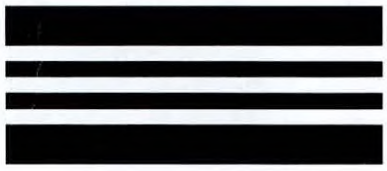

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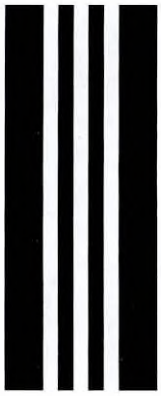

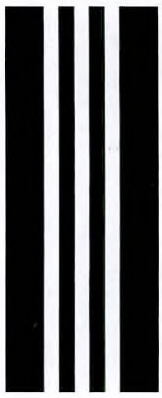

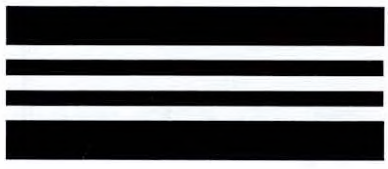

Mr. Mavrellis

REPUBLIC OF CYPRUS

ANNUAL REPORT

OF THE

DEPARTMENT

OF

WATER DEVELOPMENT

FOR THE YEAR

1966

With the compliments of the
Director of Water Development,
Nicosia, Cyprus.

REPUBLIC OF CYPRUS

ANNUAL REPORT

OF THE

DEPARTMENT
OF
WATER DEVELOPMENT

FOR THE YEAR
1966

Prepared by

Chr. A.C. Konteatis

Director,
Department of Water Development.

1. INTRODUCTION

The Depa tment of Water Development is one of the Departments of the Ministry of Agriculture and Natural Resources and it is responsible for the Government's overall policy, planning, design, construction and contributing towards the management of all water development projects of the island. Water development projects include domestic water supplies, rural and town, irrigation, drainage, flood protection, river pollution protection, ground water recharge works and other relevant works.

The main problems that the Department faced during the year under reveiw were:-

(a) Ground water control

The depletion of the main aquifers of the Western and South-eastern Messaoria as well as that of Akrotiri and Kiti continued at an increasing rate due to the expansion of plantations and the consequential increase of pumping in these areas. The extraction of water from these areas far exceeds that of natural and artificial recharge and it is therefore a matter of top priority to effect the necessary control measures in these areas before it is too late. As it is known, almost the whole of the citrus plantations of the island depend upon ground water and, if the water supply to these plantations is not safeguarded, it will result to a serious blow to the economy of the island. The measures that are being taken include the enactment and application of the Special Measures Law which will enable the cohtrol of extraction and utilization, the construction of more ground water recharge projects, the lining of canals and laying of pipelines to decrease the conveyance losses, and finally the Water Use Project of the Department of Agriculture for reducing the losses and applying the correct amount of water on the farm.

(b) Management of dams

The management of major dams has now become a serious major problem of the Department and it is a matter of great importance to establish the proper organizations for the smooth and efficient operation of these projects. Many difficulties have been encountered, both technical and financial, which are now being carefully studied.

(c) Departmental organization

The departmental organization as it now stands is not very efficient and certain reorganization programmes are now being studied with a view of implementing the necessary modifications on the departmental structure early in 1967.

We are still short of suitably qualified staff such as Civil Engineers and Geologists, and many of the available posts in the Department still remain vacant.

(d) Planning of major water development projects

A new section has been established for planning the major projects of the Department which include the investigations, testing, preliminary design and technoeconomic studies of the projects. The agricultural aspects are studied by the Department of Agriculture and are coordinated through the Inter-departmental Dam Committee.

(e) Yermasoyia dam

The major construction work of the Department during the year was the Yermasoyia dam which is under contract to the Cybarco Co. A lot of difficulties have been encountered on the site and a difficult time was experienced during floods at the end of the year. Great efforts were made during December by working day and night to raise the level of the cut off up to the river-bed to avoid serious interruption of the work, and which were successful.

(f) Domestic water supplies

The major domestic water supply problems on the island now are Famagusta and Nicosia. Famagusta is a top priority problem and investigations were made during the year for supplying domestic water supply to the town from regions outside Famagusta. This project is still being studied. In the case of Nicosia the problem is becoming acute and efforts are being made to get additional water to the town.

2. STAFF ORGANIZATION

(a) Staff

Mr. V. Kregar, U.N. Expert, Director of the Department, went on leave on 9th November, 1966, prior to the expiration of his contract with the Government of the Republic of Cyprus, on 31st December, 1966, and Mr. C.A.C. Konteatis, Assistant Director, was appointed Acting Director as from the same date.

The appointment of Mr. Hsing Sieh Hu, Executive Engineer, which expired on 1st October, 1966, was renewed for a further period of one year, i.e. till the 1st October, 1967.

Messrs. Pierre Mechin and B.S. Sivan, Senior Water Engineers, accepted appointment, on contract, for employment in the Department and assumed duties on 25th May and 8th August, 1966, respectively.

Messrs. A. Georghiades and A. Georghiou were appointed as Executive Engineers during the year under review, Mr. I.S. Jacovides was appointed as Hydrologist and Mr. Peppis as Geologist.

Mr. S.S. Bayada, Mechanical Engineer, and Messrs. Kypris and G. Zaphiris, Geologists, continued to be attached to the Geological Department - the latter till mid-December when he passed away.

A number of Technical Assistants also continued to be attached to the Geological Department in connection with the United Nations Special Fund Project.

One Executive Engineer resigned from the Government Service during the year under review.

All the Turkish employees who deserted their posts in December, 1963, continued to abstain from work during the year under review.

(b) Scholarships.

Mr. C. Konteatis, Assistant Director of the Department, spent two months in the U.S.A. with the Bureau of Reclamation, mainly in Denver Colorado, California and Arizona, where he followed up the development in the fields of water resources organization, planning, construction and management.

Mr. Nicos Ioannides, Executive Engineer, who was awarded a one year scholarship, sponsored by the United Nations, in Dam Engineering, in Denver, Colorado, returned to Cyprus and resumed duty as from 14th October, 1966, as Head of the Major Projects Planning Section of the Department.

Mr. A. Evripidou, Inspector of Works, having completed his scholarship in Denver, U.S.A., sponsored by the U.S. Aid Mission in Surveying, returned to Cyprus and resumed duty as Head of the Topography Section of the Department, as from 10th August, 1966.

Mr. S. S. Bayada, Mechanical Engineer, on loan to the Geological Department in connection with the U.N. Special Fund Project, was awarded, by that Fund, a 6-month scholarship in Drilling tenable in U.S.A.

Mr. Bayada resumed duty with the Geological Department on completion of his scholarship.

Mr. Chr. Phanartzis, Inspector of Works, who was awarded a 3-year scholarship in Hydrology, sponsored by the U.S. Aid Mission, continued his studies in Arizona University throughout the year under review.

Mr. J. Karoglanian, Technical Assistant, was awarded a one year scholarship, sponsored by the U.S. Aid Mission to Cyprus, in Soils and Materials Laboratory Work tenable in Denver, Colorado, left Cyprus on 29th October, 1966.

(c) Labour

The average number of labourers employed in the Department during 1966 was 958 as compared with 1586 in 1965. 26.3 were classed as regulars whilst approximately 38.4 were skilled employees, 14.2 semi-skilled and 47.4 unskilled. 0.7 of the labourers employed were Turks.

The approximate monthly average of labourers engaged was as follows:-

January	883
February	930
March	970
April	955
May	932
June	898
July	998
August	903
September	881
October	975
November	1070
December	1105
Average	958

During the year 12 casual heavy plant operators field workers went on 9 days' strike claiming the benefits enjoyed by the regular employees. The Joint Labour Committee approved the payment of subsistence allowance to them with a view of considering their general claim in coincidence with the problems raised by other labourers of the same status. There have been no other labour disputes or strikes during the year.

The footage bonus paid to drilling crews since 1948 was discontinued in September. This resulted after negotiations with the Trade Unions. Part of the bonus paid was incorporated in the wages of the drillers and an establishment was formed in the drilling crews.

There were no other appreciable variations in the wages structure except the normal annual increases granted to regular employees.

(d) Organization

The present organization of the Department has only been slightly modified during the last two years from what it was fifteen years ago when it was established to its present form. As the major projects carried out by the Department now constitute the major part of the work, it is considered advisable to effect more changes in the departmental structure to enable higher efficiency in the factions of the Department.

Certain reorganization programmes are being set up and it is hoped to implement them during the beginning of 1967. The modifications effected during the year under review were the establishment of the Planning Section which is not better organized to take up investigations, laboratory testing and technoeconomic studies of the various major projects. Another renovation was the establishment of 3 sub District Offices, one in Limassol, one in Famagusta and one in Morphou, mainly for the application of the Special Measures Law for the control of the ground water extraction and which, it is hoped, will form the basis for the expansion of these District Offices for carrying out more work during the next year.

The distribution of staff, vacancies and Turkish officers absented are shown on appendix 1.

3. FOREIGN ASSISTANCE

(a) United Nations Experts

Mr. V. Kregar continued to be the Director of the Department until the beginning of November 1966 when he took leave prior to the completion of his engagement.

Mr. Branko Milinusic of F.A.O. was still with us throughout the year and was very helpful in advising on major contracts, construction of major projects and planning and design of irrigation systems.

Mr. S. Hsu of the United Nations was still with us throughout the year and contributed largely in the execution of our planning and design of major dams as well as on their construction.

Mr. E. Dahmen continued for most of the year to be an Associate Expert of F.A.O. and he helped greatly in the Hydrological Section where he has been working on the calibration, measuring and evaluation of the surface water flow of our rivers.

Mr. S. Eresund was a new Associate Expert of F.A.O. from Sweden and he has been helping in the design of dams, hydrological investigations, recharge works and grouting problems.

Mr. K. Marelius, F.A.O. expert from Sweden was most of the time working together with Mr. Eresund on the same or similar problems.

(b) United Nations Special Fund for Ground Water and Mineral Explorations

This project for the ground water and mineral exploration of the island has continued with Project Manager Dr. Tornquist and Project Co-Manager Mr. Hji Stavrinou, Director of the Geological Department. Most of the ground water hydrogeological work has been completed and it is expected that in 1967 a report on the water balance of the island will be made available.

(c) United Nations Development Special Fund Project

Discussions were held and preparatory work was completed for the enactment of this Special Fund Project, by the beginning of 1967, which will undertake a complete water balance of the water resources of the island, a master plan on the possibilities of development and utilization of the island's water resources as well as a feasibility study of the main Paphos watersheds.

(d) U.S. AID experts

During the past year we only had Mr. Ben Griffin from the U.S. AID who, with his great interest on the works carried out by the Department and on training the staff of the Department, contributed a lot. The U.S. AID in Cyprus closed down by the end of the year and Mr. Griffin is expected to leave the island by the beginning of 1967.

(e) West German Mission

The West German Mission, which worked on the Kyrenia range, submitted its report in 1966 regarding the water resources and potentialities for development on the Kyrenia mountain range. The report gives a rather optimistic view of the available water resources on the Kyrenia limestone. As a result of the recommendations of the German Mission a drilling programme has been undertaken between Halevka and the Lefkonico Pass for finding water. This report will contribute in the final evaluations of the water resources as carried out by the two United Nations Special Fund Projects.

(f) British Technical Assistance

During the year Dr. Dixey, a well-known British geologist was assigned to Cyprus from British Technical Assistance funds to give opinion on the Famagusta Water Supply sources indicated in the report prepared by Mr. Konteatis. As a result of this visit, drilling of boreholes between the Vassilikos and the Tremithios river basins has been undertaken on the Pakhna and Lapathos formations as well as on river alluvium.

4. INTER-DEPARTMENTAL CO-ORDINATION AND COOPERATION

For the major projects it is necessary to be discussed with other interested Departments such as the Department of Agriculture, the Department of Geological Survey and the Department of Forests. We therefore convened regular meetings of the Inter-departmental Committee on Dams for all major projects. During these meetings we discuss problems such as the hydrological, geological, agricultural and economic aspects. Each Department has to do its share of the work which is then incorporated in the report of the Department of Water Development submitted to the Government for approval of the project.

5. HYDROLOGICAL SITUATION

In 1966 the average rainfall over the island was 18.45 inches which is only about $1\frac{1}{2}$ inch below the average rainfall experienced between the years 1908 and 1957. The highest daily rainfall was 3.7 inches and occurred at Kionia Forest Station on the 23rd of October. The snow cover continued between November and the middle of April. The temperatures were a little below normal having reached in Nicosia a maximum of 105° F., the lowest in Nicosia being 33° F. As the rainfall was a little below average, also the river flows were in most cases somewhat below average. The maximum flood recorded was 8,765 cusecs on the Stavros tis Psokas river measured near Evretou on the 12th of October, 1965, that is to say the beginning of the hydrological year 1965-1966. Regarding the ground water situation, the drop of the water table has continued in all the main aquifers of the island and in particular in Western and South-eastern Messaoria, Akrotiri and Kiti areas. The citrus plantations have been expanded to a great extent, in particular in the region of Western Messaoria and the needs for water have increased considerably.

Efforts were made to effect the application of the Special Measures Law by the instalment of water meter on every bore-hole and allocating a certain quantity of water to each bore-hole owner, which will depend upon the safe yield of the bore-hole as well as upon the water requirements of the crops based upon a high irrigation efficiency. To enable this high irrigation efficiency to be achieved the Department of Agriculture, through a Water Use Project, finances the necessary installations. It is hoped that in 1967 the Special Measures Law will start functioning. The worst situation is experienced in South-eastern Messaoria, in particular in the area enclosed between Famagusta, Kondea, Ormidhia and Ayia Napa. The expansion of the plantations in this area were not as many as in Western Messaoria, but the water resources are much more limited in this area and the prospects of finding more water in this area are non-existent. Further, the illegal drilling in this region continued.

6. PLANNING

The planning of water development projects is an important prerequisite to the design and construction of the works. The planning includes the site investigations, laboratory testing, topographic and geologic surveys, agricultural investigations for the selection of the areas to be irrigated, and preliminary designs and economic studies of the projects to be undertaken. We have now started on a more systematic level this work and it is hoped that very soon we shall have a proper Planning Section in the Department which will deal properly with this type of work. With the expected enactment early in 1967 of the United Nations Development Project, the planning of the major water development projects will be based on the right foundation. The water Development Department will contribute largely to this project and to a great extent our planning works will be incorporated within the framework of this Special Fund Project. The planning for the development of our water resources is a top priority problem because it is very much connected with the needs of the existing plantations in the ground water areas and it is necessary that very soon additional water supplies should be conveyed to these areas for maintaining the production and the income of this particular area.

7. CONSTRUCTION OF PROJECTS

The main projects under construction in 1966 were:-

(a) The Yermasoyia dam which is being undertaken by the Contractor CYBARCO. On the grouting works, which are quite extensive and include chemical grouting of the alluvium deposit, Cementation Company of London is the Sub-contractor.

(b) On the Pomos dam additional work was done on the spillway to enable its better functioning. Also additional grouting of the tunnel and cut off was carried out by Messrs. Foundation Engineering in conjunction with Messrs. Ioannou and Paraskevaides. The cut off grouting was done through drilling from the top of the embankment.

(c) Mavrokolymbos dam. On this project the Contractors CYBARCO completed the whole dam which formed their contract. Some work still remains to be done on this project in connection with certain remedial measures which have to be carried out in the reservoir against sliding.

(d) Kalopanayiotis dam. This dam, which is constructed by the Department with Howard Humphreys of London as Consultants, was substantially completed by the end of the year. Some grouting work still remains to be completed and which is done through drilling from the top of the embankment.

(e) Polemidhia dam. The last phases of the grouting work undertaken by Soil Mechanics, Soletahche were completed during the beginning of the year. Certain extensions of the grouting are required on the left hand side abutment for making the dam more impermeable and which it is aimed to undertake during 1967.

In addition to the major dams, many smaller dams were constructed in the Eastern and South-eastern Messaoria, in particular in Kondea, Avgorou, Phrenaros, Sotira, Xylophagou for recharge purposes. Also at Ayios Georghios, Kyrenia, several small dams were constructed for recharge purposes. In addition, a major diversion of the Plakos stream was made to bring water from streams coming from Kyrenia range to the sea into the existing Famagusta Dherinia reservoirs from where the water is taken to the recharge grounds.

Another interesting project was an experimental recharge scheme at Ayios Pappos where we pumped water into boreholes from Syngrassi reservoir where a temporary embankment was built to enable the storage of some water. Major irrigation distribution systems were also constructed during the year for Kiti dam, Ayia Marina dam, Pomos dam and Mavrokolymbos dam.

The work of the rural domestic water supplies was also continued to a satisfactory level having completed 34 schemes serving a population of about 40,000 people. It is worth noting that only 4 villages with a population of 1,000 persons now remain throughout Cyprus without piped water supply. Of course, the problems of the depletion of the ground water, the expansion of population and the rise of standard of living necessitates the increase of supply and, therefore, apart from the 4 villages mentioned, a lot of work will continue to be executed in the future.

As regards the town water supplies, during the year the Yermasoyia scheme for supplying supplementary water to Limassol has been completed. In Larnaca additional work on the supply of water from the Trimithios valley was undertaken during the year. The problem of Famagusta and Nicosia water supply is still the main issue regarding town water supplies and efforts are being made so that in 1967 determination of the sources and work that will be necessary for these two towns would be effected.

8. OPERATION AND MAINTENANCE OF PROJECTS

(a) Major projects

(i) Major domestic water supply projects are operated through Water Boards under the chairmanship of the District Officer of the particular District, according to the Water Supply (Municipal and Other Areas) Law. The Department of Water Development is represented on these Boards which meet regularly in every town for the proper management of the water supplies.

(ii) Major irrigation dams are managed through District Water Boards again under the chairmanship of the District Officer concerned, on which the Departments of Water Development and Agriculture are represented. The District Water Boards operate for the whole District, and for each particular project it is normal to have an Irrigation Division governed by the Irrigation Divisions Law. This system of management is still new and a lot of difficulties have been encountered especially where it is required to repay the dam in the form of a water rate per unit volume of water. Appropriate agreements have still to be signed in some of these cases and some legal modifications have to be implemented. The major dams which are governed through these Water Boards are Kiti, Polemidhia, Kalopanayiotis, Mavrokolymbos, Argaka-Magounda and Yermasoyia dams. There are, of course, many advantages in keeping the projects under Government control, such as the proper management, the high efficiency of the utilization of the water and indirectly to control the agro-economic aspects of the project. However, a lot remains to be done having the proper organization set up to deal with this system of management efficient.

(b) Minor projects

(i) Rural domestic water supplies. Rural domestic water supplies are governed through Village Water Commissions headed by the District Officer of the particular District and governed by the Water (Domestic Purposes) Village Supplies Law.

(ii) In the case of irrigation works, there can be either Irrigation Divisions headed by the District Officer, in the case of land owners, and governed by the Irrigation Divisions Law, or Irrigation Associations, in the case of water owners, again headed by the District Officer and governed by the Irrigation Associations Law.

9. WATER LEGISLATION

The enforcement of the Special Measures Law is now most important to enable the control of extraction and the efficient utilization of water in the depleted aquifers with a view to saving the aquifers and the plantations upon which a great part of the agricultural income is derived.

Other modifications and additional legislation is required to enable the proper control and management of the ground and surface water resources, and the opportunity will be taken in 1967 with the starting of the new United Nations Development Project to look into the legal problems and reconsider the recommendations made by the United Nations legal experts who came here four years ago. Our existing legislation has proved sufficiently good for small irrigation and domestic water supply projects, but where it comes to major projects, which fit into regional development and diversion of water, the available legislation does not seem to be sufficient.

10. FINANCE

The expenditure incurred by the Department during the year is summarized in Appendix No,2.

In the reports of the various sections the expenditure on the various projects is given separately. The projects were financed in the standard way as follows:-

(a) Routine Irrigation Projects
Perennial Crop Irrigation 66.7% Contribution by Govt.

(b) Drainage schemes full cost to Government except where irrigation works are also included in which case the irrigation part is financed according to the irrigation season.

(c) Flood protection schemes full cost to the Government except where irrigation is also incorporated in which case the irrigation part is financed according to the season of irrigation.

(d) Village domestic water supplies Government contribution 50%.

(e) Town water supplies no Government contribution. Excluding Kyrenia and Paphos towns where Government has contributed 1/3rd of the cost.

(f) The Government contribution for Irrigation Associations depends on the ownership of shares of water between the shareholders.

(g) For most Major Irrigation Projects the financing is now full cost to the Government which then charges water rates per unit volume of water sold.

The village shares are made available by the Government in the form of a long term low interest loan.

In the case of private drilling, test pumping, and works for Water Boards and other non Government authorities, Departmental charges to cover overheads are also charged in addition to the actual cost. Such departmental charges are:-

Water Boards	10% for materials 6% for labour & other.
Rural Municipalities	No charge.
Private individuals	25% for materials 20% for labour & other.

On the subject of the Departmental overheads a study was made which indicates that the indirect costs and overheads including the amortization of machinery exceeds 20%. A recommendation has been passed to the Government for adding a fixed sum to the estimated cost of each project which will depend upon the previous year's overheads and indirect costs. In addition the machinery will have to be hired to the works according to rates which have already been calculated and submitted to Government by the Department. The recommendation is to base this fixed sum on the overheads and indirect costs of the Development budget only.

Adding the overhead costs on our projects will:

(i) Give a more clear picture of the cost of our projects.

(ii) Save some money for the Government.

(iii) A more correct cost-benefit ratio for the economic justification of the projects will be achieved.

