



REPORT
ON
MINOR IRRIGATION WORKS
(West Bengal)

COMMITTEE ON PLAN PROJECTS
(Minor Irrigation Team)
NEW DELHI
(February, 1963)

LETTER OF TRANSMITTAL

M. THIRUMALA RAO, M.P.,
Leader, Minor Irrigation Team,
Committee on Plan Projects.

Planning Commission,
21st February, 1963.
New Delhi.

My dear Shastri ji,

The report of the Minor Irrigation Team on the study of minor irrigation works in West Bengal is sent herewith.

The report reveals the disparity that exists in the performance of the minor irrigation works of the pre-Plan period and those completed in recent years. Some of the minor irrigation works completed in the First and Second Plan periods have apparently been vulnerable to a sort of casualness in their planning, execution and operation. In heavy rainfall areas, as in northern parts of West Bengal, there seems little justification for their provision.

Another significant observation made out in the report pertains to the State tubewell programme, now in hand in West Bengal. As also brought out in the Team's report on the study of State tubewells in Uttar Pradesh, financial self-sufficiency of State tubewells in heavy rainfall areas appears problematic. Unless concerted efforts are made to have a multiple crop pattern adopted and sustained on these tubewells, it is doubtful, if they will attain financial self-sufficiency. The Team has, therefore, advised due caution to be exercised in the expansion of tubewell programme in West Bengal.

Minor Irrigation Works in West Bengal are handled by more than one department. The Team has suggested that unitary control on minor irrigation works will go a long way in improving their performance. Another item needing attention is water distribution through properly laid out field channels. The Team has drawn attention to this point quite pertinently. Besides, the legislation in the State affecting irrigation works also appears outmoded. It has, therefore, been stressed in the Report to bring out fresh legislation, so as to enable greater utilisation of irrigation works in the State, by and large.

Keeping the above factors in view, a number of recommendations have been incorporated in the Report with a view to maximise production from irrigated agriculture in West Bengal. These will also help in formulating and sanctioning further programme of irrigation expansion in the State.

(ii)

I also take this opportunity of expressing our thanks to the State Government and their officers for the co-operation, they extended to us in supplying information and for the facilities they afforded us for study of the works in the State.

Yours sincerely,

M. THIRUMALA RAO

**Shri Lal Bahadur Shastri,
Minister for Home Affairs,
Government of India,
New Delhi.**

Preface

Minor Irrigation Team appointed by the Committee on Plan Projects undertook the study of minor irrigation works in West Bengal as part of the programme laid down in the Terms of Reference, communicated *vide* committee on Plan Projects Memorandum No. COPP/ (4)/17/58 dated the 4th August, 1958 appearing on page 63 of this Report. The Team comprised Dr. A. N. Khosla, *Leader*, Shri Lal Singh, Retd. Director of Agriculture, Punjab, Shri Baleshwar Nath, Chief Engineer (Addl.), *Members* and Shri Mahavir Prasad, Irrigation Adviser, Ministry of Food and Agriculture, *Member-Ex-Officio*.

Dr. A. N. Khosla relinquished Leadership of the Team on December 12, 1960 and Shri M. Thirumala Rao, M.P. took his place.

Shri Lal Singh ceased to be Member of the Team with effect from July 28, 1960 and Dr. Arjan Singh, Retd. Director of Agriculture, Punjab was appointed Member in his place.

After the studies were initiated by Dr. A. N. Khosla in a meeting held at Calcutta (*vide* Minutes—*Appendix XIV*), the Team toured different parts of the State and made field studies on a number of minor irrigation works. A significant feature of the study is critical appraisal of deep tubewell scheme taken up in the State, recently. Utilisation of the potential so created will involve vast changes in the existing agronomic practices and their traditional background. Its financial implications too, are significant. The Team has, therefore, touched upon these aspects and has stressed upon the fact that progressive irrigation schemes should be financially self-supporting.

Discussions were held with the State officers from time to time, and the Team's report has been finalised after a conclusive meeting between the Team and the Ministers and officers of the West Bengal Government, held at Calcutta on February 14, 1963 *vide* minutes given in *Appendix XV*.



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CHAPTER I

General

1.1. West Bengal is the only State in India, which borders Himalayas in the north and sea in the south. Many rivers traverse the State. The northern portion of the State is drained by the Tista, the Amo and other hill streams, which join the Brahmaputra. Rivers emerging from the western hills in Santhal Parganas, Bihar and Chhota Nagpur flow through the south-western region of the State. The great Ganga and many of its spill-channels pass through its central plains and fan out into the fertile deltaic areas.

1.2. Physical Regions.—According to physical configuration and topographical features of the land, the State can be divided into four distinct regions :—

- (a) First is the South Western region consisting of the districts of Birbhum, Burdwan, Bankura and Midnapore, the western parts of Hooghly and Howrah districts, and the valleys of the Damodar, the Ajoy, the More, the Dwarkeshwari, the Kasai and the Silai rivers. The soils mostly consist of laterite and sandy loams. The land is fairly undulating. Agriculturally it can be classified as :—
 - (i) high land which is mostly uncultivated ;
 - (ii) medium land which is partly cultivated ;
 - (iii) low land which is generally under paddy cultivation.
- (b) Second is the Central Bengal region consisting of the districts of Murshidabad, Nadia, 24 Parganas, Malda, West Dinajpur and the eastern portion of Hooghly and Howrah districts. These are served by the spill channels of the Ganga, namely, the Bhagirathi, the Matabhanga, the Jalangi, the Bhairavi and their tributaries. The area is mostly deep alluvial in formation and with a number of depressions, called *beels*, which are saucer shaped depressions and are not easily drained.
- (c) Third is Northern Bengal region consisting of Darjeeling, Jalpaiguri and Cooch-Bihar through which flow the Tista and the Amo and their tributaries. In the agricultural region infringing the foot-hills, the top soils are porous and do not retain moisture for long.
- (d) Fourth region is the deltaic area, commonly called Sunderbans, and is built primarily by the silt carried by the Ganga through Bhagirathi-Hooghly and its many branches. This process of building the delta has also been assisted by the

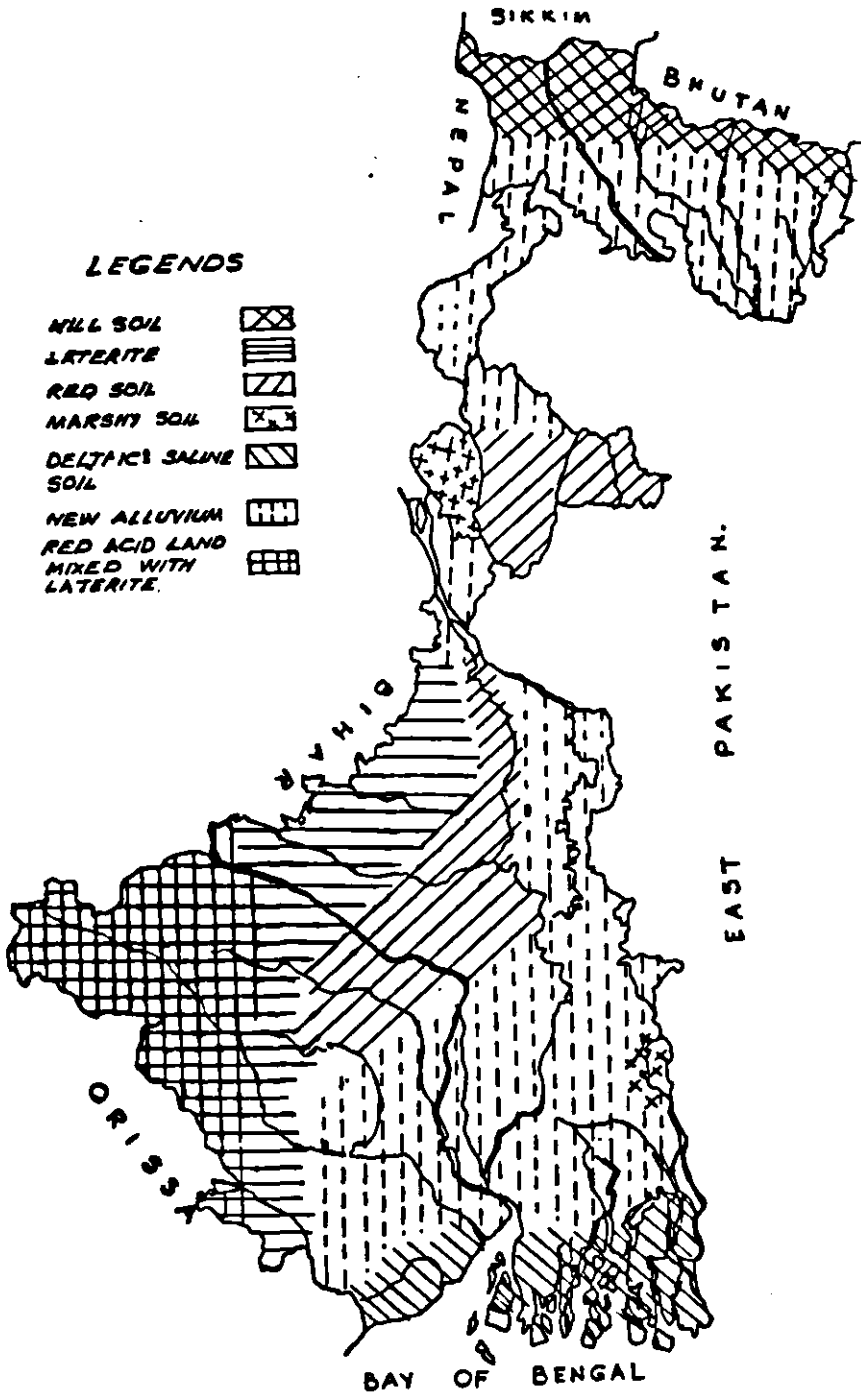


FIGURE 1.1. Soil Map of West Bengal

silt brought up by the tides from the sea. It is mostly covered by creeks and tidal channels. About 1,000 square kilometers of the area is under cultivation and the remaining is under forest of one kind or the other.

Each area has its own special problems with regard to its agriculture and irrigation. A soil map of the State is shown in Figure 1.1.

1.3. Rainfall.—Distance from sea coast to Himalayas in the north is only about 650 kilometers (400 miles). This results in early monsoon causing excessive and concentrated rainfall in the sub-mountain region of the north. Numerous hill streams swell into rushing torrents and debauch the country-side lower down. At the same time, drought conditions are sometimes experienced in the south-western parts of Bankura and Midnapore districts, leading them to near desert conditions. In this respect there is almost a mysterious variance of these phenomena. Rainfall, otherwise too, is ill-spaced. Quite often West Bengal's agricultural economy, which is primarily dependent on rainfall, has to face unforeseen hazards. An Isohyetal map in Figure 1.2 indicates the general rainfall pattern of the State. District-wise figures of annual precipitation are given in *Appendix I*.

1.4. Distribution.—During March-April, local thunder storms which bring showers of rain is a common feature in the Himalayan and sub-Himalayan districts of the State. Jalpaiguri records an average of 105.2 mms. (4.14") and 194.6 mms. (7.66") in March and April respectively. It is only in May and June that southern districts like Burdwan get rainfall which averages to 90.4 mms. (3.56"). They help in starting the agricultural operations for *kharif* crops *viz.* Jute and *Aus* paddy.

Monsoon generally reaches its peak in July during which month Jalpaiguri records 1132.6 mms. (44.59") and Bankura 278.9 mms. (10.98"). It begins to weaken from August onwards until in November the average is 25.4 mms. (1.0") only. December is the driest period of the year and there is rarely a rainy day during this month. In January and February there are only one to two days which receive 2.54 mms. (0.1") of rainfall within 24 hours. Highly irregular distribution of rainfall is obvious. Quite often rainfall supplies more than the required amount of water directly into the fields and drainage of excess water becomes a problem for agriculture and public health.

1.5. Agricultural Holdings.—Geographical area of West Bengal is 33,928 square miles. The population of the State is 34.97 million, which is 7.96 per cent of the all India population. The area of the State being only about 2.91 per cent of the total area of India, the proportionate burden on the land is heavy. Density of population is 769 as compared with all India average of 364. It is less populous than Kerala and Delhi only. The density within the State ranges from 567 in Cooch-Bihar to 2,877 in Howrah district. Though percentage of

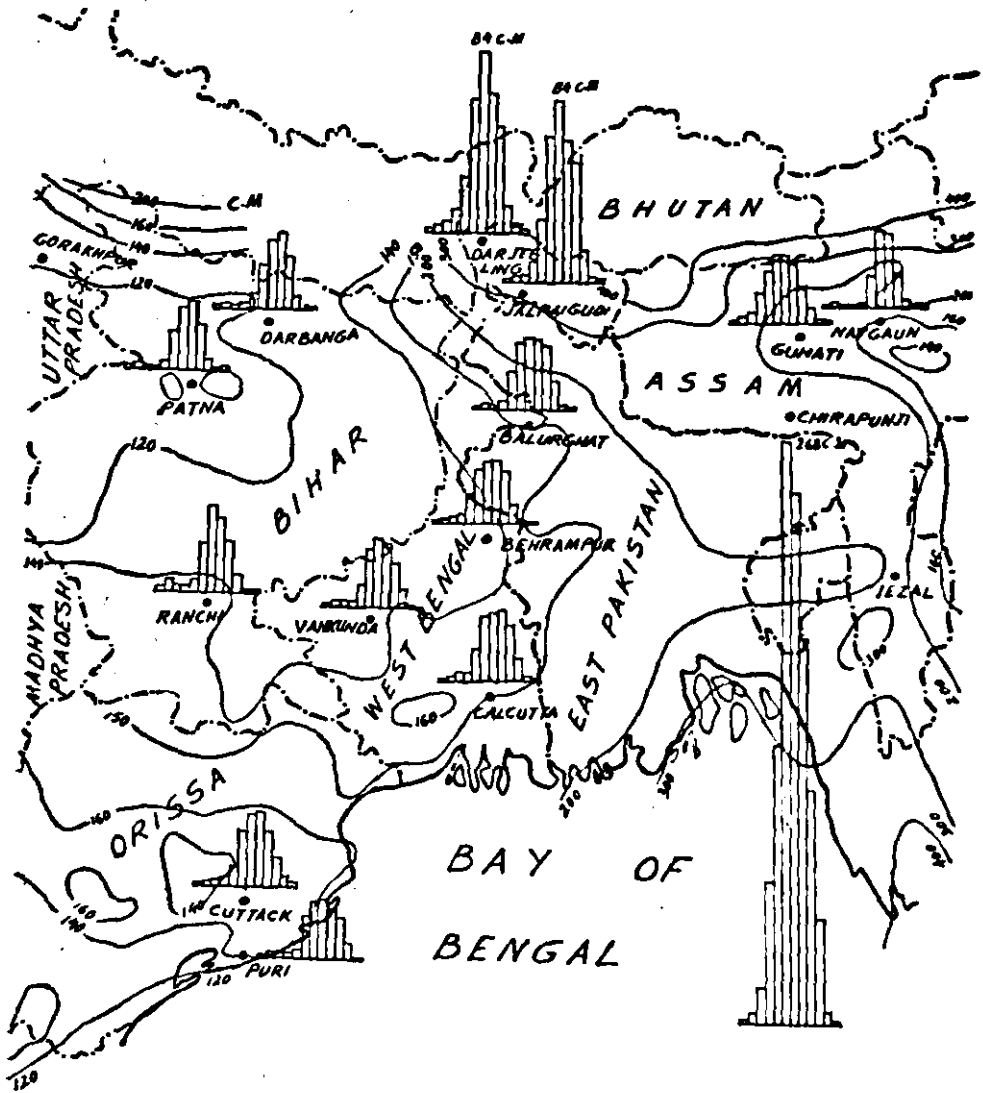


FIGURE 1.2. An Isohyetal Map of West Bengal

FIGURE 1.2

cropped area of the State is highest in India, being 61.1 per cent as against 48.8 per cent in the Punjab, 55.9 per cent in Uttar Pradesh and 47.8 per cent in Bihar, the cropped area per head is about 1/2 acre. The agricultural economy of the State, therefore, is greatly handicapped by fragmentation of agricultural land.

1.6. Irrigation Sources.—With regard to irrigation sources, canals are the largest single source of irrigation in the State. Next in order are the tanks. The following figures for the year 1955-56 are illustrative of the extent to which irrigation is done in the State from different sources :—

Source	Area Irrigated (acres)
1. Government Canals	5,90,000
2. Private Canals	9,03,000
3. Tanks	7,51,000
4. Wells	37,000
5. Other sources	4,86,000
TOTAL	27,67,000

1.7. Major Irrigation Schemes.—The major irrigation resources of the State are only few. Durgapur Barrage is expected to irrigate 9,73,000 acres of *kharif* and 55,000 acres of *rabi* in the districts of Burdwan, Bankura and Hooghly; Mayurakshi Reservoir project is proposed to irrigate 5,60,000 acres of *kharif* and 50,000 acres of *rabi* in the districts of Birbhum, Murshidabad and Burdwan; and Kangsawati Project (under execution) will take care of about 8,00,000 acres of *kharif* and 1,50,000 acres of *rabi* in the districts of Bankura and Midnapore, apart from some older canal projects like Midnapore canals. An irrigation map of West Bengal is given in Figure 1.3.

1.8. Minor Irrigation Schemes.—There are still vast stretches of land needing irrigational protection against vagaries of rainfall. This protection can be provided in many ways, *i.e.*, through small scale diversion canals; through irrigation schemes involving lifting of water from rivers and *beets*; through exploitation of subsoil resource by means of open wells or in suitable areas by means of tubewell pumping; through improvement of existing tanks and creation of new ones where necessary; and other small irrigation schemes, like *boro-bunds* and utilisation of drainage water for irrigation purposes.

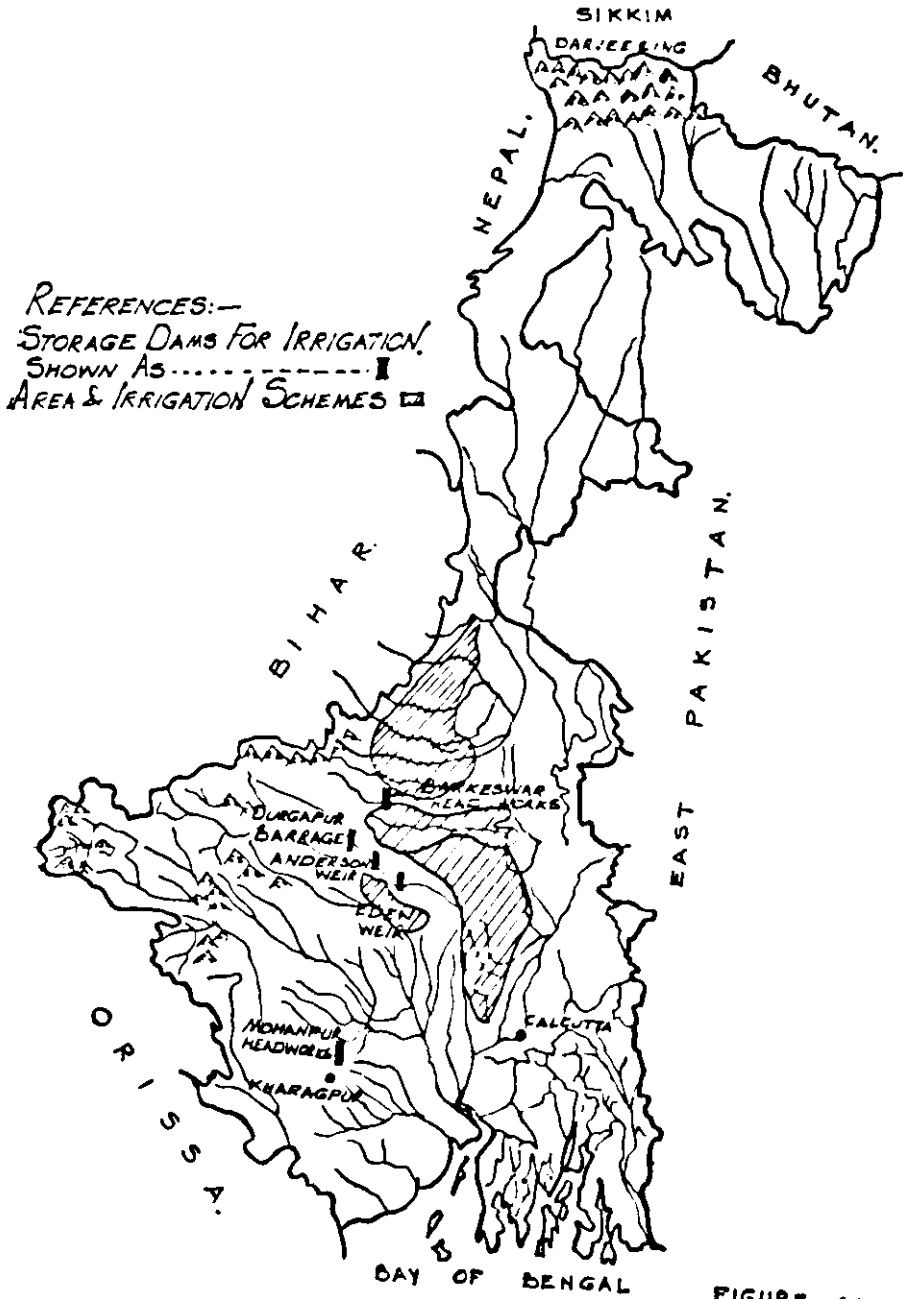


FIGURE 1.3. Irrigation Map of West Bengal

FIGURE 1.3.

1.9. Medium and minor irrigation schemes along with drainage-cum-irrigation projects, therefore, assume great significance in a land so varied in its topographical characteristics. Production can be undoubtedly increased through an efficient system of land and water management along with improved agricultural practices, because the land and water resources of the State are rich. With the population in the State increasing so fast (26·3 million in 1951 to 34·97 million in 1961), the Team feel that its food production should be geared up and no investment should be grudged, provided we are assured of good returns to the people as well as to the State.



CHAPTER II

Minor Irrigation—Diversion Canals and Bunds

2.1. According to topographical features of different regions of West Bengal, irrigation through small diversion canals and bunds is possible only in the south-west region where the ground is undulating and in the northern semi-hilly tract skirting the foot-hills of Himalayas. Such minor irrigation schemes in the above areas can be studied in three-chronological groups namely, (i) those which were completed before the First Five Year Plan, (ii) those which were completed during the First Five Year Plan, and (iii) those which were completed during Second Plan Period. Their locations are shown in Figure 2.1.

2.2. Schemes completed before the Plan Period.—Before the First Five Year Plan, minor irrigation works were mostly confined to the south-west region consisting of Birbhum, Midnapore and Bankura districts. Rainfall in northern Bengal being heavy, the necessity for irrigation schemes in that region was not felt so much as in the south-west. The schemes taken up before the First Plan period are enumerated in Table 2.1

TABLE 2.1

Scheme	Estimated cost (Rs. in lakhs)	Area assigned for irrigation (acres)	Average irrigated area (acres)	Remarks
1	2	3	4	5
1. Sallundh Canal, Bankura.	N. A.	848	1,515	Average for 8 years from 1951-52 to 1958-59.
2. Amjore Canal, Bankura.	N. A.	700	617	do.
3. Bakreswar Canal, Birbhum.	7.13	8,000	7,767	do.
4. Kashianala Canal, Birbhum.	N. A.	3,500	1,856	Average for 4 years from 1951-52 to 1954-55.
5. Fukhni Khal, Bankura.	0.60	500	213	Average for 8 years from 1951-52 to 1958-59
6. Kulai Khal, Bankura.	1.20	600	799	do.
7. Putrangi Canal, Midnapore.	2.70	2,200	1,644	do.

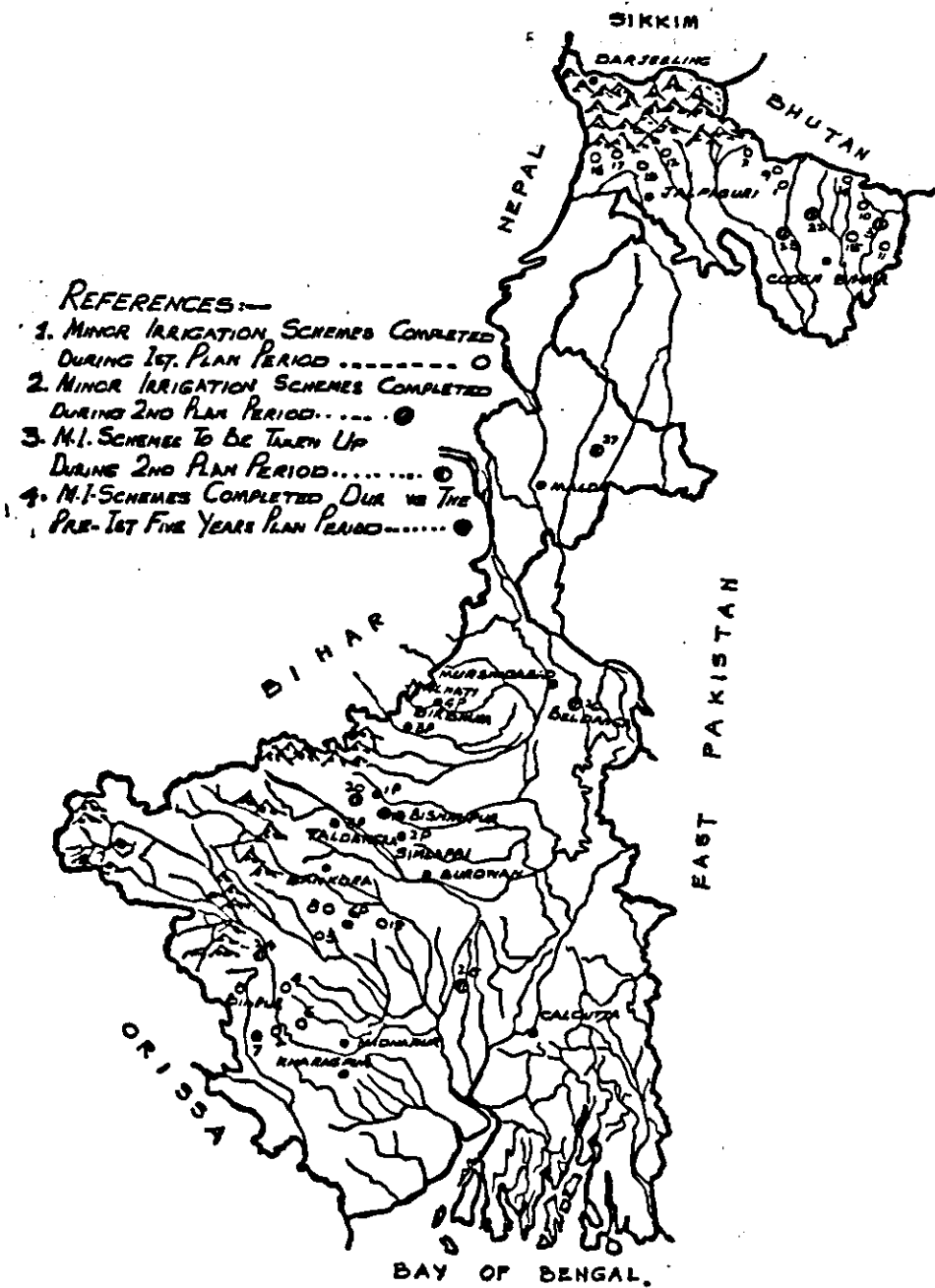


FIGURE 2.1. Minor Irrigation Map showing locations of Minor Irrigation Works in West Bengal

These schemes have now been in operation for over ten years. Records of their completed cost are not available. With regard to areas irrigated, the Team feel that the areas as given in Table 2.1 are not based on actual field-wise recording from the *mauza* map. Even so, the figures indicate that on the whole, these schemes have served areas proposed to be irrigated therefrom, though in some cases there have been short-falls.

