Scheme

This scheme was undertaken at the request of the Department of Agriculture and its objective was to supply drinking and irrigation water to the Margo Experimental Farm. The estimated cost of this scheme was £55,000 and the cost of the work carried out by our Division in 1971 reached the amount of £35,450. The source of supply are two wells in the Yialias river acquifer. Water is pumped from these two wells though an 8" ϕ A.C. pipeline 8,500 meters in length into a new R.C.C. reservoir of capacity 455 m3. An earthern reservoir of capacity 5,000 m3 has also been constructed in order to provide storage for water for use in the dry season. The work was not completed by the end of 1971 and was continued and also to provide good quality of water for blending it with hard and slightly saline water from the Margo wells.

5.9 Minor Water Supply and Irrigation Works carried out from deposits for villages or private developers

The construction Division carried out considerable work, and much of its time was spent on such works. On Rural Water Supply Works such as installation of water meters, laying of distribution mains, repairs and maintenance to existing systems the expenditure reached the amount of £34,079. On works carried out for private developers, such as the laying of distribution pipes, etc. an amount of £24,904 was spent during 1971. On minor repairs and maintenance of irrigation schemes the Division carried out works to the cost of £3,670. All this expenditure amounting to £62,653 was carried out on full cost by the villages or private developers.

5.10 Workshop

The workshop of the Department forms a branch of the Construction Division, but it carries out work for other Divisions as well, i.e. the Planning the Maintenances and Operation and Water Resources. It is equipped with all facilities for carrying out all kinds of constructional works, that include earth moving equipment, motor transport, carpentry, plumbing fittings, the slotting and perforation of drilling casing and grinding and electro-welding of drilling bits. Installations and maintenances of pumping units for domestic water supplies and irrigation are carried out by the workshop. The dispatching of materials and stores to all sites of work all over the island is also done by the workshop.

The labour force of the workshop during 1971, consisted of an average of 60 regular and 5 casual artisans specialized in all activities of this branch of the Construction Division. 8 regular labourers were employed by the Dispatching Section of the Workshop.

The maintenance of the heavy earth moving equipment and other minor machinery, including the land rovers and drilling rigs, was carried out at a cost of £46,300 and includes replacement of fittings and other accessories.

The total operational hours of the equipment and the mileage covered by the land rovers is an shown below:

Heavy earth moving equipment	16.380 hours
Motor vehicles	917.223 miles

The activity of the workshop was extended to:

		Amount spent £
22	new pumping installations for domestic supplies	8.900
9	new pumping installations for irrigation	2.450
140	repairs to pumping installations for domestic supplies	4.660
36	repairs to pumping installations for irrigation	1.230
	Various castings and fittings	17.305
	Various carpentry works	7.925
	Various masonry works	0.935
	Dispatching of materials and stores	6.500
	T o t a l	£ 49.905

Mechanical Equipment

	No.
Ruston Bucyrus Drilling Rigs 22W	10
Ruston Bucyrus Drilling Rigs 60 RL	2
Caterpillar D 8	3
Caterpillar Traxcavators 955	2
Allis Chalmers Traxcavator	1
Ruston Bucyrus Excavator RB 10	1
Ruston Bucyrus Excavator RB 19	1
Excavator Smith 3/4 cu.yd.	2

Mobile Plant

Mobile drill	1
Mini Core Drill	1
Small Core Drill	1
Core Drills 200 ft. Depth	6
Grouting Pump	1
Wagon Drill	1
Overburdens	3
Concrete Pump	1
Compressors	12
Diesel Alternators	8
Electrosubmersible test pump	7
Turbine deep-well test pumping units	2
Centrifugal pumping Units	11
Portable pumps	25
Sheepfoot Rollers	18
Vibrating soil Compactors	3
Vibrating Rollers	2
Vibrators Concrete	22
Concrete Mixers	55
Mobile Cranes	2
Hoists	3
Thornycroft Tractive unit low loader	1
Dumpers	3
5 ton Diesel Lorry (Austin)	1
Bedford R.L. Lorry	3
Land Rovers	21
Austing Gibsy	1
Toyota Land Cruiser	6
Toyota Station Wagon	8
Cortina Station Wagon	1
Pumps for Test Pipes	12
Rubber tyred Compaction Rollers	1
Unipower	2
Utility hoist crane AC 623	1
Air Pumps	2
Flush pump pneumatic	7
Cutting Machine for Pipes	6
Air Concrete Vibrators	12
Small Drilling Rig	1

Workshop Plant

	No.
Bench Drilling Machine	1
Upright Drilling Machines	4
Planer Timber Machine	1
Bandsaw Timber	1
Bar Bender	1
Bar Cutter	2

Mechanical Equipment

Electric Welders	9
Forge	1
Compressors Air (tecalemit)	2
Grinding Machines	4
Power Hack-saw	2
Wood-cutting Machine	1
Plate Bending Machine	1
Spark Plug testing machine	1
Battery Charging Unit	1
Hydraulic Press 100 ton capacity	1
Band saw Grinding Machine	1
Pipe Slotting Machine	1
Hydraulic Pipe Bending Machine	1
Tractor Track service tool	1
Soltering iron heater	2
Foundry	1
Tube valcanizing machine	1
Tyre extracting equipment	1
Paint spraying equipment	1
Letter printing machine	1
Lathes	2
Bench shaper	1
Eccentric metal shear	1

VI. MAINTENANCE AND OPERATION DIVISION

By

K.C. Hassabis
Head of Divison

This division includes two branches dealing with

(i) The operation and Maintenance of Major Irrigation Projects
(ii) The operation and Maintenance of Domestic (Town) Water Supplies.

6.1 Maintenance and Operation of Major Irrigation Projects

This branch participates in the management and operation of the Government Major Irrigation Projects and is responsible for the Maintenance of Major Projects whether Government or Contributory.

6.1.1 Maintenance of Projects

The work of maintenance includes:

(i) The regular inspection of the works
(ii) The taking of regular observations and records on the behaviour and condition of the various structures.
(iii) The actual maintenance work.

During 1971 maintenance work involved mainly routine maintenance of the various works, apart from the case of Mavrokolymbos Project where some major works have been done as detail below.

6.1.2 Summary of Expenditure on Maintenance Works

(i) Government Projects

Dams	£ 2 037
Distribution Systems.....	£ 1 305
Sub-Total (i)	£ 3 342

(ii) Contributory Projects

Government Share	£ 806
Village Contribution	£ 136
Sub-Total (ii)	£ 942
Total (i) + (ii)	£ 4 284

6.1.3 Details of Maintenance Works - Dam Projects

6.1.3.1 Argaka - Magounda

Repairs to the main gate and hydraulic system. Painting the tunnel gate and transition lining with asphalt paint. Removing of vegetation from embankment and cleaning of Access Road.

Expenditure : Dam : £38

6.1.3.2 Ayia Marina

Plastering of 80 feet of upper tunnel to protect exposed reinforcement. Painting of all metal structures. Repairs to guard house floor. Cleaning of access road. Removing of vegetation from embankment. Removing of driftwood. Painting of all manhole covers of the distribution system.

Expenditure :	Dam	£ 203
Distribution		£ 27
Total		£ 230

6.1.3.3 Kalopanayiotis

General painting of guard house and control room Painting of Bridge, Lea recorder and all metal structures. Painting of upstream bridge and treating of timbers of both bridges. Repairing of W.C. of guard house and replacing of broken window panels.

Painting of all manholes of distribution system and repairing of meters.