TECHNICAL STAFF OF W.D.D ON 31.12.1966

	MONTHLY AND DAILY PAID TECHNICAL STAFF			D	AD	SWE	EH	EE	ME	Geo.	SW	SIW	IW	CF	ACF	TA	F	S	Exp.	TS	Total Nos
1	Permanent staff			1	1	4	1	7		1	1	3	14	3	3	17	36				92
2	Temporary staff							7	1	3	2	3	6	2	9	87	17	1		2	140
3	Foreign Experts	i	U.N. (OPEX)																		
		ii	U.N.D.P																3		239
		iii	U.N. (F.A.O)																3		7
4	Foreign Missions	i	U.S.A. Aid Mission																1		
5	U.N.S.F.P. Mineral & Ground Water Surveys (On loam)								1	1				1		7	2				
	SECTION		BRANCH	DISTRIBUTION OF STAFF BY SECTIONS																	
6	Irrigation	i	Planning			1		2								1					
		ii	Dam design					2													
		iii	Dam Construction			1		4				1	3		3	4	5		3		
		iv	Distribution systems design					1					1						3		
		v	Topography										2			7			1		
		vi	Drawing office										1			16					
		vii	Soil laboratory					1								9					
		viii	Managent of dams					1													
		ix	Minor irrigation works								1	2	1	2	2	3	9			1	
7	Town Water supplies											1	1		1	1	4				
8	Village Water supplies						1					1	5	1	5	1	17				
9	Drilling									2		1	1		1	28	3			1	
10	Hydrology										1		2			15	1				
11	Workshops										1			1			4	1			
12	Turkish Officers absent from duty					1		2					1			9	2				
13	On scholarship							1					1			1					
14	Vacancies			1		1				1			2			2	6				
	TOTAL NUMBERS			1	1	4	1	14	1	4	3	6	20	5	12	104	53	1	7	2	239

REFERENCE

D See paragr. 2 of main report
AD Assistant Director
SWE Senior Water Engineer
EH Engineer Hydrologist
EE Executive Engineer
ME Mechanical Engineer
Geo. Geologist
SW Superintendent of Works
SIW Senior Inspector of Works
IW Inspector of Works
CF Chief Foreman
ACF Assistant Chief Foreman
TA Technical Assistant monthly and daily paid
F Foreman
S Storekeeper
Exp. Foreign Experts
TS Temporary Staff includes four pensioners reemployed and paid on daily wages

Appendix No.2

1966 Expenditure - Water Development Department

Details	Government Funds	Contribution by beneficiaries	Total
	£	£	£
1. Administration	145,389	-	145,389
2. Irrig. Drainage and Dams	754,176	47,787	801,963
3. Town Water Supplies	18,540	52,300	70,840
4. Village Water Supplies	58,086	50,840	108,926
5. Drilling and Prospecting	24,253	-	24,253
6. Hydrological Res. & Weirs	18,863	-	18,863
7. Workshops (Maintenance)	14,147	-	14,147
8. Purchase of Machinery, tools & Equipment	10,973	-	10,973
9. Government Water Supplies	2,690	-	2,690
10. Consultants' Fees	51,297	-	51,297
11. Major Projects Investigations	7,733	-	7,733
12. Greater Nicosia Scheme	59,460	5,400	64,860
13. Watershed Planning	683	-	683
14. The Water Supply Special Measures Law.	983	-	983
Includes Ordinary and Development expenditure	£1,167,273	156,327	1,323,600
Breakdown of Administration			
1. Personal Emoluments	82,696	-	82,696
2. Casual Assistance	6,609	-	6,609
3. Technical Assistance	17,954	-	17,954
4. Travelling	16,307	-	16,307
5. Maintenance & Oper. of M. Tr.	12,809	-	12,809
6. Rents	-	-	-
7. Leave Pay to R.E.	9,014	-	9,014
	£145,389	-	145,389

Planning Section

The Planning Section of the Department deals with the following aspects:-

(a) General Planning with special emphasis on planning for Major Projects.

(b) Investigations.

(c) Laboratory.

(d) Field Control during construction.

(a) General Planning

(i) With the increase of the major works undertaken by the Department, general planning has become an urgent necessity, and with it, it is possible to programme ahead for a considerable time.

As can be seen from the programme enclosed it is proposed to investigate 20 projects in the next five years, design 16 projects and execute 12. Meur P. Mechin was the foreign expert who has assisted in general planning.

(ii) Collection of data for watershed planning

The collection data for watershed planning consists of plotting of intakes, springs, well, etc., as well as the land irrigated and type of crops of the various existing irrigation schemes within the catchment areas of the selected rivers.

2. This work originally was put in hand in 1965 but due to the shortage of staff was delayed and started again early in 1966 when two new Technical Assistants were appointed on daily paid wages under the supervision of a monthly paid Technical Assistant. Unfortunately the one daily paid Technical Assistant left the Department in the middle of the year and now the work is being carried out by the other two persons.

3. The work is being carried out in three stages:

(a) Stage one consists of the preparation of the draft plans. Spot investigations are carried out in the fields and inquiries are taken from the persons concerned or the village authorities. During the field investigations certain difficulties arise due to the refusal of the people to give correct informations. Also more difficulties arise when Turkish villages are within the catchment area under study.

(b) Stage two consists of the preparation of the final plans by the Departmental Drawing office.

(c) Stage three consists of the preparation of a proper report on the existing registered or ap-antiquo water rights and is undertaken after the completion of the above two stages.

4. Priority was given on the collection data for watershed planning on the Paphos rivers because major investigations are going to be undertaken very soon by the Special Fund Project of the United Nations.

5. Up to date the collection data of or watershed planning purposes was finished as follows:-

(i)	Dhiarisos	Stages I, II
(ii)	Xeropotamos	- do- I, II
(iii)	Ezuza	- do- I, II
(iv)	Kha-Potami	- do- I, II
(v)	Yermasoyia	Stages I, II and III
(vi)	Marathasa	- do- I, II
(vii)	Karyiotis	- do- I
(viii)	Atsas	- do- I, II
(ix)	Khrysokhou	- do- I (work in hand)

(b) <u>Investigations</u>

These include:
(a) Site investigations and preliminary calculations
(b) Detailed geologic map of site and reservoir
(c) Drilling and test pits
(d) Laboratory testing
(e) Interpretation of results for design
(f) Feasibility report.

Schemes investigated in 1965 were as follows:-

1. Massari Dam Investigations

Investigations for the dam were started and finished in 1966. Test pits were made along the centre line of the dam axis to determine foundation conditions, and some fifty borrow pits were also carried out in the surrounding area in search for the borrow material.

In situ permeability tests were carried out as well as laboratory testing.

Geologic data and relevant cross sections for the damsite were obtained from the Water Resources division.

Feasibility and design reports were completed in 1966.

2. Syngrassi Dam Investigations

Some additional information was needed for the final design and this was carried out in 1966. Thus the position of some extra borrow areas for additional material was determined.

3. Kiti Dam Investigations

After completion of the Kiti dam and filling of the reservoir some collapsing and leakages have occured due to a branch of the old chain of well that existed near and under the spillway. The existance of this gallery was verified and positioned by putting down about 15 boreholes. With their help we also determined depths of alluvial gravels as well as possible leakages through these pervious foundations.

4. Palechori Dam investigations

Due to not so favourable conditions being discovered after previous investigations, the investigations were continued also in 1966, for the possibility of discovering less expensive damsites.

It is anticipated that investigations will also continue in 1967, to investigate also possibilities of constructing an arch dam.

5. Koma tou Yialou Dam Investigations

After reconnaissance study and report in 1965, investigations were started in 1966 for Koma tou Yialou.

Some twelve test pits were dug at the centre line of the proposed dam and permeability tests were performed.

Also investigations for borrow areas were carried out in the vicinity of the dam.

Both borrow material and dam centre line tests proved satisfactory and it is expected that investigations will continue in 1967 so as to get a complete picture of the project and prepare a feasibility report.

6. Karavas Dam Investigations

In 1966 investigations were also started for the construction of a dam at Karavas at the locality "Myli".

During these investigations a damsite was investigated with some test pits and three boreholes. Two borrow areas were also checked for availability of material.

We propose to carry on investigations also in 1967 to decide finally on a damsite and prepare a feasibility report.

(c) Laboratory

In 1966 the Water Development Department laboratory was equipped with following apparatus:

1. For tests on cement, aggregates and concrete

(i) Le Chatelier apparatus
(ii) Vicat apparatus
(iii) Riffle box for aggregates
(iv) Sieves for aggregates
(v) Aggregate crushing strength apparatus
(vi) Silt and moisture content determination apparatus for aggregates.
(vii) Determination of organic impurities apparatus.
(viii) Slump test and compacting factor apparatus.
(ix) Cubes (different sizes)
(x) Air entrainment apparatus
(xi) Curing facilities
(xii) Crushing machine (capacity 250 tons).

2. For tests on soils

(i) Liquid Limit apparatus

(ii) Normal and rapid moisture content determination apparatus

(iii) Standard and modified proctor apparatus

(iv) Sand replacement apparatus

(v) Sieve analysis, hydrometer and pipette apparatus

(vi) Permeameters (talling and constant head) for horizontal and vertical permeability

(vii) Unconfined compression apparatus

(viii) Triaxial apparatus ($1\frac{1}{2}$ inch diameter specimens)

(ix) Shear box apparatus

(x) Consolidation apparatus.

3. Miscellaneous

(i) Model tank for dam design investigation

(ii) Seismic apparatus for geophysical investigations.

Tests carried out in 1966

During 1966 the following tests were carried out:

(i) For Public Works Department

For the investigations for Limassol Port the following tests were performed in the W.D.D. laboratories:

	No
Atterbergh Limits	5
Moisture content	30
Sieve analysis	12
Triaxial test	3
Shear test	3
Consolidation	3
Specific gravity	5
Total	61

(ii) For other Government Departments

Cubes cured and crushed 503

(iii) For Water Development Department (for Contractors)

Sieve analysis for aggregates 46

(iv) For Water Development Department

The tests carried out for construction and investigation are as shown below:-

From the above it can be seen that 12,511 tests were carried out in the laboratory of the Water Development.

(d) Field control during construction

During construction control was carried out at the different sites, and laboratory personnel were posted permanently on the site in order to observe and test quality of construction.

From the table above it can be seen that 5132 tests for construction were carried out.

TESTS ON SOILS

	TESTS	Investigations						Construction					Total of each kind of test
		Scheme and number of tests						Scheme and number of tests					
		Karavas	Koma Tou Yialou	Makrasyka	Massari	Syngrassi	Palechori	Agros Dam	Kalopanayiotis Dam	Mavrokolymbos Dam	Pomos Dam	Yermasoyia Dam	
ii	Atterbergh Limits	57	19	8	59	82	1	1	4	184	10	47	468
iii	Moisture Content	318		91	424	609	44		134	1908	105	1597	5232
iii	Standard Proctor		6	7	7	12	6	1	37		4	536	616
iv	Modified Proctor												0
v	Sand Replacement											35	35
vi	Core Cutter											696	696
vii	Sieve Analysis, Hydrometer & Pipette	1		10	30	54		1	29	304	8	52	489
viii	Permeability			4	4			1	13		4	12	38
ix	Unconfined			3									3
x	Triaxial												0
xi	Shear Box												0
xii	Consolidation												0
xiii	Specific Gravity		1	2	-	7		1	1	15		11	38
	TOTAL	372	26	125	524	764	51	5	220	2411	131	2986	7615

TESTS ON CEMENT, AGGREGATES AND CONCRETE

	TESTS	Investigations						Construction					Total of each kind of tests
		Scheme and number of tests						Scheme and number of tests					
		Karavas	Koma Tou Yialou	Makrasyka	Massari	Palechori	Syngrassi	Agros Dam	Kalopanayiotis Dam	Mavrokolymbos Dam	Pomos Dam	Yermasoyia Dam	
	Le Chatelier												
i	Setting Times								0	0		0	0
ii	Sieve Analysis								322	96		52	470
iii	Aggregate Crushing								15	5		16	36
iv	Silt & Moisture Content								322	96		515	933
v	Slump								322	96		514	932
vi	Compacting factor								5	5		5	15
vii	Cubes prepared & crushed								322	96		514	932
viii	Water absorption								15	5		16	36
ix	Specific Gravity								322	96		514	932
	TOTAL								1645	495		2146	4286

MAVROKOLYMBOS DAM

This is an earth dam built at the lower reaches of Mavrokolymbos River, about two miles from the sea and having a catchment area of 15.44 sq. miles.

The dam is 133' ft. high and has a capacity of 480 million gallons.

Water from the dam will be conveyed through lined canals, to be used for the irrigation of about 2,000 donums of land in Kissonerga, Lemba and Khlorakas. Construction work on the Dam started in the 2nd half of 1964, continued through 1965 when the embankment and tunnel were constructed and was completed by the end of 1966.

During 1966 the following works were carried out:-

Excavation and lining of the Spillway.

Completion of the up-stream slope rip-rap protection layer.

Finishing of the downstream slope and seeding.

Installation of the hydromechanical equipment.

Reinstatement of borrow areas.

Extensive landslides of the loose earth material comprising the right hand side of the reservoir area occurred in January 1966. These mass movements continued slowly during the wet season of 1966.

Further movement was observed with the start of the 1966-67 rainy season. These slides were attributed to the removal of large quantities of material from the lower part of the slopes for use in construction of the dam. The increase of the moisture content of the soil mass decreased the shear strength of the undercut slope and thus destroyed the stability of the slope.

It was apparent that unless remedial measures were promptly undertaken to stabilize the slopes and thus check further mass movements the capacity of the dam would be considerably reduced. For this reason extensive investigations were initiated and the Consulting Engineers prepared the design for the remedial works which are expected to be carried out during 1967.

DESIGN SECTION

This section deals with the elaboration of studies and designs for Dams and Distribution Systems mainly for irrigation.

The staff of the design section consists at present of two Engineers, one topographer Engineer, one Inspector of Works, and a foreign Senior Engineer.

During 1966 the following design work has been done:

1. Completion of the design system.
   (i) Polemidhia Distribution System.
   (ii) Kalopanayiotis Distribution System.
   (iii) Syngrassi Dam.
2. Revision of Mavrokolymbos Distribution System.
3. Design of Massari Dam.

TOPOGRAPHY SECTION

The task of this Section is to carry out all Engineering Surveys required by the Design, Investigations and Construction Sections of the Department for major Projects. This mainly consists of topographic surveys of Dam Sites, Dam Reservoirs and Distribution schemes. Also included in the activities of this Section is the establishing at the Sites Control net for horizontal and vertical movements of constructed Dams and observing readings periodically as requested by Engineer of this Department or foreign Consultants.

Mr. C. Papdakis was in charge of this Section untill October, 1966 when I.W. A. Evripidou, who completed the Surveying Course in the United States, returned and was assigned as in charge of the Topography Section.

The staff during this year comprised:-

Insp.	A. Evripidou	Monthly paid
Insp.	D. Pitsillides	
T/A	A. Eleftheriou	
T/A.	A. Kourtellas	
T/A	Hji Loizou	
T/A	G. Kounidhes	
T/A	G. Constantinou -- Resigned	Monthly paid
T/A	P. Gerolemou -- Seconded	
T/A	D. Akridas	Daily paid
T/A	Th. Piyiotis	
T/A	G. Andreou (transferred)	
T/A	Char. Nicolaou (Resigned)	
T/A	Ghr. Georgiou	

Surveyor P. Antoniades Resigned

1 Inspector (in charge)
1 Inspector
5 T/A's (Monthly paid)
5 T/A's (Daily paid)
1 Surveyor (Daily Paid)

The surveying course sponsored by U.S. A.I.D. was completed in June 1966 and successful participants were awarded their achievement Certificates.

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Ch. Nicolaou T/A daily paid, G. Constantinou T/A monthly paid and P. Antoniades Surveyor daily paid resigned their posts and left the Department. These officers were among the participants who completed the mentioned Surveying Course.

The projects this Section has dealt with this year, were:-

Project	Type of Survey	Remarks
Koma tou Yialou	D-site-Reservoir	Started 1965, completed 1966.
Research Institute	Topography	
Yermasoyia	Distr. System	Started 1966, continuing 1967.
Massari	D-site-Reservoir location of T.W.L.	
Morphou	Dam Reservoir	
Polemidhia		
Pomos	Control hat	
Ayia Marina		
Mavrokolymbos		
Kalopanayiotis	Distr. System	
Sygrassis	Location T.W.L.	Land acquisition
Phinikaria	Road Diversion	
Vathis Intake	Topography	
Syngrassi	Setting-out of structure.	Construction.

DRAWING OFFICE

The year 1966 is the 4th year after the setting up of the Drawing Office.

The staff of the Drawing Office at the end of the year numbered 17 daily wages employees all but one female not including the Officer in charge also on daily wages.

During the first nine months of 1966, the staff varied for 4 to 8 daily paid members of both sexes.

With the employment of Female staff (who have proved themselves very competent) it is hoped that recruitments are trained and retained in the Drawing Office for good.

Nevertheless it has been found that after receiving considerable training members of the Drawing Office are attracted to better paid jobs with prospects of permanency or seek scholarships for further studies.

Four years after the setting up of the Drawing Office only one member has completed a service of 2 years, another $1\frac{1}{2}$ years, two others 1 year and the remaining eleven members approximately 3 months.

During 1966 except for work on numerous minor and major projects the Drawing Office carried out the work entailed in the preparation of the Watershed Planning Maps which show existing irrigation networks water sources, land under irrigation and crops cultivated. Such maps were prepared for the Watersheds of:-

Marathasa River;
Ezuza River;
Xeropotamos River;
Diarizos River;
Khapotami River.

Kourris and Garyllis Rivers maps are also completed (before 1966). Surveys have been carried out for Khrysokhou, Atsas and Karyiotis Rivers for which maps are to be prepared during 1967.

In September 1966, a meeting of section leaders of the Department discussed the first Instructions Manual which was finally approved by the Director. This is Instructions Manual No. 1 "DRAFTING STANDARDS". The aim of this manual is at standardising the preparation of drawings and securing the greatest possible uniformity and style in drawings. It also contains information on maps standard drawings, etc.

CONSTRUCTION SECTION ACTIVITIES

The year under review, saw yet another thriving construction activity in the field of Major Irrigation Projects, i.e. the construction of dams for irrigation, recharge, water supply or flood control purposes.

The works in hand during 1966, comprised projects constructed by W.D.D. directly and dams whose executive was entrusted to civil engineering contractors, under joint supervision from W.D.D. personnel and Consultant's engineers.

In the field, the section employed 3 executive engineers, 3 inspectors and 4 technical assistants.

A. YERMASOYIA DAM

The first year of construction activities saw the completion of the diversion tunnel as well as the coffer dam. The cut off trench excavation was completed and partial filling of the trench up to level 185 R.L. was achieved, before the onslaught of the 1966-67 winter. This multipurpose scheme is billed to cost £1,007,000 and will take 3 years to complete.

B. POMOS DAM

In 1966, the spillway chute was partially completed up to Section 14. Also the grouting of the tunnel and embankment grout curtain was undertaken and completed by Messrs. Foundation Engineering in conjunction with Ioannou and Paraskevaides. The first complete impoundment (270 M.C.) of the reservoir took place, towards the end of 1966, when the dam spillway was allowed to overspill. In the year 1966, the 2nd system of distribution was completed.

C. ARGAKA MAGOUNDA DAM

Some minor repairs to the Dam were undertaken by the Construction section in early 1966, amounting to £1000. The upstream check valve was removed, and a diversion in the stream leading to the penstock was constructed.

D. MAVROKOLYMBOS DAM

After the completion of the embankment in 1965, the Contractors Messrs. Cyprus Building and Road Construction Company completed the Spillway and the rip rap on the upstream face and redesigned installation of the hydromechanical equipment. In December 1966, the contractor moved out of the site, with the completion certificate still pending.

E. KALOPANAYIOTIS DAM

The first half of the year was taken by the grouting of the fault in the river bed, as well as the grouting of the abutments. The second half saw the completion of the embankment and spillway. The dam is ready to impound water in 1967. The distribution will be constructed in 1967.

F. POLEMIDHIA DAM

In 1966, the grouting of the foundations continued. Substantial work was done on the left and right abutments as well as on the investigations for the extension left and piezometer drilling.

Plans for the extensions left and specifications were prepared, for a separate contract amounting to an estimate £100,000. Work will be tendered for and given under a new contract. Original grouting expenditure billed £200,000.

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REPORT ON WORKSHOPS

The Workshop Section of the Department attends to the maintenance of all departmental plant and in addition serves all the other sections in respect of Development Schemes such as building of forms for concrete works, carpentry, the supply of procast concrete products, the installation of pumping plant, repairs and maintenance of town and village water supply plant, the fabricating of special pipe connections and steel sluice gates, the cutting and bending of steel reinforcement, the slotting and perforation of pipes and drilling casing, forging and electrowelding drilling bits for boreholes. Also the gate guides, transition lining, construction for Polemidhia and Mavrokolymbos have been constructed for the above dams, and the complete Supervision of the Hydromechanical equipment has been carried out by the W.D.D. Workshops at Mavrokolymbos Dam successfully.

The Workshop and Stores accommodation include Workshop's office, garage, filters shop plant maintenance bay, precast concrete yard, welders shop, smithy, a small moulding shop.

80% of the employees of the workshop and stores are employed for development projects, such as irrigation schemes, village water supplies, hydrological works and drilling. 20% are employed for the maintenance of plant and tools.

In 1966 machinery to the value of £11,000 was bought for the needs of the department such as core drilling and overburden equipment Land Rover.

A list of the chief items of plant now on charge is given in Appendix 21. Other plant is hired from contractors or borrowed from other Departments as required. A lot of earth moving machinery was hired for construction. Heavy lorry transport is all hired from contractors, but some departmental Land Rovers were used for the transport of personnel, light tools, etc.

Pumping plants were installed by the workshop for village water supplies and irrigation schemes.

MECHANICAL PLANT
(as on 31/12/66)

MOBIL PLANT:	No. 1966
Ruston Bucyrus Drilling rigs 22W	10
Ruston Bucyrus Drilling rigs 60RL	1
Water Dev. Department (1959) drilling rigs ..	-
Cheshire earth boring machine	-
Allen Trencher 12" - 21'	2
Avelling-Barford Trencher	-
Caterpillar D8	3
Caterpillar Traxcavators 955	4
Caterpillar Traxcavator HT4	1
Caterpillar Bulldozer	-
International Bulldozer	1
Ruston Bucyrus Excavator RB10	1
Ruston Bucyrus Excavator RB19	1
Compressors	16
Diesel Alternator on trailer	6
Electrosubmersible test pumps	10
Turbine deep-well tost pumping units	2
Centrifugal pumping units	4
Portable works pumps	15
Sheepfoots roller	18
Cranes	1
Hoists	3
Concrete mixers	41
Vibrators	33
Low loader	1
Austin Countryman Vans	-
Land Rovers	27
Fordson Lorry 3 ton	-
Thornycroft Tractive Unit for Low Loader ..	1
Dumpers	3
Bray Loader	1
Vibrating Rollers	4
5 ton diesel lorry	1
Soil compactors	3
Wood cutting machine	1
Cortina Saloon	1
Wagon Drill	1

REPORT ON MINOR IRRIGATION, RECHARGE AND IRRIGATION DISTRIBUTION FROM DAMS

A. MINOR IRRIGATION

There was no money in 1966 for the construction of any of our popular small irrigation schemes for village Divisions or private Associations. Some new schemes were prepared during the year and added to the long waiting list of minor irrigation projects that could be undertaken when funds become available - Appendix A.

