
# SUPPLEMENTARY REPORT

OF THE

# COMPTROLLER

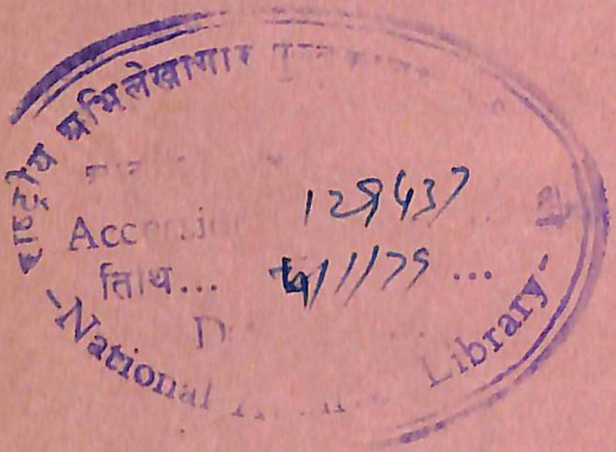
AND

# AUDITOR GENERAL OF INDIA

FOR

## THE YEAR 1975-76

UNION GOVERNMENT (CIVIL)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## ERRATA

Supplementary Report of the Comptroller & Auditor General of India for the year 1975-76 Union Govt. (Civil).

| *Page No.* | *Line No.* | *For* | *Read* |
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| (ii) | Paragraph Col. | 15.10 | 15.01 |
| (ii) | 2 under Section IV | Bettermen | Betterment |
| (ii) | Annexure Sr. No. 5 | Madhy | Madhya |
| (v) | 14 from top | Coordnation | Coordination |
| 11 | 12 from top | Kangasabati | Kangsabati |
| 12 | 1st line | Projects | Project |
| 19 | Col. 4 of table | 59.40 | 59.04 |
| 19 | Note 2 | Column | Columns |
| 22 | 7th line from top | August | November |
| 35 | 20—22 | put the sentence "only 2077 outlets—water" in brackets. | |
| 37 | 1st line | Were | Was |
| 79 | 24th line from top | Fifthe | Fifth |
| 79 | -do- | Hectare | Hectares |
| 79 | Foot note | Put—between Rengali and Mandira | |
| 88 | 11th line from top | Chambal | Chambal, Madhya Pradesh |
| 91 | 1st line | Four | Five |
| 91 | 2nd & 3rd lines | Chambal (Rajasthan) | Chambal & Bhakra (Rajasthan) |
| 99-100 | Col. 17 | 262.9 | 262.92 |
| 107 | 3rd line from top | Scheme | Schemes |
| 113 | 11th line from bottom | Programme | Programmes |
| 122 | 2nd line from bottom | Subjected | Subject |
| 124 | 14th line from bottom | 1966-67 | 1976-77 |
| 134 | 6th line from bottom | Jannary | January |
| 135 | 14th line from top | 6643 | 6634 |
| 137 | 8th line from top | from | form |
| 138 | 17th line from top | 130.7 million | 130.7 thousand million |
| 141 | 12th line from top | Of | Off |
| 149 | 1st line Col. 6 | 24.52 | 34.52 |
| 153 | 1st line Col. 6 | 12.4 | 12.5 |

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## CONTENTS

## PREFATORY REMARKS

The utilisation of potential created in irrigation projects is of considerable importance for increased agricultural production and diversified cropping pattern. Substantial amounts have been invested by the State Governments in these projects. The Central Government's involvement in these projects is close and continuous through clearance of the projects by the Central Water Commission and the Planning Commission, provision of financial assistance and monitoring their performance. From the commencement of the First Five Year Plan (1951-52) to the beginning of the Fourth Five Year Plan (1969-70), the loans given by the Central Government to the State Governments for specific projects amount to Rs. 1154 crores; from 1969-70, the Central assistance was in the form of block loans and grants, covering, among other things, irrigation projects also but without being related to individual projects. In addition, Government of India sponsored schemes of development of command areas in a few projects and soil conservation in the catchments of certain projects; the total amounts of grants and loans released to the State Governments for these schemes up to the end of March 1977 were Rs. 59 crores and Rs. 51 crores respectively.

Studies have been undertaken in audit of twenty irrigation projects in different parts of the country of which twelve are large projects, each with an irrigation potential of not less than 50 thousand hectares. These twelve projects are Bhakra Nangal (Punjab, Haryana and Rajasthan), Chambal (Madhya Pradesh and Rajasthan), Sarda Canal system (Uttar Pradesh), Eastern Main Canal in Kosi Project (Bihar), Hirakud (Orissa), Mayurakshi (West Bengal), Tungabhadra (all the canals in Andhra Pradesh and Karnataka except the Right Bank High

Level Canal in Andhra Pradesh), Nagarjunasagar (Andhra Pradesh), Parambikulam Aliyar (Tamil Nadu), Kakrapar (Gujarat), Purna and Girna (Maharashtra). The total area to be irrigated by these twelve projects was 6043 thousand hectares against the total potential of 20900 thousand hectares at the end of 1973-74. The specific loans given by Government of India for these projects amounted to about Rs. 663 crores; in addition, assistance of about Rs. 60 crores was given by the Central Government for specific centrally sponsored schemes connected with these projects like the command area development and soil conservation schemes. The studies in audit were mainly to compare the utilisation of irrigation potential with the project assumptions, to identify the reasons for under-utilisation and to check the monetary returns Governments have got from the projects so far.

Several bodies, on the all India as well as State level, have reviewed from time to time in the past, in broad perspective, the problem of under-utilisation of irrigation potential created. They have indicated a number of factors found to have a bearing on such under-utilisation as well as types of remedial measures which could reduce the lag in utilisation. While their findings and recommendations are of general applicability, the studies undertaken in audit have been in the context of the specific conditions obtaining in the selected projects. These have been based on detailed data collected from the initial records of the different departments of the State Government concerned. The aspects broadly covered in these studies are:

(*a*) the extent of area irrigated, in different crop seasons, as compared to what was planned to be irrigated in project reports;

(*b*) factors specifically relevant to the utilisation of irrigation potential in the selected projects with particular reference to efficiency in use of water for irrigation, such as the

system of distribution of available supplies of water, preparation of land for irrigated agriculture and suitability of the cropping pattern. Constructional aspects relevant to utilisation of potential such as availability of irrigable area and adequacy of the capacities of canals have also been gone into. An attempt has been made to bring in focus, through quantification in physical and financial terms, the problems and the action pending on remedial measures suggested from time to time;

(*c*) the implementation of the centrally sponsored Command Area Development Programme to accelerate the process of utilisation of irrigation potential and improve the efficiency of utilisation through inter-departmental co-ordnation;

(*d*) the progress made in the execution of the centrally sponsored schemes of soil conservation in catchments of selected projects; and

(*e*) comparison of the revenue and working expenses of the projects and return on investment to Government with the anticipated return.

The Report that follows contains the important points noticed in audit relating to the different aspects mentioned above in the selected projects. The Report comprises five sections. Section I gives a general introduction. Section II discusses the extent of utilisation of the potential created and the factors bearing on it. Section III deals with the command area and soil conservation programmes. Section IV gives an indication of the revenue and financial returns. The Report concludes with a project-wise summing up in Section V.

This Report has been prepared for submission to the President under Article 151 of the Constitution. Matters pertaining to utilisation of potential in the selected projects, referred to

in this Report, have been included in the Reports already submitted to the Governors of the States.

This Report is supplementary to the Reports on matters arising from the Appropriation Accounts etc., for 1975-76 and earlier years which have been submitted already.

This Report is not intended to convey or to be understood as conveying any general reflection on the financial administration by the departments or the authorities concerned.

## SECTION I—INTRODUCTION

### 1. Extent of area sown and irrigated

1.01 Agriculture is the core of Indian economy and over 70 per cent of population depend on it for their livelihood. Out of the country's total geographical area of 328 million hectares, the total culturable area is about 181 million hectares. The area under cultivation during the period 1950-51 to 1974-75 was as follows :

(In million hectares)

| Year | Net area sown | Area sown more than once | Gross area sown |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 1950-51 . . . . . | 118.8 | 13.1 | 131.9 |
| 1955-56 . . . . . | 129.2 | 18.1 | 147.3 |
| 1960-61 . . . . . | 133.2 | 19.6 | 152.8 |
| 1965-66 . . . . . | 136.2 | 19.1 | 155.3 |
| 1970-71 . . . . . | 141.0 | 24.9 | 165.9 |
| 1971-72 . . . . . | 140.2 | 25.0 | 165.2 |
| 1972-73 . . . . . | 136.8 | 24.7 | 161.5 |
| 1973-74 . . . . . | 142.8 | 26.8 | 169.6 |
| 1974-75 . . . . . | 138.3 | 25.5 | 163.8 |

It may be seen from the above table that the increase in net sown area has not been significant. Of the increase of 19.5 million hectares during the 25 year period, about 10 million hectares were added during the First Five Year Plan ending 1955-56.

1.02 The area sown includes both rainfed and irrigated cultivation. In 1974-75, the net area irrigated was 33.6 million

hectares out of 138.3 million hectares sown. The increase in area under irrigation over the 25 year period is indicated below :

(In million hectares)

| Year | Net area sown | Net area irrigated | Percentage of column (3) to (2) |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 1950-51 . . . . . | 118.8 | 20.9 | 17.6 |
| 1955-56 . . . . . | 129.2 | 22.8 | 17.6 |
| 1960-61 . . . . . | 133.2 | 24.7 | 18.5 |
| 1965-66 . . . . . | 136.2 | 26.3 | 19.3 |
| 1970-71 . . . . . | 141.0 | 31.4 | 22.3 |
| 1971-72 . . . . . | 140.2 | 31.9 | 22.8 |
| 1972-73 . . . . . | 136.8 | 31.9 | 23.3 |
| 1973-74 . . . . . | 142.8 | 32.5 | 22.8 |
| 1974-75 . . . . . | 138.3 | 33.6 | 24.3 |

1.03 The area sown more than once in irrigated lands during 1950-51 to 1974-75 was as below :

(In million hectares)

| Year | Net area irrigated | Area irrigated more than once | Gross irrigated area | Column (3) as percentage of (2) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 1950-51 . . . . | 20.9 | 1.7 | 22.6 | 8.1 |
| 1955-56 . . . . | 22.8 | 2.8 | 25.6 | 12.3 |
| 1960-61 . . . . | 24.7 | 3.3 | 28.0 | 13.4 |
| 1965-66 . . . . | 26.3 | 4.6 | 30.9 | 17.5 |
| 1970-71 . . . . | 31.4 | 7.3 | 38.7 | 24.4 |
| 1971-72 . . . . | 31.9 | 7.0 | 38.9 | 23.1 |
| 1972-73 . . . . | 31.9 | 7.2 | 39.1 | 23.0 |
| 1973-74 . . . . | 32.5 | 7.7 | 40.2 | 23.7 |
| 1974-75 . . . . | 33.6 | 8.0 | 41.6 | 23.8 |

It may be seen from the above table that though the area under multiple cropping in irrigated land has increased from 1.7 million hectares to 8 million hectares over the 25 year period, it is about one-third of the total area under multiple cropping.

## 2. Development of irrigation potential

2.01 Development of irrigation with reference to the different sources of irrigation since 1950-51 was as under :

(Thousand hectares)

| Source | 1950-51 | 1955-56 | 1960-61 | 1965-66 | 1970-71 | 1971-72 | 1972-73 |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Government canals | 7158 (34.3) | 8025 (35.3) | 9170 (37.2) | 9859 (37.4) | 11625 (37.0) | 11949 (37.5) | 12192 (38.2) |
| Private canals | 1137 (5.5) | 1360 (6.0) | 1200 (4.9) | 1099 (4.2) | 898 (2.8) | 901 (2.8) | 863 (2.7) |
| Total | 8295 (39.8) | 9385 (41.3) | 10370 (42.1) | 10958 (41.6) | 12523 (39.8) | 12850 (40.3) | 13055 (40.9) |
| Tanks | 3613 (17.3) | 4423 (19.4) | 4561 (18.5) | 4258 (16.2) | 4525 (14.4) | 4140 (13.0) | 3621 (11.3) |
| Wells | 5978 (28.7) | 6739 (29.6) | 7290 (29.6) | 8653 (32.8) | 11904 (37.9) | 12235 (38.4) | 13024 (40.8) |
| Other sources | 2967 (14.2) | 2211 (9.7) | 2440 (9.8) | 2475 (9.4) | 2422 (7.9) | 2607 (8.3) | 2249 (7.0) |
| Grand total | 20853 (100.0) | 22758 (100.0) | 24661 (100.0) | 26344 (100.0) | 31433 (100.0) | 31891 (100.0) | 31949 (100.0) |

NOTE.—Figures in brackets indicate percentage to total net irrigated area.

2.02 According to the latest estimates (1976), out of 180 million hectare metres of the country's river flows, 70 million hectare metres could be exploited for irrigation. Of this, about

25 million hectare metres *i.e.*, 36 per cent were tapped up to 1974. In terms of area, it has been estimated that 107 million hectares could be irrigated from surface and ground water resources, 35 million hectares with ground water and 72 million hectares with surface water of which major and medium irrigation projects are expected to account for 57 million hectares. By the end of the Fourth Plan (1973-74), a total irrigation potential of 44.4 million hectares had been created, of which major* and medium* irrigation projects contributed 20.9 million hectares, minor* projects 7.5 million hectares and ground water 16 million hectares. The total potential increased to 46 million hectares by the end of 1974-75.

2.03 The pre-Plan irrigation potential of 9.7 million hectares from major and medium projects increased to 20.9 million hectares by the end of the Fourth Plan. The targets and achievements during different Plan periods were as follows:—

| Period | Target (million hectares) | Achievement (million hectares) | Outlay (Rs. in crores) |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| First Plan (1951-52 to 1955-56) . . | 3.34 | 2.49 | 380.00 |
| Second Plan (1956-57 to 1960-61) . . | 4.86 | 2.14 | 380.00 |
| Third Plan (1961-62 to 1965-66) . . | 6.56 | 2.23 | 576.00 |
| Annual Plans (1966—69) . . . | 2.40 | 1.50 | 429.00 |
| Fourth Plan (1969-70 to 1973-74) . . | 4.80 | 2.80 | 1254.00 |

*Projects costing more than Rs. 5 crores (and from September 1975, with a culturable command area more than 10,000 hectares) are called major projects while those costing between Rs. 25 lakhs (Rs. 30 lakhs in hill areas) and Rs. 5 crores (and from September 1975 with a culturable command area up to 10,000 hectares) are called medium projects. Projects costing less than Rs. 25 lakhs (Rs. 30 lakhs in hill areas) are minor.

It may be seen from the above table that there were consistent shortfalls ranging from 28 per cent to 66 per cent in the creation of potential during the Plan periods. The Estimates Committee of the Lok Sabha in their 76th Report (1975), while expressing disappointment at the slow pace of implementation of these schemes, identified two major reasons for the slow implementation, namely, (i) financial constraints and (ii) absence of close watch on implementation of projects.

2.04 During the post-war reconstruction period, a large number of schemes for development of irrigation were investigated and taken up which included schemes like Bhakra Nangal, Damodar Valley and Hirakud. Nearly Rs. 80 crores had been spent on these projects before their inclusion in the First Plan. There were, in all, 267 schemes under implementation in the First Plan, of which 27 were major projects such as Nagarjunasagar in Andhra Pradesh, Kosi in Bihar, Chambal in Madhya Pradesh and Rajasthan, Tungabhadra in Karnataka and Andhra Pradesh and Mayurakshi in West Bengal.

2.05 In the Second Plan, 195 new projects including 25 major projects were taken up which included Rajasthan Canal, Gandak in Bihar and Uttar Pradesh, Tawa in Madhya Pradesh, Parambikulam Aliyar in Tamil Nadu, Kangsabati in West Bengal, Mahi and Kakrapar in Gujarat and Purna and Girna in Maharashtra.

2.06 In the Third Plan, nine new major schemes besides 86 medium schemes of local importance were taken up including Beas scheme in Punjab and Malaprabha and Upper Krishna in Mysore.

2.07 During the Annual Plans (1966—69), only Maharashtra launched 6 new schemes mainly for drought affected areas.

## 3. Plan provision for irrigation projects including spill-over schemes

3.01 The estimated cost of the projects taken up in each Plan, provision made and the spill-over cost of the on-going projects from Plan to Plan are indicated below :—

(Rs. in crores)

| Period | Estimated cost of on-going schemes spilling into the Plan | Estimated cost of new schemes added in the Plan | Total estimated cost of schemes for execution in the course of the Plan | Expenditure in the Plan both on on-going and new schemes | Spill-over cost at the end of the Plan |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| First Plan . . | .. | .. | 790.00 | 380.00 | 410.00 |
| Second Plan . . | 410.00 | 610.00 | 1020.00 | 380.00 | 640.00 |
| Third Plan . . | 640.00 | 364.00 | 1004.00 | 576.00 | 428.00 |
| Annual Plans (1966—69) . . | 428.00 | 172.00 | 600.00 | 429.00 | 171.00 |

As may be seen from the table above, the cost of the projects spilling into the Fourth Plan was estimated to be about Rs. 171 crores. On the basis of an assessment made by the States up to March 1970 at the time of formulation of the Fourth Plan, the spill-over cost of schemes continuing into the

Fourth Plan was placed at Rs. 1260 crores *vide* details given below:—

(Rupees in crores)

| Scheme | Estimated cost | Expenditure to end of 1968-69 | Spill-over cost | Allocation in the Fourth Plan |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| Major schemes, estimated to cost more than Rs. 20 crores each on which appreciable progress had been made . | 1605 | 890 | 715 | 484 |
| Major projects costing between Rs. 5 crores and Rs. 20 crores on which appreciable progress had been made . | 280 | 176 | 104 | 98 |
| Other major projects on which appreciable progress had not been made . . . | 350 | 12 | 338 | 86 |
| Medium schemes . . . | 225 | 122 | 103 | 103 |
| TOTAL . . . | 2460 | 1200 | 1260 | 771 |

3.02 A total Provision of Rs. 954.00 crores was made in the Fourth Plan with the following break-up :—

| Item | Outlay (Rs. in crores) |
|---|---|
| Continuing schemes . . . . . | 771.40 |
| New Schemes (estimated cost Rs. 750 crores) . . . . | 140.40 |
| Investigation and research in the States and Union Territories . | 26.50 |
| Research and design schemes of the Central sector . . | 15.50 |
| Total . . . . . | 953.80 |

3.03 In the Mid-term Appraisal (December 1971) of the Fourth Plan, it was indicated that, on account of increase in costs of various projects reported by a number of States, the total

spill-over on projects continuing into the Fourth Plan was as follows:—

| *Continuing schemes* | Rupees in crores |
|---|---|
| (*a*) Carry-over into the Fourth Plan . . . . . | 1728 |
| (*b*) Fourth Plan provision . . . . . | 824 |
| (*c*) Spill-over into the Fifth Plan . . . . . | 904 |
| *New schemes* | |
| (*a*) Cost of schemes approved and likely to be approved in the Fourth Plan . . . . . | 646 |
| (*b*) Provision in the Fourth Plan . . . . . | 121 |
| (*c*) Spill-over into the Fifth Plan . . . . . | 525 |

At the end of the Fourth Plan, the schemes under execution included 13 taken up in the First Plan, 45 in the Second Plan and 35 in the Third Plan.

3.04 In the context of the escalation in spill-over cost it is relevant to note that the Planning Commission, as early as in February 1960, had *inter alia* pointed out to the State Governments that "new projects should be taken up for execution only to the extent which the available financial and technical resources admit at the time, after meeting the optimum requirements of the projects already under construction". In the Third Plan Mid-term Appraisal (1963), it was stated that "there had been a tendency to press for the inclusion of a large number of new schemes in Five Year Plans and later to want to make an early start on them by diverting funds provided for continuing schemes which resulted in delays in completion of schemes and consequent deferment of benefits besides reducing financial returns". The Committee appointed by Government of India to look into the causes for frequent revisions of the project estimates and delay in completion of the projects and accrual of benefits, pointed out in their report (1973) that adequate

funds were not provided for the projects approved as a result of which the scheduled period of completion was revised from 5—10 years to 12—20 years.

## 4. Central Government's involvement

4.01 Although irrigation is a State subject under the Constitution, the Union Government has a key role to play in the development of irrigation potential, especially in the matter of rendering technical and financial assistance to the State Governments.

4.02 The State Governments investigate and formulate irrigation schemes and prepare the project reports. The Central Water Commission and the Planning Commission have issued detailed guidelines, from time to time, to the State Governments for investigation and formulation of the projects and preparation of the project reports.

4.03 The Planning Commission formed in February 1954 an Advisory Committee (the Technical Advisory Committee) for examining and making recommendations on the various irrigation, flood control and power projects proposed for inclusion in the Five Year Plans. Besides having the Secretary, Department of Irrigation as its Chairman and the technical head of the Irrigation Division in the Planning Commission as Secretary, the Committee has representatives from the Central Water Commission and the departments of Irrigation, Agriculture, Finance and Science and Technology as its members.

In accordance with the procedure prescribed by the Planning Commission, the project reports are submitted by the State Governments to the Central Water Commission. In the case of medium irrigation schemes, the State Governments are required to furnish only a pro forma, instead of a complete

Project Report, giving broad outlines in respect of the following:—

(*i*) the basic planning and availability of water;

(*ii*) the inter-state aspect and

(*iii*) any other important factor radically affecting the size and shape of the project.

In the case of major projects, the detailed project reports submitted by the State Governments are examined by the various directorates of the Central Water Commission, with particular reference to basic planning, main engineering works, inter-State angle, water availability *vis-a-vis* requirement, rates and cost estimates and the benefits expected to be derived from the projects. After scrutiny, the Central Water Commission makes a report to the Technical Advisory Committee. The Committee examines planning, hydrology, availability of water resources and financial and economic returns. After clearance of the projects by the Advisory Committee, the Planning Commission clears the projects after checking up the provision of funds in the Plan and general priorities during the Plan period. Any modification and revision of projects subsequent to their approval by the Planning Commission on account of (i) change in their scope, and/or (ii) change in their estimated cost (subject to certain prescribed limits) is also required to be reported by the State Governments to the Planning Commission and the Central Water Commission for review by the Advisory Committee. It has been repeatedly reiterated by the Planning Commission that no work on any scheme should be undertaken by the State Governments unless the schemes are cleared by the Advisory Committee and approved by the Planning Commission. Similarly, in the case of projects undergoing modification and revision subsequent to their approval, the State Governments are not to undertake any additional commitments before the changes are got approved by the Planning Commission in accordance with the prescribed procedure.

4.04 Prior to 1969-70, Government of India gave loans to the State Governments for specific irrigation and power projects including multi-purpose river valley projects. Some of the important projects which were aided were Nagarjunasagar (Andhra Pradesh), Tungabhadra (Andhra Pradesh and Karnataka), Damodar Valley Corporation (Bihar and West Bengal), Kosi, Sone High Level Canal (Bihar), Gandak (Bihar and Uttar Pradesh), Ukai (Gujarat), Koyna (Gujarat and Maharashtra), Beas and Bhakra Nangal (Punjab, Haryana, Rajasthan), Chambal (Madhya Pradesh and Rajasthan) Hirakud (Orissa), Rajasthan Canal, Ram Ganga (Uttar Pradesh) and Kangasabati and Mayurakshi (West Bengal).

4.05 Up to 1968-69, specific loans amounting to Rs 1154.46 crores were given by Government of India to various States for financing some of the irrigation and multi-purpose projects including the power components. The amounts given in the first three Plans and the three annual Plans (1966-69) are indicated below:—

| Period | Amount of loan given by the Central Government to State Governments for specific projects (Rupees in crores) |
|---|---|
| First Plan(1951—56) | 217.99 (includes Rs. 18.04 crores given in the pre-plan period) |
| Second Plan(1956—61) | 276.95 |
| Third Plan(1961—66) | 340.24 |
| Annual Plans(1966—69) | 319.28 |
| TOTAL | 1154.46 |

4.06 These loans were granted by the Central Government for periods varying from 15 to 40 years after allowing moratorium varying from 7 to 20 years. Loans granted for the Damodar

Valley projects and the Hirakud Irrigation Project Stage I were repayable in one instalment at the end of 40 years and those granted for the Bhakra Nangal Project were repayable in one lump sum after 15 years from the date of drawal of each instalment of the loan. No moratorium was admissible for payment of interest, which was payable annually from the first anniversary dates of different loans. The rates of interest on these loans varied from 3 per cent to $5\frac{3}{4}$ per cent per annum.

4.07 According to the Report of the Sixth Finance Commission (1973), loans taken by State Governments from Government of India prior to 1969-70 and outstanding as on 31st March, 1974 were Rs. 851.22 crores for multi-purpose projects and Rs. 97.51 crores for major irrigation projects.

In pursuance of the recommendations of the Sixth Finance Commission, Government of India consolidated the outstanding balances, as at the end of 1973-74, in respect of various categories of Plan and non-Plan loans advanced by the Central Government to the State Governments and made these repayable according to the revised periods of repayment for each category. The consolidated loans were deemed to have been drawn on the 31st March 1974. The periods of repayment for these consolidated loans were fixed as 15/20/25/30 years for different projects with a moratorium of 2 to 5 years for the 25 and 30 years' loans. No moratorium was admissible for payment of interest which was fixed as 5 per cent per annum.

4.08 From the Fourth Plan *i.e.*, from 1969-70, Central assistance was given in the form of block loans (70 per cent) and grants (30 per cent) not related to any individual sector of development or project. These block loans and grants were decided on the basis of a formula approved by the National Development Council. The outlay in respect of selected irrigation projects was earmarked while communicating the Planning Commission's approval for the States' annual Plans to the State Governments. If the actual expenditure on these earmarked projects fell short

of the outlay approved, there would be corresponding reduction in the Central assistance to the States. According to the Department of Irrigation, this enabled the Centre to keep a watch on the progress of important irrigation projects and also helped the State Governments to resist pressure for diversion of funds from one project to another.

During the Fourth Plan, a total outlay of Rs. 671.86 crores was earmarked for 48 selected projects. In the first three years of the Fifth Plan (1974-75 to 1976-77), the earmarked outlay on 70 selected projects (including the 48 projects referred to earlier) amounted to Rs. 827.56 crores.

4.09 During the Fourth Plan, non-Plan Central assistance by way of loans (Rs. 76.96 crores) was also given to some States for certain specified irrigation projects such as Nagarjunasagar, Gandak, Beas, Ghataprabha, Rajasthan Canal and Kangsabati. In addition, some States were also given loans for certain specific projects over and above the ceiling of Central assistance for Plan schemes to accelerate the pace of execution of these projects. Out of Rs. 85.20 crores of such loans outstanding as on 31st March 1974, Rs. 28.20 crores were for irrigation projects including the Western Kosi Canal, Loharu and Chakravarti Canal Projects (Haryana), Rajasthan Canal Project and Gandak Project (Uttar Pradesh).

4.10 To help the State Governments take advance action for the Fifth Five Year Plan relating to major and medium irrigation schemes, advance Plan assistance of Rs. 27.31 crores was provided during 1973-74. Advance Plan assistance sanctioned during 1974-75 to 1976-77 was as follows:—

| Year | Amount allocated (Rs. in crores) |
|---|---|
| 1974-75 | 11.19 |
| 1975-76 | 56.65 |
| 1976-77 | 48.10 |

The projects assisted included Nagarjunasagar, Tungabhadra, Gandak and Kangsabati.

4.11 Government of India also extended Miscellaneous Development Loans to the State Governments up to 1968-69 which, as mentioned by the Sixth Finance Commission, had been used in many States mostly for irrigation and power projects. As on 31st March 1974, such Central loans outstanding totalled Rs. 468.70 crores.

4.12 In addition to the Central assistance provided by the Department of Irrigation mentioned above, the Department of Agriculture, Government of India also sponsored programmes relating to the development of command areas of selected irrigation projects.

The working group on land and water development constituted by the Ministry of Agriculture in 1972 to review the progress of programmes under the Fourth Plan and to formulate the proposals for the Fifth Five Year Plan observed in their Report (March 1973) as follows:—

"It is true that both land and water are State Subjects and the Centre under the Constitution, strictly speaking, has no obligation to do anything about it. Yet the fact remains that the Centre, perhaps unknowingly, is being latterly forced by the logic of circumstances to play a growing role in the field of soil and water management..... Again, the inter-State aspects of the programme for the protection of reservoirs, major drainage schemes and flood control works are beginning to receive increasing attention with the realisation that this is something which can today be attempted only by the Centre. The Centre's direct involvement in the field of optimising the use of irrigation water during the Fourth Plan is another pointer towards this direction. But, above all, it is the Centre which, in the last resort, has to face the consequences of low production levels in agriculture, animal husbandry

and forestry, and must, therefore, interest itself in the proper management of soil and water irrespective of the strict constitutional position. It is time that the Centre took cognizance of these hard and real facts of life and decided to assume not only a larger but a more direct responsibility in the field of soil and water".

4.13 The centrally sponsored programmes, relating to the major and medium irrigation projects, launched by the Agriculture Department and the amounts of Central assistance provided to the States under the programmes are as under :

(Rupees in crores)

| Schemes | Central assistance given to the States up to the end of the Fourth Plan (1973-74) | Provision in the Fifth Plan | Central assistance given in the Fifth Plan |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| (*i*) Construction of market complexes and rural roads in selected command areas . | 14.78 (Grant) | 120.00 | 11.65 (Grant) (up to 3/76) |
| (*ii*) Command Area Development Programme . | — | | 22.17 (Grant) 10.05 (Loan) (up to 3/77) |
| (*iii*) Soil conservation in catchment areas . . | 34.80* 22.07 (Grant) 12.73 (Loan) | 36.00 | 16.29 9.48 (Grant) 6.81 (Loan) (up to 3/77) |
| (*iv*) Soil and Water Management Pilot Projects | 2.39 (Grant) | 5.00 | 0.92 (Grant) (up to 3/77) |

*This does not include the amount released to D.V.C.

NOTE.—Regarding soil conservation in catchment areas, according to the Department of Agriculture (August 1977), the provision of Rs. 36.00 crores was subsequently reduced to Rs. 32.46 crores.

No Central assistance was given after March 1976 for the scheme of market complexes and rural roads and the State Governments were to incur expenditure on the incomplete works, if any, from their own resources. Under the command area development programme launched from Fifth Plan, loan assistance of Rs. 10.05 crores was paid to the State Governments (Rs. 9.21 crores for construction of field channels and Rs. 0.84 crore for purchase of equipments). The loans to the State Governments were for a period of 15 years (5 years in case of loan for equipments) bearing interest at 5½ per cent per annum. The repayment was to commence from the first anniversary of the drawal of each instalment of the loans.

The pattern of assistance for the scheme of soil conservation in catchment areas is 50 per cent grant and 50 per cent loan. The terms and conditions governing the loans under this scheme are the same as in the case of loans under the command area development programme referred to above.

**5. Governmental investment in irrigation projects and return thereon**

5.01 Government investment in major and medium irrigation projects stood at about Rs. 3,000 crores at the end of the Fourth Plan *i.e.*, 1973-74 *vide* details given below :

(Rupees in crores)

| Period | Outlay on major and medium irrigation projects | Total Plan Outlay |
|---|---|---|
| 1 | 2 | 3 |
| First Plan(1951-52 to 1955-56) . . . . . | 380.00 (includes Rs. 80 crores for pre-Plan schemes) | 1960.00 |
| Second Plan (1956-57 to 1960-61) . . . . | 380.00 | 4672.00 |
| Third Plan (1961-62 to 1965-66) . . . . | 576.00 | 8573.00 |
| Annual Plans (1966-67 to 1968-69) . . . | 429.00 | 6757.00 |
| Fourth Plan (1969-70 to 1973-74) . . . . | 1254.00 | 15902.00 |
| TOTAL . . . . . | 3019.00 | 37864.00 |

In the Fifth Plan, the provision for irrigation projects was Rs. 3750 crores; of this the provision for the first three years of the Fifth Plan was Rs. 1383 crores as shown below:—

| Year | Annual Plan provision (Rs. in crores) |
|---|---|
| 1974-75 | 346.00 |
| 1975-76 | 422.00 |
| 1976-77 | 615.00 |
| TOTAL | 1383.00 |

5.02 In 1945-46, the net gain to the exchequer from irrigation schemes, after meeting working expenses, interest charges and deducting loss on unproductive works, was Rs. 7.92 crores *i.e.*, a return of 5.3 per cent on the investment of Rs. 149 crores. Just after Independence, irrigation works in the country as a whole yielded a net annual profit of over Rs. 1 crore after meeting the cost of maintenance and interest charges. In the subsequent periods, the irrigation and multi-purpose projects incurred losses.

