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DEPARTMENT OF WATER DEVELOPMENT

ANNUAL REPORT FOR 1957

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CONTENTS

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The engineering and geological side of all Government water development work is 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 Village Irrigation Divisions and Associations and Domestic Water Commissions is supervised by the District Commissioners. Disputes over water rights are handled chiefly by the Commissioners in consultation with the Law Officers, the Departments of Land Registration and of Water Development. Soil conservation and the agricultural problems involved in the economic use of water are responsibilities of the Department of Agriculture.

2. In 1957 the Department of Water Development carried out more works than in any previous year and its annual expenditure for the first time exceeded £1,000.000. The chief works under construction were the £950,000 Greater Nicosia Water Supply Scheme, the 105 foot high irrigation dam at Trimiklini, and the 65 foot high irrigation dam at Pyrgos. A start was made on the lining of 18 miles of irrigation channels at Kythrea. The usual quota of small irrigation and village water supply schemes was carried out, each one of minor importance in itself but contributing to an aggregate of great significance to the economy of the island. The pumping output of the new boreholes drilled in 1957 was a water production record for Cyprus. Consultants prepared plans and ordered pipes for the Morphou Bay Scheme which will eventually add 4 million gallons per day to the Nicosia water supply by pumping through a 24-mile rising main. Investigations and surveys were carried out for a number of major irrigation reservoirs.

3. The rainfall in 1956/57 averaged only 15.5 inches over the whole island or 80% of normal. It was mostly of very low intensity except for one heavy fall in June which produced high floods on the Pedias and Yialias rivers. Lesser floods occurred in the

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Skylloura area in September. No special demands were made upon the department for either drought relief works or for flood damage repairs.

4. The activities of the department are divided into six technical services dealing respectively with:-

(a) Irrigation and Drainage
(b) Town Water Supplies
(c) Geology and Drilling
(d) Hydrology
(e) Village Domestic Water Supplies
(f) Workshops.

There is continuous liaison between these services so that their work is co-ordinated in the best interests of the over-all water supply problems of the island. 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 utilised for irrigation; where gravity water supplies are not available, geological investigations may locate underground sources from which water can be pumped for irrigation or domestic use.

IRRIGATION AND DRAINAGE

5. As in previous years, the policy of the department was to undertake many small schemes rather than a few large ones but as time passes the number of simple irrigation schemes awaiting execution is getting fewer and the cost and technical difficulty of irrigating each additional donum of land is increasing. There is thus a tendency towards larger schemes.

6. The total number of irrigation and drainage schemes completed during the year was 45 providing sufficient water to irrigate 5200 donums, of which 680 donums can be irrigated perennially. Five more schemes were in progress at the end of the year and a further 77 have been planned in detail and are ready to be carried out as opportunity occurs. These figures are

not inclusive of many small works carried out by landowners following the drilling of boreholes by Government or by private contractors.

7. The rate of progress in irrigation in the period of development since the 1946 census is shown in the following table:-

	Gravity Irrigation		Mechanical irrigation (i.e. Pumped)	Total
	Perennail Donums	Seasonal Donums	Donums	Donums
1946 Census	59,409 say 59,500	284,977 say 285,000	53,131 say 53,000	397,517 say 397,000
Estimated at end of 1956	88,500	354,000	123,000	565,500
New Irrigation in 1957 (say)	500	4,500	15,500@	20,500
Estimated total at end of 1957	89,000	358,500	138,500*	586,000
Percentage increase since 1946 census and commencement of Ten-Year Programme of Development.	50%	26%	161%	47%

@ Includes 1,000 donums resulting from private drilling.
* Includes 3,500 donums resulting from private drilling.

8. The total area of arable land in Cyprus amounts to about 3,900,000 donums of which 80% to 85% is cultivated; 15% is now irrigated in an average winter and 5.8% in an average summer. It is estimated that irrigation works carried out under the irrigation development programme are causing the value of agricultural production in Cyprus to increase by about £750,000 each year.

9. The irrigation and drainage works carried out by the department may be classified in the following groups:-

(a) Schemes developing small springs by excavation at their source, by lining channels in reinforced concrete to prevent loss of water, and by constructing masonry tanks for night storage.

(b) Schemes involving the diversion of seasonal or perennial flow from rivers and water sources by means of weirs and channels.

(c) Irrigation from infiltration galleries constructed in slow yielding aquifers, in fissured rock, or in river gravels either by gravity or by pumping.

(d) Water conservation in reservoirs for periods of a few days to several months.

(e) Installation of pumping plant on wells and boreholes and the construction of distribution channels.

(f) Gravity drainage of small marshes.

(g) Flood protection and river training.

10. The lining of irrigation channels in concrete has continued during the year and this type of work is now widely recognised among Cypriot cultivators as a very effective means of increasing the volume of water reaching the fields. By the elimination of seepage losses between source and field additional water becomes available for extending the area under cultivation. In addition less labour is required for cleaning and maintaning channels. During the year 14 miles of channels were lined in reinforced concrete. These works were carried out chiefly in the village areas of Meniko, Ayios Therapon, Mesoyi, Aredhiou, Ayia Varvara-Kochati, Kaliana and Kato Pyrgos (Tylliria). A large scheme for lining about 18 miles of channels at Kythrea at an estimated cost of £80,000 was started towards the end of the year.

11. The usual quota of small schemes involving the excavation and building of springs, and the conveyance of water in pipes or channels to small irrigation tanks has been completed in the hill areas. Among the villages that have received this type of small but popular scheme are Agridhia, Melini, Aplanda and Lymbia.

12. Two concrete dams were under construction during the year, at Trimiklini and Pyrgos respectively. The former is described in detail in Appendix 6. It is 105 feet high and will serve to irrigate 800 donums at a total cost of about £56,000. Construction was almost completed at the end of the year. The Pyrgos dam is 65 feet high and will irrigate 600 donums at a cost of £50,000. It was about one third complete at the end of the year. Both schemes include concrete distribution channels and pipes.

13. At Petra two small existing reservoirs were enlarged by excavation to increase their capacity by 3 million gallons to about 15 million gallons.

14. The cost of dams built in Cyprus is usually high in relation to storage capacity because of unfavourable topography, the valleys being for the most part too steep and narrow to hold much water without a disproportionately high dam. Because of the high value of water for spring and summer irrigation from April to July, however, there are many places where the construction of dams up to about 100 feet high such as those at Trimiklini and Pyrgos mentioned above will be economically sound. Plans for a number of these have been or are being prepared as described in paragraphs 19 and 20 below.

15. A number of works was carried out with funds provided by other departments. These included pumping installations at Morphou experimental farm, irrigation pipes at Athalassa farm, 4 large anti-erosion weirs at Syngrassi and a mile of main drainage channels at Voroklini.

16. The Famagusta recharge scheme, described in

Annual Report for 1956, was completed and was ready for full operation at the end of the year. This scheme provides for the artificial re-charge of the Famagusta aquifers with water from Kouklia Reservoir, Paralimni Lake, and drainage from intervening catchments. The works, which include 6 miles of tunnels and the Ay. Lucas reservoir of 30 million gallons capacity, were completed at a cost of £45,000. The need for this scheme arose because overpumping in the Famagusta coastal area caused the ground water surface to fall below sea-level with the result that sea water penetrated inland causing many wells to become saline or brackish. It is hoped that fresh water fed into the new re-charge tunnels will cause the ground-water level to rise and impede the advance of sea water.

17. The following works that are representative of the 1957 programme are described in Appendix 6:- Petra (excavation of reservoirs), Morphou (Lekanes) chain-of-wells, Mesoyi (improvement of spring), Kaliana (concrete channels), Trimiklini (dam and channels).

18. Schemes ready for construction but not yet started include Argaka-Magounda dam and channels (£35,000), Ayia Marina Dam (£33,000), Syrianokhori irrigation channels (£26,000), Kato Lakatamia irrigation channels (£26,000), Pano Zodhia and Angolemi channels (£17,000) Polis irrigation channels (£14,000), Phinikas infiltration works and irrigation channels (£13,000), Kyra pumped irrigation scheme (£10,000) and Elea pumped irrigation scheme (£8,000).

19. Detailed investigations have been undertaken on a number of relatively large water conservation schemes during the year. These include the following:-

(a) Sklidros Dam, near Apliki. This is a concrete gravity dam about 90 feet high impounding 150 million gallons, and estimated to cost about £100,000. Provision is to be made for future heightening by means of prestressed cables anchored into the bed-rock.

(b) Marathasa Dam, near Lefka. Plans have been made for a concrete gravity dam, 85 feet high impounding 80 million gallons. The cost, including 1½ miles of channels is estimated at about £95,000.

(c) Korivas Dam, near Meniko. Here an earth dam 35 feet high is to impound 260 million gallons of water diverted from the adjacent Akaki river through two tunnels 1,000 feet and 2,200 feet long respectively. The water is to be returned to irrigation channels in the Akaki valley by means of another tunnel about 1 mile long. The estimated cost is about £90,000.

(d) Spithdhia-tous-Papadhes Dam, near Klirou. A gravity dam 120 feet high is to impound 375 million gallons in the Akaki river bed. The site of this dam is upstream of the intake for (c) above and the two reservoirs will form part of one major scheme. The estimated cost of this part of the scheme is about £210,000.

20. Preliminary investigations have been made for other dams at a number of sites including Ayios Theodoros (Soleas), Skylloura, Ay. Georghios (Akhyritou), and Ay. Nikolaos (Soleas).

21. Arrangements were completed with the Colonial Geological Service for a seismic geophysical survey to determine the depth of river gravels in many of the "dry" river beds, in particular in those which drain into the sea along the south coast of the island. The depth of the gravels as determined by such a survey will provide useful information concerning the quantity of water held in the gravels and the most favourable sites and the best means for extracting the water. The survey party will arrive early in January, 1958.

22. A proposal for a Water Use Research Centre again received study by the Land Use Co-operative Committee

and an expert from Israel visited Cyprus in December. This research station, if established, would be a centre for studying irrigation methods and practices in Cyprus and for advising irrigators about the efficient and economical use of water. It is estimated that if better methods and practices in the use of irrigation water could be made to increase perennial irrigated production by 15% the value of the products of irrigated land would be increased by between £1,000,000 and £2,000,000 annually.

TOWN WATER SUPPLIES

23. Under present conditions the principal suppliers of water in Nicosia, Limassol and Famagusta are the respective Water Boards. The members are nominated half by Government and half by the Municipality and the Chairman is appointed from among these six by the Governor. In Larnaca the water authority is the Evcaf Department while in both Paphos and Kyrenia it is the Municipality. The Department of Water Development advises all the above authorities on the technical aspects of their water supplies.

24. In 1957 the Town Water Supply section of the Department was occupied chiefly with the construction of the £950,000 Greater Nicosia Scheme, which is now nearing completion. It was also engaged in planning extensions to the water supplies of Nicosia, Famagusta and Limassol and with miscellaneous minor construction work. All these are described in Appendix 10.

25. The Greater Nicosia Scheme is being executed as a Government project, independently of the Nicosia Water Board but it is designed for eventual integration with the Water Board's works. It brings additional water to Nicosia for both the Water Board and the suburban villages and provides house-to-house distribution pipes in the streets of the outer villages where previously there was no piped water. The scheme adds about 1.5 million gallons per day to the water supply of Nicosia including half a million gallons from privately owned sources. In the summer of 1957 the

new works were sufficiently advanced to provide water in bulk to the Nicosia Water Board and thus to relieve the acute shortage of water experienced in 1956. By the end of the year two of the three main reservoirs were virtually complete and street distribution pipes were being laid in the suburban areas.

26. In Nicosia, in the area outside the walls served by the Water Board, the consumption of water in the summer months was between 40 and 45 gallons per person per day. Within the walls, where as yet there is no pressure supply the use of water was restricted as usual and was turned on for only 6 hours per day during the summer months. The overall consumption inside and outside the walls, excluding the suburban villages in which there was very little piped water, was between 33 and 38 gallons per head per day during the summer.

27. In Famagusta it was necessary to turn-off the water from 11 P.M. to 5 A.M. during the summer months and because of lack of water the consumption per head fell from 37 gallons per day in June to 33 in September. An emergency scheme undertaken late in the year will provide a small additional quantity of water in 1958. Considerable anxiety is felt as to the ability of the chief sources at Phrenaros to maintain this year's output in future and no appreciable relief is expected pending the execution of the new scheme to bring water from Xylophagou. (See paragraph 34).

28. At Limassol no prolonged restrictions were necessary owing to the success of the re-charging operations at the Chiftlikoudhia wells. During winter surplus water from the springs was poured into the old wells that were formerly saline. These wells were pumped in summer when the springs were low and at that season supplied half of the water consumed by the town. The consumption in the summer months varied between 34 and 38 gallons per person per day.

29. In Larnaca the water was cut off for 6 hours per day during the summer although the consumption was at

the relatively high level of from 37 to 41 gallons per person per day. The chief cause of the restrictions was not shortage of water in this case but rather faults in the old-style distribution system and the lack of a service reservoir.

30. Further details of water consumption and water supplies in the four chief towns are given in Appendices 11 and 12.

31. The need for more domestic water in the towns has become very evident and is caused by a number of contributary factors. The increase in population is not less than 3% per annum. The quantity of water required is more than indicated by the numerical rise in population because there is also a growing per capita consumption caused by better standards of living and, in particular, by the increasing use of water-borne sanitation. Furthermore, many of the wells in urban areas that formerly gave, in the aggregate, large quantities of water are now partly drying up or becoming subject to contamination as a greater area becomes built up. It is now necessary to assume that all town domestic water must come from the piped town supply.

32. A satisfactory summer supply under present conditions would probably require 35 to 45 gallons per person per day in the chief towns. Rising standards indicate that a prudent figure to use for the design of future works should be not less than 50 gallons per person per day. If the population increases at 3% per annum and if it takes 5 years to plan and complete a new water supply scheme it follows that plans should be prepared for a population at least 15% more than existing.

33. The present Greater Nicosia Scheme, upon completion in 1958, will temporarily relieve the water supply position in the suburban areas of Nicosia and in the area outside the walls now served by the Water Board, but it will not provide for future expansion nor will it give pressure water to the old town within

the walls. A scheme to pump an additional four million gallons per day from beyond Morphou has been prepared and pipes and machinery for the first stage which provides for two million gallons per day have been ordered. Plans for the main pumping station and pipe lines have been made by the Westminster consulting engineers, Messrs. Howard Humphreys and Sons. The first stage of the scheme is estimated to cost £850,000 and the second and final stage £550,000. A pressure pipe system for the walled town will cost a further £125,000. The total cost of these anticipated improvements will thus be about £1,525,000.

34. The water supply at Famagusta is in a dangerous state. The water level in the Phrenaros boreholes, from which practically all the water is drawn, is declining from year to year with very little recovery after the winter rains and it is unlikely that the present output will be maintained for many more years. A scheme has been prepared for supplying an additional one million gallons per day in the first instance, from near Xylophagou, through a main pipe line designed for a future flow of 2.2 m.g.d. The sources are ten boreholes that have been tested at various rates from 9,000 to 16,000 gallons per hour per borehole. The proposed main pipe line is of asbestos cement, 15" diameter and 10 miles long. A one million gallons covered service reservoir that can be enlarged in future is included in the scheme, and from this reservoir separate pipes will deliver the water to the existing Stavros reservoir, to the northern part of the town, and to the military camps at Karaolis and Ay. Nicolaos. No street distribution pipes are included. The scheme is estimated to cost about £350,000.

35. As Limassol grows more difficulties are to be expected each summer in finding sufficient water. As a short term measure it will no doubt be possible to make greater use of the re-charged ground water area at Chiftlikoudhia but new sources outside the town will be needed before many years. Preliminary plans were prepared in 1957 for pumping water from boreholes in the Kolossi-Phassouri area into the existing steel main from Khalassa,

which now runs at less than half capacity in summer when the springs are low. It is planned to pump 0.80 million gallons per day into the Khalassa pipe line which, with the water from the springs, will then be enabled to discharge 1.40 million gallons per day at the Limassol reservoir throughout the summer. The cost of these proposed works will be about £45,000. In addition a new service reservoir of about one million gallons capacity costing about £40,000 will be needed before many years, and improvements will be advisable at Chiftlikoudhia pumping station. The total cost of all the above works is likely to be of the order of £110,000.