A comparatively small amount of money was budgetted in 1966 for the lining of irrigation canals in the Morphou plain; these works are described in more detail herebelow:

Lining of Irrig. Canals in Western Messaoria

Continued overpumping for irrigation in villages situated on the Morphou - Serakhis basin, and the observed ground-water depletion has created the need of saving as much water as possible. One of the more important measures and methods indicated for this purpose, in this particular area, is the lining of distribution canals which convey irrigation water from private or public borcholes to individual farms.

The method of lining consists of the construction of reinforced concrete channel sections cast in situ with timber moulds. The flow capacity of the channels varies from 3 to 10 cubic feet per second and the cost averages at 1,000 mils per foot. It is estimated that about 20% of the water now pumped for irrigation in this area will be saved by providing watertight canals along the main lines of distribution.

Owing to the very large sums of money required to line vast length of channels involved in this project, an effort is being made to carry out the work by stages in accordance with annual budgetary provisions. The villagers pay 50% of the cost of the works by loan from Government, and a system of priorities is being followed in consultation with local Committees.

An amount of £55,000 was spent in 1966 for the lining of canals in the Morphou plain as shown on Table I below:-

TABLE I

Name of Division	Quantity of water conveyed in gallons per hour	Total Estimated Cost	Amount spent in 1966	Length of channels completed
P. ZODIA	305,000	£48,000	£9,000	8,300
K. ZODIA	473,000	£56,000	£9,000	9,960
ARGAKI	895,000	£82,000	£6,000	6,127
*KATOKOPIA	258,000	£77,000	£6,000	6,000
*PRASTIO	619,000	£63,000	£9,000	8,500
*NIKITAS	246,000	£30,000	£9,000	10,850
*OVGOS (Morphou)	1,000,000	£84,000	£7,000	8,000
TOTALS	3,796,000	£440,000	£55,000	57,737

* Work is being continued at the end of the year. For Ovgos £40,000 was spent in 1965, out of the total estimated cost.

It is noteworthy that all the farmers are showing a great interest in these works and they appreciate the results derived thereof. Schemes for lining irrigation canals are being prepared for the Divisions of Peristerona, Astromeritis, Akaki and Massari.

During 1966 arrangements were being mde for the introduction of prefabricated reinforced concrete irrigation canals with a view to improving the quality and efficiency of the works and for reducing the cost.

B. RECHARGE:

A total of £134,930 has spent in 1966 for recharge works, particularly in the Famagusta district. More notable is the supplimentary stage of works carried out on the Famagusta - Dherinia aquifer at a cost of £65,000. A list of Recharge scheme completed in 1966 is listed on Table II.

T A B L E II

No	Name	Storage in million gallons	Number of Dam or spreading grounds completed	Cost
(1)	Famagusta - Dherinia	1,100	Diversion and Enlargement of Ay. Loucas Lake, and two minor Dams.	£65,000
(2)	Makrasyka	43.	1.	£17,500
(3)	Kondea	17.	2.	£ 7,500
(4)	Avgorou	20.	8.	£12,000
(5)	Phrenaros	10.	4.	£5,230
(6)	Sotira	14.	5.	£7,500
(7)	Xylophagou	20.	4.	£9,000
(8)	Ay. Georghios (K)	20.	9.	£8,000
(9)	Syngrasis	30.	Experimental	£3,200
	Total	1,284		£134,930

The method of Recharge applied in most of these schemes is surface spreading. Flood waters running to waste in torrents are diverted into small artificial lakes or impounded on the bed of the torrent with earth dams. The water percolates through the persons impounding surface to reach the underground aquifer by vertical infiltration. Thus any harmful bacteria contained in the water are killed in the process of infiltration and any clogging of the spreading surface can be removed by mechanical scraping. In the major scheme of Famagusta -Dherinia the water is allowed to settle before used for recharge. An experiment for recharge through vertical well is being continued in Ay. Pappos from Syngrasis Reservoir. All the sites are selected after geological investigations conducted by the Geological Section of the Department for each particular scheme. The average cost of impounding water by this method is £500 for million gallons. The beneficial effect of these works to irrigation water supplies from boreholes is reflected in the interest taken by the villagers to initiate action on the implementation and to maintain these works, for which they contribute $\frac{1}{3}$ of the cost by loan from Government. The works completed in 1966 are briefly described as follows:-

(1) Famagusta - Dherinia Recharge Scheme
(1965 - 66 Programme of Works, £65,000)

This is a continuation of a larger scheme of works which has been carried out in successories stages, from 1956. The object of the works is the artificial recharge of the Famagusta - Dherinia aquifer which has been badly depleted from overpumping, and where sea-water intrusion has polluted the water of many boreholes and wells near the coast line to the detriment of a thriving citrus industry.

The older works provided for the diversion of surplus run-off waters, draining the catchment areas of "Kokkinochoria", south-east of Famagusta. Most of these waters were passing through saline surfaces round Akheritou and then diverted lower down into three interconnected artificial lakes namely: Ay. Nikolaos (300×10^6 gallons). Fresh Water Lake (750×10^6 gallons) & Ay. Loucas (100×10^6 gallon). Recharge was effected through an underground tunnel emanating from Ay. Loucas lake and terminated in Kato Dherinia; this tunnel was excavated through porous sandstone for some seven miles parallel to the coastline with its invert at sea level.

The scheme operated successfully for the last ten years but lately it has developed the following disadvantages: (a) The rate of recharge had slowed down because of clogging through the periphery of the tunnel (b) Development and recharge works on the south - east catchment area had reduced run-off (c). The smaller quantities of water passing through Akheritou marshes became saline and unsuitable for recharge.

The 1965 - 1966 programme of works was designed to overcome the said disadvantages as follows:-

(a) Surplus flood water draining from the north - east catchment. (Plakos and Kopris) were diverted into the fresh water lake. This has necessitated the construction of a two - mils long composite embankment and flood canal with two safety spillways capable to discharges at a rate and 1000 cusec and involving some 100,000 m^3 of earthworks.

(b) Pumping from the recharge tunnel into a series of spreading grounds which have been selectively located on pervious surfaces so that vertical infiltration will benefit the most depleted zone of the aquifer. Two large electrosubmersible pumps have been installed in the Ay. Memnon area. One at Kato Varosha and one diesel - engine pump on the Ay. Nicolaos valley. The rate of pumps from all units is at 4.5 million gallons daily and 10 spready grounds were established by open - cast excavations to a total holding capacity at 20 million gallons.

A separate dam reservoir of 16 million gallons capacity was constructed in the Ay. Marina locality south of Ay. Memnon for local recharge and a combined minor antiflood and recharge dam of 5 million gallons at Kato Dherinia. This latter dam has it's overflow discharging into the old antiflood dam which was constructed some years ago for recharge and for flood protection of Famagusta town. The scheme includes also the raising of the Fresh Water Lake spillway for increased storage at 1,050 million gallons. With the completion of the 1966 programme of works the total quantity of water that can be impounded in artificial lakes and spreading grounds for recharge on the Famagusta-Dherinia aquifer exceeds 1,500 million gallons.

At the time of writing some 500 million gallons of water from the "Plakos" diversion has been stored in the Fresh Water Lake and pumping into spreading grounds is in progress.

(2) Makrasyka Recharge Scheme, (£17,000)

This consists of an earth dam of 17 feet weight and impounding reservoir of 43 million gallons capacity, with overflow spillway protected with proper and appropriate concrete structures. Water is expected to percolate through the porous bed of the reservoir and replenish the underground water deposits of the area. The villagers have contributed $\frac{1}{3}$ of the cost of the scheme by loan from Goverhment. The scheme has operated quite satisfactorily during the first floods of 1966-67, when the dam filled twice and all the water was quickly absorbed into the aquifer.

(3) Kondea Recharge Scheme (£7,500)

Two earth dams were constructed one at "Aylasyka" and the other at "Ayios Mamas" localities. The former being 15 ft. high, storing a maximum of 12 million gallons and the latter 13 ft. high and of 5 M.G. capacity. Both filled up a few times in the floods of 1966-67 and proved to be very beneficial to the aquifer.

(4) Avgorou Recharge Scheme (12,000)

This scheme consisted of a number of very small earth dams and/or excavations which proved spreading ground of a total holding capacity at 20 million gallons in the higher grounds of Avgorou Area. As no actual streams exist in the area these works were constructed in small depressions where by the help of diversion embankments it will be possible to collect local run-off water during high intensity rainfalls; recharge is effected through the porous havaras which form the bed of the spreading grounds.

(5) Phrenaros Recharge Works (£5230)

These works form the 2nd Stage of the Scheme. The first stage met with considerable success in 1964. Thus encouraging the constructions of a further three small earth dams with reservoirs of 10 million gallons capacity. The Famagusta Water Board contributed towards these works, as a number of B.Hs in the area of the Recharge Works are operated for the Famagusta Water Supply.

(6) Sotira Recharge Scheme (£7,500)

This again is a continuation of earlier works and consists of a number of small earth dams on minor streams south of the village which used to run to the sea. The total capacity of the dams is 8 million gallons. A larger dam-reservoir for recharge was constructed earlier in 1963.

(7) Xylophagou Recharge Works (£9,000)

This scheme consists of 4 small earth dams on small streams which used to run to the sea. These dams have a capacity of 20 Million Gallons and their upstream reservoir beds are highly permeable.

(8) Ayios Georghios (Kyrenia) Recharge Scheme (£8,000)

Nine small earth dams have been constructed on the slopes of the Kyrenia Range between Ayios Georghios and Trimithi villages. These have a total capacity of 20 million gallons and are the first of such works to be carried out on the Morphou slopes of the Kyrenia Mountains. They have operated very successfully during the 1966-67 intensive rainfalls on the Kyrenia hills and the owners of shallow wells for the irrigation of lemons are very enthusiastic about the results.

(9) Ay. Pappos (Lapathos) Experimental Recharge Scheme

An experimental stage of works was constructed in 1966 with view to recharging the Ay. Pappos aquifer supplying domestic water to several villages from the Syngrassi Reservoir which is proposed for reconstruction in 1967. The ultimate scheme postulates pumping water from the Syngrassis reservoir into wells selectively located on or near the pumping grounds. The mouth of the old Syngrassi spillway was raised with a temporary embankment and some 30 million gallons were stored late in the year. Clear water through a float intake was pumped along a pipeline 14,000 feet long to some selected wells which absorbed water at a rate ranging from 100 to 50 cubic meters / hour, £3,200 has been spent on this scheme; the operation and the study of the results will be continued in 1967.

C. IRRIGATION DISTRIBUTION FROM DAMS

(1) Kiti (£50,000)

The distribution networks from the Kiti dam was continued from 1965 and completed during the year. The scheme as completed provides for -

(a) A conveyor Pipeline from the Dam to the top of the Kiti - Pervolia area.

(b) Unification by extension with concrete channels of the old existing spate irrigation system of KITI, KOKKINOS, SOFTADES, STEFANAKI & PERVOLIA

(c) Lining in reinforced concrete the principal distributaries within the area to be irrigated from the dam including TERSEPHANOU which is situated immediately below the dam.

A total of 8,000 feet x 21" Ø pipes and 1,000 feet of smaller diameter pipes were laid; 37,623 feet of reinforced concrete channels of sizes ranging from 33"x18"x4" to 16"x15"x4" were constructed together with the requisite number of smaller auxiliary works such as irrigation outlets, measuring devices and level crossings.

More concrete channels will be required in order complete the watertight distribution system within the area to be irrigated from the dam, estimated at 2,100 donums.

(2) Ay. Marina Distribution Stage II (£17,908)

This work followed the completion of the dam and the primary distribution system which were started in 1963 and completed at the end of 1965. It consists of a pipe network divided in three principal divisions containing 580,505,415 donums respectively. A total of 48,540 feet of pipes ranging from 6" diameter to 2½" Ø have been laid together with the construction of 230 valve outlets with concrete manholes and other ancillary works. The scheme was completed in time for operation during the summer of 1966 when water from the dam was metered out en-bloc to the Irrigation Division Committee.

(3) Pomos Distribution Stage II (£30,000)

This work followed the completion of the dam and the main conveyor channel and consists of a network of steel branch pipes emanating from the conveyor channel for secondary distribution within an area of 2870 donums. The location of the branch pipes was decided in consultation with the Department of Agriculture in view of prospective land-levelling works which were not started at the time of construction. A certain sector however, of approximately 400 donums was not provided with the secondary distribution as laid down in the scheme because of very steep slopes and other adverse conditions necessitated that land levelling works should precede the distribution network.

The actual expenditure spent in 1966 was £25,637 on the following items:-

(1)	Trenching and Laying of pipes of 6" ø to 3" ø total length	50,200 feet.
(2)	Valve outlets with concrete manholes	255
(3)	Measuring Devices	42
(4)	Asphalt Crossing	12
(5)	Cleaning and Repairs to the main conveyor channel	

The scheme was completed in time for irrigation from the dam during summer 1966.

(4) Mavrokolymbos Distribution Stage I (£124,000)

This is the major part of the Distribution system from Mavrokolymbos dam estimated at £168,000 and designed by a consulting firm from abroad. The first stage of the works estimated at £124,000 includes the main conveyor canal from the dam to the boundary of Kissonerga Khloraka and secondary distribution piping within the Potima Chiftlik and Kissonerga village. Only £15,000 was spent in 1966 out of which £3,000 was reserved for the payment of pipes ordered from abroad. The balance of £12,000 was spent for preliminary works such as access roads, water supply tank distribution for the concretor. A start was made on levelling the sites of the conveyor channel along some very rough and steep slopes over the river bank. A bench terrace of some 5,000 feet long and 30 feet wide across together with 2,000 feet of R.C.C. channel of 14 cusec capacity was completed by the end of the year. This work alone has involved the excavation of some 120,000 cubic yards of rocky precipice to accomodate the channel access road, and drainage. Work on the project is being continued over the new year and a detail report will be included in the Annual Report of 1967.

Appendix (A)

LIST OF SMALL IRRIGATION SCHEMES READY FOR IMPLEMENTATION AT THE END OF 1966 NICOSIA DISTRICT

Ser. No.	W.D.D. reference	Village	Division or Association	Locality	Nature of proposed works	Estimated Cost £	Village Contrib. %	Remarks
1	105/1963	Pera-Politiko	Division	Pedieos R.	Diversion Groyne and Intake channel for winter flood Irrig.	4,600	1/3	450 dons. peren.
2	27/1939	Ergates	Division	Pedieos R.	- do -	2,600	1/5	300 " "
3	51/54	Peristerona Astromeritis	Division	Peristeronas	Lining of channels	21,000	1/4	4,000 dons. Winter 4,000 dons. Spring
4	101/40	Akaki	Division No2	Demoskes Mersini	Lining of channels	1,200	1/3	50 dons. Spring 10 dons. Perennial
5	57/51	Kato-Koutrafas	Division	Valianitiko	Lining of channels	1,650	1/4	160 dons. Spring
6	45/51	Kalon Khorion Lefkas	Division	Sub-surface Dam	Well with infiltration gallons and pumping scheme	2,000	58%	120 dons. Perennial
7	127/40/112	Kannavia	Division	Vati	Lining of channels	580	1/3	5 dons. Spring 2 dons. Perennial
8	127/40/92/A	Milikouri	Division	Platis	Pumping Scheme	12,000	1/3	180 dons. Perennial

LIST OF SMALL IRRIGATION SCHEMES

NICOSIA DISTRICT

Ser. No.	W.D.D. reference	Village	Division or Association	Locality	Nature of proposed works	Estimated Cost £	Village Contrib. %	Remarks
9	94/52/IV	Kythrea	Association	Kefalovryson of Kythrea	Lining of channels	12,379	50% (£6,150)	1,000 dons. Perennial
10	36/42	Argates	Association	Kourtoudji	Regarding lining of exfiltration Tunnel & General improvement	7,176	48%	190 dons. Winter 266 dons. Spring 93 dons. Perennial
11	107/52	Palekhori	Association	Kamini	Storage tank & lining of channels	970	44%	15 dons. Spring 10 dons. Perennial
12	88/52	Pharmakas	Association	Koshina	Distribution system and lining of channels	2,800		146 dons. Winter 70 dons. Perennial
13	91/63	Pano Deftera	Association	Parlaki	Chain-of-wells improvements and lining of channels	10,000	52%	700 dons. Winter 99 dons. Spring 31 dons. Perennial
14	127/40/56	Lakatamia	Association	Mavrovrysi	Lining of channels	27,000	56%	2,800 dons. Winter 800 dons. Spring.
15	22/39	Gal...	Division	Esso Galata	Development of Mountain springs and Irrigation Distr. Works	11,500	⅓	200 dons. Perennial 21 dons. Winter 235 dons. Spring 104 dons. Perennial.

44.

LIST OF SMALL IRRIGATION SCHEMES
NICOSIA DISTRICT

Ser. No.	W.D.D. reference	Village	Division or Association	Locality	Nature of proposed works	Estimated cost £	Village Contrib. %	Remarks
16	22/39	Galata	Division	Ganos-Gyros Ay. Paraskevi	Distribution works (channels and pipes)	3,500	1/3	70 dons. Spring 345 dons. Perennial
17	127/40/25	Kakopetria	Division	Apliki, Taoutidhes	Lining of irrigation channels	12,000	1/3	45 dons. Winter 115 dons. Spring 100 dons. Perennial
18	30/42	Galini	Division	Mersinaki	Diversion weir and earth channels for spate irrigation of cereals	1,550	1/5	100 dons. Winter
19	127/40/92/B	Milikouri	Division	Potamos	Sub-surface weir and conveyor	800	1/3	25 dons. Perennial
20	57/195	Kato-Koutrafas	Division	Near the Village	Pumping scheme	7,000	1/3	53 dons. Perennial 35 dons. Spring
21	127/40/97/3	Moutoullas	Division	Katouris River.	General Consolidation of the exist. Distribution system	7,500	1/3	34 dons. Perennial 32 dons Spring
22	61/1952	Farmakas	Association	Domanoni	Distributions pipes	340	1/3	17 dons. Perennial
23	103/44/II	Xyliatos	Division	Palevros	Extension of the conveyor system	780	1/4	87½ seasonal
24	94/53/IV	Upper Kythrea	Division	Pano & Kato) toumbes,) Shellovarta) Pertelemes)	Lining of Canals	2,400	1/3	92 dons. Perennial

LIST OF SMALL IRRIGATION SCHEMES
NICOSIA DISTRICT

Ser No.	W.D.D. reference	Village	Division or Association	Locality	Nature of proposed works	Estimated cost £	Village Contrib. %	Remarks
	SOLEA VALLEY							
25		Kaliana	Division	Neron-tis-Tsiappas	Lining of the conveyor canals	800	1/3	
26		Korakou	"	Esso-Demma	- do -	4,800	1/3	
27		Tembria	"	Esso-Demma	- do -	5,200	1/3	
28		Evrykhou	"	Demma-Evrykhou	- do -	3,600	1/3	
29		Petra	"	Petrassis	- do -	4,000	1/3	
30		Katydata	"	Neron-Tzamis Neron-Mylou	- do -	2,600	1/3	
31		Flassou	"	Koussouliotis	- do -	2,000	1/3	

LIST OF SMALL IRRIGATION SCHEMES

KYRENIA DISTRICT

Ser. No.	W.D.D. reference	Village	Division or Association	Locality	Nature of proposed works	Estimated Cost £	Village Contrib. %	R e m a r k s
(1)	79/1961	KARAVAS	Irrig.Assoc.	Platani	Completion works, Lining of Distribution canals.	750	50%	29 dons. Perennial

LIST OF SMALL IRRIGATION SCHEMES

LIMASSOL DISTRICT

Ser. No.	W.D.D. reference	Village	Division or Association	Locality	Nature of proposed works	Estimated cost £	Village Contrib. %	Remarks
1	127/40/5/ III	Ay.Ioannis	Division	K. Agros	Distribution works	1,500	630	10 dons. spring 30 dons. Perennial
2	"	"	"	Ay.Georghios to be formed	Small tank and Distribution works	2,300	46%	25 dons spring 26 dons perennial
3	"	"	"	Pervolia	Distribution Works pipes and channels	540	140	16 dons perennial
4	"	Agridhia	"	Kaouris	- do -	900	300	17 dons perennial
5	"	"	"	Pano Enetikon	Distribution works pipes and channels	1,740	580	21 dons spring 14 dons perennial
6	127/40/18/IV	"	Division & Association	Vrysi tou khoriou to be formed	Distribution pipes	4,500	;	1 don winter 7 dons perennial
7	42/1943/2	Phini	Division	Chrysomilies	Distribution pipes	350	117	8 dons winter 11 dons spring 16 dons perennial
8	127/40/99/V	Agros	"	Taliou	Small Tank, Distribution system	1,140	380	15 dons perennial
9	"	"	Division to be formed	Dhikha-lorotsos	Small Tank, Distribution system	930	;	10 dons perennial