The losses increased to Rs. 163.19 crores in 1974-75 as reflected in the Finance and Revenue Accounts *vide* details given below:—

(Rupees in crores)

| Year ending | Capital outlay at the end of the year | Gross receipts | Working expenses | Interest on capital | Excess of expenditure over receipts(—) |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| | (Multi-purpose River Valley Projects*) | | | | |
| 31-3-1972 | 1287.98 | 5.08 | 8.70 | 45.20 | (—)48.82 |
| 31-3-1973 | 1434.63 | 7.24 | 8.79 | 50.88 | (—)52.43 |
| 31-3-1974 | 1552.78 | 8.68 | 11.06 | 53.82 | (—)56.20 |
| 31-3-1975 | 1626.28 | 11.16 | 28.11 | 28.68 | (—)45.63 |
| | Irrigation Works | | | | |
| 31-3-1972 | 1579.12 | 33.93 | 49.28 | 75.57 | (—)90.92 |
| 31-3-1973 | 1793.52 | 40.43 | 58.55 | 90.69 | (—)108.81 |
| 31-3-1974 | 2042.45 | 50.31 | 63.57 | 100.02 | (—)113.28 |
| 31-3-1975 | 2042.48 | 47.11 | 55.22 | 109.25 | (—)117.56 |

*Includes both power and irrigation components.

## 6. Projects studied in audit

6.01 One of the reasons for the poor financial performance of the irrigation projects was under-utilisation of the irrigation potential. The lag in utilisation in different Plan periods is reported to be as given below:

(In million hectares)

| Period | Total potential created at the end of period | Potential actually utilised out of column 2 | Lag in utilisation |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| Pre-Plan . . . . . | 9.7 | 9.7 | — |
| First Plan . . . . . | 12.2 | 11.0 | 1.2 |
| Second Plan . . . . . | 14.3 | 13.1 | 1.2 |
| Third Plan . . . . . | 16.6 | 15.2 | 1.4 |
| Annual Plans(1966—69) . . . . | 18.1 | 16.9 | 1.2 |
| Fourth Plan . . . . . | 20.9 | 18.8 | 2.1 |

6.02 A study was undertaken in audit of the utilisation of potential created in 12 selected projects, namely, Bhakra Nangal (Punjab, Haryana and Rajasthan), Chambal (Madhya Pradesh and Rajasthan), Sarda Canal System (Uttar Pradesh), Eastern Main Canal in Kosi Project (Bihar), Hirakud (Orissa), Mayurakshi (West Bengal), Tungabhadra (all the canals in Andhra Pradesh and Karnataka except the Right Bank High Level Canal in Andhra Pradesh), Nagarjunasagar (Andhra Pradesh), Parambikulam Aliyar (Tamil Nadu), Kakrapar (Gujarat) and Purna and Girna (Maharashtra). The total area to be irrigated by these twelve projects was 6043 thousand hectares against the total potential of 20,900 thousand hectares at the end of 1973-74.

Government of India had given specific loans totalling Rs. 662.71 crores for seven of these projects. An outlay of Rs. 202.17 crores was also earmarked for eight of these projects

by the Planning Commission during the period 1969-70 to 1976-77. The details of the expenditure incurred on the projects and the amounts of Central assistance given are indicated below:

| Name of Project | Total expenditure incurred on the project (up to March 1976) | Amount of specific loan given by Government of India upto 1968-69 | Amount of loans outstanding on 31-3-74 | Outlay earmarked for the projects from 1969-70 to 1976-77 |
|---|---|---|---|---|
| | | | | (Rupees in crores) |
| 1 | 2 | 3 | 4 | 5 |
| 1. Bhakra Nangal . . | 108.10a | 220.43 | 59.40 | 0.48 |
| 2. Chambal . . . | 73.27 | 115.68 | 108.92 | 24.03 |
| 3. Sarda . . . . | 49.05 | — | — | —(a) |
| 4. Kosi . . . . | 143.19 | 71.29 | 46.61 | 48.43 |
| 5. Hirakud . . | 82.08* | 90.72 | 86.40 | 0.40 |
| 6. Mayurakshi . . | 17.16 | 13.70 | — | 0.30 |
| 7. Tungabhadra . . | 97.88 | 3.49 | 3.49 | 36.16 |
| 8. Nagarjunasagar . . | 212.67 | 147.40 | 140.60 | 83.00 |
| 9. Parambikulam Aliyar . | 51.58 | — | — | 9.37 |
| 10. Kakrapar . . . | 17.46 | — | — | —(a) |
| 11. Purna . . . . | 16.92 | — | — | —(a) |
| 12. Girna . . . . | 13.50 | — | — | —(a) |
| | 882.86 | 662.71 | 445.06 | 202.17 |

a. After excluding Rs 29.35 crores allocated to the power portion.

*Includes expenditure on irrigation, power and flood control.

Note.—1 Figures in column 2 relate only to irrigation works or irrigation component of multi-purpose projects.

Note.—2 Amounts in column 3 and 4 cover both irrigation and power components in multi-purpose projects.

(a) For these projects, no outlays were earmarked by the Planning Commission during the Fourth Plan. However, under the pattern of Central assistance in the form of block loans and grants from 1969-70, the expenditure incurred on these projects by the State Governments also formed part of their total expenditure qualifying for the block Central assistance. The total expenditure incurred on these projects from 1969-70 to 1975-76 was Rs 19.95 crores, Sarda Rs 16.27 crores, Kakrapar Rs. 1.65 crores, Purna Rs. 1.60 crores and Girna Rs. 0.43 crores.

In addition, specific assistance was also given in respect of these projects under Centrally sponsored schemes as indicated below :

(Rupees in lakhs)

| Name of the Project | Command Area Development (up to March 1977) | | | Rural Roads and markets (up to March 1976) | Soil and Water management Pilot Projects (up to March 1977) | Soil conservation in the catchment areas (up to March 1977) | | |
|---|---|---|---|---|---|---|---|---|
| | Grants | Loans | Total | Grants | Grants | Grants | Loans | Total |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1. Bhakra Nangal | .. | .. | .. | .. | 15.52 | 592.77 | 231.10 | 823.87 |
| 2. Chambal (Rajasthan) | 390.22 | 50.00 | 440.22 | 134.65 | 14.51 | 97.77 | 97.76 | 195.53 |
| (Madhya Pradesh) | 193.11 | 55.00 | 248.11 | 94.91 | 11.11 | 365.21 | 353.14 | 718.35 |
| 3. Kosi (Bihar) | 441.65 (A) | 50.00 | 491.65 | 159.00 | 10.00 | .. | .. | .. |
| 4. Hirakud (Orissa) | 7.90 | 5.00 | 12.90 | .. | 6.70 | 145.04 | 113.43 | 258.47 |
| 5. Mayurakshi (West Bengal) | 33.37 | 32.50 | 65.87 | .. | .. | 81.33 | 80.85 | 162.18 |
| 6. Tungabhadra (Karnataka) | 114.81 | 125.50 | 240.31 | 222.08 | 12.29 | 142.48 | 144.93 | 287.41 |
| 7. Nagarjunasagar (Andhra Pradesh) | 110.64 | 85.00 | 195.64 | 170.94 | 2.70 | 22.11 | 22.11 | 44.22 |
| 8. Kakrapar (Gujarat) | 245.56 | 226.43 | 471.99 | .. | 11.68 | .. | .. | .. |
| 9. Purna & Girna (Maharashtra) | 259.63 | 111.73 | 371.36 | 100.00 (for Purna) | 19.43<br>13.67 | .. | .. | .. |
| | 1796.89 | 741.16 | 2538.05 | 881.58 | 117.61 | 1446.71 | 1043.32 | 2490.03 |

(A)Includes Rs. 353.09 lakhs on account of subsidy to small and marginal farmers for state tubewells etc.

Notes :

1. Command area development programme

Assistance for this programme was given to the States for the seletced projects; project-wise break-up of assistance in each State was not available.

2. Soil conservation scheme

(i) The figure for Bhakra Nangal includes Central assistance of Rs. 169.47 lakhs to the State of Punjab and Rs. 654.40 lakhs to Himachal Pradesh during the periods 1961-62 to 1966-67 and 1961-62 to 1976-77 respectively.

(ii) In the case of Chambal (Madhya Pradesh) the figure of Rs. 718.35 lakhs comprises Central assistance of Rs. 639.79 lakhs up to 1973-74 for the catchment areas of Chambal, Hirakud and Matatila and Rs. 78.56 lakhs for Chambal only during the years 1974-75 to 1976-77.

(iii) Out of Rs. 44.22 lakhs shown against Nagarjunasagar (Andhra Pradesh), Rs. 42.56 lakhs are for the catchment areas of Nagarjunasagar, Nizamsagar, Pochampad and Machkund and Rs. 1.66 lakhs for Nagarjunasagar alone.

(iv) For the Hirakud catchment area falling in Madhya Pradesh, Central assistance of Rs. 133.24 lakhs was given to Madhya Pradesh Government during the period 1974-75 to 1976-77.

6.03 A brief description of these twelve projects indicating the details of the canal systems and dates of completion is given in Annexure 1.

6.04 The points covered in this Report were referred (May 1977) to Departments of Agriculture and Irrigation in

the Ministry of Agriculture and Irrigation for their comments. The Department of Irrigation stated (July 1977) that irrigation is a State subject and the Central Government's role is purely advisory; the department felt that the proper forum for discussion would be the Public Accounts Committee of the legislatures of the States. Replies from the department to the points raised in this Report were not received (August 1977). The Department of Agriculture furnished their comments on the points relating to the command area development programme and soil conservation schemes and these have been taken into account in finalising the Report.

7.02 It may be seen from the table above that, for the 12 projects taken as a whole, the area irrigated (average for the five year period 1971-72 to 1975-76) was about 64 per cent of the area planned to be irrigated. There were significant variations in the level of utilisation in these projects. In Bhakra Nangal (Haryana and Rajasthan), the area irrigated exceeded what was originally planned to be irrigated. In Hirakud, it was marginally short of the original target. The level of utilisation in the Sarda Canal System, at 77 per cent, and in Mayurakshi, at 75 per cent, was higher than the average for the 12 projects taken together. On the other hand, in the Kosi Project the average utilisation for the five years was only about 18 per cent; it was as low as 11.7 per cent in 1971-72. In five projects, Nagarjunasagar, Parambikulam Aliyar, Purna, Girna and Kakrapar, the extent of utilisation ranged from 30 to 40 per cent of the area planned to be irrigated. In the Chambal project it was higher at about 58 per cent for the Rajasthan portion and 49 per cent for the Madhya Pradesh portion. In Bhakra Nangal (Punjab) and Tungabhadra the performance was near about the overall average of 64 per cent for the twelve projects.

During test check, variations in performance were noticed in the different reaches of the canal system in some projects. In Chambal (Madhya Pradesh), of the two districts, Morena and Bhind, served by the canal system, water did not reach 98 out of 560 villages in Bhind, whereas, in Morena situated in the head reaches of the canal system, only 30 out of 729 villages did not receive water in 1975-76. In the Sarda Canal system, a test check of the major branches in 13 divisions indicated that, as against the system average of about 77 per cent, the branches in the middle and lower reaches of the canal recorded achievements varying from about 45 to 67 per cent; some of the irrigation channels did not receive water for years together. In Bhakra Nangal (Punjab), while the overall performance varied from 64 to 67 per cent, the achievement in some canals of the system was about 55 per cent.

## 8. Factors affecting utilisation

8.01 Specific points relating to under-utilisation of irrigation potential in the projects studied in audit are mentioned in succeeding paragraphs. These have been grouped broadly as below :—

(a) Factors affecting efficiency in water utilisation,
  (i) construction and maintenance of watercourses and field channels,
  (ii) water distribution system,
  (iii) adequacy of control structures,
  (iv) land levelling,
  (v) transmission and distribution losses,
  (vi) maintenance,

(b) Drainage,

(c) Cropping pattern, and

(d) Other factors.

## 9. Efficiency in water utilisation

9.01 **Duty and delta.**—The relationship between the area irrigated and the quantity of water supplied in a project is usually expressed in terms of duty or delta. Duty denotes the number of acres which one cusec of water, flowing continuously between the first watering of a crop at the time of sowing and its last watering before harvesting (known as the base period), could irrigate. Delta is the depth of water required by a crop to come to maturity.

Actual duty is arrived at by dividing the area irrigated by the quantity of water supplied during the base period expressed in cusecs. Actual delta is calculated by dividing the total quantity of water delivered by the area over which it was spread.

Delta or duty is an index of efficiency in use of water for irrigation. If the actual duty is lower than the duty assumed in the project reports, it would be an indication that water is not

perhaps used with the maximum efficiency. Similar would be the pointer where the depth of water actually supplied (delta) is higher than the project assumptions.

The duty or delta as materialised, in recent years, in some of the projects test checked in audit is given in Annexure 2. It may be seen therefrom that, in most cases, the depth of water supplied exceeded, and the area irrigated per cusec fell short of the project assumptions. Some of the factors affecting duty or delta are :—

(i) Watercourses and field channels,

(ii) Water distribution system,

(iii) Control structures for water regulation,

(iv) Land levelling,

(v) Transmission losses,

(vi) Maintenance of the canal system,

(vii) Crop pattern.

The development of the cropping pattern *vis-a-vis* the pattern envisaged in the selected projects is discussed in paragraph 11. The specific points noticed regarding the other factors, as gathered in test check of the selected projects, are discussed below :

### 9.02 **Watercourses and field channels**

An irrigation system usually consists of (a) *main canal* taking off from the source of supply, (b) *branch canals* taking off at different reaches of the main canal, (c) *distributaries* taking off from the branch canals, (d) *minors* taking off from the distributaries and (e) *watercourses* from which fields are irrigated through field channels.

In December 1958, the Planning Commission recommended to the States that project authorities should assume responsibility

for the construction of watercourses at project cost for conveying water to chaks or blocks up to 40 hectares in area. Beyond this, field channels are to be built by cultivators to serve the various fields within the blocks. The responsibility for the maintenance of both the watercourses and field channels was to be that of the beneficiaries. It was also suggested by the Planning Commission that the State Government should have the power, through legislation, to construct field channels and to maintain watercourses and field channels, should the beneficiaries fail to do so themselves, and to recover the cost from the latter. In May 1959, the Planning Commission further recommended that the project authorities should mark out the position of outlets and also the alignment of watercourses and field channels at the time of marking the alignment of distributaries and minors. The cultivators whose areas lie in the command of these outlets were to be given notice to complete the construction of field channels within a specified time.

For the economic use of water, proper alignment, grading, construction and maintenance of watercourses and field channels are of the utmost importance. Absence of a system of conveyance of water through watercourses and field channels has been stressed as one of the reasons for the under-utilisation of irrigation potential. According to the Irrigation Commission (1972), the States were unanimous that the absence of field channels had been a major factor behind the lag in the utilisation of irrigation potential. In the absence of watercourses and field channels, either kutcha channels are built by the farmers or field to field irrigation is practised *i.e.*, irrigation by flooding the fields. This inefficient method of irrigation results in over-irrigation in lower fields and leads to wastage of water.

A test check in audit of selected projects disclosed the following points in regard to watercourses and field channels :

(a) In some projects, there were gaps even in respect of the distribution system the construction of which was

the responsibility of the Government. In the Kosi Project, out of 7927 watercourses taken up for construction under the project, 1448 were not completed to the end of 1975-76. In the Mayurakshi Project, 317 watercourses had been completed by March 1975 against 1000 provided for in the revised estimate (1967) of the project.

In some cases, the water flowing from the outlet into the watercourses was of such volume that it was unmanageable for the cultivators. A test check of a distributary in the Kosi Project showed that 31 out of 76 watercourses constructed had designed discharge of 3 to 5 cusecs as against 2 to 3 cusecs recommended by the Planning Commission. In the Mayurakshi Project, the test check showed that very few distributaries ended at 5 cusecs or less.

(b) In the projects studied in audit, there was legislation enabling Government to construct field channels and recover their cost from the cultivators. No field channel was constructed under the legislative provision in the Kosi, Mayurakshi and Hirakud Projects. The net irrigable area in the Bihar State requiring construction of field channels was assessed at 688 thousand hectares and the cost of construction was estimated at Rs. 2.55 crores. Information pertaining to the Kosi Project was not separately available. It was anticipated (1964) that Government would be in a position to take up the construction in a phased manner and complete it within a period of 5 years or so. No field channel was constructed by Government (June 1977). A provision of Rs. 23.81 lakhs was made in the revised estimate (1967) of the Mayurakshi Project for construction of field channels; no field channel

was constructed by Government (November 1976). In the Hirakud Project, no field channel was constructed (July 1977) by Government under the Orissa Irrigation Act, 1959 and the normal practice of irrigation in vogue was by flooding from field to field.

In the projects other than the three mentioned above, there had been some progress in the construction of field channels by Government but not to the full extent required. In the Chambal Project (Madhya Pradesh), out of the total culturable command area of about 329 thousand hectares, 202.7 thousand hectares had been covered up to March 1977. In the Kakrapar command, field channels had been constructed to cover an area of 115 thousand hectares by the end of June 1976 *i.e.*, about 50 per cent of the command area. In the Sarda Canal System, it was assessed by the project authorities (May 1974) that 24000 kilometres of field channels were required; details of the extent of the actual construction were not furnished by the Chief Engineer. A test check (January 1976) of 13 divisions in the Sarda Canal System showed that out of 1111 thousand hectares of culturable command area, only 273.68 thousand hectares were covered by field channels.

In one project, slow progress in the construction of field channels was attributed to paucity of technical staff, difficulty in construction of the channels due to limited working time available and difficulty in obtaining consent from the cultivators.

(c) Field channels already constructed had to be redone in certain cases. In the Sarda Canal System, an area of about 172 thousand hectares could not get

assured irrigation due to dismantling of existing field channels in the course of land consolidation operations. In the Chambal command (Rajasthan), new watercourses were to be constructed in an area of 50000 hectares under the Command Area Development Programme along the revised alignment of fields on a rational lay-out; 683 hectares had been covered up to March 1977. Work on another 2830 hectares was in progress (June 1977).

(d) As already mentioned, the maintenance of field channels is the responsibility of the cultivators. A few cases were noticed in test check where such maintenance was not done either by the cultivators or by Government subject to recovery of the cost from the cultivators. In the Tungabhadra command (Karnataka), the area in which the field channels were not maintained was assessed by the Chief Engineer (December 1976) at about 41 thousand hectares. In the command of the Tungabhadra Low Level Canal (Andhra Pradesh), no instance was noticed of maintenance work of field channels having been carried out by Government under the provisions of the Andhra Pradesh Irrigation Act, 1965. It may be mentioned that in the Tungabhadra Project (both in Karnataka and Andhra Pradesh), Government, in the interest of speedy development of the ayacut, had borne the expenditure (Rs. 137 lakhs) on the construction of field channels which was normally to be borne by the cultivators.

(e) In the projects where field channels were constructed by Government, recovery of the cost thereof from the cultivators was in arrears. In the Chambal

Project (Rajasthan), Rs. 31.51 lakhs were pending recovery at the end of 1976-77 out of a total expenditure of Rs. 72.48 lakhs incurred on construction of field channels completed in September 1967. In the Madhya Pradesh portion, Rs. 45.31 lakhs were outstanding at the end of March 1976. In the Kakrapar command, an expenditure of about Rs. 445 lakhs was incurred up to end of June 1976; demand statements were reported to have been sent to cultivators for Rs. 13.04 lakhs and about Rs. 3000 actually recovered up to June 1976.

### 9.03 Water distribution system

Distribution of water from irrigation canals is in two stages: up to the outlet stage, which is under the control of Government and beyond the outlet stage, where distribution rests primarily with the cultivators.

Distribution up to the outlet involves turn system or rostering of the canal supplies. Rostering of canal system is particularly important where (a) the demand is in a part of the system and water is to be conveyed to that part only and (b) the demand is on the entire system but the available supply is not enough to meet the demand.

Distribution beyond outlets involves agreement among cultivators. This involves prescribing a certain period of time as rotation period for supply to each cultivator. The main aim of rotation of this water distribution, generally known as warabandi, is to regulate and distribute evenly the available water over the command area of the canal system and ensure saving of water by reducing conveyance losses.

The draft Fifth Five Year Plan emphasised that the distribution system should not be left completely to the initiative of

farmers and that Government should be in a position to enforce an appropriate rostering system of irrigation including night irrigation.

It was observed during test audit that the rotational system of distribution of water in the canal system was introduced only recently in a few projects and did not cover the entire distribution system. In the Chambal command (Madhya Pradesh), it was introduced from the rabi season in 1972-73. In the Tungabhadra Low Level Canal, Andhra Pradesh, the rotational system was introduced from 1976-77; in order to make it effective, Government were considering a proposal to instal control structures at the heads of minors and distributaries (June 1977). In the Kosi command, there was no rotational system of distribution of water below the level of minors as control structures to regulate flow of water were provided only up to the level of minors.

Beyond the outlet stage, the system of warabandi was not generally prevalent. In the Chambal command (Madhya Pradesh), it was introduced for the first time in 1974-75 in the first 60 kilometres of the Right Main Canal; it was practically non-existent in the entire command. In the Chambal (Rajasthan), it was introduced in 1972 and was reported to have been extended to 5948 chaks out of 7471 chaks in the command area between November 1972 and March 1976. In the Sarda Canal system, the Culturable Command Area covered under the warabandi was negligible. Warabandi did not virtually exist in the Kosi, Kakrapar and Tungabhadra Low Level Canal (Andhra Pradesh) projects. Some of the reasons generally attributed for the absence of the warabandi system were lack of co-ordination among the cultivators and absence of regulations requiring cultivators to take water only in turn and inadequate staff for effective enforcement of the system.

9.04 **Control structures**

The Canal system requires adequate control structures at different points so as to minimise loss of water during conveyance. Canal regulators at reasonable intervals help ensure that water flows in the canals only to the extent required for the crops. The size of the outlets has to be adequate in relation to the area required to be irrigated. Regulation of discharge from outlets is facilitated by provision of gates. Ungated outlets lead to wastage of water and excessive supply at the head reaches resulting in short supply at the lower reaches. The points noticed on the adequacy of the control structures in the canal systems of some projects studied in audit are indicated below :

In the Chambal Project, both in Rajasthan and Madhya Pradesh, control structures were found to be insufficient to ensure adequate water at the distributaries and minors when the main canal runs at less than its full capacity. Without such control structures, the canal has necessarily to run at a capacity higher than what is necessary, contributing to water wastage and waterlogging. In Madhya Pradesh, 44 cross regulators were proposed to be installed under the Command Area Development Programme in the project at the estimated cost of Rs. 44.32 lakhs; one regulator had been installed (March 1977). In the Rajasthan portion, 22 head regulators and 135 cross regulators were proposed to be installed at an estimated cost of Rs. 57.55 lakhs under the Command Area Development Programme; eleven head regulators and forty cross regulators had been installed (June 1977).

In the Kosi project, there was no provision for gated outlets and regulated discharge through these outlets with the result that there was excessive drawal of water in the upper reaches. Temporary outlets were reported to have been provided on an

*ad hoc* basis in the initial stages of development of irrigation in the Kosi command area; it was noticed during test check that the combined discharge capacity of watercourses and direct outlets taking off from the minors, as constructed, exceeded the designed discharge of the minors. In the Mayurakshi project, many of the outlets were temporary structures though there was provision in the revised estimates (1953) for permanent outlets. The Central Team on Water Utilisation, which visited the project in October 1975, observed that "a large number of outlets (4,000) taking off from the branch canals are all uncontrolled..... and it is essential to convert these outlets into gated outlets". In the Hirakud project, the number of outlets actually installed was reported to be 18,000 while the revised estimate had envisaged provision of 3,800 outlets. The Study Group of the National Planning Council, in its report (1967), had observed that one consequence of the large number of outlets provided was the high inefficiency in water use. The Central Team on Water Utilisation, which visited the project in January 1976, noted that the location, level and size of outlets provided in the canal required to be reviewed. Only 2,077 outlets were provided (August 1976) with shutters and the other outlets did not have any arrangements for control of water. No such review had been done (July 1977).

In the Chambal command, in Rajasthan as well as in Madhya Pradesh, there was no control over the discharge from the outlets and water flowed through the outlets so long as water was above the level of the outlets. In the Command Area Development Programme provision was made for the construction of 3,000 pucca outlets in Madhya Pradesh with arrangements for controlling the flow of water; 259 such outlets had been constructed (March 1977). In the Rajasthan portion, the number of outlets was to be reduced from 7,000 to 4,000 by 1980 and redesigned suitably; 46 such outlets had been constructed (June 1977).

9.05 **Land levelling**

For optimum agricultural production, it is desirable to have land with a suitable slope so that surplus water drains off promptly with little loss of surface soil. In March 1958, the Committee on Plan Projects (Planning Commission) had observed that, without proper levelling of the land, canal irrigation is likely to result in wastage of water besides contributing to the deterioration of land due to soil erosion.

In almost all the projects seen in audit, there was no indication in the project reports of the extent of land levelling operation to be undertaken for efficient application of irrigation water. Assessments were made in a few projects after the introduction of canal irrigation. In most cases very little progress was made in land levelling. Funds for land levelling were generally provided by the Land Development Banks either out of their own resources or out of funds made available by the Agricultural Refinance and Development Corporation. The operations were left to be undertaken by individual cultivators. The execution of the work was undertaken by Government as an integral part of the Command Area Development Programmes in the Chambal Project (Rajasthan and Madhya Pradesh). The position in the different projects is indicated below :—

In the Kosi Project, about 306 thousand hectares covering about 50 per cent of the original culturable command area needed levelling particularly because the ravages of the Kosi floods made the slopes complex. A scheme for levelling the undulations in 131.23 thousand hectares was drawn up in 1966 for an outlay of Rs. 4.7 crores to be spent during the period 1966-67 to 1970-71. Loans were advanced by the Bihar State Co-operative Land Mortgage Bank for purchase of tractors by cultivators with a minimum holding of 30 acres. The tractors purchased by the cultivators were used mainly for routine agricultural operations like ploughing which were given

precedence over land levelling. There were no means available for getting tractor owners to concentrate on land levelling work only. Ultimately, the scheme was closed in February 1975; the area levelled till then under this scheme was reported to be 16.2 thousand hectares.

In the Parambikulam Aliyar Project, there was no mention of land levelling in the project report but an assessment made in 1964 showed that the land in the entire ayacut required levelling. It was expected that 25 per cent of the area (24.29 thousand hectares) would be reclaimed by cultivators out of their own resources and for reclaiming the remaining area of 72.88 thousand hectares, financial assistance amounting to Rs. 1080 lakhs was proposed to be made available to cultivators through Land Development Banks. Loans amounting to Rs. 629.81 lakhs were reported to have been disbursed for reclaiming an area of 46.25 thousand hectares; area reclaimed up to 30th June, 1976 was reported to be 43.86 thousand hectares.

In the Tungabhadra Project (Left Bank Main Canal, Karnataka), the area covered under land levelling operations by March 1976 (about 127.70 thousand hectares) was 52 per cent of the area localised (243.54 thousand hectares). The Chief Engineer stated (May 1976) that non-development of land over such large areas led to excessive drawal and wastage of water by the cultivators. The reasons for slow development of land in the ayacut, as stated by the Joint Director of Agriculture, Raichur (August 1975) were :—

(i) average individual holding was fairly high (6.07 hectares); but, the lands were heavily encumbered and owners of such lands were not entitled to land improvement loans by Land Development Banks,

(ii) lands belonging to absentee land owners (about 10,121 hectares) were not developed due to lack of interest on the part of the owners,

(iii) lands nearer the villages were developed faster, while those away from the villages were left undeveloped (about 6,072 hectares) due to lack of infrastructure facilities such as roads.

In the Tungabhadra Project (Andhra Pradesh), about 30.20 thousand hectares were reclaimed up to 1965-66; no further loans were granted by the Land Development Banks to the cultivators in the command of the Low Level Canal for reclamation purpose. The technical committee appointed by the State Government in 1974 to examine and suggest measures for speeding development of the dry ayacut observed (December 1974) that 16.19 thousand hectares of medium to heavy black soils could be developed by suitable land shaping and levelling to suit the irrigation technique. The Committee estimated that land shaping with suitable bunding would help in uniform irrigation with better moisture retention thereby achieving improved duty (area irrigated per cusec of water) by about 15 per cent. The Committee recommended that such land shaping with suitable bunding may be implemented in a period of five years. Government accepted the recommendation of the Committee and ordered (December 1976) the Collector, Kurnool district to take appropriate measures.

In the Sarda Canal system, according to the Irrigation Department (November 1976), the facilities for land levelling and land shaping were not available to the cultivators. A test check of 13 divisions (January 1976) in audit showed that 178.1 thousand hectares of land could not be irrigated due to undulating topography.

In the command areas of the Chambal Project in Rajasthan and Madhya Pradesh, land levelling operations were undertaken as an integral part of on-farm development works under programmes for command area development. In Rajasthan, an area of 50 thousand hectares of on-farm development work

was to be completed at cultivators' cost by June 1980; out of this, an area of 683 hectares was reported to have been covered up to March 1977. In Madhya Pradesh, about 12 thousand hectares of land were set apart under the Command Area Development Programme for being completed over a period of 3 years; out of this, 774 hectares were covered up to the end of March 1977. In Madhya Pradesh, the slow progress was reported to be due to, among other reasons, difficulties in obtaining consent of cultivators for consolidation of holdings, the short working season available and need to co-ordinate the activities of many departments *e.g.* Agriculture, Irrigation, Land Settlement and Revenue. An Ordinance was promulgated in July 1975 (replaced by an Act in September 1975) to enable the State Government to take possession of lands temporarily on payment of compensation so as to have a longer working season for land levelling.

9.06 **Transmission losses**

No recent measurements of transmission losses in the canal system were available in many cases. The available data disclosed losses higher than what was assumed in the project reports. The results of test check in audit are given below :—

*Tungabhadra Right Bank Low Level Canal (Andhra Pradesh)*

As stated in the project report, transmission losses in the canal would depend upon the type of soil and the wetted perimeter. In July 1953, the then Government of Madras had estimated transmission loss at 431 cusecs for a total discharge of 1800 cusecs of water in the Low Level Canal over its entire length. In February 1967, the Tungabhadra Board* anticipated

*The Tungabhadra Board was formed in October 1953 by Government of India under Section 66 of Andhra State Act, 1953 to deal with all matters relating to the Tungabhadra Project which were common to both the States of Andhra and Mysore. The Board consists of a Chairman appointed by Government of India and two members representing the Governments of Andhra Pradesh and Karnataka. The expenditure incurred by the Board is apportioned between the two States in mutually agreed proportions.

the loss in the canal up to kilometre 249, that is within the jurisdiction of the Board, at 335 cusecs. In respect of the remaining portion of the canal in the Andhra area, the Public Works Department arrived at a transmission loss of 72 cusecs. From the records maintained by the Tungabhadra Board, against the anticipated loss of 335 cusecs, the actual loss ranged between 110 cusecs and 668 cusecs as observed during the period January 1972 to March 1975. In July 1976, the Tungabhadra Board stated that the increased transmission losses were mostly due to pipings and breaches in the canal. No record of actual transmission loss in the Andhra Pradesh stretch of the canal was maintained by the Andhra Pradesh Public Works Department.

*Tungabhadra (Karnataka)*

The evaporation and transmission loss between the canal head and distributary heads was 15 per cent, as assumed in the project estimates for the Left Bank Main Canal (lined); on the Right Bank, the loss was assumed at 10 per cent for the lined High Level Canal and 25 per cent for the unlined Low Level Canal. The Karnataka Engineering Research Station, Krishnarajasagar was entrusted with the task of gauging the transmission losses; its report was awaited (May 1977). Provision was made in the revised estimates of the distribution system under all the three major canals for lining the major distributaries (capacity 50 cusecs and above) at a total cost of about Rs. 10 crores; the estimates had not been approved by Government (July 1977).

*Chambal (Madhya Pradesh)*

In the project report, losses in transmission from canal head to outlet were assumed as 6 cusecs per million square feet of wetted perimeter in earthen reaches. On this basis, total losses in transmission were worked out by the department as

33 per cent (main canal 9 per cent, branches 8 per cent, distributaries 7 per cent and minors 9 per cent). In addition, 10 per cent loss was assumed in watercourses. According to the note submitted by the Superintending Engineer, Chambal Project Circle for the 96th meeting (October 1971) of the Chambal Control Board*, actual losses found out by observations were 8 cusecs per million square feet working out to 44 per cent.

Studies of transmission losses made at the time of preparation of the Command Area Development Programme (February 1974) showed that the losses were 8 cusecs in the Right Main Canal and 10 cusecs in certain distributaries and minors per million square feet. The losses in watercourses were found by the department to be 25 to 37 per cent as against 10 per cent assumed in the project report.

*Chambal (Rajasthan)*

In the project report, transmission losses were envisaged at the rate of 2 cusecs and 6 cusecs per million square feet of wetted perimeter in the lined and unlined reaches respectively. On this basis, transmission losses were worked out by the department at 25 per cent from canal head to outlets.

