Study on Issues Related to Gap between Irrigation Potential Created and Utilized

Final Report

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By

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Content

Chapter 1

Introduction

Section 1: Background and Need for the Study

1.1.1 There is no doubt about the fact that irrigation has played an important role in accelerating the agricultural production in India. Accordingly, Government of India has made massive investment in developing irrigation sources (major, medium and minor) in the country since independence. However, issues like non-utilization of complete irrigation potential and in-equity in the distribution of water have been widely reported by many researchers from different states of the country. At this juncture the major issues are that in spite of huge investment, created irrigation potential has not yet been fully utilized in the country and more importantly, the gap between irrigation potential created (IPC) and irrigation potential utilized (IPU) is gradually increasing over time. Developing irrigation resources requires a lot of financial and environmental cost to the society, and therefore, non utilization of irrigation leads to wastage of precarious resources on the one hand, and loss of opportunity to increase the agricultural production, and subsequently the income of the rural producers, on the other. Accordingly, necessary steps are required immediately to minimize the gap between irrigation potential creation and utilization from the existing irrigation resources, before rolling out the investment in the creation of new irrigation resources.

1.1.2 Availability of reliable data on irrigated area has remained one of the major constraints in the proper planning and management of irrigation resources in all the states of the country. There exists a wide gap between data on gross and net irrigated area as reported by different State Departments, namely Irrigation, Agriculture, Revenue and Planning. There exists a lot of variation in reporting the gross and net irrigated area by various agencies. The gross irrigated area in a particular place corresponds to irrigation utilization at that place. Therefore, any deviation in reporting of gross irrigated area has its own implication for gap between irrigation potential creation and its utilization. As a result of the observed variation in gross irrigated area, program administrators and planners are quite often confused and find it difficult to take appropriate strategies for development and management of irrigation facilities in a particular place and time.

1.1.3 It is in this connection, an analytical study to find out the reasons for the gap between irrigation potential created and its utilization was initiated by Ministry of Water Resources, Government of India. The study was conducted in all the States and Union Territories by four national level institutes, namely, Indian Institute of Management, Lucknow (IIML), Indian Institute of Management, Ahmedabad (IIMA), Indian Institute of Management, Bangalore (IIMB) and Indian Institute of Management, Kolkata (IIMC).

Section 2: Objectives

1.2.1 The objectives of the study were:

- to examine the various issues associated with irrigation potential creation, irrigation potential utilization, gross irrigation and net irrigation including the definition, the reporting practices and consistencies in the data,
- to suggest procedures for collection of related data to be applied uniformly throughout the country,
- to identify clearly the irrigation potential which has been created but (a) has never been utilized, (b) has not been utilized regularly, and (c) has gone into disuse due to various reasons,
- to identify the reasons for gap in the irrigation potential created, irrigation potential utilized and gross irrigated area, and
- to suggest measures for minimizing the gap between irrigation potential created and irrigation potential utilized.

Section 3: Coverage

1.3.1 Though the study has been conducted at all India level, Indian Institute of Management, Lucknow (IIML) conducted the study in the seven States as given in Table 1.1 below:

Table 1.1: Sample States Covered by IIML

Sl. No.	State	Gross Irrigated Area in thousand hectare (2003-04)
1.	Uttar Pradesh	17931
2.	Bihar	4567
3.	Jharkhand	230
4.	Orissa	2518
5.	M.P.	5776
6.	Chhattisgarh	1179
7.	Uttarakhand	570
	Total	**32771**

Section 4: Major Issues

1.4.1 Based on the discussion with officials of Ministry of Water Resources, Government of India, State Government Departments and secondary information available on the subject, following issues were identified, which require utmost

attention at the policy and management levels at different irrigation resources in the country.

Issue # 1: There exists a wide gap between irrigation potential created and its utilization in all the selected states.

1.4.2 Although increasing irrigation potential in different states over the years is a laudable success, the inability of non-utilization of this potential is a serious concern. The aggregate data on IPC and IPU for major, medium and minor irrigation projects in different states as shown in Table 1.2 is a clear testimony of this fact.

Table 1.2: Status of Gap between IPC & IPU in different States

	Gap between IPC & IPU as % of IPC		
State	**MMI**	**MI**	**Total**
Bihar	35.96	20.28	26.07
Chhattisgarh	20.83	31.32	24.43
Jharkhand	34.99	20.00	25.64
Madhya Pradesh	39.32	5.39	20.56
Orissa	3.98	10.14	6.76
Uttar Pradesh	20.59	20.00	20.16
Uttarakhand	33.89	20.00	25.02

Source: Ministry of Water Resources, Govt. of India

Note: MMI: Major and Medium Irrigation; MI: Minor Irrigation

1.4.3 The statistics given in Table 1.2 clearly reveals that in the states of Bihar, Jharkhand, M.P. and Uttarakhand, about one third of irrigation potential created under major and medium irrigation projects has not been utilized. The corresponding figure for the states of Chhattisgarh and U.P is about 20 percent. The situation in Orissa is relatively less severe as only 3.98 percent of irrigation potential created under major and medium irrigation has not been utilized so far. Under the minor irrigation, the gap between potential created and utilization is relatively less as compared to the same under major and medium irrigation projects in all the selected states. However, its value ranges between 10.14 percent in Orissa to 31 percent in Chhattisgarh.

1.4.4 The poor utilization of irrigation potential created in different states has serious implications both for cultivators as well as for the Irrigation Departments in the country. The implications for different stakeholders can be captured as follows:

(a) Cultivators:

- Loss of opportunity for higher income from irrigated land

With non-availability of irrigation water, the poor farmers are constrained, which result in:

(a) non-adoption of high yielding variety seeds,

(b) continuance of subsistence farming, and

(c) lack of initiative to diversify the cropping pattern in favor of commercial crops, which requires high volume of irrigation water.

Due to these reasons farmers are not in a position to reap reasonable profit from farming enterprise.

(b) Government:

Creating irrigation infrastructure requires huge investment from Government exchequer, which has a very high opportunity cost. The gap between the irrigation potential created and its actual utilization results in huge loss to government in terms of:

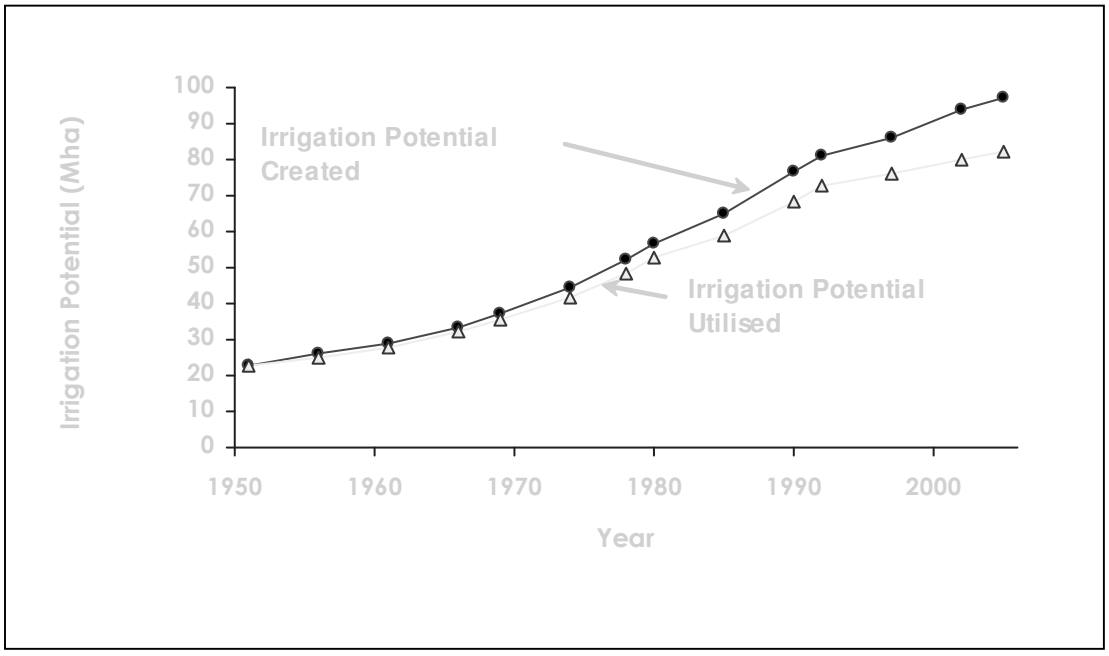
- Underutilization of high investment cost.
- Non-recovery of even variable cost for maintenance of the irrigation sources.

1.4.5 Due to lower water charges in India, the revenue to Irrigation Department is very low from irrigation water used for agriculture purpose. The limited revenue from irrigation water gets further reduced in case of non-utilization of existing capacity of irrigation potential. All these result in non-availability of sufficient funds for maintenance of irrigation resources, leading to even further poor utilization of irrigation potential of a resource. Thus a vicious circle is created in which the Irrigation Department has been trapped in most of the states in the country.

Issue # 2: The gap between irrigation potential and utilization is widening over time.

1.4.6 The existing gap between potential creation and utilization is not only very large but the gap is increasing over the years as evident from Figure 1.1, thus adding fuel in the fire. This has put a major challenge before the policy makers and all the other major stakeholders.

Figure 1.1: Gap between Irrigation Potential Created and Utilized over Time



Source: Ministry of Water Resources, Govt. of India: 2007

1.4.7 It is clear from Figure 1.1 that the gap between irrigation potential created and utilized has been widening at a higher rate since late 1970s. This problem is not a recent phenomenon but has been persisting severely since last more than 25 years. Despite the chronic problem of under-utilization of irrigation potential in India and voices raised about it at various forums in repeated number of times, no major efforts have been made by respective State Governments to tackle this problem in a spirited manner. It is really a very serious to find that the impact of vicious circle (as mentioned earlier) is getting stronger over time resulting in continuous increase in gap between irrigation potential created and its utilization.

Issue # 3: There is a lot of inconsistency in data on Gross Irrigated Area (GIA) and Net Irrigated Area (NIA) as reported by different Departments

1.4.8 The utilization of irrigation potential can be captured by gross irrigated area and net irrigated area. There are lot of variation and inconsistencies in data on utilization and potential creation at state and national level reported by different Government Departments. This probably may be due to differences in assumptions, definitions and methodologies adopted by different agencies. The mismatch in data reported for the whole country by different agencies is evident in Table 1.3.

Table 1.3: Net and Gross Irrigated Area Reported by Various Agencies

Sl. No.	Description	Total Area (Mha)	Remarks
1.	Net Irrigated Area	55.13	As per Ministry of Agriculture Report, 2003-04
2.	Gross Irrigated Area	76.86	As per Ministry of Agriculture Report, 2003-04
3.	Irrigation Potential Utilized	82.27	As per Planning Commission as on 31.03.2004
4.	Annualized Irrigated Area	146	As per satellite survey carried out by International Water Management Institute (IWMI), 2001-03

Source: Ministry of Water Resources, Govt. of India, 2007.

1.4.9 In actual, irrigation potential utilized is basically same as gross irrigated area and annualized irrigated area. However, there is wide variation in actual values reported for these items by different agencies The figures in Table 1.3 clearly brings that there is an urgent need for understanding the reasons for such variation. Accordingly an action plan has to be prepared immediately so that such confusion can be resolved at different levels at the earliest.