Expenditure :	Dam	£ 271
Distribution		£ 23
Total		£ 294

Kiti Nil

6.1.3.4 Mavrokolymbos

Raising of mouths of all filter pits. Part painting of guard house. Treating of guard house floor - Constructing of antierosion cuttings - Repairing of access road. Planting of 4000 acacias for antierosion purpose - Drilling and installing of a new piped piezometer - Constructing of metric water level indicator. General painting of bridge, penstock and transition. Constructing of 30' R.C.C. 4' x 2' channel - Painting of all manhole covers - Opening of 4 new irrigation outlet ports and installing of 4 meters with manholes - Cleaning of existing canals. Covering of 700 ft. of Irrigation canals Repairing of pipes.

Expenditure :	Dam	£ 939
Distribution		£ 797
Total		£1736

6.1.3.5 Polemidhia

General painting of guard house and fence. Painting of bridge and treating of floor with creosote. Painting of engine pier and repairing of rubber ring of penstock.

Painting of all manhole covers - Repairing of meters, air valves and sluice valves. Painting of interior of break pressure tanks - Replacing mechanisms of one 12" ∅ and one 16" ∅ Leeds meter.

Expenditure :	Dam	£ 141
Distribution		£ 448
Total		£ 589

6.1.3.6 Pomos

Plastering of 153 feet of tunnel, Painting of Bridge, vents, winch pier, and manhole covers. Treating of guard house floor - Part replacing of guard house roof - Removing of vegetation from embankment - Discarding of accomulated driftwood and tree trunks - Cleaning of access road.

Replacing of two 3" ∅ Sluice Valves

Expenditure : Dam	£ 239
Distribution	£ 10
Total	£ 249

6.1.3.7 Syngrasi Nil

6.1.3.8 Yermasoyia

Painting of radial gates and buoyancy tanks with asphaltine. Painting of bridges, platforms, ladders, fence, and piers. Painting of guard house.

Constructing of a concrete flooring near bridge.

Expenditure	£ 206
Total	£ 206

Maintenance of Dam Projects - Summary Table of Expenditure

Government Dams

No.	Project	Expenditure			Remarks
		Dam £	Distr. £	Total £	
1	Argaka	38	-	38	
2	Ayia Marina(Special Case)	203	27	230	
3	Kalopanayiotis	271	23	294	
4	Kiti	-	-	-	
5	Mavrokolymbos	939	797	1736	
6	Polemidhia	141	448	589	
7	Pomos (Special case)	239	10	249	
8	Syngrasi	-	-	-	
9	Yermasoyia	206	-	206	
	Totals	2037	1305	3342	

Maintenance of Dams
Contributory Dams

No.	Project	Expenditure			Remarks
		Govt. £	Contr. £	Total £	
1.	Agros	-	-	-	-
2.	Akrounda	-	-	-	-
3.	Ay. Loucas	-	-	-	-
4.	F'sta Recharge Dams	-	-	-	-
5.	Galini	-	-	-	-
6.	Geunyeli	-	-	-	-
7.	Gypsos	-	-	-	-
8.	Kandou	-	-	-	-
9.	Kanli	-	-	-	-
10.	Kalo Khorio (Klirou)	67	33	100	Constructing and installing of new grille- Emergency works for the unblocking of the tunnel
11.	Kyrenia range Recharge Dams	-	-	-	-
12.	Lefka Kafizes	-	-	-	-
13.	Lefka Marathasa (Special Case)	534	-	534	Purchase of new 36" x 36" Ham Baker penstock
14.	Lythrodhondas (2 dams)	33	17	50	Construction of new threaded exle and installing of, at upper dam
15.	Mia Milia	-	-	-	-
16.	Morphou-Serrakhis	-	-	-	-
17.	Ovgos	-	-	-	-
18.	Pera Pedhi	63	32	95	Construction and installing of a metal pier
19.	Petra (2 dams)	-	-	-	-
20.	Prodromos	10	5	15	Repairing of a booster pump
21.	Pyrgos	67	33	100	Repairing of outlet manholes, underpinning of R.C.C. channels and repairing of a siphon
22.	River Training General	-	-	-	-
23.	Trimiklini	32	16	48	Repairing of old Saittas road after crossing of 8" ∅ main pipeline
	T o t a l	806	136	942	

6.2 Management and Operation of Major Irrigation Projects

The quantity of water collected in most of the major dams was much below normal due to the continuing low rainfall and run-off during the rainy season.

Thus although there was an increasing demand of water for irrigation the water available at the dams was limited in quantity.

The amount of water available in the dams (excluding Yermasoyia Dam where there is no Distribution System for utilizing the water) was 5352 000 m3 of this 2466 851 m3, i.e. 46% of the water available, were used for irrigation. The corresponding quantity of water utilized in 1970 was 1 961 000 m3 i.e. there was an increase in utilization amounting to about 26%.

The gross income from the sale of water in 1971 was £26 891, compared with £22 594 for 1970 while the net income was £15 861 for 1971 and £11 417 for 1970.

Summary of the relevant data over the last four years, and for the year 1971, are given in the Tables which follows:

Data on Water Usage for 1968 - 1971

	1968	1969	1970	1971
Water in Storage in 1000 m^3	-	-	6 160	5 352
Water sold in 1000 m^3	1 185	1 038	1 961	2 467
Gross Income £	15 363	21 241	22 594	26 891
Operation £	3 507	5 911	5 849	7 688
Maintenance £	858	7 582	5 328	3 342
Total Expenses £	4 365	13 439	11 177	11 030
Net Income £	10 998	7 748	11 417	15 861

Data on the Operation of Government Dam Projects for 1971

Ser. No.	Project	Capacity $m^3 \times 10^6$	Stored water $m^3 \times 10^6$	Water sold $m^3 \times 10^6$	Gross Income £	Expenditure			Net Income	Remarks
						Operation £	Maintenance £	Total £		
1	2	3	4	5	6	7	8	9	10	11
1	Argaka - Magounda	1.150	1.150	0.159900	1 599	534	38	572	+ 1 027	No distribution System
2	Ayia Marina	0.300	0.172	0.279000	2 790	890	230	1 120	+ 1 670	Additional water imported from Pomos system
3.	Kalopanayiotis	0.358	0.358	0.051685	672	531	294	825	- 153	
4.	Kiti	1.610	0.188	0.052910	529	468	-	468	+ 61	
5	Mavrokolymbos	2.180	1.950	0.801297	8 194	1 974	1 736	3 530	+ 4 664	
6	Polemidhia	3.430	0.674	0.614074	8 537	2 596	589	3 185	5 352	
7	Pomos	0.860	0.860	0.507985	4 570	875	249	1 124	3 446	121 750 m3 sold as overflow at reduced rates
8	Yermasoyia	13.500	-	-	-	-	206	206	- 206	No distribution. Some water used for recharge
9.	Syngrasi	1.110	-	-	-	-	-	-	-	
10.	Athalassa	0.790	-	-	-	-	-	-	-	
	T o t a l s		5.352	2.466851	26 891	7 688	3 342	11 030	15 861	

6.3 Domestic Water Supply Branch Management of Domestic Water Supplies under the Provision of Law Cap. 350

This branch of the Operation and Maintenance Division, mostly concerned with Town Water Supplies has continued its activities embracing:

(i) Administration of Greater Nicosia Scheme
(ii) Water Supply to Nicosia Suburbs
(iii) Water Supply to Government residences and Institutions
(iv) Famagusta Water Supply Project
(v) Technical advice to water boards under capacity of an official member
(vi) Technical advice to Appropriate Authority regarding parcellation of land into building sites

Other than the above activities this branch represents the National Committee Cyprus of the International Water Supply Association. Cyprus is a "corporate" member of this Organization and correspondence is exchanged on subjects related to new methods adopted by developed countries on water for domestic use.