The Superintending Engineer (Canals) got the losses in the Right Main Canal system checked in 1969 and noticed a total loss of 31 per cent (Main Canal 7 per cent, branches 8 per cent, distributaries 7 per cent and minors 9 per cent). The Central Water and Power Commission measured the actual losses in the Right Main Canal over a length of about 123 kilometers in 1970 and noticed a loss of 646 cusecs, *i.e.*, 11.6 per cent of the

*Chambal Control Board was constituted in 1955 with the Union Minister for Irrigation and Power as Chairman and representatives of the two participating States and the Central Water and Power Commission. The decisions taken by the Board on policy and financial matters regarding the execution of the Project were to be implemented by both the States. From September 1973, the co-ordination of work is being looked after by a new Board, namely the Madhya Pradesh—Rajasthan Inter-State Control Board, consisting of the representatives of the two States and respective State Electricity Boards.

discharge at the head against 7 per cent in the Main Canal as worked out by the Superintending Engineer (Canals) in 1969.

The figures of losses, as assessed in 1974, on the basis of findings of the team deputed under the United Nations Development Programme, were as follows :—

| | |
|---|---|
| (i) Canal system | 25.0 per cent |
| (ii) Watercourses | 22.5 per cent |
| (iii) Field losses | 21.5 per cent |
| Total losses : | 69.0 per cent |

The nature of soil and filling was reported to be one of the main reasons for seepage losses occurring in the Right Main Canal. The problem of seepage losses existed also in the Left Main Canal, especially in the Bundi Branch which passes through fissured rocky strata. In this branch, losses from the head to tail in the length of 64 kilometres were estimated by the department in 1972 at about 50 per cent.

Among the measures taken to reduce loss of water by seepage, which also incidentally created waterlogging conditions in the adjoining areas, lining had been done over a length of 18.95 kilometres (12.85 kilometres in the Right Main Canal and 6.10 kilometres in the Left Main Canal) up to 31st March, 1974. Under the Command Area Development Programme, lining of another 21 kilometres (estimated cost Rs. 368.82 lakhs) was to be done; lining of 8.06 kilometres (0.40 kilometre in the Right Main Canal and 7.66 kilometres in the Left Main Canal) was done up to end of March 1977. Lining of another 2.67 kilometres was completed during April to June 1977.

*Girna (Maharashtra)*

The project report had estimated transmission losses for the rabi and hot-weather season at 16 per cent and 25 per cent respectively for the Jamda Left Bank Canal (JLBC)

(56 kilometres), and the Jamda Right Bank Canal (JRBC) (32 kilometres); for the Lower Girna Canal (LGC), the losses were estimated at 3.4 per cent in both the seasons. According to information furnished by the Executive Engineer, the actual losses in the canals were as under :

| Year / Season | Project assumption | | | Actual | | |
|---|---|---|---|---|---|---|
| | JLBC | JRBC | LGC | JLBC | JRBC | LGC |
| | | | | (Percentage of loss) | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1973-74 Rabi . . | 16 | 16 | 3.4 | 12 | 12 | 12 |
| Hot-weather . . | 25 | 25 | 3.4 | 36 | 7 | 36 |
| 1974-75 Rabi . . | 16 | 16 | 3.4 | 20 | 19 | 16 |
| Hot-weather . . | 25 | 25 | 3.4 | 30 | 19 | 35 |

The reasons for heavy transmission losses in the Lower Girna Canal, which is a lined canal, were awaited from the Department (June 1977).

*Purna (Maharashtra)*

Requirement of water (26760 million cubic feet) was assessed assuming a transmission loss of 10 per cent of water before it reaches the outlets. No record was available with the irrigation division concerned to show the actual transmission losses. The division, however, stated (August 1976) that losses of 20 to 30 per cent in kharif season, 30 to 40 per cent in rabi season and 40 to 50 per cent in hot-weather season were taken into account while actually releasing water for irrigation; on an average, the losses were reckoned as 40 per cent by the division.

*Mayurakshi (West Bengal)*

The project report did not take into account any transmission loss in the canal system. It took into account loss in transit from the reservoir (Canada dam) to the Mayurakshi barrage,

the percentages for kharif and rabi being 10 and 25 respectively. The extent of actual transit loss was not ascertainable (August 1977).

The Review Committee of the State Government (August 1975) estimated the quantity of water lost through seepages and leakages in canals to be 25 to 30 per cent of the total quantity of water released. The Committee observed that losses due to seepages were high in semi-pervious layers underlying the upper soil horizon, in terrain with lighter types of soils and where the canals have been constructed by earth filling.

The Committee suggested lining of the wetted perimeter of the canals in selected areas. Lining of the canals was taken up and an expenditure of Rs. 90.81 lakhs was incurred to the end of March 1977.

*Hirakud (Orissa)*

The original project report (1947) estimated the loss of water in transmission at 15 per cent. The revised estimates (1953) assumed it at 20 per cent. The State Irrigation Centre, Chakuli estimated (1973) the loss at 45 per cent in channels (17 per cent from the main canal, 8 per cent from the distributaries and 20 per cent in the fields). It was estimated in 1973 by the project authorities that, by lining of the channels in vulnerable reaches and construction of control structures, an additional area of 10.86 thousand hectares could be brought under the rabi crops by reducing the percolation loss.

9.07 **Maintenance**

The expenditure on maintenance in 1975-76 varied from project to project, from Rs. 14.50 per hectare of area irrigated in the Bhakra Nangal Project (Haryana) to Rs. 89.90 per hectare in the Parambikulam Aliyar Project. The funds allotted for maintenance were invariably less than the requirement

assessed by the Project Authorities *vide* a few examples given below :—

| Name of the Project | Requirement of funds assessed by the Project Authorities for 1975-76 | Funds allotted |
|---|---|---|
| 1 | 2 | 3 |
| | (in lakhs of rupees) | |
| Chambal (Madhya Pradesh) . . | 64.29 | 40.30 |
| Chambal (Rajasthan) . . . . | 80.75 | 63.40 |
| Mayurakshi . . . . . | 47.17 | 35.60 |

In the Sarda Canal system, the funds allotted were to the extent of about 50 per cent of funds assessed as required. The Central Team on Water Utilisation had noted (January 1976) the scope for improvement in the maintenance of the Hirakud canal system which suffered from paucity of funds. The Team had observed that in view of the intensive double cropping and near continuous operation of the canal system, a provision of Rs. 25 per hectare of the irrigated area would appear reasonable for the Hirakud Project; the actual expenditure per hectare on maintenance on this project was Rs. 13.31 in 1975-76.

The reduced allocation for maintenance had to be used not only for the maintenance of the dam and the canals but also to meet the expenditure on items like maintenance of colonies and service roads and maintenance of vehicles. In the Hirakud Project, the roads along the canal meant for inspection of the canal system were opened to the public for traffic; as these roads were not meant for heavy traffic, their condition deteriorated necessitating expenditure on repairs from the maintenance grant. In the Chambal Project (Madhya Pradesh), commission to Irrigation Panchayats for collection of revenue was to be paid from the funds allotted for maintenance.

The project authorities in many cases reported that certain essential items of work could not be executed due to paucity of funds. In one case, the maintenance work was reported to have been attended to on a selective basis with due regard to the urgency or importance of the works. The following were some of the items of maintenance which could not be carried out :—

(i) Strengthening the banks of the canal and distributaries in the vulnerable reaches (Chambal, Madhya Pradesh and Tungabhadra Right Bank Low Level Canal, Andhra Pradesh).

(ii) Clearance of silt in the canal system (Kosi, Hirakud, Mayurakshi, Kakrapar and Tungabhadra Right Bank Low Level Canal, Andhra Pradesh).

(iii) Maintenance of structures to the required standards (Tungabhadra Right Bank Low Level Canal, Andhra Pradesh and Hirakud).

Silt clearance was a major problem of maintenance in the Kosi Project. A silt ejector was installed in the Eastern Main Canal in May 1971 (cost : Rs. 37.43 lakhs). An expenditure of about Rs. 173.33 lakhs had been incurred on desilting the canal system during the eight years ending 1974-75. Due to the siltation, the carrying capacity of the canal sections was reduced to about 60 per cent (September 1976). The Kosi Irrigation Committee, set up by the State Government, had observed (1975) that due to inherent problems of siltation, heavy rainfall in the area and the predominantly sandy nature of the terrain, more funds would be required for proper maintenance than in other existing canal systems in the State.

According to the Divisional Officers, there was accumulation of silt in many minors and sub-minors in the Kakrapar Project due to which their capacities were reduced by 10 to 30 per cent. The actual discharge in the main canal and branch canals in

the Mayurakshi Project was less than the designed discharge at certain points by 19 to 41 per cent, generally due to formation of gully, siltation in beds and insufficient section of canal banks

The programmes under execution (March 1977) by the Command Area Development Authority, Chambal (Rajasthan) included Rs. 39.90 lakhs for rectification of past maintenance deficiencies.

In most of the projects test checked in audit there was no provision for maintenance of drains. The drains constructed under the pilot drainage schemes had become ineffective due to heavy siltation and weed growth in the Chambal Command in Madhya Pradesh. It was estimated (September 1976) by the Superintending Engineer, Lower Chambal Circle, Madhya Pradesh that Rs. 3 lakhs would be required annually for maintaining the drains constructed under the pilot scheme; there was no provision for maintenance of these drains in the funds allotted. Similarly, nearly 80 per cent of the reclaimed area of about 6,000 hectares got damaged again due to non-maintenance of the completed drains in the Chambal Command in Rajasthan; a sum of Rs. 1 lakh was provided for maintenance of drains in each of the years 1974-75, 1975-76 and 1976-77 against which the actual expenditure was Rs. 0.50 lakh, Rs. 0.60 lakh and Rs. 0.63 lakh respectively.

The period during which the canals were closed for maintenance was not adequate in all cases. In the Mayurakshi Project, the summer irrigation (Boro Paddy) reduced the time available for maintenance as the Boro season extended up to the middle of May or even later. The Central Team on Water Utilisation had observed (October 1975) that by cutting out the Boro Paddy cultivation from the canal supplies, a longer period would be available for maintenance and the works of desilting and repairs in the canal could be attended to. Boro irrigation was allowed under the project from 1969; the area

under Boro cultivation was about 9,000 hectares in 1975-76. In the Kakrapar Command, it was noticed from the divisional records that due to spread of perennial crops throughout the command area it was not possible to keep the canals closed for longer periods, thus leaving little time for repairs and remodelling of canals.

It was noticed during test check in audit that certain items of work which did not involve heavy expenditure but were essential for the proper maintenance of the canal system had not been executed.

To ensure effective control and regulation of the supply of water from the canals and distributaries to the fields according to the requirements, it is necessary to provide a good communication system to the staff operating the regulators. The Mayurakshi Project did not have adequate telephone facilities. Out of 32 section offices under the Mayurakshi Headquarters and the South Canal Divisions, only 9 had telephone connections. No telephone facilities existed at the regulator points. The inadequacy of telephone facilities had been referred to by the State Government's Review Committee in its report of August 1975.

In the Kakrapar Command, an estimate of Rs. 6.11 lakhs was sanctioned in November 1964 to repair the under-sluice gates in the left bank weir and to make these gates electrically operated. The work was incomplete (June 1977) due to non-availability of sufficient power; five gates remained perpetually closed and one gate was partially opened. The matter regarding supply of power was reported (September 1976) to be under correspondence with the Gujarat Electricity Board. These under-sluice gates were intended for flushing out silt which otherwise would accumulate near the left bank head regulator and pass through the left bank canal.

## 10. Drainage

10.01 An important aspect of water management is the removal of superfluous water from irrigated land through a properly designed drainage system to help satisfactory growth of crops. Some of the important points noticed in this connection during test check of selected projects are mentioned below.

10.02 In almost all the projects, there was no provision for drainage schemes in the original project report. After the introduction of canal irrigation, progressive rise in the water table was observed in many command areas. In the Chambal Project (Rajasthan), out of the culturable command area of 373 thousand hectares, the waterlogged area *i.e.* area with water table 0 to 5 feet below the ground level increased from 12 thousand hectares in October 1963 (post-monsoon) to 47 thousand hectares in October 1971; the area with water table 5 to 10 feet below the ground also increased during this period from 55 thousand hectares to 115 thousand hectares. In the command of the Chambal in Madhya Pradesh also, there was a progressive increase in waterlogged area, from about 11 thousand hectares in October 1967 to 20 thousand hectares in October 1969 and about 33 thousand hectares in October 1971; the waterlogged area constituted about 8 per cent of the culturable command area in October 1971. In the Kosi Command, an area of about 124 thousand hectares out of a culturable command area of about 639 thousand hectares of the Eastern Kosi Canal System was assessed (February 1975) to be suffering from accumulation of water. In the Kakrapar Command, the area with water table 0 to 3 metres (pre-monsoon) was reported to have increased from about 6.84 thousand hectares in 1971 to about 221.64 thousand hectares in 1976. In the Tungabhadra Command (Karnataka), an investigation completed in 1973 showed that about 7 thousand hectares were affected by waterlogging.

10.03 Some of the factors contributing to waterlogging in the projects were generally found to be excessive and unrestricted irrigation in the fields resulting in percolation of water, seepage through canal sides and bed, obstruction of natural drainages through construction of tanks in the villages, encroachment by cultivators of natural drains and clogging of drains due to weeds and silt.

10.04 Though the problem of waterlogging and drainage manifested itself in the projects on introduction of irrigation and showed a progressive worsening, no timely steps appeared to have been taken to tackle the problem. A drainage and investigation circle was set up in the Kosi Project only in 1971-72. An investigation division was formed in the Tungabhadra Command (Karnataka) in 1971-72; the proposal of the Chief Engineer for the formation of a drainage division to take up execution of the drainage works was awaiting sanction of Government (July 1977). In the Kakrapar Command, two drainage divisions were sanctioned by Government in January 1972. It was only in the case of Chambal Project (Madhya Pradesh and Rajasthan) that a comprehensive plan to provide drainage was under execution as part of the command area programme. A drainage scheme was prepared by the Kosi Project authorities in February 1975 at an estimated cost of Rs. 40 crores as part of the revised project estimate which was under consideration in consultation with Government of India (June 1977). In the Kakrapar Project, a master plan for drainage was prepared by the project authorities in December 1972 to cover about 164 thousand hectares in the Ukai-kakrapar command area at an estimated cost of about Rs. 19.73 crores; this plan was to be implemented in a period of 10 years. At the instance of the State Government (April 1976), the proposal was re-examined by the project authorities with a view to reducing the cost. The reduced estimate of Rs. 14.04 crores for the Kakrapar Command area submitted to Government in January 1977 was still under

consideration (June 1977). In the Tungabhadra Command (Karnataka), the proposal of the Chief Engineer for Rs. 226 lakhs towards drainage and other improvements of the Canal System was reported to be awaiting Government's approval (July 1977).

10.05 Even in respect of the Chambal Project where a master plan was under execution, the progress did not appear to be appreciable. In Rajasthan, the Command Area Development Authority had programmed to provide drains for an area of 167 thousand hectares within a period of 6 years commencing from July 1974 at an estimated cost of Rs. 992.25 lakhs; drains had been constructed for an area of 35 thousand hectares up to June 1977. In Madhya Pradesh, programme under the Command Area Development envisaged that 105 kms. of natural drains and 578 kms. of seepage interceptor drains would be constructed within a period of three years from June 1975 at an estimated cost of Rs. 143 lakhs to benefit an area of about 40 thousand hectares; about 45 kilometres of natural drains and 284 kms. of seepage interceptor drains were reported to be completed upto March 1977.

10.06 It was noticed in audit that even the drains constructed, mostly under individual schemes pending sanction and execution of master plan, suffered from lack of proper maintenance. As pointed out in paragraph 9.07 dealing with maintenance, nearly 80 per cent of the reclaimed area of 6 thousand hectares in the Chambal Command (Rajasthan) was damaged again due to non-maintenance of completed drains. The Central Team on Water Utilisation observed (February 1976) that natural drains in the Tungabhadra Command (Karnataka) had become weed-infested and silted. In the Sarda Canal System, the existing drains were inadequate for draining out water due to insufficient capacity, silting and poor outfalls, according to the Irrigation Department.

10.07 Lack of timely and adequate measures to tackle the waterlogging and drainage problems had its effect on utilisation of the irrigation potential created as observed in the test check of the selected projects. One per cent of the culturable command area in the Chambal Command (Rajasthan) was reported to be going out of cultivation every year on account of waterlogging. In the Chambal Command (Madhya Pradesh), areas of culturable land in a strip of 150 metres from the Right Main Canal, from Sheopur to Sabalgarh, were reported to have developed salinity and gone out of cultivation or were giving low yields. A test check of 13 divisions in the Sarda Canal System showed (January 1976) that 64 thousand hectares of low lying land in Bareilly, Shahjahanpur, Kheri, Hardoi, Sitapur, Lucknow, Rae-Bareli, Unnao and Jaunpur districts remained waterlogged and could not be cultivated.

## 11. Cropping pattern

11.01 Cropping pattern denotes the area under different crops in the cultivable command of a project. The pattern of cropping in rainfed areas is dictated largely by the climate, extent and distribution of rainfall; the choice of crops under rainfed condition is somewhat restricted. Irrigation affords some scope for determining a cropping pattern to suit the needs of a particular area. The project reports of irrigation projects generally indicate the cropping pattern to be achieved in the command area. Prescription of a suitable cropping pattern and adherence to it are essential for optimum utilisation of the irrigation potential created. In most of the projects, the prescribed cropping pattern is to be realised through agricultural extension services; the farmers are generally free to choose the crops and no compulsion is involved in the cropping pattern. The position is different in the irrigation projects in the South where Governmental involvement in the cropping pattern is more specific and direct. The entire command area in these

projects is demarcated and specific areas are earmarked for specific crops in what is known as localisation of the ayacut. Deviations from the localised cropping pattern constitute unauthorised irrigation and attract penalties.

11.02 The crop-wise details of area irrigated in the selected projects are given in Annexure 3. A comparative study made in audit of the area irrigated crop-wise and the prescribed cropping pattern in these projects disclosed the following points.

11.03 Detailed cropping pattern had not been prescribed in the original project reports in some cases. The Mayurakshi Project Report merely indicated rabi irrigation at 20 per cent of the area under kharif without specifying the crops. The cropping pattern for rabi in the Chambal Project Report (Madhya Pradesh) mentioned only wheat.

11.04 The actual cropping pattern which emerged in different command areas was substantially different from the cropping pattern as envisaged in the project reports or modified subsequently from time to time.

In the Kosi Project, the average area irrigated in rabi during the 5 year period 1971-72 to 1975-76 was about 18 per cent of the area to be irrigated while the area irrigated in kharif was about 25 per cent of the targeted area; there was no hot-weather crop as envisaged in the project report. In the Chambal Project (Rajasthan and Madhya Pradesh), rabi irrigation was comparatively more developed. In the command area in Rajasthan, the average irrigated area in kharif during the 5 year period 1971-72 to 1975-76 was about 28 per cent of the area to be irrigated, the corresponding figure for rabi being 70. Kharif irrigation had developed in the Chambal command (Madhya Pradesh) only to the extent of about 11 per cent as against 66 per cent in rabi. Rabi irrigation fared worse than kharif in the Mayurakshi Project accounting for 31 per cent as

against 83 per cent in kharif on the basis of the average area irrigated during the 5 year period 1971-72 to 1975-76.

11.05 Deviations from the prescribed cropping pattern were noticed even in the Southern projects, where Government is supposed to exercise a direct control over the prescription and enforcement of the cropping pattern. In the Parambikulam Aliyar, Tungabhadra (Andhra Pradesh and Karnataka) and Nagarjunasagar projects, the irrigated area under wet crops (paddy) exceeded the area localised for such crops, while the area under dry crops was short of the area earmarked for such crops. As wet crops consume comparatively more water than dry crops, the distortion in favour of wet crops tended to reduce the overall area irrigated.

In the Parambikulam Project, the area under wet crops was 24.9 thousand hectares against the planned area of 11.4 thousand hectares while the area under dry crops was only 16.8 thousand hectares against the targeted area of 61.4 thousand hectares in 1975-76. In the Tungabhadra Project (Right Bank Low Level Canal, Andhra Pradesh) the area irrigated under wet crops in 1974-75 was 19.8 thousand hectares against 16.6 thousand hectares localised whereas the irrigated dry crops accounted for only 20.7 thousand hectares against the localised area of 43.4 thousand hectares.

The steps taken to curb unauthorised irrigation for wet crops did not prove to be effective. The penalties levied for unauthorised irrigation were mostly waived under general orders and did not serve as deterrent. In the Parambikulam Project, penalties levied (Rs. 48 lakhs) up to 1970-71 were waived by the State Government taking into account several representations received from the farmers ; details of penalties levied or waived for the subsequent period were awaited, from the Collector, Coimbatore (May 1977). In the Tungabhadra Project (Right Bank Low Level Canal, Andhra Pradesh), against a

penalty of Rs. 12 lakhs levied up to 1974-75, Rs. 6.33 lakhs were waived by the State Government and proposals for waiver of Rs. 3.75 lakhs were reported to be under consideration (June 1977). In the Nagarjunasagar Project, a sum of Rs. 10.08 crores was waived out of the total penalty of Rs. 10.96 crores levied up to 1975-76.

11.06 The closure of the canal system and scheduling of release of water were not always conducive to the achievement of the prescribed cropping pattern.

One of the reasons for non-development of acreage under rabi crops in the Kosi Project was the long period taken up in the cultivation of kharif paddy; the kharif paddy fields were not free till the middle or end of December by which time it was late for wheat cultivation. The period of kharif paddy cultivation could be reduced by replacing the traditional varieties of paddy with high yielding varieties. High yielding varieties of paddy required early release of water in the canal system. This, however, was not possible as the main canal was normally opened for irrigation in late June or July during the last few years.

A substantial part of the cropping pattern envisaged did not develop in the Kosi Project due to non-running of the canal during the required period. The prescribed cropping pattern envisaged irrigation of 187 thousand hectares in hot weather. There was no hot-weather irrigation from the project during the last three years ending 1975-76. The Kosi Irrigation Committee (Mandal Committee), appointed by the State Government, observed (March 1975) in this connection—

> "Due to inherent problem of siltation, higher rainfall in the area, predominantly sandy nature of the soil, more maintenance work is required in the canal. It will not be possible to run the canal system for all the three crop seasons, namely, kharif, rabi and

hot weather. Due to high sub-soil water level and its tendency to rise further in a larger part of the command area, it is also not advisable to run the canal for all the three crop seasons. Therefore, the canal system may run for kharif and rabi irrigation only. The intensity of irrigation will thus reduce from 115 per cent and 121.5 per cent for Eastern Kosi Canal and Rajpur Canal respectively to 85 per cent".

Non-development of kharif paddy in the Chambal Project (Madhya Pradesh and Rajasthan) was mainly due to lack of water in summer months due to the closure of the canal, as explained by the Project Authorities. As the canal was normally closed up to the middle of June and, in some years up to the end of June, water could not be made available in time for preparation of fields.

The Joint Director of Agriculture, Raichur, informed Audit (August 1975) that the period of water supply for irrigation laid down in the Tungabhadra Project Report (15th July to 15th December) for the Right Bank High Level Canal (Karnataka) was not suited either for kharif or for rabi season. The period is too late for sowing remunerative and high-yielding varieties like hybrid jowar and bajra, hybrid jowar sown late in July is likely to be affected by shootfly and hybrid bajra by ergot disease. The period is also not suited for cotton since water is required by that crop till the end of February. Studies made under a Pilot Project Scheme (1969--1974), Bellary, showed that the latest date for sowing kharif crops is 25th June and that the yield from crops sown beyond that date is low and uneconomical. The Chief Engineer informed Audit in December 1976 that there was no proposal to change the irrigation season as supply of water in the canal was subject to the storage level in the reservoir in the middle of July. He was of the

opinion that it was for the Agriculture Department to propagate, through research and extension work, the crops that could be advantageously grown during the approved irrigation season (15th July to 15th December).

11.07 The cropping pattern which had emerged seemed largely to be the result of the farmers' choice of crops. According to the report sent by the Collector of Coimbatore to Government (September 1972), the preference of the cultivators in the Parambikulam Command Area for cultivation of paddy was due to usefulness of the crop for family consumption, easier regulation of water in the fields, simpler cultivation practices, easy marketability and the impression in the minds of the farmers that the canal water was suitable only for paddy cultivation. The demonstration farms set up to persuade the cultivators to switch over to dry cultivation did not have any impact and the running of the farms was discontinued in April 1974. In the Tungabhadra Project (Andhra Pradesh), groundnut accounted for 40 per cent of the area in the cropping pattern. The Central Team on Utilisation of Water observed (October 1975) that groundnut, with a comparatively heavy consumption of water among rabi crops, was not suitable for cultivation in the red soil. The Chief Engineer agreed with the Team's observation but stated that groundnut cultivation was high yielding and there was no other dry crop which would fetch better income to the cultivators in that area.

Certain crops included in the cropping pattern did not pick up at all. As against 14.2 thousand hectares envisaged under cotton in the original project report (1954), 31.2 thousand hectares in the revised pattern (1963), and 12.1 thousand hectares proposed in the Command Area Development Programme, the actual area irrigated was practically nil in the Chambal Project (Madhya Pradesh). The Agriculture Department had not evolved (March 1976) a variety of cotton suitable for the soil.

In the Kakrapar Project, except for perennial crops like sugarcane, there was considerable short-fall in the area irrigated under other crops. The Programme Evaluation Organisation of the Planning Commission had pointed out as early as 1966 that the real problem in the Kakrapar Project was the cropping pattern. The Committee of Ministers on under-utilisation of irrigation potential in the various projects including the Kakrapar had also reported in June 1973 that

(a) owing to well-distributed rainfall in the Kakrapar command area, demand for irrigation water for existing varieties of jowar and cotton was negligible and traditional varieties of these crops required to be replaced by improved varieties requiring irrigation and

(b) there was meagre demand for irrigation of paddy in such areas of the command where rainfall was heavy and, therefore, there was need for growing finer varieties of paddy requiring irrigation water.

During the three years ending 1975-76, there were no areas under pulses and oil seeds, rabi paddy, hybrid maize and fodder; the areas irrigated were much less than the area envisaged in the cropping pattern in respect of cotton, jowar and wheat.

11.08 Lack of field channels inhibited the development of a diversified cropping pattern. In the Hirakud Project, almost the entire area in kharif and 95.8 per cent of the area under irrigation in rabi was accounted for by paddy though the prescribed cropping pattern envisaged a mixture of paddy, wheat and other crops in rabi. The Central Team on Water Utilisation observed (January 1976) that field to field irrigation, in the absence of field channels, prevented diversification of crops under which many crops could be grown with relatively less water and the total irrigated area increased.

11.09 In many cases, the need to change the prescribed cropping pattern was recognised; revision of the cropping patterns was pending. In the Tungabhadra Project (Andhra Pradesh), a Technical Committee appointed by the State Government suggested (December 1974) cultivation of irrigated dry crops like cotton and chillies from August to November instead of during December to April in the prescribed pattern. The decision of Government on this suggestion was awaited (June 1977).

In the Tungabhadra Project (Left Bank Canal, Karnataka), the existing system envisaged mixed cropping pattern. Under each distributary and outlet, part of the area was localised as wet/perennial, part as dry-*cum*-wet (light irrigated dry) and some part was totally left out by localisation. A Technical Committee on re-localisation appointed by the State Government in 1973 recommended (December 1976) a new localisation pattern; it suggested, among other things, introduction of a block system of irrigation so that each outlet may have only one type of crop *i.e.*, perennial or irrigated dry which would be conducive to better water management. The decision of the State Government on re-localisation was awaited (January 1977).

Government of India suggested to the State Government (March 1977) formation of a committee to evolve a suitable cropping pattern for the Nagarjunasagar command area. The State Government accordingly constituted (May 1977) two special teams—one for the Jawahar Canal Command area and the other for the Lal Bahadur Canal Command area. The teams were required to send their reports to Government within three months.

The Review Committee on the Mayurakshi Project appointed by the State Government, observed (August 1975) that with the quantity of available water, rabi irrigation could be extended to at least 120 thousand hectares (as against 48.56

thousand hectares envisaged in the Project Report and 12.95 thousand hectares irrigated in 1974-75) with "a judicious crop pattern and better water management". The Committee suggested a cropping pattern for rabi; orders of Government on this pattern were not available (June 1977). The Joint Director of Agriculture (Research) stated (June 1976): "Rice in kharif followed by wheat in rabi or boro rice are most profitable cropping pattern in any irrigated area and the same is being followed in the Mayurakshi command area. These are established facts and no further research on this aspect is felt necessary".

In respect of the Girna Project, the State Government stated (July 1976) that introduction of a block system, under which specified crops are to be grown in blocks, was under consideration. In the Purna Project, Government had issued orders in January 1968 introducing a block system of irrigation with assured supply of water for each block. In August 1976, Government informed Audit that the block system in the Purna command had not yet been introduced as priority was given to food crops in irrigation projects and that modification in the irrigation management of the project was also under consideration.

### 11.10 Agricultural production and yield

It was not possible to obtain, from the concerned State Government departments, data regarding agricultural production pertaining to the command areas. Such data, as were available, were for the revenue districts as a whole in most cases. In Tungabhadra (Andhra Pradesh), the Department of Agriculture stated that it was not maintaining any records to indicate the areas grown under each crop and yield per acre in respect of the command area; the Bureau of Economic Statistics stated that the crop estimation surveys conducted by them were designed to estimate the production of principal crops only for

the whole district and no special investigations or studies were conducted for the command area of the Tungabhadra Project. Similar was the position for the Nagarjunasagar command. In the Mayurakshi Project, information on the crops grown, the average yield per hectare for such crops in the command area, separately in irrigated and non-irrigated area, prior to and after the introduction of irrigation could not be furnished either by the Agriculture Directorate or the District Agriculture Officer (March 1977).

In a few projects special studies were undertaken by the departmental authorities on the argicultural production in the command area. In the Sarda Canal System it was noticed that development of double cropping was not satisfactory; the area under double crop in 1973-74 was 9.49 per cent of the total irrigated area. This was attributed to lack of sufficient and timely supply of irrigation water in the command area. The crop data collected by the Revenue Department in the project also showed that the yield of paddy per hectare in the Canal irrigated sector was much less than the yield in the non-canal irrigated sector; in the case of wheat the yield per hectare in the canal irrigated sector was marginally higher than in non-canal sector. No separate data were available for the Kosi command but studies made (1976) by the Directorate of Statistics showed that, while there was a steady improvement in wheat yield, the performance was uneven over the years in respect of kharif rice, varying from 2.9 quintals per hectare to 8.4 quintals per hectare. In the Girna project, no significant changes appear to have occurred in the cropping pattern after introduction of irrigation. In the Purna Project, according to an assessment made in 1969, the value of agricultural production in the command, after full introduction of irrigation, was expected to be about Rs. 16 crores; actual production, as ascertained from the Command Area Development Authority, was assessed at about Rs. 5½ crores in 1974-75 at current prices, the shortfall being

attributed to non-adherence to the approved cropping pattern and under-utilisation of irrigation potential.

12. **Other factors**

12.01 Gross command area of a project is the total area which could be covered by irrigation from the project; the culturable command area is the gross command area less areas not available for cultivation like those occupied by roads, villages and patches of unculturable lands. In the project reports, culturable command area is reckoned roughly as a percentage of the gross area. The area to be irrigated annually is worked out as a percentage of the culturable command area.

In two projects, the Kosi Project (Eastern Main Canal) in Bihar and the Chambal Project in Rajasthan, detailed check by the project authorities, after the completion of the project, disclosed a reduction in the culturable command area.

The gross command area in the Kosi Project Report was 959 thousand hectares ; the culturable command area was roughly worked out as 639 thousand hectares *i.e.,* two-thirds of the gross command area and the annual irrigation target was fixed at 743 thousand hectares. The Kosi Irrigation Committee (known as the Mandal Committee) appointed by the State Government, came to the conclusion (March 1975) that the gross command area was only 745 thousand hectares and the actual culturable command area after deducting areas occupied by habitation etc., was 440 thousand hectares as against 639 thousand hectares assumed in the project report. The State Government stated (September 1976) that "The Project authorities are also seized with the task of verification of the figures of gross command area and culturable command area as found out by the Mandal Committee, so that firm figures about the areas to be irrigated from the Canal system and water requirement at different seasons for development of irrigation could be worked out".

According to a study made by the project authorities in 1965, the actual culturable command area in the Chambal Project (Rajasthan) was 229 thousand hectares against 322 thousand hectares assumed in the project report. The reduction of 93 thousand hectares was mainly due to the area covered by ravines ; about 1566 hectares were reported to have been reclaimed under the scheme of reclamation of ravines completed in March 1974.

12.02 In a few projects, major works of remodelling or strengthening of the canals were under consideration or in progress, as indicated below :-

The Left Bank Main Canal of the Tungabhadra Project in Karnataka was designed for a discharge of 3100 cusecs for irrigating an area of about 243 thousand hectares and was completed in 1968. The discharge capacity was assessed by the State Irrigation Department in 1965 at 2583 cusecs after taking into account the weak embankments and the smoothness of the bed and side slopes of the canal. There were frequent breaches in the canal as its embankments had not been consolidated to the required density during construction on account of scarcity of water. During 1972, 1973 and 1974 several breaches occurred in succession between July and September which necessitated closure of the canal from 2 to 3 weeks at a time resulting in stoppage or short supply of water to standing crops. Works to strengthen and raise the canal banks so as to raise the capacity from 3100 cusecs to 4100 cusecs were sanctioned by the State Government between 1968 and 1975 (estimated cost Rs. 1,017 lakhs) and were in progress (March 1976). The improvement works on the canal to realise the maximum discharge of 4100 cusecs were intended to utilise fully the irrigation potential created under the canal and were expected to be completed in 5 years after a decision was taken on the closure of the canal in summer. It was reported by the project authority that this problem of closure would be considered after 1977 by which time the

sugarcane growers were expected to dig a sufficient number of wells to ensure supply of water for sugarcane crops during the closure periods.