Chapter 2

Methodology

Section 1: Research Approach

2.1.1 The study used a demand and supply approach to understand the reasons for the gap between irrigation potential created and its utilization. Basically, intended supply of irrigation water can be represented by the irrigation potential created, and actual supply of irrigation water corresponds to irrigation potential utilization (gross irrigated area) at a particular point of time. The economic theory suggests that efficient firms invest in plant capacity to match the market demand in such manner so that at no pint of time, these firms would like to hold either the inventory of produced goods or its plant idle. Both the phenomenon result into a huge cost to the firms. In other words, a rigorous market research is usually undertaken by investment firms to understand the market demand on the one hand, and the means and ways to match this demand through its production and marketing systems, on the other. The economic theory further points out that the investment firms keep on evaluating the market environment continuously to adapt its production and marketing strategies as per the changing outside environment.

2.1.2 In the same vein, when an irrigation project is constructed, it can be safely presumed that the Irrigation Department identifies the market demand for irrigation water in the given place and accordingly design the project (in terms of its irrigation potential) to fulfill the market demand. This irrigation potential is calculated based on certain assumptions related to the project command area like rainfall and cropping pattern. However, the actual supply of irrigation water made through the project can be best captured by gross irrigated area in the command of the irrigation project. Any deviation between intended supply of irrigation water (irrigation potential) and actual supply of irrigation water (gross irrigated area) may arise under two possible conditions:

(a) Given the cropping pattern, the cultivators don't need irrigation water from the project.

(b) The demand for irrigation water exists, but the irrigation project has been operating below its capacity (both in terms of production and distribution).

2.1.3 For this purpose, the possible reasons for non-utilization of irrigation potential (gap between intended and actual supply of irrigation water) have been divided into demand side factors and supply side factors, as the remedial strategies to minimize the gap would be different for demand and supply side constraints. If the reason (a) holds true, it signifies the excess supply over demand and therefore requires strategies to stimulate the demand for irrigation water by changing the cropping pattern of the area in favor of high water intensive crops. If on the other hand, the gap between irrigation potential and its utilization arises due to reason (b), there exists condition of excess demand over supply, resulting in relaxing the supply side constraints. The study hypothesized

that under Indian agrarian conditions, the supply side factors are more important to explain the reasons for gap between irrigation potential and its utilization.

2.1.4 Factors affecting supply of irrigation water have been decomposed into two major categories:

- Non-availability of sufficient quantity of water (dependent on agro-climatic factors and hydrological parameters of the irrigation project)
- Ineffective distribution of irrigation water even if sufficient water is available at the time of operationalization of the project.

2.1.5 Factors affecting demand of irrigation water consist of:

- Non-adoption of recommended or assumed cropping pattern in the potential area,
- Inequality in distribution of water among the farmers due to their opportunistic behavior,
- Uncertainty related to availability of water at proper time in sufficient quantity.

2.1.6 Theoretically, the gap between irrigation potential created and irrigation potential utilized can arise due to (a) the potential has not been properly defined (overestimation of supply), (b) there has been underutilization of the potential so created, and (c) a combination of the above two reasons. As far as irrigation potential is concerned, the study concentrated on the following issues:

- Is the irrigation potential which has been calculated/ reported for a project at the time of its design and/ or operationalization still holds the same value?
- Appropriateness of the various assumptions taken up to arrive out the irrigation potential at the time of design/operationalization?
- Whether IPC should be considered as a static or a dynamic concept?

Section 2: Selection of Sample Irrigation Projects

2.2.1 From each state, time series data on gross irrigated area and irrigation potential for all completed major and medium irrigation projects was collected using the format given in Appendix - 3. The data was collected separately for Kharif and Rabi season. Based on the analysis of the data, 2 major and 4 medium irrigation projects were selected from each selected State. In States where there is only one major irrigation project (as in Jharkhand), more number of medium irrigation projects were selected in the sample.

2.2.2 The following criteria were adopted for selecting the sample major and medium irrigation projects from each State:

- Gap between IPC and IPU – high and low (to identify the reasons for very high and very low gaps),

- Coverage of prevailing agro-climatic regions,
- Inclusion of both older and newer irrigation projects, and
- All projects included in sample belong to the category of completed projects only.

2.2.3 Thus, first point above was a necessary condition for the purpose of analysis, while the next three points ensured that only relevant completed projects representing different agro-climatic reasons were included in the sample.

2.2.4 The criteria for selecting the sample minor irrigation projects were as follows:

- Gap between IPC and IPU – high and low,
- Coverage of all five different types of minor irrigation projects (i.e., dug wells, shallow tube well, deep tube well, surface flow irrigation and surface lift irrigation) subject to availability, and
- Inclusion of the sample minor projects owned by government as well as private agencies.

2.2.5 The three criteria listed above applied to minor irrigation projects situated outside the project areas of major and medium irrigation projects. For minor irrigation projects, the first criterion was a necessary condition to identify the reasons for very high and very low gaps. The rest of the criteria ensured that all the different types of minor irrigation projects have been included in the sample.

2.2.6 The sample size of farmers from command areas of various irrigation projects under each State was about 300. Thus the total sample consisted of about 2000 farmers from all 7 selected States. The sample was stratified based on the location of farmer in the distribution channel of the irrigation project. It has been voiced in several forums that there exist a lot of inequality in the distribution of water between the farmers situated at head and tail end of the distribution channel. Thus an appropriate sample of farmers was taken separately from head, middle and tail region of distribution channel so as to understand the impact of location of the farm on the supply of irrigation water.

Section 3: Methodology of Data Collection

2.3.1 At first stage, data on IPC and IPU related to each of the completed major and medium irrigation poject was collected from the Office of Chief Engineer, Water Resource Department from all the seven States (questionnaire as given in Appendix -1). List of minor irrigation projects along with their location was obtained from the 3rd Minor Irrigation Census, MoWR, GoI. From the data collected at this stage, a suitable sample of major, medium and minor irrigation projects (using the methodology as given in Section 2) was drawn.

2.3.2 At second stage the data from each of the selected major/medium and minor irrigation project was collected (using the questionnaire as given in

Appendix -2) by the team of research staff and faculty members of IIM, Lucknow. The data related to IPC and IPU and the various factors contributing the gap between the IPC and IPU was obtained from the respective office of the Chief Engineer of each project. Besides, discussion was carried out with the officials of each of the selected project to understand the qualitative factors responsible for defining the gap between IPC and IPU.

2.3.3 At third stage, primary data (questionnaire as given in Appendix -3) from 2000 farmers from 7 States was collected by team of research staff and faculty members of IIM, Lucknow.

Section 4: Tools and Techniques

2.4.1 Based on the information and data collected from the irrigation projects in different states on the one hand, and detailed discussion with Chief/Executive Engineers of the irrigation projects on the other, possible reasons responsible for gap between irrigation potential created and its utilization have been outlined in a Problem Tree Analysis, which provided a systematic way of examining the problems in a project context. Most problems in a project can generally be traced back to other problems which, in turn, could be the cause of other problems/constraints. Problem Tree Analysis visualized such links in a Problem Tree Diagram. This consisted of a diagram illustrating a set of relationship amongst the problems by fitting them in a hierarchy of cause-effect relationship. In such a diagram the causes were, conventionally, presented at lower levels and the effects were at upper level. A location of a problem in a tree diagram does not necessarily indicate its level of importance, but simply its position in the logical sequence of cause-effect linkages. The underline idea in constructing a Tree Diagram was that such a process should facilitate the organization of problems into a logical sequence which, in turn, would lead to logical conclusions and eventually to the identification of cost/effective solutions.

2.4.2 The various factors responsible for gap between IPC and IPU for each of the selected projects have been ranked or prioritized based on their importance in explaining the gap. Given the availability of data on the one hand and discussion with the project ofiicials, on the other, a score card in terms of rank of each of the identified factor contributing the gap between IPC and IPU, for each of the selected project has been developed.

2.4.3 In order to define suitable starategies for minimizing the gap between IPC and IPU, an attempt was also made to group all the factors explaining the gap between IPC and IPU, based on the various activities of management of irrigation resources. These activities are listed in Table 2.1 below:

Table 2.1: Irrigation Management Activities

Sl.	Activity	Action
1.	Water acquisition	capturing water for distribution
2.	Water distribution	distributing water (operations)
3.	Maintenance	repairing and maintaining the physical structures
4.	Resource mobilization	raising the resources for operation and maintenance
5.	Conflict resolution	resolving conflicts between users and system managers

Section 5: Sources of Information

2.4.1 The required information was collected by the team of research staff and faculty members of IIM, Lucknow, from the following sources:

- Interaction with officials of Irrigation Department and Agriculture Department in the respective States and in Govt. of India.
- Records maintained at the offices of Chief/Superintendent Engineer of selected irrigation projects.
- Use of other secondary information, published or unpublished reports about irrigation status in India and in different States.
- Focused group discussion with farmers, members of WUAs, and other village community members.
- Collection of data from farmers through structured questionnaire.
- Report of 3rd Minor Irrigation Census conducted by Ministry of Water Resources, Govt. of India.
- Web sites of Central Water Commission and Ministry of Agriculture, Govt. of India.

Chapter 3

Irrigation Potential Creation and Utilization – Issues in Reporting and Measurement

Section 1: Introduction

3.1.1 Almost every decision a manger takes, needs a proper and reliable statistics. Any resource can not be planned and managed efficiently without a proper availability of data related to its past performance as well as on its future use. The manager needs to assess the effect of the present decisions on the future performance of the resource so that the right decisions are made today to create a desired condition for tomorrow. The same holds true for irrigation water resources. The need for timely availability of accurate statistics related to irrigation water resources becomes more acute as water is life line of agriculture of millions of peoples in rural India. On the other hand, creation of water resources is capital intensive, and therefore, cost sensitive. However, availability of reliable data on irrigated area has remained one of the major constraints in the proper planning and management of irrigation resources in all the States of the country. The importance of information related to water resources has been duly emphasized in National Water Policy 2002, which stated that "*A well developed information system for water related data at national/state level should be established with a network of data banks and data bases integrating and strengthening the existing central and state level agencies*" (National Water Policy, 2002).

3.1.2 One of the key indicators widely used for proper assessment of the irrigation development relates to irrigation potential created and its utilization. This corresponds to capacity utilization of irrigation project and therefore, higher the capacity utilization, better efficiency of irrigation project can be established. The gross irrigated area in a particular place corresponds to irrigation potential utilization at that place. Besides the reporting of the data on irrigation utilization, proper measurement of irrigation potential and its utilization is of utmost importance for strengthening the irrigation supply management system at various projects level. Therefore, any deviation in either reporting or assessment of irrigation potential and gross irrigated area has its own implications for gap between irrigation potential creation and its utilization. As a result of this, program administrators and planners are quite often confused and find it difficult to take appropriate strategies for development and management of irrigation facilities in a particular place and time.

3.1.3 In this context, the standard definitions used in irrigation related statistics are reproduced below to understand the current practices of defining the irrigation potential and its utilization.