LIST OF SMALL IRRIGATION SCHEDULES

LIMASSOL DISTRICT

Ser. No.	W.D.D. reference	Village	Division or Association	locality	Nature of proposed works	Estimated cost £	Village Contrib. %	Irrigated Area
10	39/42	Pera-Pedhi	Division	Near the village	Extensions & improvement to the irrigation distribution system	2,200	734	120 dons Perennial
11	127/40/49/II	Kyperounda	"	Deisis	Pipe Distribution system	3,730	1/3	49 dons spring 57 dons perennial
12	127/40/49/II	"	Division to be formed	Vasiliko	Extension of Distribuption pipes	420	1/3	49 dons spring 9 dons perennial
13	"	"	"	Solomonidhes	New irrigation System weir, Tanks & Distribution Works	2,000	1/3	13 dons spring 15 dons perennial
14	"	Ay.Pavlos	Division	Domes	Distribution pipe system	1,060	354	22 dons perennial
15	"	"	"	Stirakas	Conveyor pipes	560	187	8 dons spring 32 dons prennial
16	127/40/134/C	Pelendria	Association	Nikomitis	Irrigation Distribution channels	630	252	15 dons perennial
17	"	"	"	Kato Psilo	Irrigation Distribution Works	940	395	16 dons spring 16 dons perennial
18	"	"	"	Avlaki Hji Stylianou	Small concrete Tank (5000 gallons) Distribution channels	700	36%	3 dons spring 8 dons prennial
19	"	"	Division	Psilon Enklisis	Small Tank, Distribution channels	1,000	334	20 dons perennial

LIST OF SMALL IRRIGATION SCHEMES

LIMASSOL DISTRICT

Ser. No.	W.D.D. reference	Village	Division or Association	Locality	Nature of proposed works	Estimated Cost £	Village Contrib. %	Remarks
20	127/40/134/C	Pelendria	Division to be formed	Kanaris	Distribution pipes	480	;	12 dons perennial
21	"	"	Division	Sarakinos	Irrigation Distribution pipes	440	147	17 dons perennial
22	61/42	Silikou	Division	Lavrania	Lining of channels	2,570	33%	73 dons perennial
23	112/59	K.Amiantos	"	Appis	INTAKE OF AMIANTOS RIVER & DISTRIBUTION CHANNELS (Construction of existing layer scheme)	1,325	1/3	20 dons perennial
24	109/1944	Akrounda	"		Distribution works	6,000	1/3	105 dons spring 75 dons perennial
25	127/40/134/C	K.Amiantos Pelendria	"	Kato Phylagra	Distribution works	2,600	1/3	5 dons spring 30 dons prennial
26	112/59	K.Amiantos	"	P.Phylagra	Storage Tank and Distribution works	1,700	1/3	10 dons spring 26 dons perennial
27	127/40/153/IV	Trimiklini	"		Extension of the Distribution	4,300	1/3	100 dons spring 400 dons perennial
28	45/1944/II	Pyrgos	"	Pattikha	Pumping scheme and Distribution system	4,300	1/3	42 dons spring 27 dons prennial
	Superseded 29/45/44/II	Pyrgos	"	Almyrovryssi	Lining of canals	4,000	1/4 £1,000	80 dons seasonal
	43/44/I	Pyrgos	"	Dimmo-tis-Pegeias	Lining of canals	3,500	1/4 £875	300 dons seas[illegible]

LIST OF SMALL IRRIGATION SCHEMES

LIMASSOL DISTRICT

Ser. No.	W.D.D. reference	Village	Division or Association	Locality	Nature of proposed works	Estimated Cost £	Village Contrib. %	Remarks
30	127/40/23	Omodhos		Pighadi	Irrigation Tank and distribution pipes	900	1/3	8 dons spring 7 dons prennial
31	68/41/II	Arakapas	Division	Angoulos Potamos Panayiotis	Lining the distribution channels	2,600	1/3	18 dons spring 62 dons perennial
32	127/40/22B	Dhymes		Kambos	Lining of channels	1,100	1/3	20 dons perennial
33	127/40/54	Athrakos	Division	Mavrosy-kiotis	Irrigation Tank and Distribution pipes	1,200	1/3	14 dons spring 26 dons perennial
34	127/40/49/36	Kyperounda	Association to be formed	Frakti Postani	Excavation of spring pumps and distribution works	1,200		8 dons spring 7 dons perennial
35	127/40/84/II	Yerasa	Division	-	Extension and completion of the distribution system	3,100	1/3	59 dons perennial
36	63/65	Kyperounda	Nothing	Livadhin tis Mesis	Irrigation Tank and Distribution pipes	1,250	1/3	22 dons perennial 18 dons spring
37	127/40/49/22	Kyperounda		Klima	Irrigation Tank and Distribution pipes	1,000	1/3	10 dons perennial 5 dons spring
38	28/1942	Lemythou	Division		Conveyor and Distribution pipes	1,200	1/3	52 dons perennial 8 dons spring

LIST OF SMALL IRRIGATION SCHEMES

LIMASSOL DISTRICT

Ser. No.	W.D.D. Reference	Village	Division or Association	Locality	Nature of proposed works	Estimated Cost £	Village Contrib. %	Remarks
39	27/40/16/C	Kalon-Khorion	Division	Near the village	Consolidation of Distribution system	1,150	1/3	44 dons Perennial 16 dons spring
40	127//40/49/48	Kyperounda	Subject to the formation of Div. or Assoc.	Appis	Distribution R.C.C. canals and pipes	600	;	12 dons perennial
41	127/40/95/II	Potamitissa	Division	P&K.Potami	Irrig. Tank and Distrib. pipes	1,140	1/3	22 " "
42	127/40/95/II	"	Nothing	Hassanis	Tank and Irrig. channels	1,200		16 " " 4 dons spring
43	127/40/17/II	Ay.Pavlos	Division	Dhima tou khoriou	Distribution pipes	500	1/3	50 dons perennial
44	127/40/49/34	Kyperounda	(To be formed)	Thymon spring	Distribution pipes	1,350	;	20 dons perennial
45	127/40/49/II	Kyperounda	Division	Kialia	Irrig. Tank and Distr. pipes	900	1/3	14 dons perennial
46	127/40/52/III	Ay.Ioannis Agrou	"	Aggoulos Dhipotamia	Distribution channels	900	1/3	12 " "
47	127/40/134/C	Pelendri	Division	Kountou-rides	Distribution channels	1,100	1/3	45 " "

LIST OF SMALL IRRIGATION SCHEMES

LIMASSOL DISTRICT

Ser. No.	W.D.D. Reference	Village	Division or Association	Locality	Nature of proposed works	Estimated cost £	Village Contrib. %	Remarks
48	42/1943/2	Phini	Division	Dhimma tou Milou	Distribution works	9,300	1/3	371 dons perennial
49	127/40/165/2	Tris Elies	Division	Milarga	Extension Distribution works	2,800	1/3	50 dons perennial
50	"	"	"	Drakontas	Extension Distribution	5,700	1/3	180 " "
51	"	"	To be formed	Diplomata	Irrigation scheme, Diversion & Distribution system	2,300	1/3	25 " "
52	127/40/15/II	Kato Amiantos	Nothing	Kardhama	Channels and pipes Distribution system	1,100		17 " " 13 dons spring
53	43/42/II	Kilani	Division	Asomatos - Skotini-Ayia Marini-Iacovides-Amoutti	Distribution works	6,650	2.217	150 dons perennial 150 dons spring
54	127/40/59/II	Louvaras	Nothing	Tsoukallas	Tank and Distribution pipes	630		6 dons perennial 4 dons spring
55	127/40/99/V	Agros	Division	Milos Lambada	Distribution channels	900	1/3	25 dons perennial
56	31/54/II	Ay.Demetrios	Division	Kaloyiros	Irrigation Tank and Distribution system	2,700	1/3	151 " " 34 " spring
57	127/40/49/47	Kyperounda	Nothing	Halospities	Irrigation Tank and Distribution pipes	1,200		15 " perenni
58	127/40/113/C	Pelendria	Nothing	Pervoloudia	Irrigation Tank and Distribution pipes	1,150		8 dons per 4 dons s

LIST OF SMALL IRRIGATION SCHEMES

LIMASSOL DISTRICT

Ser. No.	W.D.D. Reference	Village	Division or Association	Locality	Nature of proposed works	Estimated Cost £	Village Contrib. %	Remarks
59	127/40/22/B	DHEMES	Association of Division to be formed	Hji Pelendrou	Distribution Canals	900	?	16 dons perennial
60	71/41	POTAMIOU	Division	Khapotami	Diversion & Distribution works	£2,150	1/3	27 dons perennial
61	127/40/20/B	AY. THEODOROS	Division	Vassiliki & Koufes	Sub-surface Dam & conveyor pipes	£2,800	1/3	41.5 perennial 62.0 seasonal
	"	"	"	Fountoukia	Lining of Distribution channels & storage Tank			50 paid
	"	"	Association	Perdikoussa	Lining of Distribution canal	600	1/3	40 perennial
62	70/49	Ypsonas	Division	Kourris Division	Repairs	600	1/5	-

LIST OF SMALL IRRIGATION SCHEMES
PAPHOS DISTRICT

Ser. No.	W.D.D. reference	Village	Division or Association	Locality	Nature of proposed works	Estimated Cost £	Village Contrib. %	Remarks
1	127/40/64	Dhrymou	Division	old village	Excavation and building of spring, construction of storage tank, lining of channels and laying of pipes	1,450	33%	20 dons spring 14 dons perennial
2	156/55	Ay.Marina Kelokedhara	Division	Klimaterous	Excavation and building of spring	300	33%	
3	96/44	Mandria	Division	Chain of wells	Lining of channels	12,700	33%	2,200 dons winter 1,300 dons spring 600 dons perenni
4	127/40/119	Tremithousa	Association		Laying of pipes	180	44%	5 dons. spring 10 dons perennial
5	179/39/II	Nata	Division	Vrysi	Excavation and building of springs, construction of two storage tanks and laying of pipes	2,100	33%	20 dons spring 17 dons perennial
6	127/40/III	Ay. Ioannis	Division	Palia Vrysi	Construction of storage tank and laying of pipes	700	33%	6 dons spring 7 dons perennial

LIST OF SMALL IRRIGATION SCHEMES
PAPHOS DISTRICT

Ser. No.	W.D.D. reference	Village	Division or Association	Locality	Nature of proposed works	Estimated Cost £	Village Contrib. %	Remarks
7	127/40/113	Prastio	Division	B/H173/61	Pumping unit	8,000	⅓	40 dons Spring 120 dons perennial
8	99/54	Ay.Varvara	Division	Ezuza river	Lining of channels	9,500	33	300 dons perennial
9	20/43	Timi	Division	B/H No.22/62	Pumping scheme	10,000	33	40 dons spring 160 dons perennial
10	88/61	Anarita	Division	BH 87/62	Pumping works and distribution system	13,500	⅓	40 dons spring 140 dons perennial
11	127/40/106	Miliou	Division	Potima	Weir and distribution system	2,950	⅓	30 dons perennial
12	127/40/79	Dhrinia	Division		Distribution pipes	1,580	⅓	21 dons spring 19 dons perennial
13	116/59	Kholi	Division	Arghaki tou Knoussou	Distribution system	1,560	⅓	22 dons spring 25 dons perennial
14	127/40/143	Kelokedhara	Division	Ziripillis	Extensions 1964-1965	3,000	⅓	40 dons spring 210 dons perennial
15	127/40/110/II	Panagia	Association	Sarka	Distribution piping	2,380	40%	25 perennial 11 seasonal

LIST OF SMALL IRRIGATION SCHEMES

FAMAGUSTA DISTRICT

Ser No.	W.D.D. Reference	Village	Division or Association	Locality	Nature of proposed works	Estimated Cost £	Village Contrib. %	Remarks
1	78/1939/A	Lysi	Division	Kotsines	Small Recharge works	400	1/3	
2	95/44	Kilanemos	Association	Piyadhi Halospitia	Distribution pipes	280	55%	Submitted 11/1/66
3	143/39/II	Marathovounos-Pyrga	Division	Neokhoritika Merrades	Diversion weir and earth canals for spate irrigation	500	1/4	Flood Irrigation
4		Gastria	Division		Pumping scheme	3,467	1/3	

LIST OF SMALL IRRIGATION SCHEMES
LARNACA DISTRICT

Ser. No.	W.D.D. Reference	Village	Division or Association	Locality	Nature of proposed works	Estimated Cost £	Village Contrib. %	Remarks
1	58/42	Ay.Vavatsinia	Division under formation	Kaloyiannos	Distribution works	1,035		Submitted 11/1/66
2	62/51	Ay. Vavatsinia	Association	Diplona	Distribution works	1,050	49%	Submitted 11/1/66
3	96/39	Khirokitia	Division	Anefantis	Pumping scheme & Distrib. system	3,400	1/3	120 dons perennial
4	96/39	"	"	Village Division	Phase II, extension of Distribution lined canals	5,200	1/3	350 dons spring
5	43/38/II	Ay.Theodoros	Division	Pentaskinos	Improvements and Repairs of existing irrigation works	750	1/3	
6	91/61	Maroni	"	Safto	Construction of storage tank	2,320	1/3	
7	43/38/II	Ay.Theodoros	"	Pentaskinos	Pumping Scheme	4,833	1/3	

TOWN WATER SUPPLIES

1. Work of the Section of Town Water Supplies is confined to:-

   (a) Administration of "Greater Nicosia Scheme"

   (b) Water Supply to Nicosia town suburbs

   (c) Water Supply to Government residences and institutions

   (d) Technical advice to the Water Boards of Nicosia, Limassol and Famagusta.

2. The most conspicuous place of this Section's activities during 1966 is taken by (a) the achievement in maintaining regular water supply to Nicosia town and suburbs during summer months and (b) the completion of "Yermasoyia Scheme" to supplement water requirements for Limassol town.

3. Nicosia town and suburbs:- Due to the poor rainfall during winter months and the yield of all sources getting lower from month to month, it became evident that even with the water pumped from the Morphou Bay Scheme at full capacity - 2 million gallons per day - it would bring us on the border line between supply and consumption. It is noted that due to the depression of the water level in Syrianokhori area, pumping from Morphou Bay Scheme is undesirable, Anyhow, in view of this state of affairs representations were made to the Minister, who it should be stated, had shown the greatest interest and eventually favoured Nicosia water supply by his concession. Nevertheless, with this supply in service, it so ha pened on several occasions of high consumption that we were facing shortage of water to certain areas and it could only be avoided through a great deal of efforts and the close co-operation existed between the Authorities concerned. In this respect, it is worth mentioning that the Officer responsible for this Section, in addition to his duties, he was assigned as Technical Superintendent of the Nicosia Water Board as from May, 1966 until 10th January 1967, when he left for U.S.A. on a seven months scholarship.

4. The total amount of water conveyed from the various sources reached the figure of 6,605,070 c.m. and was distributed as follows:-

(a) 1,965,966 c.m. for Greater Nicosia "area of supply"
(b) 4,348,664 c.m. for Water Board "Area of Supply"
(c) 290,440 c.m. for Water Commission "Town within walls"

5. The highest daily consumption was 21,450 c.m. or 4,719,000 gallons which equals to approx. 47.2 gallons per capita.

6. During 1966 the distribution system of the Greater Nicosia Scheme was extended by 45,940 ft. of asbestos cement pipes. Most of the extensions were carried out at the expense of private developers. This figure includes pipe laying for the New Industrial Estate near Mia Milia village, an area which although outside the boundaries of supply yet water was made available from Greater Nicosia Scheme on grounds of Industrial Development. During 1966, 505 new house connections were made, bringing the total number of consumers to 8,015.

7. The necessity of supplementary supplies, in order that Nicosia and suburbs may enjoy a regular water supply, is again emphasized. Until the time comes when a long-term solution might be implemented, it is indispensable that a new supply of about 2,00 million gallons per day is made available forthwith. It is expected that Pendayia scheme will be constructed in 1967 to relieve the Morphou Bay Scheme.

8. A statement of expenditure and revenue of the Greater Nicosia Scheme is given in Appendix No. 3.

9. Limassol:- The construction of the "Yermasoyia Scheme" has been completed. In fact, this scheme was put into operation on 27/5/1966 delivering water to Mesayitonia Reservoir with a view to supplementing any deficit towards the supply and provide pressurized water to high places which could not be well-fed by the Ayia Phyla Reservoir. With this scheme in service, existing sources may now deliver some 3.000 million gallons daily against an average maximum consumption of 2.6 m.g. daily.

The figure of 3.00 m.g.d. given above does not include the yield of "Chiftlikoudhia" chain-of-wells which will be abandoned.

10. Considering that this Scheme might be affected from the construction of a dam upstream, Cyprus Government has given the Water Board of Limassol a guarantee to the effect that any deficit on the output of the bo e - holes should be supplemented free from the water in the dam.

11. As a result of the implementation of the "Yermasoyia Scheme" the so called "Kourris Scheme" which would provide better utilization of the 10" Ø main pipeline from the springs during summer when their yield diminishes is likely to be delayed. Not only this, but difficulties both administrative and technical render its approval hesitative unless sources are found at convenient points which might not be affected by the construction of a dam in the Kourris River.

12. Famagusta:- Unfortunately, existing sources could not meet water demand during summer months and, therefore, restrictions to the supply were imposed.

13. The study prepared by Water Development Department for supplementary supplies to this town has been approved by the Planning Bureau. Necessary works as outlined in the report will be carried out in stages, and the Phase I started late in the year when funds were available.

14. Facts about Water Boards of Nicosia, Limassol and Famagusta given on Appendices Nos. 4, 5 & 6. respectively.

Appendix No.

Revenue and expenditure account of the Greater Nicosia Scheme for the year 1966.

Expenditure

(a)	Pumping charges	£13,408	
(b)	Purchase of water	8,477	
(c)	Maintenance charges	3,635	
(d)	Collection fees	13,920	
	Total		£39,440
(e)	Administration	£ 2,000	
(f)	Amortization (£650,000 in 30 years at 4%)	37,590	
			39,590
	Grand Total		£79,030

Revenue

(a)	Sale of water	£92,262
(b)	Connection fees	1,078
(c)	Usage of pipelines by Water Board	2,500
(d)	Other revenue (Stores etc.)	3,750
	Total	£99,590
	Profit for the year	£20,560

29

* The sum of £12,450 paid by Water Board of Nicosia for making use of the Morphou main pipeline is excluded. (An approximate amount of £15,000 being value of water supplied to Turks could not be collected due to the abnormal political situation).

Appendix No. 4

FACTS ABOUT NICOSIA WATER BOARD

1. Total quantity of water supplied from all sources (Water Board and Water Commission) during 1966 .. .. .. 4,639,104 c.m.

2. Total quantity of water consumed including Nicosia Water Commission registered by Area meters .. .. 4,198,411 c.m.

3. Maximum daily summer consumption .. .. 13,350 c.m.

4. Total number of consumers as at 31st December, 1966 10,472

5. Extension of distribution system:-15,880 ft. 4" ø A.C. pipes

6. (i) Number of Fire Hydrants installed in 1966 18

   (ii) Total number of Fire Hydrants installed within the Boards Area of supply as at 31st December, 1966 715

Appendix No. 5

FACTS ABOUT LIMASSOL WATER BOARD

1. Total quantity of water supplied from all sources .. .. 3,173,336 c.m.

2. Total quantity of water consumed registered by area meters, and supplied direct from Boreholes 2 and 7 .. .. 3,047,375 c.m.
   overflow 45,044 c.m.

3. Maximum daily summer consumption 14,005

4. Total number of consumers as at 31st December 1966 12,960

5. (a) Extension of distribution system:-
   (i) 23,698 ft. 4" ø A.C. pipes
   (ii) 3,036 ft. 6" ø A.C. pipes
   (iii) 4,409 ft. 8" ø A.C. pipes
   Total 31,143 ft.

   (b) Total length of distribution system as at 31st December, 1966:-
   (i) 489,364 ft. 4" ø A.C. pipes
   (ii) 71,324 ft. 6" ø A.C. pipes
   (iii) 20,565 ft. 8" ø A.C. pipes
   (iv) 27,000 ft 10" ø A.C. pipes
   Total 608,253 ft.

6. (i) Number of Fire Hydrants installed in 1966 25

   (ii) Total number of Fire Hydrants installed within Board's Area of supply as at 31st December, 1966 565

Appendix No. 6

FACTS ABOUT FAMAGUSTA WATER BOARD

1. Total quantity of water supplied from all sources .. .. 1,785,496 c.m.

2. Total quantity of water consumed registered by Area meters .. .. 1,676,845 c.m.

3. Maximum daily Summer Consumption .. .. 5,829 c.m.

4. Total number of consumers as at 31st December 1966 8,820

5. (a) Extension of distribution system:

   (i) 17,700 ft. 4" ø A.C. pipes
   (ii) 4,550 ft. 6" ø A.C. pipes

   (b) Total length of distribution system as at 31st December, 1966 .. 86.35 mils

6. (i) Number of Fire Hydrants installed in 1966 32

   (ii) Total number of Fire Hydrants installed within Board's Area of supply as at 31st December, 1966 531

PROSPECTING DRILLING AND HYDROLOGICAL SURVEY

In 1966 there were two much needed and welcome additions to the staff of the Drilling and Hydrological Section. Mr. I.S. Iacovides Hydrologist gained Government service in February, and Mr. M. Peppis Geologist, in August.

There have been no depletions or additions to the complement of Drilling Rigs since the last Annual Report. The present holding is: One heavy duty Bucyrus (60 R.L.) and 10 Bucyrus 22W for standard drilling. Three other Bucyrus 22W remain in the hands of the Turks. Unfortunately one of these and the only one of its kind held, was adapted for rotary drilling. Three small bore generator operated drilling rigs were used for technical purposes only, mainly to carry out foundation tests for proposed dam sites.

Throughout the year two Bucyrus Drilling Rigs were made available to the U.N. Special Fund Project for the drilling operations carried out by the Project.

70 boreholes were drilled for water with an aggregate footage of 14,477 feet and an average depth of 207 feet. Appendix No. 7 gives a clear picture of results by districts and sub-divided districts. Another 28 boreholes were drilled for observation, technical and geological purposes, making a total of 98. As against previous years drillings carried out by small gauge machinery for technical purposes at dam sites etc., have not been included in this report and appendices; although such drillings are essential and of great importance they are after all, simply a means to an end, and have no permanency. The average time taken to complete a borehole, including, when considered necessary, the laying of casings and a preliminary test pumping of about eight hours duration was 20 days. The average footage drilled per day was 8.9. 21 old boreholes were renovated or pumping installations improved, and the days involved in that work represented the equivalent of drilling 13 new boreholes.