The Right Bank High Level Canal of the Tungabhadra Project in Karnataka was designed for a head discharge of 4000 cusecs with a free board of one foot above the full supply level and was completed in 1971-72. When water was released into the canal in July 1972, it was noticed by the engineers of the Tungabhadra Board that, even with a limited discharge of 2650 cusecs, the free board was fully engaged in several reaches. A detailed survey conducted in July 1973 disclosed several defects in construction which limited the head discharge of the canal to less than 3000 cusecs. Improvements to the canal were sanctioned by the Board in March 1975 at an estimated cost of Rs. 198 lakhs; these were expected to be completed by 1978-79.

In the case of the Right Bank Low Level Canal of the Tungabhadra Project in Karnataka and Andhra Pradesh, construction of the canal's embankment was not done with good selected soils with the result that pipings and breaches were occurring since 1955. To strengthen and improve the canal, a comprehensive estimate for Rs. 969 lakhs was approved by the Tungabhadra Board in 1975. These improvement works were taken up by the Board in November 1974 and were expected to be completed by 1978-79.

In the Kakrapar Project, there were frequent changes in the design criteria of the canals during the course of construction. The Left Bank Main Canal was designed in 1949 to carry a discharge of 3024 cusecs. The requirement was calculated as 3965 cusecs on the basis of the 1958 design criteria and 3480 cusecs on the basis of the criteria adopted in December 1969. The requirement was worked out on the assumption that the peak intensity of irrigation would be in December. As requirement of water turned out to be maximum in September-October, specially in years of scanty rainfall, the maximum discharge

requirements of the Left Bank Canal were recalculated in February 1975 as 4825 cusecs. The cost of remodelling the Canal systems both on the left and right banks was estimated at Rs. 9.11 crores. The revised estimates for the project including this remodelling were awaiting clearance from the Central Water Commission (June 1977). Work on the remodelling of the main canal was not undertaken (March 1977).

Frequent changes in the design criteria resulted in some of the branch canals and minors having less and some having more discharge capacities than the actual requirements. Remodelling of the branch canals was taken up from time to time ; certain branches, distributaries and minors, on which remodelling expenditure of about Rs. 15 lakhs had been incurred up to June 1976, required further remodelling (estimated cost Rs. 52 lakhs) to attain the required discharge capacity.

12.03 In certain projects, water could not be supplied for the entire area targeted to be irrigated in the project reports. In the Parambikulam Aliyar Project, the area thrown open for irrigation is decided by Government on the basis of the assessment of water availability during the ensuing season ; the area thrown open for irrigation every year was substantially less than the area planned to be irrigated according to the project report during the period of 9 years ending 1975-76 (73 thousand hectares against 102 thousand hectares in 1975-76). Only certain canals or sections of certain canals were thrown open for irrigation each year though the project report had envisaged supplies to the entire command to raise one irrigated crop.

The reservoir in the Girna Project was filled to the designed capacity only in one year during the period of 7 years since the completion of the reservoir in 1969-70 (storage in 1974-75 was 9300 million cubic feet against the full capacity of 21500 million cubic feet). A new project, the Girna (Panzan) Left Bank Canal Project, was commenced in October 1974 at an estimated cost of

Rs. 252 lakhs upstream of the Girna Project. The State Government stated (July 1976) that water would be made available to the new project by dilution of the crop pattern under the Girna Project.

The main Sarda Canal system in Uttar Pradesh was completed by 1930. Further additions to the system were mostly in the form of the distribution channels. A test check (January 1976) of records of 13 divisions in the system showed that water did not reach the outlets at the tail-end; out of about 32 thousand outlets, there was no irrigation in 145 outlets while irrigation ranged between 5 and 40 per cent of the area proposed to be irrigated in 6047 outlets during the period 1970-71 to 1974-75.

## SECTION III

## CENTRALLY SPONSORED SCHEMES

### 13. Integrated development of Command Areas

13.01 Efficient use of irrigation facilities for achieving optimum agricultural production in the command area of a project requires co-ordination of different activities and departments. Programmes for integrated development of several irrigation command areas have been sponsored by the Central Government from time to time.

13.02 In January 1967, a water utilisation cell was set up in the Ministry of Food, Agriculture, Community Development and Co-operation (Department of Agriculture). Some of the important functions envisaged for the Cell are :

(i) Planning and co-ordination of the programmes of command area development.

(ii) Planning of improved and intensive cropping patterns and crop rotations and suggesting improved techniques.

(iii) Scrutiny of all new major/medium irrigation projects from the agricultural angle before sanction.

(iv) Dealing with schemes of Land and Water Management Pilot Projects.

13.03 Government of India started a scheme of construction of roads and market complexes to develop the command areas of selected projects during the Fourth Plan and financed it on the condition that the State Governments would arrange for all corresponding necessary services and inputs like improved administrative arrangements, land levelling and land shaping, suitable cropping patterns, consolidation of holdings and provision of inputs like credit, seeds, fertilisers, pesticides and agricultural machinery.

A provision of Rs. 15 crores was made in the Central sector to cover 10 irrigation commands. As a result of mid-term appraisal of the Fourth Plan, the Central sector provision was increased to Rs. 25 crores adding 9 more irrigation projects to the scheme.

13.04 Administrative approvals were issued by Government of India for construction of roads and market complexes amounting to Rs. 29.29 crores. These works were required to be completed by 31st March 1974 but none was actually completed by that date, although an expenditure of Rs. 23.32 crores was reported to have been incurred by the State Governments up to 31st March 1974. Government of India released Rs. 14.78 crores to the States during the Fourth plan up to 31st March 1974. Subsequently, Rs. 11.65 crores were paid during 1974-75 and 1975-76 for completing the spill-over works sanctioned during the Fourth Plan.

13.05. The information gathered in audit from the records of projects studied is indicated in the following table :

| Name of Project and State | Amount of assistance released (up to March 1976) (Rupees in lakhs) | Expenditure incurred (up to period indicated) | Number of roads and length to be completed. | Number of roads and length completed (up to period indicated) | Number of market complexes to be put up | Number of market complexes actually put up (up to period indicated) |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Chambal . . . (Madhya Pradesh) | 94.91 | 136.27 (6/77) | 8(152 kms) | 1(50.45 kms) (6/77) | 9 | 2 nearing completion (6/77) |
| Chambal . . . (Rajasthan) | 134.65 | 90.29 (3/77) | 4(103 kms) | Nil (3/77) | 8 | Nil (3/77) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Tungabhadra (Andhra Pradesh) | 68.31 | 60.85 (12/76) | 17(108.3 kms) | 13(89.3 kms) (7/77) | 4 | 4 (7/77) |
| Tungabhadra (Karnataka) | 153.77 | 154.38 (9/76) | 21(175.30 kms) | 21(175.30 kms) (10/76) | 21 | 21 (10/76) |
| Nagarjunasagar (Andhra Pradesh) | 170.94 | 145.39 (11/76) | 15(322 kms) | 5(132 kms) (6/77) | 11 | 10 (6/77) |
| Purna (Maharashtra) | 100.00 | 99.17 (3/77) | 51(163 kms) | 20(59 kms) (8/77) | 4 | 3 (8/77) |
| Kosi (Bihar) | 159.00 | 113.12 (3/75) | 11(114 kms) | Physical progress awaited (6/77) | 10 | 8 (3/77) |

13.06 Some points noticed in test check in audit of expenditure on the works above in a few projects are mentioned below :

(i) In the Tungabhadra Project (Karnataka), it was reported (December 1976) by the Joint Chief Marketing Officer, Gulbarga that in 9 sub-markets no trading activity had developed as there were no traders and commission agents in these places and the farmers transferred their produce to the main markets or taluk headquarters. The District Marketing Officer, Bellary stated (December 1976) that most of the market roads completed under the scheme were not in good condition due to inadequate maintenance by the Public Works Divisions.

(ii) In the Purna Project (Maharashtra), although all the link roads were required to be completed first, six out of 31 link roads to Nanded and Purna Market yards, the strengthening of which had been completed in September 1975 and May 1976 respectively, had not been constructed (August 1977).

13.07 While considering (February 1972) proposals for additional funds for the scheme of roads and market complexes in the command areas, it was reported by the Department of Agriculture that the State Governments were not committing funds for the services and inputs which they were expected to provide along with road and market facilities and that all the States were not giving equal importance to this scheme.

13.08 The Irrigation Commission (1972) noted that estimates of irrigation projects did not make any provision for infrastructure facilities for full development of ayacuts resulting in delay in utilisation of irrigation potential. The Commission recommended that a comprehensive plan of ayacut development should be prepared for every major and medium irrigation project for which a special administrative agency was necessary. The National Commission on Agriculture, in their interim report

(February 1973), also recommended a package approach to ayacut development for achieving expeditious utilisation of the irrigation potential and getting the maximum return from them. The Committee of Ministers on under-utilisation of irrigation potential, in their Report (June 1973), endorsed the recommendations made by the National Commission on Agriculture and reiterated that a definite need existed for an independent command area development authority with specific responsibility for the task.

13.09 In August/September 1973, Government of India suggested to the State Governments formation of a unified organisation with direct line of command for selected irrigation projects for improved water utilisation. The following functions were envisaged for the proposed authority :

(i) modernisation, maintenance and efficient operation of the irrigation system ;

(ii) development and maintenance of the main and intermediate drainage system ;

(iii) planning and executing programmes of land development including realignment and lining of watercourses, land levelling, soil reclamation, farm drainage and field channels ;

(iv) re-drawing of field boundaries and consolidation of holdings ;

(v) enforcement of a system of 'warabandi' and fair distribution of water to individual fields ;

(vi) selection and introduction of suitable cropping patterns ;

(vii) development of ground water to supplement surface irrigation ,

(viii) supply of all inputs and services, including credit ;

(ix) development of marketing and processing facilities and communications ;

(x) preparing individual programmes of action for small farmers, marginal farmers and agricultural labour ;

(xi) diversification of agriculture through live-stock development, horticulture and farm forestry ;

(xii) soil conservation, ravine control and forestry programmes, and

(xiii) town and country planning.

The intention of Government of India was that senior officers are appointed as Administrators of the command areas with adequate financial and administrative powers in regard to activities of all the major departments involved in the command area development work.

The Command Area Development Authorities were to be ready for functioning from 1st April 1974. The Command Area Development Authorities were to be set up in 50 major projects with a total culturable command area of about 15 million hectares (later increased to 51 irrigation commands actually covering 60 irrigation projects).

13.10 In January 1975, Government of India agreed to give :

(i) grants to the State Governments to the extent of fifty per cent of expenditure on—

(a) establishment of Command Area Development Authority and Water Utilisation and Command Area Development Department at the State level,

(b) soil surveys and preparation of farm plans and supervision of the execution of on-farm development works, and

(c) equity capital support to State Land Development Corporations, Farmers' Services Societies, etc., for providing institutional finance to farmers for construction of field channels, field drains, land levelling and land shaping, and

(ii) subsidy to such farmers as are ineligible to obtain loans from institutional sources to develop their fields in the areas earmarked for on-farm development.

In February 1976 it was also decided to provide financial assistance (loan) to the State Governments, wherever found necessary, to expedite the work of construction of field channels, the cost of which will have to be finally recovered from the cultivators.

For the Command Area Development Programme a provision of Rs. 120 crores was made in the Central Sector in the Fifth Plan. Besides the assistance given to meet the spill-over expenditure on markets and roads mentioned earlier, an amount of Rs. 32.22 crores was released by way of Central assistance to the State Governments under the Command Area Development Programme in the Fifth Plan up to March 1977 as detailed below :

(Rupees in crores)

| | Grants | Loans | Total |
|---|---|---|---|
| 1. Field Channels . . . . | .. | 9.21 | 9.21 |
| 2. Soil surveys . . . . . | 9.20 | .. | 9.20 |
| 3. Establishment of Command Area Development Authority . . . . | 2.87 | .. | 2.87 |
| 4. Equity capital support to Land Development Corporations . . . | 5.21 | .. | 5.21 |
| 5. Subsidy for small and marginal farmers. | 4.64 | .. | 4.64 |
| 6. Subsidy for disadvantaged farmers . | 0.25 | .. | 0.25 |
| 7. Loan for equipment . . . . | .. | 0.84 | 0.84 |
| Total . . . . . | 22.17 | 10.05 | 32.22 |

The State-wise details of amounts released are given in Annexure 4.

13.11 Test check in audit of the functioning of the Command Area Development Authorities in a few projects disclosed the following points :

(i) There were delays in setting up the Command Area Development Authorities, in filling the posts needed for such Authorities and in vesting powers with such Authorities. The Authority for the Hirakud Command Area was set up in May 1976. In the Mayurakshi Project, the Command Area Development Authority was set up in July 1974 but the Administrator joined only in June 1976 ; three senior technical posts under the Administrator remained vacant up to March 1977. In the Tungabhadra Project (Andhra Pradesh), a separate department was formed at the Secretariat from August 1974 and proposals for the staff at field level were finalised only in late 1975. The Administrator of the Command Area in the Tungabhadra Project (Karnataka) started functioning from January 1974 but was given administrative and financial powers in accordance with Government of India suggestion only in April 1977.

(ii) The Chief Executive of the Command Area Development Authority was not always of the status necessary to co-ordinate effectively the activities of different departments in the command area. In Andhra Pradesh, Selection Grade Deputy Collectors were appointed as Administrators reportedly due to dearth of senior officers of adequate level to hold these posts. In the Purna and Girna Projects, a Superintending Engineer of the Irrigation Department assumed charge as Administrator. In the Nagarjunasagar project, two Command Area Development Authorities were created (November 1974), one for the Jawahar Canal and the other for the Lal Bahadur Canal. Both the Authorities are headed by Superintending Engineers.

(iii) In some cases, the post of Chief Executive was vacant and was held as an additional charge by other officers. Frequent changes in the incumbency of the Chief Executive were also noticed. The Area Development Commissioner for the Kakrapar Project at Surat commenced functioning in July 1974 and, for most of the time after October 1974, the post was vacant and was held as additional charge by the Area Development Commissioner of another project at Ahmedabad. The Area Development Authority for the Kakrapar Project met thrice between July and October 1974 and another two meetings were held between October 1976 and February 1977. In the Girna Command Area, there were seven changes in the office of the Administrator of the Command Area Development Authority between April 1974 and January 1977.

(iv) Some of the Command Area Development Authorities had not been vested with administrative and financial powers necessary to discharge their functions. Administrative control over the staff in the Co-operation and Revenue Departments functioning within the command area had not been transferred to the Command Area Development Authority (April 1976) in the Purna Project. In the Girna Project, the Authority's activities were confined to the maintenance of the project, distribution of water and collection of water rates as the other functions had not been transferred to the Authority from the different departments (April 1976). In the Kosi Project, the Authority was converted in December 1974 into a corporate body and renamed as the Kosi Command Area Development Agency. The Chairman of the Agency was not given adequate administrative and financial powers in relation to the functions of the departments operating in the command area.

(v) In most of the command areas studied in audit, no specific programme of development had been drawn

up. In Hirakud, the Authority was engaged mainly in up-dating the cost and other data of a programme prepared earlier (1973) by the Department of Agriculture. In the Tungabhadra Project (Andhra Pradesh), the Command Area Development activities were taken up only in the Tungabhadra Project High Level Canal. The Command Area development work in the Low Level Canal was entrusted by the State Government (October 1976) to the Collector, Kurnool district. The State Government stated (January 1977) that no additional staff or funds were given to the Collector of Kurnool for taking up such activities. In case of Nagarjunasagar project, till July 1977 on-farm development work had been completed in 992 hectares under the Jawahar Canal Command Area and 1751 hectares under the Lal Bahadur Canal Command Area. For the Kakrapar Project, the Area Development Authority did not prepare any separate programme for the Command Area development as the State Agriculture, Forest and Co-operative Department had prepared a programme for Rs. 53.30 crores in 1972-73; the programme had not been administratively approved (May 1977).

The work done in most of the projects was mainly confined to survey for on-farm development, construction of some field channels and a few schemes of land levelling. In the Kosi Project, of the total amount of Rs. 82.04 lakhs received by the Kosi Command Area Development Agency, a sum of Rs. 29.34 lakhs was spent by it up to March 1977 and the balance unutilised amount of Rs. 52.70 lakhs was kept in a nationalised bank.

Only in the Chambal Project (Madhya Pradesh and Rajasthan), a programme had been drawn up for execution over a prescribed time schedule. In the Madhya Pradesh portion of tht command, the scheme involving an outlay of Rs. 37.31 crores was taken up for execution over a period of three years. The work commenced in June 1975. In the Chambal Command (Rajasthan), a programme for development of the command area at an estimated cost of Rs. 73.20 crores commenced from July 1974, to be completed in six years. Even in these two cases, the progress in execution of works was slow *vide* details of quantities of work to be executed, estimated cost and actual expenditure given in Annexures 5 and 6. Slow progress in execution of works by the Irrigation Department in the Madhya Pradesh Command was attributed by the Project Authorities to the limited working period available. Slow progress in the on-farm development work was attributed by the Joint Director of Agriculture to unprecedented pre-monsoon showers in June 1976, reducing the available working days. In the Chambal Command (Rajasthan) some of the reasons given by the Project Authorities for slow progress in execution of works were (i) time taken to convince cultivators about usefulness of on-farm works and (ii) non-receipt of administrative and expenditure sanction during 1974-75 in regard to roads.

## 14. Soil conservation in the catchment areas

14.01 The life of a reservoir depends on the rate of siltation which is determined by several factors such as soil types, slopes, degree of erosion, silt load, meteorological conditions and stream flow in the catchment areas. Soil conservation schemes are necessary to control sedimentation in the reservoirs. These comprise bunding or terracing for controlling surface runoff in cultivated lands and afforestation and pasture development in the denuded and depleted forests and grazing areas.

14.02 In the Third Plan (1961-62 to 1965-66) Government of India allotted Rs. 11 crores for the soil conservation works under a centrally sponsored scheme for 13 catchments namely, the D.V.C., Bhakra Nangal, Machkund, Hirakud, Chambal, Mayurakshi, Kunda, Pohru, Tungabhadra, Ramganga, Dantiwada, Kangsabati and Ghod. The total area to be covered was about 300 thousand hectares. The area covered during the Third Plan was reported to be 317.24 thousand hectares at a cost of Rs. 11.08 crores. Central assistance was given in the form of loans (for 50 per cent of the expenditure) and grants (50 per cent).

14.03. Some of the works done tended to be haphazard, often confined to the less important area, due to lack of adequate field data and organisation. The Ministry of Food and Agriculture addressed the State Governments in September 1966 and May 1967 stressing the following :

(i) a judicious selection of the most critical and vulnerable areas was to be made so that by treating such areas with soil conservation measures, maximum bentfits were obtained within shortest time and expenditure was commensurate with the results obtained,

(ii) soil conservation treatment was to be decided upon on the basis of aerial photo interpretation data supported by relevant field data, and

(iii) arrangements were to be made for periodical surveys of sedimentation by the State Government authorities in order to evaluate the effectiveness of the measures taken.

*Eight more catchments were taken up in the Fourth Plan and 5* more in the Fifth Plan (up to March 1976). In July 1974, Government of India reoriented the soil conservation scheme with reference to watershed management. Self-contained watersheds were to be selected within the general priority zones and a detailed watershed management plan prepared for each watershed. The watersheds were to be taken up for implementation and completely treated within the Fifth Plan period; up to March 1976, about 232 watersheds, with an area ranging from 2000 to 4000 hectares each, were selected in 26 catchments for receiving "saturation treatment" during the Fifth Five Year Plan. The area to be covered was about 377 thousand hectares and the tentative provision made was Rs. 36 crores. The Ministry of Food and Agriculture stated (August 1977) that the target was subsequently lowered due to final provision of Rs. 32.46 crores and increase in cost. According to the estimate prepared by the Ministry of Agriculture while adopting the watershed management approach for the soil conservation schemes, about 15 to 20 million hectares were critically eroding areas out of the total catchment of 70 million hectares in 26 catchments. An area of about one million hectares was reported to have been treated by the end of the Fourth Five Year Plan *i.e.*, by the end of 1973-74; the target during the Fifthe Five Year Plan was less than half a million hectare.

14.04. Points noticed in test check in audit of the soil conservation works carried out in the catchment areas of some of the projects are mentioned below :

(a) The extent of the catchment area, the area treated under the centrally sponsored scheme, the expenditure incurred and the Central assistance released

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*These catchments were: Nagarjunasagar, Nizamsagar, Pochampad Ukai, Matatila, Mahi Stage II, Lower Bhawani, Beas Unit II, Pagladia Rengali, Mandira, Damanganga, Tawa and Teesta.

in respect of the projects test checked are given in the following table :—

| Project catchment | Catchment area | Area treated under the central soil conservation scheme up to March 1976 | Expenditure incurred up to March 1977 | Central assistance released up to March 1977 |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| | (in thousand hectares) | | (in lakhs of rupees) | |
| 1. Hirakud : | | | | |
| Madhya Pradesh . | 7226 | 172.93 | 640.93 | 133.24 |
| Orissa . . . | 1114 | 56.02 | 257.87 | 258.47 |
| 2. Chambal : | | | | |
| Madhya Pradesh . | 2292.8 | 103.15 | 278.70 | 718.35 |
| Rajasthan . . | 404.5 | 67.46 (March 1977) | 200.29 | 195.53 |
| 3. Tungabhadra (Karnataka) . | 2693.93 | 107.78 | 293.63 | 287.41 |
| 4. Mayurakshi . . (Bihar) | 185 | 29.59 (March 1974) | 165.26 | 162.18 |
| 5. Bhakra Nangal . (Himachal Pradesh) | 1982.65 | 119.67 (March 1975) | 921.77 | 823.87 |

*Notes :*

(1) In the Chambal catchment in Madhya Pradesh, an area of 116 thousand hectares was reported to have been brought under soil conservation works under a scheme in the State sector.

(2) The figure for Bhakra Nangal includes Central assistance of Rs. 169.47 lakhs to the State of Punjab and Rs. 654.40 lakhs to Himachal Pradesh during the periods 1961-62 to 1966-67 and 1961-62 to 1976-77 respectively.

(3) In the case of Chambal (Madhya Pradesh), the figure of Rs. 718.35 lakhs comprises Central assistance of Rs. 639.79 lakhs up to 1973-74 for the catchment areas of Chambal, Hirakud and Matatila and Rs. 78.56 lakhs for Chambal only during the years 1974-75 to 1976-77.

(4) For the Hirakud catchment area falling in Madhya Pradesh, Central assistance of Rs. 133.24 lakhs was given to Madhya Pradesh Government during the years 1974-75 to 1976-77.

(5) Central assistance, released on a provisional basis, was subject to adjustment on the basis of audited figures of expenditure from 1965-66; the adjustment was pending in almost all cases mainly due to non-receipt of details from the State Governments and non-reconciliation of figures. The Department of Agriculture (Government of India) stated (August 1977) that action has been initiated for reconciliation.

It may be seen from the table that only a small portion of the catchment area was covered by the soil conservation scheme implemented from 1961-62.

(b) Though the implementation of the scheme commenced in 1961-62, identification of critically vulnerable areas and fixing the priority areas were done much later. Priorities for the areas in the catchment of the Hirakud project in Madhya Pradesh were indicated, for the first time, in the technical programme for 1971-72. In the Hirakud catchment in Orissa, a master plan for soil conservation was prepared only in 1971. For the Chambal catchment in Madhya Pradesh, area-wise priorities were laid down in the technical programme for 1971-72 based on silt observations in the sub-catchments.

Government of India (Department of Agriculture) stated (August 1977) that prior to identification of priority areas with reference to aerial and field data, the scheme had been implemented in areas considered critical on the basis of visual inspection. In a specific case noticed in test check, contour bunding and other measures were executed in Durg district (Hirakud catchment in Madhya Pradesh) without technical survey and mainly in areas where the consent of the cultivators could be obtained; the work was stopped in February 1967 after covering about 30 thousand hectares.

Nineteen working plans (12 for the Sutlej basin and 7 for the Beas basin) were prepared for afforestation work in the catchment area of the

Bhakra Nangal project in Himachal Pradesh. The details of actual work done in these sub-catchments were not available with the concerned department of the State Government as no records showing the details of sub-catchment areas treated and expenditure incurred had been maintained prior to 1975-76.

(c) Arrangements to monitor the silt flow and evaluate the efficacy of the soil conservation measures undertaken were not adequate. Measurement of flow of silt in the sub-catchments/watersheds was not taken. In a few cases, the capacity of reservoirs was not reassessed in the light of the silt flow. Capacity surveys, where done, disclosed a rate of siltation higher than the project assumptions and reduction of storage capacities in a few cases. Specific instances noticed in test check are mentioned below :—

Watershed management introduced in the Fifth Plan envisaged establishment of a silt monitoring station in each of the watersheds taken up for treatment. No silt monitoring station was established in any of the 13 watersheds in which work was done during the first two years of the Fifth Plan in the Hirakud catchment in Madhya Pradesh. Government of India (Department of Agriculture) stated (August 1977) that silt monitoring of small watershed is rather a complex subject and Government of India is taking up a Central sector scheme of pilot project to refine the methodology of evaluation in this regard.

Sedimentation studies relating to accumulation of silt in the Ranapratap Sagar and the

Jawahar Sagar reservoirs of the Chambal Project were not undertaken (August 1977) by the Rajasthan Irrigation Department to evaluate the effects of the soil conservation measures taken; an estimate of about Rs. 4 lakhs for such studies at the Ranapratap Sagar reservoir was under consideration of the Irrigation Department (July 1977).

Against the annual rate of 53 acre feet per 100 square miles assumed in the Hirakud Project Report, the sedimentation rate into the reservoir was 75.07 acre feet, according to the information available in the Soil Conservation Statistics Bulletin of the Land Development Division, Ministry of Agriculture and Irrigation (May 1976).

When the Tungabhadra dam was designed, the annual rate of siltation was estimated at 90 acre feet per 100 square miles of the catchment. Based on this rate of siltation, the life of the reservoir was estimated at 311 years. A capacity survey of the reservoir subsequently conducted in 1962 by the Mysore Research Engineering Station, Krishnarajasagar assessed the rate of siltation at 377.29 acre feet per 100 square miles. At this rate, the life of the reservoir was estimated at 74 years. A survey carried out in 1971-72 indicated an annual sedimentation rate of 126.3 acre feet per 100 square miles of the catchment area. As the sedimentation surveys conducted were not found to be conclusive enough to evaluate tht rate of siltation with a fair degree of accuracy, the Tungabhadra Board

decided (1975) to have hydrographic survey more frequently, *i.e.*, once in three or five years. The Karnataka Engineering Research Station, Krishnarajasagar was accordingly asked to take up the survey in 1975 and, for this purpose, a sum of Rs. 1.91 lakhs was sanctioned in May 1975 for the purchase of a motor boat and cost of the survey. The motor boat was not acquired (March 1977) and, according to the Research Station, enquiries in the boat yards of Goa and Cochin for a boat of the required specifications were in progress. The State Irrigation Department proposed, as an anti-siltation measure, a dam across the Hirehalla stream (a tributary of the Tungabhadra River) in Raichur district which brings vast quantities of silt into the reservoir. The proposal, estimated to cost Rs. 635 lakhs, was reported to have been cleared by the Planning Commission in April 1977.

The following table gives the silt deposit per million acre feet of water inflow into the Gobind Sagar reservoir according to the capacity survey done by the Bhakra Management for a few years :—

(In acre feet)

| 1959-63 | 1963-65 | 1969-70 | 1970-71 | 1971-72 | 1972-73 | 1973-74 | 1974-75 |
|---|---|---|---|---|---|---|---|
| 2218 | 2796 | 2832 | 1220 | 2008 | 1718 | 2814 | 2889 |

A committee of officials was constituted by the State Government to look into the effect of the soil conservation measures on the agricultural lands; the committee visited various areas

in the State in May and June 1975 and its report was reported to be in the final stage (August 1977).

Silt sedimentation studies of the Gandhi Sagar reservoir in the Chambal Project were taken up in 1961. Till the end of 1974, the study was confined to the indirect method of inflow-outflow measurement of suspended silt load. The progressive silt index computed on the basis of the above study worked out to 502.59 cubic metres per square kilometre per year as against the project assumption of 357 cubic metres per square kilometre per year. The first hydrographic survey with echosounder, taken up in Madhya Pradesh by the Research Directorate of the State Irrigation Department during 1975 and completed in March 1976, indicated that the value of silt index was 964 cubic metres per square kilometre. It was anticipated that, at this rate, the dead storage of the reservoir would be silted up in 86 years. The hydrographic survery also showed that, of the total silt deposited, 28 per cent was in live storage zone and 72 per cent in the dead storage and, since the major portion (66 per cent) of the catchment consists of cultivated land, the possibility of accelerated erosion was not ruled out. Government of India (Department of Agriculture) stated (August 1977) that in view of the high sediment production the pace of soil conservation works needs to be accelerated further.

Sedimentation survey of the Mayurakshi reservoir was carried out by the River Research Institute, West Bengal in 1964-65, 1969-70 and

1972-73. The following table brings out the results of the survey :—

| Reservoir storage | As per pre-dam survey | 1964-65 survey | 1969-70 survey | 1972-73 survey | Cumulative loss of storage up to 1972-73 (2)—(5) |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| | | | (in lakhs of acre feet) | | |
| Live storage . . | 4.38 | 4.23 | 4.09 | 4.04 | 0.34 |
| Dead storage . | 0.55 | 0.48 | 0.45 | 0.34 | 0.21 |
| Total storage . | 4.93 | 4.71 | 4.54 | 4.38 | 0.55 |
| Siltation index in acre feet per year per 100 square miles . . . | 75 | 274 | 332 | 421 | |

Government of India (Department of Agriculture) explained (August 1977) that this has been a singular case and a complex one which calls for detailed examination.

(d) Co-ordination of activities seemed to be lacking in respect of the catchment of the projects falling in more than one State. In the Hirakud catchment covering Orissa and Madhya Pradesh, the inter-State body on soil conservation set up in 1963 last met in 1970. The Chambal catchment was in Madhya Pradesh (2292.8 thousand hectares) and Rajasthan (404.5 thousand hectares). The study group of Irrigation and Power of the National Planning Council (August 1967) had recommended that a master plan of soil conservation should be prepared so as to cover the entire catchment area in the two States of Madhya Pradesh and Rajasthan within a period of 10 years. No such master plan was drawn up (August 1977).

## SECTION IV

### 15. Revenue and Financial Return

Receipts from irrigation projects accrue from betterment levy and water rate. These are dealt with in the succeeding paragraphs :

15.01 *Betterment Levy.*—Betterment Levy represents Government's share in the value of land that accrues as a result of the provision of irrigation facilities. The levy was strongly recommended in the First Plan and the States were advised to promote necessary enabling legislation. The Taxation Enquiry Commission (1953-54) also recommended that betterment levy may be imposed, the amount to be limited to 50 per cent of the increase in value of land and recovery to be made over a reasonably long period. The need for and the desirability of betterment levy was also emphasised in the Second Plan.

It was noted in the Third Plan that the actual realisation in the Second Plan in all the States was expected to be Rs. 3.5 crores against the initial estimate of Rs. 47 crores. In the Third Plan Mid-term appraisal, the anticipated realisation in the first three years of the Plan was Rs. 5.76 crores against the target of Rs. 38.7 crores.

The Irrigation Commission (1972) recommended that betterment levy laws enacted by the States be amended so that half the capital cost of irrigation projects is recovered from the beneficiaries. The recovery of levy is to start three years after irrigation is provided in an area and is to be spread over a long period but not exceeding 30 years. The State Governments were advised to implement this recommendation.

The position of implementation of betterment levy in different projects examined in audit is given below :—

(a) There was no statutory provision for betterment levy in Uttar Pradesh. In other States, there were statutory provisions for assessment and recovery of betterment charges in 8 projects but these were not enforced. The estimates for betterment charges recoverable in these projects, as assumed in the project reports, totalled Rs. 59.93 crores : Kosi (Rs. 14.15 crores), Hirakud (Rs. 3.93 crores), Mayurakshi (Rs. 9 crores), Chambal (Rs. 7.67 crores), Nagarjunasagar (Rs. 10.44 crores), Kakrapar (Rs. 8.61 crores), Purna (Rs. 3.61 crores), Girna (Rs. 2.52 crores). The position obtaining in some of the projects is given below.