(a) Irrigation Potential Created (IPC)

3.1.4 The irrigation potential created by a project at a given time after its construction is the aggregate gross area that can be irrigated in an agricultural year by the quantity of water that could be made available by all the connected and completed works up to the end of water course or the last point in the water delivery system.

(b) Irrigation Potential Utilized (IPU)

3.1.5 The irrigation potential utilized is the total gross area actually irrigated by a project/scheme during a particular agriculture year.

(c) Net Irrigated Area (NIA)

3.1.6 The total area which is irrigated in an agricultural year, counting the area irrigated more than once on the same land only one time.

(d) Gross Irrigated Area (GIA)

3.1.7 The total irrigated area under various crops during a year, counting the area irrigated under more than one crop during the same year as many times as the number of crops grown and irrigated.

Section 2: Sources of Irrigation Data Reporting at State and National Level

3.2.1 Data on irrigation potential utilized for a particular major and medium irrigation project is collected at project office by the ground functionaries of State Irrigation Department. The main responsible people for this purpose are Seenchpals, Ameens, Ziledars, Patrolmen, and Canal Inspectors. Since implementation of minor irrigation schemes in States is undertaken by different Departments and Organizations, there has not been a single nodal Department in the State to compile the minor irrigation statistics for the entire State. Thus, for minor irrigation schemes, the most authentic data on irrigation utilization has been collected during periodic Minor Irrigation Census conducted by Ministry of Water Resources, GoI, through State Irrigation Departments. The data collected by Irrigation Department pertains only to area irrigated by the particular major/medium irrigation project in its command area. It does not take into account the area irrigated by private irrigation sources.

3.2.2 At State level, the data on GIA and NIA is collected by village Patwaris by plot to plot enumeration under Land Use Statistics in all the States except Orissa, where these figures are collected through sample surveys carried out by State Directorate of Economics and Statistics. Village Patwaris collect crop-wise and source-wise (including the private sources) data on irrigated area. If a farmer's

land falls under the command of an irrigation project, it is counted as "irrigated" irrespective of whether the land has been irrigated or not by the farmer. This approach is more based on irrigation potential rather than actual irrigated area.

3.2.3 At national level, state-wise data on GIA and NIA are complied by Directorate of Economics and Statistics under Ministry of Agriculture, GoI, whereas Central Water Commission (CWC) under the aegis of Ministry of Water Resources, GoI is responsible for reporting the data on irrigation potential utilization for all major and medium irrigation projects.

3.2.4 As pointed out earlier, in a particular place, theoretically IPU should be identical with GIA at a given point of time. However, there exists a substantial variation in reporting the gross irrigated area by Directorate of Economics and Statistics and irrigation potential utilization by Central Water Commission (Table 3.1). This variation is quite evident across the States in Table 3.1. It can be seen that in contrast to other States, M.P and Orissa are the two States where GIA figures have been reported more than IPU. In terms of the magnitude of the variation between the two indicators, maximum difference has been found in Jharkhand (58.85 percent), whereas it is lowest (00.47 percent) in Orissa. The variation is quite substantial in M.P. also where it varies about 25 percent.

Table 3.1: State-wise Irrigation Potential Utilised and Gross Irrigated Area

('000 Hectare)

Sl. No.	State	Irrigation Potential Utilised (IPU) (2003-04)	Gross Irrigated Area (GIA) (2003-04)	Variation between IPU and GIA
1.	Bihar	4875	4567	308 (06.32)
2.	Chhattisgarh	1243	1179	64 (05.14)
3.	Jharkhand	559	230	329 (58.85)
4.	Madhya Pradesh	4611	5776	-1165 (25.26)
5.	Orissa	2506	2518	-12 (00.47)
6.	Uttar Pradesh	21623	17931	3692 (17.07)
7.	Uttarakhand	680	570	110 (16.17)

Note: Figures in parentheses represent percent difference between IPU and GIA over IPU.
Source: Central Water Commission, MoWR, GoI. (www.cwc.nic.in)

3.2.5 The differences between IPU and GIA as shown in Table 3.1 can not be explained merely by statistical errors in reporting the data by two different agencies. A large variation between the two different indicators (which ideally should be more or less equal) is a matter of serious concern and creates a lot of confusion. The possible reasons for such discrepancy look like as follows:

(a) The data reported by Irrigation Department does not take into account the area irrigated by private irrigation sources of the farmers. IPU corresponds to

only the actual area irrigated by a particular irrigation project in its command. Thus, ideally it should not be compared with GIA as reported by Agricultutre Department.

(b) In all the States, the collection of such data has become more or less a routine work without understanding and appreciating the importance of such exercise by the ground functionaries responsible for collection of these data. It is also true that Patwaris and Seenchpals are not able to devote enough time required for collection of such data in a most rigorous manner.

(c) The approach used for collection of data used by two agencies is different with respect to irrigation water. Basically Irrigation Department (as a resource provider) collects data on actual area irrigated by a irrigation project in its command. The same data is sent to Revenue Department for collecting the water charges from the farmers. Agriculture Department (as user of irrigation resource), collects the data on potential basis (please refer para 3.2.2). The figures reported by Agriculture Department do not have any relationship with water charges to be collected from the farmers.

(d) Since the revenue from irrigation water is collected on the basis of data provided by Irrigation Department, it is the tendency on the part of farmers to under report the area under irrigation to Seenchpals, who do not monitor the irrigated area carefully and quite often do the recording of irrigated area based on verbal enquiry with farmers.

(e) There is possibility of duplicity in the recording of irrigated area in case minor irrigation schemes are located in command area of major and medium irrigation projects. Ideally, the area irrigated by minor irrigation schemes should be adjusted while recording the area irrigated by major or medium irrigation projects.

3.2.5 The irrigated potential created (IPC) figures relate to figures as proposed in the design of the project, in all the States. The CWC compiles the state-wise figures of IPC of all the completed and ongoing projects. The figure for IPC for a project is conceptualized at the time of construction of the project based on the availability of quantity of water and the projected cropping pattern in the command area whereas the water requirement per unit of area of different crops varies in different seasons and in different agro-climatic conditions.

Section 3: Irrigation Potential and Utilization – Issues

3.3.1 The definition of IPC and IPU in all the States is based on the concept of "Area Irrigated" as laid down by Panning Commission 1973. The measurement of IPU and GIA does not take in to consideration the followings:

- the duration of the crop,
- volume of water applied per unit area under the crop, and

- the number of irrigations applied per unit area of a crop

3.3.2 In an area if long duration crop, say sugarcane, is being cultivated under a particular acreage in a particular year, as compared to other area, where farmers are cultivating 2 crops on the same acreage in the same year, then the GIA of the second area would be double as compared to the first area even though the requirement of water for sugarcane is higher than that for 2 crops together in the second area. It would project a higher efficiency of the irrigation project in the second area as compared to that of in the first area. Secondly, if one farmer applies X inch of water per unit area of a crop in a particular number of irrigations, and another farmer uses Y inch of water per unit area of the same crop in the equal number of irrigations, area of both the farmers is treated at par as far as recording of GIA as well as IPU is concerned. Thirdly, though the number of watering per unit area of a crop may vary across the farmers, but the area of each farmer will be same for counting irrigated area. These issues are not captured presently in defining the concept of IPU and GIA. The moot reason behind this problem is that water rates are currently charged on the basis of area irrigated and not on volume of water consumed by a farmer.

3.3.3 The concept of volumetric approach of water utilization involves three distinct but interrelated concepts, namely water planning, water distribution and water auditing. Water planning and distribution can be entrusted to Water Users' Association based on principle of warabandi. The Irrigation Department can release the water in a particular quantity at the minor level, which will help in auditing the quantity of release of water and the consumption of water by farmers in that particular command. In this way, one can easily identify the loss of water in distribution as well as theft of water on any unauthorized piece of land.

The Warabandi Principle – equity based water delivery practice

3.3.4 The word *Warabandi* originated from two vernacular words, *wara* and *bandi*, meaning `turn' and `fixation' respectively. As such, *Warabandi* literally means `fixation of turn' for supply of water to the farmers. Under this system of management, the available water, whatever its volume, is equitably allocated to all farmers in the command irrespective of location of their holdings. The share of water is proportional to the holding area in the outlet command and allocated in terms of time interval as a fraction of the total hours of the week.

3.3.5 Almost all of the irrigation projects in all the States were designed to distribute a limited supply of water to the greatest number of farmers possible. Under this situation, the distribution of water can best be governed by the Warabandi principle, a rigid rotational cycle of fixed duration, frequency, and priority level. The main principle on which Warabandi system works is that the allocation of water is in proportion to the size of the farmer's land holding. The system is simple to plan and operate. The key features of the Warabandi system are as follows:

- Individual farms are aggregated into hydrologic units (known as *chaks*).
- Each *chak* is served by a watercourse whose capacity is proportional to the size of the chak. Design duty at the chak level in all the canal & lift systems are defined well.
- Each farm holding in the chak is entitled to take the full supply in the watercourse during a specified period proportional to its size. By having the entitlement period proportional to the size of holding and having watercourse flow proportional to the size of the chak, all farmers in the command under distributaries that receive water in that week are ensured a uniform volumetric allocation per hectare per week.

3.3.6 Since the water allowance per hectare is very low, water scarcity is a built-in feature of the system (*this is especially in case of canal irrigation where the water is provided to large area*). After the *Warabandi* is fixed, notified and published, it is practically implemented in field by the shareholders, again in a participatory manner by mutual consent. Therefore, the role of the Department would be that of a facilitator and not merely regulator.

3.3.7 Broadly there can be two methods which may be adopted for the measurement of irrigation facility being provided to the agricultural fields.

1. Area irrigated approach
2. Volumetric water supply approach.

Both the modes have certain merits & demerits which are elaborated as below:

(a) Area Irrigated Approach

Merits

- ☺ This method of irrigation measurement is very simple & had been in use till now.
- ☺ Not much skill is required in recording of measurements.
- ☺ Takes care of variety of crops having irrigation as the irrigation charges are crop type dependent.
- ☺ Takes care of area served under irrigation as the irrigation charges are per unit area.
- ☺ Takes care of different types of irrigation resources, as the irrigation charges are system wise.
- ☺ Takes care of damages caused to crops due to non supply of sufficient water.
- ☺ Takes in to consideration the wastage of water due to cutting(s) in water carrier(s) & also the unauthorized use of water for irrigation & levies punitive charges in both cases.

Demerits

- ☺ No control on the quantity of water, being utilized in the agricultural fields for irrigation.
- ☺ No consideration of location of water application, whether, at Head, Middle or at tail.
- ☺ No consideration of quantity of water application, whether one or more number of watering.
- ☺ No control over the excess use of water as water charges are not linked with water quantity.
- ☺ Leads to excess use of water.
- ☺ Leads to wastage of precious water resource.
- ☺ No consideration of water availability at the source.
- ☺ No consideration of equitable distribution of water among the stake holders vis-à-vis availability of water quantity at the source.
- ☺ Does not take in to consideration the quantity of water being wasted due to cutting of water carrier(s) or unauthorized use of water.
- ☺ Can not check over use of water in the head reaches of canal/water carrier(s).
- ☺ Does not have a system to provide water in the tail reaches of canal /water carrier(s).
- ☺ Can not ensure equitable distribution of water in the canal command(s) to the stake holders.
- ☺ No provision of differential water charges on the basis of land holdings & number of watering.
- ☺ Water audit is not precise.