2.3. Putrangi Canal Scheme.—In the case of Putrangi Canal Scheme in Midnapore district, enquiries reveal that the shortfall in irrigation is due to the fact that irrigation system is under the Bengal Irrigation Act of 1876, which lays down the periodic lease procedure. Irrigation of the fields under this Act cannot be done until cultivators approach the authorities and execute a lease bond either for one crop or for a long period. This leads to unnatural abstinence on the part of the cultivators till the time the rain fails. They normally wait for the rains, and if the rainfall is good, they save on the water rates, which they would have incurred, had they entered into a lease bond before. In some cases, they approach for the canal water so late that it is not possible to help them. Naturally a planned irrigation service in the area under command cannot be assured. Putrangi scheme consists of a weir in Putrangi *Khal* which ultimately joins Dolong river. There is only one under sluice and one head sluice with two vents, five feet each, feeding the canal and its distributary channels. The head work and canals are maintained by the department and regulation of water and supervision are done by departmental overseers, patrols and *Khalasis*.

2.4. The data given in Table 2.2 indicates the yearly performance of Putrangi Canal Scheme. Assessment figures have been calculated at Rs. 6.00 per acre, while figures for maintenance charges have been provided by the West Bengal authorities. This will indicate that the cost of maintenance is easily met with, except in the year 1953-54, when the area served was only 846 acres.

TABLE 2.2

Year	Area irrigated (acres)	Assessment @ Rs. 6/- per acre (Rs.)	Maintenance charges (Rs.)	Difference between Col. 3 & Col. 4.
1	2	3	4	5
1950-51	1,956.00	11,736.00	7,735	+ 4,001.00
1951-52	1,555.00	9,330.00	3,076	+ 6,254.00
1952-53	1,632.00	9,792.00	3,997	+ 5,795.00
1953-54	846.00	5,076.00	6,829	— 1,753.00
1954-55	1,890.00	11,340.00	1,023	+ 10,317.00
1955-56	1,914.00	11,484.00	5,854	+ 5,630.00
1956-57	1,915.00	11,490.00	9,318	+ 2,172.00
1957-58	1,809.87	10,859.22	6,617	+ 4,242.22
1958-59	1,858.54	11,151.24	4,523	+ 6,628.24
1959-60	1,851.00	11,106.00	4,928	+ 6,178.00

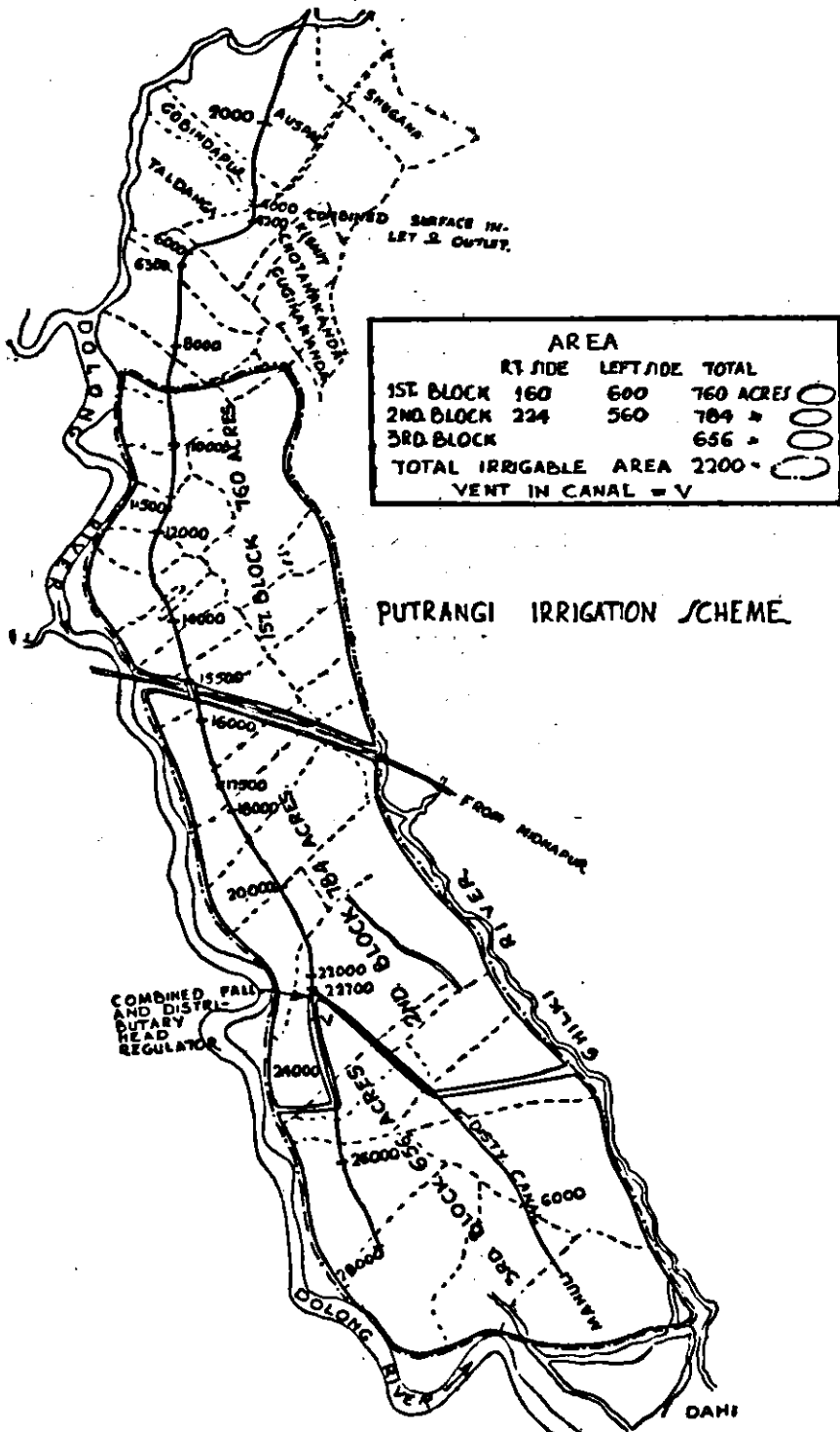


FIGURE 2.2 : Showign Block Map of Putrang Irrigation Scheme, district Midnapore (West Bengal).

A block map of Putrangi Canal Scheme is given in Figure 2.2. The three blocks consist of 760, 784 and 656 acres respectively. The irrigation is done on field to field basis. If water channels are properly laid out and agricultural planning is done to enforce a more profitable crop pattern, the performance of this scheme as also of other schemes in the region could be improved considerably.

The Team recommend that steps may be taken to make it obligatory for the beneficiaries to construct watercourses and maintain as is envisaged in the Bengal Irrigation Act III of 1876.

2.5. Schemes completed during the 1st Plan Period.— The construction of these schemes is confined mostly to two areas, namely south-western region of Bankura and Midnapore districts and northern areas of Jalpaiguri and Darjeeling districts. The performance in respect of these schemes, in so far as irrigated areas are concerned, is not as good as of the schemes completed before the Plan period. Of the 18 schemes as given in Table 2.3, only two are reported to have served as much areas as they were intended to cater for. The average performance of these schemes as against the area proposed to be irrigated for the last three years *i.e.* 1956-57, 1957-58 and 1958-59 indicate that taken altogether they served 39% and 83% and 50%

TABLE 2.3

Scheme	Estimated cost (Rs. in lakhs)	Area proposed under the Scheme (acres)	Average irrigated area (acres)	Remarks
1	2	3	4	5
1. Jampoī Irrgn. Scheme, Jalpaiguri.	0.51	800	N.A.	Annual irrigated acreage figures not available.
2. Jhargram Irrgn. Project, Midnapore.	9.74	5,000	1,396	Av. 8 years—1951-52 to 1958-59.
3. Bans Khal Irrgn. Scheme, Bankura.	0.50	1,000	415	Do.
4. Rajar Bund Scheme, Midnapore.	0.25	1,200	147	Av. 2 years—1954-55 to 1955-56.
5. Collector's Bund Scheme, Midnapore.	0.69	960	20	Av. 4 years—1955-56 to 1958-59.
6. Sepoy Bund Scheme, Midnapore.	0.47	600	140	Av. 7 years—1951-52 to 1958-59, excl. 1954-55.
7. Embankment in <i>mauza</i> Purbabatabari, Jalpaiguri.	0.13	1,090	886	Av. 8 years—1951-52 to 1958-59.
8. Chamkara Khal Scheme, Bankura.	0.64	650	248	Av. 7 years—1952-53 to 1958-59.
9. Bund & channel in Rangati River, Jalpaiguri.	0.07	1,440	1,170	Av. 8 years—1951-52 to 1958-59.
10. Dhumrihora channel in <i>mauza</i> Panbari, Jalpaiguri.	0.07	1,250	1,124	Do.

1	2	3	4	5
11. Narathali Kamakhya-guri Irrigation Scheme Pt. I., Jalpaiguri.	0.98	4,700	2,253	Av. 8 years—1951-52 to 1958-59.
12. Bundh in River Champ-sarai, Jalpaiguri.	0.16	700	700	Av. 6 years—1951-52 to 1958-59, excl. 1952-53 & 55-56.
13. Irrigation & Bundh Scheme in Sastugachi, Darjeeling.	0.12	1,000	853	Av. 5 years—1951-52 to 1958-59. excl. 1953-54, 1956 57 & 1957-58.
14. Bundh in Kultjhora, Jalpaiguri.	0.02	1,050	1,056	Av. 8 years—1951-52 to 1958-59.
15. Bundh in Chengmari Khal, Jalpaiguri.	0.12	1,800	1,117	Av. 6 years—1952-53 to 1958-59, excl. 1956-57.
16. Irrigation Bundh Scheme in <i>mauza</i> Jamaitullah, Darjeeling.	0.09	1,200	855	Av. 8 years—1951-52 to 1958-59.
17. Bundh in <i>mauza</i> Seabita, Darjeeling	0.19	540	550	Do.
18. Aulia Reservoir Scheme, Midnapore.	2.77	1,500	N.A.	Annual irrigated acreage figures not available.

respectively of their allotted area. Apparently it appears that some of the schemes had been built without any pressing need therefor. The Team made case studies of some of the schemes.

2.6. Chamkara Khal Scheme.—This scheme consists of an anicut built at a cost of Rs. 70,000 in the year 1951-52. The anicut consists of masonry wall provided with 3 under sluices. The design of the under sluices is of a very crude type and they are apparently not operable efficiently. The offtaking canal is $1\frac{1}{2}$ miles long. The downstream pitching on the side of the anicut was seen damaged at many places. It would be advantageous if the downstream pitching is laid in G.I. wire crates so that it does not get displaced after every rainy season. This kind of treatment will make the maintenance of these works convenient and cheaper in the long run.

The side pitching has been unnecessarily grouted with the result that the side drainage has been blocked and the side pitching stands damaged at places. It might have been better if the pitching had not been grouted or else weep-holes had been provided for backed up water to ooze out.

On the upstream side of the weir, it was stated that there is difficulty in feeding the channel efficiently. To avoid such a contingency two things seem necessary to be done; (i) under sluices have to be designed and placed properly and operated so as to provide scouring action, wherever there is tendency of silt accumulating and (ii) top shutters may be provided on the weir after due scrutiny of upstream and downstream floors, so that water level could be raised when necessary to force more water into the canal. Under its present condition, it is not surprising that the irrigation performance of these channels is poor. On the average for the last seven years the channel has done 248 acres as against 650 acres allotted to it. Reasons for these short-falls are inadequate supply of water in the channel and optional lease provision of Bengal Irrigation Act of 1876, which leaves the cultivators undecided till a very late stage when adequate arrangements may not be possible to meet the demand in case of failure of rains.

It is understood that Chamkara Khal scheme is likely to get under the command of Kangsabati Project. The remodelling suggested above may however be deferred to watch the development from the Kangsabati Project.

The yearly performance of the scheme is given below:—

Year	Acres	Year	Acres
1952-53	214	1956-57	254
1953-54	269	1957-58	231
1954-55	275	1958-59	202
1955-56	289		

2.7. Scheme near Nanda-Ranga Village.—The Team also saw another minor irrigation scheme recently executed near Nanda village. This is a weir on a *Jhor* between Nanda and Ranga villages. Some area has been irrigated on the downstream of the weir. It was pointed out that more land is available for irrigation on the downstream side. If greater quantity of water could be made available. Possibilities of increasing pondage on this side should be investigated. If shutters are fixed on the weir the pondage might be increased. It will, however, have to be seen how far submergence of land on upstream side will increase, and whether such submergence will be commensurate with the advantage that will be yielded to the areas on the downstream side. It is felt that on the area emerging out of the submergence relieved after the rainy season on upstream side some *rabi* crop like gram could be sown without needing further irrigation. If Nanda-Ranga scheme is likely to be benefited from Kangsabati Project effect of development therefrom needs however to be watched before taking action as suggested.

2.8. Inadequate Maintenance.—While driving through Bankura the Team also came across many *pucca* masonry irrigation and drainage structures, built many years ago. Irrigation Officers accompanying the Team informed that these works were looked after by the Revenue Department and were not in their charge. It is felt that the charge of such works of hydraulic nature in design and operation, should invariably be in the hands of technical staff

2.9. (i) The Team visited certain works which have been constructed in recent years in Bankura district through the efforts mobilised by the District Authorities. One such bund was located near village Barjora. It can serve an area of about 300 acres (paddy). In the month of March 1961, when the Team visited the tank, there was some water available but no irrigation was taking place and the fields were without any crop. It was explained that the cultivators who have their holdings below this tank were living in villages far away. They had, therefore, not sown anything during *rabi*, because they could not keep the cattle way. Such factors, therefore, stand in the way of utilisation of irrigation potential created, and the water collected during the rainy season just evaporates away. This amounts to loss of potential in case of a district like that of Bankura.

(ii) Another work which was visited by the Team is Raj Bund, situated in the village Lodna in Bankura district. This reservoir, it was gathered from the authorities, involved an expenditure of Rs. 1,50,000 and takes care of about 2,000 acres. Irrigation channels have been laid out from the reservoir. Serious retrogression of the stream bed has taken place below this bund. The causeway was in a dangerously delicate condition in March 1961. The right flank was seriously damaged. It is only a pitched up causeway. It may give way any day under a heavy shower. Apparently it has been built not on sound engineering principles. Its failure will prove to be a deterrent to the progress of co-operative efforts mobilised for putting up such works. Proper technical competence should be available and such Works should be undertaken only under careful technical supervision. Even the maintenance of this work has not been looked after because, it is considered to be the responsibility of the co-operative society which does not seem to possess necessary personnel. It is felt that works of this magnitude should either be maintained by the Irrigation Department or by the Agriculture Engineering Department, if not on a State financed basis then on a contributory work basis.

2.10. While in Midnapore district, the Team looked into the performance of Jhargram Irrigation Scheme consisting of two weirs (i) Champa Khal and (ii) Kawari Khal with a total irrigable area of 2,506 and 2,544 acres respectively. A block map showing their locations is given in Figure 2.3.

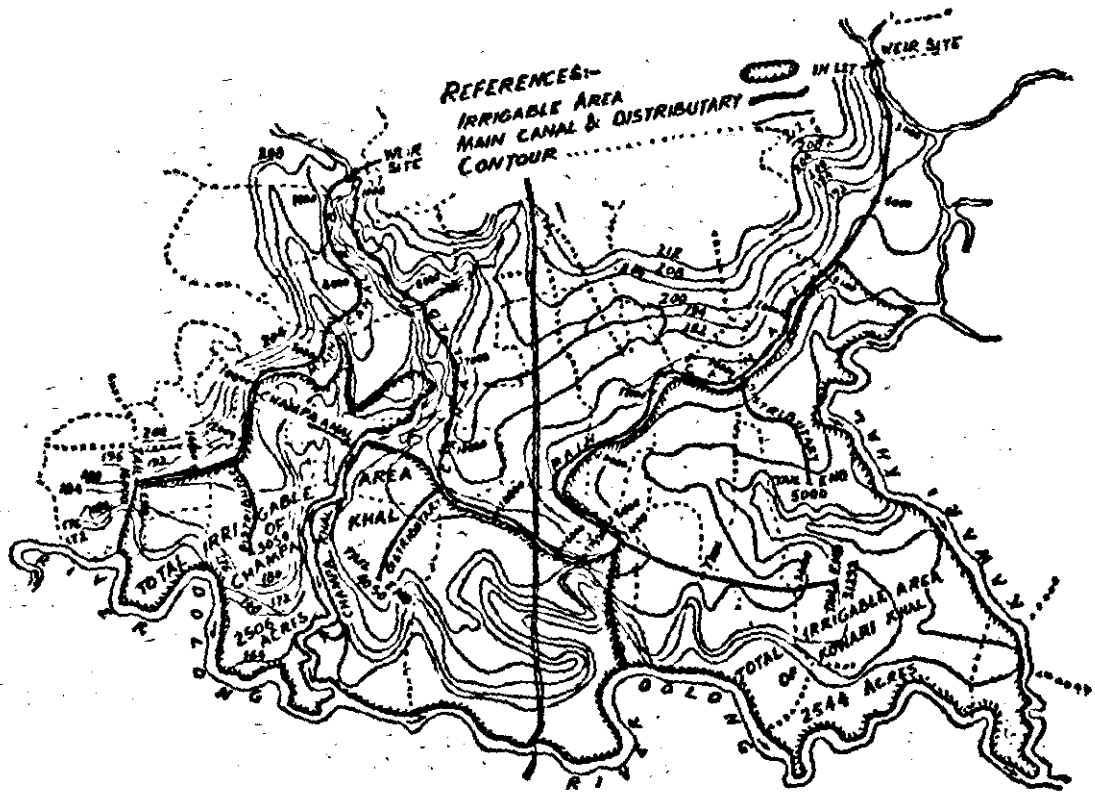


FIGURE 2.3. Index Map of Jhargram Irrigation Scheme.

Champa Khal Scheme.—This scheme consists of a weir on the river and two under sluices on either end of the weir, with head sluice on each bank with two main canals and distributaries. The structure and canals are maintained by Irrigation and Waterways Directorate and the supervision is exercised by the Department. As on other schemes, there are no water channels leading the water to the fields and irrigation is done from field to field which is wasteful.

Kawari Khal Scheme.—On the Kawari Khal scheme also there is a weir with one under sluice and one head sluice with 2 vents of 5'-3" each feeding the main canal and distributaries.

2.11. Under both the schemes in the Jhargram Irrigation Project, as it is called, the lease system under Bengal Irrigation Act of 1876 operates. The cultivator is, therefore, reluctant to take water till the rains fail. As a result, the schemes have not been able to do the areas they were intended to cater for. Another lacuna in the scheme is that the areas on the lower contours get automatic benefit of irrigation, when lands on the upper contours are irrigated. The cultivators of the lower areas, therefore, are never prepared to execute a lease for irrigation water.

2.12. The Team feels that legislation should be such as should promote maximum output from the existing land and water resources, and should not lend any weight to abstinence on the part of the cultivators and inability on the part of the Department to meet with their irrigation demands, when they come up during the period of drought. If irrigation is asked for, when it is available the demand will get spread over a longer period. The production will be firmed up and the hazards of crop failure will be obviated. These two instances of Champa Khal and Kawari Khal are not singular. It is reported to be so with other schemes as well. In the present context of country's food shortage a change in policy is urgently called for. Irrigation facilities, where they exist, should be made use of in the best interest of production. The desired results would be achieved to a great extent if irrigation charges are levied on the basis of a two part tariff by imposition of a standing charge on all the areas catered for by the irrigation schemes and a recurring charge on the actual area irrigated season after season. For example, if Rs. 6:00 are the irrigation charges for one acre it may be broken up into two parts, say Rs. 2.00 as a standing charge and Rs. 4.00 as recurring charge. The existing Act has to be amended accordingly.

2.13. Schemes Taken up During Second Plan Period.—Among the schemes taken up and completed after the First Five Year Plan, there are three schemes in Jalpaiguri district in northern Bengal, one in Murshidabad district in central Bengal, four in south west region in Bankura and Midnapore districts. These schemes are enumerated in Table 2.4.

*TABLE 2.4

Scheme	Estimated cost (Rs. in lakhs)	Area proposed to be irrigated (acres)	Average irrigated area (acres)	Remarks
1. Mole Bundh Irrg. Scheme, Bankura.	2.58	2,000	1,000	Av. 3 years. 1956-57 to 1958-59.
2. Bhora Khal Irrg. Scheme, Bankura.	2.56	2,858	1,452	Do.
3. Shibkata Irrg. Scheme, Jalpaiguri.	0.38	1,000	607	Do.
4. Bouni Irrg. Scheme, Jalpaiguri.	0.06	760	760	Do.
5. Jateswar Irrg. Scheme, Jalpaiguri.	1.46	1,920	Nil.	..
6. Jhiku Khal Irrg. Scheme, Bankura.	2.09	1,660	257	Av. 2 years—1957-58 & 1958-59.
7. Construction of an Irrg. Sluice on Chetua Circuit embkt. at Jadupur, Midnapore.	0.40	640	N.A.	Annual irrigated area figures not available.
8. Constn. of Irrg. Sluice on Bhagirathi embkt. at Mahajhanpore, Murshidabad.	0.12	1,920	N.A.	Do.

2.14. Jateswar Scheme.—The Team made case study of the Jateswar Scheme in Jalpaiguri district. This scheme is constructed at a cost of Rs. 1,47,000 and consists of diversion of river Surti into the river Fichang by putting up an earthen *bund* over river Surti to supplement the discharge of the river Fichang, and construction of Crib weir across the river Fichang. These head works are located in village Hadayatnagar P.S. Falakata, district Jalpaiguri. A Canal with a head discharge of 32.4 cusecs takes off from above the Crib weir.

2.15. The scheme caters for irrigation of 1,920 acres in the village Hadayatnagar, Bankandi and Dalgaon near Jateswar in Union No. 3 P.S. Falakata. An index map of the Jateswar Irrigation scheme showing therein the commanded area, distribution of the canal system, etc., is given in Figure 2.4.

*None of the above schemes have so far irrigated the areas proposed and three out of eight schemes have not irrigated even a single acre.

After completion of works the scheme was declared, under Bengal Irrigation Act of 1876, open for irrigation with effect from June 30, 1957. A copy of the notification is given in *Appendix II*.

2.16. It was reported that no cultivator is willing to sign lease papers for taking water from this scheme. As such, no irrigation whatsoever, has taken place from this scheme during the past three years *i.e.*, ever since it was completed, even though the irrigation cess is quite low and is fixed at Rs. 6.00 per acre. Normal maintenance cost of the scheme is reported to be Rs. 6,000 per year and in the previous year the cost has been Rs. 8,000 because of some special repairs. Apart from the blocked capital of about Rs. 1.5 *lakhs*, the State is thus running into a loss of about six to eight thousand rupees per year.

The canal has no gauges. These could be provided below the canal head and at the tail. The canal head has only one planking groove which does not make a water-tight head. Double grooving and double planking with earth filling in between may be provided.

Irrigation is intended to be done from field to field. Though no irrigation has taken place so far on this scheme, yet it would seem advantageous if regular field channel system is tried.

2.17. Water Rates.—Of the schemes built before the Plan period, during the First Plan period and after the First Plan, only about half are such where water rates are imposed under the Bengal Irrigation Act of 1876 (*Appendix III (a)*). The remaining schemes (*Appendix III (b)*) have not yet been declared under any Act and no irrigation charges are levied on these. Expenditure incurred on these is, therefore, investment without any return to the State in addition to involving yearly maintenance liability. There is no record of actual field-wise areas irrigated from these schemes. The areas indicated are based on the presumption that areas catered for must have been done from these schemes, as no irrigation charges are levied. This presumption may not be fully justified, as some of the works executed are reported to have been damaged and no repairs thereto have been carried out. The present state of maintenance of these works is also below standard, because of the inadequacy of maintenance grant. Quite a number of special repairs estimates had to be sanctioned during the past years for the diversion schemes in Jalpaiguri area, which had not yielded any revenue, thus leading to additional infructuous expenditure.

2.18. It is understood that the *Panchayats* would now be entrusted with the maintenance and booking of irrigation on such works. It will be imperative to provide the *Panchayats* with adequate technical assistance to carry out the job as well as periodic and specified field check so as to obviate any concealment of irrigation or misuse of water.

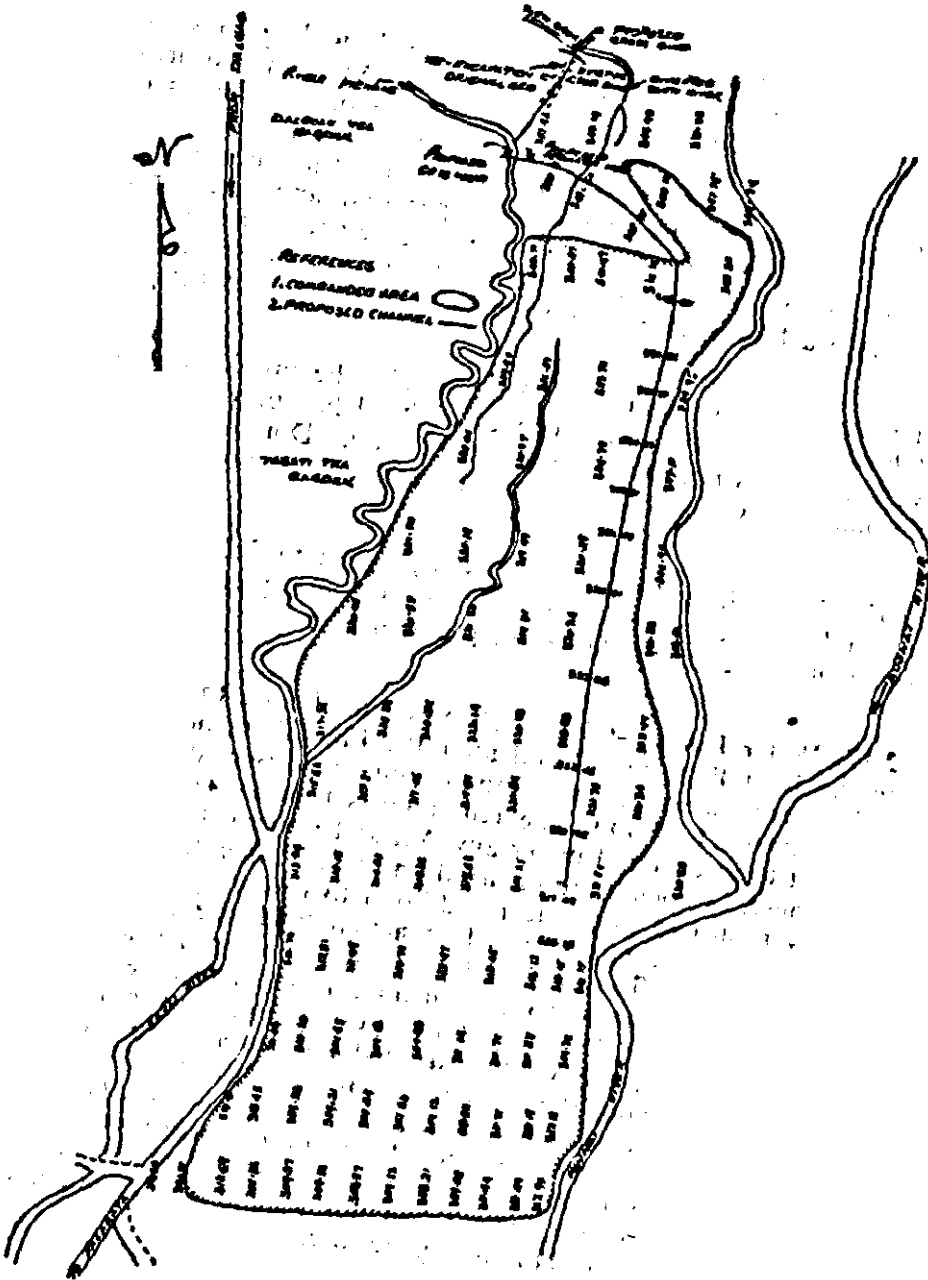


FIGURE 2.4. Index Plan of Jateswar Irrigation Scheme showing therein the commanded area

2.19. It is understood that in West Bengal both assessment and collection of charges were with the Irrigation Department which have since been entrusted to the Revenue Department. Areas irrigated are marked on the village chart and handed over to the Revenue authorities for levy of water rates and collection. The Team, however, feel that without proper exercise of physical check of the irrigated areas at site to guard against any concealment, ill-use and over-use of water, the system may not be perfect.

