No. COPP/WUP/1964/4

REPORT
ON
PTIMUM UTILISATION OF IRRIGATION POTENTIAL

LOWER BHAWANI PROJECT
(Madras State)

GOVERNMENT OF INDIA
MMITTEE ON PLAN PROJECTS
(Water Utilisation Panel)
NEW DELHI
July, 1964

PREFACE

The Natural Resources Division of the Planning Commission through Its Technical Committee on Water, entrusted the Committee on Plan Projects the study of some selected projects, regarding optimum utilisation of irrigation supplies.

The Committee on Plan Projects vide its letter No. COPP/(4)/2/62 dated 2nd August, 1962 set up a Panel under the Chairmanship of Dr. A. N. Khosla, then Leader of Irrigation and Power Team, for conducting such studies. Later, this Panel was re-constituted with effect from 1st August, 1963 as indicated below:—

1. Shri M. Thirumala Rao, M.P., Leader, Irrigation Team.	Chairman
2. Shri Baleshwar Nath, Member, Irrigation & Power Team, COPP	Member
3. Dr. Arjan Singh, Member, Irrigation Team, COPP.	Member
4. Shri B. S. Mal, Superintending Engineer, COPP.	Member-Secy.

Shri M. P. Mathrani, Consultant, Irrigation Team was also appointed as non-official member of the Utilisation Panel with effect from 2nd January, 1964.

This is the fourth report of the Panel and pertains to the study of the Lower Bhavani Reservoir and Canal Project of Madras State. It aims primarily at a resource study dealing with two main aspects namely:—

(a) investigation of causes for variation between the targets and actual performance, if any, and suggestions of appropriate corrective measures to achieve targets as planned.

(b) Indication of the extent to which the targets could be improved upon by ensuring optimum utilisation of water and the measures necessary for the purpose as also the extent to which the resources could be augmented.

The study also touches upon other ancillary features of the project, which have a bearing on the utilisation of project potential as indicated in Planning Commission Circular No. 10/55/62-Plan dated 3rd February, 1964.

The Panel had the benefit of inspecting at site varying aspects of the project and of field discussions with the State authorities at different levels during the course of their study. The State Government is already taking notice of short comings in proper utilisation of the project potential. This report, it is hoped, will prove useful to the State authorities not only in improving utilisation of irrigation supply on Lower Bhavani Canals Project, but also in the operation of other similar dry-crop irrigation projects in low rainfall region of the State.

Thanks are due to the officers of the State Government, who co-operated with the Panel and provided necessary data, as well as, facilities for inspection and site studies.

CONTENTS

The Comments of the State authorities on the Report will be published separately when received.

Salient points emerging out of the study for Optimum Utilisation of water on Lower Bhavani Canal Project (Madras State).

1. On Lower Bhavani Project, the envisaged pattern of dry crop farming of over 2 lakh acres (Approximately 1 lakh acre cotton plus 1 lakh groundnut and millets) has got vitiated to paddy farming, needing almost double the quantity of water likely to be available in normal years, thus resulting in an unstable agricultural development of the areas commanded besides denying benefit of irrigation to some sectors of the command.

2. Even in years of above normal supply over-all economic gain through intensive paddy farming does not match upto what can be achieved, in a low rainfall region like Lower Bhavani Project command, through dry crop pattern as originally envisaged in the project *i.e.* cotton, millets, groundnuts, with only a limited acreage say 10,000 acres of paddy in low lying areas.

3. The zonal system introduced in 1959 is a paddy promoting plan and will fail to deliver the goods in normal years, as has happened in the current year 1963-64, and needs to be replaced by a rational and dependable system as out-lined in para 4 below.

4. A system of intermittent running with a time span of $10\frac{1}{2}$ days needs to be given a trial, as it will not attract paddy farming and will also lead, to equitable dispersal of irrigation benefits over the entire commanded area of Lower Bhavani Project.

CHAPTER—1

BASIC DATA

Introduction

1.1. Lower Bhawani Project has been selected for a study with regards to its Optimum Water Utilisation as a representative plan-period scheme of Southern Region. The aims of the study are :—

(a) Investigation of causes for variation between the targets and actual performance and suggestion of appropriate corrective measures to achieve the planned targets.

(b) Indication of the extent to which the targets could be improved upon by ensuring optimum utilisation of water and the measures necessary for the purpose as also the extent to which the resources could be augmented.

Brief History

1.2. Bhawani river originates from Nilgiri Hills and is a tributary of Cauvery. The idea of utilising the Bhawani river water for irrigation originated as far back as 1834 and it took the form of a scheme in 1866. The scheme was considered and shelved several times for one reason or the other till it emerged in 1932 more or less in the shape of the present project *viz.* a reservoir with a dam across the River Bhawani (just below its confluence with Moyar) and a contour canal taking off from the reservoir to irrigate an ayacut of over 2 lacs acres.

The major portion of the canal command lies in the district of Coimbatore (Gobichetti Palyam, Erode and Dharapuram talukas) and some part of the district Tiruchirapalli (Karur Taluka) of Madras State. The dam site is 22 miles from Mattupalyam broad gauge railway terminus and 9 miles up-stream of Satyamanglam town.

The project after some verifications was eventually sanctioned in 1947 for Rs. 7·0 crores. Later on due to extension of the canal length, the project cost was estimated to go up to about Rs. 9·3 crores. The work on the project was started in 1948 and completed in 1956 and the entire system thrown open for irrigation by September, 1956.

The map at *Appendix I* shows the project area and its distribution system.

Proposed cropping and its water requirements

1.7. The project envisaged that the entire ayacut of 207000 acres will normally receive irrigation for one crop every year. It was anticipated that 10,000 acres lying in the hallows and valleys will come under paddy and of the remaining 197000 acres, 50% will be sown with irrigated dry rotation crops e.g. groundnuts and millets etc. and the other half with cotton. The period of supply was suggested to be from early September to middle of March but cutting off the supply during North-East monsoon period for 1½ months from middle of October to end of November.

The depth of irrigation required for cotton was assumed to be 30" inclusive of rainfall. The requirements of dry crops like groundnuts and cereals etc. was estimated to be about 20 inches. But as this dry crop was to be intermixed with cotton and 10,000 acres of paddy the overall water requirements were based on a depth of 30" or 6" per month including rainfall *i.e.* 195 m. cft. per day including rainfall and loss in transmission which worked out to about 33-1/3 % of the field requirements.

Water Availability

1.8. Three small canals take off from Bhawani River below the Bhawani Sagar Dam. Their commands are shown separately on the enclosed index map. These are Todapalli and Arekkankottai channels taking off from above the Kodiveri Anicut and Kalingurayam channel taking off above another anicut of the same name. These anicuts and channels are several centuries old and areas commanded by them have prior prescriptive claim on the natural flow of the river to the extent of average supply they were actually drawing during each fortnight of the year prior to the construction of the Dam.

Figures of daily surplus of the Bhawani over the Kodiveri anicut (16 miles below the Dam Site) are reported to be available for a long number of pre-project years. The daily surplus over the Kodiveri anicut less the requirement of Kalingarayam channel was presumed to be the quantity available for storage in the reservoir. The project mentions that the working-tables of the Bhawani Sagar Reservoir were prepared for 27 years (1916 to 1942) which showed that the full area proposed under Bhawani Project could have been irrigated only in 16 years out of the 27 years. In the remaining 11 years the ayacut could have been irrigated only partially in 7 years and practically no irrigation would have been possible in the worst 4 years. The average expected irrigation for the 27 years examined was only 170,000 acres. These working tables are not printed in the project volumes and could not be procured for scrutiny.

Regulation of Supplies

1.9. The project envisaged alternate running the sluices on what is locally known as "Intermittent System". For this purpose the ayacut was divided

into I and II turns *i.e.* all the ayacut fed by sluices under odd miles as "I turn" and that under even miles sluices as "II turn" with slight adjustments to get the ayacut equalised in both the turns.

Each turn was to extend over 5½ days so that every field on a sluice was to receive one irrigation of 2" depth at sluice head once in 10½ days while the canal and the distributaries were to run continuously from September to middle of March with a break of 1½ months, middle of October to end of November. With this 10½ days rotation each cultivator was to get his supply in night and day in alternate turns. The canal and major channels were designed on a field duty of 120 acres per cusec while the outlet sluices and small minors (to run in rotation) were based on a duty of 60 only.

Project Yield

1.10. The crop yield from the project in a year of normal supply of irrigation water was anticipated to be of the order of about 30,000 tons of millets etc. and 40,000 tons of unginned cotton, with possibilities of further 60% increase in millets in a year of plentiful water supply when two crops of millets could be raised.

Water rates and Assessment System

1.11. The recording of irrigations and assessment of water rates is done by Revenue Department. The present water rates are:—

Paddy	Rs. 15·00 an acre
Cotton	Rs. 20·00 an acre
Millets	Rs. 7.05 an acre
Other Crops	Rs. 12·50 an acre

Any area remaining uncultivated within the localised ayacut is assessed at the minimum rate of Rs. 7·50 an acre.

Betterment Tax and Financial Forecast

1.12. The project provided for levy of a betterment tax of Rs. 100/- per acre on the area included in the ayacut. The amount was expected to be recovered before the completion of the project. The project was expected to yield a financial return of 4% in the 9th year from the start of construction or 3 years after the completion of the construction.

CHAPTER—II

PERFORMANCE PICTURE

Inflow into Bhawani Sagar

2.1. The statement at *Appendix III* contains the total yearly inflows (1934-35 to 1962-63) of river Bhawani at the Dam site. Month-wise break-up of these inflows for the year 1953-54 to 1962-63 are given at *Appendix* III-A.

Appendix IV contains figures of yearly total escapage below the dam since 1954-55 and its break-up by the supplies passed into the three old canals and the net surplus.