(b) Volumetric Water Supply Approach

Advantages

- ☺ Shall ensure judicious & optimum use of water.
- ☺ Shall ensure water regulation in a much better fashion.
- ☺ Shall ensure equitable distribution amongst the stake holders.
- ☺ Collection & realization of revenue shall be easy.
- ☺ Prepaid system of water charges for the volume of water to be supplied can be enforced thus generating revenue resources prior to providing the facility.
- ☺ Shall minimize the tendency of over use/misuse of water as the user has to pay for the excess use of water.
- ☺ Shall ensure qualitative service to the stake holders with better & efficient water distribution system.
- ☺ Shall minimize the intervention of the water supplying authority as its responsibility shall seize just after the volumetric supply to the stake holder group(s) /organization(s).
- ☺ Shall require lesser operating & managerial staff thus reducing the O & M cost and making the system sustainable.

- ☺ Water accounting shall be more scientific & easy.

Demerits

- ☺ Requires efficient water distribution carrier system(s) having required capacity of water carriers & mechanism to prevent leakage / wastage of water from the system. One time renovation/rehabilitation of the system shall be necessary.
- ☺ Requires efficient & skilled staff for the proper upkeep & management of the water distribution system for supplying water on volumetric basis amongst the stake holder/water user group(s)/organization(s).
- ☺ Requires modern & efficient regulatory & monitoring system to ensure qualitative service.
- ☺ Requires efficient water audit system.
- ☺ Requires efficient Water User`s Association(s)/Group(s)/Organization(s).

3.3.8 Most of the irrigation projects were designed based on the notion of providing protective irrigation (not full irrigation) to the crops in case of failure of monsoon particularly in Kharif season. Moreover, the irrigation potential was calculated based on a particular cropping pattern in the command area of the project, as the demand of water is based on the nature of crop under cultivation. Both these assumptions have changed over time. Based on market conditions and technological changes, cropping pattern has changed almost in all the places in favor of more water intensive crops. This has resulted in increased demand of irrigation water by the farmers. On the other hand, due to lack of effective control on the distribution of water, farmers located at head of the canal over irrigate the land leaving less water availability to the users at the tail end. With less water availability, the water does not reach to the farmers at the tail end. This affects the extent of area irrigated by a particular irrigation source. This problem become more acute when there is less water availability at the irrigation resource due to less rainfall.

3.3.9 The working efficiency of any asset is bound to decrease continuously over time due to wear and tear. That is why the concepts of depreciation and economic life are usually applied in investment analysis. In order to maintain an asset till its economic life, regular maintenance is also undertaken and financial analysis of the project incorporates ex-ante provision for maintenance cost. The same should be applied for irrigation projects. The irrigation potential calculated at the time of inception of the project has been reduced over the years due to reduction in water availability and loss of capacity of canals and reservoirs. But unfortunately, no depreciation has been taken in to account in reporting the figures of IPC of a particular project. Non-availability of sufficient funds for maintenance of irrigation project has been widely accepted in all forums. Therefore, assuming the constant IPC figure for a project over the years and that too without proper maintenance looks very surprising. A periodic assessment of IPC for each project is required. In the absence of such exercise, IPC figures reported presently are highly inflated and therefore, any gap between IPC and IPU becomes artificially

high. Under this scenario, gap between IPC and IPU does not provide the correct signal for judging the working efficiency of an irrigation project.

3.3.10 Besides, the depreciation, there is also an urgent need for reassessment of IPC for each project due to the following reasons:

(a) IPC figure is for a project is based on assumed cropping pattern at the time of inception of the project. The cropping pattern has changed over time, and thus requirement of water. Therefore, even if we take "Area Approach" for defining the IPC, at present time the same area can not be irrigated by the project given the change in water demand.

(b) The rainfall, which is a major source of water to most of the irrigation project, has changed both in terms of magnitude and time pattern. With the changes in the pattern of rainfall over time in the command area of a project, the irrigation capacity of a project should be reassessed.

(c) In some cases, in order to bring down the cost of irrigation per unit of cultivated area, the IPC figure was artificially inflated at the time of sanction of the irrigation project. Although it concealed one problem of higher cost, it created a new problem of large gap between IPC and IPU at the time of performance of the project.

Section 4: Suggested Measures

3.4.1 Following suggestion are made in order to improve the present system of defining and measuring the concept of IPC, IPU and GIA for the irrigation projects:

(a) As discussed above, IPC figure for each irrigation project should be periodically reassessed treating IPC as dynamic and not as a currently presumed static variable. A concern in the similar lines has been also raised in the Report of the Task Force for Preparing Guidelines for Reporting the Figures of Irrigation Potential Created and Utilized in a Uniform Manner, Central Water Commission, 2002.

(b) The definition of IPC and IPU based on "Area Irrigated" as proposed by Planning Commission in 1973 needs a fresh look by the planners and administrators as the present approach does not provide the accurate measure of these two indicators. The concept of volumetric approach of water utilization should be debated over the "Area irrigated" approach to finalize the process of defining the IPC and IPU.

(c) Whatever the concept is used in defining these concepts, there is no doubt about the removal of dual system of reporting these figures at State level as it creates only doubts and confusion. Presently the two independent parallel institutions (Irrigation and Agriculture Departments) report these figures, but

without any coordination among them. The methodology used by Agriculture/ Revenue Department (based on complete enumeration of farms in the village) looks better provided Patwaris are motivated and properly equipped to collect such data at village level. There must be some incentive dis-incentive structure to ensure the authentication of the required data at the village level.

(d) The Task Force set up in 2002 by Govt. of India for Preparing Guidelines for Reporting the Figures of Irrigation Potential Created and Utilized in a Uniform Manner suggested for a single nodal agency in each of the State for collection of data related to irrigation resources. The Task force recommended State Agriculture Statistics Authority (SASA) functioning within the Department of Economics and Statistics may be designated as nodal agency for this purpose. But no action seems to have been taken in this regard.

(e) A periodic census of all completed major and medium irrigation projects should be undertaken as in the case of minor irrigation schemes.

Chapter 4

Major and Medium Irrigation Projects

Section 1: Sample Major and Medium Irrigation Projects

4.1.1 The data on the following variables for all completed major and medium irrigation projects from different States was collected.

- Present irrigation potential of the project for Kharif and Rabi season, separately
- Irrigation potential of the project for kharif and Rabi season, separately at the time of inception of the project
- Year of inception of the project
- Total irrigated area by the project in Kharif and Rabi season, separately during last ten years
- Agro-climatic region under which the project is located

4.1.2 The percentage utilization in terms of gross irrigated area to irrigation potential for all the projects in selected States was calculated to identify the sample projects in each State. Based on the secondary data, and criteria adopted for selection of sample irrigation projects, 6 irrigation projects (major and medium) were selected from each of the State. The sample irrigation projects from different states are given in Tables 4.1.1 to 4.1.7.

Table 4.1.1: Gross Irrigated Area as percentage of Potential Created for Sample Irrigation Projects - U.P

S. No.	Project	2004-05			2005-06			2006-07		
		K	R	T	K	R	T	K	R	T
	Major Irrigation									
1	Upper Ganga Canal System	72.26	65.71	69.08	73.33	62.36	68.01	72.60	64.08	68.47
2	Sharda Sahayak Pariyojana	74.03	66.70	70.52	71.91	63.65	67.95	72.59	4.79	40.05
	Medium Irrigation									
1	Chd. Charan Singh Gola Pump Canal	14.11	15.02	14.49	10.82	16.38	13.15	12.99	16.67	14.53
2	Chd. Charan Singh Dohari Ghat Pump Canal	50.95	38.18	44.57	48.64	39.68	44.16	47.27	37.09	42.18
3	Ghaghra Canal	32.93	1.09	22.44	26.01	131.69	60.84	76.86	19.62	57.99
4	Ranipur Canal System		10.36	10.91		55.00	55.18		8.91	9.09

Note: K = Kharif Season, R = Rabi Season, T = Total

Table 4.1.2: Gross Irrigated Area as percentage of Potential Created for Sample Irrigation Projects - M.P

S. No.	Project	2000-01			2001-02			2002-03			2003-04			2004-05		
		K	R	T	K	R	T	K	R	T	K	R	T	K	R	T
	Major Irrigation															
1	Chambal Cannal	34.31	31.43	31.86	13.29	56.43	42.83	0.4	3.91	2.8	0.0	55.99	38.34	3.74	57.98	40.88
2	Rangvan	0.0	24.95	9.46	0.0	61.92	23.48	0.0	58.09	22.03	0.0	71.36	27.06	0.0	67.2	25.48
	Medium Irrigation															
1	Segval	0.00	0.00	0.00	36.11	22.22	29.17	16.56	50.89	33.72	0.00	68.89	34.44	0.00	63.00	31.50
2	Kerva	-	33.36	33.36	-	0.00	0.00	-	0.00	0.00	-	21.66	21.66	-	21.66	21.66
3	Kulgarhi Dam	0.00	47.82	26.09	4.15	47.74	27.93	0.00	43.37	23.66	0.00	46.34	25.28	0.00	51.28	27.97
4	Satak			15			126			106			86			94

Note: K = Kharif Season, R = Rabi Season, T = Total

Table 4.1.3: Gross Irrigated Area as percentage of Potential Created for Sample Irrigation Projects – Bihar

S.No	Project	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
	Major Irrigation						
1	North Koel Res. Project	55.44	73.15	71.88	84.22	57.14	79.60
2	Western Koshi Project	4.60	5.82	5.62	9.19	6.61	7.13
3	Sone Cannal System	73.94	72.92	81.79	67.06	65.53	72.87
	Medium Irrigation						
1	Batane Res. Sche.	26.08	29.25	28.96	28.21	12.20	13.08
2	Kharagpur Sche.	93.51	90.65	86.90	89.22	92.57	94.87
3	Orni Res. Sche.		10.53	5.79	11.33	24.05	22.59

Note: K = Kharif Season, R = Rabi Season, T = Total

Table 4.1.4: Gross Irrigated Area as percentage of Potential Created for Sample Irrigation Projects – Chhattisgarh

S. No.	Project	2000-01			2001-02			2002-03			2003-04			2004-05		
		K	R	T	K	R	T	K	R	T	K	R	T	K	R	T
	Major Irrigation															
1	Tandula Jalasay	24.17		24.17	128.5		128.5	28.53		28.53	78.73		78.73	123.2		123.21
2	Kodar Jalasay	35.17	0.00	25.11	94.94	0.27	67.84	99.60	0.00	71.09	27.18	29.65	27.89	95.61	1.76	68.75
	Medium Irrigation															
1	Maroda Jalasay	33.93		33.93	64.27		64.27	59.78		59.78	42.70		42.70	47.87		47.87
2	Matea moti Jalasay	0.00	0.00	0.00	93.46	0.00	71.89	64.78	0.00	49.83	0.00	0.00	0.00	92.82	0.00	71.40
3	Kuwarpur Jalasay	20.80		33.07	15.53		22.82	81.60		90.76	11.76		20.47	21.64		21.64
4	Pralkoat Jalasay	15.48	0.00	10.32	21.88	11.65	18.47	28.18	5.00	20.45	17.50	27.03	20.67	12.56	21.20	15.44

