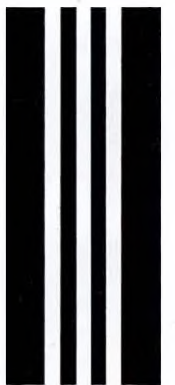
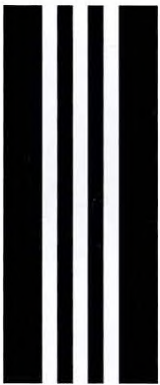


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REPUBLIC OF CYPRUS

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ANNUAL REPORT  
OF THE  
DEPARTMENT  
OF WATER DEVELOPMENT  
FOR THE YEAR  
1962

PREPARED BY  
ir. PAUL DE GRUYTER,  
*Director of the Department of Water Development.*

REPUBLIC OF CYPRUS

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DEPARTMENT OF WATER DEVELOPMENT

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ANNUAL REPORT FOR 1962

PREPARED BY

ir. PAUL DE GRUYTER

DIRECTOR OF THE DEPARTMENT

OF WATER DEVELOPMENT

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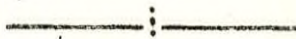
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## 1. INTRODUCTION

The engineering and geological side of all Government Water Development Work has been, as in former years, in the hands of the Department of Water Development whose duties include the search for new sources, the conservation and development of supplies for irrigation, domestic and industrial use, and the problems connected with river training, flood protection and land drainage. The administration of Irrigation Divisions and Associations and Domestic Water Commissions has been supervised by the District Officers. Disputes over water rights have been handled chiefly by the District Officer in consultation with the Law Officers and the Departments of Land Registration and Water Development. Soil Conservation and the Agricultural problems involved in the economic use of water for irrigation are responsibilities of the Department of Agriculture.

The year 1962 was a record year for the execution of water development schemes. As it is seen from the table of capital invested in water development projects on page 5 a total expenditure of £1,390,233 was incurred on schemes during the past year (£1,147,442 in 1961).

After several years of low rainfall, the precipitation in winter 1961/62 was above normal and this had a favourable effect on agricultural production in the rainfed areas and, in general, on the declining of the watertables in the overpumped aquifers (see Appendix 16).



## 2. ORGANIZATION AND COORDINATION

No fundamental changes were made during 1962 in the Department's organization.

The department consisted of six technical sections:

- (a) Irrigation and Drainage,
- (b) Town Water Supplies,
- (c) Village domestic water supplies,
- (d) Hydro-geology and drilling,

- (e) Hydrology,
- (f) Workshops;

and furthermore a Registry and an Accounts Section to deal with all administrative and financial matters.

There is a close cooperation between all Sections, so that their work is well coordinated. The organization of the Water Development Department, whereby all Government responsibilities connected with the development and use of all water resources, together with a good coordination of the separate sections, guarantees the best possibilities for development. Thus a source of water may be developed for domestic water supplies in excess of the requirements of a particular village and the surplus may be utilized for irrigation. Where surface water is not available geological investigations may locate underground sources from which water can be pumped for irrigation or domestic use. Springs now used for irrigation are more and more being used for domestic water supplies, whilst the irrigators will be supplied with water stored by means of dams, etc.

An attempt was made to establish a branch office in Limassol (or Paphos) - to begin with - but the proposal was rejected by the Council of Ministers.

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### 3. NOTES ON WORK DONE IN 1962.

Much work has been done in 1962 by all Sections of the Department, but especially considerable progress was made in the development of water for irrigation purpose. Due to lack of time and staff the design and construction of works and measures for an efficient water use did not keep up with the works which made water available for agriculture, but we hope with increased staff and coordination, to synchronize planning and construction of both sorts of works in the near future.

Mention must be made of the large number of separate works, scattered over the whole island, which are undertaken more or less simultaneously. As all these works are carried out solely by the (only) Office in Nicosia, this tends to distract the attention of the

senior officers from the main planning problems. A certain decentralization is highly desirable with the main purposes to increase the speed and quality of development planning and to get more contact with local people and better control over local events. Branch offices would be the best start for decentralization.

Leaving out all maintenance, observation and survey operations, the number of separate new (or improvement) works carried out in 1962, was as follows:

Major irrigation works	6
Minor irrigation works	112
Town Water Supply works	5
Village Water Supply works	122
Drilling operations	77 villages
Construction of new measuring weirs	12
Total	334

A more detailed account of the works undertaken in 1962 is given in the appendices 1-17.

#### 4. STAFF AND LABOUR.

The staff of the Department on 1 January and 31 December, 1962, was as follows:

<u>Staff 1962</u>	<u>1/1/62</u>	<u>31/12/62</u>
Director	-	1
Assistant Director	1	1
Senior Water Engineers	2	2
Engineer - Hydrologist	-	1
Executive Engineers	4	9
Geologists	-	3
Superintendents of Works	-	2
Senior Inspectors of Works	4	4
Inspectors of Works	6	14
Chief Foremen	2	3
Assistant Chief Foremen	2	3
Technical Assistants	22	29
Foremen 1st + 2nd Grade	33	39
Foremen 2nd Grade	2	10
Storekeeper	1	1
Accounts and Clerical Staff	33	36
Chainmen	16	5
Total	128	163



Mr. P. de Gruyter was appointed jointly by the United Nations and the Government of Cyprus, as Director of the Water Development Department (under the OPEX programme) and took up his duties on 17 April, 1962.

The average number of labourers employed by the Department during 1962 was 1716, as compared with 1744 in 1961. About 23% were classed as regulars while about 45% were skilled employees.

The approximate monthly averages were as follows:

January	1495
February	1065
March	1012
April	1210
May	1705
June	1825
July	1972
August	1967
September	1962
October	1863
November	2050
December	2464
Average	<u>1716</u>

There were no labour disputes or strikes during the year. There were no appreciable variations in the wages structure during the year except the normal annual increases granted to regular employees.

5. FINANCE.

The following is a summarized statement of the expenditure of the Department of Water Development in 1962.

	Government Funds	Contribution by Beneficiaries	Total
1. Irrigation & Drainage	£249,332	£143,949	£393,281
2. Village Water Supplies	299,208	321,329	620,537
3. Prospecting for water	69,523	-	69,523
4. Drilling upon Repayment	-	2,628	2,628
5. Greater Nicosia Scheme	3,728	-	3,728
6. Morphou Bay Scheme	40,098	-	40,098
7. Town Water Supplies upon repayment	-	17,732	17,732
8. Hydrological Research	40,520	-	40,520
9. Purchase of Plant	31,712	-	31,712
10. Miscellaneous Works for Government Authorities	10,536	-	10,536
11. Maintenance & Running of Greater Nicosia Scheme	36,166	-	36,166
12. Dept'l. and Maintenance	123,772	-	123,772
Total	£904,595	£485,638	£1,390,233

Included in the above statement are:

1. Personal Emoluments	£ 62,328
2. Wages for labour (Approximate)	400,000
3. Travelling	19,655
4. Pump testing wells and boreholes	5,500
5. Value of casing pipes fixed in boreholes	7,150
6. Total Cost of drilling and cleaning boreholes excluding items 4 & 5	58,800
7. Maintenance of Government water supplies and purchase of water	9,949

The Government does not carry the whole financial burden of water development works. Beneficiaries contribute a certain, varying, percentage towards the initial cost of the works. Towards the cost of gravity irrigation works the village contribution varies from 20% to 60% according to the type of work (value of the water) and the nature of the ownership of the water. When the water is owned collectively as by the members of an Irrigation Division, the usual contribution is 20% for spate irrigation and 33.3% for perennial irrigation. For schemes whose purpose is to recharge aquifers from which irrigation water for perennial or summer crops is

extracted, the customary rate is 33.3%, except in cases where recharge is doubtful and the water most likely will have to be used in early spring by means of canals; here the village share is 25%. In Irrigation Associations there is private ownership of water and the village share is usually higher than for a Division; each case is considered on its merits with the result that the average village contribution over the past year was about 45%. The village share of the cost of scheme is usually raised by a loan from the Government Loan Commissioners at a low rate of interest but occasionally it is paid partly or wholly in cash or in free labour. In respect of drilling, private individuals are charged the actual cost including 20% departmental charges on works and 25% on the cost of casing pipes. Municipal Corporations, companies, etc., also usually pay the full cost and departmental charges at the rate of 20% on labour and 25% on materials. Town water supply works are paid for in full by the respective authorities including departmental charges at the rate of 6% on labour and 10% on materials. The new Greater Nicosia Scheme and the Morphou Bay Scheme are, for the time being, financed wholly by Government. Domestic water schemes for rural municipalities and villages are paid for half by Government and half by the village if no house connections are wanted. If there are house connections the extra cost is borne entirely by the village.

We suggested that it would have certain advantages if dams were built at full cost of the Government (Appendix 19 - No. 5), but no decision on this issue was taken in 1962.

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## 6. THE 1963 PROGRAMME.

After having submitted our first estimates for 1963 we were asked by the Council of Ministers to prepare a budget for the construction of as many works as possible. Our second development estimates had to be reduced slightly, but anyhow a very large programme for 1963 eventually was approved. The total (regular and development) budget for 1963 amounts to £2,218,691.

The programme for the Irrigation Section was increased the most. To realize that programme an amount of £1,015,000 would have to be spent on irrigation works.

To prepare the designs for such a large programme more staff was required and also more accommodation, furniture, transport, telephones, etc. Although we encountered goodwill and cooperation from all sides, yet many difficulties and obstacles had to be overcome before the men and the tools became available. If the Director would be given more authority and the Department would be less dependent on other Departments and Services, then development could proceed quicker, easier and cheaper. This will be dealt with in later reports.

As it was designs were not all prepared in time or with sufficient accuracy and this might delay the execution (in 1963).

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7. FOREIGN ASSISTANCE.

In 1962 Cyprus received technical assistance in the field of water resources development from the United Nations and from the French Government.

F.A.O. provided, at the request of the Government of Cyprus, for the services of Dr. N. G. Krausz, Professor of Agricultural Law at the University of Illinois and of Dr. Dante Caponera, a specialist in Moslem Law. They stayed in Cyprus for some months in the beginning of 1962. Their report was received from F.A.O. in February 1963.

The French Government offered bilateral technical assistance to Cyprus by providing, through the SCET (Société Centrale pour L'équipement du Territoire) for a team of experts, one hydrogeologist, one hydrologist and one assistant hydrologist and one geophysician + one consulting engineer part-time. The team arrived in Cyprus on 15 March, 1962, but only after an agreement was reached (13 June, 1962) and funds for transport and Cypriot technical and secretarial assistance were available actual work started.

Under the Agreement France provided for 85% of the salaries of the experts, the full cost of their transport to Cyprus and back and for some equipment. The Government of Cyprus pays for all Cypriot personnel, for transport in Cyprus, and contributes a maximum of ± £7,400 for salaries of experts and equipment.

This French Mission will carry out an investigation of the important Morphou aquifer, from which much more water is extracted for the irrigation of the citrus orchards than the natural replenishment.

Furthermore much preparatory work was done in 1962 concerning technical assistance to be offered to Cyprus by the U.N. (1 Senior Irrigation Engineer, 1 Dam Design Expert and the Special Fund Project for groundwater and mineral investigations); by the U.S.A. (4 Senior Engineers and a Feasibility Study for added water supply for Famagusta town); by West Germany (a hydro-geological and soil study of some part of the Island) and by the Netherlands (an Associate Expert, to be offered to the Government of Cyprus through F.A.O.), but this assistance did not yet mature in 1962.

Mention must be made of a visit by Mr. H. E. Hedger, a Senior American irrigation engineer, who was assigned by the U.S. A.I.D. Mission to examine, during his stay in Cyprus in March-April, 1962, the ways in which the U.S. could assist the Government of Cyprus in developing its water resources.

Mr. Hedger's Report (Cyprus Water Development Programme) based on information received from the Department officials, is a valuable contribution to water development planning.

Finally we wish to mention that an Agricultural Research Institute started work in Cyprus in September, 1962, as a U.N. Special Fund Project, executed by F.A.O.

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8. ACKNOWLEDGMENTS.

We are happy and thankful for the fine cooperation offered to us by all Sides of the Government and by the officers of our Department in particular.

With great pleasure we pay tribute to our officials who at all levels performed their duty satisfactorily, often under difficult circumstances and notwithstanding some disappointments. They showed eagerness to learn, devotion to study and enthusiasm in their work, which is greatly appreciated.

Mention is made of the closer understanding and cooperation growing between the Agricultural and the Water Development Departments. We feel sure that the necessity to coordinate water resources and agricultural development as closely as possible is realized and encouraged by the Ministry of Agriculture and Natural Resources and the Government.

We trust that the cooperation between the Water Development Department and the Agricultural Research Institute will also lead to better planning and more efficient use of Cyprus' precious water.

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APPENDIX 1.

IRRIGATION

By C. A. C. Konteatis, B.Sc.(Eng.),  
A.M.I.C.E., A.M.I.W.E., Senior Water Engineer.

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The following table gives the expenditure on Irrigation Works since 1950. From the table it can be seen that the importance of irrigation has grown considerably since the past two years after Independence having in 1962 reached the figure of £400,000 representing 36.5% of the total expenditure in the Department.

The land that will be benefited by the 1962 projects is estimated to be 6284 donums of perennial crops, 1640 donums of spring crops and 5900 donums of winter crops. This extent of land does not include the land that will be benefited by the recharge works at Morphou, Famagusta, Paralimni, Sotira and Aloa.

Expenditure:

Year	Irrigation Works	Total Works in W.D.D.	Irrigation % of total Works
1950	£102,620	£ 307,162	33
1951	163,493	522,847	31
1952	171,493	585,141	29
1953	169,500	771,800	22
1954	132,500	821,900	16
1955	180,850	661,400	27
1956	125,276	852,172	14.5
1957	179,600	1,064,000	17
1958	95,275	1,049,125	10
1959	85,147	500,872	17
1960	90,686	345,491	26
1961	285,000	1,024,793	28
1962	400,000	1,089,152	36.5

## I. CONSTRUCTION WORKS.

The most important irrigation works undertaken in 1962 were the following:

### 1. Geunyeli Earth Dam.

This dam was built on the "Almyros" stream which has its sources on the Kyrenia hills and discharges on the Pedieos main river at Orta Koyu. The position of the dam is about two miles upstream of Geunyeli in the "Almyros" stream and about a mile east of the main Nicosia Kyrenia road.

The capacity of the dam is 230 million gallons and the volume of earth fill amounted to 66,000 cu. yds.

The maximum height of the dam is 50 ft.

The maximum design spillway discharge is 3500 cusec.

The maximum surface area of the water in the reservoir is 65 acres.

The slopes of the dam are 1:3 upstream and 1:2 downstream.