Atotal of 32 boreholes and wells were subjected lengthy durability and potential test pumpings ranging from about 48 hours to 226 hours continuous duration. The volume

of water pumped was 22.7 million gallons over a total pumping time of 2,382 hours. Most of the tests were carried out by means of an electrosubmersible pump of $7\frac{1}{2}$ ø with a specified capacity head range of 18,000 g.p.h. from 100 ft., to 15,000 g.p.h. from 450 ft. Experience has shown that potential test pumpings are essential in order to determine the reliability of the aquifers.

Only eight boreholes were drilled directly for irrigation purposes, four of them being classed as successful. Some of those put down as "prospectors" will, however, undoubtedly be brought into use for irrigation later on.

The area now being irrigated as a result of Government drillings is most conservatively estimated to be 112,000 donums. The 1946 census estimated that in that year some 53,000 donums were being irrigated perennially by pumped water. By the end of 1966, as a result of Government drilling alone this has been increased by 211 per cent 165,000 donums. The above estimate is based only on the initial test of each boreholes and surveys may later reveal that with modern pumping units and improved irrigation methods the irrigated area far exceeds the above figure.

Drilling Costs

The average cost of departmental drilling in 1966, was £209.6 per borehole or £1.125 per foot of drilling. These costs are inclusive of the expenses of laying casing pipes as well as a short preliminary pumping test of boreholes with promise of a fair water yield. They are exclusive of purchase price of borehole casings and the capital cost and installation charges of permanent pumping plant. They include the wages of drilling crews, filters and blacksmiths, and the cost of workshop maintenance of drilling tools and equipment. Depreciation of drilling plant and the salaries and expenses of supervisory staff are not included.

Appendix No 7

Number and Footage of Boreholes

Number of Boreholes Drilled

1946 - 1966

Purpose	1946-1959	1960	1961	1962	1963	1964	1965	1966
For Private Individuals	1,919	165	55	22	12	11	2	8
For Government	555	13	126	207	190	86	215	83
For W.D.	308	10	18	18	11	14	16	7
Total	2,782	188	199	247	213	111	233	98
Aggregate Footage Drilled	535,755	49,887	49,681	51,292	40,301	22,825	27,506	16,980
Average Depth	193	265	245	208	189	206	118	173

Boreholes Drilled in 1966

Purpose	No.	Existing Well Footage	Footage Drilled	% age Successful	Total Tested Yield G. P. D.
Irrigation	8	-	1,125	50.0	736,800
Domestic W.S.	2	220	405	100.0	199,200
Prospecting	60	619	12,947	50.0	5,614,800
Total for water	70	839	14,477	51.4	6,550,800
Observation	4	-	182	-	-
Technical and Geological	24	-	2,221	-	-
Total Drilled	98	839	16,980	-	-

Number of Old Boreholes Renovated: 21

Boreholes Drilled for Water in 1966

Summary of Results

District	Locality	Number Drilled	Number Successful	% age Successful	Total Tested Output G. P. D.	Average Yield for Successful Borehole G. P. D.
Nicosia	Sha - Mathiatis	2	1	50.0	108,000	108,000
	Nisou	1	1	100.0	48,000	48,000
	Kato Moni	3	2	66.6	343,200	171,600
	Kato Pyrgos	1	1	100.0	120,000	120,000
	Phylia	1	-	-	-	-
	Peristerona	1	-	-	-	-
	Paleometocho	1	1	100.0	72,000	72,000
Kyrenia	Karmi	1	1	100.0	144,000	144,000
Larnaca	Tersephanou-Klavdhia	9	6	66.6	789,600	131,600
	Pyla	2	1	50.0	254,400	254,400
Limassol	Trakhoni-Episkopi-Ypsonas	4	3	75.0	679,200	226,400
	Yermasoyia	3	3	100.0	463,200	154,400
Famagusta	Syngrasis-Trikomo-Ay. Elias	5	1	20.0	43,200	43,200
	Phrenaros - Sotira	4	3	75.0	499,200	166,400
	Paralimni - Ay. Napa	2	-	-	-	-
	Trypimeni	1	1	100.0	384.000	384,000
	Lysi	3	1	33.3	432.000	432,000
	Phlamoudhi	1	-	-	-	-
	Gastria - Ay Theodhoros	6	-	-	-	-
	Eptakomi	1	1	100.0	120,000	120,000
	Rizokarpaso-Ap. Andreas Monastery	10	3	30.0	304,800	101,600

District	Locality	Number Drilled	Number Successful	% age Successful	Total Tested Output G.P.D.	Average Yield for Successful Borehole G.P.D.
Paphos	Polis - Goudhi	2	2	100.0	702,000	351,000
	Akamas Forest	4	2	50.0	504,000	252,000
	Akhelia	1	1	100.0	432,000	432,000
	Amargetti	1	1	100.0	108,000	108,000
		~70	36	51.4	6,550,800	182,000

* A successful borehole is one that yields on test not less than 1000 gallons per hour of usable water.

HYDROLOGICAL - SURVEYS

The hydrological surveys have as a target the evaluation of the water resources of the Island. For this, intensive field work, study and research is required. Field work includes the plotting and levelling of the wells and boreholes, the monthly measuring of the depth of the water table, the sampling for chemical analysis of the quality of ground water, especially the Cl^- content, and the measuring or estimating the amount of water extracted from each well, borehole or spring.

2. The Water Development Department started an early accumulation of the hydrological and hydrogeological data concerning the important groundwater producing areas of the Western Messaoria, Eastern Cyprus, the Akrotiri - Peninsula and Yermasoyia-Moni areas, the Kiti-Pervolia-Aradhippou area, the central Messaoria i.e. Lakatamia-Deftera upto Politico areas, the Kyrenia coastal belts and the Ayia Marina Polis areas. The hydrogeological Surveys area expanded year after year so that a close observation network is established over the whole Island and a good knowledge of the ground water inventory of Cyprus is obtained.

3. In addition to the geological and geophysical investigation of an area, the study of its hydrological conditions is absolutely essential for the discovery development and conservation of its groundwater resources. This study is particularly very essential and necessary for a semi-arid country like Cyprus, in which uncontrolled and irrational pumping exceeding in many places the annual replenishment of the aquifers, has caused a progressive decline of the water table to a dangerous level. The excessive and uncontrolled pumping in the coastal areas, such as Famagusta Paralimni, Zakaki and Kiti Pervolia has resulted in the inland underground movement of the sea water. The catastrophic results on the citrus groves of Famagusta-Ayios Memnon was due to sea intrusion because the aquifer was very heavily overpumped. The importance and scope of knowing the hydrogeological conditions of such an overdeveloped area is not limited in the estimation of the amount of water to be safely extracted from the underground reservoirs but generally it offers the background on which all artificial recharge works are based so as to improve effectively the deteriorated conditions; the speeding up of the expansion of the hydrogeological surveys must be considered as a matter of top priority because this will serve as the diagnosis of a situation for which the general rule "it is better to prevent than to cure" fully applies.

4. A very difficult problem which we face is the estimation of the amount of water extracted from each borehole. As there are no water-meters installed on every well or borehole, except for those used for the domestic water supplies of the Towns and some villages, the amount of water extracted every year from each well or borehole is somehow concluded by questioning the owners of the boreholes. This method is obviously very inadequate, and although the information obtained from the farmers is checked and compared with the extent of land irrigated and type of crops, the accuracy of this estimation is always questionable. Furthermore this questioning does not provide analytical information on the distribution of pumping during the year. For detailed hydro-geological investigations which will enable us to draw the water balance and estimate the safe yield of each aquifer, a close observation network of monthly measured boreholes is required together with the corresponding amount of water extracted between the monthly water level observations. The fluctuations of the water table compared with the amount of water extracted can give us the profit or loss in the water contained in the aquifer, the storativety and transmissibility of the aquifer having been predetermined by means of pumping tests, the estimation of the amount of water which replenishes the aquifer can be then determined by means of a mathematical equation. In order to improve the accuracy of the hydro-geological data collected from the farmers, the hourly output of most of the boreholes was measured while pumping and provided that we can find out the hours for which each borehole was pumping for each month then we can reach a better estimation of the amount of water extracted. Other methods applied for the same purpose include the comparison of the electrically driven pumps so as the amount of water extracted to be estimated from the readings of the electric meters.

5. The survey of Western Messaoria, Eastern Cyprus triangle, including Xylophagou, Xylotymbou-Ormidhia-Akhna, Kalopsidha-Makrasyka-Kouklia-Kondea-Lyssi-Pyla-Voroklini-Aradhippou Kiti-Pervolia, Kyrenia, Akrotiri-Peninsula and Yermasoyia. Moni has now been completed in the sense that all wells and boreholes have now been plotted on L.R.O. plans and maps showing the water-table contours. Once monthly the water levels of a number of selected wells/boreholes are measured, water table contour maps are prepared twice a year, once in Spring (just before pumping starts) when the water table reaches its maximum and then for Autumn period (after pumping has stopped and just after the first rains) when the water table goes down to its minimum.

Spring and chain-of-wells are measured in Spring and Autumn to determine their maximum and minimum yield. Figures of the area irrigated in donums and type of crop and quantity of water extracted from each borehole or well or spring or chain-of-wells are also taken once a year.

6. Water samples from a number of observation boreholes for chemical analysis are taken twice a year, but in Akrotiri Peninsula where sea intrusion has occurred samples are taken every two months.

7. The most part of the field work this year was concentrated in gathering as much information as possible from the existing hydrogeologically surveyed areas. In addition the Eastern Cyprus was extended to Kalopsidha-Kouklia-Kondea-Lyssi-Assia-Tymbou-Athienou-Livadhia-Kalokhorio-Dromolaxia-Aradhippou. The Akrotiri-Peninsula was extended and covered the villages of Erimi-Kolossi-Polemidhia-Ypsonas-Ayia Phyla and Episkopi. The Western Messaoria was extended and covered the villages of Karavostasi-Xeros-Kalokhorio-Petra-Ayios Georghios-Ayia Irini-Dhiorios-Kormakitis and Livera. Hydrological Surveys were carried in the following villages of the Central Messaoria and covered the villages of Kato Lakatamia-Pano Lakatamia-Kato Deftera-Pano Deftera-Xeri-Anayia-Psomolophou-Argates-Episkopio-Pera-Politiko-Aredhiou-Malounda and Dhali area. Where the plotting of wells/boreholes on L.R.O. plans was completed in 1966 covering an area of about 446 sq. miles. It is our target that the survey will be extended during 1967 to cover an area of about 200 sq. miles. It is also our intention to extend the Western Messaoria towards the north, and south. The Akrotiri Yermasoyia Hydrological area is to be extended so as to include the catchment of the Rivers of Vassilikos, Maroni-Pendaskinos-Xeropotamos and Pouzis. We plan to cover the catchments of the rivers of Kouris-Paramali-Khapotami-Dhiarizos-Xeropotamos-Ezuza and Mavrokolymbos. It is hoped that this year the central Messaoria area will be completed.

Some notes on certain prospecting boreholes of special hydrogeological interest

Prospecting drilling was carried out this year in various geological formations and useful information about new aquifers as well as a more detailed knowledge of the already known aquifers was obtained.

A short hydrogeological description of a few selected boreholes is given below.

Drilling in the river valleys, where high yielding aquifers are known to exist gave very good results. The aquifers are essentially made of deposits of gravels and sands which have infilled during recent lines the older river beds. The success in selecting the borehole sites lies in the locating the thicker saturated alluvial sediments filling the deeper depressions in the older river bed. For this, the results obtained from the 1958 seismic geophysical survey and the use of the aerial photographs for geomorphological evidence offered a very helpful guidance.

The most interesting boreholes drilled in this type of sediments are:-

Serial No. 54/66 (Grid Ref: N. 20,900;
E. 22,950)

This borehole was located in the alluvial gravels of the Akhelia River, Paphos and it was drilled for the Government Agricultural Research Institute

It penetrated 134 feet thick gravelry deposits and the saturated zone was 104 feet thick. After completion the borehole was tested with an electrosubmersible pump of 18,000 g.p.h. output and the maximum drawdown after 170 hours pumping was 5 feet.

Serial No. 8/66 (Grid Ref: N. 52,345;

E 19,060) was drilled in the Chrysochou River valley. This borehole met 194 feet thick alluvial gravels having 160 feet thick saturated zone. It was tested with an output of 18,000 g.p.h. and the maximum drawdown observed was 84 feet.

A very useful finding was the borehole under Serial No. 38/66 (Grid. Ref: N. 60,600; E. 32,780). This borehole was located in a drowned river valley near Lysi which has its upper course in the area near the Troulli igneous inlier. The extent and course of the valley was detected on geomorphological evidence by the use of the aerial photographs.

The gravelry deposits were met at the depth of 70 feet, and they continued down to 190 feet with some sandy and silty intercalations. The static water level was at 108 feet below ground surface; when it was tested with an output of 18,000 g.p.h. the maximum drawdown was 6 feet. This borehole will soon be put into operation solving thus very satisfactorily the domestic water supply of Lysi village.

It is evident that because of the coarse nature of the sediments filling the river aquifers and their general good replenishment from the river flow, that these deposits form high yielding water basins. Although most of these river valleys are being exploited in full capacity, still there are several others where good prospects for further exploration do exist.

Drilling in the Pliocene sediments was carried out in several parts of the Island. In most areas the upper part of the Pliocene sediments is made of porous calcareous sandstone which under favourable conditions can store and yield good quantity of water. Borehole Ser. No. 86/66 (Grid Ref. N.24,100 E.12,500) was drilled near the Apostolos Andreas Monastery. It met 72 feet thick calcareous sandstone and when tested with a piston pump at 5,000 g.p.h. the maximum drawdown was $1\frac{1}{2}$ ft.

Extensive drilling was carried out in the rocks of the Pakhna Formation especially in the reef limestone and gypsum facies of the formation which represent the end of the depositional cycles of the Pakhna Formation. Borehole Ser. No. 58/66 was located directly on the reef limestone outcrop forming the highland immediately to the north of Kato Moni village. The reef limestone continued from the surface to a depth of 153 feet. At the pumping test this borehole produced a steady output of 10,000 g.p.h. and this amount is more than enough to satisfy the domestic water supply of the village which prior to the drilling of this borehole was obtaining its domestic water from a small and periodically polluted spring.

Borehole Ser. No. 70/66 (Grid. Ref. (N 11.600; E66.600) near Trachoni village was started in the Pliocene sediments overlying the Pakhna Formation. The gypsum deposits representing the top of the Formation were met after passing through 260 feet thick Pliocene sediments. The borehole was giving 4.100 g.p.h. when tested with a piston pump. Although the water struck in the gupsum aquifer is too hard to be used for drinking purposes the NaCl content is only 380 p.p.m. and it is quite suitable for irrigation.

Borehole Ser. No. 28/66 (Grid. Ref. N. 11,960; E 62,220) was drilled near Episkopi village (Limassol District for the domestic water supply of the village. The borehole was located on the chalks of the Pakhna Formation and it met two separate confined aquifers mainly made of calcareous sandstones at the depths of 107 and 130 feet below ground surface. These calcareous sandstone beds form porous and high yielding aquifers. The tested yield of the borehole was 18,000 g.p.h. with only 10 feet maximum drawdown.

Prospecting drilling in the Lapithos chalks met good success in the area near Pyla where a site was selected in order to supplement the inadequate water supply of the village. Water was struck at various depths mainly among the bedding planes and joints within the chalks. During the pumping test a steady flow of 10.000 g.p.h. was obtained.

A very important borehole is the one under Ser. No. 19/66 (Grid Ref. No. 84,850; E. 27,700) which was drilled on the Kyrenia mountains near Trypimeni village. The borehole was sited on the southern slopes of the Kyrenia Range on the Lapithos Chalks. Water was struck at the depth of 216 feet where a thin sandy layer was met at the base of the Lapithos chalks and on top of the Hilarion Limestone. The main aquifer was met within the fissured Hilarion Limestone. The borehole stopped at the depth of 437 feet being still in limestones. The static water level was at 97 feet below ground elevation and the working level was stabilized at 156 when the hole was tested with an output of 16.000 g.p.h.

Very interesting results were also obtained from drilling in the Pillow Lavas which are generally of very low permeability. Borehole Ser. No. 6/66 (Grid Ref. N. 47,100; E. 01,300) was drilled near Mathiatis village. The site was chosen near a stream on either side of which the exposed lavas were showing a fair degree of calcite reining.

The lavas were virtually free of dykes except of a set of dykes being wide apart upstream and converging further down-stream towards the selected site. The impermeable dykes within the lavas of poor but yet permeable nature are expected to act as retaining walls on either side of the lava aquifer confining thus the ground water flow towards the selected borehole site. The static water level was at 4½ feet below ground elevation and when tested with a piston pump of 4.500 g.p.h. capacity, the maximum drawdown was 50 feet. It is expected that soon this borehole will be subjected into a lengthy test with a higher capacity pump in order to determine more accurately the capacity of this newly discovered aquifer.

During the year under review the prospecting drilling programme which had started during the previous year in the unexploited and hydrogeologically unknown as yet Akamas Peninsula continued with the drilling of four additional boreholes. The purpose of this drilling programme is to explore the water potentialities of the area and develop certain parts of the Peninsula into farming units.

Geologically the Akamas Peninsula is essentially made of rocks belonging to the Trypa Group and to the Troodos Igneous Complex. The Trypa Group is in this area represented mainly by rocks of the Mamonia Complex and by some small occurrences of the Akamas Sandstone. The Mamonia Complex consists of a heterogenous melange of rocks, among which seprentines, lavas and shales are the most predominant rock types. The rocks of this Complex have generally this in common that they are essentially impermeable. The coastal plains of the Peninsula are very narrow and they are usually made of thin layers of Plio-Pleistocene calcareous sandstone. The alluvial deposits cover generally limited areas being continued along the narrow and relatively shallow streams.

From the general geological composition and structure of the Akamas Peninsula it appears that the possibilities of finding fairly good quantities of ground water are limited either in the Plio-Pleistocene calcareous sandstone and alluvial deposits or in the fractured and fault zones dissecting the rocks of the Troodos Igneous Complex and the rocky formations of the Mamonia Complex.

Boreholes under Ser. No. 40/66 and 43/66 met thin alluvial deposits and they passed into the claycy rocks of the Mamonia Complex yielding no water.

Borehole 31/66 (Grid. Ref. N. 52280 ; E 06870) met 57 feet thick alluvial gravels with the static water level at 34 feet below surface. When tested with a piston pump at 5.000 g.p.h. the maximum drawdown was 6 feet.

Borehole No 35/66 (Grid Ref. N. 52180 E06775) was proved to be very successful;it penetrated 68 feet thick of alluvial sediments and continued into water bearing fractured rocks of the Mamonia Complex up to the depth of 150 feet.

This borehole was tested with an electrosubmersible pump with an output of 18.000 g.p.h. and with a maximum drawdown of 23 feet.

The prospecting programme in the Akamas Peninsula is expected to be completed in the following year.

VILLAGE DOMESTIC SUPPLIES

The work of the Village Domestic Supplies Section is not only confined to the domestic supplies for the villages but it also includes the towns of Larnaca, Paphos and Kyrenia, all representing a population of over 400,000 or 66% of the total population of the island. This section is also dealing with the planning and execution of the Major Municipal Water Supplies for the towns of Nicosia and Famagusta, in conjuction with the small Town Supplies Section. In general all aspects of rural and urban water supply works are dealt with by this section.

The activities during the year, have been as before on the high rate, and the goal is that all villages in Cyprus will have to enjoy not only a hygienic piped supply but also adequate in quantity and at the tap in the kitchen of every housewife. It is worth mentioning that out of the 628 villages only 4 villages having a total population of not more than 1000 persons in all, do not enjoy a piped supply and 79 villages with a total population of 43,750 have an unsatisfactory piped supply, (a quantity of less than 10 g/p/h/d in summer) and communal public fountains (stand pipes). New water sources will have to be found for those villages and their old distribution system modernized by the implementation of a house-to-house system, on the Municipal Supplies standard. It may also be recorded that 301 villages with a population of 280,408 or 67.56% of the total population of the island have a satisfactory piped supply, 20-25 g/p/h/d, with a house-to-house distribution system and 237 villages, a total population of 81,000 or 19.41% having adequate supply by needing major improvements for modernizing their distribution system.

The daily satisfactory supply per capita is considered at 20 gallons but it will have to be raised to 25 gallons or even 30, to meet the rapid rise in the living standard of the rural population.

Financing. The cost of each scheme is subsidised by the Government by 50% as a practice. Any extra cost for the implementation of a house-to-house service over and above the usual village standard scheme is borne by the village, and the cost of the service pipes for the house connections is borne by the consumers.

During the year under review 34 water supply schemes were put in hand and completed. 105 schemes were prepared and submitted to the District Officers, for consideration and approval by the householders, and over 50 cases dealing with examination and maintenance of already completed and existing supplies were attended to.

The main source of supply is nowadays the underground water through boreholes, and the safeguarding of the aquifers in the plains is of paramount importance for the upkeeping of the domestic supplies to a satisfactory degree. It was experienced during the year, that though upto date schemes were constructed and put to operation to serve villages which were living in the plight of the lack of water for many centuries, and while the housewife was rejoising the flow of water through the tap in the kitchen sink, unfortunately, after several months or years of operation the source of water was exhausted by the depletion of the aquifer, either to it being poor, or affected by the illegal and uncontrolled pumping for irrigation. This resulted in having to provide emergency schemes, by the sinking of new boreholes, thus increasing the cost and the continuous search of new supplies.

All pumped supplies are operated by mean of turbine pumps with a shaft, assembled with a diesel engine, or where electricity is available electrosubmersible pumps. The latter ones though rather delicate and of more complicated construction still in view of their simplicity in installation light in weight and the deep aquifers, are more suitable and preferred to the diesel driven ones. In all schemes a one days storage is provided.

For 1966 an amount of £232,270 (including revotes and deposits was made available for village domestic supply schemes including Larnaca and Paphos towns). 34 schemes were executed, serving a population of 39,917 persons. 79,570 miles of pipes varying in size of from ½ - 15 inches were laid. 17 reinforced concrete tanks of a total capacity of 608,000 gallons and 9 pumping stations were constructed. A house-to-house service system was provided to 26 villages and 4,800 house connections were made.