A study of the statement at *Appendix III* shows that the inflow from the catchment has large variations, minimum being only 50,011 m. cft. (1935-36) and the maximum 1,98,828 m. cft. (1959-60). The requirement of old Bhawani Channels as per regulation rules are shown as 33,497 m. cft. The annual evaporation losses from the reservoir on the basis of actuals, vide statement at *Appendix V*, are of the order of 3,500 m. cft. Assuming that no escapage becomes necessary because of over-flowing and escapage, the storage that could have been available for utilisation in the canal during the past 29 years would have been as below (worked out by deducting 33, 497+3,500 say 37,000 m.cft. from the inflows given in *Appendix III*):—

1934-35	14730 m. cft.
1935-36	13011 m. cft.
1936-37	40100 m. cft.
1937-38	35249 m. cft.
1938-39	15073 m. cft.
1939-40	49000 m. cft.
1940-41	67107 m. cft.
1941-42	58925 m. cft.
1942-43	43588 m. cft.
1943-44	48399 m. cft.
1944-45	39049 m. cft.
1945-46	23592 m. cft.
1946-47	77697 m. cft.
1947-48	34692 m. cft.
1948-49	54582 m cft.

1949-50	27660 m. cft.
1950-51	32799 m. cft.
1951-52	35273 m. cft.
1952-53	43000 m. cft.
1953-54	41644 m. cft.
1954-55	36669 m. cft.
1955-56	33687 m. cft.
1956-57	31857 m. cft.
1957-58	58536 m. cft.
1958-59	36140 m. cft.
1959-60	82823 m. cft.
1960-61	47053 m. cft.
1961-62	110568 m. cft.
1962-63	77317 m. cft.

In order of magnitude the year 1955-56 is 22nd from top *i.e.* the supply available in this year *viz.* 33,687 m. cft. has 75% dependability. According to the present day standards the project targets could be based on this inflow. Allowing 3,387 m. cft. for unavoidable escapage and overflow the utilisable storage could, at best, be taken as 30,000 m. cft. against 23,000 m. cft. provided in the project.

Actual utilisation in the canal

2.2. Actually quite considerable overflow and escapage from the reservoir during heavy rainfall periods is generally unavoidable as appears from *Appendix IV*. The actual consumption of water in the canal during the past 9 years, since it was commissioned, has been:—

1954-55	21505 m. cft.
1955-56	22468 m. cft.
1956-57	26623 m. cft.
1957-58	34423 m. cft.
1958-59	40569 m. cft.
1959-60	44560 m. cft.
1960-61	43380 m. cft.
1961-62	45820 m. cft.
1962-63	47900 m. cft.

It is a lucky coincidence that ever since the commissioning of the project the inflows in the river have been comparatively good and there has not been any serious shortage, except in the current year 1963-64. A repetition of such situations may lead to difficulties.

Zonal system of irrigation

2.3. As mentioned earlier the canal was first opened for irrigation of a small area in September, 1952. As the work progressed more area and mileage of channels was gradually added until the entire ayacut was thrown open for irrigation in September, 1956. The canal was run from 1952-53 to 1958-59 on the 'Intermittent system' of running of sluices as explained in para 1·9 supra *i.e.* alternate running of odd and even mile sluices for 5½ days each from September to middle of March next.

It is reported that in these years of intermittent running of sluices much difficulty and scarcity of water in the tail reaches of almost all the distributaries was experienced for want of co-operation of the ryots in adopting the time schedule for irrigation of their fields and resorting to extensive cultivation of paddy crop which was banned, ignoring all the threats of penalty impositions and the like. This resulted in excess drawal of supplies which exceeded even 40,000 m. cft. in 1958-59 against 23,000 m. cft., the project provision.

2.4 In 1959, in consultation with the ryots, Shri Gopalaswami Iyengar, the then Member, Board of Revenue, Madras State, suggested for trial a zonal system of irrigation (instead of the intermittent system) with removal of the ban on paddy cultivation. According to this system about one half of the entire ayacut area was to get continuous irrigation supplies for first four months (August to November) and the second half of the area was to receive them continuously in the next 3½ months (December to 15th March) turn. The two zones were to alternate in receiving the irrigation benefits in the first and the 2nd turn. The State Government introduced this zonal system as an experimental measure for a year in 1959-60 and has subsequently extended it from year to year to watch its working and effect on the cropping etc.

Actual Irrigation

2.5. A statement of actual crop wise year wise irrigation both under the intermittent system (1952-53 to 1958-59) and then under the zonal system (1959-60 to 1962-63) is attached at *Appendix VI.* A study of the figures given in this statement shows that under the zonal system the cropping pattern of the ayacut has mostly changed over to wet crops, in 1962-63 130091 acres out of 178948 acres total irrigation being under paddy.

The area under cotton has gone down from 43136 acres (1956-57) to only 5208 in 1962-63 and the area under canal irrigated millets has gone down to 10497 acres only from 48266 acres (1958-59).

2.6. Statement at *Appendix VI-A* gives the annual water drawn from the reservoir into the canal and the total irrigation in the corresponding years. This shows that the total drawals rose upto 47,900 m. cft. in 1962-63 against the 23,000 m. cft. project provision while the total irrigated area has actually dropped from 209250 acres (1958-59) to 148391 acres in 1960-61. The total annual irrigation and water consumption are:—

Year	Ayacut area (Acres)	Total Irri. (Acres)	Water consumption (m. cft.)	
1954-55	1,14,600	73,109	21,501	Intermittent turn system for dry crop irrigation.
1955-56	1,67,400	101,913	22,468	
1956-57	1,94,000	136,463	26,623	
1957-58	1,94,000	188,190	34,423	
1958-59	1,93,000	209,250*	40,569	
1959-60	1,93,000	154,416	44,560	
1960-61	1,93,000	148,391	43,380	Zonal system with no crop restriction.
1961-62	1,93,000	182,133	45,820	
1962-63	1,93,000	178,948	47,900	

(*Also includes second crop taken).

Appendix VII shows the monthly and average daily discharge passed into the canal during the past 5 years 1958-59 to 1962-63.

2.7. Figures of actual irrigation and water consumption for 1963-64 are not yet available but as gathered during site inspections this year the storage position at the end of the first turn in December 1963 was rather poor with the result the full areas of II_1 zone which were to receive irrigation in II turn (December 1963 to March 1964) could not be given irrigation water. Those areas of II zone which lie below mile 63 regulator of the canal and were to receive irrigation during the II turn had to be denied the irrigation facilities this year. These areas will now receive irrigation in 1st turn of 1964-65 and the last time they received water was in 1st turn of 1962-63. Besides reducing the irrigated area considerably, this naturally must have greatly upset the owners of these areas who in spite of being within the project command could not irrigate even a single acre of their lands for full one year. Part of this area is such where the subsoil water is reported to be unfit for irrigation and this may have caused famine conditions for the persons concerned. Had the last 4 years (1959-60 to 1962-63) not been exceptionally good with regard to river inflows the zonal system (under trial) might have failed because with 23,000 m. cft. the projected supply hardly half the ayacut can be provided with wet irrigation. Apparently therefore the zonal system can work effectively only when supplies available in both periods are copious.

Actual water depths utilised

2.8. The average depth of water utilised at Canal Head per acre irrigated during the past 9 years works out to:—

Intermittent System

1954-55	1955-56	1956-57	1957-58	1958-59
81″	60 7″	54″	50″	53 4″

Zonal System

	1959-60	1960-61	1961-62	1962-63
1st Turn	75 0″	77 2″	67 7″	70 8″
2nd Turn	85 4″	84 0″	70 9″	76 6″
Average	79 5″	80 5″	69·0″	73 7″

Actual Rainfall

2.9. *Appendix VIII* gives average monthly rainfall in the canal command for the four years 1960 to 1963. Average for the four years for the South West monsoon period (June to September) was 8·37″ and for the North East monsoon (October to November) was 8·56 inches. For the remaining months the average total is 8·46″, total annual average being 25·43 inches.

Internal Distribution of supplies on sluices

2.10. The soil being extremely porous and paddy having become the major crop, it was observed that the internal distribution of water amongst various cultivators on an outlet has generally been based on 24 hours rotation *i e.* every cultivator gets water daily according to his proportionate share of time. Thus every rice field is irrigated almost daily. This means constant running of not only the channels but also the entire length of the water courses. This adds to the even otherwise heavy seepage losses.

Seepage and Drainage

2.11. The land slopes being steep and the soil being porous, a good proportion of the water applied to fields eventually seeps into the local depressions and drains. A reference to Col. 11 of *Appendix IV* will show the extent of regeneration, from the Bhawani Canal area, which goes through natural drainages of the area into Bhawani river.

Several minor irrigation schemes are reported to be under investigation to put up weirs across some major drainages and to use such seepage water flowing through those drainages for irrigation of small pockets of excluded areas.

The slopes of the lands being steep there is not much rise in spring level of wells in the ayacut. *Appendix IX* shows the depths of spring level below ground level in observation wells of the project for the last 5 years.

There is quite an appreciable number of wells in the command and many of them are fitted with pumping sets. They are used for irrigation mostly during the periods when canal supplies are not available.

Kundah & other Hydel Schemes

2.12. A net work of 14 small reservoirs and 5 hydel power-houses is under construction in Nilgiri Hills in the catchment of the lower Bhawani Reservoir both on the river Bhawani and its tributaries as well as on Pykera a tributary of Moyar river which joins Bhawani river above the Lower Bhawani Reservoir. Some of the reservoirs and the power houses have already been completed and others are under construction. The total storage capacity of all these Hydel reservoirs in the two river basins is stated to be about 11000 m. cft. and an average supply of 1400 cs. is stated to be routed through the power houses into the lower Bhawani Reservoir during the dry seasons.