It is a homogeneous embankment with a filter blanket at the downstream foundation level and extending vertically at the middle towards the crest. The fill used is a good cohesive soil of very low permeability.

To enable the construction of this dam a small checkdam of 10 million gallons capacity was built to provide water for the construction.

The construction of this dam was carried out by trackscavators which excavated the fill and loaded the tippers which in turn carried the fill on to the embankment where it was compacted by using sheepfoot rollers driven by small tractors. Water from the checkdam was continuously sprayed during compaction.

Big bulldozers were used for the excavation of the spillway.

The cost of the dam excluding the checkdam and other overheads was £22,000.

This dam is capable of irrigating about 1300 donums of spring crops when full of water.



## 2. Athalassa Dam.

This dam was built on the "Vathys" stream which is a small tributary of the Pedieos river and has its sources in the area of Xeri village. The dam is within the boundaries of the Athalassa Government farm and is about one mile north-east of the main Nicosia-Limassol road.

The volume of earth fill was 135,000 cu. yds. and the maximum height was 42 ft. The capacity of the dam is 174 million gallons and the maximum surface area of the water is 56 acres.

The extent of land that can be irrigated when the dam is full of water is 1,000 donums of spring crops.

However, the main purpose for constructing this dam was for flood protection of the Athalassa farm.

It is known that only during the flood of 1959 the damages on the farm were £6,000.

The main features of the dam are:-

The main fill used was gravel with some sand obtained from the river bed. An impervious core was provided of clay obtained from near the site. This core went down about 20 ft. through the gravel river bed to tie into the sandstone rock. The gravel zones were compacted by vibrating rollers, the clay by sheepfoot rollers. Water for the compaction was obtained through a borehole about one mile away which was conveyed to the site by a 4" dia. steel pipe where a steel tank storage was installed at a commanding place.

## 3. Prodromos Reservoir.

This reservoir built near the Prodromos-Troodos road at an altitude of about 5,000 ft. is the largest ever built in Cyprus.

It involved 165,000 cu. yds. of excavations into a decomposed igneous rock. It is a rectangular reservoir of a length of 840 ft. and width 240 ft. The depth of the reservoir is 20 ft.

The reservoir was built of 96,000 cu. yds. of earth. This earth is a sediment of drift material and boulder clay formed underneath the ice and composed of the ground up debris (fine rock flour) contributed by the melting out of euglacial material and by the abrasion of the rocks over

which the ice has passed and embedded in this clay are boulders and stony fragments of all sizes. The drift is deposited as an irregular sheet and is not stratified. The colour of the clay is reddish due to the abrasion effect of the ice over the reddish rocks in the area.

A zoned embankment was introduced by using 10 ft. thick clay on the reservoir side and 5 ft. clay on the base and using the other drift material on the outside side. The slopes of the embankment are 1:2 and the design provides for a rip rap on the reservoir slopes. Under the base a drainage net was provided to avoid damage of the clay blanket by uplift from groundwater in the mountain slope. This reservoir has not yet been completed entirely, but water has been allowed in for testing it and now it is nearly full.

Many big earthmoving machines were used to build this reservoir and in five months 165,000 cu. yds. were excavated and 96,000 cu. yds. were compacted many times under unfavourable conditions. 2,500 pinetrees were cut and sold by the Forest Department to recover the land for building this reservoir.

The reservoir's holding capacity is 25 million gallons of water which will be used to irrigate about 200 donums of deciduous fruit trees belonging to the Prodromos Irrigation Division.

The cost of the reservoir when completed will be £72,000.

#### 4. Paralimni Recharge Dams and Canal.

This scheme consists of the construction of a canal which will take water from the natural Paralimni lake to the Paralimni coastal aquifer for recharging the depleting water resources. This canal along its route will also supply water to 35 small reservoirs formed by as many dams in small rivers. The water brought from Paralimni lake and coming from the 35 catchments will be used for local recharge. The average available water of the Paralimni lake is about 200 million gallons. As the soil of the lake is rather saline, and there is a possibility of the water becoming saline, provision is made to empty the lake through the canal in about 12 days.

The canal which is 29,000 ft. long and its cross section is 12' x 3' was excavated in hard havara soil. For the excavation which amounted to approximately 50,000 cu. yds., 36,000 lbs. of explosives were used. Compressors and trackscavators were also used during the operation. The gradient of the canal is 0.5 ft. per 1,000 ft. and its capacity of flow is 30 cusecs.

The 35 small dams are of a total earth fill of 30,000 cu. yds. and their combined holding capacity is  $20 \times 10^6$  gallons of water.

These works had already one season's operation between 10/12/62 and 30/1/63 and it is estimated that about  $120 \times 10^6$  gallons of water were recharged in the aquifer  $100 \times 10^6$  gallons from the lake and  $20 \times 10^6$  gallons from the catchment of the small dams themselves.

In addition to the 35 small dams there was built one somewhat larger dam at Panayia. Its total earthfill amounted to 18,000 cu. yds. and its capacity  $10 \times 10^6$  gallons.

The total cost of the works amounted to £27,000.

#### 5. Sotira Dam.

This small earth dam whose cost was £4,000 was built on the Fonissa stream at Sotira and its purpose is recharging the aquifer.

For the dam 25,000 cu. yds. of clay were used which were excavated from Paralimni Lake and transported by lorries to the damsite where it was compacted by sheepfoot rollers.

The total capacity of the reservoir is 12 million gallons and in 1962-63 it got 4 million gallons which percolated through the river bed.

#### 6. Aloa Earth Dam.

This small dam was built for recharge purposes and its cost was only £900. Its total fill made up of clay as a core and random fill on the upstream and downstream sides was 3,500 cu. yds. The capacity of this dam is 4 million gallons of water.

7. Lapithos lining of channels.

This scheme which involved the lining in concrete of channels of 48,500 ft. of earth channels conveying water from the Lapithos Kephlovrysos spring cost £24,400. As it is known the average flow of the Kephlovrysos spring is 650,000 gallons per day and it irrigates 1500 donums of mainly lemon gardens.

8. Yenagra Spate Irrigation Scheme.

This Messaoria scheme involving the construction of a low earth embankment incorporating a concrete overflow spillway which diverts the flood flows of a local stream into an earth canal for the spate irrigation of some 900 donums of land cost £7,500.

9. Prastio Spate Irrigation Scheme.

This is also a spate irrigation scheme in Messaoria constituting mainly improvements on the existing intakes and canals of the Koprís stream of the Pedieos river.

The cost of this scheme was £11,800.

10. Ay. Theodoros (Larnaca) Irrigation Scheme.

This scheme whose cost will be £8,500 involves the construction of a concrete diversion weir and earth canals to divert water from the Pentaskynos river for the irrigation of lands belonging to Ay. Theodoros Irrigation Division which will be cultivated with winter and spring crops.

11. Avlona Pumping Scheme.

This scheme consists of one borehole which will pump water by means of 45 H.P. diesel engine at a rate of 20,000 gallons per hour for the irrigation of 200 donums of lands for Avlona.

This scheme will cost £5,500.

12. Orounda Pumping Scheme.

This scheme will cost £4,800 and consists of one borehole which will be fitted with a pump and engine to pump water at a rate of 20,000 g.p.h. for the irrigation of 200 donums of land belonging to the Orounda Irrigation Division.

II. INVESTIGATIONS AND DESIGNS FOR MAJOR IRRIGATION PROJECTS.

Appendix 2 lists the major irrigation projects which were investigated and designed for construction in 1963 with some details. A description of these projects follows:-

(i) Kanli Koyu Earth Dam.

An earth dam 40 ft. high and of total fill 68,000 cu. yds. has been designed on the "Jinnar Dere" stream. This dam whose capacity is 245 million gallons will benefit Kanli Koyu and it is hoped to cover with winter and spring irrigation 1000 donums of land.

(ii) Mia Milea Earth Dam.

This proposed dam which will be 50 ft. high has been designed for a capacity of 74 million gallons of water. Its total fill will be 62,000 cu. yds. and will benefit 600 donums for winter and spring irrigation of the village of Mia Milea. It is to store all the available water of the Symeas stream.

(iii) Trikomo Earth Dam.

This will also be an earth dam on the foothills of the north range.

Its capacity will be 93 million gallons of water which is enough for the irrigation of some 600 donums planted with winter and spring crops. The total earth fill of this dam will be 60,000 cu. yds. and it is estimated to cost £25,000.

(iv) Famagusta Recharge Scheme.

This is an extension of the existing recharge works of the Famagusta-Dherynia Irrigation Division. It mainly involves the construction of a recharge reservoir at Ay. Memnon which will get water from the infiltration gallery coming from Ay. Lucas. The water is to be pumped from the tunnel into the reservoir. The whole cost of the scheme including pumping installations and other improvement works will amount to £25,000.

(v) Famagusta Antiflood and Recharge Scheme.

This scheme involves the construction of a long low earth dam on the south of Famagusta town to check the water of some minor local catchments which in the past have caused a lot of damage by flooding the Famagusta town.

The total fill for the dam includes some 100,000 cu. yds. of earth and the spillway is designed to discharge the surplus into the nearby "Pharangos" stream and thence to the Famagusta Recharge System.

The storage capacity of this dam is 38 million gallons and the estimated cost is £35,000.

(vi) Liopetri Earth Dam.

This dam is to be built on the Liopetri stream and its holding capacity is 80 million gallons.

The purpose of the dam is to replenish the underground water resources of the area around Liopetri and Xylophagou villages.

Its total fill will be about 60,000 cu. yds. of earth and is estimated to cost £30,000.

(vii) Ayia Napa Recharge Scheme.

This is a scheme consisting of the construction of 6 small dams of a total capacity of 12 million gallons for the purpose of recharging water into the Ayia Napa aquifer.

They will be of a total earth fill of 25,000 cu. yds. and they are estimated to cost £9,000.

(viii) Tremithios Earth Dam.

This earth dam will be built on the Tremithios river at Tersephanou for the benefit of Kiti, Sophtadhes and Tersephanou villages.

Its total capacity is 350 million gallons and is enough for the irrigation of some 2,000 donums of early summer and winter crops. In addition it will facilitate recharge of the surrounding aquifer from where Larnaca and some nearby villages obtain their water supply. The total fill of the dam is about 220,000 cu. yds. of river sand and gravel and clay to be obtained from the abutments. The final designs for this dam were given to Il Nuovo Castoro of Florence, Italy.

(ix) Ayia Marina Rockfill dam.

This will be a rockfill dam for Ayia Marina on the Xeros river of Tylliria. It will be about 100 ft. high and its total fill including a clay core will be 85,000 cu. yds. It will store 70 million gallons which will be enough to irrigate about 500 donums of spring crops of the Ayia Marina village. This dam has been finally designed by the Yugoslav Consultants Energoprojekt.

(x) Pomos Rockfill Dam.

This dam to be built on the Livadhi river has also finally been designed by Energoprojekt and will involve 175,000 cu. yds. including a clay core.

The height of the dam will be 110 ft. and will be the highest dam in Cyprus. The capacity is 270 million gallons and it will irrigate about 1,500 donums of perennial crops.

The villages to be benefited are Pomos and Nea Dhimmata.

(xi) Ovgos Earth Dam.

This dam will be constructed on the Ovgos river for the benefit of the newly formed Ovgos Irrigation Division of Morphou. It will store 190 million gallons and will serve for the irrigation and recharge of the Ovgos citrus gardens and aquifer respectively. The total fill of river sand and gravel as well as a clay core will amount to 200,000 cu. yds. The estimated cost of this scheme is £120,000.

(xii) Argaka-Magounda.

This will be another rockfill dam for the benefit of Argaka and Magounda Irrigation Divisions and will be built on the Magounda river.

It will be 100 ft. high and will involve 180,000 cu. yds. of fill including a clay core. The capacity of the dam will be 270 million gallons and will be enough to irrigate 1,500 donums of perennial crops. This dam is being finally designed by Howard Humphreys of London.

(xiii) Kalopanayiotis.

It is possible to start the construction of a dam on the Marathassa river in 1963 for the benefit of Kalopanayiotis.

This will probably be partly a rockfill and partly a concrete dam. This dam is now being designed by Howard Humphreys of London.

## APPENDIX 2.

## MAJOR IRRIGATION PROJECTS

## DAMS - PROGRAMME FOR 1963.

Dam	Type of Dam	Capacity in Million Gallons	Quantity of Fill			Total Excavations cu. yds.	Total Concrete (cu. yds.)	Estimated Cost
			Main fill (cu. yds.)	Core (cu. yds.)	Filter (cu. yds.)			
1. Kanli Keuy	Earth	245	40,000	22,000	6,000	50,000	400	£30,000
2. Mia Milea	Earth	74	38,000	20,000	4,000	15,000	500	£28,000
3. Trikomo	Earth	93	40,000	15,000	4,000	10,000	300	£25,000
4. Famagusta Recharge	Earth Reservoirs	11	10,000	(Homogenous)	-	110,000	-	£14,500
5. Famagusta Antiflood and Recharge	Earth	38	100,000	(Homogenous)	2,000	25,000	500	£35,000
6. Liopetri	Earth	80	38,000	17,000	2,000	30,000	1,000	£33,000
7. Ayia Napa	Earth Dams 6 No.	12	24,000	(Homogenous)	1,000	5,000	200	£9,000
8. Tremithios	Earth	350	220,000	(Homogenous)	10,000	100,000	10,000	£120,000
9. Ayia Marina	Rockfill	70	57,000	12,000	14,000	30,000	1,500	£120,000
10. Pomos	Rockfill	270	117,000	34,000	22,500	45,000	2,500	£170,000
11. Ovgos	Earth	186	99,000	76,000	14,000	90,000	5,000	£115,000
12. Argaka-Magounda	Rockfill	270	130,000	25,000	15,000	150,000	3,500	£220,000
13. Kalopanayiotis	Rockfill	100	150,000	75,000	15,000	100,000	5,000	£200,000



APPENDIX 3.

IRRIGATION SCHEMES COMPLETED IN 1962.