Note: K = Kharif Season, R = Rabi Season, T = Total

Table 4.1.5: Gross Irrigated Area as percentage of Potential Created for Sample Irrigation Projects – Jharkhand

S.No.	Project	2000 - 01	2001-02	2002-03	2003 - 04	2004-05	2005-06	2006-07
	Major Irrigation							
1	Kanchi Irrigation Scheme	69.21	59.73	59.73	79.52	79.63	42.55	64.34
	Medium Irrigation							
1	Sona Irrigation Scheme	28.33	18.41	18.41	39.66	42.49	40.37	50.99
2	Latratu Reservoir Scheme	31.72	14.85	14.85	13.69	17.37	17.98	18.30
3	Malay Reservoir Project	37.64	36.28	36.28	33.56	4.22	18.36	77.97
4	Mayurakchi Left Bank Canal	89.66	67.88	67.88	94.09	103.45	116.65	117.73
5	Sunder Reservoir Scheme	90.26	88.95	88.95	92.00	86.00	35.00	48.15

Table 4.1.6: Gross Irrigated Area as percentage of Potential Created for Sample Irrigation Projects - Orrisa

S.No.	Project	2005-06		
		K	R	T
	Major Irrigation			
1	Rushikulya System	100.0	0.0	100.0
2	Hirakud System	100.0	100.0	100.0
	Medium Irrigation			
1	Pitamahal	100.0	38.7	76.6
2	Ramiala	100.0	100.0	100.0
3	Behuda	100.0	0.0	100.0
4	Sunei including Extn.	100.0	26.9	74.6

Note: K = Kharif Season, R = Rabi Season, T = Total

Table 4.1.7: Gross Irrigated Area as percentage of Potential Created for Sample Irrigation Project- Uttarakhand

Name of Canal		Gwalakot Hydrum Scheme	Lower Bhakhra Canal Scheme	Rudrapur Canal Scheme	Supakot Canal Scheme	Bullawal Canal
2002-03	Kharif	80	125.57	110.73	59.52	213.75
	Rabi	70	266.67	362.20	66.67	118.21
	Total	75	167.90	190.35	63.10	
2003-04	Kharif	40	123.19	111.30	48.81	208.59
	Rabi	70	265.23	367.07	60.71	126.11
	Total	55	165.80	192.28	54.76	
2004-05	Kharif	40	124.16	109.60	48.81	205.84
	Rabi	70	235.80	368.29	61.90	133.67
	Total	55	157.65	191.51	55.36	
2005-06	Kharif	40	113.76	129.38	48.81	206.18
	Rabi	70	216.87	382.93	61.90	140.20
	Total	55	144.69	209.65	55.36	
2006-07	Kharif	40	113.32	131.07	50	206.87
	Rabi	70	223.05	360.98	63.10	402.00
	Total	55	146.23	203.86	56.55	

Section 2: Analysis of Sample Irrigation Projects – U.P.

1. Doharighat Pump Canal System

4.2.1 Doharighat pump canal, one of the major lift irrigation schemes of Uttar Pradesh, was constructed on the right bank of river Ghaghara in the year 1956. With a pump house of 600 cusec water capacity, it was designed to cover a Cultural Command Area (CCA) of 55,500 hectare in the Azamgarh (now Mau) and Balia districts of Eastern U.P. Out of 55,500 hectares of CCA, 40 percent was kept as Proposed Potential Area (PPA) in Rabi and Kharif season, respectively. Thus, it was proposed that the project will irrigate a total area of 44400 hectares comprising of 22200 hectares in Rabi and Kharif season, respectively. The canal was remodeled in the year 1974 for 660 cusec water discharge capacity. For this purpose, 4 pumps of 75 cusec were installed in 1974 and 8 pumps of 60 cusec were put on in 1983.

4.2.2 The irrigated area from the project during last 7 years separately in Kharif and Rabi seasons has been presented in Table 4.2.1 below. The figures in Table 4.2.1 show a very dismal performance of the canal. During Kharif season, on an average about 50 percent of the potential has been utilized which has further gone down to only 42 percent in the year 2007-08. The same fate has occurred in Rabi season too, where the project has been able to irrigate only 37 percent of its potential irrigated area.

Table 4.2.1: Irrigated Area by the Doharighat Pump Canal System during 2001-2008

Year	Irrigated Area (hectare)	
	Kharif	Rabi
2001-02	11118 (50.54)	10438 (47.01)
2002-03	11641 (52.43)	9858 (44.40)
2003-04	11869 (53.46)	8854 (39.88)
2004-05	11204 (50.47)	8406 (37.86)
2005-06	10695 (48.17)	8738 (39.36)
2006-07	10398 (46.84)	8158 (36.74)
2007-08	9382 (42.61)	NA

Source: Office of Chief Engineer, Doharighat Pump Canal System, Gorakhpur

Note: Figures in parentheses indicate percent utilization of irrigation potential.

Reasons for Gap between Irrigation Potential and Utilization:

4.2.3 A detailed discussion with officials of the project has revealed the following key reasons for such poor performance of the project.

(a) Decreased Pump Efficiency

4.2.4 The discharge and efficiency of the pumps have gone down significantly. The maximum average discharge of water from all 10 pumps during Kharif season has been 283 cusec (Table 4.2.2) against designed discharge of 660 cusec. Thus the system is running at less than 50 percent efficiency level. The problem has further worsened in the months of Rabi season when the maximum average monthly discharge of water from all the pumps has been 208 cusec with hardly 30 percent efficiency level. The pumps are about 25 years old and have run over 60 to 80 thousand hours against the economic life of 20 thousand hours. The efficiency of motors has also gone down due to brittleness of copper strips of stator, due to fatigue. Impeller and casings that were of cast iron have eroded while interacting with sand content of water.

Table 4.2.2: Monthly Discharge of Water

(in Cusec)

S. No.	Month	Year							
		2000	2001	2002	2003	2004	2005	2006	2007
	Kharif								
1.	April	210.0	201.0	106.0	167.0	108.0	139.0	181.0	202.0
2.	May	271.0	230.0	262.0	288.0	235.0	157.0	-	-
3.	June	150.0	352.0	288.0	276.0	234.0	248.7	261.0	272.0
4.	July	344.0	332.0	327.0	310.0	305.0	357.0	310.0	353.0
5.	August	248.0	336.0	313.0	198.0	344.0	288.0	351.0	162.0
6.	Sept.	163.0	122.0	237.0	98.9	219.0	292.8	315.0	295.0
	Mean	231.0	262.2	255.5	223.0	240.8	247.1	283.6	256.8
	Rabi								
7.	October	210.0	83.0	173.0	46.8	198.0	308.0	291.0	298.0
8.	Nov.	106.0	62.0	112.0	55.4	79.0	-	-	-
9.	Dec.	111.0	-	-	78.2	98.9	110.0	139.0	181.0
10.	January	213.0	207.0	113.0	180.0	123.0	172.0	202.0	235.0
11.	February	217.0	190.0	118.0	126.0	184.0	147.0	239.0	186.0
12.	March	219.0	244.0	190.0	181.0	178.0	197.0	124.0	151.0
	Mean	187.0	169.7	114.9	125.2	134.6	151.5	193.9	207.9

Source: Office of Chief Engineer, Doharighat Pump Canal System, Gorakhpur

4.2.5 Due to reduced pump efficiency, the water at the head of canal is not adequate. Month-wise availability of water at head of canal has been given in Table 4.2.3. Ideally, at any particular day, the water in the canal should be available at 2.13 meter. Against the requirement, it is evident that average height of water in different months of Kharif season has been about 1 meter or little more than 1 meter across the years. The water availability in different months of Rabi season has been quite low, with mean availability of water varying from as low as 0.56 meter in the year 2003 to as high as 0.91 meter in 2007.

Table 4.2.3: Availability of Water at Head Point of Canal

(in meter)

Sl. No.	Month	Year							
		2000	2001	2002	2003	2004	2005	2006	2007
	Kharif								
1.	April	0.89	0.89	1.38	0.75	0.51	0.64	0.86	1.21
2.	May	1.12	1.30	1.09	1.19	0.99	0.72	-	-
3.	June	0.71	1.41	1.15	1.15	1.01	0.97	1.08	1.12
4.	July	1.37	1.34	1.31	1.31	1.23	0.41	1.22	1.43
5.	August	1.04	1.05	1.31	0.85	1.37	1.18	1.40	0.75
6.	September	0.75	0.60	0.96	0.50	0.93	1.19	1.28	1.21
	Mean	0.98	1.10	1.20	0.96	1.01	0.85	1.17	1.14
	Rabi								
7.	October	0.90	0.47	0.77	0.31	0.85	1.22	1.19	1.21
8.	November	0.56	0.38	0.56	0.36	0.46	0.20	-	-
9.	December	0.56	0.43	0.45	0.45	0.53	0.56	0.65	0.81
10.	January	0.92	0.87	0.55	0.80	0.62	0.75	0.81	0.99
11.	February	0.96	0.86	0.59	0.63	0.80	0.68	0.97	0.83
12.	March	1.23	1.07	0.90	0.81	0.78	0.85	0.60	0.69
	Mean	0.86	0.68	0.64	0.56	0.67	0.71	0.84	0.91

Source: Office of Chief Engineer, Doharighat Pump Canal System, Gorakhpur

(b) Inadequate Power Supply

4.2.6 Inadequate power supply has added the fuel in the fire for reduced discharge of water from the system. The monthly non-availability of electric power from the year 2004 to 2007 has been presented in Table 4.2.4. The figures show not only the low availability of electric power in different months but also present the erratic nature of its availability. This is also one of the reasons for not running the pumps properly resulting in low discharge of water from the pumps.

Table 4.2.4: Power Un-availability at Doharighat Pump Canal System

(Hours)

Sl. No.	Month	Year			
		2004	2005	2006	2007
	Kharif				
1.	April	57	28	54	19
2.	May	26	-	-	-
3.	June	24	53	27	10
4.	July	97	24	22	2
5.	August	24	27	14	3
6.	September	24	23	18	22
	Rabi				
7.	October	35	19	18	11
8.	November	-	-	-	-
9.	December	40	67	19	3
10.	January	14	35	27	4
11.	February	34	19	21	40
12.	March	98	-	14	18

Source: Office of Chief Engineer, Doharighat Pump Canal System, Gorakhpur

(c) Lack of Distribution Channels

4.2.7 During the discussion with the officials of the project, it came out clearly that distribution channels up to the farmers' fields are not in proper conditions. As per the rough estimate by the project officials, about 5 percent of the irrigation potential is not covered for irrigation due to this particular reason. This turns out to be about 2775 hectare. The reasons for lack of distribution channel are several. In some cases, the channels have been destroyed by the local farmers and have been encroached. In some places, the areas under original field channels have been allotted to farmers under land consolidation. Another reason is the beach of channel due to construction of road under some Village Development Program by Gram Panchyat. The staff of the Irrigation Department is not able to effectively monitor the distribution of water from head to tail. This is due to lack of time available to the staff for proper monitoring of distribution of water on the one hand, and their inability to control the dominant socio-political group of farmers on the other.