CHAPTER III

OBSERVATIONS & RECOMMENDATIONS

Anticipated storage

3.1.0. Table in Para 2.1 supra shows that the supply available for storage, after meeting the commitments of old canals and allowing for the evaporation losses, was in some bad years as low as 13,000 m. cft. Further there is a minimum unavoidable escapage and overflow etc. of about 3,500 m. cft. (Col. 3 *Appendix IV*). This confirms the apprehension contained in the original project that even the 23,000 m. cft. storage on which the project is based, may not be available in a number of years although the reservoir capacity at FRL is 27,460 m. cft. and at the MRL it is 32,800 m. cft. The question of the dependable yield has been discussed in para 2.1. On the basis of this study it is felt that the project anticipation may, at best, be based on not more than 30,000 m. cft. of utilisable storage.

Anticipated Ayacut and Irrigation

3.2.0. The project envisaged a localised irrigable area of 2,07,000 acres. The total area localised so far is only 1,93,000 acres. But an area of about 40,000 acres (15,170 acres of the villages originally excluded as per wishes of their ryots and about 25,000 acres excluded due to 12½% proportionate cut applied on the ayacut of each village from head to Noyal river crossing) is lying outside localised area in scattered patches within the canal command. This arrangement does not appear to be quite satisfactory as it imposes irrational restrictions. If some areas have to be excluded from the ayacut at all, they should be those which either have their alternative source of irrigation *e.g.* wells etc. or those that do not need any irrigation such as those lying along the left bank of the main canal, within about a furlong of its toe, which are mostly seepage affected.

Likely cropping with its water requirements and economics

3.3.0. The project originally envisaged irrigation facilities for dry crops only excepting about 10,000 acres of paddy in the hallows along the beds of streams. The anticipated cropping was:—

Cotton	98,500 acres
Millets and groundnuts etc.	98,500 acres.
Paddy	10,000 acres (in hallows along stream beds)
TOTAL . . .	2,07,000 acres.

Evidently this cropping was fixed after taking the local soil, rainfall and the topography of the area into consideration besides the availability of dependable supplies.

3.3.1. The depth of irrigation required for cotton is reported to be 30" inclusive of rainfall. The requirement of other dry crops like millets etc. is estimated to be about 20". But as these dry crops are to be intermixed with cotton and about 10,000 acres of paddy limited to low lying areas, the overall water requirements assumed in the project were based on a depth of 30" at the canal head, offsetting the rainfall contribution against the transmission losses.

3.3.2. Thus the water requirements for the above cropping work out to:—

207000×2.5=517500 acre ft. or 22500 m. cft. say 23000 m. cft.

The actual depths of water utilised by the ryots of the area are quite high as is evident from the overall depths for various years worked out in para. 2.8 of Chapter II, as also from the depths applied at the Bhawanisagar Agricultural Farm for different crops as shown in *Appendix X*. It appears that according to the prevailing agricultural practices, as also actually experienced, the water utilisation for the projected cropping will not be less than 30" average depth in the field, excluding rainfall. Cumulatively it will amount to 40 inches at canal head allowing 33 1/3% transmission losses.

3.3.3. The total requirement for 2,07,000 acres on this basis works out to 30,000 m. cft. It means that even for the cotton and dry crop cropping proposed in the project, a storage of 30,000 m. cft. is likely to be required and this is the maximum which can be assumed as dependable available supply *vide* paras 2.1 and 3.1 above. As such the dependable supplies, as available on 75 per cent dependability basis, will not be able to sustain paddy crops to a larger scale than 10,000 acres provided for in the original project.

3.3.4. The total annual rainfall in the tract being only about 29 inches and the north east (October-November) component of the rainfall, which alone could make any appreciable contribution towards the crop requirements, being only about 12 inches and the soil being extremely porous, the project could not stand justified for larger scale paddy irrigation.

3.3.5. The overall water requirements of paddy in Madras as mentioned in "Memoirs of the Development of Agriculture Madras—1954" are about 85 inches as detailed below:—

	Acre inches (including irrigation and rainfall)
1. From preparation of plots to planting	25.63"
2. From planting to flowering	48.27"
3. From flowering to last irrigation	10.89"
Total:—	**84.79"**

3.3.6 Allowing for the extremely porous soil of the Lower Bhawani Project area, the overall water requirements of paddy there may not be less than 100 inches. The rainfall contribution being only about 12 inches, the depth of water to be provided by the canal in case of paddy works out to about 88 inches. This is also corroborated from the data supplied by the Bhawani Sagar Agricultural Farm (*Appendix X*). The average duty of rice for Coimbatore is stated to be 50 although a duty of 40 is reported to give the best results.

Duty for dry crops

3.3.7. The duty of cotton is mentioned as 190 in the "Memoirs". Roughly the duty of dry irrigated crops is 3 times that of rice. The overall water depth requirement of cotton is reported about 30 inches inclusive of rainfall while that of other cereal crops is generally only about 20 inches. Excluding rain-fall contribution the dry crops requirement will thus normally be only about 18 inches *i.e.* only about ½th to 1/5th of rice crop requirements. In any case, it does not appear to be more than 1/3rd of paddy requirements and confirms the conclusion drawn in the "Memoirs" quoted above that duty of dry irrigated crops is roughly 3 times that of rice.

3 3 8. The above facts indicate that in a low rainfall area, like that of Lower Bhawani Project, in the interest of optimum use of storage water we should primarily plan for dry crop irrigation and not for paddy irrigation.

3 4.0. Further a study of the economics of various major crops (which could be successfully grown with canal irrigation in the project command) as worked out at the Bhawanisagar Research Farm and reproduced at *Appendix X* shows that net profit per acre of crop and per acre-inch of water is :—

	Profit per acre	Profit per acre-inch of water consumed
	Rs.	Rs.
Paddy	569	5·69
Cotton	978	32·60
Groundnut	196	6·60
Cholam	267	13·05
Ragi	176	3·5

These figures indicate that paddy is the most uneconomical crop so far as water consumption is concerned while cotton is the most paying crop and millets are next to cotton.

Present Cropping

3.5.0. The local ryots are hardworking and quick in adopting new techniques. Unfortunately there were no research and demonstration farms in the canal command wherefrom they could have learnt the practices and advantages of dry crop irrigated-agriculture. The only example of irrigated-agriculture they could look to was that of the adjoining areas in the command of the three centuries-old small canals (mentioned in para 1.7) wherein large quantities of water are used to grow paddy with a duty of only about 30 acres per cusec. They could not reconcile themselves to the idea of a large scale dry-crop irrigation because the canal irrigation was synonimous to them with paddy cultivation.

3.5.1. It appears that with the commissioning of the project the cultivators, especially those who could weild some influence, were tempted to take to paddy cultivation in spite of its being prohibited and penalties being imposed. This resulted in rapid and steady rise in area under paddy while area under cotton and millets rose only for 2 to 3 years in the beginning and then started declining as is apparent from *Appendix VI-B*.

Optimum Production Cropping

3.6.0. It is therefore felt that cropping proposed in the project originally, *i.e.* 50% cotton and 50% groundnuts and millets etc leaving about 10,000 acres of very low lying areas for paddy, is the best suited cropping for the area both economically and agriculturally and also from the optimum water utilisation consideration. It will also let greater number of cultivators benefit by the limited irrigation facilities available from the project.

3.6.1. It is unfortunate that under pressure from some conservative cultivators of the area the state government removed the restriction on paddy cultivation and changed over from the "intermittent system" to the "zonal system" of regulation, though as a trial. Had this not been done the cropping in the entire ayacut may have by now developed more or less on the lines of the project provisions. As a result the area would have become a rich cotton producing tract for supplying long staple cotton to the Coimbatore mills which from an overall crop planning basis is a preferable crop.

3.6.2. In years of good water supply, even two crops of millets and groundnuts could be taken from that portion of the ayacut which is not under cotton. As such the position regarding food production too would have been almost as good as with the cultivation of paddy.

3.6.3. It therefore appears desirable to aim at the cropping pattern proposed originally in the project and to restrict paddy cultivation only in low lying valleys which could be localised for paddy cultivation.

Drawbacks of the existing zonal system

3.7.0. The zonal system which is on trial since 1959 and is since being extended from year to year is explained in para 2·4 of the previous chapter. Its main drawback is that it encourages large scale cultivation of paddy.

3.7.1. Under the system all the outlets (sluices) in a particular zone run continuously for about 4 months with a copious discharge (16.66 cs. per thousand acres of irrigable areas). Natural slope of the land is steep. Soil texture is porous. Irrigation of a field therefore invariably causes seepage into its next lower field. Consequently the ryots are left with practically no other choice than to take to paddy cultivation. Other paying-crops like cotton etc. cannot stand too much moisture which is inevitable under the existing zonal system. Also irrigation period of cotton extends over about 6 to 7 months, while water is made available only for 4 months.

Unstable Development

3.7.2. With the introduction of the zonal system the area under paddy has gone upto 1,30,091 acres. If the system is continued it is likely to go up further in years of good water supply. This will be an unstable development. In year of poor supply even 50% of the paddy area in one zone may not mature (in I turn) and the other zone area may not get any water at all (in the II turn). That has happened in the II turn of the current year (1963-64) as mentioned in para 2.7. It actually shows what could happen in a year of poor supplies.

3.7.3. For successful implementation of the zonal system (as practised since 1959) the canal has to run full almost continuously from 1st August to about 7th of April *i.e.* for 250 days at 200 m. cft. daily which will be required to run the canal with full supply discharge of 2,300 cusecs. Thus the total water requirements work out to about 50,000 m. cft. Against this, the normal anticipated storage can, at best, be taken as 30,000 m. cft. only. It therefore appears desirable to replace the present zonal system of irrigation on the Lower Bhawani Project with some such system which would discourage paddy cultivation and consequently reduce the normal water requirements to only about 30,000 m. cft., the supplies normally anticipated.