Serial No.	Village	Nature of work	Cost £	Approved extent of land under irrigation in a normal year of run-off D o n u m s			Remarks
				Winter	Spring	Perennial	
1	Moutoullas	(a) Lining of channels	17,200	-	-	392	Improved and new irrigation
		(b) Improvement of springs	900	-	-	36	
2	Syrianokhori	Lining of channels	31,000	-	700	700	- do -
3	Kambos	Lining of channels	24,000	-	-	230	- do -
4	Lefka	Construction of a mass concrete dam	119,185	-	-	550	- do -
5	Ay. Andronikos	Pumping scheme and lining of channel	4,500	-	50	80	- do -
6	Famagusta-Dherinia	Extension of the ex-recharge works include the construction of a conveyor canal to take the flow of the Phrenaros, Ay. Erini and Ay. Nicolaos catchments into a dam constructed at Ay. Nicolaos where the water will go into the Ay. Loucas reservoir. The overflow will follow a canal into the Fresh Water Lake and thence into the	25,000	-	-	-	Extension and improvements on the existing recharge works
		C.F.	£221,785	-	750	1,988	

Serial No.	Village	Nature of work	Cost £	Approved extent of land under irrigation in a normal year of run-off			Remarks	
				D o n u m s				
				Winter	Spring	Perennial		
		B.F.	£221,785	-	750	1,988		
		Ay. Loucas reservoir. A weir at "Mutti-tis-Halis is diverting the overflow of the Yialias river into the Fresh Water Lake. A dam at Harangas has been constructed						
7	Palekchori	Lining of channels	18,500	900	130	-	Improved and new irrigation	
8	Karavas	Lining of channels	15,000	-	-	800	- do -	
9	Perapedhi	Sluice gate and improvement work	1,200	-	-	-	Improvement work	
10	Trimiklini	- do -	2,000	-	-	-	- do -	
11	Polis	Lining of channel	13,900	500	255	255	Improved and new irrigation	
12	Saramas	Weir, laying of pipes	3,200	-	-	50	- do -	
13	Evretou	Laying of pipes	8,900	32	57	66	- do -	
14	Phinikas	Laying of a perforated pipe-line 12" Ø in the gravels of "Xeros" river	3,700	-	-	300	- do -	
15	Geunyeli No. 2	Construction of an earth dam	22,000	1,480	-	-	- do -	
16	Athalassa	- do -	22,000	1,200	-	-	- do -	
		C.F.	£332,185	4,112	1,192	3,459		

Serial No.	Village	Nature of work	Cost £	Approved extent of land under irrigation in a normal year of run-off			Remarks
				D o n u m s			
				Winter	Spring	Perennial	
		B.F.	£332,185	4,112	1,192	3,459	
17	Lapithos	Desilting and regrading of tunnel	1,050	-	-	-	Improved and new irrigation
18	Ay. Amvrosios	Spring, laying of pipes, repairs	2,540	-	25	20	- do -
19	Elea	Laying of pipes	1,460	-	60	35	- do -
20	Bellapais	Lining of channels and laying of pipes	400	-	-	-	Improvement work
21	Lapithos	Lining of channels	24,400	-	-	1,500	Improved and new irrigation
22	Vassilia	Excavation of springs	500	-	70	25	- do -
23	Ay. Epiphaniios	Lining of channels and construction of storage tank	750	-	30	15	- do -
24	Epikho	Construction of a protective wall and irrigation ports	800	-	-	-	To complete the 1961 scheme
25	Ay. Georghios (Kafkallou)	Repairs	195	-	-	-	Improvement work
26	Kalopanayiotis	Construction of 2 small reservoirs	700	-	-	35	Improved and new irrigation
27	Galata-Sina	Excavation of springs	1,200	-	-	25	- do -
		C.F.	£366,180	4,112	1,377	5,114	

Serial No.	Village	Nature of work	Cost £	Approved extent of land under irrigation in a normal year of run-off D o n u m s			Remarks
				Winter	Spring	Perennial	
		B.F.	£366,180	4,112	1,377	5,114	
28	Patriki	Improvement works on ex. weirs	800	-	-	-	Improvement work
29	Yenagra	Construction of a weir, earth channels and irrigation ports	7,500	900	-	-	Improved and new irrigation
30	Knodhara	Construction of a weir and desilting and regrading of earth channels	1,960	410	-	-	- do -
31	Sotira	Construction of an earth dam	4,000	-	-	-	For recharge purposes
32	Gypsos	Construction of a weir	480	85	-	-	Improved and new irrigation
33	Aloa	Construction of an earth dam	900	-	-	-	For recharge purposes
34	Athienou	Improvement works	230	-	-	-	Improvement work
35	Aplanda	Construction of a storage tank	350	-	-	-	- do -
36	Kyperounda	Construction of a weir, storage tank and lining of channels	1,750	-	30	35	Improved and new irrigation
37	- do -	Excavation of spring	250	-	-	10	- do -
		C.F.	£384,400	5,507	1,407	5,159	

Serial No.	Village	Nature of work	Cost £	Approved extent of land under irrigation in a normal year of run-off D o n u m s			Remarks
				Winter	Spring	Perennial	
		B.F.	£384,400	5,507	1,407	5,159	
38	Dhymes	Construction of a storage tank and laying of pipes	860	-	10	20	Improved and new irrigation
39	Khandria	Laying of pipes	360	-	10	1	- do -
40	Ay. Demetrios	Construction of 2 storage tanks, lining of channels and laying of pipes	1,350	-	-	70	- do -
41	Yerasa	Construction of a weir, laying of pipes	1,310	50	-	18	- do -
42	Omodhos	Laying of pipes	880	-	-	26	- do -
43	Mandria	Pumping installations	4,000	-	-	140	- do -
44	Tala	Excavation of spring and laying of pipes	2,600	80	38	42	- do -
45	Kissonerga	- do -	2,000	-	-	40	- do -
46	Marathounda	Laying of pipes	1,800	-	-	82	- do -
47	Mesakhorio	Construction of a storage tank and laying of pipes	1,600	20	9	5	- do -
48	Zakharka	- do -	760	-	-	8	- do -
		C.F.	£401,920	5,657	1,474	5,611	

Serial No.	Village	Nature of work	Cost £	Approved extent of land under irrigation in a normal year of run-off D o n u m s			Remarks
				Winter	Spring	Perennial	
		B.F.	£401,920	5,657	1,474	5,611	
49	Meladhia	Laying of pipes	540	50	5	7	Improved and new irrigation
50	Istinjo	- do -	500	60	18	10	- do -
51	Ay. Isidhoros-Steni	- do -	550	-	20	10	- do - scheme revised and executed at a cost of £80 only
52	Ay. Marinoudha	Excavation of spring, construction of a weir, storage tank and channels	1,650	29	7	9	Improved and new irrigation
53	Ay. Nicolaos	Laying of pipes	340	45	45	14	- do -
54	Episkopi	Construction of an intake and channels	4,000	-	-	400	- do -
55	Galataria	Laying of pipes	1,900		20	25	- do -
56	Innia	- do -	1,230	50	25	23	- do -
57	- do -	Excavation of springs and laying of pipes	1,800	-	20	12	- do -
58	Miliou	Construction of a weir, pumping unit and laying of pipes	2,500	-	-	26	- do -
		C.F.	£416,930	5,891	1,634	6,147	

Serial No.	Village	Nature of work	Cost £	Approved extent of land under irrigation in a normal year of run-off D o n u m s			Remarks
				Winter	Spring	Perennial	
		B.F.	£416,930	5,891	1,634	6,147	
59	Kholi	Excavation of spring and tunnel	660	-	-	15	Improved and new irrigation
60	Salamiou	Construction of a storage tank and laying of pipes	1,200	9	6	4	- do -
61	Kilinia	Construction of a weir and laying of pipes	170	-	-	8	- do -
62	Nikoklia	Lining of channels and pumping unit	4,350	-	-	100	- do -
63	Ay. Amvrosios (K.)	Excavation of spring	940	-	-	-	- do -
64	Kapouti	General repairs	550	-	-	-	Improvement work
65	Askas	Two small tanks and distribution pipes	600	-	-	10	
66	Emba	Excavation of spring, laying of pipes, repairs	1,980	-	-	-	Improvement work
67	Vrecha	Improvements	330	-	-	-	
68	Livadhia	- do -	250	-	-	-	- do -
		Total	£427,960	5,900	1,640	6,284	

APPENDIX 4.

IRRIGATION SCHEMES UNDER CONSTRUCTION AT THE END OF 1962 TO BE COMPLETED IN 1963.

Serial No.	Village	Nature of work	Cost £	Approved extent of land under irrigation in a normal year of run-off D o n u m s			Remarks
				Winter	Spring	Perennial	
1	Kithasi	Pumping unit, laying of distribution pipes	4,000	-	50	70	Improved and new irrigation
2	Souskiou	Lining of channel	5,900	-	-	150	- do -
3	Peyia	Spring, construction of storage tank, pumping unit, laying of distribution pipes	4,000	-	20	30	New irrigation
4	Pelendria (Kolokasi)	Lining of channel	1,280	-	10	8	Improved and new irrigation
5	Pelendria (Hji Phisouni)	Construction of a weir, storage tank and channels	1,700	-	15	17	- do -
6	Anoyira	Repairs to spring and laying of pipes	460	-	10	4	- do -
7	Kato Amiandos	Construction of intake, channels and pipes	16,000	-	-	500	- do -
		C.F.	£33,340	-	105	779	



Serial No.	Village	Nature of work	Cost £	Approved extent of land under irrigation in a normal year of run-off			Remarks
				D o n u m s			
				Winter	Spring	Perennial	
		B.F.	£33,340	-	105	779	
8	Paralimni	(i) Construction of earth dams	9,200	-	-	-	For recharge purposes
		(ii) Recharge canal	18,000	-	-	-	- do -
9	Chattos	Improvement work	1,950	-	-	-	Improvement work
10	Engomi	Desilting and regrading of channels	3,200	2,000	-	-	Improved and new irrigation
11	Prastio	Improvement on spate irrigation works	11,800	1,100	-	-	- do -
12	Asha	- do -	2,300	5,000	-	-	- do -
13	Karavas	Lining of channels	3,350	-	-	800	- do -
14	Thermia (Boghaz)	Laying of pipes	1,300	10	10	3	- do -
15	Orounda	Pumping unit	4,800				- do -
16	Avlona	- do -	5,500	-	-	200	- do -
17	Gourri	Lining of channels	3,600	300	20	-	- do -
18	Nisou	- do -	1,800				- do -
		C.F.	£100,140	8,410	135	1,782	

Serial No.	Village	Nature of work	Cost £	Approved extent of land under irrigation in a normal year of run-off.			Remarks	
				D o n u m s				
				Winter	Spring	Perennial		
		B.F.	£100,140	8,410	135	1,782		
19	Kambi	Storage tank, channels	530	20	19	2	Improved and new irrigation	
		Storage tank, pipes	550	-	-	10	- do -	
20	Ay. Theodoros (Larnaca)	Diversion weir, earth channels	8,500	2,563	-	-	- do -	
21	Morphou	Construction of an earth dam	95,000	-	-	-	For recharge purposes	
22	Ay. Demetrios (Kaminia)	Construction of a weir, storage tank, channels	1,300	-	-	180		
23	Ay. Demetrios (Kryo Nero)	Construction of a protective wall	420	-	-	-	Improvement work	
24	Prodromos	Construction of an intake weir, laying of pipes and construction of a big reservoir	72,000	-	-	200	Improved and new irrigation	
Total			£278,440	10,993	154	2,174		

APPENDIX 5.

IRRIGATION SCHEMES APPROVED IN 1962 BUT NOT UNDERTAKEN.

Serial No.	Village	Nature of work	Estimated Cost £	Approved extent of land under irrigation in a normal year of run-off D o n u m s			Remarks
				Winter	Spring	Perennial	
1	Kythrea and Suburbs	Lining of channels	33,000	-	-	1,000	Village share not available because of arrears
2	Ay. Iacovos	Spring, channels and pipes	1,800	-	-	25	Reduced contribution asked for
3	Amargeti	Laying of concrete pipes	2,500	-	-	-	Arrears on other loans
4	Pakhyammos	Laying of pipes	1,400	-	-	-	
5	Kato Mylos	Repairs, laying of pipes	430	-	-	8	Scheme not accepted and New Scheme asked for
6	Limnitis	River training	2,700	-	-	-	Reduced river bed asked for
7	Elea	Pumping scheme	7,500	-	-	220	Acquisition of land for one pump house
8	Arsos	Pumping scheme	9,000	-	-	150	Village share not available in time
9	Kholi	Spring	200	-	15	12	- do -
		C.F.	£58,530	-	15	1,415	

Serial No.	Village	Nature of work	Estimated Cost £	Approved extent of land under irrigation in a normal year of run-off D o n u m s			Remarks
				Winter	Spring	Perennial	
		B.F.	£58,530	-	15	1,415	
10	Trimithousa (Khrysokhou)	Laying of pipes	460				Village share not available in time
11	Louroudjina	Excavation of an earth canal	750	500	-	-	Scheme not accepted. New one to be prepared
12	Kilanemos	Excavation of springs, lining of channels and laying of pipes	700	-	-	4	Not wanted
13	Kiti (Trimithios)	Impounding scheme	58,796	-	3,000	-	Evcaf land not leased
14	Axylou	Laying of pipes and construction of a storage tank	380	-	-	-	Scheme not wanted by the villagers
15	Ay. Marina - Nea Dhimmata	Impounding scheme	78,000				Loan not available in time
		Total	£197,616	500	3,015	1,419	

APPENDIX 6.

TOWN WATER SUPPLIES

By H. S. Suphi, Senior Water Engineer.

NICOSIA AND SUBURBS

Within the areas of supply of both the Greater Nicosia Scheme and the Water Board of Nicosia the demand for water was met satisfactorily. The sources of Greater Nicosia Scheme could meet the peak demand of their supply area by producing 6,000 cubic meters of water per day. The highest daily consumption within the supply area of the Water Board of Nicosia was 12,900 cubic meters. This quantity was made available from (a) the Board's own sources, (b) a number of privately owned sources and (c) the boreholes Nos. 121/58 and 77/60 situated near Morphou. The supply of water from boreholes Nos. 121/58 and 77/60 was, as in the previous year, about 4,500 cubic meters per day for a period of five months (June-October, inclusive) and was conveyed to Nicosia through the 18" steel pumping main of the Morphou Bay Scheme.

2. During the periods of high consumption it was necessary for a number of sources of the Board, including those at Morphou, to discharge their supplies into the reservoirs of Greater Nicosia Scheme instead of that of the Board. This water, after being chlorinated at its entry to the reservoir, had to be made available to the Board through the two outlets of the ring main of the Greater Nicosia Scheme. Very careful control on the quantities supplied and on the operation of the scheme was necessary and a close co-operation existed between the Water Board of Nicosia and the Department.

3. Regular meetings of the Water Board of Nicosia were held at which, among other subjects, the Board's financial difficulties were discussed at length. It was decided to apply the Council of Ministers for authority to raise the water rates within the Board's supply area to that of Greater Nicosia Scheme, as a measure to relieve, at least partly, the Board from its financial burden. The application has now been approved by the Council of Ministers.

4. The Greater Nicosia Scheme was considered to be "self-sufficient" during the year as no water was purchased from or sold to the Water Board of Nicosia. A statement of revenue and expenditure of the Greater Nicosia Scheme for 1962 is given in Appendix 7.