(d) Lack of Budget for Maintenance

4.2.8 The availability of funds for maintenance of the system is presented in Table 4.2.5. It is clear that available funds are very meager in comparison to requirement of funds for proper maintenance of the system. It was only 22 percent of the requirement in the year 2006-07. Main canal and its distributaries need de-silting at regular interval. It is not possible due to lack of budget for maintenance purpose. Channel section of system has been deteriorated because

of non-availability of sufficient maintenance fund. Different canal regulating structures like gates, gauge pillars, and tail gulls have either been damaged or are not available.

Table 4.2.5: Availability of Funds for Maintenance of the System

Year	Required amount as per the approved norms (Rs. Lakhs)	Sanctioned amount (Rs. Lakhs)
1998-99	167.71	52.93 (31.56)
1999-2000	167.71	44.73 (26.67)
2000-01	167.71	65.40 (39.59)
2001-02	167.71	65.13 (38.83)
2002-03	195.54	65.13 (33.33)
2003-04	195.54	40.07 (20.49)
2004-05	216.35	40.27 (18.61)
2005-06	216.35	44.04 (20.35)
2006-07	216.35	47.69 (22.04)

Source: Office of Chief Engineer, Doharighat Pump Canal System, Gorakhpur

Note: Figures in parentheses indicate percent of required amount.

(e) Area Converted for Non-agricultural Uses:

4.2.9 Although no precise data is available on this count, yet it is estimated by the project officials that about 555 hectare (1 percent of CCA) has been lost due to conversion of agricultural land into non-agricultural purposes. Ideally this area should have been deleted from potential irrigated area of the project, but has not been implemented yet.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.2.1).

Chart 4.2.1: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Decreased pump efficiency because of old pumps	1
2.	Inadequate power supply	3
3.	Broken minors and field channels due to lack of O&M funds	2
4.	Encroachment of area under field channels	4
5.	Diversion of cultivable land to other purposes within command area	5

Suggestions:

4.2.10 To achieve the required discharge, it has become essential to change the old pump and motors as well us to restore the channel Section for 660 cusec capacity in the main canal and distributaries only. For the above purpose following suggestions are made:

(i) 12 No. Pumps and 8 No. Motors are to be replaced.

(ii) Electric Gantry, Crane, Diesel generating system, complete old wiring and panned are to be replaced.

(iii) Presently 6 no. motors of 6.6KV each are being run. Now all the motors will run on 3.3KV. So two no of transformers of 5 MVA each are to be replaced.

(iv) Main canal section should be restored from 4.8 km. to 51.20 km. by de-silting in some reaches and widening and deepening in tight section of some reaches.

(v) Restoration of damaged lining-and completing the lining in main canal in between 25.40 km to 32.00 km..

(vi) Restoration of distributaries by strengthening of banks and restoration of internal section.

(vii) Restoration & provisions of gates for regulation.

(viii) Making leakage proof, the old masonry trough of main canal up to 4.8 km. and relaying damaged arches.

(ix) 31 No. cattle bridges to be replace by VRBs and 25 No. damages slabs to be replace by RCC slabs to save the canal from damages. Restoring damaged masonry works for canal crossing to save the canal from damaged.

(x) Restoration of escape channel section and adjacent drains near main canal.

(xi) Providing adequate maintenance budget so that system is not deteriorated over time.

2. Ranipur Canal System

4.2.11 Ranipur canal system was established in between 1947-1952. This system is originated from SAPRAR Dam. There are two canal systems running from this dam (1) Ranipur canal system, and (2) Dhasan canal system. Ranipur canal system has 13 minors and the total length of this canal system is 115 kilometers. Presently, total Culturable Command Area (CCA) of Ranipur canal system is 28528 hectares spread over 78 villages in District Jhansi. Out of 28528 hectares of CCA, the proposed potential irrigated area of this system stands at about 11000 hectares. The system is made to irrigate only Rabi crops. The water source of the Saprar dam was originally from SAPRAR River and GOMCHI nala. Due to

construction of check dams at the upper part of the river in the state of M.P., the source of the water in the dam depends mainly upon rain water.

Distributions of Dam Water:

- 365 mcft Drinking water for Mauranipur town and village area
- 1200 mcft Ranipur canal system for irrigation
- 900 mcft Dhasan canal system for irrigation
- 140 mcft Vaporization
- 87 mcft Dead storage (silt)

4.2.12 Total capacity of dam is 2692 mcft and the maximum water level is 737 feet. Dam is open for irrigation when water level is more than 716 feet. Below this level, the water is used for Mauranipur town and village area for drinking purpose. The actual irrigated area by the system during last 10 years has been presented in Table 4.2.6. It is evident from the data that performance of the project has deteriorated since 2004-05. During 2006-07, only 8.93 percent of potential area could be irrigated by the canal.

Table 4.2.6: Irrigated Area by the Ranipur Canal during 1997-98 to 2006-07

S. No	Year	Kharif (hec)	Rabi (hec)
1	1997-98	6	6555 (59.59)
2	1998-99	417	14142 (128.56)
3	1999-2000	74	13999 (127.26)
4	2000-01	43	13321 (121.10)
5	2001-02	54	13932 (126.65)
6	2002-03	22	12855 (116.86)
7	2003-04	17	14541 (132.20)
8	2004-05	63	1141 (10.37)
9	2005-06	17	6045 (54.95)
10	2006-07	22	982 (08.93)

Source: Office of Chief Engineer, Ranipur Canal System, Jhansi

Note: Figures in parentheses indicate percent utilization of irrigation potential.

Reasons for Gap between Irrigation Potential and Utilization:

(a) Lack of Water in Dam

4.2.13 As mentioned earlier, the source of water to the dam is rain water. Due to lack of rainfall, the level of water in the dam fluctuates as given in Table 4.2.7.

Table 4.2.7: Dam Water Record of during 2001 to 2007

(Feet)

Year	2001	2002	2003	2004	2005	2006	2007
Maximum Level	737	737	737	737	737	737	737
Actual Level	735.7	732.9	737	718.3	722.5	715.2	714.3
Lack of Water	1.3	4.1	nil	18.7	14.5	Below minimum level	Below minimum level

Source: Office of Chief Engineer, Ranipur Canal System, Jhansi

4.2.14 It can be seen from Table 4.2.7 that water in the dam was below the minimum level of 716 feet, which is required to open the system for irrigation. The huge gap between irrigation potential and utilization during the last 3 years since 2004-05 as given in Table 4.2.6 can be explained with lack of water in the dam since 2004 as brought in Table 4.2.7.

4.2.15 The distribution of rainfall in the project area across different months since 1996 has been reproduced in Table 4.2.8. It represents wide fluctuations across the year. It is brought out from the table that the mean rainfall has reduced since 2004, which is the main reason for lack of water in the dam during this period.

Table 4.2.8: Yearly Month wise Rainfall Data

(m.m)

Month	Year											
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Jan.	160	Nil	Nil	12.4	Nil	Nil	Nil	Nil	Nil	05.2	Nil	Nil
Feb.	8.2	Nil	Nil	Nil	Nil	Nil	22	23.0	Nil	Nil	Nil	Nil
March.	Nil	Nil	7.2	Nil	11.6	Nil	Nil	Nil	Nil	81.8	52	Nil
April	Nil	38	Nil	Nil	5.6	49.6	32	Nil	Nil	Nil	Nil	Nil
May	Nil	4.00	Nil	Nil	7.1	41.0	6.00	Nil	04.00	19.2	Nil	Nil
June	11.8	34.6	38.8	66.2	140	202.2	52	104	76.0	31.6	14	86
July	208.00	132.00	135.2	426	195	549.6	22	185	114.0	300.8	18	76
Aug.	206.00	277.8	241.8	363.4	108.8	150.6	427.2	205	218.8	178.4	126	196
Sep.	108.6	264.6	52.8	522	81.8	6.6	186.8	646	76.2	163.4	14	14
Oct.	15.0	12.04	Nil	346	Nil	12	Nil	Nil	Nil	Nil	Nil	Nil
Nov.	Nil	11.00	0.4	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Dec.	Nil	63.08	Nil	Nil	Nil	Nil	Nil	15.0	Nil	Nil	Nil	Nil
Total	717.6	837.12	476.2	1736	549.9	1011.6	748	1178	489	780.4	224	372
Mean	59.8	69.76	39.68	144.67	45.83	84.3	62.33	98.17	40.75	65.03	18.67	31.0

Source: Office of Chief Engineer, Ranipur Canal System, Jhansi

(b) Low Water Discharge

4.2.16 The actual discharge of water at the head of the canal during the year 2002 to 2007 has been shown in Table 4.2.9. The data on discharge of water shows high fluctuation across the months in the year. This is precisely due to the availability of water in the dam.

Table 4.2.9: Head Discharge Record of System during 2002 to 2007

Head Design Discharge- 260 Cusec, Proposed Discharge – 200 Cusec

Month/Year	2002	2003	2004	2005	2006	2007
Oct.	62.4	25.7	*	*	*	*
Nov.	196.76	193	*	90.6	*	*
Dec.	*	145	*	*	*	*
Jan.	*	19.2	*	*	*	*

*Note: * indicate that due to non-availability of water, canal didn't operate.*

Source: Office of Chief Engineer, Ranipur Canal System, Jhansi

(c) Lack of Budget for Maintenance

4.2.17 The availability of funds for maintenance of the system is presented in Table 4.2.10. Main canal and its distributaries do not require major de-silting work at regular interval as the area is rocky and therefore there is no problem of silt. The budget is required mainly for maintenance of canal banks, maintenance of dam gate and recruitment of temporary field staff. It is not possible due to lack of budget for maintenance purpose. Channel section of system has been deteriorated because of non-availability of sufficient maintenance fund.

Table 4.2.10: Availability of Funds for Maintenance of the System

(Rs. Lakhs)

Year	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Demand	21.38	21.38	21.38	22.81	30.54	28.33
Sanction	21.38 (100)	21.38 (100)	21.38 (100)	16.44 (72.07)	20.72 (67.85)	15.13 (53.41)

Note: Figures in parentheses indicate percent of demand.

Source: Office of Chief Engineer, Ranipur Canal System, Jhansi

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.2.2).

Chart 4.2.2: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Insufficient availability of water due to lack of rainfall	1
2.	Broken minors and field channels due to lack of O&M funds	2

3. Upper Ganga Canal

4.2.18 The Upper Ganga Canal (UGC) system commissioned as far back as 1854-55 has its origin from the mythological Ganga. The river is called Bhagirathi at its source. Descending down the valley it is joined by the Alaknanda at Dev Prayag; the Bhagirathi Kharak and Satopanth. Below confluence with Alakananda, river is called the Ganga. Cascading approximately 160 km and cutting through the Shivalik range of hills, it emerges into the plains at Haridwar. The construction of Upper Ganga Canal was conceived & constructed by Proby T. Cautley during the period 1840 -1854. In the beginning, one of the branches of river - a natural channel flowing near Haridwar - was made use of to divert practically the entire winter flow by construction of temporary obstructions across other branches. With increase in demand, the state took up construction of permanent headworks in 1913 and completed it in 1920. It consisted of a weir about 550 m long fitted with 1.8 m high falling shutters & located about 3 km upstream of old regulator. The UGC system then comprised 910 km of main canal and branches and 5280 km of distributaries to provide irrigation facilities in the district of Saharanpur, Muzaffarnagar, Meerut, Bulandshaher & Aligarh.