36. Investigations and studies have been continuing for improvements and extensions to the water supplies of all the other chief towns of the island and proposals await the provision of funds. At Larnaca proposed works include the duplication of the existing 15" main from the tunnels to the town, the construction of an 800,000 gallon service reservoir, the division of the distribution system into 6 independent areas, and the introduction of meters to replace the existing saccoraphi system of distribution. For Paphos detailed plans have been prepared for a 24 mile pipe line from the Trozena springs, Yerovasa, together with a 300,000 gallon service reservoir and extensions and improvements to the distribution system. For Morphou a new scheme includes new boreholes from which the water will be drawn, a 300,000 gallon service reservoir, and a new distribution system. Kyrenia needs additional water. Efforts spread over many years to find sufficient from boreholes have met with only partial success and there now appears to be no alternative but to pipe the water from the Karavas and Lapithos springs. A scheme has accordingly been drawn up to include supply pipe lines from the springs, a 200,000 gallon service reservoir and improvements to the distribution system.

37. The present system of administering the water supplies of the chief towns by means of independent water boards has given rise to some anxiety both on the financial and technical sides. Considerable sums of

money have been lent to the water boards by Government for capital works but it is doubtful if in every case the management has the necessary experience or receives the necessary guidance to administer the works under its control with reasonable efficiency and economy. These matters have received attention by Government during the year and among other things consideration is being given to expanding the area under the control of the Nicosia Water Board so that the whole of the town and its suburbs will be under one competent well-staffed authority instead of being divided between the Water Board, the Water Commission and several smaller Improvement Boards.

VILLAGE DOMESTIC WATER SUPPLIES.

38. The work of the Village Domestic Water Section is confined mostly to water supplies for villages and rural municipalities but it also includes the towns of Paphos, Kyrenia and Morphou which are mentioned above in paragraph 36. Sources of water are examined, measured, and where suitable, developed. Supply and distribution pipe lines are laid and storage tanks and public "fountains" constructed. A "fountain" is a combined public standpipe, trough and drainage soak pit. House connections are not normally made but there is a growing demand for this convenience. The sources of a village water supply may be springs, infiltration galleries, boreholes or wells.

39. During the year 51 village water supply works were completed and 94 miles of pipes were laid. Ten of these schemes are entirely new, 35 are improvements to existing supplies that were formerly unsatisfactory or inadequate, and the remaining 6 are for schools or police stations. It is now estimated that of the total of 627 villages named in the census of 1946, the number with piped supplies is 511 or 81%. 429 (68%) may be considered satisfactory and 82 (13%) need fundamental repairs or replacements. The 116 villages still without piped supplies are on the whole situated far from reliable sources, and the cost and difficulty of

supplying them with piped water will, in most cases, be greater than in past schemes.

40. In addition to the 51 schemes completed in 1957 a further 14 schemes were under construction but incomplete at the end of the year. Plans have been prepared for a further 237 schemes and, although many of them need modification in view of changing circumstances, most are ready for starting as soon as money becomes available. The following table indicates the work done on village water supplies during the year under review:-

VILLAGE WATER SUPPLIES
MILES OF PIPE LAID IN 1957.

Size	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	6"	Total
Miles	4.9	10.6	12.2	6.3	17.6	13.5	11.2	5.6	1.8	93.5

Elevated tanks: 5. Ground Level Tanks: 30. Pump houses: 6
Fountains: 260. Distribution Boxes: 30.

41. The schemes completed may be classified as shown below. "Village standard" means that the distribution of the water is effected by street fountains only, not by house connections.

(a)	New schemes to village standard where previously there was no piped water	10
(b)	Total replacement of an obsolete scheme	6
(c)	Improvements to village standard only	24
(d)	Improvements including house connections	5
(e)	Water supplies to schools and police stations	6
		51

Of the above 51 schemes, 35 obtain their water from springs 3 from infiltration galleries by gravity, and 13 from wells or boreholes by pumping.

42. The supply of domestic water to the thirteen dry villages of the Eastern Mesaoria by a combined scheme from Kythrea spring was commenced in 1956 and completed in 1957. Where previously the only available supply in summer was perhaps a share of 2 or 3 gallons of brackish water per head, drawn from unhygienic shallow wells, the villages now enjoy a daily supply of 150,000 gallons or about 17 gallons per head, of first-rate water. In compensation for the water acquired from the spring for the dry villages, the Kythrea irrigators have now accepted Government's offer to line in reinforced concrete 18 miles of irrigation channels at an estimated cost of £80,000.

43. The following village water supply schemes, typical of the year's work, are described in appendix 13:- Yialousa, Sellain t'Api - Ayios Theodoros - Mosphilleri - Mansoura, and Peristerona (Paphos).

DRILLING FOR WATER.

44. The activities of the Drilling Section in finding and developing new sources of underground water may be assessed by the fact that during the period 1946-1957 a total of 2,434 new boreholes has been sunk with an aggregate of 454,663 feet of drilling. Two-thirds of these boreholes were successful and the tested total quantity of water pumped therefrom was 10.4 million gallons per hour. It is estimated that, as a result of the drillings, the total additional volume of water now available for irrigation, domestic, and industrial purposes is of the order of 120 million gallons per day. The agricultural development which has taken place as a result of the perennial irrigation from borehole pumping is clearly visible in many areas throughout the island, such as in the Western Mesaoria, the Akrotiri Peninsula and around Xylophagou and Liopetri. Where previously the summer landscape was bare and arid, citrus groves and vegetable gardens are being extended year by year and the agricultural economy of these districts greatly enhanced.

45. Water for the towns of Nicosia and Famagusta and for most of the villages of the plains is derived

from boreholes located and sunk by the Department of Water Development. Schemes for additional supplies for these towns and for other villages from new boreholes sources are under construction and in the course of preparation.

46. Many of the boreholes have been sunk for private persons for irrigation under a Government subsidized drilling scheme. Other boreholes have been sunk on a full-cost basis for private individuals, public bodies and commercial companies for irrigation, domestic supply and industrial purposes. Boreholes have also been sunk for military camps and installations and each year Government has drilled at its own cost a considerable number of prospecting boreholes to test the potential resources of new areas. Applications for drilling continue to pour in, and at the end of 1957 there was a waiting list of 180.

47. Fifteen drilling rigs were employed in the field during the greater part of the year. All these are of the percussion drilling type and with one exception have a normal capacity range of 8" to 10" diameter holes to a depth of about 500 feet. One other rig, a Ruston-Bucyrus 60 R.L., is a heavier type, capable of drilling to over 1000 feet or shallower large-diameter boreholes. One machine has a rotary attachment which enables core samples to be taken. In 1957 the average drilling depth of boreholes sunk for water was 196 feet and the greatest depth 550 feet.

48. The number of boreholes sunk by the department during the year was 293. Of these, 176 were for irrigation, 14 for domestic water, 40 for prospecting for water and 3 for industrial supplies. In addition 10 observation boreholes were drilled and a further 50 for technical and engineering purposes. Of the 233 boreholes for water, 75.5% produced more than 1000 gallons per hour on test and are classified as successful. The tested outputs show that, if pumped together, these boreholes are capable of a total output rate of 1,713,000 gallons per hour. This is a new high borehole water production record for Cyprus.

49. In addition to the above Government work, a considerable amount of drilling for water was carried out by registered contractors. Fourteen privately owned percussion drilling rigs, most of them of a light, locally built, type operated during 1957. They are suitable only for drilling boreholes in favourable rock strata. Private drillers have sunk 148 new boreholes for water during 1957, of an average depth of 140 feet and a total estimated (but not tested) output rate of 340,000 gallons per hour.

50. The widespread and intensive drilling operations which have been carried out in recent years have undoubtedly discovered and demarcated most of the island's aquifers so that it is unlikely that any extensive new areas of underground water remain untapped. During 1957 Government prospecting drilling was mainly devoted to finding domestic water for rural communities and although no extensive new ground-water areas were located the results were on the whole most satisfactory.

HYDROLOGY.

51. The hydrological service continued and increased its work of collecting and recording information on the following subjects:-

(a) Changes in ground water levels
(b) Quantity of water pumped from wells and boreholes
(c) Annual re-charge of aquifers
(d) Flood run-off in rivers
(e) Summer discharges of streams
(f) Discharges of springs
(g) Run-off from different types of catchments
(h) Chemical and bacteriological analyses of water.

Special intensive studies are being made of groundwater conditions in the Phrenaros and Kokkini Trimithia areas, which are respectively of special importance to the Famagusta and Nicosia town water supplies. A third study of this type was started at Morphou Bay towards the

end of the year. Hydrological information is summarised regularly by the Engineer-Hydrologist in monthly and annual reports.

52. Among the results obtained from research on the above subjects one of the most useful is the information concerning the effect of the recent expansion of borehole pumping upon the underground water resources of the island. The increased agricultural production resulting from irrigation with pumped groundwater is of great economic value to the island and it is very important that the present pumping output should not only be maintained but that it should be increased from year to year where possible. The reservoirs of underground water, however, are not unlimited and so in developing irrigation from wells and boreholes, one must take care not to exhaust the aquifers by drawing off more water than can be replaced naturally from the rainfall or in some cases artificially by re-charge works.

53. In order to study the effect of the recent developments it is necessary to keep a careful watch upon changes of ground water level in pumped areas. For this purpose a total of 55 special observation or control boreholes has been drilled at key points, and within the special study areas some 2,000 privately owned wells and boreholes are observed at regular intervals. The chemical quality of the water is also checked periodically so that any increase in salinity can be detected at an early stage. The information obtained from these observation boreholes is showing beyond doubt that in certain areas such as Phrenaros, Famagusta, Kokkini Trimithia, Laxia and elsewhere new drilling must be rigidly controlled if existing public and private interests are to be protected and if further groundwater development is to proceed on sound lines.

54. A summary of the water levels over the past six years is given in Appendix 5. This shows, among other things, that the minimum ground water level at Kokkini Trimithia, which is still the chief source of

the Nicosia town water supply, fell by nearly 12 feet in the past six years. At Phrenaros West, one of the two chief sources for Famagusta, it fell by an average of nearly 16 feet in six years and at Phrenaros North, the other source for Famagusta, by 2.1 feet in one year. It is not possible at present to assess the real significance of this rapid decline in water level because the time that has elapsed since regular pumping began is insufficient; it is clear, however, that these places as well as others, should be watched most carefully in future.

55. Elsewhere in the island the year's records show reasonably satisfactory results. The aquifers with an underground water surface nearer to sea level showed no drastic changes during 1956-57 although the usual slow decline was not halted. In a year of sub-normal rainfall, however, this behaviour was only to be expected. In the Morphou Bay coastal area the fall in water level was 0.5' compared with 0.7' last year and in the Ayios Memnon area near Famagusta the fall of 0.7' was about the same as last year. The Xylophagou area, with, up to now, a very steady underground water level, recorded a decline of 0.9' in 1956-57.

56. 1956-57 was a bad year for the artificial recharge of aquifers owing to the low rainfall intensities everywhere and consequent lack of surplus spate waters. Little or no water was available, either from Kouklia reservoir or from Paralimni Lake, to feed into the recharge tunnel which extends along the top of the underground water table from Ayios Loucas to Ayios Memnon in the Famagusta area. The Chiftlikoudhia recharge scheme at Limassol, however, was of great value this summer when the springs supplying Limassol town decreased their flow to record low yields. Between July 12th and September 30th, 46 million gallons in all were pumped out of the wells into the town mains. This came after a winter and spring recharge of 130 million gallons, obtained from the three Limassol springs when these were discharging more water than was required.

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During August and September 1957, 51% of the town's requirements were met from the Chiftlikoudhia chain-of-wells and the consequent increase in salinity of the extracted water was only from 88 p.p.m. of NaCl to 175 p.p.m. The normal limit for potable supplies is considered to be 400 p.p.m.

57. The below-average rainfall coupled with low rainfall intensities during wet periods meant that the winter was flood-free. In the early summer a freak storm on June 12th over the eastern end of the Troodos mountains caused flood discharges of up to 8,000 and 15,000 cubic feet per second in the upper reaches of the Pedieos and the Yialias rivers respectively. Some damage was done although these high peaks were of very short duration. In neither river did the flood waters reach as far eastwards as Kouklia reservoir, 10 miles from the sea at Famagusta Bay.

58. Stream discharges during 1956-57 were generally low in sympathy with the rainfall. Run-off factors in the lower courses of the Mesaoria rivers were exceptionally low, frequently less than 1%. Mountain streams west of Troodos were also greatly affected. In the Pyrgos and Limnitis catchments, where the rainfall was about 70% of average, run-off factors were down to 15% as against more than 20% for an average year. At the eastern end of the Troodos mountains, which was the only part of Cyprus to receive more-than-average rainfall during 1956-57, a high run-off was recorded in the upper Peristerona river at Panayia Bridge where nearly 600 million cubic feet of water passed over the measuring weir during the year. Run-off records from all discharge sites are tabulated in Appendix 4.

59. The measurement of spring discharges was continued at regular intervals both in connection with hydrological investigations and for proposed village water supplies. In all 1612 gaugings were made during the year.

60. Totals of 1470 samples of water for chemical analysis and 494 samples for bacteriological analysis were collected during 1956-57 and submitted to the Government

analyst and the Government pathologist respectively for analyses. The samples were mainly taken from domestic water supplies all over the island during periodic checks and from control boreholes to test ground-water quality. Samples were also taken from all new boreholes during pumping tests and from various springs, streams and rivers used, or intended to be used, for irrigation purposes.

61. Notes on the work of the Hydrological Section for the year 1956/57 together with summarised information are given in Appendices 4 and 5.

WORKSHOPS

62. Changing labour conditions, rising costs, and the increased use of pumping both for irrigation and domestic water have made it necessary for the department to operate and maintain additional mechanical plant, and the workshops have accordingly been enlarged so as to be capable of attending to their increased responsibilities.

63. The workshop section of the department attends to the maintenance of all departmental plant and in addition serves all the other sections of the department in respect of such matters as the building of forms for concrete work, carpentry, the supply of precast concrete products, the installation of pumping plant, the fabrication of special pipe connections and steel sluice gates, the cutting and bending of steel reinforcement, the slotting and perforation of pipes and drilling casing, etc. etc.

64. The workshops and store accommodation of the department include workshop office, garage, fitters shop, plant maintenance bay, precast concrete yard, welders shop, smithy, a small moulding shop, a water-meter testing room and three store buildings. In addition there are two open storage sites one of 1½ donums, used mostly for interchangeable timber formwork, and one of 12 donums for pipes.

/22.

65. A list of the chief items of plant now on charge is given in Appendix 18. Other plant is hired from contractors or borrowed from other departments as required. Heavy lorry transport is all hired from contractors but some light departmental "Countryman" vans and some Rovers are used for the transport of personnel, light tools, etc.

MISCELLANEOUS ACTIVITIES

66. Technical advice is frequently given to public bodies including the military and to private individuals on their water supply problems. The department is often asked to provide expert opinion on water disputes. Flood discharge estimates are sometimes required by public authorities. A total of 27 prolonged pump tests of wells and boreholes was made during the year for Government, the Military, public bodies and private individuals. Three small Government water supplies in Nicosia are run by the Department. The security of water supplies throughout the island has this year caused the department a certain amount of extra work. Miscellaneous activities such as the above, and the necessity for the department to be represented at numerous committee meetings on a wide range of subjects, absorb a very large proportion of the time of the technical staff.

LEGISLATION

67. No new laws concerned directly with water development were enacted in 1957 and there were no noteworthy amendments to existing laws. Considerable attention has been given to proposed amendments of the Water Supply (Municipal and Other Areas) Law and to a proposed new Land Drainage and Reclamation Law. An order has issued under the Wells Law.

68. The proposed amendments to the Water Supply (Municipal and Other Areas) Law have two chief objects in view. They are (a) to improve the efficiency of the Water Boards and (b) to bring all of Nicosia including the suburban area under one water supply authority.