Under the Bihar Irrigation and Flood Protection (Betterment Contribution) Act enacted in 1959 and rules framed thereunder published in May 1962, betterment contribution was leviable after four years of completion of irrigation or flood protection works instead of after the introduction of irrigation as assumed in the Kosi Project Report. No action was initiated to levy betterment contribution in respect of areas brought under irrigation in the Kosi Project (June 1977). The First Revised Estimate of the Mayurakshi Project (1953) anticipated that the betterment levy may be levied at Rs. 150 per acre payable in five equal instalments. The Second Revised Estimate (1967) anticipated receipts from betterment levy at Rs. 100 per acre for cultivable land and Rs. 160 per acre for waste land which would be brought under cultivation. The financial forecast in the Second Revised Estimate anticipated realisation of betterment levy at the above rates in

instalments from 1963-64 to 1981-82. No betterment levy had been imposed in the area covered by the project. The matter was stated to be under consideration of the Government (August 1977). For the Chambal Command (Madhya Pradesh), betterment contribution was leviable under the Madhya Pradesh Irrigation Act, 1931 (as amended in 1956) at the rate of 3 per cent of the total cost of construction, improvement or extension of irrigation work per acre for the first five years and 4½ per cent of the cost per acre for the next 10 years. No steps were taken to levy betterment charges under the provisions of this Act. An amendment was made to the Act fixing the betterment contribution at a flat rate of Rs. 140 per acre; the amended provision was also not enforced (June 1977). In the Kakrapar Project, the canal was opened in 1958 but no scheme was prepared (May 1977) for the levy of betterment charges in accordance with the provisions of the Bombay Irrigation Act, 1879 (extended to Gujarat in December 1962). For the Hirakud Command, betterment charges were leviable under the Orissa Betterment Charges Act, 1955 in terms of which betterment charges payable were one-half of the increase in capital value; no assessment of betterment charges was undertaken (July 1977). In the ayacut of the Nagarjunasagar project (Andhra Pradesh), assessment of betterment charges could not be done because of non-completion of the formalities under the Andhra Pradesh Irrigation (Levy of betterment contribution and advance contribution) Act, 1955. This Act was later repealed and replaced by the Andhra Pradesh Irrigation Project (Special Land Tax Act), 1976; action under the New Act was yet

to be initiated (June 1977). In the Purna Command, betterment levy was leviable under the Hyderabad Irrigation (Betterment contribution and Inclusion fees) Act, 1952; no rules were framed under the Act and no betterment levy was imposed (August 1977). The State Government had reported (September 1976) that they were not inclined to consider levy of betterment charges as the water rates in force in the State were the highest in the country. In the Girna Project (Maharashtra), betterment levy was leviable under the Bombay Irrigation Act, 1879. This Act was repealed (January 1977) by the Maharashtra Irrigation Act, 1976 which does not provide for levy of betterment charges.

(b) In the two States of Punjab and Haryana, recovery of betterment charges was initiated under the Punjab Betterment Charges and Acreage Rates Act, 1952; owing to the non-finalisation of the schedule of betterment charges in accordance with the procedure laid down in the Act, the betterment charges could not be levied up to 1957-58. Thereafter, pending finalisation of levy rates, advance recovery of betterment charges was made from kharif 1958. In Punjab, collection of such advance betterment levy was discontinued in July 1967 and in Haryana, the Act of 1952, in its application to the State of Haryana, was repealed by an Ordinance in September 1975. In Punjab, out of the total amount of Rs. 43.97 crores to be collected, the amount collected was Rs. 6.24 crores. In Haryana, out of Rs. 57.81 crores to be collected as per project assumption, the amount collected up to 1975-76 was Rs. 17.05 crores.

(c) In four projects *viz.*, Tungabhadra (Karnataka), Tungabhadra (Andhra Pradesh), Chambal (Rajasthan) and Parambikulam Aliyar (Tamil Nadu) steps were taken for assessment of betterment charges but recovery fell short of what was envisaged in the project reports. In Andhra Pradesh, the total betterment contribution fixed for the Low Level Canal under the Andhra Pradesh (Levy of Betterment Contribution and Advance Betterment Contribution) Act, 1955 was Rs. 324.97 lakhs of which Rs. 52.41 lakhs were treated as non-collectable as the lands were stated to be under-developed. The total demand that fell due up to the end of June 1976 was Rs. 186.53 lakhs of which Rs. 41.16 lakhs were collected, leaving a balance of Rs. 145.37 lakhs. In the Tungabhadra Project (Karnataka), the assessment made up to June 1976 amounted to Rs. 1075.98 lakhs out of which the amount of instalments due up to 31st May 1976 was Rs. 70.83 lakhs and the actual collections were Rs. 15.73 lakhs. In the Chambal Project (Rajasthan), Rs. 125.26 lakhs were pending recovery as on 31st March 1977. In the Parambikulam Aliyar Project, betterment contribution of Rs. 88 lakhs was fixed in respect of 28.47 thousand hectares under five canals; in respect of other two canals covering an ayacut of 75.58 thousand htctares, no betterment contribution was fixed (May 1977). The betterment contribution collected up to the end of 1975-76 was Rs. 21.30 lakhs and the outstanding balance Rs. 3.09 lakhs. Out of the total contribution of Rs. 67.70 crores assumed in the project reports in respect of these projects, the total amount actually assessed for recovery was Rs. 18.74 crores. Against this, the

amount of instalments due for recovery up to 1975-76 was Rs. 8.06 crores of which Rs. 3.33 crores was realised as indicated below :—

| | Assumption in the project | Total amount assessed for recovery | Amount due for recovery upto period indicated | Amount realised out of Col. 3 upto period indicated |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| | | | (In crores of rupees) | |
| *Tungabhadra* | | | | |
| Andhra Pradesh . | N.A. | 3.25 | 1.87 (6/76) | 0.41 (6/76) |
| Karnataka . | 37.17 | 10.76 | 0.71 (5/76) | 0.16 (5/76) |
| *Parambikulam Aliyar* | | | | |
| Tamil Nadu . | 5.28 | 0.88 | 0.24 (1975-76) | 0.21 (1975-76) |
| *Chambal* | | | | |
| Rajasthan . | 7.08 | N.A. | 1.39 (3/77) | 0.14 (3/77) |
| *Bhakra* | | | | |
| Rajasthan . . | 18.17 | 3.85 | 3.85 (1975-76) | 2.41 (1975-76) |
| TOTAL : . . | 67.70 | 18.74 | 8.06 | 3.33 |

15.02 **Water rates**

A. *Basis for fixation of water rate*

Water rate is the charge for supply of water for irrigation. It is levied on area and crop basis and not on volumetric measurement.

In 1964, a committee known as the Nijalingappa Committee, set up by the Union Ministry of Irrigation and Power to suggest ways and means for improving financial returns from irrigation projects, recommended that rates should be fixed on a rational basis. The Irrigation Commission (1972) suggested that water rates may be fixed at such a level that irrigation projects are not a burden on general revenues, except for unproductive projects

in scarcity areas. While noting that there can be no precise formula for the fixation of water rates, it recommended the following principles as guidelines :—

(i) Water rates should be levied on a 'crop basis' except in the case of irrigation from tubewells.

(ii) The rate should be related to the gross income from the crop and not to the cost of the project. It should range between 5 per cent and 12 per cent of gross income, the upper limit being applicable to cash crops.

(iii) The rates should be within the paying capacity of irrigators and should aim at ensuring full utilisation of available supplies.

(iv) Between regions with a similar class of supply, there should be minimum disparity, if any, in the rates charged.

(v) For fixing rates, irrigation should be divided into A, B and C categories on the basis of the quantity and timeliness of supply. Lower rates may be fixed, where, on account of good rainfall, the demand for irrigation water is less or where the supply is inadequate and uncertain.

(vi) The general level of rates in a State should be such that, taken as a whole, the irrigation schemes do not impose any burden on the general revenues.

During the seventh conference of the State Ministers of Irrigation and Power held in July 1973, it was pointed out that the progress made in increasing the irrigation rates in most of the States was slow and it was recommended that the State Governments should increase water rates to realise additional resources from the people who benefit from irrigation projects

involving public outlays. As a follow-up action on the resolution of this conference, a critical study on 'Water rates and Betterment levy' was made in the Central Water Commission. The Central Water Commission in their publication 'Irrigation Rates and Betterment Levy—a critical study 1975' had suggested that the following objectives should be kept in view while formulating a satisfactory rate structure of irrigation rates :—

(i) The total recoveries on account of irrigation rates from all the projects taken together should not be less than the annual cost incurred by the State for providing the service consisting of operation and maintenance charges and at least a portion of interest and depreciation on capital invested.

(ii) The irrigation rate should be equitable in the sense that it should be related to the ability of the farmer to pay, leaving him a fair share of the net benefit.

(iii) The irrigation rates should be so fixed as not to leave any irrigation potential unutilised on account of either the system of charging rates or the level of particular rates.

(iv) In cases where the foregoing considerations are satisfied, the rates should be so fixed as to bring into the State an appropriate share of the net benefits as a part of contribution of irrigators to resource mobilisation for further investment for development.

The First Irrigation Ministers Conference held in July 1975 recommended that the State Governments should increase water rates for irrigation projects in a phased manner to realise additional resources from farmers who benefit from irrigation projects involving large outlays.

The conference also recommended that Standing Inter-departmental Water Rates Review Boards be set up by the State Governments in order to review, on a continuing basis, the rate

structure and make recommendations to the State Governments for appropriate increases in water rates and recovery of betterment levy. These recommendations were conveyed to all State Ministers incharge of irrigation in July 1975. A copy of the study on "Irrigation Rates and Betterment Levy—A critical study 1975" was also forwarded for further guidance and expeditiously constituting Inter-departmental Water Rates Review Boards. The second conference of Irrigation Ministers held in September 1976 recommended that the States should draw up a time-bound programme for suitable upward revision of water rates and implement it by March 1978.

The water rates levied varied widely from State to State. Annexure 7 prepared on the basis of test check in audit of selected projects highlights the differences in rates prevailing in the different commands.

In some of the projects, the rates remained unrevised for long periods. For example, in the Parambikulam Aliyar Project (Tamil Nadu) the rates were not revised (July 1977) since 1969-70. In the Bhakra Nangal Project (Punjab), the rates remained the same from 1949-50, till they were revised in 1974-75. In the Bhakra Nangal Project (Haryana), the rates prevalent in 1949-50, before the reorganisation of States, remained unaltered till 1974-75. In the Tungabhadra Project (Andhra Pradesh), water rates continued to be the same from 1st July 1957 till their revision on 1st July 1974.

Annexure 8 gives the percentage of water rate to gross value of produce per acre for the year 1974-75 in respect of a few important crops in some of the projects studied in audit. It may be seen that, in most of the cases, water rate as percentage of gross value was below 4 per cent. In some of the projects, the percentage was very low, for example, Bhakra Nangal (Punjab) 1.1 per cent for wheat, Bhakra Nangal (Haryana) 0.77 per cent for wheat, Bhakra Nangal (Rajasthan)

1.6 per cent for barley and Tungabhadra (Karnataka) 0.6 per cent for rice.

It may be mentioned that the revenue receipts did not cover even the working expenses in many projects (*vide* paragraph 15.03).

B. *Assessment and collection of water rate*

The role of the Irrigation and Revenue Departments in assessment and collection of water rates varied from State to State. The agencies responsible for assessment and collection of water rates in different projects are indicated below :—

| Project | | Department responsible for | |
|---|---|---|---|
| | | Assessment | Collection |
| 1 | | 2 | 3 |
| Bhakra | Punjab | Irrigation | Revenue |
| | Haryana | Irrigation | Revenue |
| | Rajasthan | Irrigation | Irrigation |
| Chambal | Madhya Pradesh | Irrigation | Irrigation Panchayat/ Irrigation |
| | Rajasthan | Irrigation | Irrigation |
| Sarda | Uttar Pradesh | Irrigation | Revenue |
| Kosi | Bihar | Irrigation | Irrigation** |
| Hirakud | Orissa | Revenue | Revenue |
| Mayurakshi | West Bengal | Irrigation* | Revenue |
| Tungabhadra | Karnataka | Revenue | Revenue |
| | Andhra Pradesh | Revenue | Revenue |
| Nagarjunasagar | Andhra Pradesh | Revenue | Revenue |
| Parambikulam Aliyar | Tamil Nadu | Revenue | Revenue |
| Kakrapar | Gujarat | Irrigation | Irrigation |
| Purna | Maharashtra | Irrigation | Revenue |
| Girna | Maharashtra | Irrigation | Irrigation |

**Separate Revenue Divisions under the Irrigation Department.

*From July 1974, joint verification of new area brought under irrigation by officer of the Irrigation Division and Zilledar of the Revenue Department.

Some important points noticed in test check in audit in this connection are mentioned below :—

(i) In Karnataka, the Revenue Department did not maintain separate records to show the areas actually irrigated and assessed for water rate for the Tungabhadra project; the figures of assessment, demand and collection related to several other sources of irrigation also in the districts of Raichur and Bellary.

(ii) In Nagarjunasagar and Tungabhadra (Andhra Pradesh) and Parambikulam Aliyar (Tamil Nadu), the demand for water rate is merged with land revenue and raised as a single consolidated demand. Collections are made against the total demand as a whole and separate accounts of collection and balance for each element (land revenue, water rate etc.) are not maintained by the Revenue Department. The water rate thus loses its separate identity and consequently separate figures for water rates collected and arrears outstanding are not available.

(iii) The figures of area irrigated as reported by the Irrigation Department did not agree with those reported by the Revenue Department in three projects, namely, Tungabhadra (Andhra Pradesh), Nagarjunasagar and Parambikulam Aliyar. There was no effective procedure to avoid such differences.

*. Demand, collection and balance*

According to departmental records, the position of demand, collection and balance outstanding in respect of water rates for the five years 1971-72 to 1975-76 is given below :

(Rupees in lakhs)

| Name of the Project | 1971-72 | | | | 1972-73 | | | 1973-74 | | | 1974-75 | | | 1975-76 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Opening balance | Demand raised | Recovery during the year | Balance | Demand raised | Recovery during the year | Balance | Demand raised | Recovery during the year | Balance | Demand raised | Recovery during the year | Balance | Demand raised | Recovery during the year | Balance |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| (1) **Bhakra Nangal** (Punjab) . | 25.63 | 345.15 | 330.21 | 40.57 | 401.24 | 394.96 | 46.85 | 406.81 | 414.13 | 39.53 | 622.52 | 526.94 | 135.11 | 673.04 | 753.64 | 54.51 |
| (Haryana) . | 7.37 | 130.67 | 127.77 | 10.27 | 139.57 | 143.92 | 5.92 | 141.54 | 138.89 | 8.57 | 141.13 | 135.92 | 13.78 | 314.01 | 282.48 | 45.31 |
| (2) **Chambal** (Madhya Pradesh) | 22.57 | 31.72 | 16.78 | 37.51 | 54.79 | 32.34 | 59.96 | 107.44 | 67.92 | 99.48 | 92.13 | 65.05 | 126.56 | 95.63 | 84.90 | 137.29 |
| (Rajasthan) . | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 16.67 | 19.70 | 63.34 | 70.92 | 61.00 | 72.54 |
| (3) **Sarda Canal** (Uttar Pradesh) | 76.07 | 233.46 | 109.70 | 199.83 | 312.84 | 286.21 | 226.46 | 326.38 | 358.76 | 194.08 | 358.74 | 346.84 | 205.98 | —Not available— | | |
| (4) **Kosi** (Bihar) . | 85.09 | 34.85 | 28.22 | 91.72 | 83.80 | 23.69 | 151.83 | 47.86 | 30.84 | 168.85 | 59.72 | 37.08 | 191.49 | 122.90 | 60.59 | 253.80 |
| (5) **Hirakud** (Orissa) . | 58.28 | 37.73 | 25.63 | 70.38 | 43.27 | 32.31 | 81.34 | 45.45 | 27.37 | 99.42 | 43.28 | 43.65 | 99.05 | 66.21 | 76.71 | 88.55 |
| (6) **Mayurakshi** (West Bengal) | 174.02 | 48.65 | 22.76 | 199.91 | 48.32 | 35.21 | 213.02 | 47.29 | 39.16 | 221.15 | 49.59 | 43.10 | 227.64 | 100.89 | 65.61 | 262.9 |
| (7) **Tungabhadra** (Karnataka) | 151.03 | 42.90 | 17.75 | 176.18 | 73.61 | 23.18 | 226.61 | 95.68 | 32.64 | 289.65 | 82.26 | 58.24 | 313.67 | 79.99 | 62.44 | 331.22 |
| (8) **Kakrapar** (Gujarat) . | 143.60 | 64.34 | 43.01 | 164.93 | 92.57 | 88.15 | 169.35 | 118.75 | 106.29 | 181.81 | 134.85 | 120.54 | 196.12 | 157.88 | 53.23 | 300.77 |
| | 743.66 | 969.47 | 721.83 | 991.30 | 1250.01 | 1059.97 | 1181.34 | 1337.20 | 1216.00 | 1302.54 | 1600.89 | 1397.06 | 1572.74 | 1681.47 | 1500.60 | 1752.89 |

Notes:—

1. For Tungabhadra (Andhra Pradesh) and Nagarjunasagar projects separate figures for recovery of water rates are not available as, under the procedure obtaining, these charges are merged with the land revenue and a single consolidated demand is raised against each cultivator.
2. For Parambikulam Aliyar project, separate figures of collection of water charges are not available as water rates are included in land revenue assessment and collection is accounted for against this assessment.
3. In the case of Bhakra Nangal (Rajasthan), the total revenue from water rates from 1957-58 to end of March 1976 was assessed as Rs. 875.87 lakhs against which actual recoveries amounted to Rs. 787.43 lakhs leaving a balance of Rs. 88.44 lakhs.
4. For Chambal (Rajasthan), the data for the years 1971-72 to 1973-74 were not available; opening balance as on 1-10-1974 was Rs. 66.37 lakhs.
5. The total outstandings of Rs. 1752.89 lakhs at the end of 1975-76 include Rs. 205.98 lakhs as outstandings in respect of the Sarda Canal System at the end of 1974-75.
6. According to the Purna Irrigation Division (May 1977), the total demand for water rates (exclusive of Local Cess) from 1963-64 to 1975-76 was Rs. 164.31 lakhs; recovery against the total demand was Rs. 9.54 lakhs. Year-wise break-up of the outstanding balance of Rs. 154.77 lakhs was not available with the division.



/3 AGCW & M/77—9

The total outstanding as at the end of 1975-76 was Rs. 1752.89 lakhs as against Rs. 991.30 lakhs at the end of 1971-72. Year-wise analysis of outstanding was not available in most of the projects.

D. *Other charges*

In addition to basic water rates, there are other types of rates prevailing in a few command areas :—

(i) In Madhya Pradesh, according to the Project Report (1954) of the Chambal Project, it was proposed to levy an irrigation cess of Rs. 2 per acre on all lands in the irrigable area. By a notification issued in June 1968, an irrigation cess of Rs. 2.50 per acre was imposed for the first time on the area commanded by a canal system. The rate was raised to Rs. 5 per acre with effect from 1st August 1972.

(ii) In Andhra Pradesh, a compulsory water cess is leviable to compel the farmers to develop the lands localised under a project and bring them under cultivation. As this is resorted to as a measure of penalty, cess is applicable so long as the cultivator does not irrigate the land. The levy of compulsory water cess for the ayacut under the Low Level Canal of the Tungabhadra project was notified by the State Government in July 1962 and April 1963 and the rates of compulsory water cess were notified in April 1968 as leviable from 1373 Fasli (1963-64) at the same rate as water cess. The demand notices were not served as the State Government was to take a view (May 1977) as to how far neglect by the farmers had contributed to non-availing of irrigation facilities.

(iii) In the Chambal command (Rajasthan), a kyari cess recoverable with water rates at the rate of 10 per cent of water rates was imposed in December 1972. This was raised to 25 per cent from kharif 1975 for recovery in cases where the cultivators failed to level their fields and provide bunding (Kyaries) thereon to avoid wastage of water in irrigation.

(iv) In the Tungabhadra project, in addition to water rate, a special assessment ranging from Rs. 5 to Rs. 25 per acre was levied from July 1974 on commercial crops under the Andhra Pradesh Commercial Crops (special assessment) Act, 1975.

(v) In the Hirakud command, water rate for paddy crop in kharif is a basic compulsory levy in respect of all land in the ayacut under this crop.

(vi) In the Kakrapar command, water rate is payable on all land for which sanction for supply of water has been granted, whether water is actually taken or not, provided that water for such supply is available.

(vii) In addition to the water rates, a rate known as owner's rate varying from Rs. 1.50 per acre to Rs. 3 per acre, depending on whether the irrigation facility is perennial or seasonal, is levied in Punjab. In Haryana, this rate was discontinued from kharif 1975.

(viii) In the Tungabhadra Project (Karnataka), in addidition to water rates there is provision for the levy of cess known as 'maintenance cess' at Rs. 4 per acre of land on the area benefited by any irrigation work. The cess is intended to meet partly the maintenance expenses of the project and is booked alongwith the demand for water rate.

15.03 **Financial return**

The working results and the financial return of the twelve projects for the period 1971-72 to 1975-76 are given in the following table :—

(In lakhs of rupees)

| Name of project | 1971-72 | | | | 1972-73 | | | | 1973-74 | | | | 1974-75 | | | | 1975-76 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gross receipts | Working expenses | Net surplus(+)/ deficit(—) | Simple interest on capital outlay | Gross receipts | Working expenses | Net surplus(+)/ deficit(—) | Simple interest on capital outlay | Gross receipts | Working expenses | Net surplus(+)/ deficit (—) | Simple interest on capital outlay | Gross receipts | Working expenses | Net surplus(+)/ deficit(—) | Simple interest on capital outlay | Gross receipts | Working expenses | Net surplus(+)/ deficit(—) | Simple interest on capital outlay | Capital outlay at the end of the year | Accumulated arrears of simple interest at the end of the year |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| **Bhakra Nangal** | | | | | | | | | | | | | | | | | | | | | | |
| (Punjab) . . . | 57.91 | 130.91 | (—)73.00 | 289.00 | 68.58 | 154.37 | (—)85.79 | 285.19 | 74.40 | 172.06 | (—)97.66 | 238.75 | 81.43 | 197.82 | (—)116.39 | 219.66 | 109.83 | 263.83 | (—)154.00 | 232.95 | 5639.80 | 4362.16 |
| (Haryana) . . | 168.97 | 151.87 | (+)17.10 | 241.00 | 191.05 | 159.54 | (+)31.51 | 240.92 | 185.78 | 182.05 | (+)3.73 | 240.98 | 171.70 | 250.39 | (—)78.69 | 240.86 | 344.45 | 262.42 | (+)82.03 | 240.84 | 3611.47 | 3064.55 |
| (Rajasthan) . . | 65.92 | 72.32 | (—) 6.40 | 136.23 | 115.75 | 64.13 | (+)51.62 | 219.15 | 138.30 | 74.51 | (+)63.79 | 149.34 | 55.28 | 85.78 | (—)29.50 | 236.46 | 163.72 | 101.29 | (+)62.43 | 237.54 | 2627.04 | N.A. |
| **Chambal** | | | | | | | | | | | | | | | | | | | | | | |
| (Madhya Pradesh) . | N.A. | N.A. | N.A. | N.A. | 54.79 | 36.46 | (+)18.33 | N.A. | 107.44 | 39.10 | (+)68.34 | N.A. | 92.13 | 46.41 | (+)45.72 | N.A. | 95.63 | 40.79 | (+)54.84 | N.A. | 3711.00 | N.A. |
| (Rajasthan) . . | 44.29 | 48.42 | (—)4.13 | 146.38 | 53.08 | 67.39 | (—)14.31 | 235.78 | 51.28 | 73.32 | (—)22.04 | 180.21 | 69.36 | 75.22 | (—) 5.86 | 295.69 | 70.92 | 71.32 | (—)0.40 | 295.76 | 3619.96 | N.A. |
| **Sarda Canal** . . (Uttar Pradesh) | 264.98 | 175.98 | (+)89.00 | 173.22 | 309.05 | 230.32 | (+)78.73 | 187.43 | 402.59 | 188.76 | (+)213.83 | 196.40 | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. |
| **Kosi** . . . (Bihar) | 30.00 | 99.00 | (—)69.00 | 375.00 | 17.00 | 100.00 | (—)83.00 | 403.00 | 23.00 | 166.00 | (—)143.00 | 434.00 | 59.00 | 204.00 | (—)145.00 | 467.00 | 61.00 | 139.00 | (—)78.00 | 497.00 | 8561.00 | 4550.00 |
| **Hirakud** . . . (Orissa) | 35.84 | 37.17 | (—)1.33 | 64.10 | 41.11 | 39.09 | (+)2.02 | 64.10 | 43.18 | 43.77 | (—)0.59 | 64.10 | 41.12 | 37.96 | (+)3.16 | 64.10 | 62.91 | 39.62 | (+)23.29 | 64.10 | 1888.00 | N.A. |
| **Mayurakshi** . . (West Bengal) | 28.00 | 72.00 | (—)44.00 | 90.00 | 38.00 | 72.00 | (—)34.00 | 91.00 | 41.00 | 70.00 | (—)29.00 | 92.00 | 44.00 | 79.00 | (—)35.00 | 93.00 | 68.00 | 92.00 | (—)24.00 | 95.00 | 1755.00 | 1742.00 |
| **Tungabhadhra** | | | | | | | | | | | | | | | | | | | | | | |
| (Andhra Pradesh) . | 16.79 | 32.27 | (—)15.48 | 98.64 | 19.59 | 41.41 | (—)21.82 | 99.15 | 50.79 | 100.32 | (—)49.53 | 99.53 | 33.42 | 80.73 | (—)47.31 | 99.53 | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. |
| (Karnataka) . . | 23.69 | 109.37 | (—)85.68 | 285.82 | 56.09 | 108.47 | (—)52.38 | 294.82 | 35.72 | 130.96 | (—)95.24 | 304.35 | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. |
| **Nagarjunasagar** . (Andhra Pradesh) . | 130.32 | 6.54 | (+)123.78 | 1091.69 | 135.57 | 6.78 | (+)128.79 | 1154.44 | 171.83 | 114.85 | (+)56.98 | 1197.80 | N.A. | N.A. | N.A. | N.A. | N.A. | N.A, | N.A. | N.A. | N.A. | N.A. |
| **Parambikulam Aliyar** . (Tamil Nadu) | 36.23 | 36.28 | (—)0.05 | 273.13 | 27.29 | 32.37 | (—)5.08 | 282.85 | 14.97 | 34.12 | (—)19.15 | 290.52 | 2.55 | 40.86 | (—)38.31 | 299.20 | 65.92 | 47.51 | (+)18.41 | 314.48 | 5152.88 | 3105.50 |
| **Kakrapar** . . (Gujarat) | 47.62 | 63.24 | (—)15.62 | 77.54 | 6.71 | 31.91 | (—)25.20 | 79.89 | 57.61 | 37.87 | (+)19.74 | 81.70 | 109.43 | 46.12 | (+)63.31 | 83.10 | 88.80 | 56.45 | (+)32.35 | 84.58 | 1745.95 | 1488.13 |
| **Purna** . . (Maharashtra) | 0.17 | 22.70 | (—)22.53 | 83.51 | 0.40 | 28.47 | (—)28.07 | 85.09 | 3.13 | 24.74 | (—)21.61 | 86.44 | 4.42 | 39.75 | (—)35.33 | 87.87 | 1.20 | 49.15 | (—)47.95 | 89.00 | 1692.00 | 1043.00 |
| **Girna** . . . (Maharashtra) | 1 00 | 16.00 | (—)15.00 | 69.00 | 1.00 | 19.00 | (—)18.00 | 69.00 | 6.00 | 18.00 | (—)12.00 | 70.00 | 8.00 | 20.00 | (—)12.00 | 70.00 | 21.00 | 25.00 | (—)4.00 | 70.00 | 1350.00 | 978.00 |

*Notes* :—

(i) According to the report submitted by the Chief Engineer, Chambal Betwa Basin to Government of Madhya Pradesh in July 1976, a sum of Rs. 5.12 crores on account of sharing of maintenance cost of the Kota Barrage and Right Main Canal had not been adjusted (June 1977) between Madhya Pradesh and Rajasthan Governments, mainly for want of details.

(ii) For Chambal (Rajasthan), gross receipts represent revenue demands raised by the departments.

(iii) For Tungabhadra (Karnataka), gross receipts and working expenses are based on figures obtained from Irrigation and Revenue Departments.

(iv) For Parambikulam Aliyar (Tamil Nadu), gross receipts represent irrigation revenue for each year intimated by the Board of Revenue (Food Production).

(v) In case of the Sarda Canal, from 1974-75 the revenue receipts and working expenses of the Sarda Sahayak project have also been booked alongwith Sarda Canal project; hence, separate figures for revenue receipts and working expenses of Sarda Canal system from 1974-75 onwards were not available.

(vi) In the Hirakud project, the amount of water rates assessed as furnished by the Revenue Department has been taken as receipts; the collection of water rate is being credited under Land Revenue and not being transferred to the Irrigation receipts for allocation among irrigation projects.

It may be seen from the table given above that, in many projects, receipts did not cover even the working expenses; in none of the projects were interest charges covered.

## SECTION V

### 16. Summing up

16.01 In the preceding paragraphs, the factors relevant to the utilisation of potential and efficiency in the use of water were discussed under a few major categories. These were water-courses and field channels, water distribution system, control structures for water regulation, land levelling, maintenance of the canal system and crop pattern. The significance of these factors varied from project to project.

16.02 There were no field channels and watercourses in some projects though there were legislative provisions empowering Government to construct such channels and recover the cost thereof from the cultivators. In a few projects, there was progress in construction of channels, but not to the full extent required. The system of water distribution in the different reaches of the canal system was not uniform; in some cases, there was no rotational system of distribution of water while in a few others it was introduced only recently. Beyond the outlet stage, the system of warabandi, which enables cultivators to take water in their turn, was not generally prevalent. In many projects, the control structures were not adequate for regulating the flow of water to the extent required for the crops. Gated outlets and regulated discharge through these outlets were absent in most projects with the result that there was excessive drawal of water in the upper reaches. In almost all the projects, there was little progress in land levelling operations required for efficient application of water. The extent of loss of water during transmission and distribution was not measured in many projects; where such data were available, the loss was found to be in excess of what was envisaged in the project reports. There was scope for

improving the standard of maintenance and repair of the canal systems. In almost all the projects, there was no provision for drainage scheme in the original project reports ; the problem of waterlogging and drainage emerged after introduction of irrigation but no timely steps appeared to have been taken in most of the projects. One significant aspect affecting utilisation was the deviation of actual cropping pattern from what was originally envisaged. Substantial deviations from the prescribed cropping pattern were noticed even in the southern projects where Government was supposed to exercise direct control over the prescription and enforcement of cropping pattern.

16.03 In order to make efficient use of water, programmes for integrated development of command area were sponsored by the Central Government in several projects for being executed through Command Area Development Authorities. It was noticed that in some projects the authorities set up were not vested with adequate administrative and financial powers. In a few cases, there were frequent changes in the incumbency of the chief executive of the Authority and the persons appointed as Chief Executives were not always of the status or level commensurate with the responsibility assigned. In most of the projects, no specific programmes were drawn up for execution in a phased manner over a definite period. In two projects, where such programmes were drawn up, the progress was not reported to be appreciable.

16.04 Studies undertaken in audit of the Centrally sponsored schemes relating to soil conservation in catchment areas brought out several shortcomings. The master plan for the catchment areas indicating priority areas was prepared only recently. Studies of siltation in reserviors were either not conducted recently or, where available, indicated that the rate of siltation was increasing. There seemed to be lack of effective inter-state co-ordination in the work relating to catchment areas which fall in more than one State.

16.05 In regard to financial returns, betterment levy was not imposed in most of the projects ; in projects where levy was imposed, assessment and collection was short of what was originally envisaged. Water rates varied widely from State to State and in almost all projects there were heavy outstandings in collection. It was also noticed that revenue receipts did not cover the working expenses in most of the projects.

16.06 In the preceding sections of this Report, attention was focussed on the different factors affecting utilisation of potential. The paragraphs that follow sum up the findings project-wise, so as to give an overall view of performance and problems in each of the twelve projects studied in audit. The summing up in regard to each individual project highlights the significant aspects of under-utilisation obtaining in the particular project and the major factors affecting the utilisation in the specific conditions obtaining there.

*Bhakra Nangal (Punjab)*

The new area to be irrigated under the Bhakra Nangal Project in Punjab was 433 thousand hectares ; the area irrigated annually (average for 5 years 1971-72 to 1975-76) was about 285 thousand hectares. The performance was uneven in the main canal systems of the project ; utilisation of potential was in the range of 58 to 72 per cent in the Bhakra Main Line, 77 to 88 per cent in the Sidhwan Branch, about 50 per cent in the Bist Doab Canal and 60 to 78 per cent in the new area under the Sirhind canal.

One of the main reasons for non-utilisation in full of the irrigation potential was reported to be installation of a large number of private tubewells.

The actual crop pattern showed a large variation from what was originally envisaged ; a substantial area came under crops like rice and sugarcane which are relatively more water-intensive. In particular, rice cultivation was not envisaged in the original crop pattern.