5. It was possible to proceed with the installation of the pumping plant at Prastio Pumping Station of Morphou Bay Scheme after the arrival in Cyprus of the two skilled erectors provided by Harland Engineering Company, the suppliers of the pumping plant. By the end of the year the larger part of the installation work within the pumping station had been completed. The installation of the 14 borehole pumping units was being carried out by the Department at the same time, but independently of the work within the station. By the end of the year eleven electrosubmersible pumps, together with their valves, meters, etc., had been installed and connected to the feeder mains. The contract for the supply of electricity to the station was signed with the Electricity Authority of Cyprus with a view to providing electric power in the station at the earliest possible date.

6. In view of the heavy demand of the Town for more water and in the absence of new sources of supply it was agreed to install an experimental plant near the Prastio Pumping Station for converting the sea water to fresh water by making use of the solar energy. If the pilot plant is successful, major plants will be provided to produce the required quantities of water.

7. The number of consumers within the supply area of Greater Nicosia Scheme continued to increase. 498 new connections were made making a total of 6,200. The distribution mains were extended by 30,000 feet of asbestos-cement mains.

#### FAMAGUSTA

8. Both the Water Board of Famagusta and the Department considered, seriously, the question of providing a new source of supply for the Town. The experience of the last few years showed that the neighbouring villages would not allow their groundwater to be piped to Famagusta; all the new sources fresh water outside the Board's supply area would have to be left for the needs of villages. It was, therefore, considered

desirable to study the subject of desalting the sea water for the needs of Famagusta. Many offers were received from the manufacturers of desalting plants which are still under consideration. An agreement was signed with the United States Aid Mission to Cyprus for the provision of a team of experts in Cyprus to carry out a feasibility study on the subject and also to make recommendations on the above offers.

9. A new 100,000 gallon capacity reinforced concrete collecting tank was constructed and the necessary pumping units were provided at Phrenaros North pumping station with a view to conveying more water through the existing gravity supply mains. No water could be supplied from Paralimni area and the existing 8" A.C. main remained idle in the ground.

10. The daily consumption of water rose to 5,540 cubic meters during the summer months. This quantity could just be made available from the existing boreholes at Phrenaros West and Phrenaros North and thus restrictions could be avoided.

#### LIMASSOL

11. The supply of water to Limassol Town from the existing sources was much the same as in the previous year. The daily demand in summer rose to 9,176 cubic meters but no restrictions were necessary.

12. The Water Board of Limassol considered the Town's future water requirements and decided to proceed with the implementation of a new scheme to supplement the existing supplies by 1.5 m.g.d. from 4 boreholes in the Yermasoyia river. It was also decided to sink new boreholes in the Kouris River with a view to providing an additional 1,500,000 gallons per day for conveyance through the existing supply main to Limassol. The boundary of the supply area was reviewed and extended to include the village of Messayitonia. Consideration was also given to supplying the inhabited strip along Limassol-Nicosia road which lies outside the Board's supply area.

LARNACA

13. In view of the prevailing administrative difficulties no improvements could be undertaken for the water supply of this Town. The present source of supply which is an old chain-of-wells could not be improved for similar reasons.

14. Larnaca is expanding rapidly and with the proposed major improvements to its harbour it is imperative that a satisfactory solution to the water supply problem of the Town is urgently found. To achieve this end it is possible that sea water will have to be converted into fresh water. It is understood that at the Dhekelia Power Station boiler capacity is available, at present, which may be utilized in conjunction with a desalinisation plant to produce fresh water from the sea at economical rates. The Power Station is only about 8 miles from Larnaca and the fresh water to be produced can be conveniently piped for distribution in the Town. The subject is being studied.

15. During summer months the daily consumption rose to 6,074 cubic meters but no restriction on the supply was necessary.



APPENDIX 7.

INCOME AND EXPENDITURE ACCOUNT OF THE GREATER NICOSIA SCHEME  
FOR THE YEAR ENDING 1962.

Expenditure	Actual	Estimated	Total	Income	Actual	Estimated	Total
	to 30/9/62	to 31/12/62			to 30/9/62	to 31/12/62	
Pumping charges	10,645	5,000	15,645	Sale of Water and meter rent	55,086	18,000	73,086
Purchase of Water	3,336	2,664	6,000	Connection fees	810	150	960
Maintenance charges	3,092	908	4,000	Usage of pipes by water Board	3,231	1,050	4,281
Collection fees	-	11,107	11,107				78,327
Supervision	928	500	1,428	Estimated loss for the year			443
			38,180	( " " " " " )			( 7,676)
Administration charges		3,000	3,000				
Amortization (£650,000 in 30 years at 4%)			37,590				
(Amortization (£650,000 in 30 years at 5½%))			(44,823)				
			£78,770				£78,770
			=====				=====

Note: Figures in brackets show results if amortization is computed at the rate of 5½% over 30 years.

APPENDIX 8.

VILLAGE DOMESTIC WATER SUPPLIES

By H. P. KARAKANNAS, M.ASCE., M.I.P.H.E., M.R.S.H.,  
Engineer-Hydrologist.  
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The work of the Village Domestic Water Supply Section is confined to the domestic supplies for the villages, but it also includes the towns of Paphos and Kyrenia, all representing a population of 392,000 persons. Sources such as springs are examined, measured and where suitable they are developed. Supply and distribution mains are laid, storage reservoirs and public fountains are constructed, and a house-to-house supply is provided practically in every village where a scheme is completed nowadays. The cost for the service connections is borne entirely by the consumer, and the supply is controlled by means of water meters, or through a break-pressure regulator, securing an equal quantity of supply to all consumers, in those cases where the supply is fixed and limited. The daily satisfactory supply per capita is now 20 gallons, but it will have to be raised to 25 gallons as the standard of living rises in the rural areas.

The sources of village domestic water supplies may be springs, borehole, infiltration galleries, or dams. It is worth mentioning that for the first time it has been found necessary to supply water to 4 dry villages in Paphos District by the construction of two small dams in the Paphos Forest, near the Ayia Station.

Practically all the village domestic supply schemes executed during the year in Famagusta, Nicosia and Larnaca districts have their source of supply successful boreholes. The traditional chain-of-wells whereby water was gravitated to the surface, in the form of a spring has now been abandoned. In some cases where a collecting gallery is excavated, there is no positive outlet, but the water is pumped out. In the case of pumped supplies, turbine pumps are installed, driven by a diesel engine or motor where electricity is available. Water is pumped into a ground level or elevated re-inforced concrete tank, the function of which is to provide one day's and over storage, and in other cases to act as a reservoir from where a uniform fixed quantity of water can be withdrawn.

The activities of the section during 1962, have been of the same magnitude as in 1961. An amount of £592,000 was allocated for village domestic supplies, and the approved programme of schemes was completed during the year. The little staff maintained its enthusiasm and zeal and this was one of the main factors for the satisfactory completion of the schemes within the fixed period. Ninety three (93) village water supply schemes serving a population of 69,000 persons were completed. It is worth mentioning that 306 miles of pipes varying in size from 10- $\frac{1}{2}$  inch were laid, almost equal to the perimeter of the island. Moreover 106 reinforced concrete tanks, 20 pumping stations and 77 public fountains were constructed. A house-to-house service was provided in 59 villages, and houses-connection were made. It is estimated that an area of about 1,000 donums of land within the villages area has been brought under irrigation by the use of the surplus water over their domestic requirements. This brings a very high return to the villagers.

It is now estimated that of the total of 627 villages named in the Census, the number with piped supplies is 569 or 90.75%. 416 or 66.35% are considered satisfactory and 153 or 24.40% need fundamental repairs, replacements or supplementary supply. Because of the increase of population, rise in the standard of living, the subnormal rainfall, and the overpumping of the aquifers, water supplies that were formerly considered satisfactory are now in need of improvements. The 58 villages without piped supply are on the whole situated far from suitable and reliable sources of water supply but every possible effort is being made to solve their water problems, even if the cost of supplying them from distant sources is much higher than in past schemes.

In addition to the 93 schemes completed in 1962, a further 19 schemes were under construction in their final stage at the end of the year. Plans were prepared for 126 schemes, all estimated to cost £1,009,000.

The following table gives an outline of the work executed during the year.

LENGTH OF PIPES LAID IN 1962

(Galvanized mild steel pipes)

Size (Nominal Diameter)	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	6"	Total miles
Length in miles	2.613	3.194	7.555	5.363	23.371	36.307	17.735	35.185	37.962	2.757	262.00

(Asbestos-cement pressure pipes)

Size (Nominal Diameter)	2"	3"	4"	6"	8"	10"	Total miles
Length in miles	1.517	14.843	11.126	13.643	0.514	1.834	43.477

Reinforced concrete tanks:-

Elevated tanks	7
Ground tanks	81
Pumping Stations	20
Fountains	77
Distribution boxes	16
House connections	59 villages

Area of land brought under

perennial irrigation = 1000 donums approximately.

The schemes completed may be classified as shown below:-

"Village standard" means that the distribution of the water is effected by street public fountains only and not by house connections.

A public fountain with trough and proper drainage system serves 6-10 houses.

Lists showing number of villages with piped water supply, schemes completed during the year, those in hand at the end of the year, and schemes prepared for execution are given in Appendices 9, 10, 11 and 12.

The successful drilling carried out during the year made it possible to complete 41 pumped supply schemes for villages in the Karpas peninsula, Eastern and central Mesaoria, Limassol (Yermasoyia region), Nicosia and Larnaca.

(a) One very important work carried out is the drilling of the successful borehole on the Bella-Paise road, from where a quantity of 200,000 per day is pumped to Kyrenia, now. The Headworks (pumping station, pumping main, and a 100,000 capacity R.C.C. reservoir) are now completed, and the water plight of Kyrenia is now over. A new distribution system has been designed for Kyrenia, and it will be completed during 1963.

(b) A big regional scheme has been completed in the Yermasoyia river and by this scheme 9 villages namely: Moutayiaka, Armenokhori, Ayios Tykhonas, Pareklisia, Monagroulli, Ayios Georghios Quarter, Ayios Athanassios, Ayia Phyla are provided with adequate supply. The water is pumped from 2 boreholes drilled through the Yermasoyia river gravels, into a balancing reservoir, from where it is pumped by two high pressure pumps each capable of 10,000 g.p.h. against 750 ft. head, to a service Reservoir, capacity 100,000 gallons, which was constructed with reinforced concrete walls and roof. Water gravitates from this reservoir to the 9 villages through trunk mains 17 miles long. In all villages new house-to-house distribution systems have been provided.

(c) Two other regional schemes were constructed in Paphos District, the Xeropiya regional scheme supplying water to 8 villages (Lysso, Meladhia, Melandra, Zakharka, Istinjo, Philousa, Pelathousa, Peristerona) from a spring near Stavros-tis-Psokas through a trunk main 20 miles long.

(d) Another scheme known as the Ayia "Regional Scheme" supplies water to 4 villages (Kritou Marottou, Kallepia, Letymbou and Pittargou) through a 4 inch trunk main 20 miles long. This is a unique scheme in the respect that for the first time the river water in the forest is tapped by means of two small dams and after passing through rapid sand filter is used for domestic purposes.

(e) A combined domestic and irrigation scheme was executed for Khlorakas, using the spring "Stavros tis Mythas" as the source of supply. A quantity of 350,000 gallons per day was distributed to all the houses of the village in spring and early summer. Their wells that had been dry were recharged, and good early vegetable crops brought a very appreciable return to all the householders. These people who, for a number of years, were irrigating their early crops by tankers, have now a very good supply both for domestic use and irrigation. The preparation of the domestic supply schemes is basically designed on a regional system whereby several dry villages are grouped together, for both administrative and economical advantages. Also, the mains are designed of a bigger capacity so that the high discharge from the sources in spring and early summer is conveyed to the village. The surplus over the drinking purposes is used for irrigation within the village, thus helping all consumers to produce their own vegetables.

APPENDIX 9.

NUMBER AND PERCENTAGE OF VILLAGES

WITH PIPED DOMESTIC SUPPLY

31ST DECEMBER, 1962

District	Villages with piped water			Villages with no piped supply		Total Villages
	Satisfactory	Unsatisfactory	Total	No.	%	
	No.	No.	No.			
Nicosia	111	47	158	18	10.23	176
Larnaca	35	18	53	6	10.17	59
Limassol	73	35	108	5	4.42	113
Famagusta	56	24	80	18	18.37	98
Paphos	119	9	128	6	4.48	134
Kyrenia	22	20	42	5	10.64	47
TOTALS	416	153	569	58		627
PERCENTAGE	66.35%	24.40%	90.75%	9.25%	9.25%	100%

Note:-

The above figures are the result of an up-to-date survey and they do not correspond with others given in the annual reports of former years. Some supplies that were previously satisfactory are now considered unsatisfactory, because with an expanded population and higher standards of living more water and more facilities are required. Certain piped supplies need improvements and extensions of their distribution systems.

APPENDIX 10.