Regulation of supplies

3.8.0. In order to discourage paddy cultivation and encourage cotton and other dry crops for optimum utilisation of water, it may seem desirable to reintroduce the "intermittent system" of regulation. Time-gap between the alternate runnings may have to be increased to such an extent that the survival of paddy crop (except in very low lying areas) under the system becomes almost impossible.

3.8.1 Cotton, groundnuts and millets etc. do not need irrigation more ore often than once in three weeks. To avoid any remodelling of sluices and channels the alternate sluices (including minors and small distributaries) on

main canal and major distributaries can be run for 10½ days and kept closed for 10½ days alternately.

3.8.2. This system of intermittent running with longer interval will be helpful in satisfactory growth of cotton as it grows best when the field dries up after each watering before the next watering is applied. The canal could be kept closed from mid October to end of November (North East rainy season) as provided in the project.

3.8.3. In years of average supplies the canal may be run with half its full supply from middle of December to middle of March as the first crop of millets would have matured by then and only cotton will continue to need water for its irrigation. However in years of good supplies the canal could continue to run with full supply and a second crop of millets and groundnuts etc. could be raised.

3.8.4. In better than the normal years when storage available for utilisation in L.B. Canal is more than 30,000 m. cft. a second crop of millets and groundnuts etc. could be raised in part of the ayacut. It could also be used for green manure crops.

3.8.5. The Panel is of the view that the crop plan and regulation arrangement suggested above will go a long way in ensuring the optimum utilisation of normal irrigation supplies on the project.

3.8.6. It will also be the best from the national return point of view *i.e.* overall benefit accruing to the cultivator and to the Government both directly and indirectly.

3.8.7. This will also enable cotton areas to develop which seem to promise maximum return per unit of land and water to the cultivator as well as to the State and does at the same time fall in the overall pattern of Agricultural Development in the country as a whole.

Effect of Kundah & Other Hydel Schemes

3.9.0. A number of hydel schemes upstream of Bhawanisagar are proposed. Some have already been completed. It has not been worked out as to how the regulation of the upper reservoirs would be done so that the irrigation on Bhawanisagar is not affected. It would seem necessary to coordinate the working of the hydel reservoirs with the irrigation from Bhawanisagar to avoid future complications.

Water-rate Structure and Betterment Tax

3.10.0. The irrigation rates in force, quoted in para 1.10 do not appear rational from the water consumption point of view and are not conducive to increase of dry crop irrigation. The water requirement of paddy is 100 inches against 30 inches of cotton and 20 inches of millets but the water rates for the three crops are Rs. 15, Rs. 20 and Rs. 7.50 per acre respectively. It would therefore seem to be advisable to revise the paddy rate in view of the enormous quantity of water required for the same.

3.10.1. The water rate structure evidently need to be reviewed. A substantial increase in the rate for paddy appears desirable in order to discourage its cultivation in lower Bhawani Project ayacut.

3.10.2. An early decision may also be taken on the question of imposition of betterment tax as provided in the project.

Assessment Procedure-modification suggested

3.11.0. At present the technical control on the water supplies ceases at the sluices (upto 150 acre ayacut). The recording of irrigation and the assessment of irrigation charges is done by the revenue authorities in Madras State. This implies that the technical personnel are unable to check the overuse or waste of water. Besides the irrigation engineers, under this system, do not become conversant with the agricultural aspect of the project as they should be.

3.11.1. It may be advantageous to extend this technical control, in the interest of optimum utilisation of water supplies, to the field level by placing the assessment responsibilities on the irrigation engineers as is the case in most of the northern India States, *e.g.* Punjab and U.P. etc. where one of the measures for judging the efficiency of an irrigation engineer (at all levels) is the amount of area irrigated within his jurisdiction with a given quantity of water and the revenue earned thereby. The staff that is employed at present by the Revenue Department for recording and assessment of irrigation could be transferred to the control of irrigation department for the same purpose. A demi official letter in this connection already addressed to the Chief Engineer for irrigation is reproduced in *Appendix XI*.

Agricultural Aspects

3.12.0. The principal factors which need to be taken into consideration while examining the agricultural aspects of the Lower Bhawani Project are:—

(i) The annual normal rainfall in the ayacut is only about 25″ to 30″ spread over all the 12 months of a year. The maximum rainfall contribution to water requirement of a canal irrigated crop is only about 12 inches.

(ii) The climate is uniform and tropical. A large variety of crops is grown in this region. *Appendix XII and XIIA* give the area and crop statistics for the two districts, Coimbatore and Tiruchirapalli, wherein the project ayacut lies. Pre-project crop statistics of the project ayacut alone could not be readily available.

(iii) The soil in the project ayacut is porous, lateritic and gravelly with clay and silt content being only about 25% resulting in low moisture holding capacity and heavy seepage losses which travel from field to field because of very steep slopes of land in the area.

(iv) The cultivator of the area is efficient and hardworking and his standard of cultivation is fairly high. He is progressive in nature; and readily adoptable to improved agricultural practices *e.g.* optimum spacing, intercultivation, manuring, application of chemical fertilisers, eradication of weeds and plant protection measures etc. They have already taken to green manuring on an appreciable scale. Crops like sunhemp, sesbania and wild indigo are being grown for the purpose. Green leaf manuring of glyricidia and calotropis procera (AK) is quite popular in the area.

(v) The holdings are generally small and scattered. There is therefore generally no mechanised cultivation.

(vi) Even prior to the introduction of Canal irrigation well irrigation was practised in this area on a small scale. The subsoil water in the ayacuts of the canal, from its head upto its crossing of Noyal river (mile 92/6), is said to be good for irrigation of crops. Electric power is available in many parts of the command and is likely to be extended further in the near future. Wells are generally fitted with diesel or electric pumping sets.

3.12.1 It is desirable that the agriculture department should take up scientific investigations and research to find out the most suitable crop varieties and their rotations best suited to the project conditions so as to yield maximum profit to the cultivators per acre-inch of water utilised. The short duration long-staple Russian variety of cotton and the hybrid maize are particularly recommended for trial.

3.12.2 In order to improve the soil texture of the area frequent and large scale green manuring is very essential. It should be given due place and priority while suggesting different crop rotations.

3.12.3 The crop rotations for areas having wells to supplement canal irrigation and for other areas which have no other source of supplemental irrigation will necessarily have to be different. Such crop rotation recommendations need to be given wide publicity and may be demonstrated both at departmental farms and on private cultivators' plots in various villages.

3.12.4 The research experiments for crop rotations and manurial requirements and its frequencies have also to be combined with experiments to work out their optimum requirements of irrigation water and its efficient use under different irrigation practices.

Agricultural Research Station Bhawanisagar.

3.13.0. At present there is an "Agricultural Research Station at Bhawanisagar" extending over an area of 315 acres which is carrying on experiments regarding crop rotations and their manurial needs etc., both for irrigated and unirrigated conditions. It was established in 1955. But so far no definite conclusions seem to have been arrived at.

3.13.1 Recently, since October 1963, this farm has also been entrusted with the research regarding efficient use of water under different irrigation practices and optimum water requirements for various crops both with respect to frequency and intensity of irrigations. It is suggested that programme for such experiments may be drawn in consultation with the project authorities. Further there needs to be proper coordination between the irrigation and agriculture officers to get the best results from such experiments.

3.13.2 It also appears desirable that at least two more such Research-*cum*-Demonstration Farms of about 40 acres each for irrigated crops may be established at some central places in the ayacut *e.g.* at Gobichetipallayam and Erode.

Todapalli, Arekkenkettai & Kalingarayam Channels.

3.14.0 As stated in para 1.7 these channels are several centuries old and run for about 10 months in a year. The water utilisation on them is said to be rather inefficient resulting in wastage and over-irrigation. But because of prescriptive rights of the ryots on them nothing much could be done to improve things. The present study has no concern with them. Still the Panel would like to suggest that the working of these old canals may be improved to achieve optimum use of the water earmarked for them. This is desirable in the larger interest of the community and from the point of view of conservation of irrigation supplies in various irrigation works on Cauveri catchment in Madras State.

SIGNIFICANT OBSERVATIONS AND RECOMMENDATIONS

I(a) The project was based on availability of 23,000 m. cft. utilisable storage. During the last few years (1958-59 to 1962-63) the supplies actually available were above normal ranging between 40,000 and 48,000 m. cft.

(b) Scrutiny of 29 years' data (1934-35 to 1962-63) however reveals that in the worst year the storage available for the Lower Bhawani Canal, after meeting commitments of old canals and allowing for the evaporation losses, can be as low as 13,000 m. cft. only. Basing computation on a 75% dependability for this period the normal anticipated supplies for the project could be taken as 30,000 m. cft. per year.

(c) *The project working should not therefore be planned on availability of more than* 30,000 *m. cft.*

II(a) Against an envisaged acreage of 2,07,000, the area localised (authorised to receive irrigation) so far is 1,93,000 acres only. About 40,000 acres irrigable land is lying outside the localised area in scattered patches in commandable locations.

(b) In the interest of a wholesome dispersal of irrigation benefits, the system needs to be rationalised.

III(a) The project anticipated the following annual irrigation and presumed that 23,000 m. cft. of utilisable storage will suffice for its maturity:—

Cotton	98,500 acres
Millets and groundnuts etc.	98,500 acres
Paddy	10,000 acres (in low lying patches)
Total:—	2,07.000 acres

(b) The actual needs for maturity of these crops according to existing agricultural practices appear to be about 30,000 m. cft.

(c) As such the dependable supplies, likely to be available, will not be able to sustain paddy crops on a larger scale than 10,000 acres provided for in the original project.