6.3.1 Administration of Greater Nicosia Scheme

Since the time some four years ago, when the idea of amalgamating this scheme with that of the Nicosia Water Board has been raised, a meeting of all interested Authorities took place and initial discussion was made on the subject. It is expected that further consideration on this matter will be given during other meetings to follow.

6.3.1.1 Water Supply to Nicosia Suburbs (Greater Nicosia Scheme)

The water supply of the Suburban area around Nicosia, consisting of nine communities is the responsibility of the Water Development Department. Water is provided from the sources of Greater Nicosia Scheme which is a self-sufficient scheme. Irrespective to this, considering the fact that water for Nicosia town and suburbs is faced commonly by both Government and the Nicosia Water Board, a new scheme providing water from Tseri area was executed at the expense of Government and put into commission by May 1971.

(i) The Greater Nicosia Scheme disposes independant pumping stations, service reservoirs and distribution system to serve its "area of supply". The highest daily consumption for 1971 was 10,630 cubic meters. Water from this scheme is also supplied "inbulk" to Nicosia Water Board.

(ii) During the year 1971, the distribution system of Greater Nicosia Scheme was extended by 25,550 ft. of 6" ∅ and 4" ∅, asbestos cement pipes, mainly laid in new parcellations and 597 new house connections were made. By 31.12.1971 the number of the consumers reached the figure of 9,925.

(iii) A statement showing expenditure and revenue of the Greater Nicosia Scheme for the year 1971 is given on page 143.

6.3.1.2 Nicosia Town and Suburbs Water Supply

The water supply for Nicosia and suburbs is faced commonly by the three existing authorities

Government
Nicosia Water Board and
Nicosia Water Commission

The responsibility, however, in securing adequate water to meet the whole area's requirements lies with Government. It is on this understanding that the Tseri Scheme was carried out and another scheme from Pendayia is in the course of execution.

With the implementation of Tseri scheme and thanks to Sykhari Adit where a stor age of 126,000 subic meters (28,000,000 m. gallons) could be accomodated, the demand was met satisfactorily. The total amount of water conveyed from all soruces was 7,747,195 cu. meters and was distributed (less unaccounted water) to:

Greater Nicosia Scheme	"area of supply"	2,561,600 c.m.
Nicosia Water Board	"area of supply"	4,155,670 c.m.
Nicosia Water Commission (Town within walls)		676,367 c.m.
		7,393,637 c.m.

The highest consumption was 27,386 cu. meters which equals to 50 gallons per capita on an estimated population of 120,000 people.

The new scheme from Pendayia, which provides an additional quantity of 10,000 cu. meters daily has been approved and its execution is likely to start early in 1972.

It is expected that this scheme will be put in operation late in the year and .therefore the possibility of shortage of water during summer would be in existence. However, due to the even increasing demand, Nicosia will soon be in need of additional supplies thus rendering the planning of other schemes necessary.

6.3.1.3 Water supply to Government residences and Institutions

Other than water supplied for domestic use, Government residences and institutions are supplied with water for irrigation. Existing sources for this purpose could suffice requirements.

6.3.1.4 Famagusta Water Supply Project

Government has undertaken the execution of a scheme for the water supply of Famagusta. This scheme is being executed in phases and will pro vide water at the region of 5.0 m.g.d. when Lefkara dam is completed. The water after treatment at Khirokitia will be conveyed for consumption to Famagusta and Larnaca towns at the .proportion of 4.0 m.g.d. and 1.0 m.g.d. respectively.

So far, pumping could only be made from Khirokitia and "Vasilikos" sources from which an amount of 1,389,452 cu. meters of water was extracted. Out of the quantity, 114,368 cu. meters were granted to local irrigators whose sources were affected from the pumping done.

In the meantime, work on the Construction of the Lefkara dam, which will form the main source of supply of this town, has started and according to contract its completion is expected late in 1973.

A statement showing expenditure and revenue of the Famagusta water supply (Government Scheme) for the year 1971 is given on page 144.

6.3.1.5 Technical Advice to Water Boards

All meetings of the existing Water Boards were attended by this Branch of the Division and technical advice was offered. Generally, other activities of these Boards render our approach and participation rather regular.

Facts about each water Board and brief description of their water supplies are outlined below.

6.3.1.6 Nicosia Water Board

Sources of supply need be supplemented immediately and major improvements must be carried out to existing distribution system. During the year 1971 this Water Board displays:

(i) The total quantity of water supplied was 2,778,643 cm.

(ii) The total quantity of water consumed registered by area meters was 4,832,037 c.m.

(iii) The total maximum summer consumption per day (including Nicosia Water Commission) was 16,756 c.m. on 17.6.71.

(iv) The total number of consumers on 31.12.71 was 12.010

(v) (i) Extension of distribution system

1.295 ft. 6" Ø A.C. Pipes
19.254 ft. 4" Ø A.C. Pipes

Re-laying of distribution system

125 ft. 4" Ø A.C. Pipes

(ii) Total length of distribution system (including extensions of 1971)

12.100 ft. 12" Ø A.C. Pipes
25.000 ft. 10" Ø A.C. Pipes
12.930 ft. 8" Ø A.C. Pipes
82.015 ft. 6" Ø A.C. Pipes
608.588 ft. 4" Ø A.C. Pipes

(vi) (i) The total number of hydrants installed in 1971 was 22.

(ii) The total number of hydrants installed up to 31.12.71 was 822.

6.3.1.7 Limassol Water Board

Due to non-agreement between the parties concerned, the new scheme for the provision of 1.5 m.g. daily from Yermasoyia valley could not be implemented. Nevertheless, existing sources could easily meet water requirements of this town. The maximum daily consumption reached the amount of 18,025 cu. meters. Other data in respect of this Water Board follows.

(i) Total quantity of water supplied from all sources 4,507,605 c.m.

(ii) Total quantity of water consumed as registered by area meters 4,468,816 c.m.

(iii) Maximum daily consumption on 18.6.1971 18,025 c.m.

(iv) Total number of consumers as on 31.12.1971 17,088 c.m.

(v) (i) Extension of distribution system
Pipelines laid during 1971

6" ø diam. 3,963 ft.
4" ø diam. 30,293 ft.

(ii) Total length of distribution system

10" ø diam. 27,000 ft.
8" ø diam. 29,117 ft.
4" ø diam. 703,339 ft.

(vi) Total number of hydrants

(i) Installed in 1971 51 No.

(ii) Total installed 924 No.

6.3.1.8 Famagusta Water Board

Part supplementation of this town's water supply continued from Khirokitia boreholes. Requirements, however, could not be faced at full and restrictions to the supply were again imposed.

During the year under review, the following information is extracted from this Water Board's records.

The total quantity of water supplied including quantity supplied from Government sources was 1,963.745 cu. meters.

The total quantity consumed as registered by area meters was 1,962,365 cu. meters.

Maximum daily consumption was 7,285 cu. meters.

Total number of consumers on 31.12.71 was 10,318.

Extension of distribution system pipelines laid during 1971:

6" ø diam. 6,516 ft.)
4" ø diam. 25,916 ft.) 32,432' ft.

Total length of distribution system (including extensions made in 1971) 596 084" ft.

Number hydrants installed in 1971 87 No.

Total installed 774 No.

6.3.1.9 Larnaca Water Board

Replenishment of the acquifer in Trimithos river, where most of this town's sources lie, was poor for the second consecutive year and their yield was kept at a low level. By pumping, however, all available sources, the demand was met satisfactorily. Nevertheless, it has now been made clear that supplementary supplies are necessary in order to avoid restrictions in future. Until the time that water may be made available from Lefkara Dam, it is indispensable that new sources of the region of 500 cu. meter daily should be found.

From records of this Water Board the following are observed:

(i) Total quantity of water supplied from all sources 1,618,000 cu.m.