2.20. Criteria for Irrigation works.—Small diversion schemes in West Bengal, which are mostly located in the south-western and northern regions, if viewed comprehensively present a dismal picture. While the schemes in the south-western region may seem justified on account of occasional drought conditions, faced by that region, those in the northern region seem to have been built without a pressing need therefor. Rainfall in the northern region ranges from 3,095.75 mm. to 4,043.58 mm. and even its distribution month after month is quite good, as will be seen from statement given in *Appendix IV*. There does not seem sufficient justification in providing irrigation facilities in northern regions. The Team, therefore feel that:—

- (i) Irrigation schemes should be taken up as far as possible after prior written consent of the beneficiaries so that the authorities may not have to face the situation as is being faced at present in the Jateswar scheme, where no irrigation is taking place for so many years, though a potential has been created in a far off region in the State at an estimated cost of Rs. 1,47,000.
- (ii) Where water supplies are perennial, gradual shifting should take place from the pattern of rain-fed agriculture to a pattern of irrigationally secured agriculture. This is possible in the northern region, particularly where the streams are perennial. In fact, during the month of May, the Team found water in almost all the streams, while driving from Siliguri to Jalpaiguri and to Falakata. This will automatically mean that emphasis will shift from *kharif* to *rabi* crops and ultimately it will result in better utilisation of the irrigation potential created in that region.
- (iii) The Bengal Irrigation Act of 1876 envisages irrigation only as an occasional need and provide wide option to the cultivators, who are tempted to weigh their personal loss or gain only without regard to overall food production resulting from their crops. These conditions do not seem wholesome, as they weaken the overall food production efforts of the State.
- (iv) Where irrigation is done from field to field, some cultivators get irrigation benefit automatically without having to pay for the same. This condition is not conducive to development of planned agriculture.

2.21. Bengal Development Act of 1935.—Another Act called Bengal Development Act of 1935, provides that all the land-owners whose lands come under notified area, will derive benefit of irrigation. The water rates will not exceed 50% of the extra yield they get through irrigation. For this purpose cropping experiments are done annually over whole of the commanded area. Again, this Act applies only to *kharij* crops. *Rabi* crops are still operated under Bengal Irrigation Act of 1876.

Fields which do not derive benefit within the notified area are exempted from the purview of this Act. If they derive benefit, penal provision is not adequate. Hence there is loose enforcement of the law. Since the revision of Bengal Development Act is in hand, it should be ensured that revised enactment caters wholesomely to a developing irrigated agriculture.



CHAPTER III

Tank Irrigation & Small Irrigation Schemes

3.1. In the State of West Bengal there are reported to be about 1 *lakh* tanks. They are mostly situated in the districts of Malda and West Dinajpur in central Bengal and in the south-west portion of the State consisting of Birbhum, Burdwan, Bankura and Midnapore. They have a water spread varying from 3 to 5 acres. Besides domestic purposes they are greatly used for irrigation of paddy land. A statement showing district-wise distribution of these tanks is given in *Appendix V*.

3.2. The Team during their tour of different districts of the State came across a large number of tanks. Spot enquiries revealed that in vast areas particularly in south-western regions agricultural economy of the tract depended primarily on tanks. Unfortunately, however, in the wake of large-scale works taken up in the recent years, the attention given to the upkeep of these tanks got unfavourably diverted. As for example in Bankura district the Team inspected the tanks in the village of Beliature, Banagram and Kothnidog. Of these 3 tanks, those in the villages of Banagram and Kothnidog appeared practically silted up. Their irrigating capacities have considerably dwindled down. The silted up fringes of the tanks are also not being put to any use. If these tanks are desilted by five to seven feet, their storage capacity will improve. And, if this silt is deposited on the fringe lands, which otherwise get submerged during rains, the same could also be put to use for agricultural purposes.

3.3. Earthwork-Specifications.—The Team also saw a new tank being built near village Lokisagar about 12 miles from Khatra. This, it was stated, was being constructed under Test Relief Scheme. The work on the tank embankment was not being done to normal earth work specifications. In fact, there were no alignment lines (*dagbel*) at site. The Team feel that not only safety of the embankment will be considerably increased, if such works were carried out under technical supervision, but their efficiency with regard to their serviceability will also considerably improve.

3.4. Another tank named Painbandh was visited by the Team in village Baurisol, within the jurisdiction of Simla-Pal Police Station. This tank covers an area of 19.59 acres and was said to belong to Pain family. It was full of weeds and lotus leaves. It was stated that it served an area of 93.22 acres which mostly belong to Pain family. The scope of utility of this tank could be considerably increased, if it is deepened and emergent land raised above normal submergence level. Pain family people may not be inclined to do so. Initiative on the part of the Tank Improvement Department seems called for in such cases.

3.5. Organisational Complexity.—Other tanks inspected by the Team were at Hamarberia, Ram Sagar, Jamuna Bund and Vishnupur. All these tanks seemed silted up to a great extent. The tank at Jamuna Bund was completely silted up and was full of weeds. An organisational complexity, which came to the notice of the Team was owing to the abolition of *Zamindari* in recent years. It was gathered that the tank still belonged to private owners. This resulted in lack of interest on the part of the *Zamindars* who owned these tanks. The cultivators have easement right in the settlement records and the owner cannot charge any irrigation rates. He can also not utilise the tank for other purposes like pisciculture because all water is taken out of it for irrigational use. This leads to a tendency on the part of the private owners to let the tanks silt up, so that they can bring land under cultivation in course of time. There is, therefore, clash of interest between irrigators and the owner of the tank.

3.6. Tank Improvement Department.—To get over the difficulty a Tank Improvement Department has been created. If the beneficiaries do not get sufficient quantity of water from the tank, they can approach this Department who can take over the tank when the complaints seem verified. It was gathered that out of the 2,500 tanks in Midnapore district about 500 tanks have already been taken over by the Tank Improvement Department.

3.7. When they are taken over, a preliminary list is prepared of the fields to be benefited from them. This list is checked up by the Tank Improvement Department Staff consisting of Inspectors and Overseers and a schedule of rates is prepared and published. Objections are invited to reach within a month. Thereafter, the rates are finalised and the beneficiaries pay the assessed rates, year after year, which are limited to a ceiling of Rs. 3.00 per acre at present. On the whole, it was gathered that the restoration charges incurred on a tank are about Rs. 100.00 per acre and maintenance grant for a period of 25 years is limited to 10 per cent of the initial cost. It is felt that greater activity should be mobilised by the State on this front, as tanks provide a valuable source of irrigation to the scarcity regions of the State.

3.8. In Midnapore district, there are certain tanks which are ultimately to come under the command of the Kangsabati Project, which is under execution at present. The utility of these tanks will thereafter cease. There are two courses open in such cases. They are:—

- (i) to utilise these tanks for limited domestic and pisciculture use and as subsidiary reservoirs if and when possible, or
- (ii) to get them silted up, so that the land could be put to agricultural use.

3.9. Since the question is linked with the operation of river valley projects, the merits of individual cases will require specific consideration and the question of tank improvements in the commanded areas of river valley projects can be decided by local authorities.

3.10. The Team also saw a tank at Fatehpuri while travelling from Jalpaiguri to Siliguri. This tank, it was gathered, was constructed as a co-operative venture by a number of people, who had purchased the land with a view to start farming operation. This tank covers an area of about 20 acres and at the time of the Team's visit (May, 1960) the water spread was about 12 acres. It was gathered that the venture proved a failure and the tank was not doing any irrigation at present. Fisheries Department wanted to take this tank on rental basis for fishery purposes. The co-operative society did not seem to have agreed to that proposal. A resource created thus lies unutilised. It would seem advantageous if such resources are created on firm basis and through intervention of the State organisations like Community Development or *Panchayats*, and are subjected to the fullest possible productive use.

3.11. Not far from this tank, within a furlong or so, the Team also visited a tubewell recently completed by the Exploratory Tubewells Organisation and provided with diesel pumping set. Spot enquiries made with the B.D.O. whom the Team interviewed, revealed that there were no plans, whatsoever, for the utilisation of tubewell potential created at so much cost. Pre-planning for the utilisation of such a resource as a tubewell would go a long way in developing irrigation.

3.12. Small Irrigation Schemes.—Apart from the tanks, there are many other small irrigation and drainage schemes, which exist in West Bengal and which can be multiplied with great advantage to the people as well as to the State. West Bengal has got a large number of *beels* and rivers. Small Irrigation schemes can be in the shape of :—

- (i) Small pumping stations,
- (ii) Embankments,
- (iii) Sluice gauge,
- (iv) Catchment ponds,
- (v) Small tubewells,
- (vi) Bore ponds, and
- (vii) Small drainage channels.

Cumulatively such schemes can help vast areas in the State. Also, through reclamation of *beels*, the lands on their fringes could be brought under cultivation.

3.13. A number of these schemes were completed during the last 8 to 10 years. The areas benefited and the expenditure incurred are given in Table 3.1.

TABLE 3.1

Year	No. of Schemes	Area benefited (acres)	Expenditure (Rs.)
<i>First Five Year Plan</i>			
1951-52	975	3,06,000	27,42,188
1952-53	920	2,72,700	29,98,589
1953-54	333	1,23,906	12,65,217
1954-55	341	98,750	11,08,663
1955-56	394	1,20,098	13,78,003
	TOTAL . 2,963	9,21,454	94,92,660
<i>Second Five Year Plan</i>			
1956-57	63	17,090	4,27,200
1957-58	195	52,993	7,33,124
1958-59	235	73,324	8,65,446
1959-60	323	85,155	8,52,180
1960-61	The progress will be assessed at the end of the year.		

3.14. Economies of Small Schemes.—These figures will go to indicate that expenditure incurred on 9,21,454 acres, which were benefited during the First Plan period comes to Rs. 94.93 lakhs. It can easily be presumed that the increase in production on account of benefit derived by the areas must be much greater. Again during the four years of the Second Five Year Plan the area benefited is 2,28,562 acres and the expenditure incurred was Rs. 28.78 lakhs. This shows that there has been an expenditure of Rs. 12.60 nP. per acre. It would be of interest to find out what has been the actual increase in yield in rupees per acre. The Team feel that a study like that should be conducted, as that will actually reveal the economies of the schemes.

3.15. The procedure followed for undertaking these schemes in the Agriculture Department is given in *Appendix VI*—(Chapters I and II of the “Instruction for the execution of Small Irrigation Schemes” enforced in Agriculture Department of the State). All these projects are taken up when 50 per cent of their cost is paid by the beneficiaries themselves in cash or in kind including labour or both. Another criterion of judging the efficiency of the project is to see that the cost of the project does not exceed Rs. 125

per ton of the additional production expected. This additional production is assessed on 1/9th ton of rice, one ton of *rabi* crops and 1/9th ton of rice for partially benefited acres, 1/3rd ton of rice in fully benefited areas in drainage projects.

3.16. While fully appreciating the need for small irrigation projects in the State, the Team feel that some of these projects could be financed wholly by Government, instead of realising half the cost thereof from the beneficiaries, if the circumstances warrant that kind of action. There may be cases when the beneficiaries may not agree to come forward to deposit the required amount and a beneficial project may remain unexecuted for a long time. Provision, therefore, should be made in the Rules to the effect that the Government may undertake to execute the work of this type, if the cultivators agree to pay all the costs in easy instalments extending over a period of five years or so. This will enable greater number of schemes to be taken up.

3.17. Pumping Sets.—It was gathered from the Agricultural Officer, Midnapore, that quite a number of pumping sets had been provided to the cultivators on the basis of spot payments or payments in one or two instalments.

Lifting water for irrigation purposes should be encouraged all through, and apart from mechanisation, manual lifting may also be propagated where it can be conveniently resorted to from natural rivulets and other sources. This has the added advantage of economising the use of water which is otherwise applied sometimes in excess.

3.18. Tank and small irrigation schemes depend, by and large, on the active co-operation of public organisations like Gram Panchayats and Community Development Programme with local officers. But technical know-how is also of great importance. From their conversation and discussions with officers and subordinates of various departments at various levels, the Team got an impression that lay-man general administrative control is somewhat over exercised giving rise to a feeling of frustration leading to indifference on the part of technical staff. It is, therefore, felt that greater responsibility should be placed on technical personnel in a programme involving so much technological skill and know-how. Also, unified control over irrigation works either through Irrigation and Waterways Directorate or through Agriculture Department is considered essential for a co-ordinated development of irrigated agriculture in the State. The Team feel that in this respect there is a vast domain of "no-man's land" in the State as between the Revenue, the Agriculture and the Irrigation Departments.



CHAPTER IV

Deep Tubewells

4.1. Geological conditions of West Bengal with regard to subsoil supplies vary considerably from west to east. The western region consisting of Purulia, Midnapore and Bankura is deficient in subsoil supplies as compared with the new alluvium formation of central region and the northern portions in the Tista valley. With a view to ascertain the availability of subsoil supplies in different regions, a programme of exploratory tubewells was undertaken by the Central Exploratory Tubewells organisations. The results obtained on these exploratory tubewells are shown in *Appendix VII*. Such wells, as have yielded good results are being taken over by the Agriculture Department of the State as production wells and will be utilised for irrigation purposes.

4.2. These results indicate that the borings made in Bankura and Midnapore districts as also at Salbari in Darjeeling and Phulwari in West Dinajpur districts produced low discharges as compared with the borings done in other districts of the central area of West Bengal, Jalpaiguri and Cooch-Bihar. While boring in Dakshinasol and Midnapore districts yielded only 10,000 gallons per hour on a draw-down of 21.08 feet, the boring in Algaria in 24-Parganas district gave 62,500 gallons per hour on 20 feet depression. At the same time, two borings in Malda district had to be abandoned as dry.

4.3. It is, therefore, clear that while there is deficiency of subsoil water in one part of the State, there is abundance thereof in the other. And, where there is abundance, the need for irrigation may not seem very pressing for ordinary agricultural operations during normal rainfall year. As such, a project for deep tubewells in these areas may appear financially unproductive. Expansion of tubewell programme in West Bengal, therefore, needs to be taken up with due caution.

4.4. Developmental Irrigation Wells.—As indicated in Figure 4.1 100 tubewells have so far been taken up in the State including the Exploratory tubewells. Of these tubewells 40 are called Developmental Irrigation Wells which have been completed lately in the Second Five Year Plan period. A statement about their engineering details is given in *Appendix VIII*.

4.5. They are sited close to each other in the central region. Through these tubewells a change in the existing crop pattern is sought. The target is to have 3 crops in a year. Trial alone will show how far success is attained for there are many limiting factors involved in the operation.

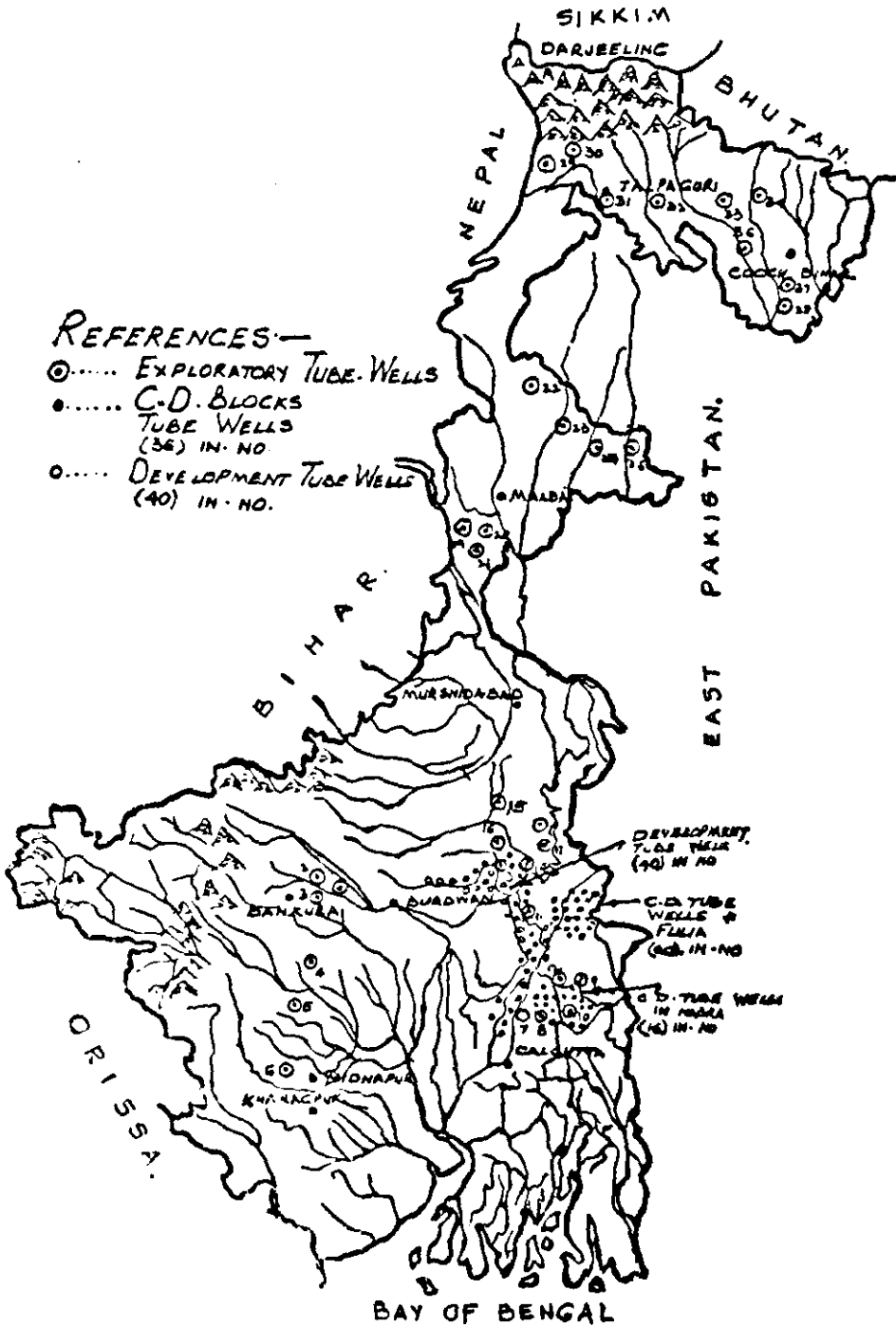


FIGURE 4.1. Showing locations of tubewells in West Bengal.

4.6. Of these, twelve tubewells in Dhublia-Plassey sector have been completed and are in operation. They were energised during April and May, 1960 and were in commission during *kharif* 1960. Their performance is given in *Appendix IX*. All the tubewells combined are reported to have served the following areas :—

	Acres
<i>Kharif</i> (Cotton and <i>Aus</i> , Paddy sown in April & May) .	349.19
<i>Aman</i> (winter paddy) sown between mid-June and early August.	317.54
Sugarcane	34.96
Jute	6.95
TOTAL .	708.64

4.7. This gives an average of 60 acres per tubewell. Total number of running hours is 821 per tubewell. Taking the discharge as 2 cusecs, water depth utilisation per acre on these tubewells works out to 27 acre inches. Energy consumption on these tubewells is also on a high side. Looking into their performance in August, 1960 only, these tubewells ran to a total of 1,821.10 hours.

Average per tubewell per month works out to about 152 hours. Total energy consumed was 21,872 units leading to an average of 1,822 units per well. Thus 12 units were consumed per hour as against 10 units envisaged in the project.

This being the first year of their functioning, performance of the tubewells, as it is, is not such from which firm conclusions could be drawn, as they have not worked for any length of time to provide data for realistic appraisal of their working.

4.8. It was indicated that during the current *rabi* season *i.e.* 1960-61, these 12 tubewells have taken care of the following crops :—

	Acres
(i) Wheat	217.44
(ii) Mustard	165.88
(iii) Paddy	10.91
(iv) Pulses	294.89
(v) Sugarcane	243.97
(vi) Other crops including <i>boro</i> paddy . . .	401.21
TOTAL .	1,334.30

This gives an average of about 111 acres per well. This again is based on free supply of water, without realisation of charges either for electricity consumed or otherwise. It is still to be seen what area will actually be irrigated from these wells when water rates or charges for electricity are realised from the beneficiaries. It, however, indicates the trend that a changeover from purely *kharif* to a crop pattern including *rabi* cultivation is possible. The Team feel that it would seem advantageous, if efforts are made to spread out agricultural activities over both *kharif* and *rabi* crops. It will not only ensure better utilisation of land and water resources but also a more wholesome pattern of agricultural production.

4.9. High Spring Level Areas.—Looking into the engineering details given in *Appendix VIII*, it would be observed that some of these tubewells have been installed in areas where spring level is quite high. Following instances are particularly quoted :—

On Tubewell serial No. 15 denomination 3T/13H in *mauza* Kachera in 24-Parganas district, the spring level is 4 feet.

On Tubewell serial No. 24 denomination 17/CB *mauza* Silinda in Nadia district, the spring level is five feet three inches.

On Tubewell serial No. 23 denomination 7T/CB in *mauza* Naqda in 24-Parganas district, the spring level is five feet nine inches.

On Tubewell serial No. 25 denomination 18/NCB in *mauza* Balia in Nadia district, the spring level is six feet.

There are many tubewells located in areas where spring level is not below ten feet. In fact, only one tubewell in this tract is located in an area where spring level is more than 15 feet. As such the general position of water table below ground is not deep. A strata (log) chart of a typical tubewell is shown in Figure 4.2. It is felt that in areas where spring level is high, extraction of water for agricultural purposes is economically possible through less expensive means than deep tubewells.

4.10. Well Design.—The well design consists of 12 inch expansion pipe to a depth of 60 feet and 8-inch slotted pipe, gravel developed, laid across the water bearing strata to a depth of about 100 to 150 feet with an intervening 6-inch G.I. pipe, total bored depth exceeding 300 feet. According to State authorities such a tubewell provided with a 17.5 H.P. turbine type pumping set will yield about 2 cusecs of water with a draw-down of 10 to 15 feet in the alluvial areas. Such a well costs about Rs. 62,000 without electric transmission line.

4.11. Economic Aspect.—Economics of such tubewells as presented by the State authorities is given in *Appendix X*. It envisages that they will be able to realise Rs. 43.00 per acre as irrigation charge (fixed plus running charges) from the cultivators. Experience alone will show

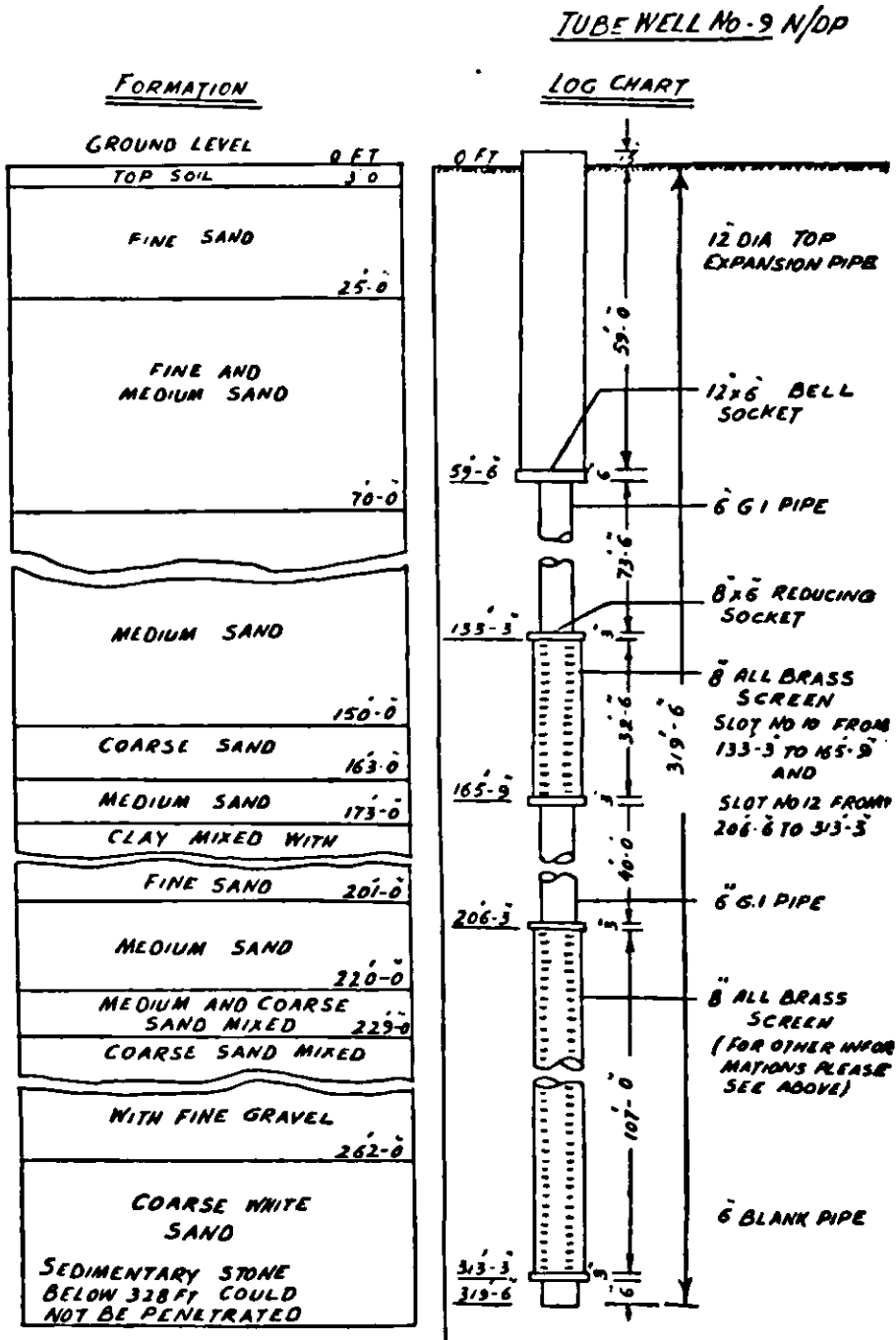


FIGURE 4.2. Showing a strata (log) chart of a typical tubewell in West Bengal.

how far they are successful. Doubt has also been expressed in the last para of the *appendix* referred to above, as to the realisation of these charges in practice. Since, however, deep tubewells are sought as part of multi-purpose social development plan of agriculture (irrigation), industrial development, rural water supply and rural electrification, the scheme of setting up big diameter tubewells as a part of a nucleus of such a social development scheme requires to be examined from a wider point of view, as the scope is not merely that of minor irrigation. Its financial position with regard to irrigation alone does not, however, appear to be promising. Before any extensive tubewell programme is taken up, it will seem proper to wait and see the performance of these wells both agriculturally and financially.