(d) The average annual rainfall of the Lower Bhawani tract is only about 29 inches. Its "North-East" component (October-November) which alone makes any appreciable contribution towards water requirements of crops, is about 12 inches.

(e) Overall water requirements of paddy for the porous soil of the area being about 100 inches, the depth of water required from the canal for maturity of paddy is thus about 88 inches. Corresponding requirement for dry-crops like cotton and groundnuts etc. is estimated to be about 30 inches.

(f) The economics of major crops as worked out on the basis of experiments conducted by the Bhawanisagar Research Farm authorities are:—

Crops	Profit per acre Rs.	Profit per acre inch of water consumed Rs.
Paddy	569	5·69
Cotton	978	32·60
Cholam	267	13·05
Groundnut	196	6·60
Ragi	176	3·50

(g) *As such in a low rainfall area, like that of Lower Bhawani Project, in the interest of optimum use of storage water, we should primarily plan for dry-crop irrigation and not for paddy irrigation. Cropping proposed in the project originally* viz. 50% *cotton and* 50% *groundnuts and millets etc., leaving about* 10,000 *acres very low lying areas for paddy, is the optimum productive cropping for the area both economically and agriculturally and also from the optimum water utilisation consideration.*

IV. In normal years one irrigated crop could be assured all over the ayacut while in years of above normal supply a second millet and groundnut crop could be had in addition. Extra supplies could also be used for green manuring.

V(a) The zonal system of regulation and distribution and allocation of supplies, on trial since 1959, has encouraged large scale cultivation of paddy. This is an unstable development because for satisfactory working of this system about 50,000 m. cft. of water is required annually while only 30,000 m. cft. could normally be anticipated.

(b) *It therefore appears desirable to do away with the present "zonal system" of irrigation and to reintroduce the "intermittent system" of regulation, with certain modifications.*

(c) To modify the same time-gap between the alternate runnings may be increased to such an extent (10½ days turn each) that the survival of paddy crop (except in very low lying areas) becomes almost impossible.

(d) Such time-spaced intermittent supply of water will be helpful in satisfactory growth of cotton and other dry-crops.

(e) It will also be the best from the National return point of view *i.e.* overall benefit accruing to the cultivator and to the Government, both directly and indirectly.

VI. Many new Hydel Reservoirs and Power Houses are being constructed under the Kundah and other schemes on Bhawani River and its tributaries upstream of Bhawanisagar. Some of them have already been completed. It seems necessary to coordinate the working of the hydel reservoirs with the irrigation from Bhawanisagar to avoid future complications.

VII (a). *The irrigation water-rate structure needs to be rationalised and the rate for paddy revised keeping in view its high water requirement.*

(b) Early steps need to be taken on the question of imposition of betterment levy (tax) as provided in the project.

VIII. The responsibility for recording and assessment of irrigation could be transferred from the Revenue Department to the Irrigation Department, leaving only collection of irrigation dues with Revenue Department as in many other States of India.

IX(a). Agriculture Department should take up scientific investigations and research to find out most suitable crop varieties and their rotations, best suited to the project area, for optimum water utilisation and its economic return.

(b) The short duration Russian Variety of cotton and the hybrid maize may particularly be tried.

(c) Large scale green manuring may be given due place and priority, while suggesting different crop rotations.

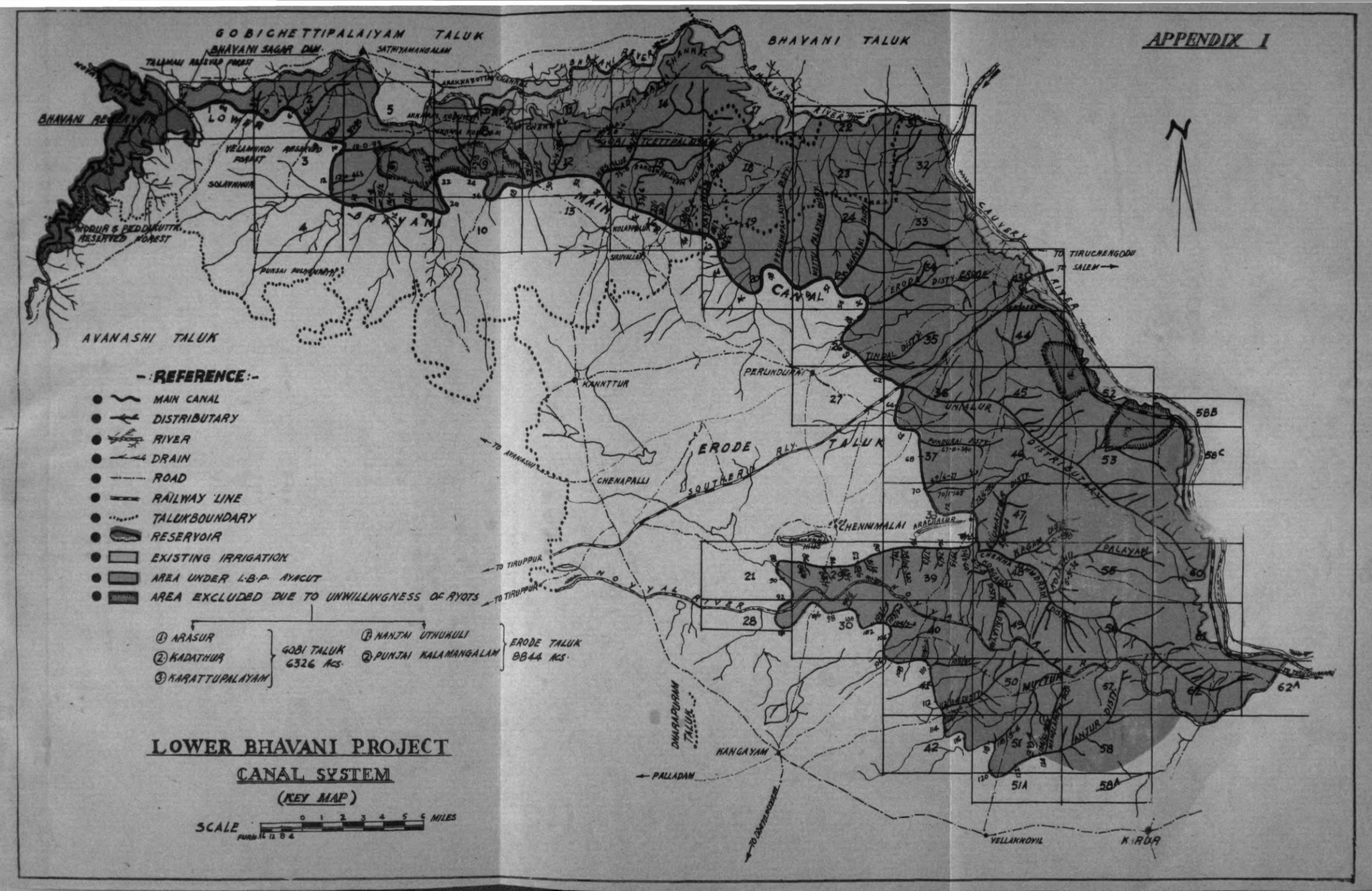
(d) Separate crop rotations may be worked out and recommended for areas having supplemental sources of irrigation like wells etc.

(e) Besides Agricultural Research Station at Bhawanisagar, at least two more Research-*cum*-Demonstration Farms, about 40 acres each, may be established at some central places in the project command, say at Gobichetipallayam and at Erode, in collaboration with Irrigation Department.

X. Efforts may be made to improve the working of old Todapalli, Arekkan Kottai and Kalingarayam Canals where lot of wastage of water and over irrigation appear to be taking place.

Index to Appendices attached to the Draft Report on Optimum, Utilisation of Irrigation Potential on Lower Bhawani Project (Madras State)

69 P.C.(e)—4


APPENDIX I
GOBICHETTIPALAIYAM TALUK
BHAVANI SAGAR DAM
SATHYAMANGALAM
TALAMALI RESERVED FOREST
BHAVANI RESERVOIR
LOWER
VELLAMMINDI RESERVED FOREST
SOLAVANNIA
MAIN
BHAVANI
MOOLUR & PEDDAKUTTAI RESERVED FOREST
PUNJAI PULIAMPATTI
KOLAPPALUR
SAUVALLAPURAM
AVANASHI TALUK
BHAVANI TALUK
BHAVANI RIVER
ARAKKANKOTTAI CHANNEL
TADA KULAM
KUTTAI PALAYAM DISTY
PERUNDURAI PALAYAM DISTY
CAUVERY RIVER
CANAL
ERODE DISTY
TINDAL DISTY
TO TIRUCHENGODU
TO SALEM
PERUNDURAI
KANNTTUR
UNNAMALAI
PUNDURAI DISTY
DISTRIBUTARY
ERODE TALUK
TO AVINASHI
CHENAPALLI
SOUTHERN RLY.
CHENNIMALAI
ARACHALUR
TO TIRUPPUR
NOYYAL RIVER
PALAYAM
CHENNIMALAI DISTY
KAGAM DISTY
MUTTUR DISTY
ANTUR DISTY
DHARAPURAM TALUK
KANGAYAM
PALLADAM
TO DHARAPURAM
VELLAKOVIL
KARUR
N
REFERENCE:-
MAIN CANAL
DISTRIBUTARY
RIVER
DRAIN
ROAD
RAILWAY LINE
TALUKBOUNDARY
RESERVOIR
EXISTING IRRIGATION
AREA UNDER L.B.P. AYACUT
AREA EXCLUDED DUE TO UNWILLINGNESS OF RYOTS
1. ARASUR
2. KADATHUR
3. KARATTUPALAYAM
GOBI TALUK 6326 ACS.
1. NANJAI UTHUKULI
2. PUNJAI KALAMANGALAM
ERODE TALUK 8844 ACS.
LOWER BHAVANI PROJECT
CANAL SYSTEM
(KEY MAP)
SCALE
0 1 2 3 4 5 6 MILES
FURLONGS 12 8 4

APPENDIX—II

NOTE ON SOILS

Geologically, the Project area may be said to be composed of rocks of schistose gneiss, hornehland-eschist and to a lesser extent mica-schist. The soils are generally shallow. They rest on gneissic rocks more or less disintegrated and weathered. At lower depths, massive gneisses are encountered. Between strata of gneiss there are veins of quartz, either white or coloured. There are also a few outcrops of felspars. Kankar nodules lie in plenty on the surface.