4.2.19 The Upper Ganga Canal takes off from the right flank of Bhimgoda barrage which replaced the old weir at Haridwar in 1991-92. The canal with a head discharge of 190 cumecs (6750 cusecs) presently provides irrigation in a gross command area of about 20 lakh hectares in 10 districts of Western Uttar Pradesh. There are 4 major cross drainage works in initial 36 kms of the main canal. The 4 cross drainage works located on the old canal are more than a century old and have outlived their lives. The project is divided into 7 divisions which are as follows:

1. Muzaffarnager Div.
2. Anupshahar Branch Divn. Meerut
3. Anupshahar Branch Narora Divn.
4. Meerut Div.
5. Bulandshahr Div.
6. Mat Branch - Div.
7. Aligarh Div.

4.2.20 For the present study, detailed analysis related to irrigation potential and its utilization has been made only in one division. For this purpose, Meerut division has been selected. The main canal of the project under Meerut division is of more than 84 kilometers with 14 distributaries and 54 minors. The project encompasses a total culturable command area (CCA) of 103208 hectares, out of which 66 percent has been taken as proposed potential area in Kharif and 41 percent has been considered as potential area under Rabi. Accordingly, the irrigated potential under Kharif and Rabi works out to be 68117 hectares and 42315 hectares, respectively.

4.2.21 The actual area irrigated by the project during kharif and Rabi seasons since the year1997-98 is presented in Table 4.2.11.

Table 4.2.11: Irrigated Area by the Upper Ganga Canal System during 1997-98 to 2006-07

Year	Irrigated Area (hectare)	
	Kharif	Rabi
1997-98	52083 (76.46)	23503 (55.54)
1998-99	41050 (60.26)	22300 (52.70)
1999-2000	40276 (59.12)	22300 (52.70)
2000-01	39073 (57.36)	22066 (52.15)
2001-02	39714 (58.30)	22944 (54.22)
2002-03	41527 (60.96)	22944 (54.22)
2003-04	42081 (61.73)	24121 (57.00)
2004-05	42449 (62.31)	24789 (58.58)
2005-06	42869 (62.94)	25198 (59.55)
2006-07	43245 (63.48)	25819 (61.01)

Source: Office of Chief Engineer, Meerut Division, Ganga Canal, Meerut
Note: Figures in parentheses indicate percent utilization of irrigation potential.

4.2.22 The data in Table 4.2.11 indicate that the project is operating about 60 % capacity utilization both in Rabi and Kharif seasons. This is quite alarming situation and requires detailed understanding about reasons for gap between irrigation potential created and its utilization.

Reasons for Gap between Irrigation Potential and Utilization

(a) Ineffective Water Distribution Mechanism

4.2.23 Outlets are most important links for proper distribution of water from canal to fields. The status of outlets in the command area has been presented in Table 4.2.12. It is clear that 418 outlets (18 percent of total outlets) are either in closed or damaged conditions. In order to fix the outlets under the canal, head and tail walls are constructed. The figures in Table 4.2.12 show that in 1220 outlets (53 percent of total outlets) either head or tail wall does not exist. Due to this the outlets are not at the same level of fields resulting in high wastage of water. Moreover, there are chances that these outlets would be destroyed in the future.

Table 4.2.12: Status of Outlets for Water Distribution

S. No.	Canal	Total Outlets	Closed Outlets	Damaged Outlets	Outlets in Proper Condition	Non-existence of Head or Tail Wall
1.	Right Jolly	387	68	35	284	208
2.	Khatuali	152	Nil	7	145	28
3.	Rast Salava	269	Nil	45	224	101
4.	Chap Salava	349	40	100	209	294
5.	Right Bhola	247	11	Nil	236	210
6.	Right Teekari	254	Nil	69	185	150
7.	Right Pooth	232	Nil	1	231	40
8.	Right Chapmola	256	26	16	214	76
9.	Jalalabad	169	Nil	Nil	169	113
	Total	2315	145	273	1897	1220

Source: Office of Chief Engineer, Meerut Division, Ganga Canal, Meerut

(b) Encroachment of Distribution Channels

4.2.24 It has been estimated that about 15184 hectare area under distribution channel has been encroached by farmers. This area has been merged with the cropped land.

(c) Loss of Command Area

4.2.25 There has been a significant loss in the command area over time due to various factors. As per the estimates of the officials of the project, the loss of command area due to various reasons has been given in Table 4.2.13. It has been estimated that about 25806 hectare of culturable land (25 percent) out of total Culturable Command of 103208 has been affected over the years due to the reasons given in Table 4.2.13.

Table 4.2.13: Estimate of Loss of Command Area

Sl. No.	Nature of Reason	Area (hectare)
1.	Urbanization	8890
2.	Industrialization	717
3.	Regional development	2099
4.	Loss of canal due to construction of roads	4300
5.	Non-utilization of canal water due to use of private irrigation sources by farmers	9800
	Total	25806

Source: Office of Chief Engineer, Meerut Division, Upper Ganga Canal, Meerut

(d) Other Reasons

(a) The area has been dominated by sugarcane crop which is very water intensive crop. Due to change in cropping pattern, the demand for water has increased. With increased demand in water, most of the water is consumed by farmers located at head of canal and water does not reach at tail end.

(b) Earlier the canals used to be clean twice in a year after the Kharif and Rabi seasons. But due to lack of funds for maintenance, now the canals are cleaned only once in a year. This has affected the water carrying capacity of canals.

(c) Sometimes, the water from the main canal is diverted for other purposes like drinking purpose and for keeping the clean water in river Ganga during religious events.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.2.3).

Chart 4.2.3: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Broken water outlets	1
2.	Encroachment of area under field channels	3
3.	Non-maintenance of channels	5
4.	Diversion of cultivable land to other purposes within command area	2
5.	Change in cropping pattern	4
6.	Diversion of water for other purposes	6

4. Ghaghar Pariyojana

4.2.26 Ghaghar pariyojana was established in 1917. This system is originated from Dhanraul dam constructed across river Ghghar near Dhanraul village in Dist. Sonbhadra. This canal system has 99 minors and the total length of this canal system is 58.8 kilometers. Presently, total Culturable Command Area (CCA) of the project is 78244 hectares. Out of 78244 hectares of CCA, the proposed potential irrigated area of this system stands at about 27124 hectares. The system is made to irrigate 19030 hectares in Kharif and 8094 hectares during Rabi season. Total water capacity of dam is 4570 mcft and the maximum water level is 1043 feet. The actual irrigated area by the system during last 10 years has been presented in Table 4.2.14. It shows that the project has performed well over the years barring some odd years when the gap between irrigation potential and utilization is quite high. More specifically, the irrigation potential utilization has been low since 2004-05.

Table 4.2.14: Irrigated Area by Ghaghar Pariyojana during 1997-98 to 2006-07

S.No	Year	Kharif (hec)	Rabi (hec)
1	1997-98	18590 (97.68)	12198 ((150.70)
2	1998-99	18564 (97.55)	12428 (153.54)
3	1999-2000	n.a	n.a
4	2000-01	n.a.	n.a
5	2001-02	18570 (97.58)	10706 (132.27)
6	2002-03	9086 (47.74)	8285 (102.35)
7	2003-04	17548 (92.21)	11448 (137.73)
8	2004-05	5447 (28.62)	3447 (42.59)
9	2005-06	4301 (22.60)	10706 (132.27)
10	2006-07	12712 (66.80)	n.a.

Source: Office of Chief Engineer, Mirzapur Canal Division, Mirzapur

Note: Figures in parentheses indicate percent utilization of irrigation potential.

Reasons for Gap between Irrigation Potential and Utilization

(a) Lack of Water in Dam

4.2.27 As mentioned earlier, the source of water to the dam is rain water. Due to lack of rainfall, the level of water in the dam fluctuates as given in Table 4.2.15. It can be seen from Table 4.2.15 that actual water availability in the dam fluctuated across the year and was only 58 percent in the year 2007. The huge gap between irrigation potential and utilization during the last 3 years since 2004-05 as given in Table 4.2.14 can be explained with lack of water in the dam since 2004 as brought in Table 4.2.15.

Table 4.2.15: Dam Water Record of during 2001 to 2007

(mcft)

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Maximum Capacity	4570	4570	4570	4570	4570	4570	4570	4570	4570	4570
Actual Capacity	3667	4408	4570	4516	2409	4426	1600	3255	2433	2631
Total Capacity in %	80%	96%	100%	98%	53%	97%	35%	71%	53%	58%
Lack of Water in %	20%	4%	-	2%	47%	3%	65%	29%	47%	42%

4.2.28 Ten years average rainfall in the project area has been reproduced in Table 4.2.16. It can be seen that average annual rainfall has been substantially less than the assumed rainfall for this project in most of the years. This has become the main reason for lack of water in the dam. The actual water capacity of dam in different years as given in Table 4.2.15 has a significant positive correlation with deviation in rainfall in different years as given in Table 4.2.16.

Table 3.5.16: Status of Rainfall in the Project Area since 1998

Assumed rainfall – 1134.1 mm

(mm)

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Actual rainfall	729	1642	938	1360	742	991	594	624	1081	660
Deviation of rainfall in %	34.5 %	More than Assumption	15.8%	More than Assumption	33.4%	11%	46.7%	44%	3%	39.7%

(b) Low Water Discharge

4.2.29 The actual per day discharge of water at the head of the canal in different months during the year 1998 to 2007 has been shown in Table 4.2.17. The data on discharge of water shows high fluctuation across the months in the year. This is precisely due to the availability of water in the dam. With an ideal discharge of 2000 feet cusec per second, the actual discharge has been quite low particularly in the months of rabi season. The problem has become acute since 2005 when in most of the months the canal could not be operated due to lack of water in the dam.

Table 4.2.17: Head Discharge Record

(Feet cusec per second)

Rabi

Year/Month	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Nov	*	1659 (82.95)	1439 (71.95)	1713 (85.65)	936 (46.80)	1650 (82.5)	*	1677 (83.85)	*	*
Dec	*	513 (25.65)	*	*	*	*	*	*	*	*
Jan	*	453 (22.65)	957 (47.85)	1216 (47.85)	1387 (69.35)	1193 (59.65)	1265 (63.25)	*	*	*
Feb	588 (29.4)	*	894 (44.70)	*	*	*	1185 (59.25)	*	*	*
March	*	*	*	*	*	*	1172 (58.60)	*	*	*

Kharif

April	*	*	*	*	*	469 (23.45)	*	*	60 (3.00)	*
May	*	*	*	744 (37.20)	589 (29.45)	*	551 (27.55)	365 (18.25)	144 (7.2)	1063 (53.15)
June	406 (20.30)	*	595 (29.75)	*	*	768 (38.40)	532 (26.60)	*	321 (16.05)	*
July	1186 (59.32)	966 (48.30)	1347 (67.35)	1024 (51.20)	*	*	*	*	*	*
Aug	1130 (56.52)	1395 (69.75)	1727 (86.35)	1564 (78.20)	*	1399 (69.95)	*	*	1578 (78.90)	*
Sep	765 (38.25)	508 (25.40)	1352 (67.60)	1627 (81.35)	*	1170 (58.50)	*	*	1652 (82.6)	*
Oct	1572 (78.60)	1061 (53.05)	1326 (66.30)	935 (46.75)	701 (35.05)	1639 (81.95)	1493 (74.65)	1680 (84.00)	1990 (99.5)	1862 (93.10)

Note: Figure in Parentheses indicate Percentage of ideal discharge per day in cusec feet/sec.