4.12. Design of Ancillaries.—The design of the tubewell pump house, the operator's quarters, store-cum-office and surge tank are given in Figure 4.3. Quarters for tubewell operators in Uttar Pradesh and in the Punjab have been built more or less to an austerity standard as compared to the Development Tubewells in West Bengal. In Uttar Pradesh and the Punjab, the well house is generally a kiosk and is not a composite building with the operator's quarter. It is necessary to keep this kiosk separate, because in case of any settlement in the tubewell boring, which is not unlikely, the whole building is endangered. West Bengal authorities could, therefore, adopt similar design. Besides, continued vibrations in the building, which are caused by a running pumping set, may have adverse effect on the occupants of adjacent rooms, which could be avoided if the operator's hut is separate. The composite type of design has not, however, been adopted in C.D. wells in Fulia and Habra Blocks. Also, if a supplementary boring is ever required, it can more conveniently be done, if the tubewell stands in an isolated kiosk.

4.13. Among many other small defects, following points emerge out of a detailed examination of the building at site :—

- (i) Doors and windows have not been provided with sun shades. In a heavy rainfall area like that of West Bengal it amounts to a false economy. Provision for sun shades seems essential. That will add to the overall usability of the building.
- (ii) Boundary wire fencing consisting of R.C. poles has been provided. Agricultural tubewells hardly need any fencing on all the four sides. A suitable hedge may serve the purposes more admirably.

4.14. The siting of these developmental tubewells, as gathered from the authorities, is also not done at the intersection of water-shed in the command. Advantage gained by the gravity flow, which is normally made use of in all irrigation projects is, therefore, totally lost. Instead, the water is lifted ten feet or so for being forced into an underground R.C. pipe system.



One of the Tube-wells in operation in West Bengal.

4.15. Unnecessary Lift.—For agricultural purposes this kind of distribution is expensive because :—

- (a) every gallon of water has to be lifted to an extra ten feet or so and is then supplied to the fields through elaborate system of underground R.C. pipes, sluice valves and V-notches, as will be clear from the water distribution plan as shown in Figure 4.4.
- (b) Reinforced concrete pipe system runs in straight line and V-notch tanks are built at distance to lead water into *kacha* channels every 500 feet apart.

6.14. These *kacha* channels, as were seen at site, particularly on development tubewell No. 2N/DP in *mauza* Hadgacha in district Nadia, are dug out in the fields in straight lines intersecting the fields. Water level drops in these channels which may require to be bunded up for flow irrigation into the fields. This is unnecessary. Ground level distribution channels could serve the purpose equally well.

4.17. Alternative Distribution System.—It is felt that considerable economy can be effected, if tubewells are sited on a commanding location, and water is led by gravity to different parts of the commanded area directly through open channels. In West Bengal, where humidity is high and the land is not so porous, evaporation and percolation losses may not be of such magnitude as to warrant an underground water distribution system in all cases.

The Team feel that the underground system only in the header pipe length would not save losses as the remaining channels are open surface ditches of considerable length. This system is not only unnecessarily expensive but also involves unnecessary lifting of water.

4.18. As indicated in the alternative plan (Figure 4.5) for tubewell No. 9N/DP at Nakashipara, the total length of open channels, which could serve the area equally efficiently if not better, works out to 4.41 miles as against 4.54 miles of open channel and the underground reinforced concrete pipeline shown in the original plan (Figure 4.4) for the same well. These underground R.C. pipelines which cost about Rs. 25,000 per well could be dispensed with without any loss of efficiency in the distribution system. This will also lead to economy in the consumption of electric energy because extra lift needed to force water into underground R.C. pipe system will not be required. The land required for open channels will remain almost the same. On the other hand, the alignment as proposed in Figure 4.5 follows the field boundaries, while in Figure 4.4 they cut across the fields. As such open channel distribution as shown in Figure 4.5 should be preferable from all points of view.

4.19. The alternative system as proposed in Figure 4.5 is tentative. This could be adjusted according to the actual requirements of levels etc. at site. This indicates a pattern of water distribution from an irrigation tubewell as is followed in other States.

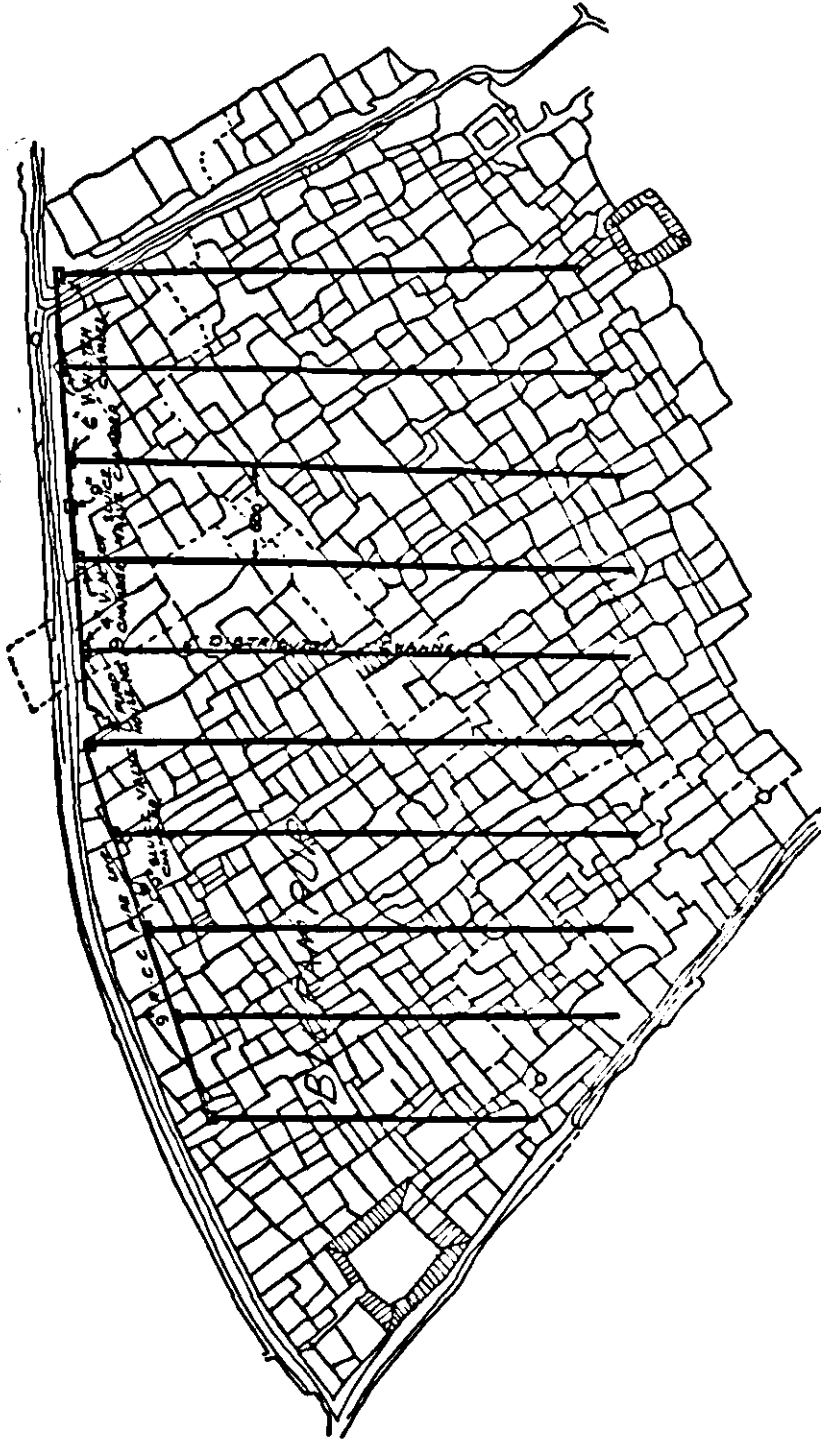


FIGURE 4.4. Showing proposed layout plan of overground *c* R. C. C. pipe line for T. W. No. 9N/DP at Nakashipara.



FIGURE 4.5. *An alternative proposed layout plan of open channels for T. W. No. 9N₁DP at Nakashipara.*

4.20. Where, however, land is too precious and where site conditions require crossing of depressions or high mounds, possibilities of using underground unreinforced pipe links as has been done in a large number of cases in Uttar Pradesh should be examined. The unreinforced underground pipe system roughly costs Rs. 13,000 per mile, as per Uttar Pradesh estimates.

4.21. In certain specific reaches, it would seem advantageous, if open channels are lined with brick masonry. On the whole, however, it is felt that there is no need to lay down an elaborate underground R.C. pipe system. An overground open channel system, masonry lined as necessary, should serve the area as efficiently besides leading to a saving on each tubewell to the tune of about Rs. 20,000.

4.22. While discussing constructional aspect of tubewells with the Joint Director in-charge of tubewells, it was gathered that administrative sanctions are given in piecemeal. They are sometimes delayed so long that a concerted programme of construction cannot be planned. Another difficulty pointed out was the delay in the electrification of tubewells. There are many tubewells lying completed, which have not so far been energised. It would seem advantageous if a more concerted action is mobilised so that the potential created in the shape of tubewells does not remain idle for want of proper co-ordination.

4.23. Load Factor.—The Team also gathered that the load factor on the tubewell being low, the State Electricity Board finds a tubewell connection comparatively a poor revenue earner. This difficulty will always face tubewell operation because it cannot provide steady all round load like industrial loads in the area. Probably, a system of staggered load operation of tubewells may improve the load factor. This may be tried.

4.24. Detailed field study was made on tubewell No. 9N/DP located in village Nakashipara, which was energised early in 1960. During *kharif* 1960 this tubewell is reported to have irrigated the following areas :—

	Acres
<i>Aus</i> paddy	43.71
<i>Aman</i> paddy	59.75
Sugarcane	2.69
TOTAL	106.15

Its discharge is 51,000 gallons and it has a commanded area of about 300 acres. It has an overhead reservoir from which water is led out through reinforced concrete pipeline into the fields, as shown in Figure 4.4.

4.25. One cultivator who owns 2.3 acres of land in this command was also examined by the Team. During the season he had the following crops on his holdings :—

	Acres
Jute	0.83
Aus	0.46
Urd	0.30
Aman	0.50

After Jute he intends to sow paddy. Jute is harvested by the middle of October. An acre yielded about 12 *maunds* of Jute with fertiliser and 8 *maunds* without fertiliser. Potatoes will be sown at the end of October. *Aus* paddy fields which are vacant (October, 1960) are being prepared for wheat. Since *Aman* paddy is over by December he intends to put the field under *boro* paddy and vegetables, specially onions. *Boro* paddy is sown in December and harvested in March and onions will be sown in November and harvested in February/March. After *Urd* he intends to grow potatoes and onions. Before this tubewell was installed, this land was lying waste and now the cultivator intends to raise two or three crops every year. He, however, feels that mere water is not sufficient to augment production. He will need fertilisers on credit to be able to raise good crops. There was, however, no forward planning available on the tubewell with regard to *rabi* cultivation in its command. Forward planning, it is felt, should be an essential feature of tubewell irrigation, because supplies are assured.

4.26. The *rabi* (1960-61) performance of this tubewell is indicated as below :—

	Acres
Wheat	9.73
Mustard	1.00
Paddy	0.84
Pulses	6.46
Sugarcane	27.00
Other crops mostly <i>boro</i> paddy	109.52
TOTAL	154.55

Though the main area under *rabi* is *boro* paddy, the figures indicate the possibility of changing the crop pattern on the tubewell.

4.27. Another tubewell No. 11N/DP was examined by the Team. This tubewell was energised in May, 1960. Its commanded area is 250 acres and discharge is 51,000 gallons per hour. During *kharif* 1960 this tubewell had done the following areas:—

	Acres
<i>Aus</i> paddy	14.92
Jute	3.08
Sugarcane	9.33
TOTAL	27.33

All this irrigation had taken place mostly in the Government Seed Multiplication Farm at Nakashipara. It was stated that there is a Sugar Factory at Plassey at a distance of about 15 miles. Scope, therefore, exists on this tubewell for development of sugarcane. If proper planning is done and balanced crop rotation is secured, more area could be brought under sugarcane on this tubewell. The figures for *rabi* 1960-61 stand as below:—

	Acres
Wheat	10.46
Mustard	2.59
Paddy	0.33
Pulses	41.77
Sugarcane	41.62
Other crops	21.14
TOTAL	117.91

4.28. On its way to Nakashipara, the Team also saw tubewell No. 40 at Mahadevnagar, which was not in commission. It was completed in June, 1960 and was waiting for electric connection (October 1960). Its discharge was reported to be 32,000 gallons at a depression of 8 feet. The spring level in this area is about 6 feet below ground. The tubewell has a boring to a depth of 450 feet and is intended to command about 300 acres. The water distribution system was not yet laid out but the building etc. were all complete. There was a tubewell operator already appointed on a pay of Rs. 85 (total) per month. Without electricity, it is not understood why the tubewell operator was engaged, unless he could cause some forward planning with regard to irrigation from this tubewell.

4.29. Tubewells in Bankura District.—Out of the Exploratory tubewells some have been put to use for irrigation in the district of Bankura. Two such tubewells, one in Panchal and the other in Govindpur, were visited by the Team.

(a) TUBEWELL AT PANCHAL

This tubewell had a test discharge of 19,500 gallons per hour at a draw down of 37.29 feet. Spring level in the area was about 14 feet below ground. It was completed and installed with pumping set early in 1960. *Rabi* areas served in March, 1961 were reported to be :—

	Acres
Wheat	33
Potatoes	5
Onions	7½
Other crops	1/2

Water distribution system, however, was very faulty on this tubewell. From the discharge tank water is led into ground ditches and is not taken to the fields in a well defined manner. Since the water is given free of charge, the actual performance of the well cannot be commented upon. Considerable areas could be irrigated under *rabi* from tubewells in this tract. The country is of a rolling nature and the rainfall is also not heavy. A number of wheat fields were seen, while driving to Panchal and the prospects of developing wheat in this area seemed quite fair.

(b) TUBEWELL AT GOVINDPUR

This tubewell had a test discharge of 17,000 gallons at a draw down of 20 feet. The spring level is about 20 feet below ground. The well was completed with pumping set in December, 1959. It has not developed any irrigation so far. There was only an area of 5 to 7 acres reported to have been served during *rabi* 1960-61. Water is led out from the discharge tank into the ground ditches and no water channel system has yet been built. With the resource so well located water channel system is of primary importance for early utilisation of tubewell supplies.

4.30. Community Development Tubewells.—Besides exploratory borings done by E.T.O. and the development tubewells of the Agriculture Department, another 36 tubewells are operated under the Community Development Organisation in the State. They have recently been taken over by the Agriculture Department. 20 of these tubewells are located in Fulia Community Development Block in Nadia district and 16 in Habra Community Development Block in 24-Parganas district. Mechanical details in respect of these tubewells are given in *Appendix XI (a & b)*. These tubewells yield discharges varying from 23,000 gallons to 39,000 gallons per hour in Habra Development Block and about 40,000 gallons per hour in Fulia Development Block. All these wells are deep wells with 8 inch diameter brass strainer. They have been provided with pumping sets of the bore-hole type with 15 H.P. 440 volts vertical motor in Fulia Block and with varying types in Habra Development Block. These types are given in *Appendix XI (a & b)*.

4.31. Fulia Development Block.—In the Fulia Development Block channels have been built, which are partly lined and partly unlined. These tubewells were put into operation in two batches *i.e.* six in August, 1955 and the remaining during the year 1958-59. Their irrigational performance, however, is poor as is indicated below:—

	No. of tubewells	Area irrigated in acres.			
		1959-60		1960-61(Upto Oct.60)	
		<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>
	1	2	3	4	5
Total	20	169	214	218	66
Average	1	8.5	20.7	20.9	3.8

4.32. Habra Development Block.—These tubewells are similar to those of Fulia group, except that their discharges are comparatively low. Their draw downs too are correspondingly less. While draw down in Fulia varies from 11.7 feet to 17.00 feet, in Habra Block it varies from 6.6 feet to 10.6 feet. The spring level is 17 feet below ground level. Irrigation performance on the tubewells are shown below:—

	No. of tubewells	Area irrigated in acres.			
		1959-60		1960-61 (Upto Oct. 60).	
		<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>
	1	2	3	4	5
Total	16	105	864	512	N.A.
Average	1	6.6	54.0	32.0	N.A.

When the Team visited tubewell No. 10/T in Habra Block in village Jeoldanga, district 24-Parganas, in March 1961, it was running and supplying water to some vegetable fields. The water was being led from the *pucca* channel into the field through irregular ditches breached at a number of places. The tubewell was apparently not running

to its full discharge. The V-notches on the discharge tank were not sharp crested, as they should invariably be to give an idea of the discharge. The performance of this well for the month of February 1961, as extracted from the records available at site is given below :—

Total number of hours run during the month	. 2 hours 25 minutes.
Total electrical consumption :	. . . 19.2 units (6.4 units × 3).
(i) Meter reading on the 1st of the month	8,567.8.
(ii) Meter reading on the last day of the month	8,574.2.
Total electrical charges	Rs. 1.92 naye paise (@10 unit per rupee).
Total electrical consumption per running hour	8 units.
Different crops raised	0.17 acre.
(1) <i>Kharif</i>	
<i>Aus</i>	} Nil
<i>Aman</i>	
Sugarcane	
Jute	
(2) <i>Rabi</i>	
Wheat	} Nil
Potatoes	
Pulses	
Mustard	
Vegetable and other crops	0.17 acre.
Total acre inches supplied in the month	0.582 acre inch.
Irrigation charge	Rs. 1.16.
Recovery	Rs. 1.16.

This will indicate that throughout February, 1961 the well ran only for 2 hours and 25 minutes and served an area of only 0.17 acre of vegetables which hardly justified even the staff employed on the well.

Again, the performance during the month of December, 1960 is equally baffling. It is reproduced below :—

Total number of hours run	257 hours and 17 minutes.
Total electrical consumption	1,926.9 units (642.3 units × 3).
(i) Meter reading on the 1st of the month.	7,643.1.
(ii) Meter reading on the last day of the month	8,285.4.
Total electrical charges	Rs. 192.6 nP. (@ 10 unit per rupee)
Electrical consumption per running hour	8 units.
Different crops raised	7.16 acres.

(1) *Kharif*

<i>Aus</i>	} Nil
<i>Aman</i>	
Sugarcane	
Jute	

(2) *Rabi*

Wheat	2.24 acres.
Potatoes	3.46 acres.
Pulses	0.17 acre
Mustard	0.17 acre
Sugarcane	Nil
Vegetable & other crops	1.12 acres.
Total acre inches supplied in the month	178.998 acre inches.
Irrigation charges	Rs. 358.27
Recovery	Rs. 358.27

During this month the well irrigated only 7.16 acres, while the acre inches applied according to the computation is 178.998 inches. This gives an average of 25 inches per acre, which is indicative of wasteful use of water. The irrigation charges for the month of December 1961 alone thus work out to about Rs. 50 per acre (358.27/7.16). This is absurdly high. It is no wonder that the irrigated acreage from this tubewell is so low, because no cultivator can afford to pay such a high price for water.

4.33. Tubewells in Habra and Fulia Development Blocks called as C.D. tubewells have been built and constructed to different specifications than the Development tubewells. They have isolated tubewell kiosks and are provided with tubewell operator's huts closeby. They are located in areas, where possibilities of development of *rabi* irrigation exist. Development effort on these wells seems to have been planned in a disjointed manner inasmuch as:—

- (i) Tubewell channels, as built, are not capable of taking full discharge of the well. Bifurcation of channel system from the very source is not very wholesome, otherwise tubewells have frequently to be run on a throttled basis, which leads to uneconomic running cost.
- (ii) The channels as built are too shallow and are subjected to over-flowing quite often. Even where lining has been done, it has been done to a poor specification. The bricks have been laid with frogs up with single tile lining, which is against normal engineering specifications. This leads to frictional resistance to the flowing water.
- (iii) It was gathered that some tubewells particularly in Habra Block waited for long time for the distribution channels, some of which were not complete at the time of the Team's visit (March, 1960).
- (iv) Since channels have been built on land donated by the cultivators themselves, they follow *zig-zag* course in a number of cases, which is not conducive to the growth of good distribution system.
- (v) Pre-payment on the basis of about Rs. 1 per 11,000 gallons is realised from the cultivators needing water. It is against the usual practice followed in respect of irrigation charges all over India. Irrigation charges are generally collected after harvesting period.
- (vi) Voltage as observed on the tubewells is not kept upto the specified mark. On lower voltage than specified, efficiency of the plant naturally goes down.
- (vii) Technical staff, like Assistant Engineer and Supervisor, to look after the engineering work in respect of tubewells had not been appointed, though provided in the estimate. Apparently, there has not been sufficient technical supervision exercised on the running of the C.D. tubewells.

4.34. Over-all Picture.—A study of irrigation tubewells in West Bengal reveals a disconcerted picture betraying a number of disquieting features, both technical and organisational. Quite a number of tubewells have been located in heavy rainfall and high spring level areas.

Siting of tubewells has been done in a large number of cases without prior contour survey of the area and without regard to its commandability of the service area through ordinary gravity flow. Unnecessary lifts involving raising of water into surge tanks or overhead reservoirs have been provided with a view to force water into underground R.C. distribution systems. Again, advantage of gravity command has been further lost in the dug out field to field channels. Design of well houses, operator's huts and even of overground field channels suffer from many technical defects as had been pointed earlier (*para 4.12*) in the report.

4.35. Water Rate Structure.—The water rate structure is very unwholesome. While irrigation has been commenced on a completely free water supply basis on Developmental tubewells, on C.D. wells in Fulia and Habra Blocks a system of pre-payment by the intending irrigators has been enforced. In one case the development will be unrealistic and in the other there will be a great lag in the growth of irrigation. It is felt that an equitable realisation of charges fitting into the agricultural economy of the State should be ordered allowing for necessary rebates in the early developmental stages.

Water rates on tubewells are being imposed on acreage basis. The Team feel that this system is not conducive to economic and optimum utilisation of tubewell supply. Tubewells afford an ideal unit where water could be supplied on a volumetric basis. Once the cultivators get accustomed to acreage basis, it will be difficult to impose volumetric system later on. In Uttar Pradesh there are more than 6,000 tubewells operating for many years and the supplies are made to cultivators on volumetric basis.

4.36. Tubewells Act.—It was gathered that difficulty is experienced by tubewell staff in getting tubewell channels aligned properly and getting right of way etc. for tubewell water on some of the wells. For this reason, on a number of wells in C.D. Blocks, channel construction had been delayed. Since, there are more than 100 irrigation wells already built in the State and more are coming up, it would seem prudent if necessary legislation is now enacted in the shape of a Tubewells Act which should facilitate construction and maintenance of tubewells and development of irrigation therefrom. Such specific enactments exist in Uttar Pradesh and the Punjab, wherein provision of the old Northern India Canal and Drainage Act has been suitably adopted to tubewell irrigation. The Team feel that similar action needs to be taken in West Bengal, unless intention be to cover tubewell irrigation in a new comprehensive legislation needed for development of irrigated agriculture.

4.37. Sharing Experience.—A unified technical and administrative control at the State level is of paramount importance in introducing and trying a new system of irrigation. This, it is gathered, is being

done now. The Team feel that advantage should also be taken of the experience gained in State controlled tubewell irrigation in other parts of the country, so that already tried experiments in comparable circumstances are not unnecessarily repeated and no infructuous expenditure is incurred. For this purpose, it will be advantageous for the West Bengal authorities to share their experience in tubewell irrigation particularly with the neighbouring State of Bihar and eastern parts of Uttar Pradesh, where the climatological and agricultural features are comparable. A couple of officers of Executive Engineer's and Assistant Engineer's ranks may be sent to Uttar Pradesh to familiarise themselves with the actual working and operation of tubewells.

Deep tubewells should be installed only in areas where their success is re-assuring both from the point of view of increased agricultural production and financial return to the State.



CHAPTER V

Auto-Wells

5.1. Round about Garbeta in Midnapore district alongside river Silai, some flowing wells, also called auto-wells, are functioning for the past 20 years or so. These wells are being utilised for domestic and irrigation purposes. They, therefore, form a source, though very limited, of minor irrigation.

5.2. Silai River Valley.—The Team on their way from Khatra to Midnapore inspected some of these auto-wells in the Silai river valley, few miles west of Garbeta. A view of one of the wells is shown in Figure 5.1.



FIGURE 5.1.—*Photograph showing an Auto-well*

5.3. In this area Silai river flows from west to east in a narrow valley varying in width. At places the banks are lateritic and rise about 25 to 30 feet above the general ground level. The area on the whole is, however, irrigable.

5.4. Hyper-piestic Zone—260 feet below ground.—The Team inspected a bunch of wells on the north bank of the river Silai near village Ram Nagar, not far from the town of Simla-Pal. The depth of these wells is said to vary from 275 to 450 feet. Typical log sheet of an auto-well yielding about 12 gallons is given in *Appendix XII*. Most of the strata consist of sand and clay or *kankar* inter-calations of sand. The shallowest hyper-piestic aquifer zone is reported to occur at a depth of about 250 feet below ground level. The diameter of

these wells varies from 2" to 2½". Their yields are from 4 to 12 gallons per minute. The officers accompanying the Team could not verify if piezometric heads have been measured on these wells.

5.5. Apparently, no scientific investigations seem to have been made in regard to these wells, so as to utilise them as an irrigational source on a planned basis. Water is led out from the well pipe through different kinds of sprouts which are not very efficient. The Team saw the water being led into a field measuring about an acre from one point only. Irrigation will be more economically done if the fields are sub-divided into smaller parts and water is led into those, one by one. It was stated that 4 auto-wells in that area, were together irrigating about 33 acres of *boro* paddy at the time of the Team's inspection in April, 1960. Double cropping is also done in this area because of facilities of irrigation provided by these flowing wells. The spring level in the area was about 30 feet at the time of Team's inspection. The cost of each auto-well was reported to be varying from Rs. 1,500 to Rs. 2,000.

5.6. Since these wells have been built through different agencies and at different times for different owners, it could not be verified whether strainers were fitted in right strata. Well screens may have been placed in certain cases, against silty or clay formation. It is felt that properly constructed wells would yield better discharges.

5.7. Indiscriminate Exploitation.—As it is, there is scope for making use of this artesian source in the region. Care has, however, to be taken that the source does not get wasted out through indiscriminate exploitation. Again, water used from these wells is not on calculated agricultural requirement basis, but as from a canal through a process of field to field irrigation.