Soils

The surface soils of the ayacut area may be generalised as red gravelly loam. The top soil is generally 6 to 9 inches in depth except in the valleys where the depth increases upto about 3 feet. Large quantities of quartz are also found on the surface of the soil. The ryots gather and use them for preparing small bunds between fields. The soils are poor and open in texture, the proportion of the finer fractions viz., clay and silt to that of the coarser fractions being small. The soil overlies disintegrated and weathered rocks. The ayacut area has a pronounced dip towards the river, the slope being generally of the order of 1 in 200 and even as steep as 1 in 100 or 1 in 50 particularly near the river margin. These factors help for facilitating drainage. The problem of moisture retentivity, however, will have to be faced. The low content of the finer fractions renders the soil porous and the seepage losses of irrigation water are likely to be considerable.

Some analysis figures of the soil samples taken at random from the area are given below :—

	Sample	*Sample*	*Sample*	*Sample*
Fine fractions	20.3	27.7	19.1	22.1
Coarse fractions	75.9	70.1	81.0	71.3

It will be seen from the analysis that the average soil contains 75 per cent of coarse fractions and 25 per cent of finer fractions. The clay content in the finer fractions is very low, generally about 5 per cent. The moisture holding capacity is only around 26 per cent under laboratory conditions. In field conditions this may be lower still.

Sd./-
Executive Engineer,
P.W.D.,
L.B.P., Canals Division, Erode.

APPENDIX—III

Statement showing the annual flows in the Bhawani River

Year	Flows in m.cft.	Sl. No. in order of magnitude	Remarks
1934-35	51,730	28	Upto 1952-53, the flows are those recorded at Godiveri Anicut from 1953-54 onwards at Bhaweni Sagar Dam site.
1935-36	50,011	29	
1936-37	77,100	15	
1937-38	72,249	20	
1938-39	52,073	27	
1939-40	86,004	9	
1940-41	1,04,107	5	
1941-42	95,925	6	
1942-43	80,688	12	
1943-44	85,399	10	
1944-45	76,049	16	
1945-46	60,592	25	
1946-47	1,14,697	3	
1947-48	71,692	21	
1948-49	91,582	8	
1949-50	57,660	26	
1950-51	69,799	23	
1951-52	72,273	19	
1952-53	80,000	13	
1953-54	78,644	14	
1954-55	73,669	17	
1955-56	70,687	22	
1956-57	68,857	24	
1957-58	95,536	7	
1958-59	73,140	18	
1959-60	1,19,828	2	
1960-61	84,053	11	
1961-62	1,47,568	1	
1962-63	1,10,317	4	

APPENDIX—III-A.

LOWER BHAWANI DAM-BHAWANI SAGAR

Statement showing the Available Yield from the Catchment of the Reservoir

(In m. Cft.)

Months	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62	1962-63
April . . .	2104·0	1965·3	1539·8	1216·0	1322·2	258·8	1645·6	3298	3166	3390·8
May . . .	1256·6	2557·0	9868·9	1420·8	7995·3	4004·4	1667·8	293	4665	6492·6
June . . .	5580·9	6635	13616·6	9836·6	10630·9	4675·9	15600	3585	13882·1	3881·7
July . . .	20058	1986·7	8574·6	14220·7	19753·8	2133·9	46174	16748	59476·6	23500·8
August . . .	20796	177690·0	5178·6	7542·4	7926·7	1025·7	9800	8868	16548·2	14269·3
September . . .	4570	4538	6205·7	4817·6	3838·7	6278	7848	5253	7021·8	9556·0
October . . .	11141	8553	9142·9	9061·4	9162·3	5452	10366	9433	8872·8	19829·0
November . . .	3667	3822·1	6288·8	9655·7	20137·6	9161	10313	15606	15376·9	8049·1
December . . .	2790	2872·0	4978·4	3875·3	5245·7	4061	7476	5756	5460·0	9438·5
January . . .	2977	2070	2260·5	2522·6	4046·8	2429	3388	4587	4009	4372·2
February . . .	2491	1304·0	1637·6	2035·5	2725·8	1751	2032	5151	5146	3119
March . . .	1312	1739·8	1396·9	2652·4	2755·6	1144·9	3517·8	2825	3943·6	4425·6
Total for the Year .	78644	73669	70686·3	68857·0	95536·4	73140·2	119828·2	84053	147568·6	110317·6

Sd/- Executive Engineer,
Lower Bhawani Project-H.W.D

APPENDIX—IV

Yearwise draw and consumption in River Bhawani and Bhawani old channels.

STATEMENT—II

Year	River discharge at Bhawani Sagar in m. Cft.	Surplus over requirements in m. Cft.	Net draw in m. Cft.	Demand for old Bhawani channels as per rules of regulation in m. Cft.	CONSUMPTION IN			Flow at Koduveri Anicut in m. Cft.	Total consumption in all the three channels Columns (6+7+8) in m.Cft.	Difference between the consumption and draw (Col. 10-4) in m. Cft.	Remarks
					Tadapalli channel in m. Cft.	Arakkankottai channel in m. Cft.	Kallingarayan channel in m. Cft				
1	2	3	4	5	6	7	8	9	10	11	12
1954-55 .	40,183	11,519	28,664	33,497	12,877	5,948	12,432	33,591	31,257	2,593	Figures
1955-56 .	45,405	11,424	33,981	33,497	13,066	7,041	13,113	24,467	33,220	..	in Col. 11 represent quantity suppleme ted to the old channel from the LBP area.
1956-57 .	31,368	3,463	27,905	33,497	13,466	7,058	9,443	12,239	29,967	2,062	
1957-58 .	47,902	19,400	28,502	33,497	13,408	6,976	13,201	40,572	33,585	5,083	
1958-59 .	38,996	8,750	30,246	33,497	13,470	7,479	13,189	15,834	34,088	3,842	
1959-60 .	52,616	24,183	28,433	33,497	14,134	7,612	11,605	36,796	33,351	4,918	
1960-61 .	45,734	16,133	29,601	33,497	13,743	7,960	9,515	21,671	21,218	1,617	
1961-62 .	81,649	52,357	29,292	33,497	12,824	7,835	10,139	61,112	30,898	1,606	
1962-63 .	45,042	16,000	29,042	33,497	13,107	8,264	10,435	26,435	31,806	..	
Average	29,578 m. Cft.										

Sd/- Executive Engineer,
P.W.D., L.B.P. Canal
Division., Erode.

APPENDIX—V

Lower Bhawani Dam Bhawani Sagar

Statement showing the Annual Ev. poration losses from the Reservoir

(In m. Cft.)

Months	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62	1962-63
April . . .	10·0	158·5	94·1	108·09	275·4	278·6	34·6	374·9	216·4	354·2
May	10·0	107·0	144·5	85·7	232·3	230·9	56·9	288·8	176·3	300·8
June	18·0	190·7	289·8	101·9	386·8	273·4	79·9	331·4	272·2	377·4
July	115·0	324·9	379·1	293·4	430·1	408·1	432·9	402·1.	469·1	428·3
August . . .	175·4	268·9	278·6	275·9	333·9	347·8	354·7	353·2	361·6	350·3
September . . .	107·3	148·2	166·3	174·9	198·5	207·8	219·6	191·5	220·5	220·3
October. . . .	65.8	90.5	95.8	104.8	102.3	101.5	122.9	105.8	116.9	123.9
November . . .	115·4	80·4	146·1	204·7	172·4	145·8	189·8	190·8	190·3	191·8
December . . .	181·3	131·4	215·8	266·4	265·2	220·8	321·1	310·8	297·1	315·3
January . . .	223·0	212·9	272·4	379·5	387·8	258·5	447·4	446·8	403·2	286·9
February . . .	169·2	176·3	206·3	326·2	358·7	203·7	401·8	340·8	370·4	419·7
March	233·0	193·4	243·6	448·5	500·1	222·5	583·2	379·1	567·6	652·3
Total for the Year .	1423·4	2083·1	2532·4	2769·99	3643·5	2899·4	3312·8	3716·0	3661·5	4021·2

Sd/- Executive Engineer
Lower Bhawani Project. H.W.D.

APPENDIX—VI

Progresaive Cultivation Figures on L.B.P. System

(In acres)

Details of cultivation of crops.	52-53	53-54	54-55	55-56	56-57	57-58	58-59	ZONAL SYSTEM 59-60 Ist turn	59-60 IInd turn	60-61 Ist turn	60-61 IInd turn	61-62 Ist turn	61-62 IInd turn	62-63 Ist turn	62-63 IInd turn	Total
Paddy	..	1271	12510	17190	32529	61898	66557	41655	31142	47204	35242	62257	53457	70020	60071	Figures for the year 1961-62 and 62-63 are P.W.D. figures.
Cotton	..	1416	26825	36015	43136	29031	19886	2506	6483	1905	5982	139	3509	145	5063	
Millets	2947	4138	24995	27971	39787	44134	48266	11327	11162	6310	9671	8426	7227	4113	6386	
Other Crops	..	2398	8709	20737	21011	53127	74541	28686	21455	18693	23384	21829	25287	16244	16906	
Area Cultivated	2947	9183	73039	101913	136463	188190	209250	84174	70242	74112	74279	92653	89480	90522	88426	
Area thrown open for cultivation	3000	30000	114600	167400	193000	193000	192664	97136	154416	97195	148391	97313	.. 182133	97511	.. 178948	Continued for Ist and IInd turns.
									95689		95763		95824		96110	
									192825	..	192958	..	193137	..	193621	Continued for Ist and IInd turns.