(ii) Total quantity of water consumed as registered by area meters 1,600,220 cu.m.

(iii) Maximum daily consumption 5,860 cu.m.

(iv) Total number of consumers at 31.12.71 4,275 cu.m.

(excluding Turkish consumers which are estimated to be around 1000).

(v) Extensions of distribution system

(i) Pipelines laid in 1971

9,350' ft. of 4" ø
2,800' ft. of 6" ø
1,750' ft. of 8" ø
10,500' ft. of 10" ø

The total length of distribution system is not available

(i) Total number of hydrants installed during 1971 : 72

(ii) Total number of hydrants installed with water supply area : 176

Greater Nicosia Scheme (including Morphou Bay Scheme)
Revenue and expenditure account for 1971

	Expenditure			Revenue	
(i)	Pumping Charges	£ 19,102.824	(i)	Sale of water	£ 163,129.873
(ii)	Maintenance Charges	£ 3,640.709	(ii)	Connection fees	£ 2,695.500
(iii)	Collection fees	£ 18,367.335	(iii)	Usage of pipelines	£ 2,237.940
(iv)	Morphou Running Expenses	£ 38,671.482	(iv)	Other revenue	£ 20,432.122
	Total	£ 79,782.350		Total	£ 188,495.435
(v)	Administration	£ 4,000			
(vi)	Amortization (£1,656,000 x 5% interest over 40 years)	£ 96,511			
	Grand Total	£180,293.350			

Note: It is estimated that water to the value of £20,000 is supplied to Turks and this amount could not be collected due to abnormal political situation. The total amount due by the Turks (calculated at minimum) since 1964 has by now reached the figure of £ 180,000.

Famagusta Water Supply (Govt. Scheme)
Expenditure and revenue account for 1971

Expenditure

Pumping Charges			
(i)	Attendants	£ 5,599.761	£ 17,671.842
(ii)	Electricity and fuel	£ 12,152.081	
Maintenance			931.135
		Total	£ 18,602.977

Revenue

Sale Water		
(i)	Famagusta Water Board	£ 63,694.200
(ii)	Local Irrigators	20.000
	Total	£ 63,714.200

VII. DIVISION OF SMALL PROJECTS PLANNING

By

P. Pantelides
Head of Division

7.1 Introduction

This Division is dealing with the design and planning of all contributory village water supply and irrigation projects, which are normally financed by Government through the Development Programme. Local Authorities concerned with these projects are the Village Water Commissions for water supplies, and the Village Irrigation Divisions and/or Private Water Associations for Irrigations Schemes. The section is dealing also with all correspondence and problems emanating from implementation and operation of projects and technoeconomic matters prior to finance, and all questions arising from priorities. Because of constantly increasing matters of procedure, more time has to be devoted to correspondence and discussions by the Head of the Division than should be necessary. A simplified procedure will, no doubt, help to carry out more productive work such as the solution of local water supply problems, the improvement of design standards, and to plan further ahead of critical time limits.

There has been no change in the staff employed in this Division during the year under review: Two Senior Inspectors of Works are in charge of Water Supply and Irrigation Projects respectively, and there are four technical teams consisting of one Inspector and one Technical Assistant operating for four combined districts in the island - in addition there are two Irrigation Engineers dealing with specific assignments.

In the design stages there is a close co-operation between the Division and the Water Resources in the field of exploratory and prospective works such as boreholes, flow records and measurements, and hydrogeological data; all drawings are being prepared by the Department's Drawing Office from drafts and data supplied from this Division and there is always the need of co-ordinating all the services concerned by the Head of the Division.

7.2 Village Water Supplies

Definition

We call villages all Communities except the major towns of Nicosia, Famagusta, Limassol and Larnaca.

Total Number of Villages = 615
Supply Rate : Optimum 130 lit/head/day
Total Population: Approximately 400,000

7.2.1 Problems

The Problems consist essentially of:

A constant increase in water requirements commensurate with the increase of population and the rise in the standards of life.

A constant drop in the available water supplies and depletion of sources because of over development in the agricultural and industrial sector.

7.2.2 Methods

To find new sources of good and adequate drinking water for supplementary domestic supplies in accordance with increased requirements.

To design intercommunal (as far as possible) systems of supplementary supply works, and to expand and up-rate the village distribution systems.

To convert fountain systems to house-to-house distribution.

7.2.3 Present Conditions

In all villages there is in operation systematic pipe water supply.

At the end of 1971:

Villages with house-to-house connection	No 398 : percent 64.71 of total
Villages with Public Fountains	No 217 : percent 35.29 of total
T o t a l	No 615 Percent 100

Rate of Supply:

The rate of supply varies seasonably in accordance with the yield of the sources; almost invariably we have higher yields in winter and lesser yields in the summer.

For record purposes of base our requirements on peak demand which occurs during the hot periods of the year.

The desirable rate of supply at this period is given at 130 lit/head/day.

Conditions regarding the rate of supply vary from year to year depending, as it is, on overdevelopment or depletion of sources and water supplies in general.

Conditions as at the end of 1971 are described in Tables I and II herebelow:-

Table I (Tentative figures pending collection of data)

House-to-House Systems			
Satisfactory Dated at or about 130lit/head/day		Unsatisfactory Rated below 130/lit/head day	
No. of Villages	Percentage of total	No. of Villages	Percentage of total
262	42%	136	22%

Table II.

Public Fountains			
Satisfactory 130 lit/Head/day		Unsatisfactory Below 130 lit/Head/day	
No. of Villages	Percentage of total	No. of Villages	Percentage of total
70	11%	147	25%

Schemes Prepared in 1971 and Submitted — As per list A

Schemes in the course of Preparation at the end of 1971 — As per list B

7.3 Description of some of the more important water supply schemes prepared in 1971.

7.3.1 Pitsillia Regional Water Supply Project: phase "B" Total Cost £28,700. The project postulates the diversion of the Pikromiloudhi Spring from Troodos to several villages in Pitsillia namely: Alona, Platanistassa, Lagoudera, Sarandi, Polystipos.

1st phase of the project at a cost of £50,000 was put in hand early in the year. The scheme provides also for house-to-house connection in all the village and the requisite service reservoirs.

As a compensation for the water of the Pikromiloudhi Spring which was used for local irrigation in the Solea Valley, a dam reservoir Project is being prepared for implementation on approval by Government and the local Authorities.

7.3.2 Regional Scheme, Nissou - Lymbia

Total cost £117,840
Villages affected: Lymbia, Kornos, Sha, Mosphiloty, Psevdas, Pyrga, Ay. Varvara of Stavrovouni.

The scheme provides for the use of two successful boreholes near Nissou, conveyance, and distribution to village.

House-to-House and Service Reservoir in all Villages.

7.3.3 Karavas Water Supply

Total Cost £130,000 will provide a complete up-to-date house-to-house distribution in the major touristic area of Karavas.

7.3.4 To Pyrgos, Pigenia, combined Kambos-Tsakkistra and combined Potami-Vyzakia at cost: £29,000, £21,000, £32,200 respectively.

All schemes provide for additional water supply from new boreholes. All villages except Tsakkistra will be given house-to-house connections.

7.4 Minor Irrigation Works

The Division prepared a list of schemes for inclusion in the 1972 Development Estimates but only 16 schemes were approved at a total cost of £94,920 and these were scheduled for implementation in 1972.

By the end of 1971 a number of schemes were ready for implementation as per Table 1.

The total area under irrigation in Cyprus at the end of 1971 was as follows :-

(a)	Permanent crops	165,000 don.
(b)	Perennial crops	160,000 don.
	T o t a l	325,000 don.