At the end of the year a draft bill was in the course of preparation.

69. The original bill for a Land Drainage Law was amended to provide for land reclamation at the request of the Director of Agriculture. The objects of the proposed law, as regards drainage, are to facilitate the maintenance and improvement of rivers and streams, the execution of river training works and the prevention of pollution. To aid the reclamation of land, new sections are now added concerning secondary land drainage for agricultural improvement, land levelling, soil treatment, etc. The new bill is under consideration.

70. A new order was made under the Wells Law controlling well sinking in a new water-bearing area in the Karpass Peninsula from which Yialousa now draws its domestic water. This area may be used to supply other villages in the central Karpass, if the water proves sufficient. A notice is being prepared regarding the Western Mesaoria between the two controlled areas of Kokkini Trimithia and Syrianokhori. It is proposed to join these into one unit which will then extend from Kokkini Trimithia to the sea at Morphou Bay.

FINANCE

71. The following is a summarised statement of the expenditure of the Department of Water Development in 1957:-

	Government Funds	Contribution from Beneficiaries	Total
1. Irrigation & Drainage	£133,500	£46,100	£179,600
2. Village Water Supplies	119,600	86,000	205,600
3. Subsidized Drilling	6,500	3,600	10,100
4. Prospecting for water	20,900	-	20,900
5. Drilling upon repayment	-	43,500	43,500
6. Greater Nicosia water supply scheme	412,300	-	412,300
7. Town water supplies upon repayment	-	5,300	5,300
8. Hydrological Research	13,000	-	13,000
9. Purchase of Plant	16,700	-	16,700
10. Miscellaneous works upon repayment	-	22,000	22,000
11. Departmental & Maintenance	135,000	-	135,000
	£857,500	£206,500	£1,064,000

72. Included in the above statement are:-

1.	Personal Emoluments	£ 62,330
2.	Wages for Labour (Approx.) ...	317,820
3.	Travelling	18,460
4.	Govt. controlled irrigation works	9,680
5.	Pump testing wells and boreholes ...	5,530
6.	Drilling, casing, and testing boreholes at Morphou Bay for Nicosia Water Supply	1,200
7.	Value of casing pipes fixed in boreholes	14,920
8.	Purchase of drilling tools ...	8,500
9.	Total cost of drilling and cleaning boreholes excluding items 5, 7 and 8	45,600
10.	Maintenance of Government water supplies and purchase of water ...	8,540
11.	Fire hydrants at Nicosia, Limassol and Famagusta	5,000
12.	Extensions to office and workshops	1,900
13.	Expenditure under 1956/61 Development Programme	722,500

73. The average cost of a new borehole in 1957 was

/25.

£175, and the cost per foot of drilling £1. Orders for pipes and other materials for the Morphou Bay Scheme were placed to the value of about £444,000. A sum of £2,500 was collected as departmental charges for works carried out for water boards upon repayment and for other miscellaneous works.

74. Water development works are usually assisted by Government grants or loans, or by both grants and loans. Towards the cost of gravity irrigation works the village contribution varies from 20% to 60% according to the type of work and the nature of the ownership of the water. Where the water is owned collectively as by the members of an Irrigation Division, the usual rate is 20% for spate irrigation and 33.3% for perennial irrigation. 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 48%. The village share of the cost of a scheme is usually raised by a loan from the Government Loan Commissioners at a low rate of interest. Occasionally it is paid partly or wholly in cash or in free labour. A borehole under the subsidised drilling scheme is carried out for a private person at a fixed price to him of £32.500 mils for the first borehole, and the balance of the cost which, in 1956 has on the average amounted to about £140, is paid by Government. Private individuals requiring a second or third borehole are charged the actual cost in full including departmental charges. Municipal Corporations, companies, etc., also usually pay the full cost and departmental charges. The recently completed town water supply schemes were paid for in full by the respective water boards, which raised the money by special loans from Government and the new Greater Nicosia scheme is, for the time being, financed wholly by Government. Village domestic water schemes 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.

STAFF AND LABOUR

75. The staff of the department was strengthened during the year by the appointment of three Executive Engineers and one Geologist. On 31st December the position was as follows:-

Director	1
Assistant Director	1
Senior Engineers	2
Engineer Hydrologist	1
Executive Engineers	4
Geologist	1
Superintendents of Works	2
Senior Inspectors of Works	8
Inspectors of Works	10
Technical Assistants	28
Foremen	79
Accounts, Clerical and Miscellaneous	43
Total	180

The three new Executive Engineers are Messrs. L.C. Mock, T.E. Scales and H.S. Suphi and the Geologist is Mr. R.D. Morris. The contract of one Senior Engineer was terminated. At the end of the year vacancies existed for 1 Senior Engineer, 2 Executive Engineers, 1 Senior Geologist, 8 Inspectors of Works and 8 Technical Assistants. Six scholars are studying in the United Kingdom for university degrees under a Government Scholarship Scheme.

76. New office accommodation now houses the Irrigation, Hydrological and Town Water Supplies Sections and has considerably relieved overcrowding.

77. The average number of labourers employed during the year was 1453 of whom 30 were unpaid, their work being considered as a contribution to the

village share of irrigation works. These figures compare with 1274 and 23 in 1956. About 39% were classed as skilled labourers of Special Grade or Grades I, II and III, and 24% were regular employees. The approximate monthly averages were as shown below:-

Month	Paid Labour	Free Labour	Total
January	1,159	47	1,206
February	1,159	75	1,234
March	1,360	105	1,465
April	1,398	74	1,472
May	1,389	62	1,451
June	1,457	-	1,457
July	1,534	-	1,534
August	1,556	-	1,556
September	1,602	-	1,602
October	1,532	-	1,532
November	1,477	-	1,477
December	1,454	-	1,454
Average	1,423	30	1,453

78. There were no serious labour difficulties during the year. Cost of Living and Field Allowance increases caused wages to rise by about 12% between 1st January and 31st December.

79. The staff has once again worked with its usual energy and enthusiasm and, in spite of disturbed conditions in Cyprus has succeeded in making 1957 a year of record achievement. For this it deserves the greatest credit.

CONCLUDING NOTE

80. Requests for small irrigation works continue and are likely to persist for a number of years, but larger schemes with dams up to about 100 feet high are also in demand. As regards rural domestic water

/28.

it is becoming necessary to group together many of the remaining waterless villages for relatively large combined waterworks. Requests for new boreholes continue unabated but the time is at hand when many will have to be refused because a general fall in groundwater levels indicates that the safe limit of pumping has already been reached in many places and sometimes exceeded. In the towns, where the living standards are rising and the population is increasing, there is an urgent need for more major domestic water supply schemes which should be started at once if hardship is to be avoided.

I.L. WARD
DIRECTOR OF WATER DEVELOPMENT

March, 1958.

APPENDIX 1

DRILLING FOR WATER

BY D.P. McGREGOR, B.Sc., A.M.I.M.M.,
ASSISTANT DIRECTOR

For the most of 1957 the department's drilling plant operating in the field consisted of fifteen rigs. At the beginning of the year there were - one Ruston - Bucyrus 60 R.L., nine Ruston-Bucyrus 22-Ws, one Bucyrus-Erie 33-W, three Edecos and one old Toronto. Three of the Ruston rigs were on loan from the Army but operated and maintained by the department. During the early part of the year the Toronto was withdrawn from service and scrapped and one of the Edecos was brought into head-quarters as a standby. These machines were replaced by two new Ruston-Bucyrus 22-Ws. 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 tungsten-carbide 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-pumpings 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 g.p.h. capacity respectively, at 100 ft. head and two 25 K.V.A. mobile diesel-electric generating sets which are used in conjunction with $7\frac{1}{2}$" 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 ft. to 8,000 gallons from 400 ft. These test-pumping units were in great demand during the year. In all 27 long test pumpings, from 48 to 1481 hours' continuous duration, were carried out, involving a total pumping time of 7,200 hours and a total volume of 101 million

/30.

gallons of water. Experience has proved how essential are these exhaustive test pumpings for proving the reliability of the aquifers.

The number of boreholes sunk during 1957 was 293 with an aggregate footage of 51,420 and an average depth of 175 feet. These figures compare favourably with those of 1956 and reflect the less abnormal political conditions existing during the year. Two hundred and thirty three boreholes with a total footage of 45,575 were drilled for water. The average drilling depth for water was 196 ft. The average time taken to complete a borehole, including the time taken to lay casing and to carry out an 8-hour test-pumping of a successful borehole was 13.6 days. The average footage drilled per day was 13 feet. The total tested yield of boreholes drilled for water in 1957 was 41,112,000 gallons per day. In addition to new drillings 53 old boreholes were cleaned and renovated, involving 356 drilling days, equivalent to the average time taken to drill 26 new boreholes. One hundred and seventy-six boreholes were sunk for irrigation, of these 138 or 78.4% produced on test an aggregate of 34.75 million gallons per day, a quantity which is considered sufficient to irrigate 17,000 donums in summer.

The number of successful irrigation boreholes drilled by Government since 1946 is now 974 with a tested output of 178 million gallons per day, sufficient to irrigate 89,000 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 82,000 donums. The Census of 1946 estimated that at that time some 53,000 donums of land were being irrigated perennially by pumped water. By the end of 1957 as a result of Water Development drilling alone this has been increased by 155% to 135,000 donums.

Apart from the necessity of meeting the normal heavy demand for new boreholes from the highly productive Mesaoria, drilling for water has been fairly evenly distributed throughout Cyprus in 1957. By districts,

the actual borehole distribution was as follows:-

Nicosia and Kyrenia	96
Famagusta	35
Larnaca	32
Limassol	38
Paphos	32

and it is interesting to note a small increase in the percentage of successful drillings, 75.5% in 1957 compared with 73.3% in 1956. This percentage would indeed have been higher but for 15 unsuccessful boreholes drilled near Ktima.

The 40 prospecting boreholes sunk during 1957 were, almost without exception, sunk for domestic water and in nearly every case in previously undeveloped areas or where earlier exploration had given disappointing results. The degree of success achieved is, therefore, most satisfactory. A typical example of ground water prospecting was at Aradhippou where six boreholes were sunk in an effort to locate supplementary domestic water for the village. The area was known to be poor in ground water and, although none of the drillings gave entirely satisfactory results, it is anticipated that two of the wells can be developed to produce sufficient water to alleviate the supply position of the village at the height of the dry season when their spring sources diminish.

A successful 'find' of ground water in a previously untapped area resulted from prospecting drilling near the main road south of Paramali village, one of these boreholes producing water at the rate of 10,000 gallons per hour, now provides a supplementary supply to Episkopi cantonment.

Another successful borehole found sufficient ground water to meet the requirements of the new agricultural livestock ranch at Orites, Paphos. The ranch is situated on a plateau at an elevation of 1200 ft. The rocks in this area are the typical non water-bearing Pakhna marls, but in this instance drilling located a limited area of water bearing gravels at the base of the marls and above the Mammonia, 400 ft. below the ground surface.

In the valley of the Tremithios west of Kalokhorio (Larnaca) a row of 6 boreholes was drilled to obtain a cross-sectional profile of the base of the river gravels. From the results it is hoped to be able to develop this source for a gravity domestic supply for the village of Kiti.

The new 60 R.L. drilling rig was successfully used to drill a large diameter borehole so as to enable "gravel pack" technique to be used. At Zodhia the village domestic supply borehole had been giving considerable trouble because of very fine sand entering the borehole and causing damage to the impellers, bearings etc. of the turbine pump, besides tending to fill up the borehole. Much of the sand was finer than 100 mesh. It was decided to try to exclude the sand by shrouding . Above water level the formation is a coarse conglomerate which makes for difficult drilling and is inclined to grip drilling pipes so as to make their extraction difficult. A hand dug well of 3 ft. diameter was therefore sunk to 97 ft. From this depth drilling was commenced with 24" drilling casing. This was followed by 21" and subsequently 18" diameter casing to a depth of 245 ft. Below this depth the borehole was continued at 12" diameter to a final depth of 325 ft. The lowest part of the borehole was the completely filled with gravel pack (7/16" to 8 mesh) up to the 255 ft. level and the next 10 ft. with coarse sand, (8-30 mesh). The 8" diameter borehole casing pipes (screen sections 0.02" opening) were then laid inside the 18" drilling casing, being kept vertical and central by spacing spiders. The sand pack was then poured into the well in lifts of about 2 ft. and the drilling casing jacked up before each successive pour. Sand pack of 3-30 mesh was used only where it covered the screen tubes or where it was opposite beds of fine sand. Elsewhere gravel pack (7/16" to 8 mesh) was used to fill the annular space between the 8" casing and the well sides. The pack was continued up to 95 ft. below ground level.

So far the results have been entirely satisfactory.

Not only has the output of the well been considerably increased but the shrouding seems to be completely effective in preventing fine sand from entering the borehole. The operation is expensive but is worth while if it ensures a long and trouble free life for the borehole and pump.

Nine new observation boreholes were sunk during 1957, bringing the total of these boreholes, in which regular water level measurements and samples for chemical analyses are taken, up to 55. Six of the new boreholes were drilled in the vicinity of the projected Nicosia supply boreholes between Syrianokhori and Prastio, and three near the coast between Ormidhia and Xylophagou. Results of water level measurements in control boreholes are given in Appendices 4 and 5.

There were fourteen privately owned drilling rigs, licensed to drill for water, operating in Cyprus during 1957. Altogether they drilled 148 new boreholes, all for water, with an aggregate footage of 20,705. 66% of these boreholes were successful and gave an estimated total output of 340,000 gallons per hour. These rigs are all locally made, some of them quite well constructed but they are, with one exception, of a rather light type generally only suitable for drilling in favourable rock conditions. As in previous years the majority of boreholes have been put down in the Famagusta and Larnaca districts where drilling is comparatively easy and wells may be sunk without casing. Three drillers, however, have recently extended their field of operations to the Limassol, Kyrenia and Morphou districts. The boreholes sunk at Limassol and Kyrenia were of poor yield, but those sunk at Morphou gave expected good results.

Another rig, locally made but of a much more robust type, continued to drill a deep borehole commenced in 1956 near Lakatamia, south of Nicosia. By the end of 1956 the depth reached was 680 feet and by September, 1957, the final depth reached was 4100 feet. From 700 ft. rotary (churn) drilling was used. No water

was found below 530 feet. On the contrary between 2830' and 3250', from 3300' to 3650'and from 3670' - 3900'the formation penetrated was solid rock salt, mainly sodium chloride with some calcium sulphate. When a depth of 2400 was reached the previous small surface flow of 600 gallons per hour of rather brackish water ceased and the static water level dropped to 300 ft. below ground level.

By law, private drilling contractors are obliged to give notice of drilling, to keep records of depths 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 1,000 donums in 1957.

The average cost of departmental drillings in 1957 was £175 per borehole or £1 per foot of drilling. These costs are inclusive of the expenses of laying casing pipes and of an 8-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 replacements of drilling tools and equipment. They do not include depreciation of drilling plant and the salaries and expenses of the supervisory staff. Fifty-three subsidized boreholes were drilled during 1957 costing an average of £190 each or £0.847 per foot of drilling. The beneficiaries' contribution to the cost was £32:10s per borehole and Government provided the balance of £157:10s. One hundred and seventy four boreholes were drilled on a full repayment basis and sixty-two were drilled entirely from Government funds.