VILLAGE DOMESTIC WATER SUPPLY  
SCHEMES COMPLETED IN 1962

Serial No.	Village	District	Nature of work	Date of completion	Population
1	Vouno	Kyrenia	/	15th January	424
2	Xerovounos	Nicosia	/	21st "	256
3	Photta	Kyrenia	*	6th February	418
4	Geunyeli	"	*	6th "	1,377
5	Pano Akourdalia	Paphos	*	10th "	102
6	Kissonerga	"	/	28th "	698
7	Spitali	Limassol	/	28th "	207
8	Khrysokhou	Paphos	/	3rd March	308
9	Kyperounda	Limassol	/ X	17th "	1,548
10	Palodhia	"	/	18th "	185
11	Mansoura	Nicosia	/	18th "	147
12	Ambelikou	"	/	24th "	548
13	Paramytha	Limassol	/	1st April	232
14	Galinoborni	Famagusta	/	3rd "	836
15	Sotira	"	* X	9th "	1,515
16	Lapathos	"	* X	9th "	579
17	Kokkinotrimithia	Nicosia	* X	7th "	1,044
18	Aradhippou	Larnaca	/ X	11th "	3,632
19	Kyli	Paphos	/	19th "	447
20	Kondea	Famagusta	/ X	19th "	1,305
21	Lythrangomi	"	*	19th "	275
22	Emba	Paphos	/	19th "	1,027
23	Lemba	"	/	19th "	166
24	Astromeritis	Nicosia	/ X	1st May	1,005
25	Pano Zodhia	"	/ X	8th "	1,346
26	Mari	Larnaca	/ X	11th "	923
27	Bellapais	Kyrenia	/ X	11th "	725
28	Kanli Keuy	"	/	30th June	101
29	Leonarisso	Famagusta	* X	31st July	707
30	Paleometokho	Nicosia	* X	31st "	1,848
31	Malounda	"	*	15th August	155
32	Platanisso	Famagusta	* X	15th "	386
33	Dhromolaxia	Larnaca	/	5th September	594
				C.F.	25,066



Serial No.	Village	District	Nature of work	Date of completion	Population
				B.F.	25,066
34	Ay. Epiphaniou (Orinis)	Nicosia	*	15th September	310
35	Eptakomi	Famagusta	* X	20th October	971
36	Kritou Marottou	Paphos	* X	20th "	197
37	Kallepia	"	* X	20th "	557
38	Letymbou	"	/ X	20th "	741
39	Pitarkou	"	* X	20th "	192
40	Melandra	"	* X	31st "	204
41	Meladhia	"	* X	31st "	134
42	Lyso	"	/ X	31st "	587
43	Philousa	"	* X	31st "	160
44	Pelathousa	"	* X	31st "	348
45	Peristerona	"	/ X	31st "	355
46	Zakharia	"	* X	31st "	89
47	Istinjo	"	* X	31st "	155
48	M. Yitonia	Limassol	/	31st "	2,898
49	Xylotymbou	Larnaca	* X	31st "	1,469
50	Argaka	Paphos	/	17th November	546
51	Makounda	"	/	17th "	196
52	Agrihia	Limassol	* X	20th "	525
53	Dhymes	"	* X	20th "	373
54	Potamitissa	"	* X	20th "	339
55	Avlona	Nicosia	* X	24th "	524
56	Lemona	Paphos	/	19th "	241
57	Paralimni	Famagusta	* X	24th December	3,477
58	Lemithou	Limassol	* X	24th "	669
59	Panayia	Paphos	/ X	24th "	1,047
60	Kambyli	Kyrenia	* X	27th "	208
61	Apliki	Nicosia	/	27th "	120
62	Galini	"	/	31st "	1,295
63	Loutros	"	/	31st "	394
64	Varishia	"	/	31st "	223
65	Ayii Trimithias	"	* X	31st "	388
66	Lakatamia Pano	"	* X	31st "	929
67	Lakatamia Kato	"	* X	31st "	1,133
68	Mouttayaika	Limassol	* X	31st "	239
				C.F.	47,299

Serial No.	Village	District	Nature of work	Date of completion	Population
				B.F.	47,299
69	Armenokhori	Limassol	* X	31st December	162
70	Ay. Tykhonas	"	* X	31st "	420
71	Pareklisia	"	* X	31st "	577
72	Monagroulli	"	* X	31st "	445
73	Ay. Athanasios	"	* X	31st "	1,183
74	Ay. Phyla	"	* X	31st "	5,231
75	Palekchori (Morphou)	Nicosia	* X	31st "	1,074
76	Koma tou Yialou	Famagusta	* X	31st "	854
77	Tavros	"	* X	31st "	312
78	Vokolidha	"	* X	31st "	337
79	Kouklia	"	* X	31st "	2,358
80	Khandria	Limassol	* X	31st "	560
81	Psematismenos	Larnaca	* X	31st "	246
82	Maroni	"	* X	31st "	526
83	Sha	"	/	31st "	343
84	Ormidhia	"	/ X	31st "	1,470
85	Tersephanou	"	* X	31st "	458
86	Prastio	Paphos	* X	31st "	83
87	Phasli	"	* X	31st "	76
88	Kyrenia town	Kyrenia	/	31st "	3,498
89	Mazotos	Larnaca	* X	31st "	545
90	Sophtadhes	"	* X	31st "	117
91	Kato Koutrapha	Nicosia	*	31st "	76
92	Pakhyamos	"	/	31st "	281
93	Nikitari	"	/	31st "	450
					68,981
					=====

/ Improvements to an existing supply.

\* New schemes.

X House-to-house service.

APPENDIX 11.

VILLAGE WATER SUPPLY SCHEMES  
IN HAND AT THE END OF 1962

Serial No.	Village
1	Ypsonas - Pano & Kato Polemidhia
2	Katydhada
3	Phterikoudhi
4	Khoulou
5	Ay. Thomas
6	Yerolakkos
7	Ay. Vasilios
8	Skyloura
9	Kyra
10	Pera
11	Psomolophou
12	Dhoros
13	Monagri
14	Spilia
15	Katokopia
16	Argaki
17	Oekos
18	Polystypos
19	Pano Koutraphas

APPENDIX 12.

VILLAGE DOMESTIC SUPPLY SCHEMES,  
PREPARED AND SUBMITTED FOR CONSIDERATION AND APPROVAL.

NICOSIA & KYRENIA DISTRICTS.

Serial No.	Name of Scheme	Amount £	Remarks
1	Astromeritis	6,100	
2	Askas	3,000	
3	Dhali	12,000	
4	Moutoullas	5,000	
5	Zodhia, Pano	5,200	
6	Kambos	3,500	
7	Kannavia	550	
8	Kakopetria	3,000	
9	Lefka	35,000	
10	Akaki	16,000	
11	Peristerona	16,000	
12	Livadhia (Pitsillias)	3,600	
13	Milikouri	2,000	
14	Yerolakkos	37,200	
	Ayios Vasilios		
	Skylloura		
15	Larnaca-tis-Lapithou	9,000	
16	Trapeza	850	
17	Ayia Irini	11,000	
18	Kondemenos	4,500	
19	Agrokypia	6,000	
20	Kato Moni	6,100	
21	Kambi Pharmaka	2,600	
22	Gourri	3,000	
23	Pendayia	9,000	
24	Argates	11,400	
25	Politiko	5,400	
26	Chakistra	2,700	
27	Ayia Marina (Xyliatou)	4,600	
28	Prastio (Morphou)	8,000	
29	Morphou	85,000	
30	Aredhiou	6,000	
	C.F.	£324,300	

Serial No.	Name of Scheme	Amount £	Remarks
	B.F.	£324,300	
31	Ayia Marina (Skylouras)	2,300	
32	Ayios Ioannis (Maloundas)	6,900	
33	Ayios Theodoros (Soleas)	1,000	
34	Kythrea Lower (7 villages)	30,000	
35	Kokkina	5,600	
36	Nikitas	600	
37	Nikitari	3,000	
	Total	£373,700 =====	
<u>FAMAGUSTA DISTRICT.</u>			
1	Rizokarpaso	54,000	
2	Lefkoniko	25,000	
3	Trypimeni	2,200	
4	Avgorou	18,000	
5	Dherinia	15,000	
6	Syngrasis	4,000	
7	Ayios Andronikos	17,500	
8	Gaidhouras - Prastio	8,000	
9	Kilanemos	2,720	
10	Komi-Kebir	10,500	
11	Korovia	1,600	
12	Ovgoros	2,500	
13	Platani	5,700	
14	Apostolos Andreas	8,500	
	Total	£175,220 =====	
<u>LIMASSOL DISTRICT.</u>			
1	Lania	} 32,852	
2	Limmatis		
3	Korphi		
4	Ay. Georghios (Sylikou)		
5	Kapilio		
6	Trimiklini		
	C.F.	£32,852	

Serial No.	Name of Scheme	Amount £	Remarks
	B.F.	£32,852	
7	Mandria	32,400	
8	Arsos		
9	Platres Kato		
10	Omodhos		
11	Potamiou		
12	Platres Pano	13,700	
13	Ayios Theodoros (Agrou)	4,300	
14	Pyrgos	800	
15	Plataniskia	10,000	
16	Louvaras	1,900	
17	Kalokhorio	3,100	
18	Pissouri	3,600	
19	Prastio Avdhimou	3,300	
20	Kouka	1,132	Combined
21	Lophos	5,932	
22	Ayios Therapon	7,534	
23	Pakhna	11,874	
24	Dhora	16,628	
25	Vasa (Kilani)	15,100	Combined
26	Mathikoloni	3,534	
27	Agrounda	5,566	
28	Yerasa	1,150	
29	Tris Elies	8,200	
30	Kaminaria	13,000	
31	Agros	3,000	
32	Souni Zanadjia	600	
33	Evdhimou	900	
34	Sotira	4,000	
35	Vasa (Kellaki)	4,000	
36	Alassa	2,000	
37	Vouni	4,000	
38	Kato Mylos	4,100	
39	Moni	1,100	
40	Mesa Yitonia	13,000	
41	Yermasoyia	4,000	
42	Apeshia	2,000	
	Total	£238,302	

Serial No.	Name of Scheme	Amount £	Remarks
<u>LARNACA DISTRICT.</u>			
1	Avdellero-Troulli	14,000	
2	Kiti	12,300	
3	Xylophagou	2,700	
4	Mosphiloti	8,300	
5	Pergamos	8,000	
6	Ayii Vavatsinias	1,500	
7	Lefkara	1,500	
8	Anglissides	} 25,000	
9	Anaphotia		
10	Aplanda		
11	Kivisil		
12	Alethrico		
13	Aradhippou	2,300	
14	Khirokitia	700	
15	Athienou	3,000	
	Total	£79,300	=====
<u>PAPHOS DISTRICT.</u>			
1	"Ayia" Scheme (Kritou-Marottou, Kallepia, Letymbou, Pitargou, Khoulou & Kourtakas)	19,000	
2	Ayia Marina-Nea Dhimmata	15,100	
3	Pomos-Paliambela	16,000	
4	Kholetria	3,600	
5	Mandria	6,000	
6	Amargeti	3,700	
7	Kathikas	9,500	
8	Steni	2,200	
9	Phiti	4,600	
10	Ayios Demetrianos	3,800	
11	Lassa	2,500	
12	Kedhares	1,800	
13	Akourdalia Pano	3,000	
	C.F.	£90,800	

Serial No.	Name of Scheme	Amount £	Remarks
	B.F.	£90,800	
14	Konia	8,988	
15	Anavargos	8,862	
16	Yeroskipou	5,350	
17	Polis - Prodromi	19,000	
18	Kritou-Terra	3,500	
	Total	£136,500	

S U M M A R Y

Nicosia & Kyrenia	£ 373,700
Famagusta	175,220
Limassol	238,302
Larnaca	79,300
Paphos	136,500
Total	£1,003,022



APPENDIX 13.

HYDRO-GEOLOGY AND DRILLING

By Y. HJI-STAVRINOU, Assistant Director and  
Chief of the Drilling Section.

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The year 1962 was a record year for prospecting drilling for groundwater. During the year the department's drilling plant consisted of 14 rigs and another 2 on loan from Limni Mines. These comprise one Ruston-Bucyrus 60 R.L. and thirteen Ruston-Bucyrus 22 Ws. The 2 rigs on loan from Limni Mines consist of 1 Ruston-Bucyrus 22 and 1 Mangold, which have both been in continual use throughout the year. A privately owned Ruston-Bucyrus type rig was used on contract drilling for a period of five months during summer.

All these rigs are of the percussion type but one 22-W is fitted with a rotary attachment enabling the rig to be used for either percussion or rotary (shot crown or tungstemcarbide crown) core drilling. The normal capacity range of the rigs is 8" to 10" diameter boreholes to depths of up to 500 feet but the 60 R.L. is a much heavier duty rig. Under normal conditions it can drill an 8" diameter borehole to a depth of over 1,000 feet or, alternatively, can be used to drill 18" diameter holes to over 250 feet depth.

The department has also a number of transportable deep-well pumping units for long, continuous test-pumping of wells and boreholes. In addition to several old reciprocating pumping units, there are two diesel-driven turbine pumps of 5,000 and 15,000 gallons per hour capacity respectively, at 100 feet head and three 25 K.V.A. mobile diesel-electric generating sets which are used in conjunction with 7½" diameter electro-submersible pumps. With these units borehole test-pumping may be carried out in the capacity head range of 18,000 gallons per hour from 100 feet to 8,000 gallons from 400 feet. In all 57 long test pumpings, from 48 hours to 910 hours continuous duration, were carried out, involving a total pumping time of 10,110 hours and a total volume of 112.8 million gallons of water. Experience has proved that such exhaustive test-pumping are absolutely essential for proving the reliability of the aquifers.

The number of boreholes drilled during 1962 was 247 with an aggregate footage of 51,292 and an average depth of 208 feet. 181 boreholes with a total footage of 44,283 were drilled for water. The average drilling depth for water was 245 feet. The average time taken to complete a borehole, including the time taken to lay casing and to carry out an eight hour test-pumping of a successful borehole was 18.5 days. The average footage drilled per day was 11.2 feet. The total tested yield of boreholes sunk for water in 1962 was 16,985,000 gallons per day. In addition to new drillings 29 old boreholes were cleaned and renovated, involving 293 drilling days, equivalent to the average time taken to drill 16 new boreholes. Only 6 boreholes were sunk directly for irrigation.

The number of successful irrigation boreholes drilled by Government since 1946 is now 1,305 with a tested output of 270.6 million gallons per day, sufficient to irrigate 135,100 donums of summer crops.

The actual area now being irrigated as a result of these drillings is conservatively estimated to be of the order of 108,600. The census of 1946 estimated that at the time some 53,000 donums of land were being irrigated perennially by pumped water. By the end of 1962 as a result of Water Development Department drilling alone this has been increased by 206% to 161,600 donums.

Drilling for water has been fairly evenly distributed throughout Cyprus in 1962. By districts, the borehole distributions is as follows:-

Nicosia and Kyrenia	87
Famagusta	36
Larnaca	9
Limassol	22
Paphos	27

168 prospecting boreholes were sunk in 1962. Most of these were drilled for domestic water supply purposes.

In fact the programme of the prospecting drilling for 1962 was so arranged as to secure a source of water supply to a great number of villages which are at the moment in great need of a satisfactory supply. It is considered that a total of about 42 villages will be supplied with a satisfactory domestic water supply from the successful bore-

holes put down in 1962. The prospecting drilling of 1962 produced very interesting discoveries.

Prospecting drilling was carried out in practically all types of aquifers likely to be met in Cyprus. Firstly the seismic survey of 1958 proved once again very helpful in the siting of boreholes in a number of river valleys like the Kouris, Yermasoyia, Dhiarizos, Ezuza, Xeropotamos and Khrysokhou where a number of successful boreholes were drilled in the deep alluvia of these rivers.

A very useful find of the year were the boreholes put down in the Khrysokhou valley where the gravels were found to be up to 160 feet in depth and completely saturated with water. Two of the boreholes put down in this valley went to 702 and 600 feet in depth. They both struck a number of aquifers below the level of the alluvia. These deeper aquifers are the gypsum beds of the Paleno formation which in turn are underlain by the Terra limestone series consisting of the aquiferous terra reef limestone and creamy marls and chalks. Both boreholes were almost artesian the S.W.L. remaining only a few feet below ground level. These boreholes have not yet been test pumped with an electrosubmersible pump but it is certain that they will prove very good producers. When tested with a deep well pump they were producing 6,000 g.p.h. (which is the maximum capacity of the pump) with very little drawdown.