The total area under irrigation controlled by statutory Divisions and/or Associations was as follows:-

(a)	Permanent Crops	60,000 don.
(b)	Perennial or Seasonal	80,000 don.
	T o t a l	140,000 don.

7.5 Interdepartmental Committee

This committee was set up towards the end of 1969 by the Director General Ministry of Agriculture and Natural Resources with the view to co-ordinating the activities of technical services in the planning stages of Small Irrigation Project, and for evaluating technoeconomic data.

Schemes which are usually referred to this committee concern the improvement of old existing Irrigation Schemes, New Irrigation Pumping Schemes and Minor Storage Schemes. Schemes submitted to District Agricultural Officers prior to examination by the committee appear on Table II and schemes recommended or not by the committee on Table III and IV respectively.

7.6 Recharge Works

At the end of 1971 the following recharge schemes were ready for implementation and were included in the 1972 Development Estimates.

Famagusta District

1. Makrasyka
2. Ay. Napa
3. Akanthou
4. Aloa

Kyrenia District

1. Vasilia
2. Karavas
3. Ayios Amvrosios

7.7 Western Messaoria Control Pumping Schemes

The object of this Project is to safeguard against water depletion in the Western Plain. Citrus growers who buy water from private boreholes apply for a formation of Irrigation Division whereby they are issued with permits to construct their own boreholes and piped distribution works in accordance with designs prepared by this Division.

By the end of 1971 seven schemes were prepared and submitted to the District Officer. These schemes covered an area of 1530 donums of citrus and 780 don. of seasonal crops. A further 29 schemes were prepared in a preliminary form which cover an area of 3735 don. citrus and 1865 don. seasonal. There were 18 applications for the preparation of such schemes outstanding at the end of 1971.

The implementation of this project, however, with Government funds and subsidies is still a matter of consideration because of several financial and techno-economic factors involved.

LIST OF SMALL IRRIGATION SCHEMES(Ready for construction at the end of 1971 including schemes approved for execution in 1972 shown x)

NICOSIA - KYRENIA DISTRICT

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of proposed works	Estimated cost £	Village contrib. %	Irrigation Perm. don.	Irrigation Seas. don.	Remarks
1.	105/1963	Pera Politiko	Division	Pedieos	Diversion groyne & Intake channel for flood irrig.	5,000	1/5	-	450	Revised 1971
2.	36/42	Ergates	Associat.	Kourtouji	Improvement works to tunnel etc.	7,700	48%	93	266	190 don. winter Revised 1970
x3.	127/40/103	Laghoud-hera	Associat.	Pano Affita	Irrigat.tank & Distri.works	950	44%	10	3	Revised 1970
4.	42/1948	Apliki	Associat.	Kalogyros Tourkou	Irrigat.tank & Distri.works	1,900		31	9	Revised 1970
5.	41/39	Katokopia	Associat.	Ktirka	Lining of canals	9,900		143	465	Revised 1970
6.	127/40/98/IV	Kalopana-yiotis	Division	-	Distribution Works	9,720	1/3	133	-	
7.	39/44	Vyzakia	Division	-	Lining of canals	11,200	1/3	-	140	
8.	63/52	Meniko-Akaki	Division	Afxenti-Riatikon	-do-	21,500	1/3	-	500	4000don.winter
9.	127/40/39/III	Palekhori	Division	Pera Avlaki Halkomatas	Irrigat.tank & Distri.works	3,150	1/3	31	-	Revised 1971
10.	42/42	Pera	Division	Fassera	Lining of canals	6,000	1/3	219	300	
11.	30/46	Phlassou Evrykhou Korakou	Division	Kousou-liotis	-do-	10,000	1/3	130	700	
12.	62/67	Korakou Phlasou Linou	Division	Dimma Shelloshi	Lining of canals	14,000	1/3	53	250	
13.	42/50	Evrykhou	Division	-	-do-	12,500	1/3	470	330	

NICOSIA - KYRENIA DISTRICT (Cont')

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of proposed works	Estimated cost £	Village contrib. %	Irrigation perm. don.	Irrigation Seas. don.	REMARKS
14.	61/66	Katydhata	Division	Dimma Djamis and Mylou	Lining of canals	11,000	⅓	470	230	
15.	127/40/118	Kaliana	Division	Neron tis Tsappas	- do -	5,000	⅓	150	-	
16.	33/43/9	Klirou	Associat.	Laoura	- do -	4,700	40%	30	185	
17.	127/40/107	Askas	Associat.	-	Repairs to exist. works	270		30	-	
x18.	127/40/97	Moutoullas	Division	-	Improvement Works	12,700	⅓	380	36	
19.	123/40/A1	Exometocki	Associat.	Within Village	Flood protection works	2,300	?	-	-	
20.	25/42/II	Neokhorio	Associat.	Alakatia	Flood protection works	620	-	-	-	
x21.	69/52/IV	Kato Pyrgos	Division	Katouris	Distri. works 3rd phase	15,000	⅓	1600	-	
x22.	26/45/II	Ay.Marina (Xyliatos)	Division	Ay.Kyriakos	Lining of canals	1,300	⅓	-	60	
x23.	63/51	Ay.Amvrosios	Associat.	Mouthouna	Improvement works	900	54%	50	11	
x24.	62/44		Associat.	Steradja	Small sub-surface weir & distri.works	700	42%	32	-	
x25.	106/1970	Mosphilli	Division	-	Pumping scheme & Distri.pipelines	7,000	⅓	45	20	
x26.	91/60	Ay.Georghios (Petra)	Division	Petrassis	Lining of conveyor canal	15,000	⅓	300	678	
x27.	76/44/II	Tymbou	Division	Intake No.1	Repairs to weir	800	1/5	-	-	

NICOSIA - KYRENIA DISTRICT (Cont')

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of proposed works	Estimated cost £	Village contrib. %	Irrigation		Remarks
								Perm. don.	Seas. don.	
x28.	123/40/A/1	Exometochi	Division	No.2	Construction of screw gates etc	350	¼	-	-	
x29.	34/1946	Katokopia Arghaki etc.	Division	Naos	Construction of intake works	550	1/5	-	-	

FAMAGUSTA DISTRICT

Ser. No.	W.D.D. Reference	Village	Division of Associat.	Locality	Nature of proposed works	Estimated cost £	Village contrib. %	Irrigation		Remarks
								perm. don	Seas. don.	
x1	28/44	Koma-tou-Yialou	-	-	Drainage scheme	1,500	-	-	-	

LIST OF SMALL IRRIGATION SCHEMES

LIMASSOL DISTRICT

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of proposed works	Estimated cost £	Village Contrib. %	Irrigation		Remarks
								Perm. don.	Seas. don.	
x 1	127/40/49/54	Kyperounda	Associat.	Kardhama-Solomidhes	Excav. of spring & distri. works	2,470	50%	14½	13½	Revised 1969
2	127/40/36	-do-	Associat.	Frakti	-do-	1,750	-	7	8	Revised 1970
3	127/40/49/55	-do-	Associat.	Livadhi-tis-Messis	Irrigat. tank & distri. pipes	1,650	44%	22	18	Revised 1970
4	127/40/49/48	-do-	Associat.	Appis	Distri. pipes	800		12	-	Revised 1970
5	127/40/49/II	-do-	Division	Dhiala	Irrigat. tank & distr. pipes	900	⅓	12	-	
6	127/40/49/47	-do-	Associat.	Khalospitia	-do-	1,800	-	15	-	Revised 1970
7	40/49/II	-do-	Associat.	Vassiliko	Distr. pipes	620	40%	9	5	Revised 1970
8	127/40/134/2	Pelendria		Sarakinos	-do-	630	⅓	17	-	Revised 1970
9	61/42	Silikou	Division	Lavrania	Lining of channels & general improvements	3,460	⅓	73	-	Revised 1970
10	127/40/23	Omodhos	Division	Pighadhi	Irrig. tank & distr. pipes	1,350	⅓	7	8	Revised 1970
11	127/40/52/III	Ay. Ioannis (Agros)	Division	Angoulos	Distr. channels	1,160	⅓	12	-	Revised 1970
12	"	-do-	Associat.	Kephalovrysos	Distr. works	1,700	42%	16	9	Revised 1970
13	42/43/III	Phini	Division	Dhimma-tou-Mylou	Distr. works	11,300	⅓	371	-	Revised 1969
x14	"	-do-	Division	Ambelaki	Irrig. tank & distr. works	5,400	⅓	28	-	Revised 1969
15	127/40/165/2	Tris Elies	Division	Drakondas	Extension of distr. works	7,200	⅓	180	-	Revised 1969