It is noteworthy that the major new supply scheme for Larnaca town was planned, designed and executed by this section. By this scheme Larnaca a town where there was lack of water for over a quarter of century has now a new satisfactory supply. The source is 6 NOS. Boreholes (112/60, 95/60, 112/65, 126/65, 41/66 and 3/65) all located in the Trimithios river basin, from

where a quantity of 1.2 million gallons is pumped into a 600,000 gallons reservoir, at 300 feet A.S.L. from where it gravitated to Larnaca through a 15 inch trunk main. By this the pressure of water in the town is new stabilized and it flows to the roof tanks of all buildings. Over 1000 motor pumps, which were used to raise the water from the ground tank of each house to the roof tank are now obsolete, and a great economy in electricity consumption and other expenses has been effected. It is also noteworthy that all saccoraphia in the town have been replaced by meters, and all supply is now controlled. A ring main 15 inch in diameter of asbestos cement pressure pipes class "C" has been installed and the town divided into six independent supply areas. Work will continue in improving the existing distribution system within the town, during 1967, as phase III and on completion of this phase, Larnaca New Scheme will be implemented as a whole.

a) Dhenia - Mammari

A pumping scheme for Dhenia and Mammari villages has been executed during 1966, and now Mammari, which had to be provided with domestic water by means of a tanker, enjoys a satisfactory piped supply. The source of supply is a successful borehole No. 26/62 situated about a mile west of Kokkinotrimithia village. The water is pumped through a 4 inch in diameter galvanized pumping main, 6500 feet in length into a 60,000 gallons capacity R.C C. circular balancing tank and from there it flows by gravity to the storage tanks of the two villages. A 30,000 gallons capacity storage tank has been constructed for Mammari and a 10,000 gallons capacity storage tank for Dhenia. In both villages there has been installed a new distribution system and each house has a continuous controlled metered supply. In all, about 300 water meters of $\frac{1}{2}$ inch in diameter have been installed.

b) Another important pumping scheme has also been executed during 1966, in the Larnaca District for Pervolia village. This scheme is combined with Meneou and Tersephanou which will also be supplied eventually from the same source of supply, which are two successful boreholes NOS. 153/61 and 17/66 in the Trimithios river, situated near Kiti Dam. The water is pumped from the boreholes into a 100,000 gallons capacity R.C.C. balancing tank from where it flows by gravity to Pervolia village. A new distribution system has been implemented in Pervolia and all the houses have now a continuous metered supply.

Reinforce concrete tanks

Service reservoirs	17 (608,000 gallons capacity)
School tanks	8
Pumping stations	9
House connections	4800

The scheme completed may be classified as shown below:

"Village standard" means that the distribution of the water is effected by street fountains only, and not by house connections. A public fountain with trough and proper drainage system serves 6-10 houses.

"House-to-house" means that the distribution of the water is effected by individual house connections. Distribution mains are laid in all inhabited areas, and the consumer bears the cost of the service connections. The supply is controlled by means of water meters or break-pressure regulators securing an equal quantity of water to all houses, in those cases where the supply is fixed and limited. Practically in all the new schemes in all Districts water meters were installed.

Lists showing the number of villages with piped water supply, schemes completed during the year, schemes in hand at the end of the year and schemes prepared for execution are given in appendices 9-13.

Appendix No. 9

LENGTH OF PIPES LAID IN 1966

(Galvanized mild steel Pipes)

Size Nominal Diameter	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	Victaulic Pipes 6"	Victaulic Pipes 8"	TOTAL	
Length in miles	7,617	1,361	8,379	5,833	3,341	5,466	6,008	5,818	3,117	1,548	6,144	54,632	

(Asbestos - Cement pressure pipes)

Size Nominal Diameter	2"	3"	4"	6"	8"	10"	12"	15"	-	-	-	TOTAL	
Length in miles	2,725	6,872	4,806	5,303	1,268	0,007	3,404	0,553	-	-	-	24,938	

Appendix No. 10

VILLAGE DOMESTIC WATER SUPPLY

SCHEMES COMPLETED IN 1966

Ser. No.	Village	Type of scheme	G.P.D. Daily quant. available	population	Nature of work	Estimated cost £
	NICOSIA & KYRENIA DISTRICT					
1.	Sykhari	Pumping	7,000	356	*	£ 14,000
2.	Vouno	"	9,000	424	* H	
3.	Dhenia	Pumping	7,000	324	* H	25,000
4.	Mammari	"	17,000	839	* H	
5.	Kapparovounos (Trapeza)	Pumping	2,000	79	+	700
6.	Ay. Epiktitos	Pumping	12,000	1,192	* H	25,000
7.	Klepini	"	2,000	233	* H	
8.	Ay. Marina	Gravity	5,000	516	+	148
9.	Xyliatos	"	2,000	132	+	
10.	Ergates	Pumping	13,000	637	* H	
11.	Episkopio	"	5,000	241	* H	
12.	Kambia	"	6,000	267	* H	34,000
13.	Analiontas	"	3,000	131	* H	
14.	Kalopanayiotis	Gravity	15,000	920	+	18,000
	Total		105,000	6,291		£116,848
	FAMAGUSTA DISTRICT					
1.	Kantara	Pumping	6,000		+	£ 8,000
2.	Melanagra	"	3,000	175	* H	4,016
3.	Ay. Napa	"	20,000	836	+	4,000
4.	Ay. Theodhoros	"	18,000	828	+	7,310
5.	Ardhana	"	6,000	433	* H	8,273
6.	Yerani	Gravity	8,000	211	+	500
	Total		61,000	2,483		£32,101

Ser.	Village	Type of scheme	G.P.D. Daily quant. Available	Population	Nature of work	Estimated Cost £
	LIMASSOL DISTRICT					
1.	Kato Mylos	Gravity	4,000	192	* H	£ 6,670
2.	Pakhna	"	31,000	1,564	+	600
3.	Dhora	"	14,000	715	+	325
4.	Episkopi	Pumping	40,000	1,987	+	2,200
5.	Asgata	Gravity	12,000	608	+	225
6.	Ay. Mamas	"	9,000	469	+	400
7.	Ay. Athanasis	Pumping	24,000	1,183	+	450
8.	Erimi	"	12,000	601	+ H	1,400
9.	Ay. Phyla	"	104,000	5,231	+ H	400
10.	Trimiklini	"	6.000	330	+	800
	Total		256,000	12,880		£13,470
	LARNACA DISTRICT					
1.	Tersephanou	Pumping	9,000	458	* H	£16,000
2.	Pervolia	"	15,000	732	* H	
3.	Larnaca Phase II	"		17,000	+	59,500
		Total	24,000	18,190		£75,500
	PAPHOS DISTRICT					
1.	Melamiou	Gravity	2,000	73	* H	£ 1,200

SUMMARY

Nicosia	£116,848
Famagusta	32,101
Limassol	13,470
Larnaca	75,500
Paphos	1,200
Total	£239,119

Appendix 11

VILLAGE WATER SUPPLY SCHEMES IN HAND AT THE END OF 1966

Serial No.	Village	Amount Revoted
	NICOSIA & KYRENIA DISTRICT	
1.	Kalokhorio (Klirou)	£ 11,840
	FAMAGUSTA DISTRICT	
1.	Trikomo	£ 340
	LIMASSOL DISTRICT	
1.	Ay. Ioannis (Agros)	£ 4,900
	PAPHOS DISTRICT	
1.	Polis - Prodromi	£ 15,000

Appendix 12

VILLAGE DOMESTIC SUPPLY SCHEMES
PREPARED AND SUBMITTED FOR CONSIDERATION AND APPROVAL

Nicosia & Kyrenia District

Ser. No.	Village	Population 1960 census	Nature of scheme	Quantity of water to be avaialble G.P.D.	Estimated Cost
1.	Morphou	6,642	* H	300,000	£ 86,000
2.	Aredhiou	355	* H	7,000	8,450
3.	Kharcha	600	* H	12,000	8,900
4.	Karmi)		* H		
5.	Trimithi (	1,776	* H	30,000	21,000
6.	Ay. Yeorghios)		+		
7.	Kythrea	2,995	* H	60,000	23,500
8.	Kythrea lower villages				
	Neokhorio) Trakhoni (Palekythro (Voni) Epikho (Exo Methokhi Bey Keuy)	5,100	* H	100,000	30,000
9.	Vasilia) Agridhaki (Sisclipos) Ayios Ermolaos (Ayia Marina (Skyl.)) Asomatos (Panagra) Orga) Livera)	3,531	* H		72,000
10.	Dhikomo Pano) Dhikomo Kato (	2,592	+ H		19,000
11.	Mathiatis	409	* H	8,000	11,000
12.	Gourri	392	+ H	8,000	1,900
13.	Lythrodhondas	1,488	+ H	30,000	17,000
14.	Pyroi	466	+ H	10,000	2,000
15.	Lymbia	1,383	+ H	30,000	25,000
16.	Ay. Kebir	418	* H	10,000	16,150
17.	Pendayia	1,105	+ H	22,000	9,000
18.	Alona	569	+ H	12,000)	40,000
19.	Platanistassa	590	+ H	12,000)	
	C.F.	30,321		651,000	£385,900

Ser. No.	Village	Population 1960 census	Nature of scheme	Quantity of water to be available G.P.D.	Estimated cost.
	B.F.	30,321		651,000	£385,900
20.	Apliki	120	+ H	2,400	1,750
21.	Kambi (Pharmaka)	228	* H	4,500	2,600
22.	Klirou	1,008	+ H	20,000	8,850
23.	Nikitari	450	* H	9,000	6,600
24.	Sarandi	164	* H	3,400	2,500
25.	Tembria	690	+ H	13,800	12,120
26.	Varishia	223	+ H	4,600	2,600
27.	Vroishia	235	+ H	5,000	6,700
28.	Kato Moni	253	* H	6,000	6,400
29.	Palekhori (Orinis)	832	+ H	16,000	3,300
30.	Pharmakas	479	+ H	10,000	2,720
		35,093		745,700	£447,040

Famagusta District

Ser. No.	Village	Population 1960 census	Nature of scheme	Quantity of water to be available G.P.D.	Estimated Cost
1.	Yialousa	2,541	+	60,000	£2,600
2.	Mandres	398	+ H	8,000	2,900
3.	Marathovouno	2,020	+ H	40,000	9,900
4.	Karovia	297	+ H	6,000	1,600
5.	Leonarisso	707	+	14,000	2,500
6.	Komi-kebir)	952			
	Ofkoros (	362	+ H	50,000	25,910
	Patriki)	581			
	Kridhia (	353			
7.	Dry villages) Mesaoria (		+	100,000	20,000
8.	Ashia	2,209	+ H	44,000	19,500
9.	Angastina	778	+ H	16,000	6,800
10.	Pyrga	449	+ H	19,000	3,900
11.	Vitsadha	402	+ H	8,000	3,500
12.	Kalopsidha	975	+	18,000	3,400
13.	Makrasyka	747	+	15,000	900
14.	Gypsos)	1,184	+	21,000	
	Milia (	1,141	+	21,000	
	Piyi)Mersiniki	1,038	+	20,000	19,000
	Peristerona)	571	+	11,000	
15.	Kondea	1,305	+ H	26,000	7,850
16.	Styllos)	538		10,000	
	Engomi (	667		13,000	19,079
	Limnia)	1,201	+	24,000	
	Ay. Serghios)	1,790		34,000	
17.	Mousoulita	219	+ H	4,000	1,330
	Total	23,425		572,000	150,069

Limassol District

Job No.	Village	Population 1960 census	Nature of scheme	Quantity of water to be available G.P.D.	Estimated cost
1.	Pano Platres	413	+	15,000	£ 8,500
2.	Asomatos	340	* H	7,000	6,700
3.	Kilani	1,034	+ H	20,000	2,300
4.	Sykopetra	217	* H	4,000	2,800
5.	Pendakomo	598	* H	12,000	11,900
6.	Pareklishia	577	+ H	4,000	2,400
7.	Potamos tis Yermasoyias and the Coastal Area	1,748	* H	40,000	47,000
8.	Prastio (Evdimou)	342	+ H	7,000	3,300
9.	Yerasa	243	+ H	5,000	1,200
10.	Souni-Zanadja	66	+	1,000	900
11.	Vouni	990	+ H	20,000	2,300
12.	Erimi-Kolossi	1,352	+ H	27,000	2,400
13.	P. Kivides	456	* H	9,000	4,150
14.	Ay. Dhemetrios	223	* H	5,000	3,900
15.	Phini	924	+ H	20,000	5,000
16.	Paleomylos	200	+ H	4,000	1,700
17.	Anoyira	620	+ H	12,000	4,000
18.	Kouka	63	+ H	1,000	1,100
19.	Pyrgos	702	+ H	14,000	1,800
20.	Zoopiyi)				
21.	Kellaki (	408			
22.	Prastio)	195	* H	40,000	46,100
23.	Kalon Khorion (	549			
24.	Louvaras)	328			
25.	Eptagonia (	427			
	Total	13,015		267,000	159,450

Larnaca District

Ser. No.	Village	Population 1960 census	Nature of scheme	Quantity of water to be available G.P.D.	Estimated cost
1.	Melini	221	+ H	5,000	£ 3,000
2.	K. Drys)	307			
3.	Vavla (	133	* H		
4.	P. Lefkara)	1,771		40,000	39,200
5.	K. Lefkara)	304			550
6.	Pyla	961	* H	20,000	11,000
7.	Voroklini	695)	* H		
8.	Livadhia	1,329 (	* H	40,000	27,900
9.	Alaminos	564	+ H	9,000	1,100
10.	Pyrga	381	+ H	6,000	3,600
11.	Meneou	170	* H	3,000	4,000
12.	Kornos	859	+	12,000	700
	Total	7,695		135,000	91,050
	Paphos District				
1.	Kritou-Terra	518	+ H	10,000	£ 1,900
2.	Emba	1,027	+ H	20,000	6,500
3.	Peristerona	355	+ H	7,000	2,000
4.	Ay. Nicolaos	418	+ H	8,000	3,200
5.	Episkopi	726	+ H	14,000	5,600
6.	Ay. Ioannis	819	+ H	16,000	2,900
7.	Lemona	241	+ H	5,000	1,400
8.	Magounda	196	+ H	4,000	700
9.	Akoursos	194	* H	4,000	2,200
10.	Annadhiou	203	*	4,000	1,500
11.	Kilinia	229	+	4,000	500
12.	Nikoklia	139	* H	3,000	2,600
13.	Arminou	250	+ H	5,000	4,600
14.	Kedhares	259	* H	5,000	1,800
	Total C.F.	5,574		109,000	£37,400

Ser. No.	Village	Population 1960 census	Nature of scheme	Quantity of water to be available G.P.D.	Estimated Cost
	B.F.	5,574		109,000	£ 37,400
15.	Loukrounou	35	* H	1,000	350
16.	Polemi	880	+ H	17,000	8,400
17.	Pretori	392	+	8,000	720
18.	Stavrokonnos	627	+	12,000	1,000
19.	Tsadha	907	+ H	18,000	5,100
20.	Yiolou	605	+ H	12,000	2,150
21.	Phiti	342			
	Lassa	279			
	Ay. Dhemetrianos	234	+	65,000	10,000
	Kathikas	763			
	Polemi	880			
	Psathi	65			
	Total	11,583		242,000	65,120

S U M M A R Y

Ser. No.	District	Amount £	Remarks
1.	Nicosia & Kyrenia	£447,040	
2.	Famagusta	150,669	
3.	Limassol	159,450	
4.	Larnaca	91,050	
5.	Paphos	65,120	
	Total	£913,329	

Appendix No. 13

DEPARTMENT OF WATER DEVELOPMENT

NUMBER AND PERCENTAGE OF VILLAGES WITH PIPED SUPPLIES 1966

District	Satisfactory Piped Supply				Unsatisfactory Piped Supply								No piped supply								Total No. of Villages	Total population
	Villages with House-to-house				Villages with Fountains				Villages with House-to-house				Villages with Fountains				Villages					
	No.	%	Pop.	%	No.	%	Pop.	%	No.	%	Pop.	%	No.	%	Pop.	%	No.	%	Pop.	%		
Nicosia	86	48.32	114.938	73.54	63	35.39	25.885	16.56	-	-	-	-	27	15.17	4.988	9.60	2	1.12	478	0.30	178	156,279
Kyrenia	20	42.55	14,661	53.28	14	29.80	5,145	18.70	1	2.12	3,496	12.70	12	25.53	4,215	15.32	-	-	-	-	47	27,517
Famagusta	55	56.12	56,340	70.77	22	22.45	7,271	9.13	3	3.06	2,864	3.60	18	18.37	13,140	16.50	-	-	-	-	98	79,615
Limassol	69	60.52	46,569	73.09	34	29.82	10,168	15.96	-	-	-	-	10	8.78	6,606	10.37	1	0.88	370	0.58	114	63,713
Paphos	48	36.36	25,025	50.99	83	62.44	23,801	48.50	-	-	-	-	1	0.76	250	0.51	-	-	-	-	132	49,076
Larnaca	23	38.98	22,835	58.93	21	35.59	8,247	21.28	3	5.09	2,983	7.68	11	18.65	4,551	11.72	1	1.69	170	0.44	59	38,836
Total	301	47.93	280,408	67.56	237	37.74	80,517	19.41	7	1.12	9,343	2.25	79	12.57	43,750	10.54	4	0.64	1,018	0.24	628	415,036

Note: Certain schemes that were previously satisfactory are now considered not satisfactory for the reasons of:-

(a) Boreholes have been exhausted by the depletion of the aquifer.
(b) Yield of springs greatly reduced by the continuous drought.
(c) Higher consumption demand as a result of the increasing population and standard of living.
(d) Schemes with less than 10 gallons per day per capita are classified unsatisfactory.

REPORT ON THE HYDROLOGICAL SECTION

(This report covers the period from 1st October, 1965 to 30th September, 1966).

I. Meteorological data

The principal features of the weather during the year were:-

(a) The average rainfall over the whole island was 18.45 inches which is 93.09 of normal as compared with the average, derived from 50 years period 1908 - 1957, which is 19.82 - See Appendix No.14 and No.15.

(b) October, January and September were the months with above average rainfall. Precipitation during the other months was below normal.

(c) The highest daily fall in the year was 3.70 inches which occurred at Kionia Forest Station on the 23rd October, 1965.

(d) Some snow fell at the high altitudes of Troodos mountains late in November, 1965 and continued at intervals till March, 1966. Snow cover persisted till middle of April, 1966.

(e) Temperatures were mainly below normal in winter months and normal in Spring and Summer months. The highest temperature recorded at Nicosia was 105° F on the 9th, 30th and 31st July, 1966 and the lowest 33° F on the 18th December, 1965.

II Flood discharges

The most remarkable flash flows during the year occurred in the valleys of rivers flowing west and north of the central massif. The highest flood-flows were 8765 cusecs in Stavros tis Psokas river recorded near Evretou on 12th October, 1965, and 3178 cusecs in Serakhis river recorded at Massari bridge on 13th October, 1965.

The following table summarizes some of the larger floods and of the rainfalls measured in the catchment or in adjacent catchment on the day of the flood or on the previous days. Floods of less importance have been ignored.

River	Location	Peak Flow		Rainfall		
		Cusecs	Date	Inchs.	Place	Date
Khrysokhou	Skoulli	211.8	7/1/66	1.05	Stroumbi	6/1/66
Stavros-tis-Psokas	Evretou	8765.0	12/10/65	1.17	Stavros-tis Psokas	12/10/65
		647.5	15/12/65	1.96	" "	15/12/65
		212.3	5/1/66	1.52	" "	4/1/66
				1.35	" "	4/1/66
Ezuza	Akhelia	707.6	12/10/65	2.26	Pano Panayia	12/10/65
		248.4	15/12/65	0.91	Akhelia Olive Nursery garden	15/12/65
		328.7	5/1/66	1.00	Pano Panayia	5/1/66
Khapotami	Kissousa	281.3	29/9/66	0.35	Omodhos	29/9/66
Ezuza	Kannaviou	1511.9	12/10/65	2.26	Pano Panayia	12/10/65
		311.5	9/1/66	1.35	" "	8/1/66
		211.3	27/2/66	1.20	" "	27/2/66
		243.7	19/3/66	1.40	" "	18/3/66
				1.12	" "	19/3/66
		288.6	4/5/66	0.35	" "	4/5/66
Xeros	Peyia	215.2	7/1/66	0.90	Peyia Elementary School	6/1/66
				0.96	" "	7/1/66
Dhiarizos	Philousa	538.1	12/10/65	1.72	Kaminaria	11/10/65
				1.57	"	12/10/65
		353.1	7/1/66	1.50	Kykko Monastery	6/10/66
				1.18	"	7/1/66
		538.1	29/9/66	1.43	Trikoukkia	29/9/66
Peristerona	Panayia Bridge	278.6	23/10/65	2.00	Alona	23/10/65
		748.7	7/1/66	1.20	Polystipos	6/1/66
		331.6	9/1/66	1.24	"	8/1/66
		240.5	27/2/66	2.00	Alona	26/2/66
Akaki	Malounda	203.1	5/10/65			
		331.6	23/10/65	2.40	Palekhori	23/10/65
		396.5	7/1/66	1.20	"	7/1/66

River	Location	Peak flow		Rainfall		
		Cusecs	Date	Inches	Place	Date
Elea	Ghaziveran	425.0	5/10/65	2.33	Kapoura	5/10/65
Serakhis	Massari	3037.1	5/10/65	2.11	Panayia Bridge	5/10/65
		3178.3	13/10/65	1.06	K/Trimithia	13/10/65
		346.1	23/10/65	2.40	Palekhori	23/10/65
		459.1	28/12/65	1.02	Polystipos	26/12/65
		828.5	7/1/66	1.50	Kambi	7/1/66
Elea	Vizakia	2977.0	5/10/65	2.33	Kapoura	5/10/65
Yermasoyia	Yermasoyia Police Station	225.3	7/1/66	1.00	Kalokhorio	7/1/66
Kouris	Erimi-Bridge	226.8	13/12/65	1.60	Saittas Nursery garden	12/12/65
		609.2	15/12/65	1.10	"	15/12/65
		289.7	5/1/66	1.36	"	4/1/66
		423.0	7/1/66	1.00	"	7/1/66
		1032.4	9/1/66	1.00	"	9/1/66
		724.3	24/1/66	2.24	Amiandos	24/1/66
		669.9	29/9/66	1.98	Saittas Nursery garden	29/9/66
Syrgatis	Skarinou	316.1	8/10/65	0.85	Pano Lefkara	7/10/65
Garyllis	Kato Polemidhia	372.6	8/10/65	0.40	Kalokhorio Limassol	8/10/65
Vasilikos	Kalavasos	255.4	30/9/66	0.50	Ora Police Station	30/9/65
Kouris	Khalassa	265.5	12/10/65	1.44	Saittas Nursery Garden	12/10/65
		247.6	7/1/66	1.00	"	7/1/66
		233.0	29/9/66	1.98	"	29/9/66
Kryos	Khalassa	232.3	9/10/65	1.00	Saittas Nursery garden	9/10/65
		249.9	13/12/65	1.42	Kilani Police Station	12/12/65
		232.3	5/1/66	1.40	"	4/1/66
		232.3	24/1/66	0.79	"	24/1/66
		873.2	29/9/66	1.94	"	29/9/66
Zygos	Khalassa	1366.7	6/10/65	0.80	Saittas Nursery Garden	5/10/65
		2895.8	23/10/65	2.28	Kyperounda	22/10/65
		208.7	12/12/65	1.53	"	12/12/65
		289.6	29/9/66	1.15	"	29/9/66

River	Location	Peak flow		Rainfall		
		Cusecs	Date	Inces	Place	Date
Vathis	Athalassa	205	6/10/65	0.80	Athalassa	6/10/65
		205	12/10/65	0.50	Dheftera	12/10/65
		376	30/9/66	0.38	"	30/9/66
Mylou	Kornos	327	7/10/65	0.30	Kornos	6/10/65
Aradhippou old bridge	Aradhippou	240	17/10/65	0.78	Aradhippou	16/10/65
Panayia Yematousa	"	499	12/10/65	0.75	"	12/10/65

III. River Dishcarges

The low rainfall during the Hydrological Year resulted in keeping the basic flow of most streams below average.