APPENDIX 2

NUMBER AND FOOTAGE OF BOREHOLES

Number of boreholes drilled 1950 - 1957

Purpose	1946-50	1951	1952	1953	1954	1955	1956	1957
For private individuals and Companies	455	157	195	169	182	170	128	202
For Government	123	41	21	51	57	101	55	62
For War Department and Air Ministry	61	32	26	10	15	62	30	29
TOTALS	639	230	242	230	254	333	213	293
Aggregate Footage Drilled	119,615	47,766	41,022	44,563	49,159	58,437	42,681	51,420
Average Depth	187	208	170	194	194	175	200	175

Boreholes Drilled in 1957

Purpose	No.	Existing Well Footage	Footage Drilled	%age Successful	Total Tested Yield in gals/day
Irrigation	176	5,985	35,161	78.4	34,749,600
Domestic Water Supplies	14	115	2,401	71.4	2,354,400
Prospecting	40	95	7,692	70.0	4,008,000
Industrial	3	39	321	-	NIL
TOTAL FOR WATER	233	6,234	45,575	75.5	41,112,000
Observational Boreholes (not tested)	10	-	2,471	-	-
Technical and Geological Boreholes	50	-	3,374	-	-
TOTAL DRILLED	293	-	51,420	-	-

Old Boreholes Renovated: 53

APPENDIX 3

BOREHOLES DRILLED FOR WATER IN 1957

Summary of Results

District	Locality	No. of boreholes drilled	No. Successful *	%age Successful *	Total Tested Output Gals/day	Average Yield per Successful Borehole Gals/day
Nicosia	Western Mesaoria	69	67	97.1	25,596,000	382,000
	Petra-Peristeronari	2	2	100.0	218,400	109,200
	Limnitis	6	4	66.6	657,600	164,400
	Yerolakkos-Kokkini Trimithia	4	4	100.0	472,800	118,200
	Dheftera-Xeri-Anagyia	11	8	72.7	602,400	75,300
Kyrenia	Kyrenia-Karavas	4	2	50.0	93,600	46,800
Famagusta	Liopetri-Sotira-Avgorou	12	7	58.3	1,521,600	217,400
	Kouklia-Akhna-Kondea	12	10	83.3	1,380,000	138,000
	Ephtakomi-Ay.Theodoros	5	1	20.0	112,800	112,800
	Ay.Andronikos (Karpas)	3	3	100.0	597,600	199,200
	Trikomo	3	1	33.3	62,400	62,400
Larnaca	Kalokhorio-Aradhippou	13	9	69.2	609,600	67,700
	Alaminos-Kiti-Kivisil	13	8	61.5	1,077,600	134,700
	Xylophagou-Pergamos	5	5	100.0	480,000	96,000
	Arsos	1	-	-	-	-
Limassol	Phassouri-Zakaki-Akrotiri	16	16	100.0	4,108,800	256,800
	Episkopi-Kandou	4	2	50.0	360,000	180,000
	Polemidhia-Ay.Athanasios-Limassol	8	8	100.0	854,400	106,800
	Paramali	10	8	80.0	1,212,000	151,500
Paphos	Timi-Ktima-Anavargos	18	3	16.6	168,000	56,000
	Orites Forest-Kouklia	4	3	75.0	324,000	108,000
	Ay.Nicolaos	5	2	40.0	288,000	144,000
	Terra	1	1	100.0	86,400	86,400
	Argaka	3	2	66.6	100,800	50,400
	Tsadha	1	1	100.0	127,200	127,200
	TOTALS	233	177	78.0	41,112,000	232,300

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

/37.

APPENDIX 4

HYDROLOGICAL NOTES 1956-57.

By M. Grehan, B.Sc., A.M.I.C.E., A.M.I.W.E., Engineer - Hydrologist and L. Mock, B.Sc. Executive Engineer.

(This report covers the period from 1st October 1956 to 30th September, 1957).

Meteorological.

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

(a) The average rainfall over the whole island was only 15.5 inches or about 80% of normal. The average rainfall since 1908 is 19.4 inches.

(b) October and November were very dry months. Normally above 17% of the year's precipitation falls during these months. This year only about 2½% was measured.

(c) Although the rainfall during December, January and February was not much more than one half of the rainfall during these months last year, the number of days on which rain fell was only 1 or 2 less than last year, indicating a low average intensity.

(d) The most intense rainfall occurred at the beginning of the summer, on June 12th, when an estimated 4 inches of rain fell in one hour in the Makheras Monastery area and caused floods in the Pedieos and Yialias Rivers. At the end of the summer, on the 30th September, 3.6 inches of rain fell in the Skylloura area in about 90 minutes to cause floods in the Ovgos catchment.

(e) Until the end of January, temperatures were generally about 2 degrees below normal. Thereafter until April they were about normal. The highest temperature recorded at Nicosia was 107° F on August 16th and 20th.

Flood Discharges.

Heavy floods caused by isolated heavy thunderstorms occurred unusually in June and September.

/38.

These two floods provide an interesting contrast in run-off, the June storms occurring over the mountain rocks in the Makheras area and the September storm over the foothills of the Kyrenia Range near Skylloura. The overall run-off from the mountain rocks at the beginning of the summer was probably between 40 and 50 per cent with a peak intensity rate of run-off of perhaps 65%. The overall run-off from the Kyrenia foothills at the end of the summer was about 12% with a peak intensity rate of run-off of about 17%. In June the peak rate of flow in the Pedieos River at Nicosia was estimated to be between 6,000 and 8,000 cusecs and in the Yialias River at Kochati, 12,000 to 18,000 cusecs. In September the peak rate of flow at the Ayios Vasilios weir was 2,100 cusecs and at the Ovgos recorder near Morphou it was about 1,900.

River and Stream Discharges.

At the beginning of the Hydrological year - October 1956 - water level recorders had already been installed and were in operation at the gauging stations given in the following table:-

Gauging Station No.	River or Catchment	Location	Type of Installation
1*	Pedieos	Old railway bridge north of Nicosia	Water-level and flow-velocity measurement
2	Yialias	About 2 miles south-west of Kochati. (This gauging station replaced the Nisou bridge recorder)	60-foot measuring weir with 2'0"x 6" notch
3*	Ovgos	Road bridge on Morphou-Kyrenia road	Water-level and flow-velocity measurement
4*	Serakhis	About 1 mile north-west of Morphou	- do -
5*	Xeros (Lefka area)	Road bridge at Karavostasi	- do -
6*	Marathasa	Road bridge on Lefka-Skouriotissa road	- do -

Gauging Station No.	River or Catchment	Location	Type of Installation
7/=	Harangas (Famagusta)	About 1 mile west of Varosha-Dherinia road	Water-level recorder on existing 70-foot weir
8/=	Catchment near Avgorou	Near Avgorou turn-off on Nicosia-Famagusta road	40-foot measuring weir with 2'0"x 6" notch
9	Paralimni Lake	At exit of outfall tunnel	2-foot standing-wave weir
10	Pyrgos	Near Phlevas saw-mill	30-foot measuring weir with 2'0"x 6" notch
11	Limnitis	At Limnitis saw-mill	- do -
12	Ovgos	Near Syrianokhori	6'7" sharp-edged weir with 2'0"x 6" notch (this weir is for measuring summer flows only and is removable)
13A	Kouris	Under road bridge on Limassol-Troodos road near Trimiklini	18-foot measuring weir with 2'0"x 6" notch
13B	Kouris	On irrigation channel by-passing weir 13A	1'6" standing-wave weir
14	Peristerona	At Panayia Bridge Forest Station	25-foot measuring weir with 2'0"x 6" notch
15*	Tremithios	At Kiti village	Water-level recorder on existing 70-foot irrigation weir
16*	Yermasoyia	Road bridge on Nicosia - Limassol road	Water-level and flow-velocity measurement
17*	Kouris	About 1 mile north-east of Kandou	Water-level recorder on 300-foot irrigation weir
18	Main drain on north side of Old Akhyritou Reservoir	About 1 mile east of Kalopsidha (at Kolopannes)	25-foot measuring weir with 2'0"x 6" notch

/40.

Gauging Station No.	River or Catchment	Location	Type of Installation
19/=	Catchment near Akhna	Near Ay. Yeorgios Church about 2 miles north-east of Akhna	40-foot measuring weir with 2'0"x 6"
20/=	Catchment west of Phrenaros	About 1 mile north-west of Phrenaros-West pumping station	40-foot measuring weir with 2'0"x 6" notch
21+	Catchment in Kokkini-Trimithia area	About 2 miles west of Kokkini Trimithia	40-foot measuring weir with 2'0"x 6" notch
22/=	Catchment in Liopetri area	About 1 mile south-west of Liopetri	- do -
23	Akaki	About ½ mile south-west of Malounda	- do -
24	Skylloura	About ½ mile west of Ay.Vasilios	60-foot measuring weir with 2'0"x 1'0" notch
25	Ak Sou	At Petra-tou-Dhiyeni	30-foot measuring weir with 2'0"x 6" notch
26A	Almiros	About 2 miles north of Geunyeli	40-foot measuring weir with 2'0"x 6" notch
26B	Almiros	About 2 miles north of Geunyeli	Venturi flume with 1'0" throat on 2'6" wide irrigation channel by-passing weir 26A
27	Khrysokhou	At Skoulli	40-foot measuring weir with 2'0"x 6" notch
28	Evretou (Stavros Psokas)	About 1 mile west of Trimithousa	25-foot measuring weir with 2'0"x 6" notch
29	Syrgatis	Immediately south of the Skarinou road bridge on Nicosia-Limassol road	Water level and flow velocity measurement
30	Dhiarizos	Road bridge on Limassol-Ktima road	- do -
31	Xeros (Paphos)	- do -	- do -

/41.

* These stations are primarily intended to estimate river spates but enable approximate figures for annual flows to be calculated at the end of the year.

/= For the Phrenaros Area Hydrological Survey.

+ For the Kokkini Trimithia Area Hydrological Survey.

Measured discharges:-

During the year 1956-57 the discharges measured at the gauging stations listed in the previous paragraph were as follows:-

Gauging Station No.	River or Catchment	Total Rainfall on Catchment ($x10^6$ c.ft.)	Total run-off ($x10^6$ c.ft.)	Max. Peak flow (cusecs)	Max. run-off in 24 hour period ($x10^6$ c.ft.)	%age run-off
1	Pedieos	2,473	108	7,000	57	4.4%
2	Yialias	1,583	181	15,000	40 to 50	11.4%
3	Ovgos (Morphou)	2,697	25	1,950	25	0.9%
4	Serakhis	8,784	1,506	3,500	29	1.7%
5	Xeros (Karavostasi)	1,656	Nil	Nil	Nil	Nil
6	Marathasa	1,346	8	40	0.4	0.6%
7	Harangas	183	0.5	25	0.5	0.3%
8	Avgorou	374	Negligible	-	-	-
9	Paralimni Lake	Not applicable	Negligible	-	-	-
10	Pyrgos	721	100	55	3.4	13.8%
11	Limnitis	1,086	187	58	4.6	17.2%
12	Ovgos (Syrianokhori)	Summer discharges only; see next paragraph				
13A) 13B(	Kouris (Trimiklinis)	1,335	349	80	45	26.1%
14	Peristerona	1,848	595	455	27	32.2%
15	Tremithios (Kiti)	1,907	1.5	200	0.5	0.1%
16	Yermasoyia	2,907	114	350	11	3.9%
17	Kouris (Kandou)	6,345	415	56	5	6.5%
18	Kolopannes	Not applicable	Negligible	-	-	-
19	Akhna	299	Negligible	-	-	-
20	Phrenaros West	106	Negligible	-	-	-
21	Kokkini Trimithia	346	3.3	650	3.3	0.9%
22	Liopetri	120	0.09	4.6	0.09	0.1%
23	Akaki (Malounda)	2,624	328	387	23	14.5%

Gauging Station No.	River or Catchment	Total Rainfall on catchment (x10^{6}c.ft)	Total run-off (x10^{6}c.ft	Max. Peak flow (cusecs)	Max.run-off in 24 hour period (x10^{6}c.ft.)	%age run-off
24	Skylloura (Ay.Vasilios)	994	23	2,100	2.6	2.3%
25	Ak-Sou (Petra tou Dhiyeni	112	2.4	175	0.4	2.1%
26a) 26b(	Almiros " (Geunyeli)	394	23	360	3.7	5.9%
27	Khrysokhou (Skoulli)	871	57	231	1.8	6.5%
28	Evretou	1,518	121	79	3.7	8.0%
29	Syrgatis (Skarinou)	2,370	61	46	1.2	2.5%
30	Dhiarizos	5,166	720	1,500	23.9	13.9%
31	Xeros(Paphos)	4,186	95	350	6.1	2.3%

Summer Discharges:-

The table below summarizes the basic summer flows which are measured. The quantities for the Pyrgos, Limnitis and Kouris Rivers have already been included in the annual totals of the previous paragraph.

Catchment	Month	Discharge (million cubic feet)		Average discharge (cusecs)	
		1955-56	1956-57	1955-56	1956-57
Pyrgos River near Phleyia	June	1.94	1.50	0.75	0.60
	July	0.42	0.50	0.16	0.19
	August	0.21	-	0.08	-
	September	0.37	0.20	0.14	0.08
Limnitis River near Limnitis	June	4.08	6.0	1.58	2.3
	July	0.62	1.0	0.23	0.4
	August	0.13	0.11	0.05	0.04
	September	0.25	0.13	0.10	0.05
Ovgos River at Syrianokhori	June	1.97	1.30	0.76	0.50
	July	0.48	0.40	0.18	0.15
	August	0.21	0.21	0.08	0.08
	September	0.08	0.15	0.03	0.06
Kouris River at Trimiklini	June	16.1	14.0	6.2	5.0
	July	8.9	9.1	3.3	3.4
	August	6.2	6.4	2.3	2.4
	September	5.1	5.0	2.0	1.9
Khrysokhou River near Skoulli	June		4.5		1.7
	July	Not available	3.4	Not available	1.2
	August		2.9		1.1
	September		2.5		1.0
Karyotis River-Ayios Nicolaos Stream near Kakopetria	June		18.9		7.3
	July	Not available	14.3	Not available	5.3
	August		13.3		5.0
	September		12.6		4.9
Karyotis River-Platania Stream near Kakopetria	June		3.8		1.5
	July	Not available	3.6	Not available	1.3
	August		3.0		1.1
	September		2.2		0.9

Spring Discharges.

During the year 1612 spring discharges were measured, giving an average of over 134 measurements each month. 273 springs are now measured regularly, 75 at monthly intervals, 110 every 2 months, 86 every 3 months and 2 every 6 months.

Because of the low rainfall, nearly all spring discharges were well below average; and in some areas, where this has been the second year of poor rainfall, the yields were the lowest ever measured. Spring flows began their seasonal increase later than usual because in 1956, September, October and November were dry months. And in some cases, for example, Kourkas spring near Paphos and the Kephalovrysos spring near Lapithos, there was no increase in flow at all during the winter. The discharges from the chains-of-wells in some areas were sustained above normal through the dry season by the above average rainfall in the spring and early summer.

On high ground at the eastern end of the Troodos Mountains the rainfall was average or in some places, slightly above-average, mainly due to heavy storms during the spring and early summer and spring discharges here have not been less than normal. For example, Koshinas spring at Pharmakas was yielding 118,000 g.p.d. at the end of September compared with 108,000 g.p.d. at the end of last year. The average discharge of this spring for this time of the year is about 116,000 g.p.d.

Over the rest of the mountains within the Nicosia district the spring yields were not much lower than a year ago although the rainfall was only between 80 and 100% of normal.

Owing to the later rains in the Kionia area, mentioned above, the Pavlakis chain-of-wells near Kato Dheftera was discharging the high abnormal quantity of 340,000 g.p.d. at the end of September. The previous highest discharge in September since measurements began in 1953 was 89,000 g.p.d. The yields of the Arab Ahmet and Makedhonitissa chains-of-wells were both higher this summer than in 1955/56.

/45.

Over a large part of the Limassol district the rainfall has been only about 80% of average or less for the past two years and the upper Kouris catchment has had three successive years with rainfall only about 80% of average. As a result spring yields were below average in nearly all parts of the Limassol district and some in the Kouris Valley were the lowest on record. For example, the Kephalovrysos spring used for the Limassol Water Supply was only discharging 150,000 g.p.d. at the end of September, the lowest rate of flow ever measured. Similarly the yield of Kissousa spring, which was only 92,000 g.p.d. in September was also the lowest on record.