LIMASSOL DISTRICT (Cont')

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of proposed works	Estimated cost £	Village contrib. %	Irrigation Perm. don.	Irrigation Seas. don.	Remarks
16.	43/42/II	Kilani	Division	Asomatos Skotini Ay. Mavri	Distri.works	8,650	1/3	150	-	Revised 1970
17.	127/40/59/II	Louvaras		Tsoukkallas	Irrig.tank & distr.pipes	800		6	4	-do-
18.	127/40/22	Dhymes		Hji Pelendros	Distr. works	1,300		16	-	-do-
19.	45/44/2	Pyrgos	Division	Alavrovrysi	-do-	5,700	1/4	-	80	-do-
20.	127/40/99	Agros	Division	Pano Taliou	-do-	1,560	1/3	11	8	Revised 1969
21.	45/44/2	Pyrgos	Division	Dimma tis Regenas	-do-	4,600	1/4	-	300	Revised 1970
22.	91/45	Moniatis	Division	-	-do-	5,300	1/3	134	16	Revised 1969
23.	127/40/16	Kalokhorio	Division	Vrysi tou Khoriou	Improvement works	250	1/3	35	-	
24.	127/40/84	Yerasa	Division	-	Replacement of chain with pipes	2,000	1/3	180	-	

PAPHOS DISTRICT

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of proposed works	Estimated cost £	Village contrib. %	Irrigation Perm. don.	Irrigation Seas. don.	Remarks
1.	65/62	Khoulou	Division	Kartavine	Pumping scheme & distr. works	4,000	1/3	30	18	Revised 1970
2.	127/40/142	Episkopi	Division	-	Flood protection works	1,400	1/3	-	-	
x3	127/40/94	Nata	Division	-	Pumping scheme		1/3			
x4	83/1939	Pano & Kato Akourdalia	Division	-	constr. of Irrig. tank & distr. works	1,600	1/3	6	27	
x5	97/1944	New Dhimmata	Division	Symvoulas	Replacement of pipes	1,800	1/3	-	20	
6	99/54	Arghaka	Associa.	Ay. Varvara	-do-		1/3			

LARNACA DISTRICT

Ser. No.	W.D.D. Reference	Village	Division or Associat.	Locality	Nature of proposed works	Estimated cost £	Village contrib. %	Irrigation Perm. don.	Irrigation Seas. don.	Remarks
x1	44/38	Psematismenos	Division	-	Pumping scheme & distr. works	13,500	1/3	48	97	
x2	45/38/A3	Kalavassos	Division	Kopetrasyrmata	-do-	13,250	1/3	-	240	
x3	91/61	Maroni	Divisionn	Xalona	-do-	28,000	1/3	-	300	

LIST OF SMALL IRRIGATION SCHEMES SUBMITTED TO DISTRICT AGRICULTURAL OFFICERS FOR STUDY

Ser. No.	Village	Nature of works	R e m a r k s
A.	NICOSIA KYRENIA DISTRICT		
1.	Palekhori (O) (Pera-Avlaki Halkomatas)	Distribution works	Existing Irr. Works
2.	Erghates (pumping Scheme from B.H. No. EB 19)	New pumping scheme	
3.	Kakopetria (Pano & Kato Apotheri)	Distribution works	Existing Irr. Works
4.	Neo-Khorio-Trakhoni	Distribution works	Existing Irr. Works
5.	Ayios Theodhoros (Soleas) "Halkopotamos"	Weir and distribution works	-do-
6.	Pharmakas (Koskinas)	Distribution works	-do-
7.	Kythrea (Vartelemes, Shielovorta, Toumbes)	Distribution works	-do-
8.	Moutoullas	Distribution works	-do-
9.	Philia (Ovgos Springs)	Irrig. works	
10.	Katydhata	Distribution works	-do-
11	Yerakies	New pumping scheme	
12.	Kakopetria (Dasulidhes, Phrangiko)	Distribution works	-do-
13.	Milikouri	New pumping scheme	-do-
14.	Milikouri "Mylos, Potamos tou Katsoura"	Distribution works	Existing Irri. Works
15.	Pedhoulas	Distribution works	Existing Irr. works
16.	Pakhyammos "Avgusta"	New Irr. Scheme	

Ser. No.	Village	Nature of Works	R e m a r k s
B.	LIMASSOL DISTRICT		
1.	Kyperounda (Piyi Dhymou)	Distribution Works	Existing Irr. Works
2.	Prodhromos (Hardji)	Storage tank	-do-
3.	Kilani	Distribution works	-do-
4.	Apsiou	Distribution works	-do-
5.	Kyperounda-Dhymes (Hji Pelendros)	-do-	-do-
6.	Kyperounda-Dhymes (Solomides)	-do-	-do-
7.	Moniatis	-do-	-do-
C.	PAPHOS DISTRICT		
1.	Kritou Terra (Kephalovrysos)	Distribution works	Existing Irr. Works
2.	New Dhemmata	Replac. of pipeline	-do-
D.	LARNACA DISTRICT		
1.	Kalavassos	New Pumping scheme	
2.	Maroni	New Pumping scheme	
E.	FAMAGUSTA DISTRICT		
1.	Vitsadha	New Pumping scheme	
2.	Ay. Andronikos	Distribution works	Existing Irr. Works

List of schemes approved by the Inter-Departmental Committee in 1971

1. Statos
2. Kyperounda - Dhymes (Solomides)
3. Laghoudhera (Pano Affita)
4. Vasillia (Paleokastro)
5. Palekhori (Halkomatas)
6. Apliki (Kaloyiros-Tourkou)
7. Askas (Piyi Pano Ambelia)
8. Nea Dhimmata
9. Ay. Amvrosios (Mouthouna)
10. Ay. Amvrosios (Sterdja)
11. Psematismenos
12. Tembria (Esso Dhimmata)
13. Korakou (Esso Dhimma)
14. Korakou - Phlasou - Linou (Shellossi)
15. Linou (Linopsos)
16. Maroni

List of schemes not approved by the Inter-Departmental Committee in 1971

1. Kyperounda (Hji Pelendros)
2. Pendayia (Kalokerinon Neron)
3. Philia - Massari Pumping scheme
4. Peristeronari

Summary of List A

District	Estimated Cost £
Nicosia	225,600
Kyrenia	151,800
Famagusta	80,690
Limassol	41,600
Larnaca	28,390
Paphos	34,400
T O T A L	£562,480

List "A"