Sd/- Executive Engineer, P.W.D.,
L.B.P. Canals Division, Erode.

APPENDIX—VI-A

Statement showing the quantity of water consumed in the L.B.P. System (1954-55 to 1962-63)

Year and Fasli	Area thrown open for Irrigation	Area cultivated		Total	Consumption of water in m. cft.		Total in m. cft.	Remarks
		Ist turn	IInd turn		Ist turn	IInd turn		
	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)		cf.)	
1954-55 (1364)	1,14,600	..	..	73,019	..	..	21,501	Intermittant turn system for dry crop irrigation.
1955-56 (1365)	1,67,400	..	..	1,01,913	..	..	22,468	
1956-57 (1366)	1,94,000	..	..	1,36,463	..	..	26,623	
1957-58 (1367)	1,94,000	..	..	1,88,190	..	..	34,423	
1957-59 (1368)	1,93,000	..	..	2,09,250 (includes II crop taken also)	..	..	40,569	
1959-60 (1369)	1,93,000	84,174	70242	1,54,416	22750	21810	44,560	Zonal system of Irrigation without crop restriction.
1960-61 (1370)	1,93,000	74,112	74279	1,48,391	20760	22620	43,380	
1961-62 (1371)	1,93,000	92,653	89480	1,82,133	22770	23050	45,820	
1962-63 (1372)	1,93,000	90,522	88425	1,78,948	23310	24590	47,900	

EXECUTIVE ENGINEER,
Lower Bhawani Project Canal
Division.

APPENDIX—VI-B

Progressive Cultivation Figures in L.B.P. system
(Both Crops)

(In acres)

Crop	52-53	53-54	54-55	55-56	56-57	57-58	58-59	59-60	60-61	61-62	62-63
Paddy .	..	1,271	12,510	17,190	32,529	61,898	66,557	72,797	82446	1,15,714	1,30,091
Cotton .	..	1,416	26,825	36,015	43,136	29,031	19,886	8,989	7,887	3,648	5,208
Millets .	2,947	4,138	24,995	27,971	39,787	44,134	48,266	22,489	15,981	16,655	10,499
Other Crops .	..	2,358	8,709	20,737	21,011	53,127	74,541	50,141	42,077	45,753	33,150
Area cultivated .	2,947	9,183	73,019	1,01,913	1,36,463	1,88,190	2,09,250	1,54,416	1,48,391	1,81,720	1,78,948

Executive Engineer, P.W.D.,
L.B.P. Canals Division, Erode.

P.W.D., COIMBATORE CIRCLE. APPENDIX—VII

L.B.P. Canals Division, Erode.

L.B.P. Main Canal Discharge particulars for the period from 1958 to 1962.

Year	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March
1958-59												
Total	38115	155	35	..	6843	64784	73457	55116	75041	63543	47710	39987
Average discharge in cusecs per day	1271	5	5	..	263	2159	2448	1968	2421	2118	1704	1290
1959-60												
Total	150	175	..	3817	65486	67425	55306	52353	53032	73373	62197	66613
Average discharge in cusecs per day	5	6	..	1272	2112	2248	1786	1745	1964	2367	2145	2149
1960-61												
Total	21282	155	20	3017	60015	62988	62398	49072	61854	71491	57932	68233
Average discharge in cusecs per day	1419	5	5	1002	2143	2010	2013	1692	2209	2306	2069	2201
1961-62												
Total	2097	..	..	30819	69570	69790	70594	56202	62348	72050	64439	71261
Average discharge in cusecs per day	2097	..	..	1926	2244	2326	2277	1938	2149	2324	2301	2299
1962-63												
Total	13836	155	5	..	65653	71913	70400	62317	62502	70964	63995	65591
Average discharge in cusecs per day	1997	5	5	..	2118	2393	2271	2149	2155	2289	2285	2116

Sd/- Executive Engineer,
P.W.D.,
L.B.P. Canals Division, Erode.

APPENDIX—VIII

Statement of Average Rainfall in the command of Lower Bhawani Canal for the period 1960 to 1963.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14
						SOUTH WEST MONSOON				NORTH EAST MONSOON			
	inch.	inch.	inch.	inch.	inch.	inch.	inch.	inch.	inch.	inch.	inch.	inch.	inch.
1960 . . .	..	..	1·17	2·14	3·14	0·97	3·81	1·19	3·10	4·0	5·57	0·09	25·18
1961 . . .	1·02	0·54	..	0·48	1·83	1·20	1·66	2·25	2·22	6·04	2·39	1·80	21·43
1962 . . .	0·20	2·00	0·10	2·80	5·60	0·90	0·50	3·20	5·60	7·00	2·00	2·10	32·20
1963 . . .	0·50	..	0·40	1·30	1·70	0·30	1·30	1·40	3·90	3·30	3·90	4·90	22·90
Total . . .	1·72	2·54	1·67	6·72	12·27	3·73	7·27	8·04	14·82	20·34	13·86	8·89	101·71
Average . . .	0·43	0·64	0·42	1·68	3·07	0·84	1·82	2·01	3·70	5·09	3·47	2·22	25·43
							8·37″				8·56″		

APPENDIX—IX

Statement showing the rise of Water Table in Irrigated Areas of the Lower Bhawani Project (Head Works Division)

Sl. No.	Particulars of well (Mileage of canal near the well)	Month	Depth of water below ground level in feet during the years.				
			1959	1960	1961	1962	1963
1	2	3	4	5	6	7	8
1	O-6-140 (L) M.C.	Nov.	3·86	3·8	3·87	3·93	4·7
		May	„	4·50	4·70	3·75	5·03
2	0-6-540 (L) M.C.	Nov.	0·63	0·63	0·76	0·76	1·38
		May.	„	1·80	1·66	1·88	2·21
3	1-1-460 (L) M.C	Nov.	0.67	0·42	0·67	0·57	0·59
		May	„	2·17	0·43	0·92	1·01
4	0-7-180 (R) M.C.	Nov.	0·45	·05 (above G.L.)	·05 (above G.L.)	0·44	1·45
		May	„	0·45	1·23	1·53	1·23
5	1-2-250 (R) M.C.	Nov.	10·20	10·92	10·7	10·45	12·12
		May	„	12·45	11.35	12·39	12·7
			1957-58	1958-59	1959-60	1960-61	1961-62
6	Well at 2/7-8 of Unjalur Disty	Nov.	2·5	1·5	1·5	3·5	6·5
		May	2·5	6·5	6·5	8·5	8·5
7	Well at M 3-6-80 of Unjalur Disty	Nov.	..	1·5	1·5	4·5	8·5
		May	1·5	7·5	5·5	6·5	7·5
8	Well at M. 5/5(L) of Kugalur Disty	Nov.	..	14·5	14·5	16·5	25·5
		May	14·5	15·5	14·5	26·5	27·5

Sl. No.	Particulars of well (mileage of canal near the well)	Month	Depth of water below ground level in feet during the years				
			1957-58	1958-59	1959-60	1960-61	1961-62
1	2	3	4	5	6	7	8
9	Well at M. 1/4 Branch at 1/2-3 of 23/3 Disty .	Nov. .	..	7·0	10·0	6·0	6·5
		May .	6·5	10.0	12·0	5·0	4·0
						(above G.L.)	
10	Well at 3/0-20 R. of Erode Main Disty .	Nov. .	0·0	0·5	0·5	1·0 (minus)	1·0
		May .	1·5	4·5	7·50	9·50	5·50
			(above G.L.)		(above G.L.)		
11	Well at 1/3-4 of 2/5-540 Kagam 3/10-138 of Channasamudram Disty	Nov. .	(above G.L.) 2 Ft.	1·5	5·0	1·11	10·0
		May .	above G.L. 2 Ft.	7·0	0·0	6·0 above G.L. 2ft.	
12	Well at 6/0 R of M.C. .	Nov. .	7·0	8·0	8·0	9·5	8·0
		May	7·25	16·50	15·0	13·0	10·0
13	Well at 60/0-1(L) of M.C.	Nov.	7·50	9·0	8·50	8·50	8·50
		May .	7·50	9·0	8·50	10·50	10·50
14	Well at 63/0-1 left of M.C. . .	Nov.	8·0	8·0	8·0	8·0	10·0
		May .	8·0	8·0	8·0	10·0	10·0
15	Well at 0/0 and 0/1 of Unjalur Disty .	Nov. .	0·0	0·0	0·0	0·0	1·50
		May .	0·0	4·5	4·5	5·5	0·5
16	Well at 7/7-8L of M. Canal . .	Nov. .	0·9	0·9	0·9	1·9	0·9
		May	7·5	7·5	8·0	5·0	4·5
			(above G.L.)		(above G.L.)		(above G.L.)
17	Well at 18/3-4(L) of M. Canal .	Nov. .	1	1.0	1·0	1	1
		May .	2.5	6.0	6·0	3·5	0·0