Prospecting drilling on the Hilarion Limestone was continued in 1962. After the completion of the drilling of the Kyrenia borehole now successfully supplying this town with a good domestic water supply work continued on the southern part of the range at Dhikomo. At the beginning of the year the Nicosia boreholes Nos. 169/56 and 117/56 situated very close to each other were deepened to a depth of 414 and 354 feet respectively. Water in both boreholes was struck at 345-385 and both boreholes now pump water to Nicosia especially in summer when the demand for water is at its peak.

Drilling on the same limestone was then undertaken in the foothills of the range between the villages of Dhikomo and Sykhari. Here a successful borehole No. 173/62 was drilled which went to a depth of 252 feet. Water was struck at 126-132 feet below ground level. It was tested for a

period of 55 hours at the rate of 18,000 g.p.h. but it was found that after 30 hours pumping a fairly big spring "Mana tou Nerou" used for irrigation at Dhikomo was adversely affected and pumping was stopped. The spring fully recovered after 15 days from the time pumping was stopped. Because of this adverse effect of the borehole on the spring the borehole cannot be put into effective use. This is very unfortunate because it is certain that if these springs were brought under proper control the area under irrigation and naturally the income from the springs would be increased by five times. The ineffective use of the water of the springs is due to the fact that the flow of the springs coming out of the Hilarion Limestone is at its maximum in the wet season when water is not required for irrigation whilst in summer when water is badly needed for irrigation the flow of the springs is at its minimum. Thus as things are at the moment the area which can be brought under irrigation is limited by the outflow in July-August. The best way of making efficient utilization of the water available is to bring the springs under control and this can be done by pumping the annual flow of the springs during the summer irrigation period thus lowering the water table and providing enough storage for the next wet season. An attempt on these lines is being made to convince the owners of the Dhikomo "Mana tou Nerou" spring to accept such a scheme which if successful will act as a good pilot project for the efficient utilization of the water of the other springs on the Kyrenia hills.

Another useful find as a result of prospecting drilling in 1962 was the discovery of a good aquifer in the area of Ayia Irini on the Kormakiti peninsula. Here two boreholes penetrated deep Pleo Pleistocene deposits of sands, gravels and sandstones. These boreholes are very free yielding one of them producing 15,000 g.p.h. with very little drawdown. This aquifer has been earmarked for the supply of domestic water supplies to a number of villages in this very dry part of the country.

Two successful boreholes were put down in the upper Lapithos beds of the Larnaca District. These beds consist of flaggy white chalks, marls and occasional black shales.

This rock formation has no primary porosity but where the beds have been faulted water is struck in the fault zones. The two above boreholes have been located near the stream beds one of them near the banks of Tremithios river and the other one on the banks of the Pouzis river. The action of percolating water from the stream beds also opens up the fissures in the bedrock by dissolving away part of the  $\text{CaCO}_3$ . The Klavdhia borehole is artesian with a surface flow of 2,000 g.p.h. whilst the second one near the village of Anglisidhes is semi artesian. On an eight day test both boreholes produced 9,000 g.p.h. each. The NaCl content of the Klavdhia borehole was 603 p.p.m. whilst that of Anglisidhes was 211 p.p.m.

During the year prospecting drilling was continued in the Makedhonitissa area and it was discovered that this basin extends to well south west of the Nicosia Airport west of which a number of boreholes were drilled in the last two or three years. Two boreholes were drilled for the Nicosia Water Board which on test produced 18,000 g.p.h.

A last but by no means least useful find as a result of prospecting drilling in 1962 were two boreholes put down on the Koronia reef limestone on the northern flanks of Troodos. The Koronia reef limestone are the uppermost beds of the Pakhna chalk series. This limestone is a shallow water deposit of coralline reef limestones. They are compact, hard, semicrystalline rocks with a splintery subconchoidal fracture, in places composed of masses of broken shells. These reef limestones are well exposed all along the northern fringe of the Troodos massif and south of Famagusta at Cape Greco and Pyla.

The two boreholes drilled in this limestone in 1962 are at Potami (Grid ref. N 60,070 E 73,710) and the second one at Politico (Grid ref. N 52,050 E 93,000). The borehole at Politico penetrated 153 feet of the Koronia reef limestone series. The borehole was tested with a deepwell pump giving 5,000 g.p.h. (maximum capacity of the pump) with  $1\frac{1}{2}$  feet of drawdown. It is certain that with a bigger pump this borehole can produce more water than the tested yield. The boring at Potami went through 295 feet of this limestone. It was test-pumped for 396 hours at an average rate of 16,500 g.p.h.

The maximum drawdown obtained was 18'5". It was measured by means of a mercury manometric apparatus. The recovery of the static water level after pumping was stopped was not full, remaining 4 feet below the level at which pumping commenced. The limestone behaved like a porous reservoir emptied at a constant discharge rate.

There were thirty six privately owned drilling rigs, licensed to drill for water, operating in Cyprus at the end of 1962. Altogether they drilled 76 new boreholes all for water with an aggregate footage of 17,271. Unfortunately there were quite a number of illegal drillings of which no information is available. Of these legal boreholes 78.9% were successful and gave an estimated total output of 601,000 gallons per hour. Twenty five are locally made some of them quite well constructed, but they are of a rather light type generally only suitable for drilling in favourable rock conditions. There has been a tendency towards the use of imported drilling rigs by private contractors. In 1962 in addition to 25 locally made rigs there were seven Ruston-Bucyrus 22W, one Ruston-Bucyrus 60 R.L. and 3 Swedish made rigs. As in previous years a considerable number of boreholes have been sunk in the Famagusta and Larnaca districts where drilling is comparatively easy and wells may be sunk without casing; there has, however, been increased activity in the Nicosia district during 1962 where drilling rigs were operating near Nicosia and in the vicinity of Morphou, and one drilling rig sunk several successful boreholes in Paphos district.

By law, private drilling contractors are obliged to give notice of drilling, to keep records of depth of boreholes and static water levels and to retain borehole samples for inspection by an officer of the Water Development Department. Test pumpings are not normally carried out but from information received it is possible to arrive at an approximate figure of the total water yield of these private drillings. As many of the boreholes were drilled in the bottom of existing wells the increase in yields is somewhat conjectural but it is conservatively estimated that the increase in perennial irrigation as a result of these drillings is of the order of 3,000 donums in 1962.

The average cost of departmental drillings in 1962 was £224 per borehole or £1.078 mils per foot of drilling. These costs are inclusive of the expenses of laying casing pipes and of an eight hour test pumping of successful boreholes. They are exclusive of the purchase price of borehole casing pipes and the capital cost and installation charges of permanent pumping plant. They include the wages of the drilling crews, fitters and blacksmiths, and the cost of workshop maintenance, fuel and lubricating oils, bit sharpening and repairs and replacement of drilling tools and equipment. They do not include depreciation of drilling plant and the salaries and expenses of the supervisory staff.

No subsidized boreholes were drilled in 1962 for no funds were made available for subsidized drilling. 207 boreholes were drilled entirely from Government funds.

Appendix 14 shows boreholes drilled by Government since 1955 and those drilled by Government in 1962.

Appendix 15 shows summary of results of boreholes drilled by Government in 1962.

APPENDIX 14.

NUMBER AND FOOTAGE OF BOREHOLES.

NUMBER OF BOREHOLES DRILLED

1955-1962.

Purpose	1946-1955	1956	1957	1958	1959	1960	1961	1962
For Private Individuals and Companies	1,328	128	202	106	155	165	55	22
For Government	394	55	62	35	9	13	126	207
For W.D. and A.M.W.D.	206	30	29	16	27	10	18	18
Totals	1,928	213	293	157	191	188	199	247
Aggregate footage drilled	360,562	42,681	51,420	32,842	48,250	49,887	49,681	51,292
Average depth	187	200	175	209	253	265	245	208

BOREHOLES DRILLED

IN 1962.

Purpose	No.	Existing Well Footage	Footage Drilled	% successful	Total Tested Yield G.P.D.
Irrigation	6	191	1,073	33.3	184,800
Domestic Water Supply	6	217	1,976	66.6	633,600
Prospecting	168	1,711	40,921	49.4	16,113,600
Industrial	1	-	313	100.0	52,800
Total for Water	181	2,119	44,283	49.7	16,984,800
Observation	14	-	1,925	-	-
Technical and Geological	52	15	5,084	-	-
Total Drilled	247	2,134	51,292	-	-

Old Boreholes Renovated - 29.



APPENDIX 15.

BOREHOLES DRILLED FOR WATER IN 1962.

SUMMARY OF RESULTS.

District	Locality	No. Drilled	No. Successful *	% age Successful	Total Tested Output G.P.D.	Average Yield per Successful Borehole G.P.D.
Nicosia	Western Mesaoria	10	8	80.0	1,908,000	238,500
	Makedhonitissa - Ay. Trimithia - K. Trimithia	9	6	66.6	964,800	160,800
	Kambia - Pera - Argates	13	7	53.8	501,600	71,660
	Dheftera - Yeri - Strovolos	13	10	76.9	1,240,800	124,080
	Ay. Theodoros - Pyrgos - Limnitis	6	4	66.6	837,600	209,400
	Kapouti	3	-	-	-	-
Kyrenia	Liveras - Dhiorios - Ay. Irini	27	5	18.5	1,132,800	226,560
	Dhikomo - Aghirda	4	3	75.0	806,400	268,800
	Halevga	1	-	-	-	-
	Photta	1	-	-	-	-
Famagusta	Lapathos	14	3	21.4	237,600	79,200
	Sinda - Kondea - Koukليا	5	1	20.0	144,000	144,000
	C.F.	106	47	-	7,773,600	-

District	Locality	No. Drilled	No. Successful *	% age Successful	Total Tested Output G.P.D.	Average Yield per Successful Borehole G.P.D.
	B.F.	106	47		7,773,600	
	Peristerona - Piyi	4	-	-	-	-
	Knodhara	4	1	25.0	72,000	72,000
	Avghorou	3	2	66.6	302,400	151,200
	Ornithi	2	-	-	-	-
	Ay. Napa	1	-	-	-	-
	Yerani	1	-	-	-	-
	Ay. Andronikos	1	1	100.0	148,800	148,800
	Mersiniki	1	-	-	-	-
Larnaca	Anglisidhes - Klavdhia - Pyrga	3	3	100.0	372,000	124,000
	Pergamos - Pyla	3	-	-	-	-
	Kelia	2	-	-	-	-
	Lefkara	1	-	-	-	-
Limassol	Erimi - Ypsonas - Kandou	6	5	83.3	1,567,200	313,400
	Yermasoyia	5	5	100.0	2,160,000	432,000
	Evdhimou - Prastio	3	1	33.3	38,400	38,400
	Zakaki - Asomatos	2	2	100.0	240,000	120,000
	Moni	2	2	100.0	84,000	42,000
	C.F.	150	69	-	12,758,400	-

District	Locality	No. Drilled	No. Successful *	% age Successful	Total Tested Output G.P.D.	Average Yield per Successful Borehole G.P.D.
	B.F.	150	69		12,758,400	
	Alekhtora	2	-	-	-	-
	Phasoula	1	1	100.0	72,000	72,000
	Sotira	1	1	100.0	38,400	38,400
Paphos	Anarita - Mandria - Kouklia	8	6	75.0	1,154,400	192,400
	Akhelia - Ay. Varvara - Ktima	5	4	80.0	1,248,000	312,000
	Goudhi - Skoulli	5	5	100.0	650,400	130,080
	Souskiou - Mamonia	5	2	40.0	792,000	396,000
	Kithasi - Trakhypedhoula	3	2	66.6	271,200	135,600
	Polemi	1	-	-	-	-
	Totals	181	90	49.7	16,984,800	190,840

\* A successful borehole is one that yields on test not less than 1,000 gallons per hour of usable water.

APPENDIX 16.

HYDROLOGICAL NOTES

By Nicos Chr. Toufexis, Senior Inspector of Works.

(This report covers the period from 1st October, 1961, to 30th September, 1962.)

1. Meteorological Data.

The main characteristics of the total precipitation during the year were:-

- (a) The average rainfall over the whole island was 23.96 inches which is 120.88% of normal as compared with the average since 1908 which is 19.82 inches.
- (b) November and March were the only months of the year with below average rainfall. The precipitation in all other months was considerably above average.
- (c) The highest daily rainfall in the year was 5.66 inches and it occurred in Pano Amiandos on the 15th December, 1961.
- (d) Some snow fell at the high altitudes of the Troodos mountains in November, December, 1961, and January, February and March, 1962.
- (e) Temperatures were generally above normal during the year. The highest temperature recorded at Nicosia was 108° F. on the 9th August.

2. Flood Discharges.

Quite a number of floods were reported during the hydrological year 1961-62, the most serious of which occurred early in winter and late in spring in the valleys of rivers flowing from the central massif. The highest flood-flows were 4970 cusecs in Tremithios river recorded near Ayia Anna and 4400 cusecs in Xeros river (Paphos) recorded at Limassol-Paphos road, on the 15th December. The rainfall on this day was 2.13 inches at Kornos and 3.45 inches at Kykko Monastery.