Betterment levy collected was Rs. 6.24 crores against Rs. 43.97 crores assumed in the project report. The collection of betterment levy was discontinued from March 1968. Water rates for the different crops in Punjab were not changed till 1973-74. After the revision in 1973-74, the rates per acre for the major crops varied from 1 per cent to 2.9 per cent of the gross value of produce per acre. Receipts from the project did not cover even the working expenses during the period 1971-72 to 1975-76.

*Bhakra Nangal (Haryana)*

The total area to be irrigated under the project in Haryana was 717 thousand hectares; of this, 81 thousand hectares were in the restricted perennial zone (where water is made available for the entire year except during July and August) and 636 thousand hectares were in the perennial zone. Utilisation of potential (average for five years 1971-72 to 1975-76) was about 88 per cent in the restricted perennial zone. In the perennial zone, the area actually irrigated, 790 thousand hectares (average for 5 years 1971-72 to 1975-76), was in excess of the area planned to be irrigated. One of the main reasons reported for non-utilisation in full of the irrigation potential in the restricted perennial zone was installation of a large number of private tubewells.

The actual crop pattern showed a large variation from what was originally envisaged; a substantial area came under relatively more water-intensive crops like rice.

Betterment levy collected was Rs. 17.05 crores against Rs. 57.81 crores assumed in the project report. The Act for the collection of betterment levy was repealed in September 1975. Water rates for the different crops were not changed till kharif 1975. Receipts from the project did not cover even the working expenses in 1974-75; interest charges were not covered in 1975-76.

*Bhakra Nangal (Rajasthan)*

The area irrigated by this project in Rajasthan during the period 1971-72 to 1975-76 exceeded the area planned to be irrigated (231 thousand hectares). Betterment levy assumed on the basis of rates laid down in November 1959 amounted to Rs. 1817 lakhs; this was reassessed as Rs. 385 lakhs (1975-76) due to reduction in rates, exemptions etc. The actual recoveries up to 1975-76 aggregated to Rs. 241 lakhs. During the five years ended 1975-76, the receipts from the project covered the working expenses in three years; in none of the years was interest charge fully covered.

*Chambal (Madhya Pradesh)*

Extent of area irrigated varied from 43 to 56 per cent of the area planned to be irrigated during the years 1971-72 to 1975-76. In 1975-76, the area irrigated during kharif was about 15 thousand hectares against 82 thousand hectares envisaged in the project report; in rabi, the area irrigated was about 138 thousand hectares against 191 thousand hectares.

Lag in utilisation was substantial during kharif. Paddy cultivation could not be developed as irrigation facilities could not be made available for seedlings in summer months when the main canal was closed for weed clearance, maintenance and other works. For similar reasons, there was no development of sugarcane cultivation as water could not be assured throughout the year as needed for the crops. A revised cropping pattern proposed by the Agriculture Department in 1973 and adopted for the Command Area Development Programme envisaged annual irrigation of about 227 thousand hectares as against 273 thousand hectares originally planned to be irrigated.

The volume of water released during kharif and rabi for the area actually irrigated was higher than the project assumption indicating that water was not being used with maximum efficiency. Some of the factors responsible for this were delay in land

levelling, transmission losses, inadequacy of control structures in the canal system, lack of systematic water distribution and lag in construction of watercourses and field channels. Land levelling work had been completed in only about 3.3 thousand hectares. Transmission losses from the canal head to outlets were found to be much higher (44 per cent) than what was originally envisaged (33 per cent). Control structures necessary to facilitate distribution of water during periods of reduced canal flow were insufficient; only one out of 44 cross regulators required for this purpose was installed up to March 1977. There was no control over discharge through outlets and up to March 1977, 259 adjustable outlets out of the target of 3000 such outlets were installed. Rotational system for distribution of water among different minors and distributaries was introduced in 1972-73 rabi season. The system of distribution of water among cultivators beyond outlets, called warabandi, was introduced for the first time in 1974-75 in the first 60 kilometres of the Right Bank Main Canal; even in this reach, it was reportedly not functioning satisfactorily. Watercourses and field channels were constructed up to March 1975 to cover about 202 thousand hectares out of the culturable command area of 329 thousand hectares. Watercourses earlier constructed would have to be reconstructed after consolidation of holdings and land grouping under the Command Area Development Programme under execution.

For intensive development of the Command Area and for realising the cropping pattern drawn up by the Agriculture Department in 1973, a Command Area Development Programme, estimated to cost Rs. 37.31 crores, was under execution by the Command Area Development Authority. It covered on-farm development, installation of control structures and land levelling operations. Works commenced in June 1975 and were scheduled to be completed in 3 years; the progress was reported to be slow and the works are expected to be completed by June 1980.

The life of the reservoir was estimated 100 years in the project report. The area treated under soil conservation measures

up to March 1976 was about 17 per cent of the area affected. Survey carried out in 1975 indicated that the volume of silt was much higher than the project assumptions indicating accelerated erosion of the reservoir.

No recovery has been made towards betterment contribution. There were heavy arrears in the collection of water rates, the outstanding balance increasing from about Rs. 37.51 lakhs at the end of March 1972 to Rs. 137.29 lakhs in March 1976. Pro forma accounts of the irrigation projects in the State have not been prepared from 1959-60 onwards in the absence of required data from the departments; in the absence of data, it has not been possible to work out precisely the net surplus and deficit on revenue account.

*Chambal (Rajasthan)*

The area irrigated in kharif (25 thousand hectares) in 1975-76 was 32 per cent of the area planned to be irrigated (78 thousand hectares) according to the project report; the area irrigated in rabi (136 thousand hectares) was 66 per cent of the target (205 thousand hectares).

The lag in utilisation was more pronounced in kharif. Non-development of area under paddy in kharif was due to lack of water needed for the crop in the summer months when the Right Main Canal remained closed for weed removal, maintenance and other works. Soil in the area is reported to be not suitable for cultivation of cotton.

The total irrigable area assumed in the project report was 373 thousand hectares; this was reduced to 229 thousand hectares due to the distribution system not covering the entire area and large areas under ravines.

There was a progressive rise in sub-soil water level in the command area with the commencement of irrigation resulting in

waterlogging ; one per cent of the culturable command area was reported to be going out of cultivation every year. Only a few pilot drainage schemes were executed till recently and the drains constructed were not maintained. Provision of drainage in 167 thousand hectares has been taken up under the Command Area Development Programme started in July 1974 and expected to be completed by 1980.

Water supplied for the area irrigated was more than what was envisaged in the project report indicating that water was not being used with maximum efficiency. Some of the factors responsible for this were lack of systematic distribution of water, non-levelling of lands, loss of water in transmission and inadequate maintenance. A number of unauthorised outlets were installed by the cultivators in the early stages of irrigation ; about 800 such outlets were yet to be closed (July 1977). Warabandi, the system of distribution of water among cultivators beyond the outlets, did not cover the entire command and its enforcement, where introduced, was reported to be not adequate due to paucity of field staff. Levelling of 50,000 hectares was taken up under the Command Area Development Programme in July 1974 and an area of about 700 hectares was reported to have been levelled (June 1977). Losses of water from the canal head to the fields were assessed by the department (1974) at 69 per cent. Programme under execution by the Command Area Development Authority provide for about Rs. 40 lakhs for rectification of past maintenance deficiencies.

A Command Area Development Programme for intensive development of the command area commenced in July 1974 for completion by June 1980. The programme is executed by the Area Development Commissioner ; it is estimated to cost about Rs. 73 crores. The progress in implementation has been poor reportedly due, among other things, to time taken to convince the farmers about the utility of the programme.

Out of the total catchment area of about 4045 square kilometres in Rajasthan, an area of about 675 square kilometres was covered under soil conservation measures till March 1977 at a cost of about Rs. 200 lakhs. Silt sedimentation studies of the Gandhi Sagar reservoir conducted in 1975-76 showed that the siltation rate was about thrice the rate assumed in the project report. No sedimentation studies have been conducted for the Rana Pratap Sagar and the Jawahar Sagar reservoirs.

According to the financial forecast in the project report, about Rs. 700 lakhs were to be realised as betterment charges by March 1977 ; the actual realisations were Rs. 14 lakhs. The receipts from the project did not cover even the working expenses during the five year period ended 1975-76.

*Sarda Canal System (Uttar Pradesh)*

The total area irrigated (827 thousand hectares) in the Sarda Canal System during 1975-76 was about 75 per cent of the area proposed to be irrigated (1100 thousand hectares); the percentage of utilisation was comparatively less in rabi (69 per cent as against 84 per cent in kharif). Some of the factors responsible for non-utilisation of the potential in full were availability of water, efficiency in use of water, waterlogging and land levelling.

The original Sarda Canal System completed in 1930 did not have any reservoir. Two reservoirs, Sarda Sagar and Nanak Sagar, were completed in 1961-62. Extensions of the system consisted mainly of additional canals. The total length of the irrigation channels of the system increased from 6634 kms in 1930 to 14838 kms. in 1973-74, sprawling over 17 districts. Test check in audit disclosed that there was no irrigation at all during the last few years from some of the channels; irrigation in the lower reaches of the system particularly suffered from lack of water.

The area irrigated per cusec of water was less than what was assumed in the project reports indicating that water was not being used with maximum efficiency. Data collected from the divisions in test check showed that the average transmission losses during 1970-71 to 1974-75 in the Hardoi branch system were 79 per cent more than the losses assumed in kharif season and 41 per cent more in rabi season. According to the assessment of the State Government's Irrigation Department (May 1974), about 24 thousand kilometres of field channels were required to be constructed. A good part of the command area was not covered by field channels ; in some cases existing field channels had been dismantled in the course of consolidation operations as the consolidation officials reportedly did not consult the Irrigation Department. The outlets provided in the system were ungated and did not facilitate effective control of distribution of water. There was also virtually no system of distribution of water beyond the outlets among cultivators. In some irrigation channels certain repair works could not be carried out and silt was not cleared due to lack of funds ; non-clearance of silt affected supply of water to the tail-end areas. The funds allotted for maintenance were generally less than 50 per cent of the requirement as assessed by the project authorities. According to the Irrigation Department of the State Government, facilities were not available to farmers for land levelling which is necessary to adjust the slope of the irrigable land for economic use of water. Drains and escapes were not sufficient for draining out the water in the command area due to their inadequate capacity, silting and blockage at several places because of encroachment of cultivators. Large areas of low-lying lands remained waterlogged and uncultivated.

The average yield of important crops in the command area was less than the average yield of the State as a whole. The yield of paddy in the canal irrigated sector in the command area was less than the yield in the non-canal irrigated sector. The area under double cropping was also less than the area in other

canal systems of the State. The Area Development authorities attributed the position to the lack of sufficient and timely supply of water.

No law had been enacted enabling levy of betterment contribution though the State Government had decided (1961) in principle to impose betterment levy. According to the Administrative Accounts for 1969-70 to 1973-74 (the latest year up to which figures relating to the Sarda Canal System were available separately) the receipts covered the working expenses, but did not generally cover the interest charges.

*Kosi (Bihar)*

The average area irrigated during the period 1971-72 to 1975-76 was about 18 per cent of the area planned to be irrigated (743 thousand hectares).

The cropping pattern envisaged irrigation of 187 thousand hectares in hot weather; there was no hot-weather crop from the project during the last 3 years ending 1975-76 due to non-running of the canal during the required period. The acreage under rabi crops was also poor, one of the main reasons being the long period taken up in the cultivation of kharif paddy. The kharif paddy fields were not free till the middle or end of December by which time it was late for wheat cultivation. The period of kharif paddy crop could be reduced by replacing traditional varieties of paddy with high yielding varieties. This could not be done as high yielding varieties of paddy required early release of water in the canal system whereas the main canal was normally opened for irrigation in late June or July during the last few years.

The culturable command area of the project was reduced, on re-assessment, from 639 thousand hectares assumed in the project report to 440 thousand hectares. The carrying capacity

of the canal sections was reduced to about 60 per cent due to siltation although a silt ejector costing about Rs. 37 lakhs had been installed in May 1971 and substantial expenditure was being incurred on desilting.

The depth of water supplied to the fields was higher than what was assumed in the project report indicating that the water released was not being used with maximum efficiency. Test check in audit disclosed that many of the watercourses constructed had a designed discharge which was more than what was manageable for the cultivators. Structures to regulate flow of water into the watercourses were not provided; in the absence of such structures, it was not possible to enforce any rotational system of distribution of water from the watercourses. No field channels had been put up by Government although legislative provision existed for their construction by Government and recovery of the cost subsequently from the cultivators. Warabandi for regulation of supply of water among cultivators beyond outlets did not operate. Land levelling measures necessary for efficient application of water were yet to be taken in a large part of the command area. It was estimated that an area of 306 thousand hectares has irregular topography requiring land levelling operations; only about 16 thousand hectares were reported to have been levelled under a scheme financed by the Bihar State Co-operative Land Mortgage Bank.

The Kosi Area Development Authority started functioning from January 1974 for promoting integrated development of the command area of the project. This was converted in December 1974 into a corporate body and renamed as the Kosi Command Area Development Agency. The Chairman of the Agency was not given adequate administrative and financial powers in relation to the functions of the departments operating in the command area. Out of Rs. 82 lakhs received by the Agency from Government, Rs. 29 lakhs were spent up to

March 1977 mainly on establishment, survey and demonstration and the un-utilised amount of Rs. 53 lakhs was kept in a nationalised bank.

Betterment contribution envisaged in the project report had not been levied. Receipts from the project did not cover even the working expenses during the five years ending 1975-76.

*Hirakud (Orissa)*

There was nearly full utilisation of the irrigation potential during the 5 years 1971-72 to 1975-76. In 1975-76, area irrigated in kharif was about 153 thousand hectares and in rabi 92 thousand hectares. There were disparities in the intensity of irrigation between different reaches of the canal system; a test check showed that area irrigated (average for three years 1972-73 to 1974-75) as percentage of the Culturable Command Area in the head, middle and lower reaches was 75, 61 and 50 respectively.

The cropping pattern visualised for rabi was not realised. As against about 54 thousand hectares envisaged for paddy cultivation during rabi, the area under paddy was 87 thousand hectares. As crops other than paddy require less water, more area could be irrigated during rabi if the diversified cropping pattern had materialised. The Central Team on Water Utilisation, which visited the project in January 1976, observed that the main reason which inhibited the development of diversified crop was the absence of field channels which necessitated irrigation by flooding from field to field. The Irrigation Department of the State Government had estimated (1975) that an additional 13.5 thousand hectares could be brought under rabi if field channels were constructed. It was reported that the number of outlets was far more than was conducive for economy in use of water; also, most of the outlets did not have any arrangements for control of water. The

maintenance of the canal system was reported to be inadequate. The authority for the integrated development of command area was set up recently in May 1976.

No betterment charges had been levied. Receipts from the project, by way of water rate, covered the maintenance expenses for some years but did not cover the interest charges in any of the five years 1971-72 to 1975-76.

*Mayurakshi (West Bengal)*

Area irrigated in kharif during the five years 1971-72 to 1975-76 ranged from about 193 thousand hectares to 207 thousand hectares. Area to be irrigated was about 241 thousand hectares as per the 1953 project estimate; this was reduced to 227 thousand hectares in the revised estimate (1967). During rabi, the area irrigated ranged from 3 thousand hectares to 25 thousand hectares. As per project estimate (1953), the area planned to be irrigated for rabi was about 48 thousand hectares; this was reduced in 1967 to 20 thousand hectares. A review committee appointed by the State Government (August 1975) stated that, with the quantity of water available for rabi irrigation, area irrigated could be extended to at least 120 thousand hectares, with judicious crop pattern and better water management. Government had not taken a decision on the revised cropping pattern on the lines suggested by the Committee.

Several factors had been affecting efficiency in use of water. Transmission and distribution losses were higher than what was envisaged in the project report. No field channels were in existence necessitating irrigation by flooding from field to field, with consequent wastage of water. There was a large number of temporary and ungated outlets with no arrangements for control of water. It was noticed during test check that the actual discharges in several branch canals were less than the

designed discharges due, reportedly, to inadequate maintenance. The period during which the canals could be closed for maintenance was not adequate. Summer irrigation (Boro paddy) reduced the time available for maintenance as the Boro season extended up to the middle of May or even later. The Central Team on Water Utilisation had observed (October 1975) that, by cutting out Boro paddy cultivation from the canal supplies, a longer period could be available for maintenance.

A Command Area Development Authority was set up in July 1974 and an officer of the rank of Joint Director of Agriculture was appointed as the Administrator in June 1976. No comprehensive programme has been drawn up for the integrated development of the area through co-ordination of the activities of different departments and organisations.

Betterment levy had not been imposed. Receipts from the project, by way of water rates, did not cover even the working expenses in any of the five years 1971-72 to 1975-76.

*Tungabhadra (Karnataka)*

The three main canals in the project are the Left Bank Main Canal and the Low Level and High Level Canals on the Right Bank.

*Left Bank Main Canal.*—This is the largest canal in the project. The area irrigated during 1975-76 (about 111 thousand hectares) was 46 per cent of the area to be irrigated (about 244 thousand hectares). Some of the factors responsible for under-utilisation were the nature of the cropping pattern, inadequate canal discharge, slow progress in land levelling and waterlogging.

There were large scale violations of the prescribed cropping pattern constituting unauthorised irrigation; the extent of such unauthorised irrigation was about 39 thousand hectares in 1975-76. The major portion of unauthorised irrigation was

accounted for by paddy which was grown in areas in excess of the areas earmarked (localised) for the purpose. The penalties levied on unauthorised irrigation did not appear to have served as a deterrent; against the total amount of Rs. 160 lakhs levied up to March 1976, only Rs. 23 lakhs were collected. A technical committee was appointed by State Government in January 1973 to look into the cropping pattern, unauthorised irrigation and the water distribution system. It recommended (December 1976) adoption of a revised cropping pattern restricting the areas under paddy and sugarcane. To ensure better water management, the committee also suggested a block system of irrigation under which each outlet would have only one type of crop instead of the existing mixed cropping pattern under which each outlet catered for wet, perennial and dry crops. The committee also suggested enhancement of penalty for unauthorised irrigation and a vigorous drive for collection of penalties. A decision by the State Government on these recommendations was pending.

The canal was designed for a discharge of 3100 cusecs. The actual discharge capacity was assessed by the department as 2583 cusecs, and the requirement as 4100 cusecs to irrigate the area originally visualised. Works were in progress, against estimates sanctioned for about Rs. 10 crores, mainly on strengthening and raising the canal banks; these were expected to be completed in about 5 years.

Land levelling in the command area was done largely through the land development banks. The area developed by March 1976 (about 128 thousand hectares) formed about 52 per cent of the area proposed to be irrigated. Non-levelling in such large areas led to excessive drawal and wastage of water by the farmers. Among the reasons given by the State Government authorities for slow progress in land levelling were absentee land-ownership and lack of assured water supply due to limited canal capacity.

The natural drains in the command area had become weed-infested and silted; encroachments were made by the cultivators into the natural drainages. Measures for removal of weeds and silt, excavation of drains and lining of major distributaries were under consideration of Government. Field channels, constructed at Government cost, were required to be maintained by the farmers. Such maintenance was not always done in practice; the Chief Engineer stated that channels were not maintained in areas (about 40 thousand hectares) where irrigation was not done due to non-supply of water.

*Right Bank Low Level Canal.*—The area irrigated in 1975-76 (about 34 thousand hectares) was 92 per cent of the area to be irrigated (37 thousand hectares). Some of the factors which stood in the way of full utilisation of potential were breaches in the canal, violation of cropping pattern, irrigation during summer months involving heavy transmission losses and non-development of land in certain areas in the command.

*Right Bank High Level Canal.*—The area irrigated during 1975-76 (about 36 thousand hectares) was about 44 per cent of the area to be irrigated (81 thousand hectares). Among the factors responsible for under-utilisation were inadequate discharge in the canal and the unsuitable irrigation season. The designed discharge of the canal was four thousand cusecs. It was found that the canal could safely take only a limited discharge of 2650 cusecs. Improvements to the canal (estimated cost about Rs. 2 crores), taken up in November 1974, were expected to be completed by 1978-79. According to the Agriculture Department of the State Government, the period of water supply for irrigation from the canal (15th July to 15th December) was not suited either for kharif or for rabi season. The irrigation season could not be changed as the supply of the water in the canal was subjected to the storage level in the reservoir in the middle of July. The Chief Engineer

stated that it was for the Agriculture Department to propagate, through research and extension work, the crops that could be grown during the approved season.

The Command Area Development Authority was set up in the Tungabhadra Command (covering all the canals) in January 1974 with a full-time Administrator as its Chairman. It was only in April 1977 that the Administrator was given powers of the head of a major department in respect of the several departments engaged in the development of the command area. No master plan for the command area had been prepared.

There were delays in notifying the areas benefited from the project and in assessing the notified areas to betterment levy. The collection of dues was also heavily in arrears; out of Rs. 70 lakhs due up to 31st May 1976, only about Rs. 16 lakhs were collected. Regarding water rates, separate records were not maintained to show the assessment and the collections made for this project.

The receipts from the project did not cover even the working expenses during the period 1970-71 to 1973-74 (for which the figures were available from the departments).

*Tungabhadra (Andhra Pradesh)*

The area proposed to be irrigated under the command of the Low Level Canal was about 60 thousand hectares and the area actually irrigated ranged from 64 to 67 per cent during the years 1971-72 to 1975-76.

The area irrigated under wet crops (such as paddy) was about 20 thousand hectares in 1975-76 against 17 thousand hectares earmarked for this purpose (localised) whereas the irrigated dry crops (such as cotton, groundnut, chillies) accounted for only 19 thousand hectares as against 44 thousand

hectares. As wet crops consume more water than dry crops, the distortion in the pattern of cultivation, as between wet and dry crops, frustrated the objective of spreading the benefits of irrigation over the entire ayacut. The excess area under wet crops constitutes unauthorised irrigation attracting penalty. Such penalties were mostly waived and did not prove to be a deterrent. Against the total penalty of Rs. 12 lakhs levied up to 1974-75, Rs. 6.33 lakhs were waived by the State Government and proposals for waiver of Rs. 3.75 lakhs were stated to be under consideration. In order to increase the irrigated area under dry crops, a technical committee appointed by the State Government in December 1974 suggested cultivation of crops like cotton and chillies from August to November instead of during December to April as prescribed in the cropping pattern. The decision of Government on this suggestion was pending (June 1977).

Area irrigated per cusec of water in rabi (dry crops) was less than what was envisaged in the project report indicating that water was not being used with maximum efficiency. The rotational system for distribution of water among different channels of the canal system was introduced from 1966-67; suitable gates and shutters necessary for controlled distribution had not been installed. There was no efficient system of distribution of water, beyond the outlets, among cultivators as regulations requiring cultivators to take water only in their turns had not been formulated.

The organisational and administrative machinery required for the integrated development of the command area was not set up. The work was entrusted in October 1976 to the Collector, Kurnool district without additional funds and staff.

The impact of irrigation on agricultural production in the ayacut could not be assessed as relevant records, separately for the Command Area, were not being maintained by the Agriculture Department and the Bureau of Economics and Statistics.

Collection of betterment contribution was heavily in arrears; of the total demand for Rs. 186.53 lakhs due on 30th June 1976, only Rs. 41.61 lakhs were collected. Water rates were revised in July 1974; the earlier revision was in July 1957. The receipts from the project were, over the years, consistently less than the maintenance expenditure.

*Nagarjunasagar (Andhra Pradesh)*

It was envisaged that about 832 thousand hectares of irrigation potential would be created by 1968, but a potential of 427 thousand hectares only was created by the end of 1975-76. The delay in completion of the dam and the canal system was attributed to paucity of funds.

In 1975-76, the area irrigated was 54 per cent of the area proposed to be irrigated (302 thousand hectares) under the Jawahar Canal and for the Lal Bahadur Canal, it was 68 per cent of the area proposed for irrigation (125 thousand hectares). About 64 thousand hectares were reported to be under unauthorised wet cultivation in the Jawahar Canal. Unauthorised irrigation attracts penalty; such penalties were waived and did not prove to be a deterrent. As against the total penalty of Rs. 10.96 crores levied up to 1975-76, a sum of Rs. 10.08 crores was waived and proposal for the waiver of Rs. 0.12 crore was under consideration.

No suitable cropping pattern was finalised for the ayacut, though water was released in the canal in 1967. On the suggestion of the Government of India the State Government constituted (May 1977) two special teams, one for the Jawahar Canal Command Area and the other for the Lal Bahadur Canal Command Area to finalise the cropping pattern.

For the project, two separate Command Area Development authorities were set up in November 1974 for the Jawahar Canal and the Lal Bahadur Canal. Till July 1977 on-

farm development work had been completed in 992 hectares under the Jawahar Canal Command Area and 1751 hectares under the Lal Bahadur Canal Command Area. The slow progress was reported to be due to shortage of requisite technical staff in the field.

Betterment levy had not yet been imposed. Though a part of the project was opened for service in August 1967, no revenue accounts had been opened till 1972-73. In 1973-74 (the latest year for which the data were available), the receipts did not cover the interest charges.

*Parambikulam Aliyar (Tamil Nadu)*

The extent of area irrigated varied from 14 to 41 per cent of the area localised (101.5 thousand hectares).

The area thrown open for irrigation every year was substantially less than the area planned to be irrigated according to the project report. The area thrown open for irrigation is decided by the State Government on the basis of the assessment of the availability of water during the ensuing season. Only certain canals or sections of certain canals were thrown open each year from 1968-69 onwards though the project report had contemplated annual supplies to the entire ayacut to raise one irrigated crop.

The area under wet crops was 24.9 thousand hectares against the planned area of 11.4 thousand hectares while the area under dry crops was only 16.8 thousand hectares against the targeted area of 61.4 thousand hectares in 1975-76. The steps taken to curb unauthorised irrigation for wet crops did not prove to be effective. The penalties levied for unauthorised irrigation were mostly waived under general orders and did not serve as a deterrent. Penalties levied (Rs. 40.68 lakhs) up to 1970-71 were waived by the State Government in April 1973 taking into account the representations received from the farmers. The cropping pattern which actually emerged seemed largely to be the result of the farmers' choice of crops. The demonstration

farms set up to persuade the farmers to switch over to dry cultivation had little impact and the running of the farms was discontinued in April 1974. As wet crops consume comparatively more water than dry crops, the distortion in favour of wet crops tended to reduce the overall area irrigated.

The betterment contribution in respect of the area served by the Parambikulam Main Canal (73.13 thousand hectares out of the total localised area of 101.5 thousand hectares) had not been fixed even though the Main Canal had been completed in February 1970. There was no revision of the rates of water cess fixed in 1969-70. Government ordered levy of additional assessment on commercial crops from July 1976 but postponed (February 1977) collection of dues for the crop year 1976-77. Receipts from the project did not meet even the maintenance expenses during the four years ending 1974-75. The interest charges were not covered during 1975-76.

*Kakrapar (Gujarat)*

The area irrigated during 1975 and 1976 (about 90 thousand hectares) was about one-third of what was planned to be irrigated.

The Programme Evaluation Organisation of the Planning Commission had pointed out, as early as in 1966, that the real problem in the Kakrapar project was the cropping pattern. The prescribed cropping pattern did not materialise. Except for perennial crops like sugarcane, there was considerable shortfall in the area irrigated under other crops in 1976. There was no area under pulses and oilseeds, vegetables (two seasonal) rabi paddy, hybrid maize and fodder. A revised cropping pattern for the project was reported to be under consideration.

There were frequent changes in the design standards for determining the canal capacities resulting in some of the branch canals and minors having less and some having more discharge

capacities than required. The Left and Right Bank canals needed remodelling to accommodate the revised discharge requirements ; a proposal for remodelling at an estimated cost of Rs. 9.22 crores was under consideration.

Field channels were constructed by Government subject to recovery of cost from the cultivators. The progress in construction was poor, the area covered up to June 1976 (115 thousand hectares) being 65 per cent of the area required to be covered. Recovery of cost was heavily in arrears ; of Rs. 375 lakhs incurred up to June 1976, Rs. 122 lakhs were recovered by Government.

The area irrigated per million cubic feet of water was less than the project assumption, indicating that water was not being used with maximum efficiency. The rotational system of distribution of water among the different channels was not fully effective as the outlets were opened and closed by the cultivators also. Beyond the outlets, there was no system of distribution of water among cultivators which could enable them to take water in their turn. Certain repair and remodelling works of canals could not be carried out due to spread of perennial crops throughout the command area ; this also resulted in weed growth in some parts of the canals as it was not possible to keep the canals dry for sufficient time to arrest such growth. It was seen from divisional records that capacities of channels were, as a consequence, reduced by 10 to 30 per cent.

Water table has been recording a progressive rise after the introduction of irrigation. In December 1972, a master plan for drainage was prepared covering an area of 126 thousand hectares (out of the CCA of 227 thousand hectares) to be executed over a period of 10 years. The cost of drainage works was estimated in 1975 at about Rs. 20 crores. The drainage problem was taken up for investigation long after the commencement of the project and little progress had been made in completing the necessary drainage works.

A Command Area Authority for the integrated development of the command area was set up in May 1974. The post of the Chief Executive of the Authority was filled for short spells; for most of the period the post was held as an additional charge by the Chief Executive of another command in Ahmedabad. A programme for the development of the command area, earlier drawn up by another department, was adopted by the Command Area Development Authority; this was pending the State Government's approval (May 1977).

Though the Kakrapar canal was opened in 1958, no amount had been recovered by way of betterment charges. The receipts from the project covered maintenance expenditure but did not cover the interest charges.

*Purna (Maharashtra)*

Area irrigated during the five years 1971-72 to 1975-76 varied from 20 to 31 thousand hectares as against 62 thousand hectares planned to be irrigated. The actual cropping pattern differed substantially from what was visualised in the project report. The shortfalls were significant in regard to kharif seasonals, long staple cotton, sugarcane and other perennials. To ensure adherence to the prescribed cropping pattern, the State Government ordered (January 1968) introduction of a block system of irrigation for the command under which specific crops are to be grown in separate blocks. Government informed Audit (August 1976) that, as priority was being given to food crops, the block system had not been introduced; modification in the "irrigation management" of the project was under consideration.

Area irrigated per cusec of water was less than what was visualised in the project report indicating that water was not being used with maximum efficiency. Transmission and distribution loss was heavy; it was assessed at 40 per cent as against 10 per cent assumed in the project report.

A Command Area Development Authority was set up in May 1974. Detailed plans and estimates for modernisation of the irrigation system of the project were under preparation (July 1977).

Betterment levy was not imposed. Receipts from the project by way of water rate did not cover the maintenance expenses in any of the five years 1971-72 to 1975-76.

*Girna (Maharashtra)*

During the period 1971-72 to 1975-76, area actually irrigated ranged from about 40 per cent to 77 per cent of the area that could have been irrigated with the available water; in 1975-76, the area irrigated was about 23 thousand hectares against the potential of 56 thousand hectares.

Area irrigated per cusec of water was less than the project assumption indicating that water was not being used with the maximum efficiency. Transmission loss was higher than the project assumption. Water distribution system was reported to be not functioning satisfactorily. About 16 per cent of the culturable command area remained to be covered by field channel (June 1977).

The actual cropping pattern followed in the command area bore no relation to the pattern visualised in the project report. There were significant shortfalls in the area under cotton, chillies, kharif jowar, bajra and perennials other than sugarcane and banana. Introduction of a block system under which specific crops are to be grown in separate blocks was under consideration of the State Government (July 1976).

The reservoir was completed in 1969-70 and during the seven years since its completion, it was filled to the designed capacity only in one year; three medium projects, taken up for execution upstream of the Girna dam, would reduce the availability of water of the Girna project area. It was stated by

Government that water would be made available for these projects by dilution of the prescribed crop pattern for the Girna Project.

A Command Area Development Authority was set up in April 1974 ; up to January 1977 there were seven changes in the office of the Administrator of the authority.

No betterment charges were levied in the project. Receipts by way of water rate did not cover the working expenses during 1971-72 to 1975-76.

(K. P. RANGASWAMI)
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NEW DELHI ;

The 8th December, 1977.

Countersigned

(A. BAKSI)
*Comptroller and Auditor General of India.*

NEW DELHI;

The 9th December, 1977.

## ANNEXURE I

(Referred to in paragraph 6.03)

**Brief description of the 12 projects**
**Bhakra Nangal (Punjab, Haryana and Rajasthan)**

Bhakra Nangal Project is a multi-purpose River Valley Project on the river Sutlej for irrigation and for generation of hydro-electric power. Work on this Project was started in 1945-46 and completed in 1963.

The various component units of the project are:—

(*i*) *Bhakra Dam.*—The dam is flanked on the two sides by two power plants at its foot. Behind the dam is the Gobindsagar reservoir having a live storage of 6.03 million acre feet.

(*ii*) *Nangal Dam.*—About 12.90 kilometres downstream of the Bhakra Dam is the Nangal Dam to divert the supply received from the Bhakra Dam to the Nangal Hydel Channel. It provides for a storage of 24,000 acre feet of water to moderate the fluctuations of supplies from the Bhakra Dam.