5.8. There are reported to be about 30 wells in the Garbeta area. Some more wells are proposed to be built in the relatively low ground. The Team recommend that:—

- (i) detailed records should be kept of the geological and hydrological characteristics of the strata encountered during the drilling and testing operation of each such auto-well;
- (ii) where such wells exist their supplies should be conserved. They should be sealed against side leakage;
- (iii) a record of piezometric heads should also be kept, so that the dependability of the source from a long range view could be judged;
- (iv) the water from the wells should be used on a scientific basis and no wastage, as occurs in field to field irrigation, should be permitted; and
- (v) aquifer performance test may be conducted and computation of reliable aquifer constants should be made. That alone will reveal the hydrological character of the aquifers.

CHAPTER VI

Agricultural Aspects

6.1. Consolidation of Holdings.—Of the total population in West Bengal nearly 57 per cent is dependent on agriculture. The average size of holding is 4.82 acres (1951) and the total cropped area *per capita* is 0.57 acre as against 0.9 acre in the country. The excessive pressure on land is further aggravated by disparities in the distribution of land. With the rapid growth in population, the holdings are getting further sub-divided and fragmented. In fact, small uneconomic holdings, coupled with inadequacy of production requisites, present formidable obstacle to agricultural development and place the farmers at a great disadvantage in getting more per unit of land. The holdings can neither be efficiently cultivated nor irrigated. In easing the situation and promoting land development including the utilisation of water resources, consolidation of holdings has an important role to play but, in this State, it has not yet received the attention it deserves.

6.2. Culturable Waste.—Increasing demand for food can only be met with by greater production, which can be achieved by lateral as well as vertical growth. Because of the growing towns, cities and industries which are sprawling over farm lands, the scope for spreading laterally is rather limited. According to a rough estimate there are about 13-lakh acres in the State which are classified as culturable waste. All of these areas are, however, not easily reclaimable. The Committee on the Location of Culturable Waste Lands in India has observed that about 1.13-lakh acres have been located in West Bengal by the Agriculture Department, which lie in blocks of 250 acres or more and can be reclaimed at a cost of Rs. 116 per acre. Most of these areas are eroded, *tarai*, *khar* or saline lands. There are also smaller blocks and long strips of productive land along nearly 23,000 miles of roads and 2,000 miles of railway lines, which if brought under cultivation, can add to agricultural production. A part of the Railway area has already been taken over by the Department of Agriculture and leased out to the cultivators. Still a large area is available which should be taken over from the Railway authorities for cultivation.

6.3. Intensive Cultivation.—For stepping up agricultural production, vertical growth, *i.e.*, higher production per acre, offers the greatest scope. Since water is a primary factor in agricultural production, its provision to crops in times of need is essential to meet the increasing demand for food. With a heavy rainfall and extensive net work of rivers, nature has endowed West Bengal with abundance of water. For irrigation, as well as promotion of drainage in water-logged areas, a number of canals have been dug but the rivers and canals are active mostly in the rainy season. By and large, this is the time when crops do not normally need irrigation in this State, except in times of scarcity

and drought. Winter months are, however, practically rainless, and if water is available during this period in adequate quantity, considerable increase in production could be brought about.

6.4. Irrigated Area and Crops.—During 1959-60, out of the total geographical area of 218.74-lakh acres, the cultivated area (including 8.5-lakh acres of current fallows) was 141.33-lakh acres and the gross area sown was 154.83-lakh acres of which 37.10-lakh acres or nearly 25 percent was irrigated and drained. Crop-wise details of the irrigated area are available for the year 1955-56*, which are shown below:—

Crop	Area (in thousand acres)
Rice	2,484.5
Wheat	50.5
Other cereals	19.8
All cereals	<u>2,554.8</u>
Pulses	88.7
Total food grains	<u>2,643.5</u>
Oilseeds . . . . .	..
Sugarcane	29.6
Cotton . . . . .	..
Jute . . . . .	..
Tobacco	31.0
Fruit & Vegetables	137.6
Total cropped area	<u>2,841.7</u>

It will be observed that present irrigation system mostly supply water to paddy crop which accounts for nearly 90 per cent of the total irrigated area. Since rainfall in the main rice growing period is normally adequate, and even excessive in some areas, the farmers are generally reluctant to use canal and tubewell water for this crop except when absolutely necessary. Irrigation in this State is thus, largely supplemented to natural precipitation, and a protective measure to meet the hazards of drought. In winter, water is largely applied to cash crops like vegetables, fruits, sugarcane, tobacco and potatoes. To some extent wheat and pulses are also irrigated, but their area is not much. With the development of irrigation facilities the area, sown more than once, is increasing. In 1959-60, it was 22-lakh acres, thus forming nearly 14 per cent of the cropped area.

*Excluding Purulia and Islampur.

6.5. Food Crops.—Rice is the major crop of the State, occupying an area of nearly 109 lakh acres or 70.5 per cent of the total cropped area and *aman* is the major type grown. Pulses including gram cover nearly 12 per cent, jute and Mesta over 6½ per cent, vegetables and fruits 5 per cent, oilseeds (mustard and linseed) about 3 per cent and sugarcane 0.5 per cent of the total cropped area. Thus rice among the food crops and jute among the commercial crops occupy dominant position in the rural economy of the State. Crop statistics of the State for the last two years are given in *Appendix XIII*.

6.6. The Team observed that during the last three years, the production of food grains was lower as compared with the years 1955-56 and 1956-57. The yield of rice per acre also showed a downward trend. While in 1956-57 it was 944 lbs. per acre, in 1959-60 it was 856 lbs. per acre. Although this yield is higher than that of the All India average of 808 lbs., yet it is lower than some of the other States like Madras and Andhra. The Team felt that there is an ample scope for stepping up out-turn per acre and improve the standard of cultivation of paddy in this State.

6.7. The shortfall in agricultural production is generally attributed to the following causes:—

- (a) Absence of cultivation on large tracts of agricultural land owing to deposit of sand left by floods and lack of moisture due to drought;
- (b) delayed transplantation owing to late rainfall causing reduction in yield;
- (c) scorching of seedling after repeated transplantation due to lack of rain;
- (d) dependence of bulk of cropped area on rains which are quite often untimely, uncertain, scanty or excessive;
- (e) inadequate and improper arrangements for drainage and controlling floods;
- (f) comparatively low rainfall in winter and absence of adequate irrigation facilities; and
- (g) inadequate use of chemical fertilisers, manures, leguminous crops and other soil building practices.

6.8. Rice Cultivation.—Because of small holdings, food habits of population, high rainfall, and prevalence of low lying areas, with certain amount of water-logging, rice is widely grown on the same land year after year. There are four types of soils in this State *viz.*, alluvial, red, laterite and saline. On the alluvial soils, generally *aman* crop of rice is grown. On the red and laterite soils, *aus* is cultivated on the high lands and *aman* crop on the low lands. In the coastal saline areas, which remain submerged in water for most part of the year, rice is the only crop that is raised. There is generally an impression that

rice crop could be grown indefinitely without declining yields, as "fallowing" after removal of the crop till its next sowing season, recuperates the soil. It has, however, been determined that a good crop of rice removes 54 lbs. of nitrogen, 22 lbs. of phosphate and 83 lbs. of potash* and West Bengal soils respond to the application of nitrogenous and phosphatic fertilizers. Thus, in order to raise rice production in this State, it is necessary not only to fertilize the soil adequately but also to adopt suitable crop rotations. Wherever possible it will be desirable to raise each year a winter crop after summer crop. Experiments conducted at the Central Rice Institute, Cuttack, Orissa, have shown that it is possible to step up rice production by 21 per cent by raising, on the same land, two crops of rice in a year and by 64 per cent and 81 per cent by adopting the rotations, *Dhaincha* (green manured)-rice-rice", and "*Mung* (green manured)-rice-rice" respectively. The value of green manuring in improving soils, soil fertility and crop yields is fully established and realised all over the country. To some extent, efforts are being made by the Department of Agriculture, West Bengal, to popularise *Dhaincha* as a green manure crop for paddy. Its seed is, however, a limiting factor which can be overcome by distributing it in small packets to cultivators to make them self sufficient in it, as has been done in States like Madras.

6.9. Need for growing Legumes.—Growing of legumes in a cropping system is also a useful practice for the maintenance of soil fertility. It is for this reason that legumes are always included in a good rotation. In West Bengal, pulses occupy less than 12 per cent of the total cropped area which is rather low. It is only some of the progressive farmers who are growing crops like gram, *lentil*, *lakhori* etc. after rice and this practice is not widely adopted by the cultivators. *Phaseolus Trilobus* is also being grown on some of the *aman* lands. This is a promising legume as a catch crop for irrigated area. Lucerne, peas and beans are the other crops which were found to be growing at some farms. Enlargement of crop yield through suitable rotations and double cropping, is an important trend noticeable in some parts of West Bengal, wherever irrigation facilities are available but a good deal of extension work shall have to be carried out before the cultivators are convinced of the usefulness of the practices of growing legumes before or after rice.

6.10. Evolving Suitable Crop Rotation.—Soil is a factor of prime importance in determining what crops to grow and in what sequence, but how much of each crop should be grown depends upon a number of other physical and economic considerations. In contrast to continuously growing a single crop on the same land, systematic rotations have many advantages and their benefits must be brought home to the cultivators fully before they could be expected to adopt them. In evolving a rotation for an area, the aim to be kept in view is to obtain maximum production per unit of land and at the same time maintain, and

* Soil management in India page 219.

even improve, the soil fertility. In a certain measure, there may, at times, be a conflict between the social needs and individual interests, as a grower is primarily concerned in obtaining large economic returns rather than the maximum yields per acre. Any recommendation in regard to change in cropping system must, therefore, be made with considerable care. As the water requirements of crops vary from place to place and season to season, different irrigated areas of the State will have different problems for the solution of which, it seems necessary to divide it into different zones and set up a research centre in each of them.

6.11. Crop Planning Research.—Research work on crop planning requires to be broad-based and directed to the best and efficient utilisation of land and water resources so as to feed the ever increasing population of the State. Under such a programme, tubers could play an important role, as they are the cheapest source of carbohydrate food. Depending upon the local conditions, even if a moderate area of about 5 per cent is put under the tubers and they enter into the diet of the people, it could go a long way in solving the food problem of the State. Already potatoes are being grown in this State on an area of about 1.4-lakh acres. Apart from increasing the area under this crop, there is also a possibility of growing such crops as sweet potatoes and tapioca. In China and even in U.S.A., it is cultivated on a large scale and enters into the diet of the people. Some of its varieties are yielding more than 200 maunds of tuber per acre. Sweet potato has a number of advantages over the potato; the chief amongst them is ease of propagation and less rigid requirements of soil, manures and irrigation and also has greater food value. Tapioca, which was introduced in Travancore with the object of relieving distress and as a substitute for rice, is now widely accepted as a food material in Kerala and has been of considerable help in tackling the food problem of that area. It is a tropical crop and needs warm and humid climate. It is a very high yielding tuber and can stand heavy rains of even more than 100 inches, as well as considerable drought. It can also be cheaply converted into starch and finished products. Its cultivation deserves to be extended in West Bengal. With the increase in area under tubers and acre-yield of rice some of the area could be released from paddy and diverted to pulses, oilseeds, fodder etc., for the extension of cultivation of which there is a considerable scope.

6.12. Scope of Spices, Coconut and Cotton.—Coconut, arecanut, cashewnut, pepper and cardamum are, at present, being grown in this State to some extent. There appears to be an ample scope for extending area under these crops. The cultivation of coffee on a commercial scale also offers scope for extension in areas, where soil and climatic conditions are suitable. Cattle found in West Bengal are of non-descript type and cows are very low yielders. The *per capita* consumption of milk is low. Since pressure on land is very heavy, the production of fodder on a large scale has some limitation but by

growing improved and nutritious fodders, there is a possibility of improving the condition and yield of milch cattle. There is also a vast scope for poultry development, which is quite popular and successful in this State.

6.13. By experiments it has been observed that Andrew variety of Sea-Island cotton could be grown successfully in areas of high rainfall in the western coast of India, in Kerala and Mysore. Its trial has also been made in Assam. It would be desirable to conduct trials of this variety in some of the suitable areas of West Bengal, in order to find out the possibility of producing this crop. If found successful, it will prove to be of a great advantage in stopping the imports of long staple cotton from abroad and thus affecting considerable savings in foreign exchange.

6.14. Organisation of Research for Crop Planning.—Crop planning is of paramount importance and it seems necessary to build up a strong organisation to deal with this problem effectively. During their visit, the Team observed that while there is a large number of Specialist Officers for attending to research work on different crops, there is no well organised section to deal with agronomic aspects of crop production. Since the irrigated area in this State is fairly large and there is also a considerable scope for introducing new crops and rotations, besides providing a Central Research Station, it will be desirable to have Regional Sub-Stations in the main irrigated areas of the State, each manned by competent staff and provided with adequate facilities. These centres should have close association with the organisation of putting up demonstrations in the cultivators fields for introducing new crops and rotations. In addition, they should also deal with important problems of water management and drainage, such as methods of water conveyance, its application to fields, preparation of land for irrigation and optimum size of the beds etc. In any programme of crop planning, the knowledge of the amount of water required at critical periods of plant growth is very important to formulate correct plans for water management and crop rotations. The Team also, therefore, lay great stress on investigation on the water requirements of the principal crops in relation to their physiology, soil and climatic conditions of the different regions. So far, no serious investigation in West Bengal seems to have been made on this aspect of the problem and it is now high time for the Agriculture Department to take it up in co-operation with the Irrigation Department.

6.15. Demonstration of Crop Rotation.—Side by side, with the research on the evolution of suitable cropping patterns for different areas, it will be necessary to lay out a large number of demonstrations in the irrigated areas, in order to show the advantages of the recommended rotations to the farmers. Already the Department of Agriculture fully realises the importance of this work and a number of demonstrations are arranged annually under a regular Departmental scheme

of setting up one centre in each Union of the State. For this purpose, a piece of land is selected with a progressive grower, where all agricultural operations are carried out by the cultivator at his own cost, under the expert technical guidance of the officers of the Department of Agriculture. Improved seeds and other agricultural implements worth Rs. 1,000 are also supplied to him by the Government, out of which 50 per cent is realised in the subsequent years and the rest is treated as subsidy. If the same centre is selected to function in the following year as well, the subsidy is increased. During the year 1954-55, 653 such centres were set up. The Team, however, did not come across any such centres, in the tubewell irrigated areas, where with assured perennial water supply, considerable scope exists for the modification of the existing cropping system. It will, therefore, be desirable for the Agriculture Department to draw up a programme of demonstrations in consultation with the Irrigation Department.

6.16. The efficiency of water used by crops is intimately co-related to soil fertility. A well fertilized crop uses water more efficiently than crops grown on low fertility level. Good fertility ensures a greater supply of water to crops, as in well fertilized fields, crops develop extensive and deeper root system. The use of fertilisers will afford not only the best means of securing rapid and substantial increase in agricultural production but will also result in increased efficient use of irrigation water. Thus, all programmes of water utilisation and soil conservation including soil fertility, deserve top most priority as they will make greatest contribution to agricultural production of the State



CHAPTER VII

Irrigation in Tidal Regions

7.1. The southern deltaic region of West Bengal lying within 24-Parganas district forms mostly the tidal region. This area has been built primarily by the silt carried by the Ganga (Bhagirathi-Hooghly) and its many branches. The process of building delta has also been assisted by silt brought up by the tides from the sea. As at present the entire tract is inter-woven by innumerable channels and creeks—both big and small. These also serve as drainage carriers of the area.

7.2. Rainfall in the region is in the neighbourhood of 1,524 mms. (60 inches). Most of this falls within the 3 months of the monsoon period. The tidal channels, therefore, play an important role in the disposal of drainage.

7.3. The expanse of the area is over 3,000 square miles. Out of this 1,600 square miles are under reserved forests in Sunderbans. Of the remaining 1,400 square miles, about 1,000 square miles are under cultivation. This cultivated area is more or less under constant threat of inundation by saline water from the sea, when in high tide. This involves construction and proper maintenance of protective embankments not only along the sea face, but also along tidal channels. To make planned agriculture a success in this area, it is necessary that adequate and dependable protection is afforded to the lands against inundation from the saline action of the sea.

7.4. The Area being vast, the problem is gigantic, apart from being fairly intricate. The Team has no expertise on the subject and cannot, therefore, go into details. They, however, visited some of the drainage basins and their drainage and sluicing arrangements in Diamond Harbour area. The Mogra-Hat Drainage Sluice at Diamond Harbour is a big work consisting of 30 vents of 5 feet by 7½ feet. The automatic flap on the downstream side permits water to flow towards the sea only. The sluices are capable of passing down about 5,200 cusecs of water. At the time of Team's inspection (October, 1960) there was break in monsoon resulting in demand for irrigation. The sluices were, therefore, closed. Some basins and their sluicing arrangements were inspected by the Team.

7.5. Prior to the abolition of *Zamindari* in West Bengal, which came into effect in April, 1955, these lands were protected against saline action through individual efforts of the *Zamindars*. Now the entire task has devolved on the Government. It was gathered that the embankments are now built mostly as test relief works. Often, the embankments so built offer little resistance and give way when most needed, because the basic idea of test relief work is to provide

relief to some workers and due regard cannot be paid to the technical side of the work. As a result, we do not create permanent assets, as we should, in building such embankments. The Team feel that work of this nature should invariably be handled with due technical competence. In fact, the responsibility in this respect should rest on technical departments which should be strengthened, if necessary.

7.6. There are about 2,200 miles of embankments, which afford protection to 1,000 miles of cultivated area. There are reported to be breaches in many places from year to year on account of various factors such as high tide levels, wind direction, velocity of water etc. This creates a feeling of uncertainty. The area cannot, therefore, be developed in bold and assured manner. As a result, we are unable to get full benefit from such a fertile tract.

7.7. But the problem is not simple. Even if the 2,200 miles of embankment were properly strengthened, their maintenance will not be an easy job. The one apparent way to reduce the length of these embankments is by closing estuaries as has been done in the Polders of Netherlands. This will also relieve lands occupied by hundreds of miles of embankments for cultivation. Apart from the cost of such operations being prohibitive, it is felt that the natural climatic conditions in the deltaic areas in West Bengal vary considerably from those of Holland.

7.8. Instead we may start with closing mouths of such channels and creeks, which are either dying or are fully mori-bund. This will help doing away with the embankments running along those channels and creeks. The length of embankments will thus be reduced to some extent.

7.9. As the experience is gained on such channels we can expand our activities to more lively channels one by one.

7.10. Irrigation from tidal channels is only periodic. On a small scale it can be well controlled with the help of embankments and sluicing arrangements, as is being done in a large number of cases. The problem, however, is involved with vital technical condition and financial consideration, which are currently under study of the State Government. It is hoped that some tangible scheme will be worked out, so as to enable agricultural production potential of these tracts being utilised to the maximum extent.



Recommendations

West Bengal has got vastly varying climatic and topographical features. What applies to the south-western part of the State is wholly inapplicable to its northern and north-eastern regions. It is, therefore, not possible to present generalised study of minor irrigation works in the State, as a whole. Besides, agrarian operations in the State are, by and large, based on the age-old pattern of rain-fed agriculture, supplemented by small tanks in some parts of the State. There is, therefore, little irrigational tradition to build up a comprehensive system of irrigated agriculture thereon. The Team has looked into the problems of the State from a broad-based view—and, minor points indicating shortfalls and shortcomings, which came under observations during individual case studies, have not been included in the report, except where they have a generalised application. They were, however, discussed with the officers concerned and the State authorities at appropriate levels, who will undoubtedly take action to remedy them. The report, as it is, deals mostly with matters involving policy decisions and of wide interest. The Team's recommendations are summarised below :—

I. The Bengal Irrigation Act of 1876 and the Bengal Development Act of 1935 need to be amended. *(Paras 2.12 and 2.21)*

II. Water rates on Two-Part Tariff basis in suitable form should be imposed. *(Para 2.12)*

III. The Irrigation Revenue Administration involving booking, assessment and collection, now under Revenue Department, should also envisage a percentage of actual field check by different grade of Officers with a view to guard against any concealment, over-use or ill-use of water. *(Para 2.19)*

IV. It will be advantageous if new irrigation schemes are undertaken as far as possible after obtaining prior undertaking from the beneficiaries so that there is an assured utilization of irrigation supplies. *(Para 2.20(i))*

V. Where irrigation schemes are built, a gradual shifting from rainfed agriculture to irrigated agriculture should take place. *(Para 2.20(ii))*

VI. All Irrigation works, big or small, should be provided with proper gauges, masonry bed bars and fool-proof water regulating arrangements. *(Para 2.16)*

VII. Wasteful practice of field to field irrigation which is common in the State should be replaced with a field channel water distribution system. Construction and maintenance of water courses should be made obligatory for the beneficiaries. *(Paras 2.4, 2.16 and 2.20(iv))*

VIII. Rules for execution of small irrigation schemes should be suitably amended so as to enable the Government to fully finance beneficial small schemes in the event when local contribution to the extent of 50% is not forthcoming. In such cases the contribution share from the beneficiaries may be realised in easy instalments subsequently.

(Paras 3.15 and 3.16)

IX. Irrigation tanks which lie silted up, should be desilted with a view to increase their storage capacity and to relieve their fore-shore lands from unnecessary submergence. This land could, with advantage, be used for agricultural purposes in some areas.

(Para 3.2)

X. Tanks under Test Relief Scheme should be built under technical supervision so as to ensure safety of their embankments and serviceability of the tanks.

(Para 3.3)

XI. Progress of reclamation work on *ex-Zamindari* tanks should be accelerated by the Tank Development Department of the State.

(Para 3.7)

XII. Co-operative construction and maintenance of irrigation tanks should be encouraged and they should be placed under charge of village *Panchayats* or Community Development Block Administration.

(Para 3.10)

XIII. Sub-soil water level in the context of a heavy rainfall and the yearly requirements of irrigation should be duly considered before installing irrigation tubewells.

(Para 4.3)

XIV. Pre-planning to utilise the costly irrigation potential created by irrigation tubewells should be done before they are installed.

(Paras 3.11, 4.25 and 4.27)

XV. An equitable realisation of charges on tubewell irrigation on volumetric basis fitting into the agricultural economy of the State should be ordered allowing for necessary rebates in the early developmental stages.

(Para 4.35)

XVI. Tubewells, at present, under different departments, should be brought under integrated control either of the Agriculture or Irrigation Department and a specific Tubewell Act should be enacted to facilitate their construction, maintenance and operation.

(Paras 4.36 and 4.37)

XVII. Tubewells should normally be located at the inter-section of water-sheds in its commanded area so that advantage is taken of natural gravitation to facilitate open channel distribution instead of through underground R.C.C. pipeline system.

(Para 4.14)

XVIII. Irrigation channels from tubewells could, with advantage, be built overground and costly R.C.C. underground pipeline system could be dispensed with.

(Paras 4.17 and 4.18)

XIX. Where land is precious or a depression or a high mound is to be negotiated, simple spun un-reinforced pipeline could be used.
(Para 4.20)

XX. A couple of officers of the ranks of Executive Engineer and Assistant Engineer should be sent to Uttar Pradesh to familiarise themselves with the actual working and operation of tubewells.
(Para 4.37)

XXI. Before tubewells are installed, a coordinated planning with the Power Department with regard to timely power supply should be ensured so that completed tubewells do not lie idle for want of electricity.
(Para 4.22)

XXII. For auto-wells, detailed records of the geological and hydrological characteristics should be collected and maintained. A record of piezometric heads should also be kept.
(Paras 5.8 (i) and (iii))

XXIII. Aquifer performance test for auto-wells should be conducted and reliability computation thereof should be made to determine the hydrological character of the aquifers.
(Para 5.8 (v))

XXIV. Culturable waste lands, which lie along roadways and railways should be brought under cultivation in order to add to agricultural production.
(Para 6.2)

XXV. In order to increase rice production, it is necessary not only to fertilise the soil but also adopt suitable crop rotations.
(Para 6.8)

XXVI. In order to spread the cultivation of green manure crop or legume crop, seeds should be distributed to cultivators to make them self-sufficient.
(Para 6.8)

XXVII. (i) A pattern of crop rotation suitable to local agronomic conditions should be evolved having in view the need to obtain maximum production as well as maintain fertility of the soil and also considering the social needs to increase production.
(Para 6.10)

(ii) Research work on crop planning should be broad-based and directed to the best and efficient utilisation of land and water resources.
(Para 6.11)

(iii) Wide-spread demonstrations should be organised in irrigated areas by Agriculture Department in co-operation with the Irrigation Department in order to show the advantage of recommended crop rotations.
(Para 6.15)

(iv) Demonstration centres should be organised in fields on tubewell commands also.
(Para 6.15)

XXVIII. The areas under pulses and spices including coconut, for which there is ample scope in the State, should be increased.
(Para 6.12)

XXIX. (i) In order to increase the yield of milch cow, improved and nutritious types of fodder crops should be grown to make the best use of limited land resources in the State. *(Para 6.12)*

(ii) Poultry farming, which is popular and successful in the State and for which there is vast scope, should be developed. *(Para 6.12)*

XXX. Trials of Andrew variety of Sea-Island cotton should be conducted for its suitability to soils in the State. *(Para 6.13)*

XXXI. Research on agronomic aspects of crop production should be organised. *(Para 6.14)*

XXXII. (i) Besides providing a Central Research Station, Regional Research Sub-Stations should be established with complete staff and adequate facilities in the main irrigated areas of the State. *(Para 6.14)*

(ii) These centres should be closely associated with the organisation of agricultural demonstration in the cultivators' fields. *(Para 6.14)*

(iii) In addition, these centres should deal with problems of water management and drainage like water conveyance, application in fields, preparation of land and determination of optimum size of beds for efficient irrigation. *(Para 6.14)*

XXXIII. In co-operation with the Irrigation Department, the Agriculture Department should specially undertake investigations into the water requirements of crops. *(Para 6.14)*



Terms of Reference of the Minor Irrigation Team

The minor irrigation projects may be divided for study into two parts :—

- (a) Works already in existence.
- (b) Works which are now being constructed.

2. Case studies should be made of a number of projects of each type under the above headings with a view to judging their efficiency having regard to the objectives with which such works were carried out.

3. The following points should be especially borne in mind:—

Existing Projects

- (i) The present state of repair and maintenance.
- (ii) The system of keeping works in proper maintenance with particular reference to the customary obligations of villagers for keeping such works in a sound condition from year to year, the Team should also examine the extent to which these obligations are enforced, the reasons for the failure to do so and the steps that should be taken to carry out such obligations efficiently.
- (iii) Reasons, if any, for non-utilisation of water by cultivators.
- (iv) Improvements necessary to make the projects more efficient either in the matter of better agricultural planning and practices or in respect of engineering works.
- (v) Cost of restoration if the project is in a state of disrepair and whether it has been included in the Plan.

New Projects

- (i) Method of selection—procedure and principles on which priorities are based.
- (ii) Flow Chart of the construction Project should be prepared to examine whether any avoidable delay has occurred in its completion.
- (iii) Whether fullest use is made of catchment capacity in preparing designs.
- (iv) Economics of design.
- (v) State of agricultural planning with a view to optimum utilisation of benefits.

(vi) Institutional arrangements provided for the proper maintenance of new works with special reference to the customary obligation of villagers in this regard.

(vii) Costs of actual construction compared to estimated costs—the reasons for increase if any and the care with which the initial estimates were framed.

4. Any other matter which the Team considers necessary to report upon having a bearing on economy and efficiency of such projects.

5. The following information should be gathered by the Team for each State, taken as a whole in regard to existing minor irrigation works :—

(i) The total area irrigated from them according to Settlement registers.