The rainfall was less than 70% of normal over a large part of the Paphos District and, although the rainfalls on the previous two years were above average, spring yields decreased substantially during the year and in some cases are the lowest on record. Notably the springs supplying Paphos were very low during the summer but their yield is also reduced by nearby pumping. The rate of flow of the Kourkas spring decreased throughout the winter and was only about 8,000 g.p.d. at the end of September. The Mylari springs were yielding little more than 60,000 g.p.d. at the end of September. In September, 1954 when measuring began the rate of flow was about 150,000 g.p.d. The yield of the Loutra-tis-Aphroditis Springs was only 193,000 g.p.d. at the end of September. The previous lowest yield was 217,000 g.p.d. in December, 1954, the first year measurements were made.

Only small areas of the Kyrenia Range near Koronia and Akradhes had an average rainfall. The rainfall on most of mountains was down to less than 80% of average and in the extreme west it was only 60%. Spring yields are the lowest for several years. For example the Kephalovrysos at Lapithos which was discharging 790,000 g.p.d. at the end of September has not been lower since 1953. There was no increase at all in its rate of flow during the winter of 1956-57.

The Kephalovrysos at Kythrea was discharging 2,750,000 g.p.d. at the end of September which is less

than at any time in the past 2 years but more than in 1954 when the discharge was 2,550,000 g.p.d. at the end of September.

There was only about 80% of the normal rainfall in the Famagusta area after two years during which it had been well above average and spring yields are the lowest for several years. The maximum yield of the Panayia spring was only 96,000 g.p.d. in January compared with a maximum yield last year in March of 308,000 g.p.d. The yield at the end of September was 56,000 g.p.d. while the minimum rate of flow of the previous year in October 1956 was 84,000 g.p.d.

In the lower part of the Trimithios valley in Larnaca district the rainfall was less than 70% of normal and the yield of the Bekir Pasha chain-of-wells during the summer was the lowest since 1941. At the end of September its rate of flow was only 723,000 g.p.d.

In contrast, in the northern part of the district where there was a good spring rainfall with floods in the Yialias River, the yield of the Athanasis chain-of-wells during the summer was higher than the preceding 2 years although its winter yield was comparatively low. At the end of September its rate of flow was 380,000 g.p.d. compared with 230,000 g.p.d. a year ago and 195,000 g.p.d. in 1955.

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:-

Nicosia	Quantity (Million Cub. Ft.)	Percentage
Total extraction during 1956/57	107.7	100
Trimithia	51.1	47.4
Athalassa	2.1	1.9
Arab Ahmet (Upper & Lower)	10.7	9.9
Laxia	7.2	6.7
Makedhonitissa	6.3	5.9
Dhali	0.3	0.3

/47.

Nicosia	Quantity (Million Cub. Ft.)	Percentage
Sykhari	3.9	3.6
Prodhromos Wells	15.1	14.0
Others	11.0 (approx.)	10.3
Famagusta		
Total extraction during 1956/57	45.6	100
Phrenaros West	15.8	34.7
Phrenaros North	25.5	56.0
Panayia	1.7	3.7
Others	2.6	5.6
Limassol		
Total extraction during 1956/57	60.9	100
Kephalovrysos, Kria Pighadhia and Mavrommata	51.3	84.2
Chiftlikoudhia	9.6	15.8

Ground-Water Levels.

Irrigation pumping was necessary during the late autumn owing to the failure of the seasonal rains and groundwater levels continued to fall until December. Usually the ground-water level begins to rise in November when pumping normally ends.

Good rainfall during the spring and early summer of 1957, and early rains at the end of the year reduced the demand for pumped water during part of the normal irrigation season. Also the heavy June flows in the Pedieos, Meriki and Yialias Rivers, which sustained the discharges of the chains-of-wells drawing water from the river gravels, certainly retarded the drop of the water level in the aquifers recharged by these rivers.

In addition, over the western Mesaoria, although the rainfall was below average it was not a great deal less than last year and it was higher than in 1954-55. As a result the decrease in the average water levels of the control boreholes at Kokkini Trimithia during the irrigation season was less than it had been in the previous 2 years although it is estimated that 13 million cubic

/48.

feet of water more than last year was pumped out. The average fall of the water level in the control boreholes was 1.8' during the year compared with 2.3' in 1955-56 and 2.7' in 1954-55.

Similarly at Morphou Bay and near Famagusta, where the aquifers are chiefly recharged by underground flow into them, the average fall of the water levels was less than might have been expected in view of the low rainfall. At Ayios Memnon the average decrease was 0.7' in 1956-57 compared with a decrease of 0.56' last year and a rise of 2.2' in 1954-55. At Morphou Bay the coastal boreholes recorded an average fall of 0.5' compared with 0.7' last year and another borehole about 1½ miles inland gave an average decrease of 1.5' compared with 2.9' last year.

On the other hand in the hydrological study area at Phrenaros where the aquifer is chiefly recharged by rain falling on the area there was an average decrease in water level of 2.9' compared with 2.3' last year although the irrigation season was shorter this year. This year the rainfall in this area was less than 90% of normal whereas last year it was 30 to 40% more than normal.

The water table in the Xylophagou area is sensitive in the same way to the rainfall on the area. The average water level of the control boreholes decreased by 0.9' during 1956-57 mainly as the result of the rainfall being only about 80% of normal during the year. The average rainfall in this area is 13.9" and in 1954-55 and 1955-56 when the rainfalls were 20.6" and 17.2" respectively, the average water level in all boreholes but one increased during each of the two years. Nevertheless since 1951 the average water level in all the control boreholes has dropped by about 1.8'.

Appendix 5 gives the water levels recorded at all observation wells and boreholes during the years 1950-51, 1955, 56 and 1956-57.

Recharge Activities.

There was negligible recharge through the wells at Ayios Loucas from Kouklia Reservoir or Akhyritou

Reservoir as a result of the low rainfall. The exceptional floods in the Pedieos and Yialias Rivers in June did not reach Kouklia.

Because of a dispute between the villagers of Ayios Memnon and Paralimni the sluice gate at the overflow from Paralimni Lake was kept closed and no recharge through the Ayios Memnon wells was possible.

From the 9th November until the 12th July, 20.8 million cubic feet of spring water which was not required for the Limassol Town Supply was recharged into the Chiftlikoudhia chain-of-wells. The maximum quantity recharged during any month was 3.5 million cubic feet in March which is equivalent to an average of about 710,000 gallons a day. The average rate of recharge over the whole period was about 528,000 gallons a day. Between the 12th July and the end of the hydrological year 7.3 million cubic feet were pumped from the wells to augment the town supply.

In 1956-57 the salinity of the well-water, which was 88 ppm. of NaCl at the end of recharge in July, had risen to 175 ppm. by the end of September. In 1956 the corresponding figures were 88 and 129 ppm.

Chemical Analyses.

During the year 1470 samples of water were sent to the Government Analyst. This number included 376 samples for full chemical analysis and 682 samples for partial chemical analysis from wells or boreholes, springs or service mains supplying towns and larger villages. The remaining 412 samples which received partial analysis were collected from springs, observation boreholes and irrigation boreholes.

Bacteriological Analyses.

During the year 494 samples of water, taken mainly from town water supplies were analysed by the Government Pathologist.

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

/50.

Water Supply	No. of Samples	No. of unsatisfactory samples
Nicosia	269	29
Famagusta	129	13
Limassol	41	9
Larnaca	24	9
Paphos	13	7
Kyrenia	1	0
Others	17	8
Totals	494	75

At Nicosia most of the unsatisfactory samples came from the Arab Ahmet and Makedhonitissa chains-of-wells. Water from these sources tends to be unsatisfactory in the summer but more reliable in the winter months.

At Famagusta every monthly sample of the Panayia Spring water at the main reservoir was unsatisfactory.

At Limassol a chlorinator was installed at Chiftlikoudhia and all the samples from this source were satisfactory. Although the quality of the spring water entering the main reservoir was not reliable, all samples collected after chlorination were satisfactory.

At Paphos, monthly bacteriological sampling was started in June when samples from the main reservoir and from the town mains were unsatisfactory. A chlorinator was installed at the reservoir and since then all samples have been satisfactory although the unchlorinated water at the inlet to the reservoir is often unsatisfactory.

Special Investigation at Phrenaros.

The Phrenaros area is the chief source of water for the Famagusta town supply. The rapid fall of the ground water levels, two to three feet per year, has given cause for some anxiety and a special investigation is in progress to determine, if possible, the maximum safe rate of pumping.

Contour surveys have been made of the ground surface contours, and of the interface between the

"black" miocene clay and the overlying miocene water bearing gravels. The level of the ground water is measured regularly at all wells and boreholes in the area and the ground water contours plotted therefrom twice each year. Rainfall on the area is carefully recorded by specially placed rain-gauges and run-off is measured at measuring weirs fitted with automatic recorders. The area covered by these investigations was originally 23 square miles but has now been reduced to 13 square miles.

The results of the two years' observation now completed appear to indicate that the aquifer is replenished mostly from the rain that falls directly over it and that the present rate of extraction exceeds the average rate of replenishment. Unless some means of artificial recharge is found it will therefore be necessary to reduce pumping in this area to avoid exhaustion of the aquifer.

Special Investigation at Kokkini Trimithia.

The Trimithia area is one of the chief sources for Nicosia town water supply and, as at Phrenaros, a rapid fall in ground water levels has given cause for anxiety as to the future of this most valuable aquifer, where the average ground water level has fallen by 1.8', 2.3' and 2.7' in the past three seasons (1956/57, 1955/56 and 1954/55).

The method of survey is similar to that described above for Phrenaros. In this case the area investigated covers 19 square miles.

It appears that the aquifer is naturally re-charged by the streams to the south, so that it is not dependent for its water entirely upon the rain that falls on the overlying surface. It is not yet certain if the aquifer is being overpumped or if it will be able to maintain its present yield over a long period.

Special Investigation at Morphou Bay.

This investigation is now being started. Preliminary plans covering about 16 square miles have been

/52.

prepared, a register of wells and boreholes is being compiled and ground water levels are being recorded.

This will be a most important study as it will cover the best water bearing area in Cyprus and will include the future chief source of the Nicosia water supply. The area covered will eventually be extended to about 100 square miles.

New Works and Costs.

By the end of 1956-57, 34 permanent gauging stations had been established. During the summer three new weirs and two measuring flumes were constructed and one existing weir was widened. Details of these works are as follows:-

(1) Tremithios River near Ayia Anna.

40 ft. wide weir with 2'0"x 6" notch.
Situated on boundary of pillow lavas.
Total Cost £1,200.

(2) Karyotis River near Pendayia.

60 ft. weir with 2'0"x 6" notch.
This weir will measure the loss of surface water out to sea in the Karyotis River.
Total Cost £1,700.

(3) Alakati River near Ayios Amvrosios.

22 ft. weir with 2'0"x 6" notch.
This weir is the first to be constructed on a stream draining northwards to the sea from the Kyrenia Range.
Total Cost £700.

(4) Platania Stream near Kakopetria.

20 ft. long standing wave flume with a 2'0" wide x 2'0" deep channel containing a hump 12" high.

(5) Ayios Nicolaos Stream near Kakopetria.

25 ft. long standing wave flume with a 3'0" wide x 2'3" deep channel containing a hump 12" high.
Total Cost of both above flumes (i.e. (4) & (5) £1,150.

These two flumes are situated in the two main tributaries of the Karyotis River above the highest irrigation intakes and will measure almost all the summer water available in the Karyotis River.

(6) Yialias River near Kochati.

The existing 40 feet wide weir was widened to 60 ft.

After the June floods it was decided to increase the range where practicable of those recorders having too short a float tube for the highest floods. The table below lists the recorders which were raised during the summer.

Site	Old Range in ft.	New Range in ft.	Cost in £
Yialias River near Kochati	4	20	850
Peristerona River near Panayia	7.75	20	350
Ak-Sou-River at Petra-Tou-Dhiyeni	4.5	15	150
Khrysokhou River at Skoulli	6.5	15	850
Limnitis River near Limnitis	5	15	300
Almiros River at Geunyeli	5.25	15	100

APPENDIX 5

WATER LEVELS IN CONTROL BOREHOLES

FEET ABOVE SEA LEVEL

	Borehole No.	Maximum Water Level			Minimum Water Level		
		50-51	55-56	56-57	50-51	55-56	56-57
1. Kokkini Trimithia (Police Station)	90/50	685.8	675.9	672.0	681.2	672.6	669.2
2. Kokkini Trimithia (North Side)	160/50	682.7	674.7	671.7	679.8	671.8	670.1
3. Kokkini Trimithia (East Side)	161/50	686.0	675.8	670.5	680.2	670.1	666.8
4. Astromeritis (Katokopia Road)	91/50	370.4	357.7	357.5	365.1	330.3	330.3
5. Morphou (North of Ovgos River)	168/50	89.2	89.7	80.8	84.1	81.6	77.6
6. Morphou (Government Experimental Farm)	92/50	83.7	71.6	67.8	69.9	57.3	51.6
7. Prastio (27 M.P.)	93/50	27.1	23.4	20.5	22.1	18.6	15.0
8. Ghaziveran (between 29-30 M.P.)	94/50	18.5	15.7	15.8	16.2	14.2	10.9
9. Pendayia (on road to Peristeronari)	95/50	10.6	11.8	10.2	8.0	7.2	6.9
10. Xylophagou (West of village)	70/51	24.4	20.9	20.3	23.4	20.1	19.6
11. Xylophagou (West of village)	71/51	18.8	14.4	13.9	17.7	13.0	11.8
12. Xylophagou (West of village)	72/51	23.2	26.0	24.7	22.6	22.9	21.0
13. Xylophagou (East of village)	73/51	11.3	11.3	11.3	10.3	9.5	10.5
14. Xylophagou (East of village)	74/51	11.1	11.6	11.4	11.1	10.8	10.6
15. Pergamos	86/51	256.6	251.3	248.3	254.7	248.0	245.1
16. Phrenaros (Famagusta W.S.B.Hs)	51/51	87.0	74.8	71.8	86.6	71.8	68.8

/55

	Borehole No.	Maximum Water Level			Minimum Water Level		
		50-51	55-56	56-57	50-51	55-56	56-57
17.Phrenaros(F'sta W.S.B.Hs)	52/51	85.8	74.5	71.1	85.4	71.1	68.6
18.Phrenaros(F'sta W.S.B.Hs)	53/51	85.2	77.1	74.3	84.9	74.0	72.1
19.Phrenaros(F'sta W.S.B.Hs)	67/53	-	76.3	74.2	-	74.4	72.5
20.Phrenaros(North) F'sta W.S.B.Hs)	108/52	-	63.8	60.5	-	60.4	57.3
21.Phrenaros(North) F'sta W.S.B.Hs)	109/52	-	63.6	59.9	-	59.6	57.3
22.Phrenaros(North) F'sta W.S.B.Hs)	110/52	-	63.2	60.1	-	59.9	57.6
23.Phrenaros(North) F'sta W.S.B.Hs)	76/56	-	58.1	57.6	-	57.8	55.8
24.Phrenaros(North) F'sta W.S.B.Hs)	77/56	-	64.1	63.8	-	63.9	62.6
25.Phrenaros(North) F'sta W.S.B.Hs)	78/56	-	65.6	65.0	-	65.3	63.1
26.Phrenaros(North) F'sta W.S.B.Hs)	79/56	-	72.8	72.8	-	72.4	70.8
27.Ay.Nicolaos Camp F'sta	89/56	-	29.4	29.3	-	29.3	28.5
28.Ay.Memnon (South)	69/38	-	(-) 13.6	(-)13.3	-	(-)17.9	(-)18.6
29.Ay.Memnon (South)	50/53	-	(-) 9.9	(-)10.1	-	(-)12.3	(-)13.7
30.Makrasyka (South of village)	48/54	-	114.9	113.2	-	110.4	108.3
31.Makrasyka (South of village)	49/54	-	118.0	116.4	-	115.9	114.2
32.Kalopsidha (S.W. of village)	54/54	-	64.7	63.3	-	60.5	57.1
33.Kalopsidha (S.W. of village)	55/54	-	72.4	70.8	-	70.9	69.2
34.Kalopsidha (S.W. of village)	56/54	-	74.1	72.6	-	73.1	71.5
35.Kolossi	88/54	-	13.5	11.5	-	9.5	8.0

/56.