IV. Water Level Recorders

At the end of the hydrological year the following water level recorders were in operation:-

Recorder No.	Catchment	Location	Type of installation
3	Ovgos	Morphou-Pnasi Monastery Bridge	Water level recorder on 35 ft. bridge.
4	Ovgos and Serakhis	Syrianokhori	Water level recorder on 40 ft. measuring weir.
5	Xeros (Nicosia)	Nicosia-Xeros bridge	Water level recorder on 71 ft. bridge.
6A	Marathasa	Nicosia-Xeros main road	Water level recorder on 50 ft. measuring weir.
6B	"	Upstream of Lefka dam	Water level recorder on 23' 9" bridge.
8	Avgorou	Near Avgorou	Water level recorder on 40 ft. measuring weir.
9	Paralimni	Near Paralimni lake out flow	Water level recorder on the recharge channel
13A	Kourris (Trimiklini)	Limassol-Troodos Bridge	Water level recorder on 18 ft. measuring weir
13B	"	Near 13A	Water level recorder on 1'-6" flume.
14	Peristerona (Nicosia)	Near Panayia Forest Station	Water level recorder on 20 ft. measuring weir.
15	Tremithios	On the spillway of kiti dam etc.	Water level recorder on 212 ft. [illegible] spillway.
16	Yermasoyia	Near Yermasoyia Police Station	Water level recorder on 80 ft. measuring weir.
17A	Kourris (Erimi)	Erimi bridge	Water level recorder on 66 ft. bridge
17B	"	"	Water level recorder 55'-66" bridge.
	Kalopannes	Near Kalopsidha	Water level recorder on 25 ft. measuring weir

Recorder No.	Catchment	Location	Type of installation
19	Akhna	Near Akhna Police Station	Water level recorder on 40 ft. measuring weir.
20	Phrenaros	Near Asprovouniotissa church	Water level recorder on 40 ft. measuring weir.
22	Liopetri	Near Liopetri	Water level recorder on 40 ft. measuring weir.
23	Akaki	Near Malounda	Water level recorder on 40 ft. measuring weir.
24	Skylloura	Near Ayios Vasilios	Water level recorder on 60 ft. measuring weir.
27	Khrysokhou	Near Skoulli	Water level recorder on 40 ft. measuring weir.
28	Stavros-tis-Psokas	Near Evretou	Water level recorder on 25 ft. measuring weir.
29	Syrgatis	Skarinou station	Water level recorder on 70 ft. measuring weir.
30	Dhiarizos	Kouklia (Paphos) main bridge	Water level recorder on 40 ft. bridge.
32	Alakati	Platimatis locality near Ay. Amvrosios Kyrenia	Water level recorder on 22 ft. measuring weir.
33A	Karyiotis	Near Pendayia-Xeros main road bridge	Water level recorder on 60 ft. measuring weir.
33B	"	Near Evrykhou	Water level recorder using natural section of river
34	Tremithios	Near Ayia Anna	Water level recorder on 40 ft. measuring weir.
35	Elea	Chaziveran-Pendayia main road bridge	Water level recorder on bridge
36A	Ayios Loucas (Akhyritou outlet tunnel)	Near Ayios Loucas (Famagusta)	Water level recorder on Ayios Loucas Lake
36B	Ayios Loucas Lake	"	Water level recorder on Ay. Loucas Lake at outlet.
37	Atsas	Upstream of Petra Dam	Water level recorder on 25 ft. measuring weir.
38A	Serakhis	Massari main bridge	Water level recorder on 58'-6" bridge.
38B	"	"	Water level recorder on 39'-6" bridge.
41	Yialia (Polis)	Kato Yialia main road bridge	Water level recorder on 14'-10" measuring weir.
43	Mavrokolymbos	Potima Chiftlik	Water level recorder on 40 ft. measuring weir.
44	Ezuza	Near Ahelia	Water level recorder on 85 ft. measuring weir.
45	Khapotami	Near Kouklia	Water level recorder on 50 ft. measuring weir.
46	Garyllis	Near the Armenian Cemetery at Kato Polemidhia	Water level recorder on 66 ft. measuring weir.

Recorder No.	Catchment	Location	Type of installation
47	Vasilikos	Near Kalavasos	Water level recorder on 75 ft. measuring weir.
48	Maroni	Near Khirokitia	Water level recorder on 40 ft. measuring weir.
49	Kambos	Potamos-tou-Kambou	Water level recorder on 45 ft. measuring weir.
50	Pouzis	Near Mazotos	Water level recorder on 45 ft. measuring weir.
52	Kourris	Khalassa-Lophos Road bridge	Water level recorder on 23 ft. measuring weir.
53	Kourris and Kryos.	Near Khalassa	Water level recorder on 101 ft. measuring weir.
54	Kourris-Zyghos	Mia Kremmos Locality	Water level recorder on 75 ft. measuring weir.
55	Elea-Asinou	Near Nikitari	Water level recorder on 25 ft. measuring weir.
56	Vathis	Near Athalassa	Water level recorder on 33'-6" ft. measuring weir.
57	Elea Vizakia	Near Vizakia	Water level recorder on 29'-6" ft. measuring weir.
58	Aloupos	Aloupos Chiftlik	Water level recorder on 55 ft. measuring weir.
59	Khapotami	Near Kissousa	Water level recorder on 20 ft. measuring weir.
60	Syrgatis-Mylou	Near Kornos	Water level recorder on 30 ft. measuring weir.
61	Ezuza	Near Kannaviou	Water level recorder on 45 ft. measuring weir.
63	Melini Ayia Trias (Yialousa)	Near Ayia Trias (Yialousa)	Water level recorder on 22 ft. measur ng weir.
64	Karyiotis-Ayios Nicolaos	Near Ayios Nicolaos Monastery Kakopetria	Water level recorder on 20 ft. measuring weir.
65	Karyiotis-Platania	Near Kakopetria	Water level recorder on 20 ft. measuring weir.
67	Dhiarizos	Near Philousa	Water level recorder on 60 ft. measuring weir.
68	Serakhis	On Morphou Dam spillway	Water level recorder on 250 ft. dam's spillway
70	Aradhippou	Near Panayia Yematousa church	Water level recorder on 16 ft. measuring weir.
71	"	On Nicosia-Larnaca old road bridge	Water level recorder on 27'-9" measuring weir.
72	Akrounda	Downstream of Akrounda Dam	Water level recorder on 25 ft. measuring weir.
73	Panagra	On Panagra-Kyrenia old road bridge	Water level recorder on 27 ft. measuring weir.

All Water level recorders used on the above stations are of the float operated type except on stations No.6B, 14 on which Pneumatic recorders have been installed.

V. Measured discharges 1965-1966

The discharges which could be measured during the year at the Gauging Stations of the previous paragraph are as follows:-

No.	Catchment	Rainfall during 1965-66 10^6 cu.ft.	Runoff during 1965-66 10^6 cu.ft.	Maximum discharge in a day 10^6 cu.ft.	Maximum flow cusecs	Runoff in % rainfall 1965-66
3	Ovgos Morphou	2461.9	-	-	-	-
4	Serakhis and Ovgos	8837.4	-	-	-	-
5	Xeros Karavostasi	2206.9	18.561	1.797	26.000	0.82
6A	Marathasa Lefka	2037.7	70.628	4.338	60.220	3.47
6B	-dO- (upstream of the dam	1595.5	425.475	12.466	162.237	26.67
8	Avgorou	196.8	-	-	-	-
9	Paralimni	240.0	-	-	-	-
13A	Kouri (Trimiklini)	1762.88	351.18	5.73	167.06	19.92
13B	" "					
14	Peristerona Panayia Forest Station	1605.1	400.00	31.257	748.678	24.92
16	Yermasoyia (Yermasoyia) Police Station	3873.25	238.37	9.97	225.26	6.15
17A	Kouris (Erimi Road Bridge	8916.81	649.26	73.67	1032.39	7.28
17B	-do- -do-					
19	Akhna	308.3	-	-	-	-
20	Phrenaros	81.7	-	-	-	-
22	Liopetri	103.2	1.6	1.1	42.6	1.6
23	Akaki Malounda	1505.3	358.412	13.945	331.608	23.81
24	Skylloura, Ayios Vasilios	973.9	1.475	0.010	0.117	0.15
27	Khrysokhou (at Skoulli)	1802.01	182.80	9.30	211.8	10.14
28	Stavros-tis-Psokas (at Evretou)	2708.80	503.89	20.96	8765.0	18.60
29	Syrgatis (Skarinou)	2540.67	80.14	3.31	316.05	3.15
30	Dhiarizos (at Kouklia)	5661.24	878.78	14.55	173.4	15.52
32	Alakati (at Ay. Amvrosios, Kyrenia	195.4	4.6	2.4	98.5	2.4
33A	Karyiotis, Pendayia	2135.5	101.913	5.118	69.074	4.77
33B	-do- Evrykhou	1664.4	407.247	11.247	145.498	24.49
34	Tremithios (at Ayia Anna)	1005.5	6.3	1.1	53.5	0.6
35	Elea Ghaziveran	2551.2	7.623	2.052	425.000	0.30
37	Atsas Evrykhou	607.8	46.263	1.230	228.429	7.61

No.	Catchment	Rainfall during 1965-66 10^6 cu.ft.	Runoff during 1965-66 10^6 cu.ft.	Maximum discharge in a day 10^6 cu.ft.	Maximum flow cusecs	Runoff in % rainfall 1965-66
38A	Serakhis, Massari	5646.5	241.093	24.820	3178.350	4.27
38B	-do- -do-					
41	Yialia (at Polis)	515.05	39.33	1.12	34.8	7.64
43	Mavrokolymbos	959.53	47.97	2.52	78.7	5.00
44	Ezuza (at Akhelia)	5106.76	342.34	17.83	707.6	6.66
45	Khapotami (at Kouklia, Paphos)	2629.21	151.81	3.03	144.5	5.77
46	Garyllis at (Kato Polemidhia)	1826.05	38.62	5.89	372.64	2.11
47	Vasilikos at (Kalavasos)	2797.49	92.84	4.62	255.40	3.32
48	Maroni at (Khirokitia)	1221.49	26.33	0.76	18.58	2.16
49	Kambos, Potamos-tou-Kambou	1298.3	29.897	2.676	36.209	2.30
50	Pouzis (at Mazotos)	836.8	1.7	0.5	36.2	0.2
52	Kouris Khalassa	2950.04	880.15	13.40	265.53	29.84
53	Kryos Khalassa	4713.63	940.96	12.84	873.23	19.96
54	Zyghos Khalassa	3073.71	494.63	13.99	4502.66	16.09
55	Asinou Nikitari	271.2	3.691	0.058	1.446	1.36
56	Vathis (at Athalassa)	352.5	14.4	3.0	375.5	4.1
57	Elea, Vyzakia	1461.3	164.619	13.377	2976.970	11.27
58	Aloupos-Aloupos Chiftlik	863.4	-	-	-	-
59	Khapotami (at Kissousa)	1061.26	156.06	5.32	281.3	14.71
60	Mylou (atKornos)	526.7	23.5	1.4	326.9	4.5
61	Ezusa (at Kannaviou)	2395.36	695.78	25.22	1511.9	29.05
63	Melini (at Ayia Trias	58.0	1.6	0.01	0.1	2.8
64	Ayios Nicolaos Kakopetria	516.2	470.219	5.004	81.931	91.09
65	Platania-Kakopetria	328.1	86.486	1.729	105.945	26.36
67	Dhiarizos (at Philousa)	4092.32	985.12	23.81	538.1	24.07
70	Panayia, Yematousa (at Aradhippou)	180.0	5.4	1.3	499.1	3.0
71	Aradhippou near old bridge	335.8	2.7	1.3	40.0	0.8
72	Akrounda (Dam)	594.65	24.83	1.15	78.96	4.18
73	Panagra (old road bridge)	593.4	7.977	1.923	119.550	1.34

VI. Spring discharges

During the Hydrological year, 2062 spring discharges were measured, averaging to 172 measurements every month. The output of 316 springs is now being measured regularly, 169 of these at monthly intervals, 22 every two months, 20 every three months, 31 every four months, 41 every six months, and 39 every year.

Most spring flows increased considerably during the heavy early winter rains and at this period were higher than last year. But, yields began to deteriorate earlier than normal during the relative, dry late winter and spring months; and by the end of the year many springs were lower than last year and below normal.

Troodos was the only area in the island that had an above average rainfall. Spring flows were higher than last year and above normal. Thus, the combined flow of the springs used for Troodos water supply was 40,000 gallons per day in September, 1966, compared with 36,000 gallons per day last year. The average flow for September since regular measurements commenced in 1955 is 30,000 gallons per day.

On the northern slopes of the Kyrenia range, the Kephalovrysos Lapithos had its seasonal increase early in November, 699,000 gallons per day, and for the remaining months of the year the rate of flow was gradually decreasing to 362,000 gallons per day. On the southern slopes, the Kephalovrysos Kythrea had a steady decline throughout the year. Its descharge in September was 1,665,000 gallons per day, which is lower than last year and below normal.

In the central Mesaoria plain the yield of the chain of wells followed same behaviour as most springs, i.e. increase in their flow early in winter, but gradual decrease during the remaining months of the year to a below normal level.

VII. Chemical Analyses

During the year 3,444 samples of water were sent to the Government Analyst for partial chemical analysis. Of these 1,323 samples were taken from springs, wells or boreholes which are used or proposed as water supply sources. The remaining 2,121 samples derived from springs observation boreholes and from other miscellaneous sources. In addition 1,578 samples of water were taken from boreholes used for irrigation purposes and were sent to the Geological Laboratory.

VIII. Bacteriological Analyses

During the year 1,039 samples of water were taken mainly from town water supplies were analysed by the Government Pathologist.

The total number of samples taken and the number of unsatisfactory ones are as follows:-

Water Supply	Number of Samples	Number of Unsatisfactory Samples
Nicosia	620	63
Famagusta	201	8
Limassol	86	12
Larnaca	52	2
Paphos	56	9
Kyrenia	24	-
	1,039	94

At Nicosia most of the unsatisfactory samples came from private boreholes which supply water to Nicosia Water Board as well as from Bernera and Arab-Ahmet chain of wells. All chlorinated samples at all reservoirs were satisfactory.

The unsatisfactory samples at Limassol, Famagusta, Larnaca and Ktima were usually of unchlorinated water. All chlorinated samples at the main reservoir were satisfactory.

IX. Improvements and Repairs to the Existing Measuring Sites

During the year the following improvements and repairs were carried out on the existing measuring sites.

1. Elea measuring site near Vizakia:-
   Reducing the length of the lower section of the weir by 9' 6" and widening the sill by 1 ft.

2. Karyiotis measuring site near Evrykhou:-
   Stabilization of the river bed near Evrykhou by constructing one measuring weir 9 ft. with a notch 3 ft. x 1 ft. for low flows and installation of one iron foot bridge for current meter measurements.

3. Aradhippou measuring site at the old road main bridge:-
   Repairs to the apron which had been undermined by floods.

4. Kourris measuring site near Erimi:-
Raising the sill of the weir and the intake pipe system by 1 ft.

5. Kryos and Kourris measuring site:-
Widening the sill by 1' 9" and making a notch 16' 8" x 2' 4" for the normal flows.

6. Kourris measuring site near Khalassa:-
Reducing the length of the lower section of the weir by 9' 6".

7. Zyghos measuring site near Khalassa:-
Widening the sill by 1' 9" and making a notch 9' x 1' 8" for the normal flows.

8. Ezuza measuring site near Kannaviou:-
Reducing the length of the lower section of the weir by 12' 4" and making a notch 5' x 1' for the low flows.

9. Dhiarizos measuring site near Philousa:-
Reducing the length of the lower section of the weir by 27' 8", widening the sill by 1 ft. and making a notch 5' x 1' for the low flows.

10. Ezuza measuring site near Akhelia:-
Reducing the length of the lower section of the weir by 40' 8" and widening the sill by 1' 9".

11. Xeros measuring site near Peyia:-
Making a notch 6' 8" x 1' on the existing weir for the low flows and installation of a float tube for the water level recorder.

12. Vathis measuring site near Athalassa:-
Raising the sill of the weir by 10" and making a notch 3' x 10" for the low flows.

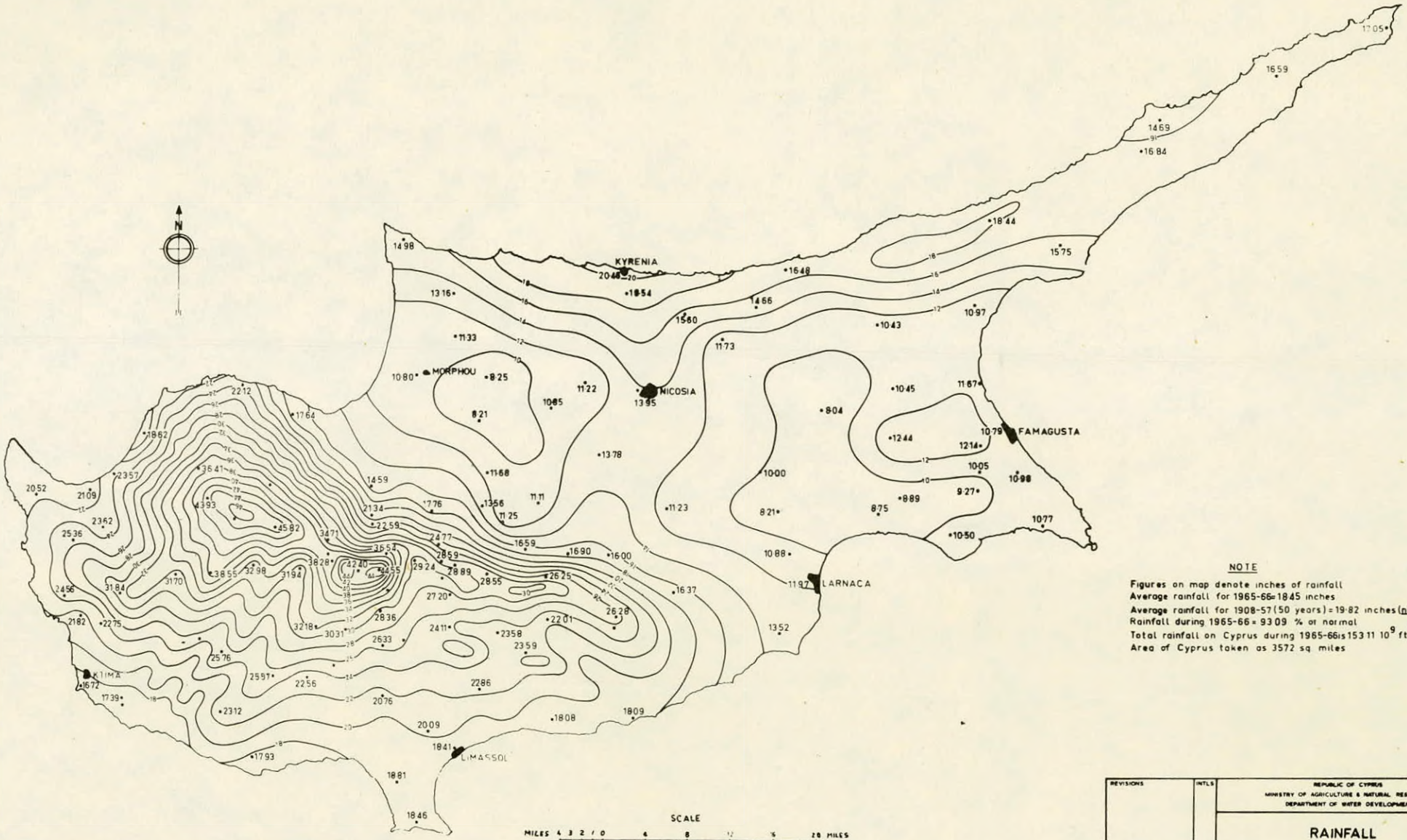
Minor repairs were also carried out on Khapotami (Kissousa) and Alakati, Ayios Amvrosios (Kyrenia) measuring sites.