(ii) The area actually irrigated from year to year beginning from 1947.

(iii) The reason for the reduction, if any, in the area irrigated.

6. In addition, the Team will carry out a study of the tubewell schemes of the Punjab and the U.P. with reference to the fact whether optimum use has been made of the facilities available by ensuring scientific crop planning and by improving agricultural practices. The study should be based on an examination of individual tubewells, which may be divided into most successful, successful and least successful varieties for the purpose of study. The Team should also select a few tubewells for which alternative crop planning and practices may be recommended that are being carried out at present in order to make them more successful. The consideration mentioned regarding minor irrigation works in paragraph 3 *mutatis mutandis* be taken into consideration for the study of tubewells also.



APPENDICES

Appendices

- I. Statement showing annual rainfall in the districts of West Bengal from 1948-1957. (1.3)
- II. Copy of Irrigation and Waterways Department's notification No. 26-1, dated May, 1957. (2.15)
- III. (a) List of Minor Irrigation Schemes on which water rate has been imposed under Bengal Irrigation Act of 1876. (2.17)
(b) List of Minor Irrigation Schemes which have not yet been declared under any Act. (2.17)
- IV. Statement showing normal monthly rainfall at the stations of Jalpaiguri, Falakata, Siliguri and Kurseong. (2.20)
- V. Statement showing district-wise distribution of Irrigation tanks and bunds in West Bengal. (3.1)
- VI. Extract from "Instruction for the execution of Small Irrigation Schemes". (3.15)
- VII. Statement showing number and details of sites explored in West Bengal during the 1st Exploratory Project. (4.1)
- VIII. Statement showing details of Development Tubewell Irrigation in the Second Five Year Plan. (4.4 & 4.9)
- IX. Statement showing the progress of Development Tubewell Irrigation in the State of West Bengal for the month of August, 1960. (4.6)
- X. Statement showing economics of functioning of a State Tubewell. (4.11)
- XI. (a) Statement showing mechanical details of tubewells in Fulia Development Block. (4.30)
(b) Statement showing mechanical details of tubewells in Habra Development Block. (4.30)
- XII. Details of a typical Log-sheet of an auto-well in West Bengal. (5.4)
- XIII. Statement showing estimate of acreage and yield of principal crops in West Bengal for 1958-59 and 1959-60. (6.5)
- XIV. Minutes of the Meeting held at Retunda, Writers' Buildings, Calcutta on the 6th April, 1960 at 11.45 a.m.
- XV. Minutes of the Meeting held at Writers' Building, Calcutta on 14th February, 1963 at 3.00 p.m.



APPENDIX-'I'

Annual Rainfall in the Districts of West Bengal from 1948—57

District	Normal rainfall	Annual rainfall in millimetres									
		1948	1949	1950	1951	1952	1953	1954	1955	1956(P)	1957(P)
1 24-Parganas	1,579	1,901	1,785	1,595	1,300	1,579	1,433	1,225	1,486	1,773	(1,207)
2 Nadia . .	1,401	1,448	1,152	1,067	(1,043)	1,551	2,214	1,298	1,115	1,732	1,236
3 Murshidabad .	1,338	1,666	1,529	(908)	957	1,338	1,400	1,233	1,477	1,639	1,415
4 Burdwan . .	1,271	1,261	1,391	1,302	1,126	1,250	1,353	1,139	(992)	1,601	997
5 Birbhum . .	1,234	1,254	1,589	1,149	(881)	1,137	1,270	1,039	1,097	1,718	1,304
6 Bankura . .	1,217	1,375	1,342	1,317	1,012	1,137	1,150	987	(958)	1,407	1,106
7 Midnapore . .	1,428	1,593	1,354	1,365(a)	1,190	1,344	1,617	1,036	1,449	1,965	(935)
8 Hooghly . .	1,516	1,759	2,136	1,126(a)	1,533	1,340	1,524	1,225	1,201	1,866	(1,138)
9 Howrah . .	1,676	1,733	2,274	1,301	1,808	1,901	1,415	902	(722)	1,834	..
10 Jalpaiguri . .	4,136	4,895	4,669	3,726	4,536	4,682	(3,101)	5,262	4,994	4,099	3,113
11 Darjeeling . .	3,212	3,256	3,838	4,071	3,372	3,890	3,036	2,907	2,809	(2,607)	2,722

12	Malda . . .	1,498	1,484	1,420	1,644	991	1,585	2,142	1,242	1,343	1,473	(920)
13	West Dinajpur	1,802	1,353	1,771	1,568	1,302	2,305	1,880	1,734	1,829	2,221	(998)
14	Cooch-Bihar .	3,193	..	..	2,807	3,043	2,897	2,801	3,467	3,232	3,460	(2,187)
15	Calcutta . .	1,605	..	..	..	..	..	..	..	1,377	1,743	(1,295)
16	Purulia . . .	..	..	..	..	..	..	..	..	..	(1)	1,129

Source : 1. Relief of Distress in West Bengal—January-July, 1955—Appendix III.
2. Statistical Hand Book—1959, Table 4·1 (for 1955, 1956 and 1957 and Normal Rainfall.)

NOTE.— Figures in brackets show minimum rainfall.
Bo'd Figures show maximum rainfall.
Normal rainfall is annual average from 1942 to 1954.

APPENDIX "II"

Copy of Irrigation and Waterways Department's Notification 26-1, dated May, 1957

In supersession of the Government of West Bengal, Irrigation and Water ways Department notification No. 30-1 dated the 13th December, 1956 the following draft of rules, Schedule of rates and appendices where in exercise of the powers conferred by Sections 78 and 99 of the Bengal Irrigation Act, 1876 (Bengal Act III of 1876), the Governor proposed to make for the supply of water from the Fichang rivety of the projected Jateswar Irrigation Scheme in the District of Jalpaiguri, are hereby published for the information of persons likely to be affected thereby.

2. The draft will be taken into consideration after the 30th June, 1957. Any objection or suggestion with respect thereto received by the undersigned before that date will be considered :—

DRAFT RULES, SCHEDULE OF RATES AND APPENDICES

Leases for a term of years

1. The country served by the canals shall be mapped out into blocks of convenient size in accordance with the features of the ground, natural or artificial. So far as may be practicable, the blocks shall be separated by drainage lines. This shall be done by the Sub-divisional Canal Officer under the guidance and control of the Divisional Canal Officer.

2. Each Block determined as above shall be numbered and recorded with its gross and irrigable acres in registers to be maintained by the Sub-divisional Canal Officer. The blocks shall also be marked on maps to be maintained by the same officer.

3. Leases for not more than six years may be granted for the whole irrigable area of a block or for definite parts of a block under the following conditions :—

I. Ordinarily the whole irrigable area of any village so far as situated within the block must be included in the lease. If the lands of a village within the block are divisible into two or more distinct parts which can be irrigated independently a separate lease may be granted for each part.

II. All leases within one block shall be so granted that they may expire on the same date.

III. No lease shall be granted when the supply of water must of necessity be delivered across an unleased area, unless a channel exists, which, in the opinion of the Sub-divisional Canal Officer, will deliver water without waste across the unleased area.

4. The Superintending Engineer shall fix from time to time the gross area for which and the limits of the canal within which, leases for a term of years may be granted.

5. Maps of all villages in which lands have been brought under lease for a term of years, or in which there is any possibility of such leases being taken, shall be kept in the Sub-divisional Canal Office. These maps to be at scale 32" = 1 mile when such are available and elsewhere at scale 16" = 1 mile.

6. The preliminary application for a lease for term of years, either new or renewal, may be of an informal nature, but it must be in writing. It may be presented and shall be received either at the Sub-divisional or Sectional Canal Office, in the latter case the Sectional Officer shall forward it immediately to the Sub-divisional

Canal Officer. The Sub-divisional Canal Officer as soon as he has, by personal enquiry or by an enquiry made by the Sectional Officer, satisfied himself that the land in question constitutes a definite block or a definite part of a block, and that could be irrigated, shall at once inform the Divisional Canal Officer giving such particulars as that officer may direct, and shall ask his formal approval to the lease being proceeded with. On receipt of such approval the Sub-divisional Canal Officer shall proceed to make the detailed assessment. The lands to be brought under lease shall be indicated on a copy of the map referred to in rule 5.

7. The Sub-divisional Canal Officer on receipt of the application shall depute an *amin* to prepare the *khasra* or detailed assessment paper. This shall be done on the ground with the aid of the revenue survey map and *khasra*. Should the survey map and *khasra* not be available, the *amin* shall make a sketch map, and shall measure the areas of the holdings with a chain or measuring-rod.

8. When the *amin* has completed the *khasra* he shall forward it to the Sub-divisional Canal Officer who shall forward it to the Divisional Canal Officer for approval.

9. As soon as the *khasra* has been approved by the Divisional Canal Officer he shall return it to the Sub-divisional Canal Officer endorsed with his signature in token of approval.

The Sub-divisional Canal Officer shall then prepare a *khatian* or abstract of the *khasra*, and shall have the form of application given as Appendix I to these rules, filled up and signed or marked by each of the applicants, in the presence of two witnesses.

When the application has been completely signed, the Sub-divisional Canal Officer shall send it to the Divisional Canal Officer, by whom the permit or formal approval of the lease shall be signed and issued in the form given as Appendix II to these rules. The permit shall be made over to the representative of the cultivator by the Sub-divisional Canal Officer through his Sectional Officer. The Divisional Canal Officer shall return the application to the Sub-divisional Canal Officer with a copy of the permit for record.

10. Should it happen that the cultivators of the block proposed for lease are not unanimous, and that some of them decline to sign the application, the Sub-divisional Canal Officer shall report the matter to the Divisional Canal Officer and the Sub-divisional Canal Officer shall hold a local enquiry, recording the statements of the persons who decline to sign and recording his personal opinion on the reasons given. He shall then send a report to the Divisional Canal Officer, who shall decide whether the lease may be accepted excluding the fields in the occupation of persons who declined or whether the lease shall be declined. The Divisional Canal Officer may grant a lease when not less than 95 per cent of the net irrigable area of the block has been signed for. In particular cases should it be desirable to grant a lease even though an area larger than 5 per cent of the block has not been signed for, this may be done on the written orders of the Superintending Engineer. The reasons for granting the lease shall be fully recorded.

COVERING LEASES

11. Applicants for a lease for a term of years who may require water before the lease has been concluded can obtain a supply on tendering an application for a covering lease in the form given as Appendix II to these rules. This application shall be signed in the presence of the *tahsildar* or of some other responsible officer nominated for the purpose by the Sub-divisional Canal Officer. The signatures shall be those of the leading cultivators in the block in question and they shall represent holders of not less than 75 per cent of the irrigable land within the block.

As soon as the Sub-divisional Canal Officer receives the application duly signed, he shall issue a permit in the form given as Appendix IV to these rules, and shall at once supply water.

SEASON LEASES

12. Applications for water to irrigate spring rice or other crops between the 16th November and 15th June may be presented at the Sub-divisional Canal Officer or to the Sectional Officer. They shall be in the form given as Appendix V to these rules.

In the applications the areas for which water is required shall be specified but the rate shall be charged on those areas for which water is actually used as determined by measurement.

The permit in the form given as Appendix VI to these rules shall be granted by the Sub-divisional Canal Officer if he is able to supply the water.

SUPPLY OF WATER

13. The Divisional Canal Officer shall control the supply of water throughout the Division in his charge.

14. No water shall be supplied to any lands except such as have been brought under a lease for a term of years or for the season, or to such as are provided for by a covering lease.

15. Under the forms, of Irrigation lease, in use, no specific supply of water is promised, but the undertaking is to give such a supply to each lessee as may be necessary for the lands leased. The supply shall be given, as may be required for the proper cultivation of the crops under irrigation, according to the exigencies of the season.

16. The Divisional Canal Officer may give the required supply by rotation, should this be advisable for the efficient working of the canals in his charge. In such a case, he is required to give the lessees written notice informing them of the periods when they will be supplied with water.

COLLECTION OF WATER-RATES

17. The rates due for water supplied shall be collected by the Divisional Canal Officer or other officer in charge of the Revenue Division through his staff of *tahsildars* and peons. All *khatians* or demand statements shall be signed by the Divisional Canal Officer or other officer in charge of the Revenue Division after scrutiny in his office.

18. At the time of preparation of the *khatian* in the Sub-divisional Canal Office each person assessed shall be furnished with an extract from the assessment paper, showing the particulars of the charge against him. This extract shall be furnished in such form as may from time to time be approved by the Sub-divisional Canal Officer for the purpose.

19. Each person on paying the sum due from him shall be given a receipt in the form prescribed for the purpose.

20. For the purposes of account of control over establishment and of general administration, the Divisional Canal Officer or other officer in charge of the Revenue Division is in the position of an Executive Engineer in charge of a Division and is directly subordinate to the Superintending Engineer. In regard to any proceedings taken under the Public Demands Recovery Act, 1913 (Bengal Act III of 1913), the Divisional Canal Officer is subject to the control of the Collector of the district.

UNAUTHORISED USE OF WATER AND WASTE OF WATER

21. Should it be necessary to take action under the provisions of Sections 79 and 80 of the Bengal Irrigation Act, 1876 (Bengal Act III of 1876) proceedings shall be instituted only under the direct and special order of the Divisional Canal Officer. The primary record of the facts regarding the unauthorised use or the waste of water shall be made by the Sub-divisional Canal Officer and his subordinates. The parties whom it is proposed to assess shall be informed in writing, and shall be called on to show cause why they should not be assessed. The record of their statements shall be made by the Divisional or by the Sub-divisional Canal Officer. The Divisional Canal Officer shall consider the facts and statements recorded, and shall, in deciding the case, give his reasons for or against assessment, both as regards the facts and as regards the law and he shall determine rate to be charged subject to the provision in the schedule of rates attached to these rules.

22. Should the Divisional Canal Officer decide on making an assessment, he shall have the assessment paper prepared by the Sub-divisional Canal Officer and his staff. Each person assessed shall be furnished with a statement of the charges against him, and an abstract of the demand or *khatian* shall be sent to the officer in charge of the Revenue Division, who shall proceed to recover the sums assessed. The period of one month within which an appeal may be presented to the Collector under section 91 of the Bengal Irrigation Act, 1876 (Bengal Act III of 1876), shall be computed from the date on which the statement of the charge may be furnished to the person assessed, which date shall be endorsed on it.

23. No proceedings shall be instituted if the unauthorised use or the waste of water have occurred through the act or neglect of a canal officer or a subordinate officer employed on the canal. During the irrigation of autumn rice, the passing on of surplus water from leased to unleased fields is not an unauthorised use of water.

COMPLAINTS AND APPLICATIONS

24. All complaints or applications with respect to the supply of water, to defective drainage, and generally with respect to the administration of the canal, shall be received on presentation at either Divisional or Sub-divisional Canal Officers.

Complaints and applications received by a Divisional Canal Officer may be transferred to his Sub-divisional Canal Officer for disposal at his discretion.

Any such complaints or applications, if presented to the Sectional Canal Officer or to his staff shall be returned endorsed with instructions as to the proper office at which to present them. If received by post, they shall be at once forwarded to the Divisional or Sub-divisional Canal Officer.

25. Complaints or applications with respect to corrections of the assessment with respect to the actions of the *amins* in assessing and with respect to the actions of the *tahsildars* and other staff employed in collections, shall be received at the office of the Divisional Canal Officer or other officer in charge of the Revenue Division.

26. Receipts in the prescribed form shall be given at all offices for complaints on applications presented. The receipt of all complaints and applications shall be recorded in registers to be kept for that purpose.

27. The officer receiving the complaint or application shall either make a personal enquiry into the matter or he shall nominate in writing some responsible person to hold the enquiry.

28. The orders passed on all complaints or applications shall be in writing and a copy of every order shall be furnished to the complainant or applicant.

The copy of order may be sent by post (registered) if this is convenient.

The period within which an appeal may be presented under Section 91 of the Act shall be computed from the date on which the copy of the order is received by the person.

29. When an appeal to the Collector is from the order of a Sub-divisional Canal Officer, the proceedings shall be called for through the Divisional Canal Officer, who may record on them such remarks as he may think desirable, provided that he does not thereby detain the proceedings.

In all cases in which an appeal against an assessment is preferred to the Collector, that officer may, if he thinks fit, direct that the collection of water-rates be suspended till the appeal is heard.

30. The Divisional Canal Officer may revise the proceedings of his Sub-divisional Canal Officer and the Superintending Engineer may call for and revise the proceedings of all officers under his control.

REMISSIONS AND ALTERATIONS OF DEMAND

31. Wherever the crop on land entitled to a supply of water suffers material injury from an insufficient supply of water, or from any interruption in the supply of water, remission of the rate due on such crop shall be given by the Divisional Canal Officer provided that the person claiming remission shall have applied for such remission not less than fifteen days before the reaping of the crop.

32. On the occasion of lands being brought under a lease for a term of year the Divisional Canal Officer may remit the rates for the first season on those fields which from the nature of the cultivation the then obtaining, or from other causes have not, in that season, derived any benefit from the supply of canal water.

33. Should the crop on lands under lease for a term of years suffer material injury from excess of water due to deficient drainage, the Divisional Canal Officer may grant remission of the rates due on such lands in whole or in part provided that the person asking for remission shall have applied at least fifteen days before the reaping of the crop.

34. Revisions of the assessment required in consequence of land under lease being left uncultivated or of land being appropriated for purposes other than cultivation shall be made under the orders of the Divisional Canal Officer.

35. Revisions of the assessment required in consequence of incorrect entries of the names of occupants of lands under lease or of incorrect entries of arrears of amounts in the assessment papers, or required by changes, in the occupation of lands shall be made under the orders of the Divisional Canal Officer or other officer in charge of the Revenue Division, provided that no change involving any increase or decrease in the total area under lease for a term of years shall be made, without the concurrence of the Divisional Canal Officer.

36. Remissions of water-rates on account of injury to the crops caused by inundation, by blight, by storms or by any extraordinary cause shall only be allowed under the special orders of the State Government.

IRRECOVERABLE DEMANDS

37. The Superintending Engineer may sanction the writing off of those demands which are reported, after due enquiry by the Divisional Canal Officer, or other officer in charge of the Revenue Division, as irrecoverable owing to the poverty of the defaulter or of his successors in case of his death, or owing to the defaulter having absconded.

CULTIVATORS' REPRESENTATIVES

38. Whenever the preliminary application for a lease for a term of years has been approved by the Divisional Canal Officer, the officer in charge of the Revenue Division shall, with concurrence of the Sub-divisional Canal Officer, select as representative of the cultivators a suitable person or persons who shall generally be acceptable to the cultivators and who shall each have a direct interest in the land for which the lease is executed.

39. The person or persons so selected shall be required to give assistance to the Canal Officers in respect of the following matters :—

- (i) in the preparation of applications for leases,
- (ii) in the measurement of irrigated lands,
- (iii) in recording the names of the occupiers of the holdings,
- (iv) in receiving demand statements and distributing to the cultivators the individual notices of assessment,
- (v) in attending, when required, at enquiries into complaint,
- (vi) in reporting to the Circle Officer any changes in the occupancy of lands under lease, and
- (vii) in assisting, the *tahsildar* in collecting rates.

40. For such assistance the cultivators' representative or representatives shall be entitled to free irrigation of the lands in his or in their own occupation, which may lie within the boundaries of the leased area subject to a total limit, of 3 per cent of the area assessed. The Divisional Canal Officer or other officer in charge of the Revenue Division may disallow in whole or in part this free irrigation, and may recover the rates which would otherwise have been payable in whole or in part if the assistance specified in rule 39 has not been efficiently rendered. The reasons for such disallowance shall be recorded in writing.

41. The Divisional Canal Officer shall maintain in his office a register containing a record of the names of all representatives and of the areas of free irrigation allowed to each.

42. Applicants for season leases shall be required to nominate one of their members who must have a substantial interest in the land to be irrigated as their representative. The representative so nominated shall perform the same duties as stated in rule 39 and shall receive remuneration on the same scale as in rule 40.

POWER TO DECLINE OR CANCEL LEASES

43. Should it be proved, after due enquiry, that the supply of water given to any leased area is habitually wasted or used for the irrigation of lands not under lease, it shall be competent for the Superintending Engineer to direct that the lease shall be cancelled with effect from the 16th of June next following. The order to cancel a lease shall be passed before the 1st of April of the year in which it is to take effect.

44. The Superintending Engineer may give directions to the Divisional Canal Officer to decline applications for irrigation leases of lands in villages where there has been persistent difficulty in realising the water-rates, until all arrears have been paid.

He may further suspend, or altogether cancel, any lease for a term of years, if on the 1st June of any year water-rates to the extent of half the demand for one year are in arrears. Previous notice of intention to put this rule in force shall be given not later than the 15th April preceding.

MISCELLANEOUS.

45. Tanks may be supplied with canal-water without charge, when water can be made available without injury to the cultivation dependent on a canal, under the following conditions :—

- (i) that the water is to be exclusively used for domestic purposes, or for watering cattle;
- (ii) that a channel exists through which water can pass without waste ;
- (iii) that the water shall only be supplied on the written order of the Sub-divisional Canal Officer;
- (iv) that any new outlet or sluice which may be required to allow of the supply being given shall be provided at the cost of the persons who ask for the water ; and
- (v) that the supply of water may be stopped at any time if it is found that it is being misused.

46. Except when a public right-of-way exists, no person shall without the permission expressed in writing of the Divisional or Sub-divisional Canal Officer, pass himself, or cause any animal or vehicle to pass, on or across any of the works, banks or channels of a canal, or drainage work which is part of the canal system except by means of such bridges, fords and ferries as may have been provided for the purpose.

Any person who after due warning commits a breach of this rule may be proceeded against under clause (9) of section 93 of the Bengal Irrigation Act, 1876 (Bengal Act III of 1876).

47. The use of any part of the banks or berms of any canal, drainage work which is part of the canal system, or flood embankment which is subject to the provision of the Bengal Irrigation Act, 1876 (Bengal Act III of 1876), as a place for answering the calls of nature, is prohibited. Any person who, after due warning, commits a breach of this rule may be proceeded against under clause (9) of section 93 of the Bengal Irrigation Act, 1876 (Bengal Act III of 1876).

48. Should water be required for purposes other than irrigation it may be supplied, when available at a rate of two rupees per 10,000 cubic feet of water.

49. No Officer employed on the canals, unless especially expected by the State Government from the operation of this rule, shall have any interest in the distribution of water from any of the canals or purchase or bid for any Government property sold thereon either in his own name or in the name of another, or jointly, or in shares with other.

Schedule of rates of water supplies from the Jateswar Irrigation Scheme.

For water supplied on a lease for a term of years—Supply given from 16th June to 15th November of each year. . . .Rs. 6 per acre per season.

The rate is due in two equal instalments on the 1st of January and the 1st of February of each year Provided that when the sum payable by any lease is less than Rs. 20 the whole amount shall be due on the 1st of January in each year.

For water supplied on a covering lease to irrigate lands for which a preliminary application for a lease for a term of years has been received and failing the completion of the same Rs. 6-8 per acre.

Supply given from the date of covering lease to 15th November of that year. The rate is due as in the case of a lease for a term of years.

For water supplied on a seasonal use for the irrigation of any crops between 16th November and 15th June Rs. 6-8 per acre.

The rate is payable on 1st June following.

For the unauthorised use of water or for the waste of water such rate may be charged as may be determined by the Divisional Canal Officer under rule 21, subject to a limit of Rs. 12 per acre. Such rate shall be due on presentation of the notice of assessment to the person assessed.

APPENDIX 'III(a)'

Minor Irrigation Schemes on which water rate has been imposed under Bengal Irrigation Act of 1876

Schemes	Rate
1 Putrangi Canal	Long lease Rs. 6/-
2 Rukni Canal	Covering Lease Rs. 6/8/-
3 Kulai Canal	Single watering (<i>Kharif</i>) Nil
4 Bans Khal Scheme	Single watering (<i>Rabi</i>) Nil
5 Rajar Bundh Scheme	Season lease (<i>Rabi</i>) Rs. 6'8/-
6 Jhargram Irrigation Scheme	Sugarcane Nil
7 Collector's Bundh Scheme	Unauthorised irrigation upto maximum Rs. 12/-
8 Chamkara Khal Irrigation Scheme	
9 Bhalukajhor Irrigation Scheme.	
10 JampoI Irrigation Scheme.	
11 Jhiku Khal Irrigation Scheme.	
12 Mole Bundh Irrigation Scheme.	
13 Jateswar Irrigation Scheme.	
14 Aulia Reservoir Scheme.	
15 Bhora Khal Irrigation Scheme.	
16 Sal Bundh Irrigation Scheme	Long lease Rs. 2/4/-
	Covering lease Rs. 3/-
	Single watering (<i>Kharif</i>) Nil
	Single watering (<i>Rabi</i>) Nil
	Season lease (<i>Rabi</i>) Rs. 4/-
	Sugarcane Nil
	Unauthorised Irrigation upto maximum Rs. 7/8/-

APPENDIX 'III (b)'

Minor Irrigation Schemes which have not yet been declared under any Act.

- 1 Amjore Canal.
- 2 Embankment in *mauza* Purbabatabari.
- 3 Bundh and Channel in Rangali River.
- 4 Dhumrijora Channel in *mauza* Panabari.
- 5 Narathali Kamakshyaguri Irrigation Scheme Part I.
- 6 Bundh in river Champsarai.
- 7 Irrigation & Bundh Scheme in Sastagachi.
- 8 Bundh in Kultighara.
- 9 Bundh in Chengmari Khal.
- 10 Irrigation Bundh Scheme in *mauza* Jamaitullah.
- 11 Bundh in *mauza* Siabita.
- 12 Santal Colony Irrigation Scheme.
- 13 Shibakata Irrigation Scheme.
- 14 Bouni Irrigation Scheme.
- 15 Construction of Irrigation Sluice on Chetua Circuit Embankment.
- 16 Construction of Irrigation Sluice on Bhagirathi Embankment at Majhumpur.

APPENDIX 'IV'

Normal Monthly Rainfall at the Stations of Jalpaiguri, Falakata, Siliguri and Kurseong

Month	Jalpaiguri	Falakata	Siliguri	Kurseong
1	2	3	4	5
1 January	0.31	0.30	0.42	0.68
2 February	0.67	0.68	0.69	1.09
3 March	1.27	1.33	1.20	1.61
4 April	3.69	4.30	3.59	3.94
5 May	11.82	13.21	11.43	11.61
6 June	25.94	26.23	27.51	31.76
7 July	32.22	29.04	33.84	42.61
8 August	25.27	22.65	28.76	34.41
9 September	21.22	18.91	22.88	24.61
10 October	5.56	4.60	6.89	5.97
11 November	0.47	0.48	0.77	0.57
12 December	0.17	0.15	0.17	0.34
Annual	128.63	121.88	138.15	159.20

APPENDIX 'V'

Statement showing district-wise distribution of irrigation tanks and bundhs in West Bengal—(So far as information of Agricultural Department is concerned).

District	Actual or estimated No. of irrigation tanks and bundhs (approx.)
1 Hooghly	24,109
2 Murshidabad	8,528
3 Malda	10,107
4 Birbhum	10,000
5 West Dinajpur	3,000
6 Bankura	25,000
7 Midnapore	5,000
8 Burdwan	10,551
9 Howrah	1,000 (estimated)
10 Nadia	1,000 Do.
11 24-Parganas	2,000 Do.
12 Purulia	2,000 Do.
13 Cooch-Behar	(Not known)
14 Darjeeling } 15 Jalpaiguri } 16 Calcutta }	Nil.
	1,02,295 or say 1,00,000

APPENDIX-'VI'

Extract from "Instruction for the execution of Small Irrigation Schemes"

CHAPTER I

1. Subject to the conditions prescribed below the following types of work will come under the purview of the scheme:—

- (a) Irrigation, drainage, bunding projects.
- (b) Chatahs, embankments, culverts, sluices.
- (c) Small surface wells (still subject to Government sanction).