Water Supply - Schemes prepared in 1971 and submitted to D.Os

NICOSIA DISTRICT

Ser. No.	Village	Nature of scheme	Estimated cost (£)
1.	Alona Lagoudhera Sarandi Platanistassa Polystypos	Phase II of the regional scheme. Additional supply and house-to-house	28,740
2.	Lymbia Kornos Sha Mosfiloty Psevdhas Pyrga Ay. Varvara Monastery	Regional scheme Additional supply and house-to-house	117,840
3.	Kambos Tsakkistra	Additional supply and Improvements	20,900
4.	Pyrgos Pano Piyenia	Additional supply and house-to-house	29,050
5.	Macheras Monastery	Additional storage	5,000
6.	Akaki	Extentions	3,200
7.	Argates	Extentions	550
8.	Xeri	Extentions	410
9.	Palekhori (Orinis)	Extentions	620
10.	Ay.Marina (Xyl.)	Extentions	650
11.	Korakou	Improvement and House-to-house	14,440
12.	Astromeritis	Extentions	1,700
13.	Alithinou	Improvements and house-to-house	2,500
	T O T A L		£225,600

KYRENIA DISTRICT

Ser. No.	Village	Nature of scheme	Estimated Cost (£)
1.	Elea Phterykha	Additional supply and house-to-house	20,400
2.	Karavas	Additional supply and improvements to the existing distribution system	130,000
3.	Trimithi	Extentions	1,400
	T O T A L		£151,800

FAMAGUSTA DISTRICT

1.	Akhyritou	Additional supply and house-to-house	23,300
2.	Paralimni	Additional supply	17,200
3.	Phrenaros	Additional supply and improvements	28,000
4.	Ayios Elias	Improvements and house-to-house	7,540
5.	Vitsadha	Installation of conveyor from Marathovounos	4,650
	T O T A L		£80,690

LIMASSOL DISTRICT

1.	Erimi	Additional supply and house-to-house	7,000
2.	Armenokhori	House-to-house	3,100
3.	Prodhromos	Improvements	1,700
4.	Pakhna	Additional storage	3,400
5.	Kellaki	Additional supply and house-to-house	9,000
6.	Episkopi	Improvements to the distribution and additional storage	17,400
	T O T A L		£41,600

LARNACA DISTRICT

Ser. No.	Village	Nature of scheme	Estimated cost (£)
1.	Ayios Theodhoros) Alaminos) Skarinou)	Additional supply and house-to-house	20,090
2.	Athienou	Extentions	7,000
3.	Meloushia	Additional storage	1,300
	T O T A L		£28,390

PAPHOS DISTRICT

1.	Marathounda	Improvements and house-to-houe	6,260
2.	Kili	House-to-house	6,860
3.	Ayia Marina (Khr.)	Additional supply	800
4.	Inia	House-to-house	8,880
5.	Akoursos	Additional supply and house-to-house	6,100
6.	Polis) Prodhromi)	Extentions to Latsi area	3,000
7.	Kannaviou	House-to-house	2,500
	T O T A L		£34,400

List"B"

Water supply scheme in the course of preparation at the end of 1971

NICOSIA DISTRICT

Ser. No.	Village	Nature of scheme
1.	Klirou Kalon Khorio Mitsero	Regional scheme Additional supply From new B/H at Ayios Ioannis area

FAMAGUSTA DISTRICT

1.	Trikomo Boghaz Gatria Arnadhi Spathariko Ayios Georghios Limnia Ay. Serghios Styllos Engomi	Regional scheme Additional supply from two B/Hls near Tripimeni village
2.	Kondea	Additional supply from new well and house-to-house
3.	Dhavlos	Additional supply from new spring and improvements to distribution system
4.	Phlamoudhi	Additional supply from new spring
5.	Dherinia	Additional supply from new B/Hs

LIMASSOL DISTRICT

1.	Paramytha Spitalli Palodhia	Additional supply from new springs and house-to-house
2.	Sotira	Additional supply from new B/H
3.	Kalon Khorio	Additional supply from new spring

PAPHOS DISTRICT

1.	Pretori	Improvements and house-to-house
2.	Panayia	Improvements
3.	Mamonia	Additional supply and house-to-house
4.	Ay. Marnia (Kel.)	House-to-house

VIII. REGIONAL OFFICES

by N. Chr. Toufexis,
Superintendent of Works

8.1 Limassol Regional Office

8.1.1 General

By the end of the year the staff of the Limassol Regional Office was composed of one Executive Engineer (Mr. M. Dymiotis) as Head of the Limassol and Paphos Regions, 3 monthly paid Technical Assistants, 3 daily paid Technical Assistants, 3 hourly paid Technical Assistants and one female typist.

The above personnel was engaged on the collection of Hydrological and Hydrogeological data as well as for maintenance of Dams.

8.1.2 Stream Gauging and Rainfall observing stations in operation

The following number of permanent stream gauging and rainfall observing stations were in operation during the year under weekly or monthly visits for observation, measurement and maintenance:-

(i) 22 stream gauging stations equipped with automatic Water Level Recorders
(ii) 5 rainfall observing stations

8.1.3 Surface Water Hydrology

Weekly visits were made during the year to the stream Gauging Stations equipped with automatic water level recorders for observation and for calibration purposes by the use of current meters. Also samples of stream water for chemical and suspended sediment analyses were taken regularly.

Data taken from Rainfall Observing Stations at the end of every month were sent to the Meteorological Office.

8.1.4 Ground Water Hydrology

Ground Water conditions in the Limassol and Akrotiri-Phassouri areas were observed with the help of 556 observation wells and boreholes. The distance from established Bench Mark on top of the observations wells and boreholes to the groundwater level was measured twice-a-year:

In March before the irrigation period and in November after the Irrigation period.

In addition, monthly and weekly measurements of the ground water level as well as sampling of water for chemical analysis, were taken in 110 observing boreholes.

Also 1020 spring discharges were gauged valumetrically or by current meter.

8.1.5 Chemical Analyses

A total number of 1259 water samples were taken from springs, wells/boreholes and streams and sent to the Government Laboratory for chemical analysis.

In addition to the above 1160 samples of ground water were taken in March and November and were analysed by the Limassol Regional Office for Chloride content.

8.1.6 Suspended Sediment Analyses

A total number of 41 samples of stream water were taken at the Permanent Gauging Stations and analysed by the Soil Laboratory for suspended sediment.

8.1.7 Bacteriological Analysis

144 samples of ground water were taken from springs and boreholes used for the Limassol water supply and sent to the Pathological Laboratory for analysis.

8.1.8 Questioning

The annual questionaire was carried out on 1400 wells and boreholes during the summer for determination of the groundwater extracted, the area irrigated and kind of crops planted.

8.1.9 Well sinking permits

95 applications for drilling of wells or boreholes in the Special Measures Law area and 46 application in the non conservation area were investigated and submitted to the District Office Limassol.

8.1.10 Water Meters

During the year, 10 water meters were installed on an equal number of boreholes in Akrotiri-Phassouri area, raising the total number to 388.

8.1.11 Maintenance of Dams

Routine maintenance and inspection of major dams in Limassol and Paphos Regions and their distribution system was carried out by the Regional Officer.

8.2 Paphos Sub-Regional Office

8.2.1 General

By the end of the year the staff of the Sub-Region was composed of 2 monthly paid Technical Assistants, 2 daily paid Technical Assistants, 4 hourly paid employees and one female typist.

The above personnel was engaged on the collections of hydrological and hydrogeological data as well as for maintenance of dams.

8.2.2 Stream gauging and Rainfall observing Stations in operation

The following number of permanent stream gauging and Rainfall observing stations were in operation during the year under weekly or monthly visits for observations, measurement and maintenance:

(i) 11 stream gauging stations equipped with automatic Water Level recorders.
(ii) 7 Rainfall observing stations.

8.2.3 Surface Water Hydrology

Weekly visits were made during the year to the stream Gauging Stations equipped with Automatic Water Level recorders for observation and for calibration purposes by the use of current meters. Also samples of stream water for Chemical and Suspended sediment analysis were taken regularly.