(*iii*) *Nangal Hydel Channel*: This channel, which takes off from the left bank of the Sutlej just above the Nangal Dam, is a lined channel, 64.3 kilometres long, with a full supply discharge of 12500 cusecs. This lined channel runs along foothills to Ganguwal and ends near 1.6 kilometres of Ropar; from there the channel converts itself into the Bhakra Main Line. This channel, completed in July 1954, was primarily meant for running the two power houses *en route* at Ganguwal and Kotla (19.3 and 29 kilometres respectively from Nangal) and then to feed the Bhakra Main Line Canal.

(*iv*) *Remodelling of Ropar Headworks and Sirhind Canal and construction of Bist Doab Canal.*—Before the construction of the Nangal Dam, the Sirhind Canal constructed in 1882 and taking off from the left bank of the river at Ropar, had the first claim on the free flow of the river Sutlej. To effect improvement of water supply in the area already under irrigation and to provide irrigation to new tracts in the command of the Sirhind Canal, the capacity of the Sirhind Canal was enlarged from 9040 cusecs to 12500 cusecs and a new branch called Sidhwan Branch was added to it. Besides, a new canal, known as the Bist Doab Canal, with a discharge capacity of 1800 cusecs was constructed to take off from the Right Bank of the Sutlej at Ropar

headworks to serve the previously unirrigated areas on the right side of the river. Remodelling of the Ropar Headworks was taken up in 1952 and completed in June 1955. The Bist Doab Canal was completed in 1954. The remodelling of the Sirhind Canal was completed in 1962-63.

(*v*) *Bhakra Canals*. The Bhakra Main Line Canal is a continuation of the Nangal Hydel Channel and is designed to carry a discharge of 12457 cusecs. It is a lined channel, 174 kilometres long, and proceeds from near Ropar almost straight to Tohana at the border of Hissar district of Haryana where it bifurcates into two branches—Bhakra Main Branch (lined) and Fatehabad Branch (unlined). In all, there are nine branches and one sub-branch. These canals were completed in 1954-55 and were opened in July 1954.

The area to be irrigated under this project is 433.4 thousand hectares in Punjab, 675.5 thousand hectares in Haryana and 230.6 thousand hectares in Rajasthan.

*Chambal* (*Rajasthan and Madhya Pradesh*).—The Chambal Valley Development Project, a joint venture of Rajasthan and Madhya Pradesh Governments, was initially approved by the Planning Commission in 1952. The project is a power-*cum*-irrigation project comprising three dams on the river Chambal, Gandhi Sagar dam located in Mandsaur district of Madhya Pradesh, Ranapratap Sagar dam located near Rawatbhata in Chittorgarh district of Rajasthan 34 kilometres downstream of Gandhi Sagar dam and Jawahar Sagar Dam located at 38 kilometres downstream of Ranapratap Sagar dam. At the barrage near Kota city, Chambal waters are diverted into the main canals designed to serve both the States of Madhya Pradesh and Rajasthan.

The Left Main Canal with a full supply discharge of 1500 cusecs lies entirely in Bundi district of Rajasthan. The Right Main Canal with a discharge capacity of 6656 cusecs at its head flows for the first 124 kilometres in Kota district of Rajasthan and then enters Madhya Pradesh in Morena district through an aqueduct over the Parvati river with a designed discharge of 3900 cusecs. The project is designed to irrigate 283.5 thousand hectares of land in each State (in Kota and Bundi districts in Rajasthan and Morena and Bhind districts in Madhya Pradesh).

Work on Gandhi Sagar dam commenced in Jannary 1953 and was completed in November 1960. The canal system in Rajasthan was completed in essential details in 1960 and irrigation was started in November 1960. Construction of the canal system in Madhya Pradesh was completed between 1960 and May 1971. The sections of the main and branch canals were commissioned for irrigation between 1961 and 1971.

*Sarda Canal System* (*Uttar Pradesh*).—The Sarda Canal system takes off from the Sarda river at Banbassa in Naini Tal district. The project for construction of a barrage across the river at Banbassa for diverting the river supplies for irrigation was completed by 1930.

The main canal, 44 kilometres long, was designed for a discharge of 9500 cusecs. There are 6 important branch systems, the total length of the entire system including the main canal being 6634 kilometres. The project envisaged irrigation of 546.56 thousand hectares (303.64 thousand hectares in rabi and 242.92 thousand hectares in kharif) in culturable command area of 3313.77 thousand hectares spread over 9 districts of Pilibhit, Hardoi, Shahjahanpur, Sitapur, Sultanpur, Bareilly, Lakhimpur-Kheri. Lucknow and Unnao.

Extensions of the system were taken up between 1938 and 1960-61 and the length of irrigation channels increased from 6643 kilometres to 12066 kilometres and the proposed irrigation from 546.56 thousand hectares to 887.22 thousand hectares (362.81 thousand hectares in kharif and 524.41 thousand hectares in rabi) in a culturable command area of 3313.77 thousand hectares. Four more districts, namely, Rae Bareli, Pratapgarh, Allahabad and Barabanki were brought within the ambit of the Sarda Canal system.

In the original Sarda Canal Project there was no provision for storage of water. The Sarda Sagar Project was completed in two stages, in 1958-59 and 1961-62, for providing a storage reservoir for the Sarda Canal system. The head discharge of the Main Sarda Canal was increased from 9500 cusecs to 12400 cusecs and additional area of 144.53 thousand hectares was proposed for irrigation by constructing 1827 kilometres of additional channels and remodelling 2027 kilometres of existing channels. Another project for creating additional storage capacity for the Sarda Canal system *viz.*, the Nanak Sagar Project was completed in 1962-63 along with new channels for a length of 576 kilometres; additional irrigation of 39.27 thousand hectares was envisaged. As the requirements of irrigation were not met by these additional supplies, the Dalmau pump canal project, in 2 stages, for pumping water from the river Ganga into the Sarda Canal system at kilometres 93.99 of the Purwa branch canal was taken up and Stage I was completed in 1969-70. Stage II taken up in 1972-73 was in progress (June 1977). Stage I was to provide irrigation for additional 29.15 thousand hectares and Stage II for additional 28.34 thousand hectares.

The total length of the irrigation channels of the Sarda Canal system increased from 6634 kilometres in 1930 to 14838 kilometres in 1973-74 (main canal 44 kilometres, branches 2413 kilometres, distributaries and minors 12381 kilometres).

*Kosi (Bihar).*—The Kosi Project provides for two flood embankments and protective measures, a barrage across the river at Hanumannagar in Nepal, 5 kilometres from the Indian Border, a hydel power station to generate 20000 kilowatts of power (to be shared equally between India and Nepal) and three main canal systems for irrigation.

Construction of the two embankments on either side of the river, the right embankment extending from Jalpapur (Nepal) to Jhamta (Darbhanga district) and the left embankment from opposite Belka in Nepal to Maina in Saharsa district of Bihar, were completed substantially in 1957, from which year the annual spill of the Kosi river was confined between the embankments. The embankments were intended to protect an area of 214 thousand hectares—47 thousand hectares in Darbhanga district on the western side and 167 thousand hectares in Saharsa district on the eastern side.

The main canal systems are the Eastern Main Canal with a discharge capacity of 15000 cusecs, to irrigate 583 thousand hectares in the districts of Purnea and Saharsa, the Rajpur Branch Canal taking off from the Eastern Main Canal to irrigate 161 thousand hectares annually in Saharsa district and the Western Kosi Canal designed to irrigate an area of 313 thousand hectares annually in the district of Darbhanga.

The construction of the Eastern Kosi Main Canal system was started in April 1957 and the Canal was opened for irrigation in July 1964. The Rajpur Branch Canal system was taken up in 1962 and was opened for irrigation in a partial stage of completion in 1967-68. The Western Main Canal was under construction and expected to be completed by 1980.

*Hirakud (Orissa).*—Construction of a dam across the Mahanadi was originally envisaged mainly as a flood control measure. Later, it became a multipurpose project comprising a dam with a live storage of 4.72 million acre feet, two power houses (one below the main dam with 4 units of 37500 kilowatts each and 2 units of 24000 kilowatts each and another at Chiplima 26 kilometres below the dam with 3 units of 24000 kilowatts each) and three perennial contour canals, unlined for most part, with a culturable command area of 157 thousand hectares.

The Bargarh canal (89 kilometres), the longest of the three canals, has a designed discharge of 4802 cusecs and covers 400 villages in four tehsils of Sambalpur and Balangir districts with a culturable command area of 126.32 thousand hectares. Two branch canals, Attabira (C.C.A. 34.37 thousand hectares) and Retamunda (C.C.A. 15.29 thousand hectares), and three major distributaries *viz.*, Gudbhaga (C.C.A. 13.45 thousand hectares), Bhimtikra (C.C.A. 19.34 thousand hectares) and Bargarh (C.C.A. 12.72 thousand hectares) from the canal system. There are 46 distributaries, 65 minors, 22 sub-minors and 1607 watercourses covering a total length of 2768 kilometres.

The Sason Canal taking off from the left bank with a designed discharge of 630 cusecs flows a little over 23 kilometres before bifurcating into Paramanpur distributary and Huma tail distributary; these two distributaries pass through Sambalpur and Kushinda Tehsils of Sambalpur district covering a culturable command area of 23.24 thousand hectares. Sambalpur and Hirakud distributaries, with designed discharges of 127 cusecs, cater to 4.29 thousand hectares in Sambalpur district.

The Hirakud Project was started in 1949 and opened for irrigation in 1956. The Bargarh Canal was opened in September 1956 and the left side canals in October 1956.

*Mayurakshi* (*West Bengal*).—The project is intended to provide mainly irrigation within a gross command area of 321 thousand hectares in West Bengal and 8 thousand hectares in Bihar. The project serves the districts of Birbhum (221 thousand hectares), Murshidabad (80 thousand hectares) and Burdwan (20 thousand hectares) in West Bengal.

The main components of the project as constructed are:—

(*a*) a dam, named the Canada Dam, at Messanjore (Bihar) across the river Mayurakshi with a reservoir of live storage capacity of 445000 acre feet;

(*b*) a hydel power station at the dam site capable of generating 4000 kilowatts of power ;

(*c*) a canal taking off the dam, constructed by Government of Bihar, for irrigating 8 thousand hectares of land in Bihar (completed in March 1956);

(*d*) a barrage across the river Mayurakshi at Tilpara, West Bengal, 37 kilometres downstream of the dam for distributing water in the canal system of the project ;

(*e*) a canal system in West Bengal with three minor barrages across the rivers Brahmani (at Baidara), Dwarka (at Deocha) and Kopai (at Kultore) and one weir across Bakreswar (at Kadisala).

The work on the Mayurakshi Barrage was started in January 1945 and completed in July 1951. The work on the Mayurakshi Dam (Canada Dam) at Messanjore (Bihar) was started in February 1951 and completed in November 1955. The main works of the distribution system consisting of main canals and branch canals were completed by 1956.

*Tungabhadra* (*Andhra Pradesh and Karnataka*).—The project was taken up as a joint venture by the then Governments of Madras and Hyderabad in February 1945. After the formation of the Andhra State in October 1953, the project became the joint venture of the Governments of Andhra, Mysore and Hyderabad. With the reorganisation of the States in November 1956, it became the joint venture of the Governments of Andhra Pradesh and Mysore (now Karnataka).

The storage reservoir of the river Tungabhadra at Mallapuram (Bellary district in Karnataka) is designed to have a live storage of 130.7 million cft. of water over an area of 378.14 square kilometres. There are four canal systems :—

(*i*) The Left Bank Main Canal (a lined canal) runs for 227 kilometres in Raichur district of Karnataka. It is designed to carry a head discharge of 7000 cusecs up to 24th Kilometre for power and irrigation. Thereafter, the canal is designed for a head discharge of 3100 cusecs to irrigate an area of 234.82 thousand hectares. The canal and all its distributaries were completed in 1968.

(*ii*) The Left Bank High Level Canal is a small unlined channel designed for 33 cusecs and runs for 16 kilometres in Raichur district to irrigate 468.83 hectares.

(*iii*) The Right Bank Low Level Canal an unlined canal, is 371.2 kilometres long out of which the first 156.6 kilometre are in Bellary district of Karnataka State and under the control of the Tungabhadra Board. (The remaining 214.6 kilometres are in Kurnool district under the control of Government of Andhra Pradesh). Initially, it runs as a power canal for 22.54 kilometres with a head discharge of 2500 cusecs. Power is generated at 22.54 kilometres and 700 cusecs of water are let

back into the river. The Low Level Canal for irrigation starts at the point with a head discharge of 1800 cusecs to irrigate 37.52 thousand hectares in Bellary district of Karnataka and 60.20 thousand hectares in Kurnool district of Andhra Pradesh. Construction of the canal was completed by the Tungabhadra Board in 1957. The distribution system in Karnataka was completed by the Karnataka Irrigation Department by 1962-63; the distribution system in Andhra Pradesh was completed by March 1957.

(*iv*) The Right Bank High Level Canal is a lined canal and runs for 196.42 kilometres out of which 111.09 kilometres are in Bellary district of Karnataka and the remaining in Andhra Pradesh. It is designed for a head discharge of 4000 cusecs to irrigate 80.94 thousand hectares in Karnataka and 101.21 thousand hectares in Andhra Pradesh. The canal was completed in two stages in Karnataka by 1971-72 and was under construction in Andhra Pradesh (June 1977). At the end of 1975-76, distributaries and field channels covered an area of 64 thousand hectares in Karnataka.

*Nagarjunasagar* (*Andhra Pradesh*).—The Nagarjunasagar Dam across the river Krishna is situated 2.41 kilometres downstream of Nandikonda (Nalgonda district) and has a water spread of 285 square kilometres. The reservoir has a live storage capacity of 240.02 thousand million cft. Two canals take off from the reservoir, one on the right side, called the Jawahar Canal (discharge 11000 cusecs), to irrigate 475.30 thousand hectares in 6 taluks of Guntur district and 3 taluks of Prakasam district and the other on the left side, called the Lal Bahadur Canal (discharge 11000 cusces), to irrigate 396.76 thousand hectares in 3 taluks of Nalgonda district, 4 taluks of Khammam district and 6 taluks of Krishna district.

The planned length of the Jawahar Main Canal is 204 kilometres, of which the Canal was constucted up to kilometre 112 (March 1977). It has six branch canals, their carrying capacities ranging from 564 cusecs to 3436 cusecs and lengths ranging from 2 kilometres to 60 kilometres.

The planned length of the Lal Bahadur Canal is 179 kilometres, of which the Canal was constructed up to kilometre 155 (October 1976). It has two branch canals and 72 major distributaries. The discharge capacities of the branch canals (length 34.6 kilometres) are 555.19 cusecs and 1770.81 cusecs. The discharge capacities of the major distributaries range from 0.72 cusecs to 459.30 cusecs and their lengths range from 46 metres to 37 kilometres.

*Parambikulam Aliyar (Tamil Nadu).*—The Parambikulam Aliyar Project is a multi-purpose river valley project designed to utilise the waters of several west flowing rivers in the Anamalai range of Western Ghats to generate power and to irrigate the dry and arid regions of Pollachi, Udamalpet, Dharapuram and Palladam taluks of Coimbatore district. Water impounded in the reservoirs located in the hills was transferred to the two reservoirs constructed in the plains, namely, Aliyar and Tirumurthi reservoirs through the Sarkarpathi power house. The irrigation canals take off from the tail race of the Sarkarpathi power house, the Aliyar reservoir and the Tirumurthi reservoir.

The particulars of the canals and their dates of completion are given below:—

| Name of canal | Date of completion | Off-take point | Length (in kilometres) | Capacity (in cusecs) | Area to be irrigated (in thousand hectares) |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| Vettaikaranpudur canal | September 1965 | Aliyar reservoir | 17.6 | 95.00 | 4.6 |
| Aliyar Feeder Canal | June 1965 | Sarkarpathi power house | 13.1 | 286.00 | 1.9 |
| Sethumadai canal | June 1965 | Sarkarpathi power house | 8.4 | 63.00 | 2.0 |
| Pollachi canal | September 1965 | Aliyar reservoir | 48.3 | 300.00 | 9.5 |
| Udamalpet canal | June 1967 | Tirumurthi reservoir | 30.5 | 278.00 | 7.6 |
| Uppar canal (right flank) | October 1967 | Uppar reservoir | 12.7 | 72.00 | 1.0 |
| Uppar canal (left flank) | October 1967 | Uppar reserovir | 17.5 | 106.56 | 1.5 |
| Parambikulam Main canal | February 1970 | Tirumurthi reservoir | 126.1 | 1031.00 | 73.1 |

The canals are intended to irrigate an area of 19.03 thousand hectares with wet crops (mainly paddy) and an area of 75.30 thousand hectares with dry crops (cotton, groundnut and millets). Including the area of about 2.84 thousand hectares to be irrigated with water impounded in the storage tanks in Dharapuram taluk, the project is expected to benefit a new ayacut of 97.17 thousand hectares besides stabilising existing ayacuts of about 3.64 thousand hectares in Tamil Nadu and 8.10 thousand hectares in Kerala State.

*Kakrapar (Gujarat).*—A project for the construction of a pick-up weir on the Tapi river at Kakrapar in Surat district to provide irrigation in Surat and Valsad districts was sanctioned in June 1949 as a first stage in the development of the lower Tapi basin. From the pick-up weir at Kakrapar, two canals take of :—

(*i*) The Right Bank Main canal, 64.40 kilometres long, is designed for a discharge of 1125 cusecs to cater to a culturable command area of 61.5 thousand hectares in Surat distirict.

(*ii*) The Left Bank Main Canal, 64.40 kilometres long, is designed for a discharge of 3024 cusecs to serve a culturable command area of 166 thousand hectares in Surat and Valsad districts.

As a second stage of the development of the lower Tapi basin, a multi-purpose project was sanctioned in 1961 at Ukai about 26 kilometres upstream of the Kakrapar weir, comprising a storage dam, four generating units and a canal system to irrigate an area of 152.6 thousand hectares in Surat and Bharuch districts. This second stage project was expected to bring an additional area of 22.75 thousand hectares of perennial crops under the Kakrapar Command. On the whole, the annual irrigation envisaged in the Kakrapar Command was 265 thousand hectares.

According to the revised Project Report (1958), the first stage covering the culturable command area of 227 thousand hectares was to have been completed by 1965-66. By June 1965, the culturable command area actually covered by canals was about 73 per cent. By June 1976, canals had been constructed to cover a culturable command area of 213.63 thousand hectares. The work on the second stage was completed in 1972 and water was impounded in the reservoir during June/September 1972.

*Purna (Maharashtra).*—The Purna Project is an irrigation-*cum*-hydro electric project on the river Purna in Parbhani district. The project consists of a reservoir at Yeldari with a live storage of 32629 million cubic feet of water,

a diversion dam at Sidheshwar, 64 kilometres downstream of Yeldari along the river, with a live storage of 2854 million cubic feet of water and a power house at the toe of the Yeldari dam with an installed capacity of 22.5 M.W.

Water released fro m the Yeldari reservoir for power generation is let into the Purna river. The Sidheshwar dam acts as a pick-up dam to hold the entire monsoon run off from its catchment between Yeldari and Sidheshwar as well as releases from the Yeldari power house.

The main canal, 45 kilometres long, takes off from the left flank of the Sidheshwar dam and is designed to irrigate 62 thousand hectares, 40 thousand hectares in Parbhani district and 22 thousand hectares in Nanded district.

The construction of the project, which was expected to be completed by June 1964, was completed in June 1968 except for certain items of work found necessary subsequently.

*Girna* (*Maharashtra*).—The Girna river rises in the Western hills of Kalwan sub-division in Nashik district and, after traversing a course of 146 kilometres in Nashik district and 168 kilometres in Jalgaon district, joins the Tapi river near Nandre in Jalgaon district. The project consists of a dam on the river Girna at Panzan in Nashik district and is essentially an irrigation project. The water from Girna dam is let into the Girna river and three canals take off from two pick-up weirs—one at Jamda (48 kilometres from the dam downstream) and the other at Dahigaon on the same river, 65 kilometres downstream of Jamda.

The work on the project was started in 1957-58 and was scheduled for completion in 1963-64; it was completed in 1969-70. The gross command area is 92.92 thousand hectares of which 79.28 thousand hectares are culturable. The area planned to be irrigated annually is 57.21 thousand hectares in Jalgaon district.

## ANNEXURE 2

(Referred to in paragraph 9.01)

| Project | Duty (in acres per cusec at canal head) | | | | | |
|---|---|---|---|---|---|---|
| | As per project report | Actually materialised | | | | |
| | | 1971-72 | 1972-73 | 1973-74 | 1974-75 | 1975-76 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. Tungabhadra Low Level Canal (Andhra Pradesh) | | | | | | |
| Kharif (wet) | 50 | 87 | 80 | 88 | 75 | — |
| Rabi (dry) | 160 | 59 | 76 | 60 | 75 | — |
| 2. Parambikulam Aliyar (Tamil Nadu) | 85 | 62.8 | 70.0 | 50.3 | 47.0 | 41.9 |
| 3. Purna (Maharashtra) | | | | | | |
| Kharif | 127 | 73 | 66 | 55 | 59 | 6 |
| Rabi | 128 | 72 | 88 | 66 | 78 | 74 |
| Hot weather | 89 | 29 | water not released | 35 | 39 | 40 |
| 4. Girna (Maharashtra) | | | | | | |
| *Jamda Left Bank Canal* | | | | | | |
| Rabi | 28.34 | 11.74 | 17.00 | 16.15 | 17.81 | — |
| Hot weather | 20.24 | 10.93 | 12.14 | 17.81 | 11.74 | — |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| *Jamda Right Bank* | | | | | | |
| Rabi . . . . | 28.34 | 21.45 | 24.69 | 28.34 | 21.45 | — |
| Hot weather . . | 20.24 | 10.93 | 21.45 | 23.48 | 15.36 | — |
| *Lower Girna Canal* | | | | | | |
| Rabi . . . | 28.34 | 12.95 | 14.17 | 18.62 | 12.95 | — |
| Hot weather . . | 20.24 | 7.69 | 9.71 | 11.33 | 6.47 | — |
| | | *Delta (in feet at canal head)* | | | | |
| 1. Chambal (Madhya Pradesh) | | | | | | |
| Kharif. . . . | 3 | 96 | 53 | 30 | 26 | 16 |
| Rabi . . . . | 2 | 3.3 | 2.8 | 3.7 | 3.0 | 3.3 |
| 2. Chambal (Rajasthan) | | | | | | |
| *Right Main Canal* | | | | | | |
| Kharif . . . | 3 | — | 10.3 | 13.6 | 7.9 | 10.2 |
| Rabi . . . . | 2 | — | 2.2 | 2.3 | 2.4 | 2.7 |
| *Left Main Canal* | | | | | | |
| Kharif . . . | 3 | — | 10.1 | 8.7 | 6.5 | 6.7 |
| Rabi . . . . | 2 | — | 2.7 | 2.8 | 2.7 | 2.9 |
| 3. Kosi Eastern Main Canal (Bihar) | | | | | | |
| Kharif . . . | 2.4 | 9.2 | 6.8 | 6.7 | 6.3 | 5.0 |
| Rabi . . . . | 1.2 | 19.3 | 15.9 | 9.8 | 14.9 | 16.7 |

*ANNEXURE 3*

(Referred to in paragraph 11.02)

(In thousand hectares)

## CROP-WISE DETAILS OF AREA IRRIGATED

| Name of the Project | | Area planned to be irrigated crop-wise | Area actually irrigated | | | | | Average for 5 years |
|---|---|---|---|---|---|---|---|---|
| | | | 1971-72 | 1972-73 | 1973-74 | 1974-75 | 1975-76 | |
| 1 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| BHAKRA NANGAL (Punjab) | | | | | | | | |
| *Restricted perennial* | | | | | | | | |
| 1. Nangal Hydel Channel . | Kharif | 1.0 | 0.1 | 0.5 | 0.3 | 0.6 | 0.6 | 0.4 |
| | Rabi | 2.0 | 1.9 | 1.6 | 1.6 | 1.7 | 1.7 | 1.7 |
| 2. Bist Doab . . . | Kharif | 40.4 | 18.1 | 20.9 | 19.3 | 21.9 | 18.8 | 19.8 |
| Canal . . . . | Rabi | 50.5 | 26.8 | 26.0 | 25.4 | 23.1 | 25.3 | 25.3 |
| 3. Bhakra Main Line . . | Kharif | 45.4 | 25.4 | 25.3 | 25.9 | 28.2 | 28.1 | 26.6 |
| | Rabi | 56.8 | 34.4 | 33.8 | 34.1 | 31.2 | 32.7 | 33.2 |
| Total Restricted Perennial. . | | 196.1 | 106.7 | 108.1 | 106.6 | 106.7 | 107.2 | 107.0 |
| Percentage of area irrigated to area planned to be irrigated (Restricted Perennial) . . | | | 54.4 | 55.1 | 54.5 | 54.4 | 54.6 | 54.6 |
| *Perennial* | | | | | | | | |
| 4. Bhakra Main Line . . | Kharif | 20.0 | 12.7 | 12.1 | 14.2 | 13.7 | 14.3 | 13.4 |
| | Rabi | 25.0 | 17.5 | 17.5 | 19.2 | 17.5 | 18.6 | 18.1 |

| 1 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 5. Sidhwan Branch . . | Kharif | 47.2 | 41.0 | 41.9 | 41.6 | 41.6 | 40.0 | 41.3 |
| | Rabi | 59.0 | 45.5 | 44.2 | 46.6 | 45.3 | 45.6 | 45.4 |
| 6. Sirhind Canal. . . | Kharif | 38.3 | 26.8 | 29.2 | 29.5 | 30.9 | 33.4 | 30.0 |
| | Rabi | 47.8 | 26.7 | 27.6 | 28.6 | 32.0 | 33.0 | 29.6 |
| Total perennial . . . | | 237.3 | 170.2 | 172.5 | 179.7 | 181.0 | 184.9 | 177.8 |
| Percentage of area irrigated to area planned to be irrigated (Perennial) . . | | | 71.7 | 72.7 | 75.7 | 76.2 | 77.9 | 74.9 |
| Total Restricted Perennial & Perennial . . . . | | 433.4 | 276.9 | 280.6 | 286.3 | 287.7 | 292.1 | 284.8 |
| Percentage of total area irrigated to total area planned to be irrigated . . . . | | | 63.9 | 64.7 | 66.0 | 66.4 | 67.4 | 65. 7 |
| BHAKRA NANGAL (Haryana) | | | | | | | | |
| A. Zone–I Restricted perennial | | | | | | | | |
| Cotton . . . . | | 7.5 | 0.5 | 0.7 | 0.8 | — | — | 0.7 |
| Sugarcane . . . | | 4.5 | 0.8 | 0.6 | 0.9 | — | — | 0.8 |
| Rice . . . . | | 2.1 | 21.8 | 20.2 | 21.5 | — | — | 21.1 |
| Wheat . . . . | | 26.3 | 25.4 | 9.9 | 18.4 | — | — | 17.9 |
| Oil Seeds . . . | | 3.7 | 5.7 | 14.7 | 11.1 | — | — | 10.5 |
| Other Foodgrains . . | | 12.6 | 3.3 | 8.1 | 4.6 | — | — | 5.3 |
| Miscellaneous . . | | 21.5 | 13.3 | 15.1 | 14.8 | — | — | 14.4 |
| | Total | 78.2 | 70.8 | 69.3 | 72.1 | — | — | 70.7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *B Zone–III Perennial* | | | | | | | |
| Cotton | 134.6 | 165.4 | 190.2 | 173.7 | — | — | 176.4 |
| Sugarcane | 12.2 | 13.3 | 13.8 | 17.3 | — | — | 14.8 |
| Rice | 4.3 | 30.0 | 28.2 | 27.0 | — | — | 28.4 |
| Wheat | 215.4 | 130.8 | 66.8 | 126.8 | — | — | 108.1 |
| Oilseeds | 24.8 | 102.5 | 171.3 | 117.1 | — | — | 130.3 |
| Other foodgrains | 64.5 | 226.0 | 192.4 | 199.2 | — | — | 205.9 |
| Miscellaneous | 159.9 | 122.6 | 151.1 | 165.6 | — | — | 146.5 |
| Total .. | 615.7 | 790.6 | 813.8 | 826.7 | — | — | 810.4 |
| Total A & B | 693.9 | 861.4 | 883.1 | 898.8 | — | — | 881.1 |
| BHAKRA NANGAL (Rajasthan) | | | | | | | |
| Kharif | 93.00 | 101.22 | 119.84 | 122.23 | 107.29 | 134.41 | 117.0 |
| Rabi | 138.00 | 138.05 | 128.34 | 139.67 | 169.23 | 172.50 | 149.5 |
| Total | 231.00 | 239.27 | 248.18 | 261.90 | 276.52 | 306.91 | 266.5 |
| CHAMBAL (Madhya Pradesh) | | | | | | | |
| *Kharif* | | | | | | | |
| (1) Paddy | 54.6 | 2.7 | 5.4 | 8.9 | 9.6 | 14.1 | 8.1 |
| (2) Sugarcane, garden crops etc. | 13.7 | 0.2 | 0.4 | 0.5 | 0.7 | 0.5 | 0.5 |
| (3) Cotton and other crops | 13.7 | — | 0.3 | — | 0.1 | 0.1 | 0.1 |
| Total | 82.0 | 2.9 | 6.1 | 9.4 | 10.4 | 14.7 | 8.7 |
| Percentage of total area shown in the respective columns to total area shown in column 2. | | 3.5 | 7.4 | 11.5 | 12.7 | 17.9 | 10.6 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| Rabi | | | | | | | |
| (1) Wheat | | | | | | | |
| (a) Ordinary . . | *191.3 | 48.2 | 56.3 | 40.4 | 47.7 | 20.2 | 42.5 |
| (b) High Yielding variety . . | | 36.2 | 38.7 | 37.8 | 56.9 | 72.1 | 48.3 |
| (2) Gram . . . | | 15.5 | 19.5 | 24.6 | 17.0 | 28.5 | 21.0 |
| (3) Rape and mustard . | | 6.9 | 8.8 | 11.3 | 11.7 | 16.2 | 11.0 |
| (4) Others . . . | | 7.8 | 3.2 | 1.6 | 0.5 | 1.4 | 2.9 |
| Total : | 191.3 | 114.6 | 126.5 | 115.7 | 133.8 | 138.4 | 125.7 |
| Percentage of total area shown in the respective columns to total area shown in column 2. | | 59.9 | 66.1 | 60.5 | 69.9 | 72.3 | 65.7 |
| Grand total . | 273.3 | 117.5 | 132.6 | 125.1 | 144.2 | 153.1 | 134.5 |
| CHAMBAL (Rajasthan) | | | | | | | |
| *Kharif* | | | | | | | |
| Paddy . . . . | 56.0 | 11.2 | 13.8 | 12.5 | 18.7 | 24.3 | 16.1 |
| Cotton . . . . | 13.0 | Nil | Nil | Nil | Nil | Nil | Nil |
| Sugarcane . . . | 7.4 | 0.7 | 1.1 | 2.4 | 3.3 | 2.2 | 1.9 |
| Vegetable & garden . | 1.8 | 0.4 | 0.8 | 0.4 | 0.5 | 0.2 | 0.5 |
| Other crops . . . | Nil | 1.0 | 10.0 | 0.8 | 4.5 | 0.4 | 3.3 |
| Total : . . | 78.2 | 13.3 | 25.7 | 16.1 | 27.0 | 27.1 | 21.8 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Percentage of total area shown in the respective columns to total area shown in column 2* | | 17.00 | 32.86 | 20.58 | 24.52 | 34.65 | 27.90 |
| *Rabi* | | | | | | | |
| Wheat | 197.8 | 93.7 | 100.4 | 87.4 | 90.6 | 87.4 | 91.9 |
| Gram | 7.5 | 31.9 | 45.1 | 41.4 | 29.9 | 38.1 | 37.3 |
| Other crops | Nil | 14.0 | 9.7 | 14.0 | 17.0 | 14.2 | 13.8 |
| Total | 205.3 | 139.6 | 155.2 | 142.8 | 137.5 | 139.7 | 143.0 |
| Percentage of total area shown in the respective columns to total area shown in column 2 | | 67.90 | 75.60 | 69.57 | 66.98 | 68.04 | 69.65 |
| Grand Total | 283.5 | 152.9 | 180.9 | 158.9 | 164.5 | 166.8 | 164.8 |
| SARDA CANAL SYSTEM (Uttar Pradesh) | | | | | | | |
| Paddy | 115.98 | 191.09 | 259.92 | 232.79 | 307.69 | 230.00 | 244.29 |
| Other Kharif | 172.32 | 23.89 | 51.42 | 59.92 | 47.77 | 79.00 | 52.40 |
| Rabi | 662.75 | 517.00 | 485.83 | 486.64 | 497.17 | 458.00 | 488.93 |
| Sugarcane | 149.12 | 42.91 | 61.94 | 78.14 | 69.64 | 60.00 | 62.53 |
| Total | 1100.17 | 774.89 | 859.11 | 857.49 | 922.27 | 827.00 | 848.15 |

*Proposed crop pattern under rabi has not been distinctly stated in the Project Report. The Report mentions that 70 per cent area would be under rabi (mostly wheat).