2. Projects under the scheme will be undertaken only after the following conditions have been fulfilled :—

- (a) Projects must ordinarily be within the intensive cultivation area.
- (b) Cost of each project must not exceed Rs. 10,000.
- (c) No project shall be undertaken unless 50 percent of the cost thereof is paid by the beneficiaries in cash or kind (including labour) or both. In calculating the contribution of the beneficiaries, credit should be given for the value of land given free by them for these projects.
- (d) Each such project should result in appreciable increase in the production and the cost incurred for each individual project should not ordinarily exceed Rs. 125 per ton of additional production expected. For the purpose of calculating additional production the following *ad hoc* yardstick should be adopted:—
 - (i) *Projects Meant for Irrigating Lands.*—Additional production of 1/9th ton of rice and or 1 ton of *rabi* per acre.
 - (ii) *Drainage Projects.*—Additional production of 1/9th ton of rice per acre for partially benefited areas and 1/3rd ton of rice per acre in case of fully benefited areas.

CHAPTER II

INITIATION OF SCHEME

1. Each scheme should ordinarily originate from the Agricultural Inspector at the Thana level. He may initiate a scheme *suomoto* or on the petition received from the public. In any case, preliminary investigation in every case must be done by him. After examination, if the scheme is *prima facie* feasible, he should satisfy himself on the following points before sending it up to the Sub-Divisional Agricultural Officer :—

- (a) The majority of the beneficiaries just express in writing the desire that the scheme be taken up and that it would benefit them.

- (b) The application as at (i) must be accompanied by a rough sketch of the project traced on the *mauza* map together with the command area traced therein and a complete list of plots in the command area with their cadastral survey numbers, area present, utilisation and extent of benefit expected on each plot, and the names and addresses of the owners of the plots.
- (c) A written undertaking from at least 60 per cent of the beneficiaries regarding payment of the specified contribution and for subsequent maintenance.
- (d) If the project affects a person's land or interest, the person or persons concerned must surrender their right in the land in public interest or express their willingness to suffer any damage or forgo their interest in public good. This consent must be obtained by the beneficiaries in writing and submitted along with their application noted above. If the affected person desires compensation the amount of compensation must be amicably settled between the person affected and the beneficiaries. The beneficiaries must also accept it in writing. The amount of compensation must be included in the estimate. After the scheme is sanctioned and before the work is taken up, the person or persons affected must make a gift of their land or surrender their interest in writing and the document will be registered and thereupon compensation, if any, will be paid to them. Before the compensation is paid the opinion of the Sub-divisional Officer or the Land Acquisition Officer should be taken about the reasonableness of the amount settled. Ordinarily no scheme should be taken up which involves acquisition of land. In rate cases, if acquisition of land is essential as the amount of compensation could not be amicably settled in the aforesaid manner and the execution of scheme is considered of paramount importance, Sub-divisional Agricultural Officer will, in framing estimate consult the land Acquisition Collector for the valuation of the property to be acquired and include such valuation in the estimates.
- (e) If the project interferes with any right or interest of any local authority or any Government department written consent from the authorised officers of the local authority or Government must be obtained.
- (f) On being satisfied on the above points, the Agricultural Inspector will draw up a scheme in the prescribed proforma, prepare estimates of different items of construction in consultation with the beneficiaries and take into account the rates prevalent in the neighbourhood for similar types of work. In the estimate a provision should be made for contingency up to 5 per cent of the total estimated cost which can be utilised for the following purposes:—
- (i) to meet charges, for any variation of rates, of work sanctioned by Government;
 - (ii) to meet expenditure for any extra volume of work beyond the specification sanctioned by Government;
 - (iii) to meet any expenditure not provided for in the detailed estimate sanctioned by Government.

The Agricultural Inspector will then send all relevant papers to the Sub-divisional Agricultural Officer.

2. The Sub-divisional Agricultural Officer on being satisfied about the acceptability of the scheme, will send his Supervisor (a) to examine the technical feasibility of the scheme and (b) to prepare proper plans and estimates after an on-the-spot enquiry. For preparing estimates these technical officers must keep in view the rates at which similar works in the neighbourhood have been or are being undertaken

by the Irrigation and Waterways Department, Tank Improvement Organisation, Works and Buildings Department and other local authorities. Their estimates must not without adequate reasons to be specified in writings, exceed the rates of other departments. If the estimates finally prepared by the technical staff are higher than those prepared by the Agricultural Inspector, this should be intimated to the beneficiaries for (a) getting their consent to the taking up of the scheme on the basis of higher cost and (b) their willingness to pay the enhanced contribution. If the scheme, after investigation by these technical officers, is considered technically not feasible, it should be dropped by the Sub-divisional Agricultural Officer.

3. The next step for the Sub-divisional Agricultural Officer will be to place the schemes before the Sub-divisional Grow More Food Committee. If the technical aspect of the scheme is called in question by the representative of the Irrigation and Waterways Department at the Committee, it should be held over pending further enquiry by officers of that department. If the Sub-divisional Agricultural Officer has genuine misgivings about the assurance of beneficiaries to pay their contribution, he may, in consultation with the Sub-divisional Grow More Food Committee, insist on prior cash contribution from the beneficiaries before he sends up the scheme for sanction. Such cash realisation should be credited in revenue deposit.

4. After approval of the Sub-divisional Grow More Food Committee, the Sub-divisional Agricultural Officer will send up each project in the prescribed proforma together with plans and estimates in triplicate to the Superintendent of Agriculture who, in consultation with the Engineering Overseer attached to this office, will put them up before the District Food Committee for approval. Of the approved schemes, a projects costing not more than Rs. 2,000 each will be submitted to the District Magistrate for sanction who have been given the necessary authority and funds for the execution of such projects. Schemes costing more than Rs. 2,000 will have to be sent up by the Superintendent of Agriculture to the Directorate for sanction.

APPENDIX-'VII'

No. and details of sites explored in West Bengal during the First Exploratory Project

Site	Dist.	Date of starting	Date of completion	Depth of drilling in ft.	Length of pipes lowered in ft.	Discharge in I.G.P. H.	Draw down in ft.	S.W. L.	Date of pump installation	Diescl/ Electric	Date of handing over	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13
250 Panchal	Bankura	31-3-58	4-4-58	501	..	..	..	..	..	..	..	..
Do.	Do.	1-10-58	18-10-58	927	903	19,500	37.29	13.69	18-1-60	Diescl	18-1-60	..
251 Rupal Ganj	Do.	5-4-58	6-4-58	1,004	..	..	..	..	..	..	..	..
Do.	Do.	7-5-58	19-5-58	513	489	17,700	21.30	15.25	22-12-59	Do.	12-1-60	..
252 Govindpur	Do.	7-4-58	10-4-58	265	..	..	..	..	..	..	..	..
Do.	Do.	3-5-58	26-5-58	283	156	17,000	20.00	19.49	Dec.'59	Do.	12-1-60	..
253 Kurchidanag	Midnapore	24-5-58	31-5-58	1,004	..	..	..	..	..	..	..	..
Do.	Do.	20-6-58	..	886	..	..	..	..	..	..	..	..
Do.	Do.	20-6-58	27-7-58	930	899	15,000	25.86	19.34	8-1-60	Do.	8-1-60	..
254 Dakhinsol	Do.	5-6-58	13-6-58	700	..	..	..	..	..	..	..	..
Do.	Do.	14-10-58	27-10-58	406	..	..	..	..	..	..	..	..
Do.	Do.	28-10-58	9-11-58	410	395	10,000	21.08	49.10	..	..	..	Not accepted by State as extracted well & abandoned.

APPENDIX-VII¹ (contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13
255	Ditpur . .	Midnapore	14-6-58	9-7-58	735	..	..	..	..	..	..	..
	Do. . .	Do. . .	27-7-58	13-8-58	322	295	15,000	30.00	9.22	8-1-60	Diesel	8-1-60
256	Jaiganj . .	Murshidabad	29-9-58	30-9-59	1,000	..	..	..	..	..	..	..
	Do. . .	Do. . .	1-10-58	31-10-58	250	247	44,450	9.27	12.86	..	Do.	..
257	Bhat Jungala . .	Nadia . .	26-10-58	25-11-58	1,003	465	45,616	2.00	14.57	..	Do.	..
258	Takipur . .	Murshidabad	1-11-58	21-11-58	1,000	292	38,750	12.34	11.06	..	Do.	..
259	Algaria . .	24-Parganas	21-11-58	..	1,023	..	..	..	..	..	..	..
	Do. . .	Do. . .	21-11-58	..	320	..	..	..	..	..	..	..
	Do. . .	Do. . .	21-11-58	9-12-58	426	409	62,500	20.00	12.38	..	Do.	..
260	Nawada . .	Murshidabad	24-11-58	3-12-58	1,001	369	47,750	16.26	17.96	..	Do.	..
261	Domkal . .	Do. . .	29-11-58	16-12-58	516	442	41,550	9.87	9.75	..	Do.	..
262	Neulia . .	Nadia . .	28-11-58	..	551	..	..	..	..	..	..	..
	Do. . .	Do. . .	3-12-58	23-12-58	590	562	50,050	9.22	10.54	..	Do.	..
263	Debagram . .	Do. . .	4-12-58	20-12-58	500	238	38,400	10.43	11.30	..	Do.	..
264	Barachampa . .	24-Parganas	13-12-58	31-12-58	1,020	520	42,200	13.81	11.79	..	Do.	..
265	Jugpur . .	Nadia . .	21-12-58	30-12-58	500	358	42,550	9.39	12.47	..	Do.	..
266	Khamarakulia . .	24-Parganas	22-12-58	21-1-59	1,007	530	48,700	21.15	13.03	..	Do.	..
267	Dakhinchatra . .	Do. . .	3-1-59	15-1-59	505	398	50,400	15.75	12.03	..	Do.	..

Pump installation in progress.

Do.

Do.

268	Patiram . . .	W.Dinajpur .	28-1-59	17-2-59	1,000	172	49,230	20·21	14·98	Aug.'60	Do.	Sept.' 60	
269	Fulbari . . .	Do. . .	16-2-59	7-3-59	514	416	16,333	22·38	10·77	Do.	Do.	2-9-60	
270	Mandilpur . .	Malda . .	18-2-59	6-3-59	851	432	46,250	16·50	32·23	30-6-60	Do.	2-9-60	
271	Kityanandapur .	Do. . .	7-3-59	..	505	..	Abandoned as dry	..	..	..	..	..
272	Bhagoon . . .	W. Dinajpur	11-3-59	22-3-59	1,009	476	46,850	14·23	8·20	22-7-60	Do.	Sept. '60	
273	Buniadpur . .	Co. . .	25-2-59	12-3-59	1,008	821	25,300	24·56	9·65	July '60	Do.	Sept. '60	
274	Padajote . . .	Darjeeling .	19-3-59	20-4-59	1,006	..	..	..	..	..	..	..
	Do. . .	Do. . .	21-4-59	8-5-59	551	517	26,650	28·66	14·70	25-4-60	Do.	17-5-60	
275	Kheripara . .	Malda . .	28-3-59	-4-59	515	Abandoned. as dry			..	..	..	..	} Not accept- ed by State Govt.
276	Salbari . . .	Darjeeling .	6-4-59	22-4-59	503	395	18,300	50·45	10·95	..	..	..
277	Phatapokur . .	Jalpaiguri .	15-4-59	27-4-59	500	304	48,300	19·58	20·48	21-4-60	Do.	18-5-60	
278	Madhabdang . .	Do. . .	13-5-59	2-6-59	1,000	490	25,000	37·36	16·88	May '60	Do.	18-5-60	
279	Phalimari . . .	Cooch-behar	17-5-59	19-6-59	1,000	642	41,900	14·13	14·41	May '60	Do.	28-5-60	
280	Baganbari . . .	Jalpaiguri .	5-6-59	28-6-59	526	419	33,150	11·79	14·41	May '60	Do.	20-5-60	
281	Dewanhat . . .	Cooch-behar	4-6-59	23-6-59	500	488	15,780	21·68	3·95	..	..	..	Pump in- stallation in pro- gress.
282	Dharambarikoti	Do.	20-6-59	10-7-59	952	516	27,000	20·00	2·08	May '60	Do.	28-5-60	

APPENDIX 'VIII'

Details of Development Tubewell irrigation in the Second Five Year Plan. Administrative approval G. O. No. Dated, 21st August '58 sanctioning 40 tubewells

N-Nadia
T—24 Parganas
DP—Dhubulia & Plassi.....Sec.
B.H.—Barasat & Haringhata.....
H.R.—Haringhata & Ranaghat.....
C.B.—Chardah & Bongaon.....
N.H.—Naihati & Habra.....

District	P.S.	Mauza	Denomi- nation	Date of Starting the Tubewell	Date of Comple- tion of Tubewell	Dis- charge (Gallons)	Draw down	Spring Level	Pump House & Opera- tors Quarters	Lined Channel (Hume Pipe or open channel)	Turbine Pump	Electric energy supplied to motor on	Agency
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Nadia	Kaliganj	Kamari	1N/DP	4-1-59	7-2-59	40,000	8' 0"	15' 0"	Completed	Completed	Completed	12-12-59	M/s Pioneer Tube- well Industries (Pvt.) Ltd.
2 Nadia	Do.	Hatgach	2N/DP	8-1-59	7-2-59	Do.	Do.	13' 0"	Do.	Do.	Do.	28-4-60	Do.
3 Nadia	Do.	Do.	3N/DP	2-2-59	16-2-59	Do.	Do.	11' 9"	Do.	Do.	Do.	28-4-60	Do.
4 Nadia	Do.	Debaram	4N/DP	2-2-59	16-2-59	Do.	Do.	11' 9"	Do.	Do.	Do.	27-4-60	Do.
5 Nadia	Do.	Do.	5N/DP	15-2-59	30-3-59	43,380	7' 10"	12' 6"	Do.	Do.	Do.	27-4-60	M/s. Hindustan tube- well Co.
6 Nadia	Do.	Do.	6N/DP	16-2-59	29-3-59	49,500	10' 11"	15' 4"	Do.	Do.	Do.	5-1-60	M/s. Pioneer Tube- well Industries (Pvt.) Ltd.
7 Nadia	Nakasipara	Bikrampur	7N/DP	17-2-59	4-3-59	41,000	5' 0"	13' 6"	Do.	Do.	Do.	29-4-59	Do.
8 Nadia	Do.	Do.	8N/DP	4-2-59	28-2-59	46,000	7' 0"	10' 3"	Do.	Do.	Do.	29-4-60	M/s. F. Husain and Brothers.
9 Nadia	Do.	Do.	9N/DP	12-1-59	8-2-59	40,000	8' 0"	12' 2"	Do.	Do.	Do.	15-8-59	Do.
Nadia	Do.	Bamandanga	10N/DP	27-2-59	30-3-59	42,000	8' 6"	8' 6"	Do.	Do.	Do.	3-5-60	Do.

11	Nadia	Nakasipara	Jagadanandapur.	11N/DP	1-3-59	25-3-59	40,000	7'-0"	8'-6"	Do.	Do.	Do.	30-4-60	Do.
12	Do.	Kaliganj	Panichata	12N/DP	18-3-59	29-3-59	40,000	7'-0"	12'-0"	Do.	Do.	Do.	5-3-60	M/s. Pioneer Tubewell Industries (Pvt.) Ltd.
13	24-Parganas	Amdanga	Sadhanpur	1T/13H	3-1-60	30-1-60	30,000	8'-6"	10'-0"	Do.	Do.	Do.	..	Do.
14	Do.	Do.	Adahata	2T/13H	25-12-59	29-1-60	32,000	8'-9"	9'-3"	Do.	..	Do.	..	Do.
15	Do.	Do.	Kachiara	3T/13H	22-1-60	16-2-60	53,333	8'-0"	4'-0"	Do.	..	Do.	..	Do.
16	Do.	Do.	Mahadebpur	4T/13H	20-12-59	27-1-60	31,000	8'-0"	6'-0"	Do.	..	Do.	..	Do.
17	Do.	Habra	Mondalpara	5T/NH	19-1-60	16-2-60	53,333	8'-0"	13'-0"	Do.	..	Do.	..	Do.
18	Nadia	Ranaghat	Patuly	13N/HR	26-12-59	30-1-60	42,000	8'-0"	14'-0"	Do.	..	Do.	..	M/s. F. Huslan and Brothers.
19	Do.	Kaliganj	Gobindapur	14N/DP	28-1-60	7-3-60	30,000	9'-6"	9'-6"	Do.	..	Do.	..	Do.
20	Do.	Chakdah	Itapukur	15N/CB	6-2-60	1-3-60	38,500	7'-0"	11'-0"	Do.	..	Do.	..	Do.
21	Do.	Do.	Purba Bishnupur.	16N/CB	21-2-60	21-3-60	33,780	5'-9"	8'-9"	Do.	..	Do.	..	M/s. Pioneer Tubewell Industries (Pvt.) Ltd.
22	24-Parganas	Habra	Iswargacha	6T/NH	29-2-60	22-3-60	31,800	5'-9"	9'-9"	..	..	..	..	Do.
23	Do.	Bongaon	Nanda	7T/CB	16-3-60	29-3-60	31,800	4'-6"	5'-9"	..	..	..	..	Do.
24	Nadia	Chakdah	Sitinda	17N/CB	10-3-60	22-3-60	40,800	4'-6"	5'-3"	..	..	..	..	Do.
25	Do.	Do.	Balia	18N/CB	13-3-60	29-3-60	33,780	4'-6"	6'-0"	..	..	..	..	Do.
26	Do.	Nakasipara	Louhagacha	19N/DP	20-3-60	20-4-60	31,800	5'-0"	16'-6"	..	..	..	..	M/s. F. Huslan and Brothers.
27	Do.	Do.	Dahakul	20N/DP	20-3-60	20-4-60	40,800	6'-0"	9'-0"	..	..	..	..	Do.
28	Do.	Kaliganj	Chakbege	21N/DP	10-3-60	13-3-60	53,950	12'-0"	13'-9"	..	..	..	..	M/s. Reliable Water Supply.
29	Do.	Do.	Asachia	22N/DP	16-3-60	22-3-60	45,600	13'-0"	12'-0"	..	..	..	..	Do.
30	Do.	Do.	Tegharia	23N/DP	22-3-60	25-3-60	51,000	11'-0"	14'-6"	..	..	..	..	Do.

APPENDIX 'VIII'—(contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
31	Nadia	Kaliganj	Hijli	24N/DP	30-3-60	19-4-60	33,780	10'-0"	13'-0"	..	..	..	M/s. Reliable Water Supply.
32	Do.	Do.	Baritna	25M/DP	28-3-60	3-3-60	45,600	11'-0"	12'-0"	..	..	..	Do.
33	Do.	Do.	Chandpur	26N/DP	7-6-60	29-6-60	45,600	9'-0"	12'-0"	..	..	..	Do.
34	Do.	Do.	Govindapur	27N/DP	25-5-60	30-6-60	40,000	11'-0"	15'-0"	..	..	..	Do.
35	Do.	Krishna Nagarpool.	Dhubulla	28N/DP	16-6-60	5-8-60	40,000	10'-0"	12'-0"	..	..	..	Do.
36	Do.	Do.	Do.	29N/DP	30-5-60	5-8-60	43,000	12'-0"	14'-6"	..	..	..	M/s. F. Husain and Brothers.
37	Do.	Banaghat	Ghatigacha	30N/HR	8-7-60	29-8-60	41,200	16'-0"	12'-6"	..	..	..	Do.
38	24-Parganas	Bongaon	Bardanberia	8T/CB	20-5-60	25-7-60	45,600	11'-6"	9'-6"	..	..	..	M/s. Pioneer Tube-well Industries (Private) Ltd.
39	Do.	Do.	Barackpore	9T/CB	26-6-60	28-7-60	36,200	12'-0"	12'-6"	..	..	..	Do.
40	Do.	Do.	Saibaria	10T/CB	25-5-60	25-7-60	40,800	9'-6"	9'-9"	..	..	..	Do.

APPENDIX 'IX'

Statement showing the progress of irrigation on Developmental Tubewells in West Bengal for the month of August, 1960 (1st year operation)

Area of group	No. of tubewell in operation	Total potential of the tube-well in acres on a standard basis of		Area irrigated during the current <i>Kharif</i> or <i>Rabi</i> season as the case may be						Average area irrigated per tubewell i.e. col. 9/2,	Total working hours	Average hours run per tubewell i.e. col. 12/2	Units of electricity consumed	Average unit consumed per tubewell i.e. Col. 14/2
				<i>Kharif</i>				<i>Rabi</i>						
				<i>Aus</i>	<i>Aman</i>	<i>Sugar-cane</i>	<i>Jute</i>	Total	<i>Wheat</i>					
<i>Aus paddy (Kharif)</i>	<i>Wheat (Rabi)</i>													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Dhubulia Plassy Sector, Distt. Nadia	1N/DP	100	200	69.76	54.58	..	..	124.34	..	..	216.55	..	2,619	..
2 Do.	2N/DP	100	200	25.97	30.85	..	..	56.82	..	..	189.00	..	2,216	..
3 Do.	3N/DP	100	200	16.94	39.50	15.84	..	72.28	..	..	226.20	..	2,722	..
4 Do.	4N/DP	100	200	45.58	19.22	..	..	64.80	..	..	103.00	..	1,217	..
5 Do.	5N/DP	100	200	18.95	22.19	..	..	41.14	..	..	124.00	..	1,488	..
6 Do.	6N/DP	100	200	45.77	50.03	..	..	95.80	..	..	279.00	..	3,357	..
7 Do.	7N/DP	100	200	14.00	12.00	..	..	16.60	..	..	88.30	..	1,062	..
8 Do.	8N/DP	100	200	41.88	13.35	..	..	55.23	..	..	110.00	..	1,308	..

No Rabi

APPENDIX 'IX'—(contd.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
9	Do.	9N/DP	0	200	43.71	59.75	2.69	..	106.15		..	214.30	..	2,582	..
10	Do.	10N/DP	100	200	..	..	16.43	..	16.43		..	6.45	..	95	..
11	Do.	11N/DP	100	200	14.92	..	..	3.08	18.00		..	29.10	..	379	..
12	Do.	12N/DP	100	200	11.71	26.07	..	3.87	41.65		..	235.10	..	2,827	..
TOTAL			1200	2400	349.19	317.54	34.96	6.95	708.64		60.00	1821.10	152.00	21,872	1,822

No Rabi

N.B.—Crop position and pumping hours in the command of 12 tube-wells.

		(Acres)		
(A)	1. <i>Kharif</i> (<i>Aus</i> autumn paddy) (sown between end of April to end of May)	349.19	(B) Total pumping hours for the above cropping—	May, 60—1,935 hrs.
	2. <i>Aman</i> (Winter paddy) (sown between mid-June to early August)	317.54		June, 60—2,547 hrs.
	3. Sugarcane	34.96		July, 60—3,529 hrs.
	4. Jute	6.95		Aug., 60—1,821 hrs.
TOTAL		708.64		TOTAL 9,852 hrs.

i. e. 60 acres on an average per tubewell.

i. e. 821 hours on an average per tube-well.

(C) *Rabi* (Not yet started).

APPENDIX 'X'

Statement showing Economics of Functioning of a State Tubewell

Capital cost of sinking on 12" x 6" x 8" Tubewell sunk to a depth of 400 ft. with 100 ft. of slotted pipe fitted with three stage turbine pump and 17.5 H.P. motor so as to yield a discharge of two cusecs (44,000 gallons) per hour at a draw-down not exceeding 20 ft.

ITEM-WISE BREAK-UP OF CAPITAL EXPENDITURE

	Rs.
(i) Tubewell proper 12" x 6" x 8" sunk to a depth of 400 ft. with 100 ft. of slotted pipe,	22,000
(ii) Three stage turbine pump of two cusecs capacity connected to 17.5 H. P. motor.	6,000
(iii) Pump house, motor foundation and operator's quarter	6,500
(iv) Surge tank with 9" under ground RCC spun pipe for water transmission upto a length of 5,000 ft. fitted with delivery spouts and valves 500 ft. apart (average cost Rs. 5 per ft.).	25,000
(v) Land acquisition	1,000
(vi) Transport, internal wiring and other contingencies	1,500
	62,000

1. ECONOMICS :

(i) Fixed charges.

(A) Depreciation :

(a) Tubewell proper. 5 per cent of Rs. 22,000	1,100
(b) Pump and motor. 10 per cent of Rs. 6,000	600
(c) Pump house and operators' quarter. 1 per cent of Rs. 6,500.	65
(d) Water transmission by under ground RCC pipes. 1 per cent of Rs. 25,000.	250
(e) Land Acquisition	Nil

2,015

Say 2,000

(B) Interest charges :

Interest @ 4 per cent on 62,000	2,480
---	-------

(C) Pay of staff :

(a) Pay of one operator. Scale Rs. 50—75	100
(b) Pay of water transmission Assistant. Scale Rs. 20—25.	55
(c) One-twentieth of the pay of one Mechanical and one electrical Supervisor. Scale Rs. 125—250 (1 Mech. & Electrical Supervisor will be incharge of 20 tubewells).	23
	178
	178 × 12 = 2,136
Proportionate T. A. for Supervisor in one tubewell.	30
	2,166
(A) Depreciation	2,000
(B) Interest	2,480
(C) Pay of staff	2,166
	6,646
GRAND TOTAL	6,646

— This amount has got to be realised from the command of 200 acres (details given below) for a tubewell irrespective of whether the tubewell runs or not or in other words a fixed charge of Rs. 33 per acre has got to be levied over the beneficiaries to make this part of the scheme self financing.

2. RUNNING CHARGE :

On the standard pattern of double cropping with early *aus* followed by *rabi* the total running charge of a tubewell is estimated to be about :

- (i) *Aus* paddy crop 60 days @ 15 Hrs. 900 hrs.
- (ii) *Rabi* crop (wheat) 100 days @ 12 Hrs. 1,200 hrs.

—————
2,100 hrs.

Say, 2,000 hours per year
on average.

— Electrical tariff for 2,000 hours running @ 10 K. W. per hour comes to 20,000 units which @ 10 N.P. per unit comes to Rs. 2,000 for two crops.

— It will be seen from above that the cost of running the motor for one hour giving a discharge of 2 cusec is Re. 1 or in other words 45,000 gallons of water can be lifted by spending Re. 1: This discharge of water will be reflected in the electrical meter board where for every 10 units of consumption, the charge comes to Re. 1. We can therefore, very conveniently charge the farmer actually using the water on a volumetric basis @ 45,000 galls. per Rupee, to be actually measured electrically @ Re. 1 per 10 units of consumption.

To make the scheme self financing, therefore, there should be a two-way charge one against fixed charges another against the actual sale of water. The fixed charge, as stated earlier will be Rs. 33 per acre for two crops, and water may be sold @ Re. 1/- for 10 units of electrical consumption.