Sl. No.	Particulars of well (mileage of canal near the well)	Month	Depth of water below ground level in feet during the years				
			1957-58	1958-59	1959-60	1960-61	1961-62
1	2	3	4	5	6	7	8
18	Well at 26/2-400 R of M. Canal	Nov.	3·5	1·5 above G.L.	0·5	0·5 above G.L.	0·0
		May	12·5	5·5	1·5	0·5	0·5
19	Well at 35/5-6 L of M. Canal	Nov.	5·25	5·25	5·25	8·25	6·00
		May	6·25	6·25	6·25	10·25	„
20	Well at M. 11/5(L) of Unjalur Disty	Nov.	4·0	4·0	0·25	4·0	8·0
		May	10·0	7·0	6·0	14·0	10·0
21	Well at M. 8/2-3(L) of Chennasamudram Disty	Nov.	1·0	1·0	1·0	4·0	1·0
		May	3·0	10·0	10·0	3·0	„
22	Well at M. 14/3-1 (R) of Chennasamudram Disty	Nov.	0·5 above G.L.	—1·0	0·5	—1·0 above G.L.	11·0
		May	5·0	12·0	10·0	22·0	12·0
23	Well at M-10/7-56 of Bhawani Disty	Nov.	5·5	7·5	12·5	12·75	6·0
		May	5·0	17·0	17·5	19·0	2·0
24	Well at 38/6-7(L) of M. Canal	Nov.	2·0	2·0	3·0	6·0	5·0
		May	6·0	6·5	6·75	10·0	„
25	Well at 38/6-7(R) of M. Canal	Nov.	6·0	6·0	6·0	6·0	4·5
		May	7·5	7·75	11·0	14·50	8·0
26	Well at 46/7-8(L) of M/ Canal	Nov.	17·0	18·0	23·0	18·0	20·0
		May	17·5	25·25	25·0	23·0	25·0
27	Well at 48/7-8(L) of M. Canal	Nov.	2·0	1·5	4·5	2·5	4·5
		May	2·0	4·0	4·0	7·5	7·5
28	Well at 65/4(L) of M. Canal	Nov.	2·0	2·0	2·25	2·5	2·75
		May	2·0	3·0	12·5	15·0	2·75

Sl. No.	Particulars of well (mileage of canal near the well)	Month	Depth of water below ground level in feet during the years				
			1957-58	1958-59	1959-60	1960-61	1961-62
1	2	3	4	5	6	7	8
29	Well at 71/6(L) of M. Canal	Nov.	00·0	00·0	00·0	00·0	00·50
		May	9·0	12·0	17·5	12·0	,,
30	Well at 79/0(L) of M. Canal	Nov.	9·0	9·0	9·25	9·25	9·5
		May	9·0	9·5	14·0	15·0	,,
31	Well at 94/4-5(L) of M. Canal	Nov.	—2·0 above G.L.	2·5	—2·0 above G.L.	5·0	2·5
		May	2·5	6·5	2·5	8·0	,,
32	Well at 102/0-1(L) of M. Canal	Nov.	2·5	13·0	16·0	10·5	20·0
		May	7·5	7·5	13·0	22·0	23·0
33	Well at 117/3-4(R) of M. Canal	Nov.	12·5	14·5	12·0	14·0	12·0
		May	22·0	11·0	17·0	25·0	15·0
34	Well at 1/4(L) Branch Disty. of 33/2 of Kugalur Disty	Nov.	7·0	7·0	7·0	7·0	12·0
		May	10·25	10·50	11·0	14·0	13·0
35	Well at 0/3-260(R) of Unjalur Disty	Nov.	2·5	6·5	5·50	5·50	6·0
		May	6·0	6·0	5·0	6·0	6·0

APPENDIX—X

Statement showing the average yields of the major crops and their economics at the Agricultural Research Station, Bhawani Sagar.

Sl. No.	Name of Crops	Variety	Duration of crop (in days)	Average yield per acre (in Kgs.)	Cost of cultivation per acre (in Rs.)	Net profit per acre (in Rs.)	Number of irrigation required.		
1	2	3	4	5	6	7	8		
1.	Paddy . . .	ASD 5	150	1700	325	619	Standing water of 2 inches is maintained. Irrigation 2 to 3 inches once in 3 days		
		TKM 6	115	1800	295	661			
		(C) 30		1440	310	477			
2.	Cotton . . .	NCU 1	155	959 (Kapas)	475	978	8—10	Say	100″
3.	Groundnut . . .	TMV 2	105	615 (Pods)	300	196	10—12	Say	30″
4.	Cholam . . .	CO 18	90	950	225	267	6—8	Say	20″
5.	Ragi . . .	CO 2	110	800	210	176	16—18	Say	50″

APPENDIX—XI

Lower Bhawani Project

Copy of demi official letter No. COPP/WUP/14/63 dated April 17, 1964 from Shri Baleshwar Nath, Member, Irrigation Team and Water Utilisation Panel, Committee on Plan Projects, Planning Commission, to Shri K. V. Ekambaram, Chief Engineer for Irrigation, Chepauk, Madras-5.

During our recent tour of Lower Bhawani Project area we had occasion to observe at many places that field water management of Irrigation supplies is not adequately water conservation oriented. The soil depths being generally low and the nature of the soil being porous, water application to irrigable crops has, of necessity, to be more frequent. Field water management, therefore, becomes a matter of paramount importance, as the irrigation operations are almost continuous and seepage takes place almost insistently.

But, to our surprise we found that the technical control on the supplies of water almost ceases at the canal sluices. While field water management of irrigation supplies is as important, if not more, as collection and transmission of water in the dams, canals and distributaries, the technical control slackens after the water has left sluices. Though watercourses have been built to some extent, yet the detailed internal distribution of water in the fields is not subject to adequate technical control.

Apparently, there is a great need for extending the technical control of irrigation staff to the field level, as far as possible. That will in its turn lead to a better efficiency of irrigation per m. cft. of water, and will eventually lead to build up a water conservation consciousness in the Ryots also. In other words, wastage and over-application of water at any stage has to be taken serious notice of, so that irrigators get alerted about it.

As we discussed at Madras on April 13, 1964, considerable improvement can take place if the technical control of irrigation staff is extended to the field level as far as possible. This can be achieved to a great extent if the system of assessment as is prevalent in Punjab, Uttar Pradesh, Gujarat, Maharashtra, etc., is adopted in Madras also. In these States the assessment is done by the Irrigation Department staff and the assessment papers are eventually forwarded by the Divisional Engineers to the Collectors concerned for collection season after season. That in our opinion will bring about an improvement in the field water management to some extent and may also

result in a less frequent periodicity of irrigation application to different crops on a more scientific basis with the collaboration of field Agricultural staff, than what has been possible so far.

Since this suggestion involves a change of policy, we would very much like to have the comments from yourself, and the Revenue administration of your State, before formulating our recommendation in this respect.

With kind regards,

APPENDIX—XII

Area under various crops in the concerned districts of Madras for the year 1955-56 (in acres)

Crops	DISTRICTS	
	Coimbatore	Tiruchirapalli
	(Acres)	(Acres)
RICE		
Autumn	91175	367470
Winter	54094	136844
Summer	3964	14094
Total	146233	518408
CHOLUM OR JOWAR		
Kharif	356316	243272
Rabi	185678	79990
Total	541994	323262
CUMBU OR BAJRA	276350	257516
Maize	541	3284
Ragi or Marua	154047	51181
Wheat	1628	1
Barley	..	..
OTHER CEREALS AND MILLETS		
Kharif	128507	213415
Rabi	62875	14052
Total	191381	227467
Gram	1657	148
Tur or Arhar	11626	50448
OTHER PULSES		
Kharif	81074	30233
Rabi	165978	33116
Total	247052	63349
SUGAR CANE	20708	16440
Other	1470	540
Chillies	14118	28859
Turmeric	8560	3444
Cardamom	3285	..
Betalnuts	1669	2
Other Spices	3537	20075

Crops	DISTRICTS	
	Coimbatore	Tiruchirapalli
	(Acres)	(Acres)
FRUITS		
Mangoes	578	3218
Citrus Fruits	371	366
Banana	5062	10320
Others	724	1055
Cashew Nuts	..	24532
VEGETABLES		
Tapioca	360	510
Sweet Potatoes	399	2969
Onions	5987	2784
Others—Kharif	2212	2072
Rabi	1504	891
OILS SEEDS		
Groundnut	274245	196956
Castor	4920	3770
Sesamum (Till)	80351	80893
Rape and Mustard	180	9
Cocount	12061	7489
FIBRES		
Cotton	268341	44165
Mesta	269	90
Sanhemp	900	2
Others	656	385
Indigo	..	61
Coffee	3986	..
Tea	25199	..
Tobacco	47474	3357
Cincona	81	..
Indian Hemp	1574	..
Rubber	521	..
Other Plantations	1141	1379
Fodder Crops	7103	250
Green Manure Crops	609	2469
Other Non Food Crops	22107	8653
Total Area sown under all crops	2421895	1964266
Area sown more than once	445516	221113
Net Area Sown	1976379	1743153

APPENDIX—

Classification of area in the concerned districts in

Sl No.	Districts	Area according to Survey or Gen. of India	Area according to village papers	Not available for cultivation		
				Forest	Land put to non-agricultural uses.	Barren and uncultivable land
1	2	3	4	5	6	7
1	Coimbatore .	4537600	4552066	1443347	160824	143506
2	Tiruchirapalli .	3528960	3523474	197207	517684	170692

Total Area irrigated in acres from different sources in the con-

Districts	CANALS	
	Government	Private
Coimbatore	159203	„
Tiruchirapalli	183378	„

XII-A

Madras for the year 1955-56 (in Acres)

Other cultivable land			Total	FALLOW LAND		Total	Net area sown	Total cropped area	Area sown more than once
Permanent Pasture and other grazing land	Land under misc. trees, crops and groves not included in net area sown	Culturable waste		Fallow land other than current fallow	Current fallows				
8	9	10	11	12	13	14	15	16	17
49182	15954	119720	184856	74906	568248	643154	1976379	2421895	445516
135502	49552	394352	599406	97290	217952	315242	1743153	1964266	221113

ermed Districts in Madras for 1955-56.

Tank	Wells	Other Sources	Total
19339	307264	3989	489795
202476	118484	4995	509333

GMGIPND—69 PC—(6520)—Mono (N.S.)—11-5-66—500.