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
|---|---|---|---|---|---|---|---|---|
| KOSI (Bihar) | | | | | | | | |
| *Kharif* | | | | | | | | |
| Paddy . . . . | 415.78 | 60.32 | 141.29 | 90.28 | 88.26 | 138.05 | 103.64 | |
| *Rabi* | | | | | | | | |
| Wheat . . . | 140.89 | 23.08 | 26.32 | 18.62 | 34.01 | 30.77 | 26.56 | |
| *Hot weather* | | | | | | | | |
| Paddy . . . . | 187.05 | 3.64 | 20.24 | Nil | Nil | Nil | *4.78 | *There was no hot weather irrigation from the year 1973-74 |
| Jute . . . . | | Nil | Nil | Nil | Nil | Nil | Nil | |
| Sugarcane . . . | | Nil | Nil | Nil | Nil | Nil | Nil | |
| Total . | 743.72 | 87.04 | 187.85 | 108.90 | 122.27 | 168.82 | 134.98 | |
| Percentage of area irrigated to area planned to be irrigated . | | 11.7 | 25.3 | 14.6 | 16.4 | 22.7 | 18.2 | |
| HIRAKUD (Orissa) | | | | | | | | |
| *Rabi* | | | | | | | | |
| Paddy . . . . | 54.42 | Details of area irrigated year-wise not available, | | | | | 87.04 | |
| Cash crop . . . | 27.20 | average area irrigated during the years 1971-72 to | | | | | 2.62 | |
| Other crops . . . | 9.06 | 1974-75 is shown in column 8. | | | | | 1.20 | |
| Total | 90.68 | | | | | | 90.86 | |
| MAYURAKSHI (West Bengal). | | | | | | | | |
| Kharif . . . | 240.93 | 193.02 | 197.85 | 205.65 | 206.77 | 206.77 | 202.10 | |
| Rabi . . . . | 48.56 | 20.23 | 3.03 | 25.09 | 12.95 | 15.38 | 15.30 | |
| Total . | 289.49 | 213.25 | 200.88 | 230.74 | 219.72 | 222.15 | 217.40 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *TUNGABHADRA (Andhra Pradesh)* | | | | | | | |
| *Kharif* | | | | | | | |
| Area localised (wet ayacut) as indicated in brackets . . . | | 24.59 (16.42) | 21.40 (16.42) | 24.11 (16.44) | 19.76 (16.64) | 19.57 (16.67) | 21.88 (16.51) |
| Percentage of area irrigated to area localised . . . . | | 149.77 | 130.36 | 146.68 | 118.75 | 117.40 | 132.59 |
| *Rabi* | | | | | | | |
| Area localised (dry ayacut) as indicated in brackets. . . | | 15.08 (43.75) | 17.01 (43.74) | 16.09 (43.74) | 20.68 (43.41) | 19.28 (44.17) | 17.63 (43.76) |
| Percentage of area irrigated to area localised . . . | | 34.48 | 38.88 | 36.78 | 47.63 | 43.66 | 40.28 |
| *Total* | | | | | | | |
| (a) Localised area . | | 60.17 | 60.16 | 60.18 | 60.05 | 60.84 | 60.28 |
| (b) Irrigated area . . | | 39.68 | 38.41 | 40.20 | 40.43 | 38.85 | 39.51 |
| Percentage of (b) to (a) | | 65.94 | 63.85 | 66.81 | 67.33 | 63.86 | 65.55 |
| TUNGABHADRA (Left Bank Main Canal (Karnataka) | | | | | | | |
| *Kharif* | | | | | | | |
| Paddy . . . . | 20.91 | 29.70 | 28.87 | 24.94 | 20.86 | 28.40 | 26.55 |
| Sugarcane . . . | 8.44 | 2.79 | 3.21 | 4.54 | 4.35 | 4.23 | 3.82 |
| Garden . . . | 6.34 | 0.31 | 0.34 | 0.92 | 0.24 | 0.21 | 0.40 |
| Light (Dry cum wet) . . | | | | | | | |
| Kharif . . . | 89.07) 88.80) | 14.69 | 19.13 | 25.19 | 23.29 | 22.57 | 20.98 |
| Rabi . . . . | | Nil | Nil | Nil | Nil | 1.26 | 0.25 |
| Cotton . . . | 29.98 | | | | | | |
| Total . . | 243.54 | 47.49 | 51.55 | 55.59 | 48.74 | 56.67 | 52.00 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| *Rabi* | | | | | | | |
| Paddy | | Nil | Nil | 0.01 | Nil | 0.02 | 0.00 |
| Sugarcane | | 0.84 | 1.23 | Nil | Nil | 0.96 | 0.61 |
| Garden | | 0.12 | 0.12 | 0.08 | 0.01 | 0.05 | 0.08 |
| Light (dry cum wet) | | 47.30 | 48.89 | 56.68 | 54.87 | 26.18 | 46.78 |
| Cotton | | 61.95 | 55.49 | 61.15 | 61.99 | 31.48 | 54.41 |
| Total : | | 110.21 | 105.73 | 117.92 | 116.87 | 58.69 | 101.88 |
| *Summer* | | | | | | | |
| Paddy | | 14.44 | 7.67 | 12.58 | 11.31 | 18.12 | 12.82 |
| Sugarcane | | 1.42 | 1.96 | Nil | Nil | 2.69 | 1.21 |
| Garden | | 0.15 | 0.13 | 0.09 | 0.07 | 0.16 | 0.12 |
| Light (dry cum wet) | | 20.94 | 25.98 | 24.77 | 21.42 | 25.62 | 23.75 |
| Cotton | | Nil | Nil | Nil | Nil | 0.01 | 0.00 |
| Total : | | 36.95 | 35.74 | 37.44 | 32.80 | 46.60 | 37.90 |
| Grand Total : | 243.54 | 194.65 | 193.02 | 210.95 | 198.41 | 161.96 | 191.79 |
| NAGARJUNASAGAR (Andhra Pradesh) | | | | | | | |
| *Jawahar Canal Kharif | | 140.08 | 113.36 | 140.89 | 177.73 | 163.56 | 147.13 |
| Rabi | | 21.46 | 5.67 | 14.17 | 70.85 | 18.62 | 26.15 |
| *Lal Bahadur Canal Kharif | | 52.63 | 59.11 | 77.73 | 84.21 | 85.02 | 71.74 |
| Rabi | | 70.85 | 57.89 | 73.68 | 87.85 | 97.57 | 77.57 |
| Total | | 285.02 | 236.03 | 306.47 | 420.64 | 364.77 | 322.59 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *PARAMBIKULAM ALIYAR (Tamil Nadu)* | | | | | | | |
| *Wet* . . . . | | 7.6 | 12.4 | 5.5 | 12.4 | 24.9 | 12.6 |
| (Area thrown open) as indicated in bracket | | (9.8) | (12.8) | (6.1) | (8.5) | (11.4) | (9.7) |
| Percentage of area irrigated to area thrown open . . . . . | | 77.6 | 96.9 | 90.2 | 147.1 | 218.4 | 129.9 |
| *Dry* . . . . . | | 26.0 | 20.8 | 8.9 | 14.9 | 16.8 | 17.5 |
| (Area thrown open) as indicated in bracket | | (52.2) | (63.1) | (24.4) | (46.5) | (61.4) | (49.5) |
| Percentage of area irrigated to area thrown open . . . . . | | 49.8 | 32.9 | 36.5 | 32.0 | 27.4 | 35.3 |
| KAKRAPAR (Gujarat) | | | | | | | |
| *Kharif* | | | | | | | |
| Paddy . . . . . | 57.79 | 23.88 | 27.93 | 26.30 | 32.78 | 34.00 | 28.98 |
| Cotton . . . . . | 9.47 | 3.24 | 13.35 | 13.35 | 9.30 | 6.47 | 9.14 |
| (two seasonal) | | | | | | | |
| Jowar . . . . . | 20.15 | 1.21 | 5.66 | 2.02 | 4.85 | 1.62 | 3.07 |
| Groundnuts . . . . . | — | 2.43 | 2.83 | 2.42 | 4.05 | 2.42 | 2.83 |
| Other kharif crops . . . . | — | 2.83 | 2.01 | 1.21 | 2.42 | 2.42 | 2.18 |
| Green Manure . . . . | — | — | — | — | — | — | — |
| Oil seeds . . . . . | 9.06 | — | — | — | — | — | — |
| Vegetables . . . . . | 11.37 | — | — | — | — | — | — |
| (two seasonal) | | | | | | | |
| Total kharif : . . . . | 107.84 | 33.59 | 51.78 | 45.30 | 53.40 | 46.93 | 46.20 |

*The State Government has constituted (May 1977) two special teams to finalise the cropping pattern.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| *Rabi* | | | | | | | |
| Jowar | — | — | 0.40 | 0.40 | 0.40 | 0.40 | 0.32 |
| Wheat | 32.89 | 7.28 | 9.31 | 10.52 | 10.52 | 11.33 | 9.79 |
| Cotton (Lakshmi) | 27.26 | — | — | — | — | — | — |
| Oil seeds and pulses (including gram & val) | 9.96 | — | — | — | — | — | — |
| Hybrid maize | 4.64 | — | — | — | — | — | — |
| Fodder | 11.37 | — | — | — | — | — | — |
| Paddy | 11.99 | — | — | — | — | — | — |
| Other miscellaneous crops | — | 1.61 | 3.64 | 3.64 | 4.05 | 4.44 | 3.48 |
| Total Rabi | 98.11 | 8.89 | 13.35 | 14.56 | 14.97 | 16.17 | 13.59 |
| Hot weather paddy | — | — | — | 2.02 | 8.10 | 5.26 | 3.07 |
| Hot weather vegetables | 5.26 | — | — | — | — | — | — |
| Fruit trees | 10.36 | — | — | — | — | — | — |
| Perennial crops | 27.29 | 12.14 | 12.95 | 14.57 | 15.37 | 21.44 | 15.29 |
| Total kharif, rabi and perennial crops | 248.86 | 54.62 | 78.08 | 76.45 | 91.84 | 89.80 | 78. 15 |
| PURNA (Maharashtra) | | | | | | | |
| Kharif Rice | 6 | 3.03 | 6.20 | 1.42 | 2.21 | — | 2.57 |
| Kharif seasonals | 5 | 1.91 | 1.36 | 0.39 | 0.46 | — | 0.83 |
| Rabi seasonals | 21 | 8.57 | 12.34 | 9.42 | 11.41 | 18.73 | 12.09 |
| Hot weather seasonals including hybrid crops | 5 | 4.89 | — | 5.25 | 4.71 | 7.16 | 4.40 |
| Long staple cotton | 11 | 2.22 | 0.47 | 1.06 | 1.63 | 0.46 | 1.17 |
| Other two seasonals | 4 | 1.52 | 1.09 | 0.91 | 0.56 | 0.88 | 0.99 |
| Sugarcane and other perennials | 10 | 3.18 | 2.35 | 1.80 | 1.74 | 4.25 | 2.66 |
| Total | 62 | 25.32 | 23.81 | 20.25 | 22.72 | 31.48 | 24.71 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sugarcane | 0.97 | — | 0.74 | 1.34 | 0.72 | 0.80 | 0.90 |
| Banana | 1.05 | — | 0.83 | 0.44 | 0.81 | 1.49 | 0.89 |
| Other perennials | 2.58 | — | 0.13 | 0.12 | 0.10 | 0.13 | 0.12 |
| Cotton | 9.19 | — | 0.24 | 2.40 | 5.05 | 0.95 | 2.16 |
| Chillies | 2.83 | — | 0.02 | 0.05 | 0.21 | 0.17 | 0.11 |
| Paddy | 2.02 | — | 2.31 | 1.35 | 1.37 | 1.78 | 1.70 |
| Jowar (kharif) | 9.31 | — | 2.63 | 0.81 | 0.14 | 0.81 | 1.10 |
| Jowar (rabi) | 3.64 | — | 4.54 | 1.92 | 4.42 | 5.25 | 4.03 |
| Bajra | 8.50 | — | 1.65 | 0.56 | 0.04 | 0.19 | 0.61 |
| Groundnut | 1.98 | — | 0.63 | 2.66 | 0.37 | 0.38 | 1.01 |
| Wheat | 9.31 | — | 4.85 | 12.61 | 0.47 | 8.80 | 6.68 |
| Other crops like gram and pulses | 5.83 | — | 3.30 | 2.21 | 3.17 | 2.22 | 2.73 |
| TOTAL | 57.21 | — | 21.87 | 26.47 | 16.87 | 22.97 | 22.04 |

NOTES : (*i*) Kharif seasonals include Hybrid—Jowar and other seasonals.

(*ii*) Rabi seasonals include wheat, Hybrid Jowar, Gram and other seasonals.

(*iii*) Hot weather seasonals include Hybrid Jowar, Groundnut and other seasonals.

(*iv*) Other two seasonals include Chillies and Turmeric.

ANNEXURE 4

**State-wise details of Central assistance released up to March 1977 for Command Area Development Programme (referred to in paragraph 13.10)**

| Sl. No. | Name of State | Irrigation projects covered | Amounts released (Rupees in lakhs) | | |
|---|---|---|---|---|---|
| | | | Grants | Loans | Total |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1. | Andhra Pradesh | (1) Nagarjunasagar<br>(2) Tungabhadra (L.L.C.)<br>(3) K.C. Canal<br>(4) Pochampad | 110.64 | 85.00 | 195.64 |
| 2. | Assam | (5) Jamuna | 2.00 | 8.00 | 10.00 |
| 3. | Bihar | (6) Kosi<br>(7) Gandak<br>(8) Sone<br>(9) Chandan Kiul-Badua | 441.65@ | 50.00 | 491.65 |
| 4. | Gujarat | (10) Ukai-Kakrapar<br>(11) Mahi-Kadana<br>(12) Shetrunji | 245.56 | 226.43 | 471.99 |
| 5. | Haryana | (13) Jui Lift Irrigation<br>(14) Gurgaon Canal<br>(15) Rewari Lift Irrigation | 26.13 | 32.50 | 58.63 |
| 6. | Jammu and Kashmir | *(16) Ranbir Canal<br>*(17) Kathua Canal<br>*(18) Pratap Canal<br>(19) Tawi Lift Irrigation | 8.47 | 1.00 | 9.47 |

@Includes Rs. 353.09 lakhs on account of subsidy to small and marginal farmers for State tubewells etc.

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| 7. | Karnataka | (20) Tungabhadra<br>(21) Malaprabha<br>(22) Ghataprabha<br>(23) Krishanaraja Sagar | 114.81 | 125.50 | 240.31 |
| 8. | Kerala | (24) Malampuza<br>(25) Peechi<br>(26) Chalakudi | 2.55 | 2.50 | 5.05 |
| 9. | Orissa | (27) Hirakud<br>(28) Mahanadi Delta<br>(29) Salandi | 7.90 | 5.00 | 12.90 |
| 10. | Madhya Pradesh | (30) Chambal<br>*(31) Barna-Halali<br>*(32) Kharang-Maniyaru-Hasdeo<br>(33) Tawa | 193.11 | 55.00 | 248.11 |
| 11. | Maharashtra | (34) Jayakwadi Stage-I-Purna<br>(35) Ghod and Bhima<br>(36) Girna and upper Tapi Stage I.<br>(37) Krishna<br>(38) Bagh & Itiadoh | 259.63 | 111.73 | 371.36 |
| 12. | Manipur | (39) Loktak Lift Irrigation | — | 1.00 | 1.00 |
| 13. | Rajasthan | (40) Chambal<br>(41) Rajasthan Canal<br>(42) Bhakra Gang Canal | 390.22 | 50.00 | 440.22 |
| 14. | Tamil Nadu | (43) Cauvery System<br>(44) Periyar<br>(45) Lower Bhawani | 1.00 | 0.50 | 1.50 |
| 15. | Uttar Pradesh | (46) Gandak<br>(47) Ram Ganga<br>(48) Sarda Sahayak | 379.79 | 218.00 | 597.79 |
| 16. | West Bengal | (49) Kangsabati<br>(50) Mayurakshi<br>(51) D.V. System | 33.57 | 32.50 | 65.87 |
| | | | £2216.83 | 1004.66 | 3221.49 |

* These projects have not been taken up by the State Governments concerned.

£This excludes Central assistance for construction of rural roads and markets of Rs. 1164.81 lakhs (Grants ) given during the first two years of the Fifth Five Year Plan.

ANNEXURE 5

(Referred to in paragraph 13.11)

**Statement showing the progress of works under the command area development Programme in Chambal (Madhya Pradesh)**

| Item of work to be executed | Quantity of work to be executed | Quantity executed (up to (March 1977) | Estimated cost | Expenditure incurred (up to March 1977) |
|---|---|---|---|---|
| | | | (in lakhs of rupees) | |
| 1 | 2 | 3 | 4 | 5 |
| (1) *Irrigation Department* | | | | |
| (*i*) Canal security works | | | | |
| (*a*) Completing the Right Main Canal erosion protection works | | | | |
| Earthwork . . | 3.00 lakh cum | 2.42 lakh cum | | |
| Boulder toe . . | 0.75 lakh cum | 0.31 lakh cum | | |
| Road surfacing . . | 20 kms | 15 kms | | |
| Masonry lining . . | 1.60 lakh sq.m. | 0.21 lakh sq.m. | | |
| Strengthening cross drainage structures . | 4 | Nil | 94.00 | 57.18 |
| (*b*) Additional protection works to the Right Main Canal | | | | |
| Concrete lining of rocky reaches . . . | 1.52 lakh sq.m. | 0.05 lakh sq.m. | | |
| Masonry lining of earthen reaches . . . | 0.20 lakh sq.m. | 0.01 lakh sq.m. | | |
| Masonry lining at cross drainage structures . | 19 | 3 | 195.12 | 23.45 |
| Lengthening cross drainage structures . | 20 | Nil | | |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| (*ii*) Canal capacity works converting water courses into minors | 110 kms | 6.83 km | 217.16 | 48.12 |
| Widening of distributaries and minors | 299 kms | 89.9 kms | | |
| (*iii*) Canal control works | | | | |
| Cross regulators | 44 | 1 | 165.23 | 21.26 |
| Escapes | 11 | 1 | | |
| Pucca outlets | 3000 | 259 | | |
| Tail clusters | 100 | 4 | | |
| (*iv*) Aquatic weed control | — | — | 32.42 | 6.64 |
| (*v*) Drainage-Improvement of natural drains | 105 kms | 45.3 kms | 143.00 | 68.56 |
| Provision of seepage interceptor drains | 578 kms | 283.64 kms | | |
| (*vi*) Chak drainage | | | | |
| Improvement of drainage in 20,000 hectares of flat land for providing field drains and larger collector drains | 20,000 hec. | Nil | 288.00 | Nil |
| (*vii*) Miscellaneous | | | | |
| Buildings | 158 | 82 | 150.21 | 45.88 |
| Service Roads | 210 kms | 145 kms | | |
| Access bridges | 54 | Nil | | |
| Communication system | | 50 kms | | |
| Total | | | 1562.14 | 452.69† |
| (2) *Public Works Department* | | | | |
| Construction of roads, mainly in on-farm development area | 206 kms | Earthwork 104.2 kms; Collection of metal—13.6 kms; Collection of Moorum—11.6 kms; Consolidation 1 km | 746.00 | 37.90 |

†Includes expenditure on operation and maintenance (Rs. 104.5 lakhs) and purchase of machinery and equipment (Rs. 77.1 lakhs)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| (3) *Agriculture Department* | | | | |
| On-farm development providing a full package including land levelling, construction of water courses, field channels, field drains and access roads inside the chaks | 12,000 hec. | 744 hec. | 221.00 | 107.06* |
| Ravine erosion control . | 50 kms | 14.5 kms | 32.00 | 0.13 |

In addition to the estimated outlay of Rs. 1562.14 lakhs for irrigation works, Rs. 746 lakhs for roads works and Rs. 253 lakhs for on-farm and other works, the Command Area Programme provides for escalation and contingencies, administration and operation cost during construction.

*Includes expenditure of Rs. 20.65 lakhs on purchase of machinery and equipment.

ANNEXURE 6

(Referred to in paragraph 13.11)

**Statement showing the progress of works under the command area development Programme—Chambal (Rajasthan)**

| Sl. No. | Items of work | Estimated cost (in lakhs of rupees) | Unit | Quantity to be executed | Quantity executed up to June 1977 | Expenditure incurred up to June 1977 (in lakhs of rupees) |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. | *Canal lining* | | Kilometre | 21.08 | 10.73 | |
| 2. | *Canal capacity works* | | Kilometre | 797 | 383 | |
| 3. | *Control structures* | | | | | |
| | (*i*) Head regulators | | Number | 22 | 11 | |
| | (*ii*) Adjustable proportionate modules | 1312 | Number | 4000 | 46 | |
| | (*iii*) Cross regulators | | Number | 135 | 40 | |
| | (*iv*) Tail clusters | | Number | 560 | 201 | |
| 4. | *Drainage* | | | | | |
| | (*i*) Surveying | | Hectare | 229000 | 169789 | |
| | (*ii*) Planning and Designing | | Hectare | 167000 | 141681 | |
| | (*iii*) Construction | | Hectare | 167000 | 34800 | |
| 5. | *On-farm Development@* | 840 | Hectare | 47000 | 20601 | |
| | (*i*) Surveying | | Hectare | 48500 | 11194 | |
| | (*ii*) Planning and Designing | | Hectare | 50000 | 683(a) | |
| | (*iii*) Construction (involving levelling of land, re-alignment of boundaries of fields of individual cultivators and construction of watercourses, field drains and farm roads) | | | | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 6. | *Roads* . | 500 | Kilo-metre | 247 | 99.55 | |
| | Total . | 2652 | | | | *1574.63 |

In addition to the estimated cost of Rs. 2,652 lakhs, the Command Area Development Programme provides Rs. 980 lakhs for administration and operation cost during construction, Rs. 513 lakhs for fertilizers, Rs. 325 lakhs for physical contingencies, Rs. 12 lakhs for afforestation, Rs. 880 lakhs for interest during construction and Rs. 1,958 lakhs for price increase.

(*a*) Work on another 2380 hectares was in progress as on 30th June 1977.

*Break-up of total expenditure was awaited from the department (July 1977).

@The cost of on-farm development work in full package area covering 50000 hectares including construction of watercourses, field drains, farm roads, land-shaping and boundary re-alignment is to be borne by the beneficiaries. Schemes under the on-farm development work are formulated by the State Government and sent to the Agricultural Refinance and Development Corporation and are financed by Agricultural Refinance and Development Corporation through Land Development Bank and Commercial Banks. The loans sanctioned by the Land Development Bank and Commercial Banks are pooled and placed at the disposal of the Rajasthan Land Development Corporation. The works are executed by the Command Area Project authorities on behalf of the Rajasthan Land Development Corporation.

## ANNEXURE 7

(Referred to in paragraph 15.02)

**Water rates for different crops in different projects**

(Rates in rupees per acre)

| Project | Paddy | Wheat | Cotton | Maize | Jowar | Gram | Sugarcane | Effective from |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1. BHAKRA NANGAL | | | | | | | | |
| Punjab . | 19.50 | 11.69 | 13.50 | 12.75 | — | 8.94 | 33.00 | Kharif 1974 |
| Haryana . | 30.00 | 25.00 | 25.00 | 20.00 | — | 20.00 | 40.00 | Kharif 1975 |
| Rajasthan . | 28.00 | 21.00 | 25.00 | — | 12.00 | 20.00 | 40.00 | March 1976 |
| 2. CHAMBAL | | | | | | | | |
| Madhya Pradesh | 25.00 | 32.00 | 16.00 (8/72) | — | 21.00 | 17.00 | 40.00 (8/72) | 1973-74 |
| Rajasthan . | 28.00 | 21.00 | — | — | 12.00 | 20.00 | 40.00 | March 1976 |
| 3. SARDA CANAL | | | | | | | | |
| Uttar Pradesh | 40.00 | 40.00 | 16.00 | — | — | — | 66.00 | 1st April 1976 |
| 4. KOSI . . | | | | | | | | |
| Bihar (A) | 31.50 (kharif) 55.50 (Hot weather) | 18.00 | — | — | — | — | 55.50 | July 1974 |
| 5. HIRAKUD | | | | | | | | |
| Orissa | Kharif (Rs. 8) Rabi (Rs.24.00) | 9.00 | — | — | — | — | 27.00 | 1st April 1975 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 6. MAYURAKSHI | | | | | | | | |
| West Bengal | 20.00(B) | 24.00 | — | — | — | — | — | 1st July 1974 |
| 7. TUNGABHADRA | | | | | | | | |
| Andhra Pradesh | 30.00 | 20.00 | 20.00 | — | — | — | 60.00 | 1st July 1974 |
| Karnataka | 30.00(C) | 18.00 | 18.00 | 18.00 | 18.00 | — | 120.00<br>80.00<br>(D) | 1st July 1976 |
| 8. NAGARJUNASAGAR | | | | | | | | |
| Andhra Pradesh | 30.00 | 20.00 | 20.00 | — | — | — | 60.00 | 1st July 1974 |
| 9. PARAMBIKULAM ALIYAR | | | | | | | | |
| Tamil Nadu | 25.00 | — | — | 15.00 | — | — | 30.00 | 1969-70 |
| 10. KAKRAPAR | | | | | | | | |
| Gujarat | 42.00 | 42.00 | 50.00 | 11.00 | 11.00 | — | 237.00 | 16th June 1976 |
| 11. PURNA | | | | | | | | |
| Maharashtra | 20.24 | 30.36 | 101.21 | — | 20.24 | — | 303.64 | 1975-76 |
| 12. GIRNA | | | | | | | | |
| Maharashtra | 20.24 | 30.36 | 101.21 | — | 20.24 | — | 303.64 | 1975-76 |

(A) Rates for kharif on a long lease basis (for 3—7 years) is Rs. 30 per acre and for season lease is Rs. 31.50 per acre. Under long lease, cultivators not only pay a lower rate for kharif but also can take water free during rabi.

(B) For Boro variety of rice grown in hot-weather, rate chargeable is Rs. 96.50 per acre.

(C) In Malnad areas, rate is Rs. 20.00.

(D) Rs. 120 if harvested after 12 months but before 18 months. Rs. 80 if harvested within 12 months.

ANNEXURE 8

(Referred in paragraph 15.02)

**Water rates as percentage of gross value of produce per acre for 1974-75**

| Crop | Water rates per acre | Gross value of produce per acre | Percentage of water rate to value of produce |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| | | Rupees | |
| 1. BHAKRA NANGAL | | | |
| **Punjab** | | | |
| Wheat | 11.69 | 1050 | 1.1 |
| Gram | 8.94 | 638 | 1.4 |
| Sugarcane | 33.00 | 3324 | 1.0 |
| Rice | 19.50 | 680 | 2.9 |
| Maize | 12.75 | 906 | 1.4 |
| American cotton | 13.50 | 542 | 2.5 |
| **Haryana** | | | |
| Wheat | 5.84 | 761 | 0.77 |
| Rice | 9.75 | 519 | 1.88 |
| Barley | 6.37 | 417 | 1.53 |
| Bajra | 4.87 | 163 | 2.99 |
| **Rajasthan** | | | |
| Wheat | 15.00 | 539 | 2.7 |
| Barley | 11.00 | 686 | 1.6 |
| Gram | 15.00 | 532 | 2.8 |
| Jowar | 12.00 | 309 | 3.9 |
| 2. CHAMBAL | | | |
| **Madhya Pradesh** | | | |
| Paddy | 25.00 | 1058 | 2.4 |
| Wheat | 32.00 | 900 | 3.6 |
| Jowar | 21.00 | 498 | 4.2 |

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| Bajra | 17.00 | 424 | 4.0 |
| Gram | 17.00 | 475 | 3.6 |
| Rape & Mustard | 17.00 | 542 | 3.1 |
| **Rajasthan** | | | |
| Wheat | 15.00 | 539 | 2.7 |
| Gram | 15.00 | 532 | 2.8 |
| Jowar | 12.00 | 309 | 3.9 |
| Barley | 11.00 | 686 | 1.6 |
| 3. SARDA CANAL | | | |
| **Uttar Pradesh** | | | |
| Paddy | 21.00 | 284 | 7.4 |
| Wheat | 18.75 | 496 | 3.8 |
| Sugarcane | 60.00 | 1437 | 4.2 |
| 4. KOSI | | | |
| **Bihar** | | | |
| Kharif Rice | 31.50 | 1651.74 | 1.91 |
| Wheat | 18.00 | 1168.06 | 1.54 |
| 5. MAYURAKSHI | | | |
| **West Bengal** | | | |
| **Murshidabad Distt.** | | | |
| Paddy | 20.00 | 542 | 3.7 |
| Wheat | 24.00 | 925 | 2.6 |
| **Birbhum Distt.** | | | |
| Paddy | 20.00 | 642 | 3.1 |
| Wheat | 24.00 | 752 | 3.2 |
| 6. TUNGABHADRA | | | |
| **Andhra Pradesh** | | | |
| Rice | 30.00 | 1300 | 2.33 |
| Groundnut | 20.00 | 920 | 2.20 |

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| **Karnataka** | | | |
| Rice | 20.00 | 3196 | 0.6 |
| Wheat | 12.00 | 1102 | 1.1 |
| Sugarcane | 40.00 | 4200 | 1.0 |
| Jowar | 12.00 | 1012 | 1.2 |
| Maize | 12.00 | 1452 | 0.8 |
| Bajra | 12.00 | 1520 | 0.8 |
| Cotton (Hybrid)) | 12.00 | 3200 | 0.4 |
| 7. PURNA (for 1975-76) | | | |
| **Maharashtra** | | | |
| Paddy | 20.34 | 1265 | 1.6 |
| Wheat | 30.36 | 1265 | 2.4 |
| Hybrid jowar | 20.24 | 1215 | 1.7 |
| L.S. Cotton | 101.21 | 2429 | 4.2 |
| Sugarcane | 303.64 | 4049 | 7.5 |
| Groundnut | 101.21 | 1215 | 8.3 |
| 8. GIRNA | | | |
| **Maharashtra** | | | |
| Rice | 15.00 | 720 | 2.1 |
| Wheat | 23.25 | 923 | 2.5 |
| Sugarcane | 267.20 | 3995 | 6.6 |
| Jowar Kharif | 15.00 | 281 | 5.3 |
| Jowar rabi | 23.25 | 256 | 9.0 |
| Bajra | 15.00 | 238 | 6.4 |

## GLOSSARY OF TECHNICAL TERMS

*Acre Foot :* A unit of volume of water required to cover an area of one acre to a depth of one foot.

*Aqueduct:* Where an irrigation channel comes across a natural drainage line (*e.g.*, stream or river), a masonry work known as cross drainage work is provided. When drainage water at the point of crossing goes under canal water, the cross drainage work is called an aqueduct.

*Base Period :* The number of days required for raising a crop.

*Catchment Area :* Area from which rainfall flows into a river or reservoir.

*Capacity :* It is authorised full supply discharge of a channel.

*Command Area—Gross and Culturable :* Gross Command Area is the total area within the extreme limits set for irrigation by a project. The Gross Command Area less areas not available for cultivation *e.g.*, areas occupied by villages, roads, isolated patches of unculturable lands is called Culturable Command Area.

*Contour canal :* In alluvial area, canal is on main ridge for most of its length except (in some cases) its head reach which may be nearly parallel to contour of the ground. Such a canal in head reach is called contour canal; it irrigates on one side only.

*Cusec :* A unit commonly used to denote the rate of flow of water the cubic feet per second.

*Cusec day :* The volume of water resulting from a discharge of one cusec for one day (24 hours).

*Delta :* Delta is the depth of water required by a crop to come to maturity. Actual delta is arrived at by dividing the total volume of water delivered by the area over which it has spread.

*Duty :* Duty is the relation between the area irrigated and the quantity of water required to irrigate it. It is the area irrigated divided by the water supplied in the base period expressed in "cusecs" (cubic feet per second).

*Fall :* If the ground slope exceeds the slope given to a channel, the extra fall in the ground level is overcome by providing masonry structures known as falls.

*Free Board :* The margin provided between the full supply level of a channel and the top of the channel banks.

*Full supply discharge :* The maximum discharge that an irrigation channel normally carries at its head to satisfy the irrigation requirements of its command area is called its designed (or authorised) full supply discharge.

*Full supply level :* The maximum level of water in the irrigation channel when full supply discharge is flowing in the channel.

*Intensity of irrigation :* The total area irrigated under different crops in a year expressed as a percentage of the Culturable Command Area of the project.

*Localisation :* Demarcation of specific areas for growing specific crops.

*Piping :* The flow of water under or round a structure built on permeable foundations, which, if not prevented or stopped, will remove material from beneath the structure and cause it to fall.

*Regulators:* These are structures provided on an irrigation channel and are necessary for the efficient working of the channel. The function of these regulators at the head of the channel is to pass into the channel the required quantity of water at the required level. A regulator constructed across the channel is called a cross regulator and used to control the quantity and level of water on its upstream as well as downstream sides.

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