	Bore-hole No.	Maximum Water Level			Minimum Water Level		
		50-51	55-56	56-57	50-51	55-56	56-57
36.Syrianokhori	150/54	-	10.2	9.2	-	8.0	7.2
37.Syrianokhori	151/54	-	9.6	8.8	-	7.8	6.5
38.Syrianokhori	152/54	-	7.0	6.2	-	4.5	3.9
39.Syrianokhori	153/54	-	4.6	3.9	-	3.0	2.4
40.Syrianokhori	1/55	-	23.0	18.0	-	14.1	12.0
41.Syrianokhori	23/55	-	20.4	16.3	-	15.2	12.2
42.Laxia	208/55	-	672.2	668.1	-	666.3	663.7
43.Ephtakomi	163/55	-	683.2	678.3	-	677.0	672.8
44.Syrianokhori	201/56	-	-	17.2	-	-	12.2
45.Syrianokhori	209/56	-	-	16.1	-	-	11.5
46.Prastio	11/57	-	-	25.0	-	-	13.4

/57.

APPENDIX 6

DESCRIPTION OF CERTAIN IRRIGATION SCHEMES

By A.H.P. McLaughlan, A.M.I.C.E. Senior Engineer
and J. Karapetian, B.E.M., Superintendent of Works.

(A) PETRA.

A request was made by the Irrigation Division Committee of Petra, to expand their irrigation system, so as to bring under irrigation 2,000 donums of cereals and 10,000 olive trees in the dry months of the year.

Work to increase the capacity of the two reservoirs previously constructed by this Department commenced in early September 1957, when the reservoirs were empty. Two 19RB dragline excavators were used on the upper site and temporary roads and working spaces were constructed by traxcavator. This latter machine was also used to level the spoil on completion of the works. An average of about 4 ft. of silt was removed from the bed of the reservoir and where possible the sides were excavated to the rock face. At least 9,000 cub. yards were removed, and the majority of this silt was spread and levelled on adjacent fields. The capacity increase is about 1½ million gallons.

At the lower site a section of the river bed about 200 ft. by 100 ft. was excavated 9 ft. deep by a traxcavator, and the spoil carted away by lorries. A 19RB excavator was used to remove a soft rock outcrop and to dredge the bed of the reservoir. The quantity excavated was about 7550 cubic yards, representing an increase in capacity of about 1¼ million gallons.

The total increase in capacity of the two reservoirs was thus just under 3 million gallons, or over 25% of the original capacity. The cost of the work was £2,000 towards which the beneficiaries paid £666. Works were completed on 20/11/57.

(B) MORPHOU (LEKANES) CHAIN OF WELLS.

These works were carried out for an Irrigation Association known as the LEKANES Kalokerino Water Irrigation Association which has about sixteen shareholders. Their aim was to tap more water and extend their chain-of-wells to connect their irrigation system with an

existing borehole which was situated at a distance of 2,600 feet from the head-well.

37 new wells were sunk and 2,600 feet of tunnels were driven to connect the borehole with the old head-well. Compressors were used for driving the tunnels in rocky strata. 750 feet of the tunnels were driven in running sand where, to render the tunnel safe, the tunnel was lined in reinforced cement concrete oval blocks of 3'6"x 2'0". The mouths of the old wells were built and covered with reinforced concrete slabs. The invert of the old tunnel was thoroughly cleaned out and re-graded.

Work on the scheme started in September 1955 and will be completed in January, 1958. The total cost is estimated to be £5,425 towards which the Irrigation Association Committee contributed the sum of £3,738. The scheme will provide sufficient water to irrigate an extent of about 400 donums under various seasonal crops.

(C) MESOYI.

The flow of "MANA-TOU-NEROU" spring, which was 38,880 gallons per day before excavation, was increased by the construction of 200 feet of tunnel to 70,000 gallons per day.

The water has now been conveyed by 3700'x 4" ϕ pipes into an Irrigation tank of 34'x 34'x 5' where the water is stored during night. The irrigation tank was an old one and was repaired by plastering the wells inside in cement and installing a 4" diameter sluice-valve. In order to distribute the water stored in the irrigation tank, 380'x 8"x 8" of R.C. channels have been provided.

Before the construction of the works an extent of about 39 donums was irrigated in summer and about 50 donums of spring cereal crops. As a result of the improvement it has been possible to bring 150 donums under irrigation of which 70 donums is perennial irrigation. For the execution of this project the sum of £2,975 was expended, of which the beneficiaries paid £1,245. The works were started on 7/12/56 and completed on 22/5/57.

(D) KALIANA.

This scheme was executed for an Irrigation Association which lost a valuable proportion of its water through wastage from earth channels which required lining in concrete to prevent leakage.

The works consisted of 3 small concrete intake weirs, the lining of 10,000 feet of channels in reinforced concrete, and the construction of river pipe crossings and irrigation ports. Difficulties were encountered in the transport of materials to the site of this job. These were overcome by constructing new temporary roads.

The scheme was put in hand on 6/3/57 and was completed on 20/7/57. Towards the execution of this work the beneficiaries contributed £1,564 against the total cost of £3,128. The works enabled the area under irrigation to be increased from about 150 donums to 230 donums.

(E) TRIMIKLINI.

This is a water conservation scheme consisting of a 105-foot high dam on the Kouris River, together with a system of distribution pipes and channels. The dam is the highest yet built in Cyprus. It is sited in a narrow gorge near Saitta and can be seen from the double-arched bridge on the main Limassol-Troodos road.

The dam has a maximum height of 105 feet from river bed-rock to spillway and is of the mass concrete gravity type, 80 feet thick at the base and 11'3" thick at the top. It contains some 8,000 cub. yards of concrete. The reservoir is some 2,500 feet long and impounds 55 million gallons of water. The distribution system includes 6,000 feet of reinforced concrete channels and 12,000 feet of pipes of 8" diameter to 3" diameter. A by-pass pipeline 10" diameter, 2,900 feet long laid in the bottom of the reservoir carries compensation water through the dam to lands downstream of those irrigated by the scheme.

The dam is built in sections with copper expansion joints between sections at 40 foot intervals. A system of drainage pipes is built into the dam to relieve upthrust due to possible seepages under or around the main structure. A de-silting gallery with a removable

gate protected by a pipe grill is left in the base of the dam, and a penstock operating from the spillway is provided for dewatering the reservoir in emergency or for inspection. The outlet to the irrigation channels consists of a vertical 6" perforated pipe fixed to the upstream face of the dam controlled by a valve downstream. The outer 5 feet of the dam was cast in 1:2:4 concrete and the core in 1:3:6.

The lower section of the dam, from the foundation to 40 feet above bed level was cast with the mixing platform placed at a low level supplied by aggregate through a pipe chute. The concrete for the upper portion was mixed on the abutment at spillway level and placed by a crane.

Work started in April 1956 and was practically complete at the end of 1957. The total cost is approximately £56,000 and the area brought under new perennial irrigation about 800 donums.

APPENDIX 7

IRRIGATION SCHEMES COMPLETED IN 1957

Ser. No.	Location	Nature of Construction	Donums Commanded New Irrigation		
			Winter or Spring	Summer	Total
1.	Chato	Overflow-Spillway, bank etc.	100	-	100
2.	Orounda	R.C. Channels	-	18	18
3.	Aplanda	Spring, tank, R.C. Channels	14	50	64
4.	Steni	Weir, R.C. Channels and piping	50	50	100
5.	Konia	R.C. Channels	-	5	5
6.	Agridhia	Irrigation tank and piping	-	8	8
7.	Zodhia (Kato)	Irrigation ports, river crossing	100	-	100
8.	Karavas	Springs R.C. Channels	-	40	40
9.	Akaki	R.C. Channels	-	8	8
10.	Milikouri	Small weir and piping	-	-	-
11.	Lasa	R.C. Channels	-	8	8
12.	Palekhori	R.C. Channels	-	6	6
13.	Athalassa (Farm)	Piping etc.	-	10	10
14.	Palekhori	R.C. Channels	-	4	4
15.	Pelathousa	Excavation and building of spring	-	7	7
16.	Melini	Small Weir, R.C. Channels and tank	-	28	28
17	Palekhori	R.C. Channels and piping	-	3	3
18.	Mesoyi	Spring R.C. Channels piping and tank	200	40	240
19.	Ayios Therapon	R.C. Channels	-	60	60
20.	Tembria (Kaliana Station)	R.C. Channels	-	8	8
21.	Lymbia	R.C. Irrigation tank and piping	-	32	32
22	Kochati-Ayia Varvara	R.C. Channels	280	-	280
23.	Phini	Irrigation tanks and piping	-	22	22
24.	Ay.Nicolaos	Piping, distribution system	-	20	20
25.	Palekhori (Petrides)	R.C. Channels	-	8	8
		Carried Forward	744	440	1,184

Ser. No.	Location	Nature of Construction	Donums Commanded New Irrigation		
			Winter or Spring	Summer	Total
		Brought Forward	744	440	1,184
26.	Palekhori (Mylouri)	Piping	-	6	6
27.	Anglisidhes Pano	Piping	20	-	20
28.	Kithasi	Antiflood works	-	-	-
29.	Tseri	Tunnelling, improvement works	600	-	600
30.	Kaliana	R.C. Channels	190	95	285
31.	Aredhiou	R.C. Channels	800	-	800
32.	Galata-Sinarkotis	Measuring weirs	-	-	-
33.	Vroisha	Piping and channelling	50	-	50
34.	Kapilio	R.C. Channels	-	70	70
35.	Ay.Dhimitrios	Repairs to channels	-	-	-
36.	Aradhippou	Repairs to Drains etc.	-	-	-
37.	Petra	Widening and deepening Reservoirs bed	525	20	545
38.	Famagusta-Dherinia	Recharge Works: Stage III	-	-	-
39.	Syngrasi	Construction of weirs, channels	1,000	-	1,000
40.	Kouklia (F)	Repairs to Prastion-Kouklia Banks	-	-	-
41.	Yenagra	Channel and earth bank	100	-	100
42.	Nea Dhimmata	Piping and settling tank	-	3	3
43.	Ay.Theodhoros (Larnaca)	River training	-	-	-
44.	Meniko	R.C. Channels and ports	200	50	250
45.	Strongylo	Irrigation canals, improvements	300	-	300
		Totals	4,529	684	5,213

/63.

APPENDIX 8

IRRIGATION SCHEMES IN HAND AT THE END OF 1957

Ser. No.	Location	Nature of Construction	Donums Commanded New Irrigation		
			Winter or Spring	Summer	Total
1	Trimiklini	Construction of a dam	700	100	800
2	Kythrea (Kefalovrysos etc.)	R.C. Channels and Irrigation ports	-	1,000	1,000
3	Ay. Marina	Construction of a dam and piping	700	300	1,000
4	Pyrgos (Tyllirias)	Construction of a dam and R.C.Channels	1,000	600	1,600
5	Morphou (Lekanes-Chain-of-Wells)	Extension of Tunnels	400	32	432
		Totals	2,800	2,032	4,832

APPENDIX 9

IRRIGATION SCHEMES READY FOR CONSTRUCTION AT THE END OF 1957 BUT NOT YET STARTED

Ser. No.	Location	Nature of Construction	Donums Commanded New Irrigation		
			Winter or Spring	Summer	Total
1.	Peristerona (Trehaton Neron Eterias)	Cleaning and repairs to tunnels Lining of channels in R.C.	1,500	-	1,500
2.	Ay.Ioannis (Malounda) (Neron-tou-Khoriou)	Tunnelling and lining of channels in R.C.	800	50	850
3.	Argaka-Magounda III	Construction of a dam piping and channels	1,200	200	1,400
4.	Askas (Pano Ambelia)	Irrigation Tank and Piping	-	12	12
5.	Ay.Epiphanios(Orinis) Parisi)	Irrigation tank and channels	20	14	34
6.	Vouni(Klokkaris)"Palea Vrysi)"	Irrigation tank and piping R.C.channels	- -	12 10	12 10
7.	Phini(Kambitou-Stavrou)	Weir tank and channels	-	68	68
8.	Vikla	Weir, pipes and irrigation tank	135	32	167
9.	Gouphes	Channels and irrigation ports	100	-	100
10.	Sotira	Weir R.C.channels and irrigation tank	300	150	450
11.	Marathounda	Weir, irrigation tank and piping	-	100	100
12.	Potami (Poliati)	Weir, channels and tank	70	22	92
13.	Psevdas	Irrigation ports, culverts	200	-	200
14.	Kalokhorion (Ll)	Repairs and lining of channels	10	5	15
15.	Episkopion (N)	Construction of intake and channels	300	-	300
16.	Krini	Lining of channels in R.C.	200	100	300
		Carried Forward	4,835	775	5,610

Ser. No.	Location	Nature of Construction	Donums Commanded New Irrigation		
			Winter or Spring	Summer	Total
		Brought Forward	4,835	775	5,610
17.	Louroujina (Armyrkos)	Cleaning and lining of chain-of-wells construction of an irrigation tank and channels	-	26	26
18.	Kalopanayiotis Oekos (Pano Gnoudhias)	Irrigation tank	-	26	26
19.	Pera (Phaseron)	Tunnels, cutting R.C. channels	720	-	720
20.	Prodhromos (Kyparisi)	Irrigation tanks	-	14	14
21.	Khalassa (Ypsonas)	Groyne intake and channels	1,000	-	1,000
22.	Ay.Yeorghios (Ll) Kato Pighadhia	Piping	-	18	18
23.	Plataniskia	Lining of channels in R.C.	-	10	10
24.	Kaminaria (Hlios)	Spring and irrigation tank	-	10	10
25.	Prodhromos (Hardji)	Small weir and R.C. channels	-	24	24
26.	Tris Elies (Lakkotis)	Lining of channels in R.C.	-	6	6
27.	Athrakos (Halourakes)	Weir channels and piping	-	24	24
28.	Agros (Pano Vrysia)	Construction of an irrigation tank	-	4	4
29.	Agros (Kato Netikon)	Construction of an irrigation tank and channels	-	6	6
30.	Kyperounda (Kardhama) (Paranga)	Excavation of spring	-	5	5
31.	Ayios Pavlos (Styrakas)	Irrigation tank and channels	-	24	24
32.	Kato Amiandos (Pelendria Chrysovrysi)	Spring, piping irrigation tank	-	21	21
		Carried Forward	6,555	993	7,548

/66.

Ser. No.	Location	Nature of Construction	Donums Commanded New Irrigation		
			Winter or Spring	Summer	Total
		Brought Forward	6,555	993	7,548
33.	Ay.Andronicos (F) (Vrysi)	Lining of channels in R.C.	10	60	70
34.	Polis Chiftlik	Lining of channels in R.C.	-	330	330
35.	Kithasi(Dhiarizos)	Irrigation tank and piping	12	12	24
36.	Pano Archimandrita	Spring and R.C. channels	-	5	5
37.	Meneou (New Mental Hospital)	Tunnels, pumphouse Irrigation tank and piping	-	40	40
38.	Odhou	Lining of channels in R.C.	-	10	10
39.	Mousoulita-Marathovounos (Pedhieos river)	Reformation of banks cleaning and regrading of canal	1,000	-	1,000
40.	Kato-Lakatamia	Chain-of-wells and R.C. channels	400	100	500
41.	Malounda	Tunnels and R.C. channels	80	40	120
42.	Platanistasa	Irrigation tank and channels	-	20	20
43.	Kyra	Groyne intake, overflow spillway Irrigation ports	1,600	-	1,600
44.	Pano Zodhia, Nikitary etc.	Groyne intake, lining of channels in R.C.	4,000	-	4,000
45.	Kambos	Lining of channels in R.C.	-	200	200
46.	Geunyeli-Kanli Yerolakkos	Construction of a weir and channels	1,000	-	1,000
47.	Pano Koutraphas	Groyne intake and channelling	-	160	160
48.	Ay.Trimithias	Intake and channelling	230	-	230
49.	Polystipos	Irrigation tank and channels	-	6	6
50.	Athrakos (Dhimma tou Mylou)	Construction of a weir	-	5	5
		Carried Forward	14,887	1,981	16,868

Ser. No.	Location	Nature of Construction	Donums Commanded New Irrigation		
			Winter or Spring	Summer	Total
		Brought Forward	14,887	1,981	16,868
51.	Platanistasa (Ktoros)	Spring, irrigation tank	-	4	4
52.	Palekhori (Sklidhros)	Construction of a dam and R.C. channels	600	100	700
53.	Lefka (Marathasa)	Construction of a dam and channels and piping	-	500	500
54.	Skylloura	Weirs and canals	800	-	800
55.	Syrianokhori	Lining of channels in R.C.	700	700	1,400
56.	Ay.Theodhoros (Tyllirias)	Small weir and piping	-	4	4
57.	Mora	Channelling, improvement works	600	-	600
58.	Potami	Repairs	-	-	-
59.	Akaki (Merika water)	Repairs to channels etc.	-	-	-
60.	Orounda (Maoutchos)	Extension of tunnels	-	80	80
61.	Galata-Sinaoros (Kappadhouka Ishassou)	Lining of channels in Reinforced Concrete	-	20	20
62.	Lapithos (Koliaridhes)	Spring and channelling	-	12	12
63.	Statos (Akrea)	Spring, irrigation tank and piping	-	30	30
64.	Pomos (Paliambela)	Weir, channels and piping	750	-	750
65.	Evretou-Simou Philousa	Weir, lining of channels in R.C.	-	40	40
66.	Nata-Kholetria (Platania)	Weir and channel	-	35	35
		Carried Forward	18,337	3,506	21,843

/68.