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

River	Location	Peak flow		Rainfall						
		Cusecs	Date	Inches	Place	Date				
Yialias	Kochatis	1670	15.12.61	2.60	Mandra-tou Kambiou	15.12.61				
Ovgos	Morphou-Kyrenia Bridge	2210	20. 1.62	1.65	Skylloura	20. 1.62				
Serakhis	Near Morphou	1800	29.10.61	1.13	Morphou	29.10.61				
				1.40	Peristerona Police Station	27.10.61				
				2.00	- do -	28.10.61				
				1.13	- do -	29.10.61				
				- do -	- do -	1260	9. 5.62	3.60	Panayia Bridge Forest Station	9. 5.62
- do -	- do -	-	-	2.97	Ay. Epiphanios	9. 5.62				
Peris- terona	Panayia Bridge Forest Station	840	15.12.61	1.28	Panayia Bridge Forest Station	15.12.61				
- do -	- do -	600	7. 2.62	2.90	Palekchori	7. 2.62				
Tremithios	Kiti	1860	15.12.61	2.13	Kornos	15.12.61				
				0.90	Kiti	15.12.61				
				- do -	Ayia Anna	4970	15.12.61	2.13	Kornos	15.12.61
				- do -	- do -	1162	30.10.61	1.15	- do -	30.10.61
				- do -	- do -	3200	9.11.61	0.05	- do -	9.11.61
								0.12	Kiti	9.11.61
								0.22	Perakhorio	9.11.61
								0.46	Meneou	9.11.61
								0.15	Larnaca	9.11.61
				Yermasoyia	Near Police Station	3370	16.12.61	2.50	Kalokhorio Limassol	15.12.61
Kouris	Erimi Bridge	930	16.12.61	1.56	- do -	16.12.61				
				5.10	Amiandos	15.12.61				
				2.70	- do -	16.12.61				
				3.42	Saittas	15.12.61				
				2.10	- do -	16.12.61				
				3.60	Kilani	16.12.61				
				4.35	Pano Platres	15.12.61				
				1.50	- do -	16.12.61				
Kokkini- Trimithia	Near Kokkini- Trimithia	1230	20. 1.62	2.07	Kokkini- Trimithia	20. 1.62				
Khrysokhou	Skoulli	1910	16.12.61	3.60	Ayia Forest Station	15.12.61				
				1.25	- do -	16.12.61				

River	Location	Peak flow		Rainfall		
		Cusecs	Date	Inches	Place	Date
Stavros-tis-Psokas	Evretou	3400	16.12.61	1.80	Stavros-tis Psokas	15.12.61
				1.18	- do -	16.12.61
Syrgatis - do -	Skarinou - do -	2390	15.12.61	2.60	Pano Lefkara	15.12.61
				0.35	- do -	25. 5.62
Dhiarizos	Limassol-Paphos Bridge	2400	15.12.61	1.55	Kornos	25. 5.62
				2.53	Ayios Nicolaos	15.12.61
Xeros (Paphos)	Limassol-Paphos Bridge	4400	15.12.61	3.45	Kykko Monastery	15.12.61
				1.34	Akhelia	15.12.61
				0.60	Kelokedhara	15.12.61

### 3. River Discharges.

The high rainfall intensities experienced all over the island during 1961-62 resulted in high flows in most of the mountain rivers and their total discharges by the end of the year were generally above average.

### 4. Water level recorders.

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

Recorders No.	Catchment	Location	Type of installation
1	Pedhieos	Nicosia Ex-Railway Bridge	Water level recorder on 40 ft. measuring weir.
2	Yialias	Near Kochatis	Water level recorder on 60 ft. measuring weir.
3	Ovgos	Morphou-Kyrenia Bridge	Water level recorder on bridge.
4	Serakhis	Near Morphou	Water level recorder.
5	Xeros (Nicosia)	Xeros Bridge	Water level recorder on bridge.
6	Marathasa	Lefka-Skouriotissa Bridge	Water level recorder on bridge.
8	Avgorou	Near Avgorou	Water level recorder on 40 ft. measuring weir.
9	Paralimni	Near Paralimni Lake	Water level recorder on 30 ft. flume.

Recorders No.	Catchment	Location	Type of installation
10	Pyrgos (Tyllirias)	Near Phileyia	Water level recorder on 30 ft. measuring weir.
11	Limnitis	Near Limnitis Saw mill	Water level recorder on 30 ft. measuring weir.
13 A	Kouris (Trimiklini)	Limassol-Troodos Bridge	Water level recorder on 18 ft. measuring weir.
13 B	- do -	Near 13 A	Water level recorder on 1'-6" flume.
14	Peristerona	Near Panayia Bridge Forest Station	Water level recorder on 25 ft. measuring weir.
15	Tremithios	Kiti	Water level recorder on 73 ft. irrigation weir.
16	Yermasoyia	Near Police Station	Water level recorder on 54 ft. measuring weir.
17	Kouris	Erimi bridge	Water level recorder on bridge.
18	Kolopannes	Near Kalopsidha	Water level recorder on 25 ft. measuring weir.
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.
21	Kokkini- Trimithia	Near Kokkini- Trimithia	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 Vassilios	Water level recorder on 60 ft. measuring weir.
25	Ak-Sou	Near Petra-tou-Dhigheni	Water level recorder on 30 ft. measuring weir.
26 A	Almyros	Near Geunyeli	Water level recorder on 40 ft. measuring weir.
26 B	- do -	Near 26 A	Water level recorder on standing wave flume with 1 ft. throat.
27	Khrysokhou	Near Skoulli	Water level recorder on 40 ft. measuring weir.
28	Stavros-tis-Psokas	Near Trimithousa-Evretou road junction	Water level recorder on 25 ft. measuring weir.
29	Syrgatis	Near Skarinou	Water level recorder.
30	Dhiarizos	Limassol-Paphos bridge	- do -
31	Xeros (Paphos)	Limassol-Paphos bridge	- do -

Recorders No.	Catchment	Location	Type of installation
32	Alakati	Platimatis near Ay. Amvrosios (Kyrenia)	Water level recorder on 22 ft. measuring weir.
33	Karyiotis	Near Pendayia	Water level recorder on 60 ft. measuring weir.
34	Tremithios	Ayia Anna	Water level recorder on 40 ft. measuring weir.
35	Elea	Elea bridge (near Ghaziveran)	Water level recorder on bridge.

5. Measured discharges 1961-62.

The discharges measured at the gauging stations of the previous paragraph are as follows:-

Recorder No.	Catchment	Rainfall during 1961/62 $10^6$ c. ft.	Runoff during 1961/62 $10^6$ c. ft.	Maximum discharge in a day $10^6$ c. ft.	Maximum flow cusecs	Runoff in % Rainfall 1961/62
1	Pedhieos	2031	119.26	18.49	390	5.87
2	Yialias	1558	398.5	18.92	1670	25.58
3	Ovgos	3848	122.43	56.03	2210	3.18
4	Serakhis	10260	142.28	29.52	1800	1.39
5	Xeros	2143	169.39	8.87	175	7.9
6	Marathasa	1936	333.13	5.35	73	17.2
8	Avgorou	408	3.78	2.61	251	0.93
9	Paralimni	-	0.63	0.10	6.2	-
10	Pyrgos (Tyllirias)	1078	427.38	16.1	330	39.64
11	Limnitis	1435	501.62	30.78	680	34.95
13	Kouris (Trimiklini)	2306	453.22	28.98	360	19.65
14	Peristerona	2571	681.26	34.98	840	26.49
15	Tremithios (Kiti)	2650	45.64	8.09	1860	1.72
16	Yermasoyia	5184	515.86	23.46	3370	9.95
17	Kouris (Erimi)	12196	2052.4	44.27	930	16.82
18	Kolopannes	-	10.41	6.83	160	-
19	Akhna	385	0.03	0.03	-	-
20	Phrenaros	157	31.28	6.57	272	19.92
21	Kokkini-Trimithia	419	15.6	15.53	1230	3.72



Recorder No.	Catchment	Rainfall during 1961/62 10 <sup>6</sup> c. ft.	Runoff during 1961/62 10 <sup>6</sup> c. ft.	Maximum discharge in a day 10 <sup>6</sup> c. ft.	Maximum flow cusecs	Runoff in % Rainfall 1961/62
22	Liopetri	188	9.89	3.42	100	5.23
23	Akaki	2438	469.61	21.20	338	19.26
24	Skyloura	1464	30.58	11.70	544	2.09
25	Ak-Sou	182	8.97	2.77	272	4.92
26	Almyros	499	29.8	16.32	506	5.97
27	Khrysokhou	1718	288.55	71.84	1910	16.79
28	Stavros-tis-Psokas	2699	619.33	133.30	3400	22.94
29	Syrgatis	3051	272.63	13.39	2390	8.93
30	Dhiarizos	8317	1483.9	77.50	2400	17.8
31	Xeros (Paphos)	7072	1151.03	75.28	4400	16.27
32	Alakati	275	13.66	2.48	466	4.96
33	Karyiotis	2753	166.62	6.90	340	6.05
34	Tremithios (Ay. Anna)	1862	181.31	12.64	4970	9.73
35	Elea	3940	38.4	3.65	197	0.97

#### 6. Spring Discharges.

During the hydrological year 1584 spring discharges were measured, giving an average of 132 measurements each month. 239 springs are now measured regularly, 98 at monthly intervals, 31 every 2 months, 32 every 3 months, 20 every 4 months, 57 every 6 months and 1 every year.

The above normal rain which fell in all parts of the island during winter led to above average discharges.

The Troodos area was affected by the heavy rains and by the snow falls in the early months of the year. All spring discharges maintained their high rate of flow throughout the summer. The springs used for the water supply of Troodos were discharging 44,000 gallons per day in September compared with 26,000 gallons per day last year.

The three springs used for the Limassol domestic water supply, Kephlovrysos, Kria Pighadhia and Mavrommata, themselves fed from the southern slopes of Troodos were yielding 1,109,000 gallons per day in September, which is the highest rate of flow since 1953.

In the central Mesaoria plain the flow of the chain of wells was above normal and has followed the same behaviour which was observed in most springs of the Troodos Range.

Springs in the Kyrenia Range maintained a steady above average flow throughout the year without having abnormal seasonal increases. The Kephalovrysos Karavas has proved to be the most constant spring in the island having very little fluctuations in its rate of flow. During the greater part of the year it was yielding 604,000 gallons per day. The Kephalovrysos Kythrea flowing at the rate of about 1,850,000 gallons per day during the last seven months of the year has similarly shown a steady discharge.

7. Ground-water used for Town Water Supplies.

Details of the water extracted from underground reserves for the three largest towns of Cyprus are given below:-

	<u>Quantity</u> ( <u>Million Cub. feet</u> )	<u>Percentage</u>
<u>Nicosia</u>		
Kokkini Trimithia	105.2	59.1
Morphou	18.8	10.6
Arab Ahmet at Strovolos	12.6	7.1
Laxia	9.7	5.5
Dhikomo	7.0	3.9
Dhali	5.0	2.8
Sykhari	4.0	2.2
Athalassa	1.2	0.7
Makedhonitissa	2.5	1.4
Others (Approx.)	12.0	6.7
<b>Total Extraction</b> during 1961-1962	<b>178.0</b> =====	<b>100</b> =====
<u>Famagusta</u>		
Phrenaros West	20.6	38.6
Phrenaros North	31.6	59.3
Others	1.1	2.1
<b>Total Extraction</b> during 1961-1962	<b>53.3</b> =====	<b>100</b> =====

	<u>Quantity</u> ( <u>Million Cub. feet</u> )	<u>Percentage</u>
<u>Limassol</u>		
Kephalovrysos		
Kria Pighadhia and Mavrommata springs	76.0	80
Chiftlikoudhia chain of wells	11.0	11.6
Others	8.0	8.4
Total Extraction during 1961-1962	<u>95.0</u> =====	<u>100</u> =====

8. Groundwater Levels.

The total number of wells and boreholes measured for observation purposes over the whole island has increased from 94 in 1960/61, to 124 in 1961/62. Of these, only 65 may be considered as permanent observation boreholes.

Due to the well-above-normal rainfall during the wet months of the year, the groundwater levels reached their maximum recovery mostly between February and April, and in most aquifers this recovery was greater than that of the year 1960/61.

The seasonal decline in the groundwater level recorded at the end of the year was again in most cases less than in 1960/61, but in all aquifers this decline was greater than the year's seasonal recovery, thus leaving a deficiency in the water table.

At Kokkini Trimithia area, which provided Nicosia with about 63% of the year's Domestic Water requirements, the water table had gone down by the end of summer by 8 feet, causing a deficiency in the water table of 3 feet, which is about  $\frac{1}{3}$  of last year's. It is worth mentioning that the groundwater level had recovered during the wet months of the year by 5 feet, which is ten times greater than last year's seasonal recovery, and a record figure for the ten-year observations. The average annual fall in the area is 3.4 feet.

In the Morphou Bay area about  $1\frac{1}{2}$  miles inland, the water level was depressed as far as 3.6 feet below sea level. In spite of the fact that there was a record recovery of the water level during the wet months of the year, and although

the rainfall was also above normal, the water level decline during summer was almost the same as last year's, and this is due to the exhaustive overpumping from the aquifer by irrigation boreholes.

The newly constructed Morphou Dam may cut down the rate of decline by replenishing the depleted aquifer and providing water for spring irrigation through channels during years of good rainfall.

The average annual decline in the area is 3.3 feet, this year's fall being only 0.5 feet, the lowest ever recorded.

In the Phrenaros North and Phrenaros West areas the water level has been declining steadily with little or no seasonal recovery during the wet months, the average rate of fall being 3.1 feet per year. This year's decline at Phrenaros North, was 3.2 feet, compared with 4.1 feet of last year's.

At Phrenaros West the year's decline was 4.7 feet and this is by 1.1 feet greater than last year's, the reason being the intensive pumping for irrigation from a number of illegal boreholes sunk in the same aquifer, around the Famagusta Water Board boreholes.

If strict control over illegal drilling and pumping is not exercised, the rate of depletion of the aquifer will increase dangerously.

In the Xylophagou reef limestone aquifer the average rate of decline has reached a maximum of 1.2 feet per year in 1961/62.

Although this year's fall was 1.7 feet compared with 2.5 feet of last year's, the average minimum water level is 1.5 feet above sea level this year, compared with 3.2 feet last year.

One of the observation boreholes has recorded a minimum year's water level of 4.5 feet below sea level.

Had the year's rainfall not been above normal, the situation would have been much worse, due to the rapid increase of pumping from private boreholes for irrigation purposes during the last few years.

The observation borehole at Kolossi has recorded the most interesting results of the year, as concerns the water table level.

Although the water level in the first month of the year was at its minimum for the last seven years, being depressed as far as 2.2 feet below sea level, it reached its maximum level in June, i.e. 7.7 feet above sea level, having recovered by almost 10 feet, a record figure.

The reason was of course the replenishment of the aquifer from local rainfall which was well above normal, and from the Kouris river which discharged four times as much water as the average of the last six years.

9. Recharge Activities.

Artificial recharge, whereby use is made of rainy season waste-water or surplus water from domestic water supplies to recharge depleted aquifers, has been practised in Cyprus. During the period December, 1961 to May, 1962 this form of activity was in operation in the following areas:-

	<u>Total Recharge</u> <u>into the Aquifer</u>
<u>Famagusta</u>	
(From rainy season waste-water)	
Ayios Loucas basin	100 million cubic feet
Fresh water basin	19
Kharangas Earthen dam	56
Total	<u>175 million cubic feet.</u> ===
<u>Limassol</u>	
(From surplus water from the town domestic water supply)	
Chiftlikoudhia	
Chain of Wells	<u>7.3 million cubic feet</u>
Total	<u>7.3 million cubic feet.</u> ===

10. Chemical Analyses.

During the year 3,858 samples of water were sent to the Government Analyst for partial chemical analysis. These include 1821 samples taken from springs, wells or boreholes which are used or proposed as water supply sources. The other samples were taken from observation boreholes, springs and irrigation wells and boreholes.