If the tubewell runs fully for 2,000 working hours in a year, it will have an average command of 200 acres producing *aus* in *kharif* and wheat or other *rabi* crops in *rabi* season with intermediate leguminous crops, and the total cost of irrigation on 200 acres annually comes to :

(a) 200 × Rs. 33	Rs. 6,600 fixed charge.
(b) 2000 hrs. running @ Re. 1 per hour	Rs. 2,000
	Rs. 8,600

which converted in acreage basis come to Rs. 43 per acre on two crops.

(On an estimation of the command area, it may be stated, on the basis of say wheat, that on 1200 hrs. of running the pump will discharge 2,400 cusecs of water irrigating 2,400 acre inch. If the duty of wheat is taken as 10' even then 240 acres can be commanded. The water transmission being through RCC underground pipe system, there will be little loss in transmission but even assuming 20% loss, the tubewell should comfortably command 200 acres.)

It is therefore, suggested that in regard to realisation the following procedure may be adopted :—

- (a) In the first year there shall be no realisation of either the fixed charge or of sale of water.
- (b) In the second year there will be no charge on the fixed charges, but the actual sale value of water should be realised @ Re. 1/- per 45,000 gals. of water measured electrically over the meter @ Re. 1 for 10 units.
- (c) In the third year there should be general levy of about Rs. 15 per acre over the entire 200 acres command representing 50% of the fixed charges, and the full value of sale of water to be realised.
- (d) In the fourth year full fixed charge i.e. an amount of Rs. 33 shall be levied over the entire command of 200 acres, and in addition, the actual sale value of water.

It is doubtful how far this realisation will be effective in practice, but there is one very significant and important point in calculating the economies of this scheme which has lately been evolved by the Chief Minister of the State that the Deep Tubewell Irrigation Scheme has got to be a part of an integrated social development scheme, the tubewell forming the central resource for giving rural water supply, and the electricity brought to the tubewell, which will be only utilised 25% in the year for agricultural purposes, should be utilised for setting up industrial estates and for rural electrification. On the background of this multipurpose socio-developmental plan of Agriculture (Irrigation), Industry, Rural water supply and Rural Electrification, the scheme of setting up big diam. Tubewells, with the agricultural economy pattern, as stated earlier, should prove to be a very useful scheme.

APPENDIX 'XI(a)'

Mechanical details of irrigation tubewells in Fulia development block

Location of Tubewell (Name of Mauza)	Total depth of Tubewell	Length of Channel		Yield of wells (galls P/H)	Static water level (below GL)	Draw down	Date of energising the pump	Remarks
		Unlined (earthen) approximate (miles)	Lined with Brick approximate (miles)					
1	2	3	4	5	6	7	8	9
1 Bathna .	358'-0"	2	3/4	40,800	18'-6"	13'-0"	10-8-55	
2 Arbaldo (1) .	270'-0"	2	3/4	40,000	14'-1"	11'-2"	18-8-55	
3 Baincha .	350'-0"	2	3/4	40,800	20'-6"	11'-3"	15-8-55	
4 Arbaldo (2) .	218'-7"	1½	3/4	40,800	13'-8"	8'-0"	10-8-55	The Electric Transformer was out of order during the entire Rabi Season. Hence the supply of Irrigation water was stopped during the period.
5 Nidkur .	270'-0"	2½	3/4	40,800	20'-0"	13'-3"	15-8-55	
6. Arbaldo (3) .	248'-11"	1½	1	36,200	17'-6"	17'-0"	22-6-58	(A) <i>Details of Cost of the Schema (20 units of tubewells).</i>
7 Boalia (1) .	208'-10"	1½	1	40,800	18'-0"	17'-0"	20-6-58	
8 Mollaber .	263'-2"	1	1	36,200	17'-6"	17'-0"	21-6-58	
								Rs.
								(a) Cost of Tubewell 3,45,052
9 Denui .	211'-4"	1½	1	36,200	18'-0"	16'-6"	22-6-58	(b) Cost of Pumping Equipment 2,00,000
10 Chandra (1) .	241'-0"	2	1	36,200	17'-0"	16'-0"	21-6-58	(c) Pump house and Operators' Qrs. 77,638

11	Boalia (2)	. 257'-0"	1½	1	40,600	17'-6"	17'-0"	20-6-58	(d) Unlined channel . . .	1,07,241
12	Bansdole	. 208'-7"	1½	1	40,800	16'-6"	17'-0"	21-6-58	(c) Lined channel . . .	1,17,169
13	Boalia (5)	. 216'-0"	2	1	40,800	19'-0"	16'-0"	20-5-58	(f) Falls and culverts . . .	40,492
14	Arbandi	. 202'-10"	1½	1	36,200	17'-0"	16'-0"	20-4-59	(g) Electric Transmission line	3,25,400
15	Mahisdanga	. 239'-4"	2	1	45,600	16'-6"	16'-6"	25-6-58	(h) Installation of Pumping Equipments . . .	5,000
16	Chandra (2)	. 210'-0"	2	1	40,800	16'-0"	17'-0"	21-6-58	(i) Sewerage & Miscellaneous work . . .	4,675
17	Taherpur (1)	. 210'-11"	1½	1	40,800	17'-0"	16'-0"	25-6-58	(f) Establishment . . .	88,462
18	Taherpur (2)	. 237'-8"	1	1	40,800	17'-0"	16'-6"	20-6-58	TOTAL . . .	13,11,129
Hence cost of one Unit Rs. 66,056										
19	Gobindapur (Colony II).	346'-7"	1½	1	40,800	17'-6"	16'-0"	22-6-58	(B) <i>Pumping Equipments</i>	
20	Gobindapur (Colony I).	344'-8"	1½	1	40,800	16'-0"	16'-0"	4-3-59	Bore-hole turbine pump with hollow shaft vertical Motor (15 H.P.) 440 Volt. The machineries have been received from America under J. C. M. Programme.	

APPENDIX

Mechanical details of irrigation

Sl. No.	Location of Tube-well (Name of Mauza)	Particulars of Tubewells—Well pipe				Total depth of T.W.	Yield of wells (Gallon per hr.)	Static water level (below G.L.)	Draw down
		6" dia. (GI)	8" dia. (GI)	12" dia.	8" dia. all Brass Tej Strainer				
1	Srikrishnapur	300'-8"	x	50'-0"	73'-10"	424'-6"	30,000 to 39,000		10'-0"
2	Buzrukdigha	294'-10"	x	50'-0"	98'-4"	443'-2"	31,000		9'-0"
3	Beraberi	227'-6"	x	49'-4"	100'-4" (Hagusta)	377'-2"	27,000 to 31,000		9'-6"
4	Natni	317'-0"	x	50'-0"	75'-0" (Hagusta)	442'-0"	27,000 to 31,000		9'-6"
5	Sahara	251'-5"	x	51'-0"	98'-1"	400'-6"	27,000 to 35,000		9'-0"
6	Patdanga	253'-9"	x	50'-0"	98'-3"	402'-0"	35,000 to 39,000	On an average 17' ft. below G. L.	6'-6"
7	Anerberia	264'-7"	x	50'-6"	97'-11"	413'-0"	23,650		9'-9"
8	Jeeldanga	103'-0"	x	50'-0"	97'-0"	250'-0"	27,200		9'-9"
9	Bhatsala	94'-5"	x	47'-6"	97'-0"	240'-11"	27,200 to 31,000		8'-6"
10	Janaphul	251'-5"	x	49'-5"	89'-19"	390'-8"	23,000 to 27,200		9'-0"
11	Bergum	97'-1"	x	48'-7"	98'-0"	243'-8"	31,000		8'-6"
12	Pairagachi	325'-3"	x	46'-6"	98'-3"	430'-0"	31,000		10'-6"
13	Rawtara	302'-10"	x	56'-0"	100'-0"	458'-10"	27,000 to 31,000		8'-0"
14	Guma	281'-0"	x	57'-0"	98'-0"	436'-0"	27,000 to 31,000		8'-4"
15	Salua	250'-5"	x	50'-0"	99'-8"	400'-1"	23,000 to 31,000		9'-0"
16	Ranidanga	97'-9"	x	50'-0"	92'-4"	240'-1"	31,000		8'-6"

'XI (b)'

tubewells in Habra development block

T. Well (av.)	Details of cost (average under each sub-work of the scheme)		Falls & culverts	Electric high tension line	Remarks		
	Pump- ing equip- ment (av.)	Pump- house & opera- tors Qrs.				Channel System	
						Un-lined	lined
Rs. 17,000/- to 21,000/- on an average.	Rs. 8,000/- each.	Rs. 3,000/- each approximate.			(ii) As channels and culverts for all the tubewells have not been completed as yet the expenditure incurred has not been furnished.		
				Rs. 7,000/- each.	(ii) Pumping Equipments (a) Submersible pump with one stage, motor 400/440 volts 3 phase 30 cycles AC. R.P.M. 2900, H.P. 15, 4 sets. (b) Demming U.S. Oil Lubricated Turbine Pumping set with Motor 12 H.P., 1450-R.P.M. — 2 sets. (c) Jyoti Oil Lubricated 3 stage Bore-hole Turbine Pumping set with Motor 15- H.P. 1440 R. P. M. 10 sets.		

APPENDIX 'XII'

Typical Log-Sheet of an Auto-Well in West Bengal

Total depth—443.0 ft.

Diameter of borehole—2'

Position of strainers—322-339 ft.

Discharge—12 gallons (Imp.) per minute.

Depth (In feet)	Formation
0—10	Clay.
10—21	Sand.
21—84	Clay.
84—115	Sand.
115—156	Clay.
156—167	Sand.
167—196	Clay.
196—210	Sand mixed with clay.
210—218	Sand.
218—252	Clay.
252—262	Sand.
262—273	Clay.
273—322	Clay black hard.
322—339	Sand.
339—344	Clay.
344—361	Clay, Kankar with intercalations of sand.
361—382	Silt.
382—412	Clay, soft.
412—443	Clay, hard.

APPENDIX 'XIII'

Estimate of acreage and yield of principal crops in West Bengal (including territories transferred from Bihar) for 1958-59 and 1959-60

Crops	Area (‘000- acres)	1958-59		1959-60			
		Yield rate mds./ acre	Produ- ction (‘000- tons)	Yield rate mds./ acre	Produ- ction (‘000- tons)		
RICE							
1. Autumn . . .	1,272.5	7.07	330.3	1,476.8	8.48	459.9	
2. Winter . . .	9,213.5	10.95	3,707.8	9,339.9	10.69	3,669.0	
3. Summer . . .	47.4	11.04	19.2	98.9	11.77	42.8	
TOTAL RICE . . .	10,533.4	10.48	4,057.3	109,15.6	10.40	4171.7	
CEREALS (other than Rice)							
4. Wheat . . .	87.0	7.50	24.0	119.3	7.15	31.3	
5. Barley . . .	107.9	7.28	28.9	159.6	4.62	27.1	
6. Jowar . . .	4.9	6.58	1.2	5.0	3.55	0.7	
7. Bajra . . .	1.1	5.54	0.2	0.9	6.31	0.2	
8. Maize . . .	133.9	7.36	36.2	139.4	8.99	46.1	
9. Ragi . . .	27.5	6.17	6.2	26.8	5.54	5.5	
10. Other cereals . . .	24.9	5.90	5.4	24.7	5.95	5.4	
TOTAL . . .	387.2	7.18	102.1	475.7	6.65	116.3	
TOTAL CEREALS (including Rice) . . .	10,920.6	10.37	4,159.4	11,391.3	10.25	4,288.0	
PULSES							
11. Gram . . .	476.5	6.21	108.8	545.3	5.11	102.4	
12. Tur . . .	108.9	7.40	29.6	52.3	4.90	9.4	
13. Kharif . . .	56.2	5.59	11.5	74.9	5.26	14.4	
14. Rabi . . .	1,188.3	4.98	217.7	1,151.3	4.78	202.4	
TOTAL PULSES . . .	1,829.9	5.47	367.6	1,823.8	4.90	328.6	
TOTAL FOOD GRAINS (Cereals & Pulses) . . .	12,750.5	9.66	4,527.0	13,215.1	9.51	4,616.6	

APPENDIX 'XIII'—(contd.)

1	2	3	4	5	6	7
OILSEEDS						
15. Til	11.8	4.38	1.9	10.3	4.23	1.6
16. Mustard	240.1	4.78	42.2	269.0	2.76	27.2
17. Linseed	95.4	3.21	11.3	135.0	2.00	9.9
18. Other Oilseeds	5.3	5.62	1.1	5.5	6.23	1.3
TOTAL OILSEEDS	352.6	4.36	56.5	419.8	2.59	40.0
19. Jute*	875.8	2.96	2,596.1	823.6	2.63	2,169.6
20. Mesta*	362.1	2.38	861.1	214.4	1.90	408.2
21. San-hemp*	14.6	1.02	14.9	11.9	1.65	19.7
22. Cotton**	(a)	..	(b)	0.55	..	(b)
23. Sugarcane	65.9	484.91	1,174.0	80.6	31.56	1,277.9
24. Potato	122.6	99.58	448.5	p138.3	p128.42	p652.5
25. Tobacco	38.7	6.89	9.8	37.6	7.48	10.3
26. Ginger (Dry)	1.6	11.77	0.7	1.6	11.81	0.7
27. Chillies (Dry)	16.2	10.68	6.4	16.8	9.08	5.6

N.B.— (*) Yield rate and production figures are in terms of bales of 400 lbs. each.

(**) Yield rate and production figures are in terms of bales of 392 lbs. each.

(a) Area less than 50 acres.

(b) Production less than 50 bales.

(p) Provisional figures (winter potato only).

APPENDIX 'XIV'
Committee on Plan Projects
(Minor Irrigation Team)

Minutes of the Meeting held at Writers' Building, Calcutta on the 6th April, 1960.

Present

Dr. A. N. Khosla, Leader.

Shri Baleshwar Nath, Member,
Minor Irrigation Team.

Shri Mahavir Prasad, Member,
Minor Irrigation Team.

Shri D. S. Borker, Secretary,
Minor Irrigation Team.

Shri Ajoy Kumar Mukherjee, Minister,
Irrigation & Works, Government
of West Bengal.

Shri A. D. Khan, I.C.S.,
Secretary Irrigation.

Shri C. K. Ray,
Secretary Agriculture.

Shri A. L. Das, I.S.E.,
Chief Engineer, Irrigation.

Shri B. N. Banerjee,
Joint Director, Agriculture.

In attendance

Shri H. M. Brahma, P.A. to Chief Engineer, Irrigation.

Initiating the discussions, the Leader, Dr. Khosla stated that the Minor Irrigation Team intended taking up the study of different types of Minor Irrigation Works existing in West Bengal, as enumerated at the end of the note with a view to judging their efficiency in achieving the objectives initially set for such works. The assessment would cover a wide field including items such as (i) benefits from the schemes (ii) public participation (iii) procedure and finance for the sustained maintenance of the completed works (iv) co-ordinated development of irrigation and drainage through minor and major schemes and (v) Expenditure on and revenue returns from drainage schemes.

2. Dr. Khosla further referred to the progress on tubewell schemes in the other States and indicated similar possibilities in West Bengal also, with the fiat of the State. He re-iterated that with a suitable modification in the cropping pattern, tubewell proposals could be considered in areas where there are no other means of irrigation.

3. The Minister, Irrigation and Works, West Bengal pointed out that compulsory levy had already been enforced in respect of River Valley Projects in the State and as such he anticipated no difficulties in the implementation of Tubewell Irrigation Schemes as well. With regard to water rate, he mentioned that the acreage rate for tubewell irrigation had been worked to be approximately Rs. 22/-. He desired that the Team may visit Kangsabati Project with a view to help and guide the local engineers. The Leader stated that Irrigation & Power Team (Major) may do so if possible.

4. Shri C. K. Ray gave an appraisal of the problems confronted in Murshidabad and Nadia districts in which there were neither any canal projects nor any large tanks. A number of small tanks which did exist could not ensure proper irrigation.

He stated that tubewells were being sunk in places where electricity was available in close proximity. In his opinion the nature of the problems pertaining to minor irrigation works in West Bengal differed from those in Southern India.

5. He pleaded for augmenting financial allocations for Minor Irrigation Schemes in view of increasing demands.

6. Shri B. N. Banerjee stated that although irrigation from tanks was in vogue in the past in the upper areas, the tanks had since been silted up and rendered ineffective. He agreed with the views expressed by Shri Ray that it would neither be practicable nor economically feasible to construct new large tanks at this stage. He, however, stated that the State Government had formulated a scheme to recondition quite a large number of small tanks in areas where it was neither possible to provide canal water nor sink tubewells.

7. Summing up the discussions, the Leader Dr. Khosla assured that the Team would consult the State Authorities while carrying out their study in accordance with Terms of Reference.

MINOR IRRIGATION SCHEMES

- (i) Renovation of channels in tidal regions and designing it to serve the dual purpose of irrigation and drainage.
- (ii) Irrigation Schemes through diversion of stream water in the sub-mountainous region.
- (iii) Pumping from tanks or drainages for irrigation.
- (iv) Construction of auto-tubewells.
- (v) Renovation of small sized tanks and improvements which originally belonged to *Zamindars*.
- (vi) Tubewells.

APPENDIX 'XV'
Committee on Plan Projects
(Minor Irrigation Team)

Minutes of the meeting held at Writer's Building, Calcutta on 14th February, 1963

Present :

Shri M. Thirumala Rao, M.P.,
Leader,
Minor Irrigation Team.

Shri Baleshwar Nath, Member,
Minor Irrigation Team.

Shri J. R. Kumar, R. O.,
Minor Irrigation Team.

Shri Ajoy Kumar Mukherjee, Minister
incharge of Irrigation and Waterways.

Shri Smarajit Bandopadhyaya,
Minister of State, Agriculture.

Shri R. D. Singh, I.S.E.,
Chief Engineer,
Irrigation & Waterways.

Shri R. Ghosh, I.A.S., Secretary,
Agriculture & Food Production.

Shri B. N. Chowdhary,
Deputy Secretary,
Irrigation & Waterways.

Shri B. N. Banerjee,
Engineering Adviser Agriculture.

Points of the Draft Report on which the West Bengal Government offered comments were taken up as per comparative statement prepared by the Minor Irrigation Team of the Committee on Plan Projects, Planning Commission, and forwarded to West Bengal Government with their letter No. COPP/B/MIT/63/634-636, dated the 7th January, 1963.

Para 1.5.—It was agreed that area and population figures be corrected as pointed out by West Bengal authorities.

Para 1.7.—As per revised targets, areas proposed to be irrigated from Durgapur Barrage for *Kharif* and *Rabi* are respectively 9,73,000 and 55,000 acres against 10,26,000 and 3,00,000 acres originally fixed. The Team agreed to correct the report accordingly.

Para 2.4.—After some discussion, laying of field channels was agreed to by the State authorities, as far as possible.

Para 2.6.—In view of the fact that *Chamkara Khal* scheme is likely to get under the command of Kangsabati Project, it was agreed that the action on the recommendations made by the Team may be deferred.

Para 2.7.—The Chief Engineer, pointed out that the Nanda-Ranga scheme is also likely to get in the command of Kangsabati Project and further action on this scheme needs also to be deferred.

Para 2.8.—The team agreed to modify the draft report according to the comments of the West Bengal Government.

Para 2.9.—It was agreed that work of hydraulic nature should be under competent technical supervision who should carry out a periodical inspection of the works, more particularly before the rainy season. It was stated that necessary senior Engineering posts are being created in the Agriculture Department of the West Bengal Govt.

Para 2.10.—Same remarks apply to this paragraph as to 2.4.

Para 2.12.—It was agreed that second part of the paragraph 2.12 suggesting restriction of commands be deleted.

Paras 2.13. to 2.15.—Corrections to be carried out as per revised figures provided by the West Bengal Government.

Para 2.16.—It was agreed to omit reference to the foot bridge in the first sub-para of the draft report. While agreeing to the suggestions made by the Team, it was stated that irrigation on the Jateswar Scheme can commence only when new enactment in this respect is legislated. The Team however expressed concern over non-utilisation of the potential created by the scheme for so many years since its completion. It was also decided that water courses should be laid out on the scheme.

Para 2.17.—It was agreed that recording of irrigation will help in proper utilisation of the potential. The Minister of Irrigation and Waterways stated that it is intended to hand over such works to Panchayats for maintenance and booking of irrigation. The Team however felt that it is for the State authorities to devise ways and means, to effect proper booking of the irrigation.

Para 2.18.—To be dropped.

Para 2.19.—It was said that in West Bengal both assessment and collection of charges were with the Irrigation Department, which have since been entrusted to the Revenue Department. It was advised that the areas irrigated are marked on the village chart and handed over to the Revenue authorities for levy of water rates and collection. It was, however, expressed by the Team that without proper exercise of physical check of the irrigated areas at site to guard against any concealment, ill-use and over-use of water, the system may not be perfect.

Para 2.20.—The Team pressed that, as far as possible, their recommendation to obtain prior written consent of the beneficiaries to utilise water should be kept in view and that would undoubtedly help speedier development of irrigation on new works.

Para 2.21.—It was advised that the Bengal Development Act is being revised.

Para 2.22.—The draft paragraph was agreed to be amended according to the West Bengal Government's comments.

Paras 3.2, 3.8 & 3.9.—Since the question is linked with the operation of river valley projects in the State, the question was not discussed in detail. It was, however, felt that the merits of individual case will need specific consideration, and the question of improvement of tanks can be decided by local authorities thereafter.

Para 3.4.—The Draft report is to be amended according to the comments sent by the West Bengal Government.

Para 3.5.—It was decided that the paragraph may be deleted.

Paras 4.3, 4.4 & 4.5.—A sample progress of 26 wells in Nadia district (Annexure to this Appendix) was produced at the time of meeting. The Team felt that out of over 200 tubewells, a sample of 26 tubewells did not reflect the performance of the tubewells scheme in the State. The Team required complete data in respect of all the tubewells operating so as to judge their performance in the correct perspective. These details should indicate the date of their commission, consumption of electricity, hours run, expenditure incurred and the revenues actually realised apart from areas irrigated. In any case, it was apparent that the scheme could not be financially self-supporting unless tubewells attain a figure much more than what has been done so far. Another point raised in the Meeting was about water rate-structure on the tubewells. It was gathered that the State Government are imposing water rates on acreage basis. The Team expressed that the system was not conducive to economic and optimum utilisation of tubewell supply. Tubewells afford an ideal unit where water could be supplied on a volumetric basis. Once the cultivators get accustomed to acreage basis, it will be difficult to

impose volumetric system later on. The Team also pointed out that in U.P. there are more than 6,000 tubewells operating for many years and the supplies are made to cultivators on volumetric basis.

Paras 4.3 & 4.7.—Paras to be amended as per comments of the West Bengal Government.

Paras 4.12 & 4.13.—Report to be amended as per comments of the West Bengal Government.

Paras 4.14 to 4.21.—The Secretary, Agriculture, West Bengal stated that on tubewells they have altered field channel system to some extent. The Team asserted that the system of underground only in the header pipe length and the remaining open surface ditches of considerable length was not conducive to a better efficiency than that of an over ground system because it did not save losses. As indicated in the draft report the Team expressed that the system being operated on the West Bengal tubewells was not only unnecessarily expensive but also involved unnecessary lifting of water.

Para 4.35.—The Team expressed that instead of giving free water to the cultivator it will be a better practice if irrigation is started on slab rate basis, increasing year after year to attain full rate say in the 4th year *i.e.*, $\frac{1}{4}$ th in the first year, $\frac{1}{2}$ in the second year, $\frac{3}{4}$ in the third year and full rate in the fourth year.

Para 7.2.—To be deleted.

Paras 7.7, 7.8 & 7.9.—It was agreed that the recommendation in respect of this Chapter may be deleted from the Draft report as the question is being studied by the West Bengal authorities separately.

ANNEXURE TO
Sample progress report for 26

	Tubewell	Kharif Acreage					Total
		Aus	Aman	Sugar cane	Jute	Other crops	
1	1N . .	5.72	63.91	98.84	23.24	1.49	193.20
2	2N . .	98.92	37.41	12.66	150.17	4.15	303.41
3	3N . .	127.33	84.40	41.86	65.80	12.03	331.42
4	4N . .	40.42	128.96	8.65	45.70	..	223.73
5	5N . .	45.73	54.11	30.35	20.73	..	150.92
6	6N . .	84.09	68.36	..	19.38	..	171.83
7	7N . .	15.08	14.58	5.37	54.22	12.34	91.59
8	8N . .	84.18	66.36	3.91	96.17	4.75	225.37
9	9N . .	6.64	36.22	29.90	43.34	..	116.10
10	10N . .	15.00	10.00	123.00	20.00	1.00	169.00
11	11N . .	43.50	11.11	26.21	158.14	..	238.96
12	12N . .	68.82	72.10	7.57	50.10	13.33	211.92
13	13N . .	123.90	65.63	41.43	47.86	4.22	285.04
14	19N . .	75.30	65.00	..	43.00	1.03	184.33
15	20N . .	78.90	103.43	0.92	30.39	1.75	215.39
16	21N . .	107.57	57.35	16.33	37.20	2.81	221.26
17	22N . .	126.68	30.74	47.39	51.70	11.20	267.71
18	23N . .	153.88	50.30	54.37	64.45	9.50	332.50
19	24N . .	66.46	32.22	72.36	25.47	13.39	209.90
20	25N . .	63.37	67.00	104.08	25.55	9.07	269.07
21	26N . .	36.17	101.73	12.11	52.31	..	202.32
22	27N . .	29.15	63.37	10.64	4.52	..	107.68
23	28N . .	181.87	15.00	16.22	1.81	..	214.90
24	29N . .	104.15	55.00	..	6.00	12.99	168.14
25	79N (Exp)	49.04	30.96	..	9.63	20.00	109.63
26	80N (Exp)	77.43	23.03	9.00	20.64	29.36	159.46
		1909.20	1388.38	773.17	1167.52	164.41	5402.68

APPENDIX XV

(Twenty six) Tubewells in Nadia District

Rabi Acreage for Jan.'63.					
Wheat	Potato	Pulse	Sugarcane	Other crops	Total
59·32	9·86	0·66	18·05	7·68	95·57
81·86	4·42	0·90	0·13	6·12	93·43
56·40	6·06	..	1·69	5·24	69·39
73·27	3·93	3·17	2·05	6·73	89·15
77·64	0·55	0·58	3·57	2·83	85·17
78·88	1·82	..	..	4·59	85·20
67·92	6·44	0·26	0·54	4·04	79·20
80·53	14·03	..	1·65	10·62	106·83
27·83	..	0·33	10·16	4·07	42·39
5·95	..	..	49·61	0·16	55·72
36·03	1·50	5·28	9·98	19·50	72·30
122·65	3·84	0·45	..	3·33	130·17
56·68	8·28	..	..	1·99	66·94
20·90	3·01	2·24	2·01 (Boro)	15·70	43·86
44·02	2·33	4·48	10·18	17·01	78·02
58·43	4·35	..	6·59	6·68	76·15
72·48	8·44	3·39	2·77	7·77	94·85
58·63	4·72	2·96	10·06	2·90	79·27
61·23	3·12	1·49	5·88	13·69	85·41
73·01	5·77	..	8·28	21·40	108·46
61·56	2·38	1·17	3·70	4·67	73·48
99·67	3·15	0·40	0·66	3·46	167·34
5·43	..	..	..	15·25	20·68
19·48	1·57	..	..	22·81	43·86
3·12	0·66	1·41	13·97	14·10	33·26
23·65	0·33	8·56	0·16 (Boro)	2·57	35·27
1426·47	100·56	37·83	191·69	224·80	1951·35

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