Ser. No.	Location	Nature of Construction	Donums Commanded New Irrigation		
			Winter or Spring	Summer	Total
		Brought Forward	18,337	3,506	21,843
67.	Ay.Nicolaos(P) (Kamushlik)	Irrigation tank repairs, lining of channels in R.C.	15	-	15
68.	Sarama (Vrysino)	Construction of a weir and piping	200	95	295
69.	Phinikas (Xeros River)	Spring, R.C.channels and piping	-	270	270
70.	Marona (Dhiarizos River)	River training works	-	-	-
71.	Terra (Limni)	Pumping scheme	-	24	24
72.	Istinjo (Halassa)	Spring, pipes and R.C. channels	-	25	25
73.	Xeros Co-operative Farming Society	River training works	-	-	-
74.	Akhyritou (Ay.Georghios)	Construction of a dam	500	-	500
75.	Ayios Sozomenos	Groyne intake, lining of channels in R.C.	600	-	600
76.	Peristerona-ri (Karkotis and Marathasa)	Groyne intakes, lining of channels, irrigation ports	800	-	800
77.	Kiti (Kokkines Ammous)	Overflow spillway, channelling	250	-	250
		TOTALS	20,702	3,920	24,622

/69.

APPENDIX 10
TOWN WATER SUPPLIES

by R.S. Wood B.Sc., A.M.I.C.E., M.I.W.E., Senior Engineer

In 1957 the Town Water Supply Section was engaged chiefly upon the construction of the £950,000 Greater Nicosia Scheme. As promised this was brought into partial operation in May 1957 and the Water Board of Nicosia was thereby enabled to avoid restrictions throughout the summer.

The section was also occupied with minor constructions works at Famagusta and at Government House, Nicosia and with planning major extensions for Famagusta, Nicosia and Limassol water supplies. Details are given below under the headings of Construction, Planning and Operation.

CONSTRUCTION

Greater Nicosia Scheme. Five submersible pumps were installed in the boreholes at Kokkini Trimithia and the 100,000 gallon reception reservoir was completed. Three electric centrifugal pumps were fixed to pump the water from the reservoir to the elevated tank at Paleometokho.

The 8 mile pipeline from the elevated tank at Paleometokho to the elevated tank at Engomi was laid in 10" and 12" asbestos cement pipes, and the 10" pipeline was completed from Engomi to connect up with the existing Water Board ring main at Ayii Omoloyitadhes.

Work proceeded throughout the year on the 1.75 million gallon Engomi reservoir. The first compartment was put into service on 6th July and the whole reservoir early in the new year. This reservoir, like most of the others in the Greater Nicosia Scheme, has mass concrete walls and a reinforced concrete slab roof. The water is chlorinated but not filtered or softened.

A turbine pump was installed in each of the three boreholes at Dhali. The reception reservoir of 100,000 gallons capacity was completed and two centrifugal pumps driven by diesel engines were fixed in the adjoining pump house to pump the water to an elevated tank which

/70.

was built on a nearby hill. The 8" pipeline was laid 10 miles from the elevated tank to Lakatamia reservoir, and the one mile 10" and 8" pipeline from Lakatamia reservoir, to Strovolo reservoir was completed. Water was supplied to the Nicosia Water Board through this pipeline on July 22nd.

The first compartment of the 850,000 gallon Lakatamia reservoir was put into use on October 6th. The 8" steel pumping main from Engomi reservoir to Lakatamia was laid and two electric centrifugal pumps installed ready for use to pump water when required from Engomi to Lakatamia reservoir. A stand-by diesel engine was fitted to operate one of these pumps in an emergency.

Three submersible pumps were fixed in the boreholes at Dhikomo, and a switch house and collecting tank built. A 6" steel pipeline was laid from Dhikomo to Sykhari a distance of 5 miles. An 8" pipe was laid in the Sykhari Adit to connect the spring source to a collecting tank which was constructed below the adit. An 8" steel pipe was laid 5 miles from the collecting tank, constructed at the junction of the Sykhari and Dhikomo mains, to Mandres reservoir. These 6" and 8" steel pipelines were coated in asphalt as protection from the probably corrosive soil of the Kythrea beds and liquid asphalt was poured into moulds round the joints to complete the coating after the pipes were laid.

By the end of the year the first compartment of the 850,000 gallon Mandres reservoir was filled and a 12" spun iron pipeline laid from Mandres reservoir to the new ring main at Omorphita Byepass, a distance of 2 miles.

The first section of the 12" iron ring main from Engomi reservoir to Ayios Dhometios was laid by June 7th and a regular supply was given to the village water tank from that date. The ring main from Engomi to the connection with the existing Water Board ring main at Pallouriotissa was completed in November.

Pipe trenches were excavated by trencher and traxcavator. A traxcavator prepared a temporary track for the lorries to deliver the pipes to the site along

the pipeline and a traxcavator or small bulldozer prepared the pipeline for the Allen trencher, which followed behind and excavated the trench where possible. When the pipes were 10" to 12" diameter and heavy in weight a traxcavator, which had been fitted with special hooks on the bucket, was used to unload the lorries and lower the pipes into the trenches. Where the pipeline ran along a road a mobile Neal crane was used instead of a traxcavator for unloading and lowering the pipes. Compressors had to be used for trench excavation in some areas, chiefly on the pipelines from Dhikomo to Sykhari and Kokkini Trimithia to Engomi.

Laying pipes for the distribution system commenced in October and by the end of the year five gangs were working in the Trakhona and Ayios Dhometios districts, and three compressors were in operation excavating trenches in the higher rocky area of Strovolo district.

Famagusta Emergency Scheme. In mid summer when water restrictions were in force in Famagusta, the Board was offered three boreholes in the Ayios Loucas area not required by the Army. A scheme was prepared and constructed ready for operation by the end of November. Three submersible pumps were fixed in the boreholes and 3" steel rising mains laid to a steel tank, erected on the roof of an existing building. A switch room, chlorination room and store were constructed in the building and a 4" main laid from the tank to connect up with the existing distribution system. This supply will make available a further 70,000 gallons per day for distribution in this area, where previously only a restricted supply was available in the summer months.

Government House Water Supply. An alternative water supply system for Government House and the surrounding Government residences was constructed to supply water from the Government boreholes at the Secretariat, in case of a breakdown of the Water Board supply. A 20,000 gallon reinforced concrete tank was constructed in the Secretariat compound into which the existing submersible pumps can discharge. Two electric centrifugal pumps were installed to pump the water through a new 4" pipeline laid to two

similar tanks constructed near Government House. Distribution pipes were laid from these tanks to connect up with the existing distribution system.

PLANNING

Famagusta Scheme 1956. The 10 mile pipeline 15" diameter from Xylophagou and Liopetri to the proposed new reservoir at Kato Varosha, Famagusta was surveyed in detail, and sections were prepared. Similar plans were prepared for 6 miles of pumping mains and auxiliary pipelines of 6" to 12" diameter. The design of the reservoir was also completed. It is to be built of mass concrete walls and reinforced concrete main beams and roof slab. The design is similar to the Greater Nicosia scheme reservoirs so that the same shuttering may be used. The capacity will be 1 million gallons. Plans include a 55 foot high elevated tank of 4,800 gallons at Xylophagou and a 10,000 gallon reinforced concrete tank near Liopetri.

Panayia Pipeline, Famagusta. A route for the proposed Panayia pipeline from Panayia spring to Famagusta has been surveyed, levels taken and sections prepared. The pipeline is to be laid in 8" and 6" asbestos cement pipes and will take the place of the existing old Venetian masonry aqueduct which has become blocked by roots, leaks at several places, and allows the water to be contaminated through open joints in the covering slabs. The new pipeline is 9½ miles long and will approximately follow the line of the aqueduct, except at certain sections where the aqueduct deviates round the contours.

Morphou Bay Scheme, Nicosia Water Supply. A scheme was prepared for the installation of submersible pumps in 14 boreholes at Syrianokhori and for laying steel pumping mains from the boreholes to a reception reservoir in the area, which is included in the Morphou Bay scheme of water supply to Nicosia. Orders have been placed for the pumps and pipes. The Morphou Bay scheme includes the construction of a reservoir and pumphouse at Syrianokhori and laying a 16" steel pumping main from this reservoir to Engomi reservoir, a distance of 24 miles. Messrs. Howard Humphreys and Sons are the consultants for the main pumping station and pumping main.

Limassol Water Supply. To supplement the Limassol water supply a preliminary scheme has been prepared to install submersible pumps in 5 boreholes in the Phassouri district and to pump the water direct into the existing main which brings the water from the springs to the reservoir at Limassol. This pipeline passes within two miles of the boreholes and has sufficient capacity to take the water from the boreholes in summer when the springs are low.

OPERATION

Greater Nicosia Water Supply. Water has been supplied to Nicosia Water Board and Ayios Dhometios village since May from pumps operating at Kokkini Trimithia, Paleometokho and Dhali. The water has been chiefly supplied from the Kokkini Trimithia district. The Dhali supply was tried out for a short period in July and was in operation from September to November. The bulk of the water supplied through the pipeline from Kokkini Trimithia came from the private boreholes owned by Mr. Charalambous, and some of this water was pumped for the Board from Kokkini Trimithia reservoir to the elevated tank at Paleometokho. The water supplied from Engomi reservoir was chlorinated at the reservoir and the supply from Dhali at Strovolo reservoir by the Water Board.

Government Water Supplies. The Department continued to operate the Government waterworks, which supplied an average in July of 125,000 gallons per day to Government residences, offices and institutions. All meters on these supplies, and on the domestic supplies from the Water Board to Government residences, are read regularly and recorded. 156 meters have been tested in the year for Government water supplies, Water Boards and Evcaf and 44 meters have been repaired.

Water Boards. The water Boards of Nicosia, Famagusta and Limassol have been advised on technical matters and Board meetings have been regularly attended by the Senior Engineer (Town Water Supplies).

APPENDIX 11

TOWN WATER CONSUMPTION, SUMMER 1957

QUANTITY SUPPLIED AT SOURCE IN GALLONS PER HEAD PER DAY.

Town	Estimated population	June g.h.d.	July g.h.d.	August g.h.d.	September g.h.d.
Nicosia (Water Board and Water Commission)	64,000	*33.5	*38.4	*34.6	*33.0
Limassol	37,000	36.6	38.0	36.4	33.6
Famagusta	27,000	*37.0	*36.4	*35.5	*32.8
Larnaca	18,000	*41.3	*40.5	*37.2	36.9

* Restricted supplies see notes below:

Notes

1. The population figures are taken from "Population Estimates October 1956" published by the Statistics Section of Financial Secretary's Office, Nicosia. In the case of Nicosia the population in the part of the Water Board area outside the Municipality is estimated by this Department. Unless otherwise stated the quantity of water supplies is measured by meter at source.

2. Nicosia. The water is mostly measured by meter at source but the Sykhari and lower Arab Ahmed water is measured by gauging. Within the town walls, in the low pressure area supplied by the Nicosia Water Commission, water was turned on for only 6 hours per day throughout the period under review and these restrictions caused a very low consumption in the area affected. The Nicosia Water Board imposed no restrictions on the area it supplies, which is outside the town walls. In that part of the town the population is about 37,000 and the consumption of the order of 40 to 45 g.h.d.

3. Limassol. The water supplied is measured by meter at the outlet of the reservoir and an allowance of 3% is added for losses in the supply pipelines from the springs to the reservoir. There were no prolonged restrictions in 1957.

4. Famagusta. Measured by meter at source. Restrictions were imposed from June 25th to November 4th and during this period the water supply was cut off each night from 11 p.m. to 5 a.m. Water sold to ships amounted to an average of about 1.0 g.h.d.

5. Larnaca. The water supplied is measured by gauging at source and 9% is deducted for water supplied by saccoraphi for irrigation of plantations and farms. The water was cut off for 6 hours per day from May to November.

APPENDIX 12

DATA CONCERNING TOWN WATER SUPPLIES

	Nicosia*	Limassol	Famagusta	Larnaca
(a) Sources in regular use, Nos. ...	29*+	3	9	1
(b) Sources for emergency use Nos. ...	5•	1	6	0
(c) Capacity of sources in an average summer m.g.d. ...	2.40	1.00	1.00	1.00
(d) Main reservoir capacity, m.g.	4.2	0.80	0.70	Nil
(e) Supply mains, miles	48	18	13	3.5
(f) Distribution mains, miles ...	119	61.5	65	25
(g) Pumps in regular use on wells or boreholes	6473	7225	6295	919
(i) Saccoraphia connections (domestic)	3128	-	-	1336
(j) Hydrants - Nos.	626	380	404	21

* Excludes works of former private water companies which only supply about 4% of the total water.

\+ Includes 10 boreholes at Kokkini Trimithia owned by Mr. Charalambous. In May under a new agreement Mr. Charalambous undertook to supply Nicosia Water Board with a maximum of 3 million gallons per day and minimum of 600,000 g.p.d.

• Includes 3 boreholes owned by Mr. Charalambous.

m.g.d. = million gallons per day.

m.g. = million gallons.

APPENDIX 13

DESCRIPTION OF CERTAIN VILLAGE WATER SUPPLIES
by C.G. Papadakis, Senior Inspector of Works

(A) Yialousa

This is a pumping scheme in which the source of supply is from boreholes drilled east of Ayios Andronikos village.

Before execution of this scheme, Yialousa derived its supply from two chains-of-wells on the outskirts of the village and the water was distributed at 2 central storage tanks fitted with taps. The yield of the chains-of-wells proved, year after year, less adequate to meet the increasing demands of an expanding population ever seeking a higher standard of living. The inhabitants, quite naturally, became more and more anxious to have an abundant and efficient supply with house connections. All efforts made to secure a supplementary gravity supply failed due to the absence of suitable springs in the area but fortunately a convenient underground source was located in the neighbourhood. Prospecting drilling by the department in the Akrades State Forest basin east of Ayios Andronikos, and test-pumpings, proved the presence of a rich underground aquifer which could more than meet the domestic needs of Yialousa. The neighbouring village of Ayia Trias has now asked for participation in the scheme in the future.

The scheme comprises pumping installations, service reservoirs and a new distribution system. Two pumping units each consisting of one deepwell turbine pump of 10,000 gallons per hour capacity and a 21 H.P. Diesel engine work alternately and pump water from two adjacent boreholes drilled 6 ft. apart, into a 30,000 gallons balancing tank constructed nearby. Two other pumping units each consisting of a 10,000 g.p.h. centrifugal pump and a 40 H.P. Diesel engine also work alternately and pump the water from the balancing tank through a 6" steel pumping main, 5,000 ft. long, against a head of 230 feet, into a distribution box superimposed on a 20,000 gallons storage tank constructed on the escarpment at "Ayia Solomoni" locality. All four pumping units are accommodated in a

/78.

common engine/pumphouse built over the two boreholes. In future the water will be divided through the distribution box between Yialousa and Ayia Trias in proportion to their population.