11. Bacteriological Analyses.

During the year, 1,006 samples of water 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:-

<u>Water Supply</u>	<u>Number of samples</u>	<u>Number of unsatisfactory samples</u>
Nicosia	593	69
Famagusta	216	57
Limassol	43	6
Larnaca	34	1
Paphos	71	9
Kyrenia	49	
Total	<u>1,006</u> =====	<u>142</u> ===

At Nicosia most of the unsatisfactory samples came from private boreholes at Paleometokho and Kokkini Trimithia area which supply water to Nicosia Water Board. 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 reservoirs were satisfactory.

12. Special Investigations.

During the year the routine measurements of static water levels in November, just when pumping stopped, and in March, just before pumping commenced, were taken for the areas under Hydrological Investigation at Phrenaros, Western Mesaoria, Kyrenia and Akrotiri-Phasouri.

Groundwater contour maps were prepared showing the year's seasonal water level variation; the extraction of water from each area was also estimated for the year.

In the Phrenaros Hydrological area which covers about 24 square miles, the total extraction of groundwater was 2082 million gallons in 1961/62, compared with 1867 million gallons in 1960/61. The number of wells and boreholes in use during the above two years was 510 and 494 respectively.

Although this year's local rainfall was about 123% of normal, the groundwater level decline indicates that there is still an excess of extraction over recharge in the area, especially around the Famagusta Water Board boreholes, where pumping from illegal boreholes is going on.

The extraction during the year from an area of 145 square miles covered by the Western Mesaoria Hydrological Survey, was 12500 million gallons compared with 14125 million gallons in 1960/61.

This year's extraction is less than last year's partly due to the fact that the upper Peristerona and Akaki rivers were flowing until May, feeding intakes for irrigation in the higher parts of the study area.

Also the local rainfall which was about 126% of normal, contributed to the diminishing of the extraction from groundwater for irrigation purposes.

In the Kyrenia Hydrological Survey, covering an area of about 42 square miles, the extraction (including the discharge of springs) was greater than last year's, being 2056 million gallons and 1440 million gallons respectively.

As the Hydrological Investigation in this area commenced only 2 years ago, the data available is insufficient for giving a clear idea of the relation between the three factors of rainfall, recharge and extraction.

It is however obvious from the questioning carried out in summer that the quantity extracted is beyond any doubt greater than what the capacity of the aquifer can yield.

In the 41 square miles covered by the Akrotiri-Phasouri Hydrological Survey, this year's extraction is by 38% greater than last year's, being 5677 million gallons to 4106 million gallons.

The main recharge factor is the flow of Kouris river, the influence of which was recorded in the water level of the Kolossi Observation Borehole, this year's wet season.

A sea intrusion to the South of Zakaki village is being viewed with considerable concern, samples of water for chemical analysis being taken every month from wells and boreholes in the vicinity; no definite conclusion as regards this affair has yet been reached at.

In the South Eastern Mesaoria, apart from Phrenaros area, the hydrological activities were extended to cover up to the end of the year an additional area of about 88 square miles. From this area a quantity of 4827 million gallons was extracted during the year.

Future water level measurements will show the relation between extraction and recharge in the area.

The total area which have so far been under hydrological investigation over the whole island is 340 square miles and it is still continuing so as to cover the South-Eastern Mesaoria and Polis (Paphos) areas.

### 13. New Measuring Sites.

By the end of the hydrological year 1961-62 the following new measuring weirs were completed, where automatic water level recorders will be installed.

1. Weir on the Atsas river upstream of Petra Dams:-  
A 25-ft. broad-crested measuring weir (with a 2'-0" x 6" notch for low flows).
2. Weir on Livadhi river near Paphos:-  
A 70-ft. broad-crested measuring weir (with a 2'-0" x 6" notch for low flows).
3. Measuring Site on Xeros river (Ayia Marina Khrysokhous):-  
Stabilization of the river bed under Nicosia-Paphos main road bridge.
4. Measuring Site on Yialia river at Kato Yialia:-  
Stabilization of the river bed under Nicosia-Paphos main road bridge.



5. Measuring Site on Magounda river at Kato Argaka:-  
Stabilization of the river bed under Nicosia-Paphos main road bridge.
6. Weir on Mavrokolymbos river at Potima Chiftlik:-  
A 40-ft. broad-crested measuring weir (with a 2'-0" x 6" notch for low flows).
7. Weir on Ezuza river at Akhelia:-  
A 85-ft. broad-crested measuring weir (with a 2'-0" x 6" notch for low flows).
8. Weir on Xeros river (Paphos) at Phinikas:-  
A 120-ft. broad-crested measuring weir (with a 2'-0" x 6" notch for low flows) to substitute the station on Limassol-Paphos road bridge.
9. Weir on Khapotami river near Kouklia (Paphos):-  
A 50-ft. broad-crested measuring weir (with a 2'0" x 6" notch for low flows).
10. Weir on Garyllis river at Kato Polemidhia:-  
A 66-ft. broad-crested measuring weir (with a 2'-0" x 6" notch for low flows).
11. Weir on Vassilikos river at Kalavassos:-  
A 75-ft. broad-crested measuring weir (with a 2'-0" x 6" notch for low flows).
12. Weir on Maroniou river near Khyrokitia:-  
A 40-ft. broad-crested measuring weir (with a 2'-0" x 6" notch for low flows).
13. Serrakhis river measuring site at Massari:-  
Stabilization of the river bed under Katokopia-Massari road-bridge.
14. Repairs to the existing measuring sites:-

Besides the construction of new measuring weirs, repairs or developments have been carried out to the existing measuring weirs during the year.

1. Kokkini-Trimithia measuring weir:-

The 40-ft. broad-crested weir has been extended to 55-ft. as the spillway was not wide enough to let through some flash flows experienced in the past.

2. Ovgos river measuring site:-

The recorder on Morphou-Kyrenia main road bridge has been removed and installed at a better place on Morphou-Pnasi Monastery road bridge about 2 miles downstream of the old site. The river bed has been stabilized.

3. Dhiarizos river measuring site:-

Stabilization of the river bed by constructing a 40-ft. measuring weir under the bridge.

4. Kouris river measuring site:-

Stabilization of the river bed under the bridge.

5. Yermasoyia measuring weir:-

Repairing the existing weir damaged by the floods of December 1961.

6. Xeros river (Nicosia) upstream of Kafizies Dam:-

Construction of a small notch for getting better measurements during the summer.

7. Marathassa river upstream of Lefka Dam:-

Preparing the place for installing a pneumatic level recorder.

8. Karyiotis river near Evrykhon:-

Preparing the place for installing a pneumatic level recorder.

9. Peristerona river at Panayia bridge Forest Station:-

Repairing the existing measuring weir and installing an Iron foot-bridge for getting flood-flows measurements.

15. Water Consumption.

The records which are regularly kept on the actual quantity of water used in practice by ordinary irrigators in the Eastern and Western Mesaoria, show that most of them, especially in Morphou area, are over-irrigating their crops. There is no doubt that if better methods and practices were used in the application of the irrigation water a smaller quantity would produce equal crops.

16. Water Level in Control Boreholes.

(Feet above sea level.)

Serial No.	Place	Bore-hole Number & Year	Maximum Water Level			Minimum Water Level		
			Year after drilling	60-61	61-62	Year after drilling	60-61	61-62
1	Kokkini-Trimithia	90/50	686.60	658.00	-	682.40	656.80	-
2	Kokkini-Trimithia	160/50	682.70	658.50	656.67	679.40	654.58	653.00
3	Kokkini-Trimithia	161/50	686.00	650.67	638.46	679.40	627.33	621.50
4	Astromeritis	91/50	372.14	341.91	336.66	366.54	335.99	325.41
5	Morphou	168/50	89.27	66.07	67.95	83.57	62.82	62.49
6	"	92/50	86.43	43.31	41.98	76.13	15.36	14.36
7	Prastio	93/50	31.49	6.44	4.52	24.29	0.46	- 1.14
8	"	11/57	26.31	7.52	-	14.73	1.79	-
9	Ghaziveran	94/50	22.52	7.77	8.81	18.22	4.90	4.62
10	Pendayia	95/50	10.60	4.83	10.50	8.00	2.17	2.48
11	Syrianokhori	150/54	10.51	4.69	4.30	9.01	2.80	2.22
12	"	151/54	10.12	1.56	1.70	8.83	1.31	1.00
13	"	152/54	8.32	2.65	2.15	6.07	1.07	0.99
14	"	153/54	5.79	2.16	1.92	4.71	1.46	1.25
15	"	1/55	24.09	4.59	3.43	17.80	- 2.49	- 3.24
16	"	23/55	21.89	1.06	1.81	17.64	- 2.05	- 3.36
17	"	201/56	18.45	3.30	1.97	13.02	- 2.36	- 3.61
18	"	209/56	17.24	4.91	3.49	12.49	- 2.46	- 2.67
19	"	195/57	7.07	2.61	2.40	5.19	0.86	0.69
20	"	209/57	4.56	1.54	2.33	2.96	0.92	0.87
21	"	212/57	3.69	1.40	2.02	2.36	0.40	0.36
22	"	248/57	10.58	2.69	1.69	6.44	0.36	- 0.31
23	"	253/57	10.76	3.30	1.88	6.72	0.75	0.05
24	Xylophaghou	70/51	19.10	10.97	9.80	17.50	8.89	7.43
25	"	71/51	13.10	2.20	- 0.05	11.20	- 2.68	- 4.47
26	"	72/51	17.15	12.48	19.23	14.65	9.57	11.32
27	"	73/51	- 6.03	4.99	5.28	4.03	3.28	3.93
28	"	74/51	6.85	3.80	2.97	4.45	2.38	1.63
29	Ormidhia	189/57	- 1.55	- 1.48	- 1.02	- 2.27	- 2.52	- 2.15
30	"	227/57	0.70	0.24	0.05	0.20	- 0.38	- 0.51
31	"	246/57	0.22	0.48	- 0.19	- 0.32	- 0.65	- 0.65

2. Ovgos river measuring site:-

The recorder on Morphou-Kyrenia main road bridge has been removed and installed at a better place on Morphou-Pnasi Monastery road bridge about 2 miles downstream of the old site. The river bed has been stabilized.

3. Dhiarizos river measuring site:-

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APPENDIX 18.

MECHANICAL PLANT

(as on 31/12/62)

<u>MOBILE PLANT:-</u>	<u>No.</u>
Ruston Bucyrus Drilling rigs 22W .. .. .	11
Ruston Bucyrus Drilling rigs 6ORL .. .. .	1
Water Dev. Department (1959) drilling rigs .. .. .	1
Edeco Drilling Rigs .. .. .	2
Cheshire earth boring machine .. .. .	1
Allen Trencher 12"-21' .. .. .	2
Avelling-Barford Trencher .. .. .	1
Caterpillar Traxcavators 955 .. .. .	4
Caterpillar Traxcavator HT4 .. .. .	1
Caterpillar Bulldozer .. .. .	1
International Bulldozer .. .. .	1
Ruston Bucyrus Excavator RB10 .. .. .	1
Ruston Bucyrus Excavator RB19 .. .. .	1
Compressors .. .. .	11
Morrison diesel alternator on trailer .. .. .	3
Electrosubmersible test pumps .. .. .	10
Turbine deep-well test pumping units .. .. .	2
Plunger deep-well test pumping units .. .. .	2
Centrifugal pumping units .. .. .	4
Portable works pumps .. .. .	18
Sheepfoots roller .. .. .	12
Cranes .. .. .	2
Hoists .. .. .	3
Concrete mixers .. .. .	47
Vibrators .. .. .	30
Low loader .. .. .	1
Austin Countryman Vans .. .. .	6
Land Rovers .. .. .	13
Fordson Lorry 3 ton .. .. .	1
Humber Utility Vans .. .. .	2
Thornycroft Tractive Unit for Low Loader .. .. .	1
Aveling Barfor Dumpers .. .. .	2
Bray Loader .. .. .	1
Vibrating Rollers .. .. .	2
5 ton diesel lorry .. .. .	1
Soil compactors .. .. .	2

WORKSHOP PLANT:-

	<u>No.</u>
Lathes .. .. .	4
Shaping machine .. .. .	1
Screwing machine .. .. .	1
Drilling machine .. .. .	3
Planning Timber Machine .. .. .	1
Bandsaw timber .. .. .	1
Bar Bender .. .. .	1
Bar Cutter .. .. .	1
Electric Welders .. .. .	3
Forges .. .. .	3
Pipe slotting machine oxy-acetylene .. .. .	1
Vibrating table .. .. .	1
Water Meter Testing Plant .. .. .	1
Concrete block making machine .. .. .	2
Compressor air (Tecalemit) .. .. .	1
Milling machine .. .. .	1
Grinding machine .. .. .	2
Hack-saw Electrical .. .. .	1
Concrete testing machine .. .. .	1
Slotting Machine .. .. .	1
Electrowelding machine .. .. .	1
Steel cutting machine (high speed) .. .. .	1



APPENDIX 19.

LIST OF IMPORTANT LETTERS AND REPORTS, 1962.

No.	Date	Title
1	7 December 1960	Some Notes on the Conservation of Underground Water in Cyprus.
2	August 1961	The Impoundment of the River Waters of Cyprus.
3	March 1962	Outline of our water - its development and use.
4	May 1962	Report of the Functional Committee on Water Resources.
5	16 June 1962	Traditions, water laws and water development.
6	16 June 1962	Draft for revised schemes of service.
7	29 June 1962	Desalting plants for Mesaoria.
8	8 June 1962	"Cyprus Water Development Programme", prepared by Tudor Engineering Co. (Mr. H. E. Hedger) for the U.S. A.I.D. Mission.
9	2 July 1962	Report on financial matters of the Water Development Department.
10	28 July 1962	Desalting plant for Famagusta.
11	5 August 1962	Report on the Irrigation Section of the Water Development Department in connection with the U.S. A.I.D. offer.
12	7 August 1962	Instructions for Project Reports.
13	11 August 1962	1963 Development Estimates.
14	27 September 1962	Consulting Engineers for 1963 projects.
15	1 October 1962	Maintenance of Dams.
16	9 October 1962	Comments on proposals of the British Trade Mission.
17	14 October 1962	Some notes on the development of Cyprus water resources.
18	26 October 1962	Masterplans for S.W. watersheds.
19	31 October 1962	Notes on the purchase and use of machinery.
20	November 1962	Some notes on the development of Cyprus water resources.
21	November 1962	Some notes on groundwater development in Cyprus.
22	November 1962	A short description of some water development works undertaken by the Water Development Department.

No.	Date	Title
23	10 November 1962	Consulting Engineers for 1963 Projects.
24	14 November 1962	Consulting Engineers for 1963 Projects.
25	4 December 1962	Consulting Engineers for 1963 Projects.
26	11 December 1962	Consulting Engineers for 1963 Projects.
27	December 1962	Preparation of an avant-projet for the full development of the Argaka-Magounda Watershed in Paphos District.
28	-	Summary of data concerning the dams to be constructed in 1963.