Data taken from Rainfall observing stations at the end of every month were sent to the Meteorological Office.

8.2.4 Ground Water Hydrology

Ground-water conditions in the South-Western Paphos and Polis-Khrysokhou areas, were observed with the help of 481 wells/boreholes. The distance from established Bench Marks on top of every observation well/borehole to the ground-water level was measured twice-a-year. In March before the irrigation period and in November after the irrigation period.

In addition, monthly or more frequent measurements of the ground water were taken in certain observation boreholes during the year for special studies.

Also 652 spring discharges were gauged volumentrically or by current meter.

8.2.5 Chemical Analyses

A total number of 489 samples of stream and ground water were taken and sent to the Government Laboratory for Chemical Analysis.

319 samples of ground water taken from observations wells/ boreholes during March and November were analysed by the Paphos Sub-Regional Office for chloride content.

8.2.6 Suspended Sediment Analyses

A total number of 51 samples of stream water was taken at the permanent Gauging Stations and analysed by the Soil Laboratory for suspended sediment.

8.2.7 Questioning

The annual questionaire was carried out on 2356 wells/boreholes and springs in South Western Paphos and Polis-Khrysokhou areas, during summer for the determination of the ground water extracted, the area irrigated and kind of crops planted.

8.2.8 Well sinking and citrus plantation permits

A total number of 250 applications for well sinking permits were investigated and reports submitted to the District Officer Paphos, while 33 applications for citrus plantation permits were examined and reports submitted to the Sub-Committee for citrus plantations, Paphos.

8.2.9 Extension of Hydrological Survey Areas

Extension to the hydrological survey areas were made at Polis and Pissouri. 70 wells/boreholes were plotted on L.R.O map and all necessary details were entered into the appropriate Register.

8.3 Morphou Sub-Regional Office

8.3.1 General

By the end of the year the staff of the sub-Regional Office was composed of one Inspector of Works (Mr. A. Nicolaides) as the Head of the Office, one monthly paid Technical Assistant, seven daily paid Technical Assistants, and one casual employee. The above personnel was engaged on the collection of Hydrological and Hydrogeological data in the Morphou Sub-Region.

8.3.2 Stream Gauging and Rainfall observing Stations in operation

The following number of permanent stream gauging and Rainfall observing stations were in operation during the year under weekly or monthly visits for observations, measurements and maintenance:

(i) 22 stream gauging stations equipped with automatic water level recorders
(ii) 3 rainfall observing stations

8.3.3 Surface Water Hydrology

Weekly and monthly visits were made during the year to the stream gauging stations equipped with automatic Water Level Recorders for observations and for calibration purpose by the use of current meters. Also samples of stream water for chemical and suspended sediment analyses were taken regularly.

Data taken from rainfall observing stations at the end of every month were sent to the Meteorological Office.

8.3.4 Ground Water Hydrology

Ground water conditions in the Western Mesaoria were observed with the help of 330 wells/boreholes. The distance from established Bench Marks on top of the observation wells/boreholes to the ground water level was measured twice-a-year: In March before the irrigation period and in November after the irrigation period.

In addition to above observations, monthly measurements of the ground water level as well as sampling of water for chemical analysis were taken from 125 wells/boreholes for special studies.

Most of the springs in the area were measured on a routine basis, a small number was gauged for a short period after the request of another Departmental Division. During the year, 1100 springs discharges were gauged. 70 springs were gauged once-a-month and 80 springs twice-a-year.

8.3.5 Questioning

The routine questionaire was carried out during the summer months on 900 wells/boreholes in use for the determination of the ground-water extracted, the area irrigated and kind of crops planted.

8.3.6 Chemical Analysis

Samples of water were taken at various frequencies in Morphou Regional Area. Throughout the year, 1460 samples of water were taken from wells/boreholes, springs, rivers and streams at weekly, monthly and annual intervals and submitted to the Government Analyst for Ionic and Boron Analysis.

In addition, 600 samples of ground water taken from observation wells/boreholes during March and November were analysed by the Morphou Sub-Regional Office for chloride content.

8.3.7 Bacteriological Analysis

60 samples of water were taken from wells or boreholes used for the water supply of Nicosia and sent to the Pathological Laboratory for analysis.

8.3.8 Suspended Sediment Analysis

30 samples of streams water were taken at the Permanent Gauging Stations and analysed by the Soil Laboratory for suspended sediments.

8.3.9 Well sinking and citrus plantation permits

A total number of 910 applications for well sinking and 500 cases for citrus plantations were investigated and reports were submitted to the District Officer Nicosia.

8.3.10 Plotting and Levelling of new boreholes

A total number of 85 new legal and illegal boreholes were plotted on map and necessary details entered into the appropriate register.

8.3.11 Water Meters

During the year, 55 water meters were installed on an equal number of boreholes in Morphou area raising the total number to 577.

8.4 Famagusta Regional Office

8.4.1 General

By the end of the year the staff of the Famagusta Regional Office was composed of one Inspector of Works (Mr. G. Frangopoullos) 3 Technical Assistants, 2 daily paid Technical Assistants, 4 regular employees and one female typist. All the above personnel was engaged on the collection of hydrological and hydrogeological data in the Famagusta Region.

8.4.2 Stream gauging and rainfall observing stations in operation

The following number of permanent stream gauging and rainfall observing stations were in operation during the year under weekly or monthly visits for observation, measurements and maintenances:

(i) 10 stream gauging stations equipped with automatic Water Level Recorders
(ii) 3 Rainfall observing stations

8.4.3 Surface Water Hydrology

Monthly visits were made during the year to the stream Gauging Stations equipped with automatic Water Level Recorders for observations and for calibration purpose by the use of current meters. Also samples of stream water for chemical and suspended sediment analysis were taken regularly.

Data taken from rainfall observing stations at the end of every month were sent to the Meteorological Office.

8.4.4 Ground-Water Hydrology

Ground-Water conditions in the Eastern Messaoria were observed with the help of 1000 observation wells/boreholes. The distance from established Bench Marks on top of the observation wells/boreholes to the ground water level was measured twice-a-year: In March before the irrigation period and in December after the irrigation period.

In addition, monthly measurement of the ground water level as well as sampling of water for Chemical Analysis were taken in 119 Government observation boreholes.

Also the yield of seven springs was measured once per month.

8.4.5 Chemical Analyses

A total number of 480 samples of water, were taken monthly from boreholes, wells, springs and streams, and sent to the Government Laboratory for chemical analysis.

758 samples of ground water staken from observation wells/boreholes during March and December were analysed by the Famagusta Regional Office for chloride content.

8.4.6 Suspended Sediment Analyses

A total number of 4 samples of stream water was taken at the Permanent Gauging Stations and analysed by the Soil Laboratory for suspended sediment.

8.4.7 Bacteriological Analyses

254 samples of ground water were taken from wells/boreholes used for the water supply of Famagusta and sent to the Pathological Laboratory for analysis.

8.4.8 Questioning

The annual questionaire was carried out on 16335 wells and boreholes during the summer for the determination of the ground water extracted, the area irrigated and kind of crops planted.

8.4.9 Well sinking permits

A total number of 1113 applications for sinking of wells or boreholes in the conservation area as well as 43 applications in the non conservation area were examined and submitted to the District Officer Famagusta.

8.4.10 Plotting of new boreholes

A total number of 455 new legal and illegal boreholes were plotted on map and all necessary details entered into the appropriate Register.

8.4.11 Water Meters

During the year, 3 water meters were sold to an equal number of owners of wells/boreholes, raising the total number of water meters sold in the Region to 478.

8.4.12 Miscellaneous

Minor repairs and maintenance of certain villages water supply systems were carried out during the year by the Regional Office.