From the distribution box the water flows directly into the 20,000 gallons storage tanks. Part of the water is distributed to the upper quarters of the village through an independent system while the remaining quantity is conveyed, in a 4" G.I. pipeline 3000 ft. long, into a second storage tank of 30,000 gallons capacity which is also used to store the flow from the chains-of-wells. An independent system fed from this storage tank serving the lower quarters of the village. Nineteen new public fountains, 5 in the upper and fourteen in the lower system, were constructed at selected sites and about 24 miles of galvanised iron pipes ranging from 1" to 4" in diameter were laid in all. The reticulation mains in both systems are designed to allow direct house connections.

Work commenced in July 1957 and the scheme would have been completed by the end of the year had the village not asked meantime for certain minor extensions. These extensions are expected to be completed early in 1958.

The cost of the work is £40,700 or £13.6 per person of the 1957 population estimated at about 3,000.

(B) Sellain T'Appi - Ayios Theodhoros - Mosphilleri - Mansoura.

This is a combined gravity scheme serving the four neighbouring villages of Sellain T'Appi, Ayios Theodhoros, Mosphilleri and Mansoura in the Tylliria area. The source of supply known as "Teratsia" is situated in the Paphos State Forest about 2 miles south of the old Livadhi village. This village, whose inhabitants used the flow of this spring for irrigation purposes until 1953, was moved by the Forest Department to a new site near Morphou in that year. Since then the water of the "Teratsia" spring has been running to waste because, due to evaporation and transpiration

losses, its flow in summer time never reached the nearest cultivable area which is about 10 miles further downstream.

The spring was developed and about 75% of its minimum flow, amounting to 21,000 gallons per day, is piped through a composite pipeline (26,000 ft. of 2" diameter 8,000 ft. of 1½" and 8,000 ft. of 1¼), laid across precipitous and densely wooded country, to a distribution box near Sellain T'Appi. The share of water of this village flows directly into a nearby 2,000 gallons storage tank while the shares of the other 3 villages is conveyed through a common pipeline, 5,000 ft. long x 1¼" diameter to a second distribution box at the locality "Athkiadjia". Here the pipeline bifurcates and one branch, consisting of 6,500 ft. of 1" diameter conveys the share of Ayios Theodhoros to the village while the other branch, consisting of 9,000 ft. of 1½" conveys the share of Mosphilleri and Mansoura as far as a third distribution box superimposed on the storage tank of the former village. The share of Mansoura is piped to the village in an independent pipeline of 5,000 ft. of 1" diameter. The water in each village is distributed through a system of storage tanks and street fountains. Four storage tanks each of 2,000 gallons capacity and 42 fountains were constructed in all.

The most difficult task in the execution of the scheme was the transport of pipes. This was accomplished on mules and/or on men's shoulder from the nearest roadside across precipitous and mountainous country to the site of the work. Labour was not available locally and had to be transported to and from work by lorry daily. Security operations in the area also necessitated frequent stoppages of work.

The scheme was put in hand in January 1957 and completed in July 1957. The total cost of the work was £18.500 or £30.8 per person of the combined population of the four villages, now assumed at 600. The share per capita of the supply is 35 gallons per day. Because of the poor financial standing of the four villages their shares in the cost of the scheme was reduced from the normal one-half to one-fourth.

(C) Peristerona (Paphos).

This is another pumping scheme. Before its execution the inhabitants used to obtain their domestic water from a spring situated in the outskirts of the village and at a level too low to allow a gravity supply.

The flow of the spring is collected in a 10,000 gallons storage tank constructed nearby. A pumping unit, consisting of 4,000 g.p.h. centrifugal pump and a 6 H.P. Lister Diesel engine, is housed in a common masonry engine/ pump-house close to the tank and pumps the water through 400 ft. of 3" pumping main into a second 10,000 gallons storage tank constructed at a site commanding the whole village. The distribution of the water in the village is effected by means of 8 public fountains erected at selected sites.

The cost of the works was £3,600 or £9 per person of the village population now assumed at 400. The per capita share of water made available by the scheme is 20 gallons per day. Work was put in hand in September, 1957, and completed in November, 1957.

APPENDIX 14

NUMBER AND PERCENTAGE OF VILLAGES WITH PIPED DOMESTIC WATER

31st December, 1957.

District	Villages with piped water			Villages with no piped water		Total Villages
	Satisfactory	Needing Improvement	Total			
	No.	No.	No.	No.	%	No.
Nicosia	114	18	132	44	25	176
Larnaca	46	4	50	9	15	59
Limassol	86	16	102	11	10	113
Famagusta	54	12	66	32	33	98
Paphos	102	20	122	12	9	134
Kyrenia	27	12	39	8	17	47
Totals	429	82	511	116	19	627
Percentage	68	13	81	19	19	100

Note: The above figures were obtained from a new survey and they do not correspond with others given in the annual reports of former years. Some supplies that were formerly satisfactory, are now considered to be unsatisfactory, because, with an expanded population and higher standards of living, more water and more facilities are required.

APPENDIX 15

VILLAGE WATER SUPPLY SCHEMES COMPLETED IN 1957.

No.	Village	District	Nature of Work	Date of completion
1	Vouno	Kyrenia	∠	2nd January
2	Alassa	Limassol	∠≡	12th "
3	Yerovasa	"	∠≡	17th "
4	Livadhia	Larnaca	∠	23rd "
5	Mamoundali	Paphos	∠	1st February
6	Karavas	Kyrenia	∠	1st "
7	Yenagra	Famagusta	*	4th "
8	Dhali	Nicosia	∠	16th "
9	Aphania	Famagusta	*	21st "
10	Dhiorios	Kyrenia	∠	21st "
11	Ornithi	Famagusta	*	21st "
12	Anadhiou	Paphos	∠	13th March
13	Korakou	Nicosia	∠	19th "
14	Malounda	Paphos	∠	2nd April
15	Marathovounos	Famagusta	∠	5th "
16	Pomos	Paphos	∠	13th "
17	Monarga	Famagusta	*	17th May
18	Knodhara	"	∠	30th May
19	Katokopia	Nicosia	∠	1st June
20	Mansoura	"	*	2nd "
21	Topsu Keuy	Famagusta	∠	5th "
22	Saramas	Paphos	∠	22nd "
23	Ay.Theodhoros (Tyllirias)	Nicosia	*	22nd "
24	Episkopi	Limassol	∠	2nd July
25	Mosphili	Nicosia	*	10th "
26	Asha	Famagusta	∠	11th "
27	Platanistasa	Nicosia	∠	13th "
28	Lyso	Paphos	∠	13th "
29	Kophinou	Larnaca	∠	16th "
30	Sellain t'Appi	Nicosia	*	18th "
31	Klepini	Kyrenia	∠	4th August
32	Skarinou	Larnaca	∠	13th "
33	Dhromolaxia	"	∠	24th "
34	Ay.Tykhonas	Limassol	∠	7th September
35	Pyrga	Famagusta	*	10th "
36	Aghirda	Kyrenia	∠	14th October
37	Galatia	Famagusta	∠	18th "
38	Alona	Nicosia	∠	24th "
39	Ay.Khariton	Famagusta	∠	30th "
40	Akhna	"	∠≡	30th "
41	Aradhippou	Larnaca	∠	5th November
42	Kotchati	Nicosia	*	5th "
43	Moutayiaka	Limassol	∠	5th "
44	Lemona	Paphos	∠≡	6th "
45	Peristerona	"	∠	14th "
46	Goshi	Larnaca	∠≡	16th December
47	Pergamos	"	∠≡	22nd "
48	Petra	Nicosia	∠	23rd "
49	Elea	"	∠	31st "
50	Kritou Terra	Paphos	∠	31st "
51	Terra	"	∠	31st "

* New scheme where previously there was no piped supply
∠ Replacement or improvement of an old supply
∠≡ Water supply to schools and Police Stations.

/83.

APPENDIX 16
VILLAGE WATER SUPPLY SCHEMES IN HAND AT THE END OF 1957

Serial No.	Village	Serial No.	Village
1	Alekhtora	8	Skarinou
2	Melousha	9	Ay.Theodhoros (F)
3	Ay. Ioannis (Selemani)	10	Yialousa
4	Ammadhies	11	Gourri
5	Limnitis	12	Lazania
6	K. Zodhia	13	Polis
7	P. & K. Dhikomo	14	Pyroi

APPENDIX 17

VILLAGE WATER SUPPLY SCHEMES READY FOR CONSTRUCTION AT THE END OF 1957

Serial No.	Village	Serial No.	Village
1	Ghaziveran	6	Ambelikou
2	Khirokitia	7	Mitsero
3	Arsos (L)	8	Sykhari
4	Mallia	9	Ay. Ermolaos
5	K. Akourdalia		
Nos. 1-9 have already provided their shares in the cost of the work.			
10	Argaka	12	Miliou
11	Magounda	13	Paleosophos
Nos. 10-13 have applied for loan			
14	Analiondas	53	Bey Keuy
15	Ay. Trimithias	54	Epikho
16	Paleometokho	55	Moutoullas
17	Tymbou	56	Kambos
18	Kambia	57	Mammari
19	Kokkinotrimithia	58	Skylloura
20	Mathiatis	59	P.Zodhia
21	Orounda	60	Alithinou
22	Psomolophou	61	Varisha
23	Xeri	62	Argaki
24	Apliki	63	Ay. Vasilios
25	Aredhiou	64	Ay. Yeorghios (Kafkallou)
26	Palekhori (Orinis)	65	Dhali
27	Ay. Sozomenos	66	Kalopanayiotis
28	Kalokhorio (Kapouti)	67	Phterykoudhi
29	Katydhata	68	Mora
30	Lagoudhera	69	Evrykhou
31	Loutros	70	Dhenia
32	Askas	71	Tembria
33	Mandres	72	Astromeritis
34	Masari	73	Karavostasi
35	Ay.Marina (Skyllouras)	74	Kalokhorio (Lefkas)
36	Yerolakkos	75	Ay. Nicolaos (Lefkas)
37	Eliophotes	76	Peristeronari
38	Kythrea	77	Pendayia
39	Lythrodhondas	78	Ay. Irini (K'nia)
40	Kakopetria	79	Ay. Epiktitos
41	Piyenia	80	Ay. Yeorghios (K'nia)
42	Spilia	81	Karpasha
43	P. Pyrgos	82	Myrtou
44	Kato Zodhia	83	Kazaphani
45	Galini	84	Kormakitis
46	Pakhyammos	85	Vasilia
47	Milikouri	86	Kremmama Kamilou
48	Palekythro	87	Sisklipos
49	Neokhorio	88	Trapeza
50	Trakhoni	89	Larnaca-tis-Lapithou
51	Exometokhi	90	Kalogrea
52	Voni	91	Ay. Amvrosios (K'nia)

Serial No.	Village	Serial No.	Village
92	Vouno	147	Livadhia
93	Kondemenos	148	K. Lefkara
94	Orga	149	Delikipos
95	Photta	150	Klavdhia
96	Pileri	151	Petrophani
97	Ay. Trias	152	Psematismenos
98	Vokolidha	153	K. Polemidhia
99	Livadhia (F)	154	P. Polemidhia
100	Tavros	155	Ypsonas
101	Akhna	156	Kaminaria
102	Styllos	157	Dhymes
103	Engomi	158	Kalokhorio (Ll)
104	Paralimni	159	Mesayitonia
105	Lysi	160	Mandria
106	Koma-tou-Yialou	161	Lophos
107	Gastria	162	Pakhna
108	Patriki	163	Phasoula (Ll)
109	Dherinia	164	Plataniskia
110	Strongylos	165	Potamiou
111	Prastio (F)	166	Sotira
112	Trypimeni	167	Vasa (Kilani)
113	Yerani	168	Yerasa
114	Ay. Efstathios	169	Silikou
115	Phrenaros	170	Apsiou
116	Aphania	171	Pendakomo
117	Psillatos	172	Vasa (Limassol)
118	Vitsadha	173	Ay. Dhimitrios
119	Monarga	174	Dhora
120	Makrasyka	175	Evdhimou
121	Akanthou	176	Ay. Ioannis Agros
122	Galatia	177	Kyperounda
123	Ay. Symeon	178	Kilani
124	Neta	179	Prodhromos
125	Korovia	180	K. Amiandos
126	Galinoporni	181	Ay. Yeorghios (Ll)
127	Avdhellero	182	Kolossi
128	Troulli	183	Yermasoyia
129	Tersephanou	184	Ay. Therapon
130	Anaphotia	185	Mathikoloni
131	Kivisil	186	Tris Elies
132	Odhou	187	Asgata
133	Zyyi	188	Akrotiri
134	Alethriko	189	Arsos (Ll)
135	Maroni	190	Dhoros
136	Tokhni	191	Monagri
137	Anglissides	192	Lania
138	Voroklini	193	Trimiklini
139	K. Dhrys	194	Lemythou
140	Ayii Vavatsinias	195	P. Arkhimandrita
141	Athienou	196	K. Arkhimandrita
142	Kalavasos	197	Khlorakas
143	Xylophagou	198	Ay. Marinoudha
144	Alaminos	199	Tala
145	Tremetousha	200	Marathounda
146	Kellia	201	Trakhypedhoula

Serial No.	Village	Serial No.	Village
202	Kallepia	220	Lemba
203	Timi	221	Amargeti
204	Nata	222	Kili
205	Maronas	223	Pomos
206	Armou	224	Kilinia
207	Anavargos	225	Kholetria
208	Mesakhorio	226	Kedhares
209	Khrysokhou	227	P. Arodhes
210	Akoursos	228	Steni
211	Skoulli	229	Dhrymou
212	Kissonerga	230	Letymbou
213	Stroumbi	231	Tsadha
214	Vretcha	232	Kathikas
215	Lasa	233	Kouklia
216	Inia	234	Mandria
217	Salamiou	235	Goudhi
218	Trimithousa	236	Ay. Yeorghios (P)
219	Emba	237	Pitargou

APPENDIX 18.
MECHANICAL PLANT
(as on 31/12/57)

		No.
(A) MOBILE PLANT:	Ruston Bucyrus drilling rigs 22W ...	11
	" " " " 33W ...	1
	" " " " 60RL ...	1
	Edeco drilling rigs ...	3
	Cheshire earth boring machine ...	1
	Allen Trencher, 12"21 ...	2
	Aveling-Barford Trencher ...	1
	Caterpillar Traxcavators 955 ...	3
	" " HT4 ...	1
	Caterpillar Bulldozer, D2 ...	1
	Ruston Bucyrus Excavator, RB10 ...	1
	Compressors ...	11
	Morrison diesel alternator on trailer for use with electro-submersible pumps	2
	Turbine deep-well test pumping units	2
	Plunger deep-well test pumping units	2
	Centrifugal pumping units ...	4
	Portable works pumps ...	17
	Sheepsfoot roller ...	1
	Cranes ...	2
	Hoists ...	3
	Concrete Mixers ...	27
	Vibrators ...	12
	Low Loader ...	1
	Austin Countryman Vans ...	6
	Land Rovers ...	6
	Light Lorry - 15 cwt. Morris ...	1
	Thorneycroft Tractive Unit for Low Loader ...	1

/88.

(B) WORKSHOP

		No.
PLANT:-	Lathes ...	5
	Shaping Machine ...	2
	Screwing Machine ...	1
	Drilling Machine ...	3
	Planing Machine (timber) ...	1
	Bandsaw (timber) ...	1
	Bar Bender ...	1
	Bar Cutter ...	1
	Electric Welders ...	3
	Forges ...	2
	Pipe slotting machine, oxy-acetyline	1
	Vibrating table ...	1
	Water meter testing plant ...	1
	Concrete block making machines	2
	Concrete testing machine ...	1
	Compressors Air (Tecalemit)...	1
	Milling machine ...	1