X. Hydrological Surveys and Construction of Measuring weirs costs

During the year the following expenditure were incurred by the Hydrology Section on the observation and Research made on the surface and ground water of the island:

	Approved Estimate Cost	Actual Expenditure
	£	£
Hydrological Surveys	16,548	15,653
Construction and Maintenance of Measuring Weirs	4,000	3,210
Totals =	£20,548	£18,863

Appendix No. 14

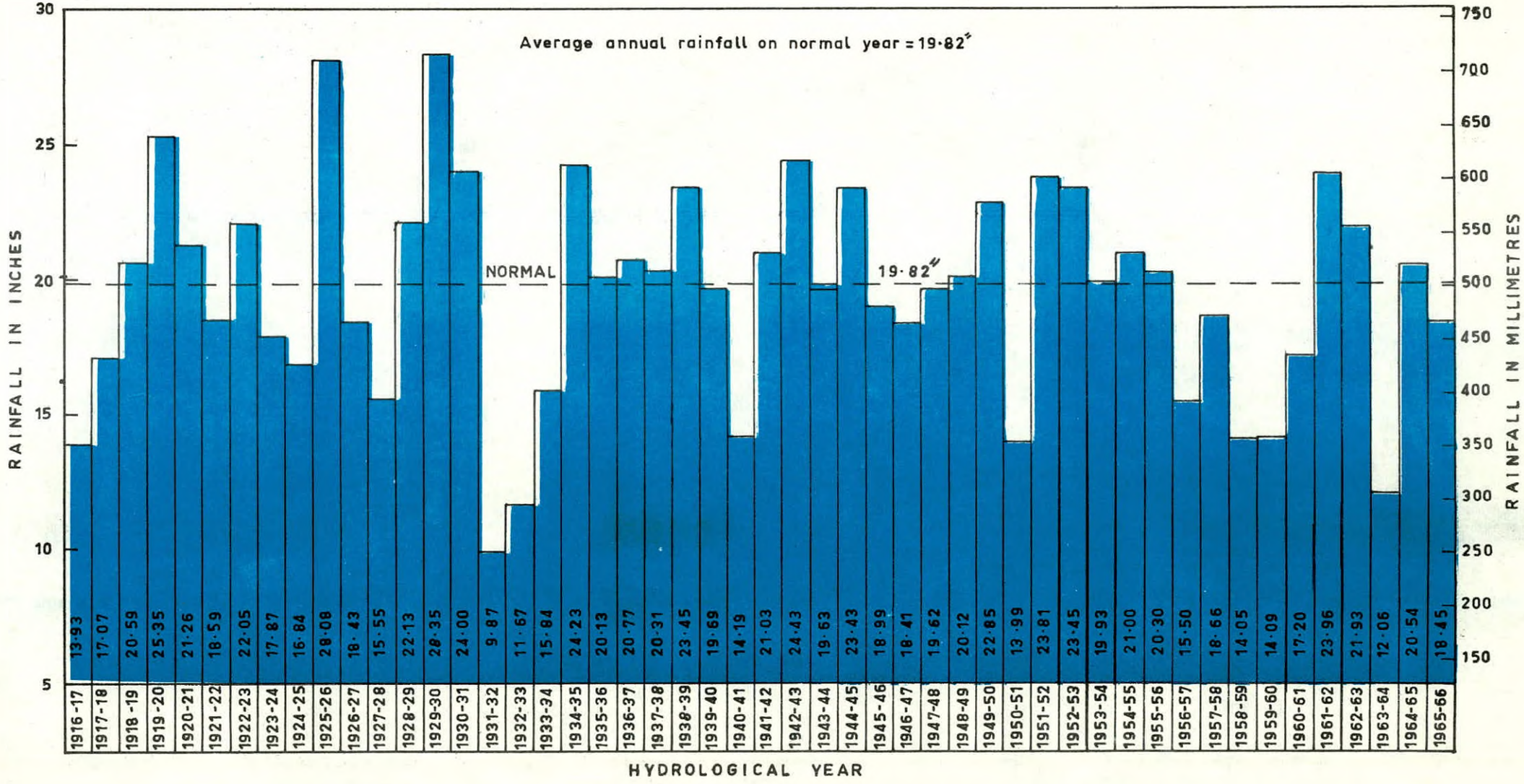


NOTE

Figures on map denote inches of rainfall
Average rainfall for 1965-66 = 18.45 inches
Average rainfall for 1908-57 (50 years) = 19.82 inches (normal)
Rainfall during 1965-66 = 93.09 % of normal
Total rainfall on Cyprus during 1965-66 is 153.11 10^9 ft^3
Area of Cyprus taken as 3572 sq. miles

REVISIONS	INITLS	REPUBLIC OF CYPRUS MINISTRY OF AGRICULTURE & NATURAL RESOURCES DEPARTMENT OF WATER DEVELOPMENT
		RAINFALL
		ISOHYETAL MAP OF CYPRUS BASED ON RAINFALL FROM 1st OCT. 1965–30th SEP. 1966
		MAY 1966 | DO | DRG. No.
		SURVEYED BY | TRACED BY
		DESIGNED BY | CHECKED BY
		DRAWN BY | APPROVED BY

AVERAGE ANNUAL RAINFALL OF CYPRUS
50 YEARS:-1916-1966



Annual Report Yermasoyia Dam

A) Introduction

Yermasoyia Dam is located in the Limassol area, 4½ miles upstream of the main road to Nicosia.

Yermasoyia Dam is an earthfill dam, approximately 120 ft. height. Its storage capacity is 3,080 MG. After its completion it will be the largest dam in Cyprus. The design was entrusted to Messrs. "ENERGOPROJEKT". Consulting Engineers Beograd, and the construction contracted to Messrs. CYBARCO LTD.

This multipurpose scheme is billed to cost £1,007.000 (without the distribution).

B) Supervision

The Supervision is done jointly by the consultants, and the W.D.D. The consultants are represented by the Resident Engineer, one grouting Engineer and four technicians. W.D.D. is represented by two Engineers, one Inspector of works, one Technical Assistant, Laboratory Assistants and Foremen.

C) Progress of the work

The contractor erected his offices and his camp during the last months of 1965. The works on Yermasoyia Dam started at the beginning of January, 1966.

1) The Cofferdam

The cofferdam is a part of the main dam body, and was constructed in two parts.

On the 6th of February, 1966 the contractor stripped the right hand area under the cofferdam, and started with the filling. After the river flow stopped by the end of June 1966 the stripping started in the river section. Over this area a clay blanket was placed of three feet thickness.

The height of the cofferdam was increased 5 ft. i.e. from elevation 205' to 210'. The elevation now is 206'. On the upstream part of the cofferdam, the Resident Engineer approved that the contractor places a counter weight.

2) a) Tunnel and shaft excavation and concreting

The tunnel excavation began on the 24th of February, 1966 from the outlet part. The excavation was proceeding by explosives, in a very high progress.

After some dangerous cracks have been met, the excavation stopped at the inlet on the 16th of March and at the outlet on the 21st of April. The stations were 292' and 352' respectively. After the excavation stopped the concreting of the tunnel started. The excavation started again on the 23rd of May. On the 19th of July, the tunnel was totally excavated.

The first casting in the valve chamber took place on the 14th of July 1966. The roof of the valve chamber is not yet cast.

b) Shaft. The shaft excavation began on the 23rd of January, 1966. The total height of the shaft is 90 ft. and up to now is excavated only 60 ft. height which is also been cast. A pilot hole of 2 ft. diameter is opened through.

3) Cut off trench

The excavation of the cut off trench started on the 24th of June 1966. When the excavation was going on, the consultants decided to deepen the cut off trench for another 15 ft. By a mistake of the contractor the excavation went 6 ft. deeper, and so on the 3rd of August, 1966, during a meeting on the site, a second deepening (up to the rock) has been decided. The rates of the excavation and the filling in the deepen cut off trench are higher than in the bill of quantities. On the 17th of August 1966 the rock has been found on the elevation 129'.

After a concrete slab of 15'x60'x2' has been placed over the rock, the filling started on the 2nd September, 1966. The filling continued without any troubles up to the middle of October after some heavy rain has fallen on the site.

On the 18th of October started the seepage in the cut off trench. The elevation was 152'. Because the contractor had no available pumps on the site to cope with the big inflow, the water filled the right side of the cut off trench. After the water was extracted and everything was ready to start again with the filling, new heavy rains delayed the work.

The first emergency meeting was called on the site on the 17th November, 1966. The first emergency action to stop the seepage was to grout the part below the cofferdam where the seepage was. So from the 19th to the 24th November 9 tons of cement-bentonite mixes were injected. After it, a dyke has been constructed in the lake, from where the water was pumped to the other lake in order to reduce the leakage, but without any success. The third measurement, which was also the most successful was to construct a wooden sheet pile cofferdam, to form one sump and pump the water out by increasing the pump capacity.

So on the 26th November the Department supplied the contractor with two additional pumps.

On the 1st December 1966 the Director of the Department visited the site for an emergency meeting. Together with the contractor, one program was adopted. According to the program the filling of the trench would finish on the 20th December. But due to the weather and the inexperience of the contractor the work was delayed.

On the 10th of December, we decided to divide the cut-off trench longitudinally and fill only the upstream part, from elevation 176' to 186' because of shortance of time. According to this program the work finished on the 29th December, 1966.

4) Grouting works:

The contractor started with the drilling on the right abutment, after this area has been totally stripped. During May was allowed to the contractor to grout the right abutment with cement-bentonite mix. Because it has been decided to deepen the cut-off trench the alluvial grouting was postponed. After some platforms were prepared, on the steep left abutment, the drilling started.

In July 1966, the R.E. asked the contractor to drill some exploratory holes on the left bank. Because the results of the permeability tests were very high, it has been decided to extend the grout curtain towards the left bank. The grouting of the extension started in October, 1966 and is still going on. Meanwhile started also the drilling and the grouting in the tunnel. Nearly 71% of the tunnel grouting is finished. Because the concrete works in the shaft and the valve chamber are not yet finished no grouting has been undertaken.

5) Spillway

The spillway excavation started at the beginning of June, 1966. The total excavation is 200,000 cu. yds. Up to the 31st December, 1966 were 144,900 cu. yds. excavated. The excavation goes on with one blasting per day.

6) Hydromechanical equipment

The 24" ø discharge pipe arrived in April, 1966 on the site and the contracts started immediately with placing. By the middle of November the frames and the trash racks arrived from the W.D.D. workshops. Because the perforated intake pipe is still under construction the trash racks are not yet placed. On the 29th December, 1966, the wheel gate, its lifting mechanism, the aeration pipe and the shaft ladder, arrived from Greece.

7) Dam

In order to use up the excavated material from the tunnel and shaft excavation, it was allowed to the contractor to prepare the downstream part of the dam and start with the filling. The area was stripped properly and compacted by four passes with the pneumatic roller. For the filter under the dam, material from the river bed, was used, which was been properly washed during the river flow.

The thickness of the layer and the compaction method have been changed.

Apart from the material of the tunnel and shaft excavation material from the spillway and the cut off trench excavation was used.

The elevation of this part is 230'.

8) Placing of Piezometers

The installation of the piezometers in Yermasoyia dam, took place on the 20th of September, 1966. Mr. Volla from Officine Galileo Milano, has installed these. Four capsules are installed in the downstream part of the dam.

The locations of the instruments are on the sections 3-3 and 5-5.

D) W.D.D. works by direct labours

1) After the preparation of the area and the erection of the offices for the supervision staff, started the access road for heavy machinery. The road is constructed along the river, and the material used was from river gravel. The length of this road is nearly 2 miles.

2) Water supply for Yermasoyia

The main pipeline of the water supply for Yermasoyia was diverted, because it was passing through the site.

3) Diversion road to Akrounda

The diversion road to Akrounda started in February, 1966. The new road is placed along the reservoir boundaries. On this road were constructed 8 culverts and one bridge. The bridge is still under construction. Up to the 31st December, 1966, 4 kilometers of road were constructed.

4) Diversion road to Phinikaria

The diversion road to Phinikaria is under design.

The bridge over the existing road to Phinikaria was removed and reconstructed approximately 1000 yds. upstream.

5) Investigations

In all borrow areas some new pits were excavated, in order to find the exact volume of the material. Also a new area called "N" in the locality "Kameno Khorio" has been tested. This area is outsite the acquisition.

Maintenance and Operation Section

This section has only come into existence very recently. The objects of this section are:-

(a) The operation of Government Dams
(b) Routine maintenance of all dams
(c) Design and construction of works aimed to stop the leakage and maintain the safety of the dam.

The number of dams in Cyprus is increasing very rapidly and it is very essential that this section is well equipped and organised to cope with the amount of work involved.

There are in all 43 completed dams in Cyprus which can be divided into the following categories.

(a) Large Dams
(capacity over 100 million gallons) 11 No.

(b) Medium Dams
(capacity between 50 & 100 million gallons) 8 No.

(c) Small Dams
(capacity under 50 million gallons) 24 No.

The total amount of water that can be impounded today by dams in Cyprus amounts to 5,300 million gallons. With the completion of Yermasoyia Dam now under construction the total capacity of Dams will increase to 8,300 million gallons.

The rate of Dam construction in Cyprus in terms of amount of storage is shown in the following table:-

Year	Total capacity of Dams (million gallons)
1960	1398
1962	2401
1963	3853
1964	3985
1965	4735
1966	5300

Major projects are now financed fully by the Government and water is sold to the beneficiaries according to the Government Water Works Law Cap. 341. The first dams to be declared as Government water works are the following:-

1. Argaka - Magounda
2. Kiti (Tremithios)
3. Polemidhia
4. Mavrokolymbos
5. Kalopanayiotis.

The only projects that were in the past declared as Government Water Works are the Eastern Mesaoria Irrigation Works consisting of the Kouklia, Akhyritou and Syngrassis reservoirs.

In 1966 only Argaka - Magounda and Kiti Dams were operational. The Polemidhia dam although completed and nearly half-full, it was not possible to sell any water from this dam as the Distribution system was not completed. Mavrokolymbos and Kalopanayiotis dams have only just been completed, and no water has yet been impounded by them.

Income from Government Water Works.

As Kiti dam did not impound any water in 1965/66, it was only possible to sell water from Argaka - Magounda dam which filled completely and the Eastern Mesaoria Irrigation works.

The income from the Government water works is as follows:-

(i)	Eastern Mesaoria Water Works	£100
(ii)	Argaka - Magounda	£522
	Total	£622

The price of water from each dam varies according to the cost of the project and the Government subsidises the water by 25% to 50%.

Operation of Government Water Works

Difficulties are experienced at the moment with the selling of water from Government dams. These are the teething difficulties one could expect, and I am sure they will be over come in the near future.

In the case of Argaka - Magounda there is no proper distribution system yet, and difficulties are experienced with water rights. Until the water rights are finally settled, no proper distribution system can be constructed and until that time it will not be easy to sell water from this dam.

The main distribution system from Kiti dam is completed but difficulties are experienced with the measurement of the quantity of water as the distribution consists of concrete canals, with no means to measure the water to each consumer.

The ideal distribution system should be of pipe conveyors with water meter to measure the quantity of water given to each consumer. Such case will be reached when the distribution system at Polemidhia dam is completed, and will serve as an example for the operation of Government dams.

In order to achieve economy in water it is essential that the water is sold by the cu.m. and to achieve this it is necessary to have means of measuring the water for each consumer.

Works executed in 1966

During the short period of its establishment the maintenance and operation section carried out the following work in 1966.

1. Kalon Khorio (Klirou)
   The following works were carried out.
   Repairs to gate, inlet to outlet pipe and desilting of the dam.

2. Lefka dams
   Damages were maliciously caused by blasting to Marathasa and Kafizes dams. For Kafizes dam the damage was mainly on the outlet pipe, and the platform and operating mechanism of the penstock. All damages were repaired.

For Marathasa dam the small scouring gate was broken completely and a new one was ordered through the Crown Agents. As the gate will not be delivered in time to close the dam to impound water, arrangements have been made for temporary closing the dam. A lot of desilting work was also carried out for this dam.

3. Kiti (Tremithios) Dam

When the dam filled for the first time 1964/65, a big quantity of water was leaking through the Bekir Pasha chain of wells dischanging into the Larnaca salt Lake. Works were carried out to stop this leakage, and so far the results are very encouraging. The works will be completed in 1967, and their success will be proved when the dam fills completely.

4. Agros Dam

A scheme was designed to stop the leakages at Agros dam. It involves the lining of part of the reservoir with Polythene sheeting and is expected to be carried out this year.

REPORT ON KALOPANAYIOTIS DAM

This report is mainly dealing with construction work during 1966. Further information about the above dam is included in 1964 and 1965 annual reports.

A. At the beginning of 1966 the situation on the site was as follows:-.

(a) Embankment. The embankment was raised up to elev. 162' by the middle of December 1965 and was left at this level for the winter season. It was decided that field permeability tests be carried out to determine the actual permeability of the clay core, and of the two vertical transition zones.

(b) Spillway. The spillway main excavation was completed by the end of September 1965 and concreting started immediately so that 950 cu. yds of concrete were used for various sections of the spillway by the end of 1965.

One half of the cut off wall was completed during 1965 and the hand excavation for the other half started on December 1965.

(c) Outlet works. The excavation and concreting of the tunnel and the forebay as well as the main part of the valve chamber were completed by the end of 1965.

(d) Grouting. Grouting works by the contractor Messrs. Foundation Engineering of London in association with "Ioannou and Paraskevaides Ltd" were performed under the river bed section, around the tunnel and under the above mentioned cut-off wall.

B. Work during 1966

(a) Embankment. During the winter season we carried out the above mentioned tests which indicated that the permeability of the clay core was of the range of 10^{-6} cm/sec but the permeability of the two transition zones was lower than required. So it was decided that the filtry material to be delivered from Morphou seashore and construct another horizontal filter blanket at el. 162' and the transition zone downstream, whilst the upstream transition zone would continued being constructed with filtry material from the river bed.

On the 26th April 1966, the filling started again and it reached el. 233.5' on the 30th August 1966. The last 2 ft. up to crest level 235.5', were left due to grouting work. The two rock blankets on the sides of the embankment were delayed up to the end of the year because the rock material was taken from the river bed after blasting of large stones. The following quantities of material were placed.

Material		During 1966	Total
Clay core	:	18,420 cu. yds	40,814 cu. yds.
Transition zone U/S	:	3,841 " "	5,069 " "
" " D/S	:	3,816 " "	5,516 " "
Randomfill	:	96,781 " "	136,301 " "
Rock blanket	:	7,070 " "	7,920 " "
Horizontal gravel	:	1,850 " "	3,500 " "
Rock Toe	:	-	5,311 " "

The above work was carried out in two shifts whilst departmental and hired machinery were used.

(b) Spillway. The work on the spillway consisted of the following: Excavation of the foundations and the concreting of the side walls and other parts of the spillway, the filling behind them and the construction of accessories. The work went on all around the year with intervals and the last concrete was poured on the 20th December, 1966. The main concreting work was completed by May, but later we had to remove to another place the aggregate and cement stores as well as the concrete mechanical equipment and to make an excavation of about 6,000 cu. yds. to form the approach channel. This excavation meant to us a lot of costly delays because if it was done at the very beginning it would be better.

About 1750 cu. yds. of concrete of all classes were used to construct the side walls, the slabs and the flip bucket of the spillway. About 400 cu. yds of selected rubble were placed behind the side walls as drains. A concrete staircase, a steel bridge and concrete steps will help the passage from the guard house to the dam crest and the exit of the tunnel.

Cut-off-wall. The other half of the 5' wide cut-off wall mentioned above, was excavated in two parts to avoid any collapses of earth material. It reached el. 142' which means a depth of 113' out of which 25 ft. were mechanically excavated and the rest of 88 ft. were excavated by hand. The hand excavation was a little delayed due to the fact that under el. 168' water was met coming out from the sides. The quantities of excavation and concreting of the cut-off wall during 1966, are as follows.

Hand excavation: 1.227 cu. yds.
Concrete : 1.143 cu. yds.

(c) Outlet works. The tunnel was completed by the construction of a small part of 8 ft. of conduit and an open channel at the end of it. Then the construction of the rest of the valve chamber was ahead to a point to allow the installation of the penstock which was done on the 10th of August. At the same time the 12" dia. perforated pipe for the irrigation was installed. The valve chamber was completed by the beginning of September. After the construction of the valve control house a German expert from the company which supplied the penstock, arrived in Cyprus on the 11th October and supervised the installation of the hydraulic system for the operation of the penstock.

(d) Grouting. The contractor of the grouting came back at Kalopanayiotis on February 1966, and with the help of the departmental O/D completed grouting in the river bed (a small part was left ungrouted) as well as the consolidation underneath the weir block of the spillway. The rest of the grouting was undertaken by the department. A grouting group executed a line under the cut-off wall during April and May and later in September when the embankment was completed they started grouting of the west abutment from el. 233.5 through clay core. This grouting is very difficult due to the bad condition of the rock of this abutment and it will take some time of the next year to be completed.

(c) Miscellaneous

(a) A concrete weir was constructed at the headwaters of the reservoir mainly for measuring purposes and to divert the summer water through an 8" dia' pipe to the end of the tunnel for Lefka village.

(b) The excavation of the new road was about ready at the end of the year. The realignment of the road was necessary because the old one was almost destroyed. The deck asphalting of the new road will be undertaken by P.W.D.

(c) Leakage measuring points were installed downstream of the dam, and measurements of the discharge of three springs are taken since last June.

(d) A crack was found on the west to the dam hill a third of a mile away from the embankment on the 28th November 1966. Measuring points were installed in three lines to enable us measure any further progress of the crack.

(f) Cost: The initial cost of the dam was estimated to £230.000. After some surplus than estimated work was done at the foundations and grouting, an extra amount of £19,700 was provided for contigencies which brought the initial estimated cost to £249,700.

An amount of £90,239 was spent during 1966, which brought the total up to the end of December 1966, cost to £206,303.

There remain now to complete the dam, some small odd jobs like railings, settlement markers and the execution of a new line of grouting at the west abutment.