* indicate that due to non-availability of water, canal didn't operate.

4.2.30 The operational status of the canal has been presented in Table 4.2.18. The canal could not be operated in most of the days in Rabi season since the year 2001. During Kharif season, the canal was non-operational in most of the days in year 2002, 2005 and 2007.

Table 4.2.18: Status of operation of Canal

(Days)

Rabi

Year/ Month	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Nov	*	2	17	3	7	8	*	9	*	*
Dec	*	8	*	*	*	*	*	*	*	*
Jan	*	17	26	5	12	13	16	*	*	*
Feb	22	*	15	*	*	*	8	*	*	*
March	*	*	*	*	*	*	4	*	*	*

Kharif

April	*	*	*	*	*	3	*	*	1	*
May	*	*	*	5	8	*	5	10	31	6
June	12	*	3	*	*	6	10	*	19	*
July	16	11	7	16	*	*	*	*	*	*
Aug	12	18	27	31	*	15	*	*	20	*
Sep	16	30	2	16	*	24	*	*	15	*
Oct	26	31	26	25	16	31	22	29	16	20

Note: * indicate non-operation of canal

(c) Lack of Budget for Maintenance

4.2.31 The availability of funds for maintenance of the system is presented in Table 4.2.19. Main canal and its distributaries do not require major de-silting work at regular interval as the area is rocky and therefore there is no problem of silt. The budget is required mainly for maintenance of canal banks, maintenance of dam gate and recruitment of temporary field staff. It is not possible due to lack of budget for maintenance purpose. Channel section of system has been deteriorated because of non-availability of sufficient maintenance fund.

Table 4.2.19: Availability of Funds for Maintenance of the System

(Rs. Lakhs)

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Required amount as per approval norm	59.37	141.03	158.00	178.13	237.50	60.00	48.6	52.14	29.58	100.0
Sanctioned amount	57.59 (97)	47.02 (33.34)	77.46 (49.03)	35.10 (19.70)	50.57 (21.29)	52.18 (86.97)	48.6 (100)	52.14 (100)	29.18 (98.65)	26.65 (26.65)

Note: Figures in parentheses indicate percent of required amount.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.2.4).

Chart 4.2.4: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Insufficient availability of water due to lack of rainfall	1
2.	Broken minors and field channels due to lack of O&M funds	2

5. Sharda Sahayak Pariyojna

4.2.32 Sharda sahayak pariyojna has been implemented to augment and extend irrigation of lower reaches of Sharda canal system. The original Sharda Sahayak project was formed in 1976 at a cost of Rupees 99.91 crores. The main water source of system is Sharda and Ghaghara Rivers. The project envisaged diversion of supplies of river Ghaghra and Sharda by constructing barrages. Two barrages have been constructed on rivers; one is Girija barrage on Ghaghra River and second Sharda barrage on Sharda River. The system has one 258.8 Km. feeder canal with capacity of 23000 cusec discharge. Sharda sahayak system has five major branches which cover 16.55 lakh hectare culturable command area. The length of five branches and water discharge is given below in the Table 4.2.20.

Table 4.2.20: Main Branches of Sharda Sahayak and their Water Discharge

S.No.	Name of Branch	Length (Km.)	Discharge (Cusec)
1.	Dariyabad Branch	153.00	8530
2.	Barabanki Branch	30.00	1250
3.	Haidergarh Branch	30.30	5050
4.	Allahabad Branch	59.00	5264
5.	Pratapgarh Branch	16.00	1150

4.2.33 The present command area is 19.03 lakh hectares which was 19.25 lakh hectares at the time of inception. The potential command area in Kharif stands about 11.09 lakh hectares, while 7.94 lakh hectares constitutes the Rabi potential. Against this total command area, actual irrigated area is less than fifty present. Nine year actual irrigated area has been reproduced in Table 4.2.21 below which shows the dismal performance of system. The operational details in terms of number of days in a month canal was in operation has been presented in the Table 4.2.22.

Table 4.2.21: Actual Irrigated Area by Sharda Sahayak System during last nine years

Year	Actual Irrigated Area (hectare)			
	Kharif		Rabi	
1998-1999	402483	(63.70)	431797	(45.61)
1999-2000	393963	(64.47)	416578	(47.53)
2000-2001	364748	(67.11)	370860	(53.29)
2001-2002	389827	(64.84)	412967	(47.98)
2002-2003	373699	(66.30)	348139	(56.15)
2003-2004	339694	(69.36)	358784	(54.81)
2004-2005	346961	(68.71)	373507	(52.95)
2005-2006	349466	(68.48)	356036	(55.15)
2006-2007	343681	(69.00)	334401	(57.88)

Note: Figures in parentheses indicate percentage gap between irrigation potential and utilization.

Table 4.2.22: Operational Detail of Sharda Sahayak Canal

Year	Jan	Feb	March	April	May	June	July	August	Sep	Oct	Nov	Dec
1997	31	28	31	5	closed	22	31	15	30	31	30	29
1998	31	28	31	14	closed	23	31	10	25	31	12	31
1999	31	28	31	6	closed	10	31	31	30	31	30	31
2000	31	28	31	4	closed	closed	31	31	30	31	13	31
2001	31	28	30	29	20	29	29	19	30	31	7	31
2002	31	28	31	20	31	30	31	31	30	24	6	31
2003	31	28	31	10	closed	30	31	31	30	31	30	27
2004	31	29	31	30	18	30	31	31	30	27	23	31
2005	31	28	31	26	23	30	31	31	30	25	19	31
2006	31	28	31	30	19	30	31	31	30	28	30	31
2007	31	28	31	30	14	30	31	31	30	20	30	31

Reason of Gap between Irrigation Potential Created and Utilized

(a) Inconsistency of Water Discharge at Main Canal Head

4.2.34 The average monthly water discharge from the canal head has been presented in the Table 4.2.23 against 23000 cusec ideal discharge. This inconsistency in water discharge from the canal head strains farmers in their crop planning. This leads to create a gap between potential irrigation and actual utilization.

(b) Lack of Budget

4.2.35 Lack of budget provision for the maintenance of canal system is one of the prime reasons to under utilization of irrigation potential. The efficiency of system goes down due to non-maintenance. Without regular maintenance, no system can work properly. Sharda Sahayak is a huge irrigation system, and demands huge amount for maintenance. In the last few year ratio of sanctioned amount is one third of demand amount. Actual budget amount which has been issued in last eight years are given in Table 4.2.24.

Table 4.2.23: Head Water Discharge of main Canal

(in cusec)

	Jan	Feb	March	April	May	June	July	August	Sep	Oct	Nov	Dec
1997	13297	12699	11267	6760	CLOSE	12859	16370	7594	16147	16374	8300	3925
	(42.18)	*(44.78)*	*(51.01)*	*(70.6)*		*(44.08)*	*(28.82)*	*(66.98)*	*(29.79)*	*(28.8)*	*(63.91)*	*(82.93)*
1998	6603	12595	13822	13230	CLOSE	13346	18359	16811	14302	14690	7004	1533
	(71.28)	*(45.23)*	*(39.9)*	*(42.47)*		*(41.97)*	*(20.17)*	*(26.9)*	*(37.81)*	*(36.3)*	*(69.54)*	*(93.33)*
1999	10178	11158	10550	9344	CLOSE	10807	18151	16221	9787	9610	12628	10931
	(55.74)	*(51.48)*	*(54.09)*	*(59.37)*		(53.0)	*(21.07)*	*(29.47)*	*(57.41)*	*(58.29)*	*(45.05)*	*(52.47)*
2000	13772	12517	13082	11012	CLOSE	CLOSE	15620	20458	16120	16165	10492	15884
	(40.11)	*(45.57)*	*(43.12)*	*(52.11)*			*(32.08)*	*(11.05)*	*(29.91)*	*(29.71)*	*(54.38)*	*(30.93)*
2001	14330	12314	11202	1079	12353	16367	18125	17741	18995	13248	7506	14706
	(37.69)	*(46.45)*	*(51.29)*	*(53.04)*	(46.28)	(28.83)	*(21.19)*	*(22.19)*	*(17.41)*	*(42.39)*	*(67.36)*	*(36.05)*
2002	12711	9565	13969	14000	15832	18239	20520	21004	17944	1245	10095	14531
	(44.73)	*(50.41)*	*(39.26)*	*(38.75)*	*(31.16)*	*(20.69)*	*(10.77)*	*(8.67)*	*(21.97)*	*(94.58)*	*(56.1)*	*(92.91)*
2003	11031	12556	13145	12166	CLOSE	15830	19783	18830	14148	13706	6915	9607
	(52.3)	*(45.52)*	*(42.87)*	*(47.1)*		*(31.17)*	*(13.9)*	*(18.09)*	*(38.48)*	*(40.4)*	*(69.93)*	*(58.23)*
2004	11466	11598	11834	11096	9330	14877	19452	20724	21200	18682	5500	13288
	(50.14)	*(49.57)*	*(48.54)*	*(51.75)*	*(59.39)*	*(35.31)*	*(15.42)*	*(9.89)*	*(7.82)*	*(18.76)*	*(76.08)*	*(42.22)*
2005	13467	14209	15918	13603	15400	20089	21166	20842	18806	18313	3116	11097
	(41.44)	*(38.22)*	*(30.79)*	*(40.85)*	*(33.04)*	*(12.65)*	*(7.97)*	*(9.38)*	*(18.23)*	*(20.37)*	*(86.45)*	*(51.75)*
2006	12512	10947	10716	9549	9771	13434	20013	21447	22242	13686	5984	1328
	(45.59)	*(52.4)*	*(53.4)*	*(58.48)*	*(57.51)*	*(41.58)*	*(12.98)*	*(6.74)*	*(3.29)*	*(40.49)*	*(73.98)*	*(94.22)*
2007	11665	11333	9915	11502	11773	17510	20500	18657	21350	10842	5848	13269
	(49.28)	*(50.72)*	*(56.89)*	*(49.99)*	*(48.81)*	*(23.86)*	*(10.86)*	*(18.88)*	*(7.17)*	*(52.86)*	*(74.57)*	*(42.3)*

Note: Figures in parentheses indicate percentage of discharge gap

Table 4.2.24: Availability of Maintenance Budget

(Rupees in lakh)

Year	Demand	Actual Received	Lack Of Amount In Percentage
2001-2002	3899.22	1495.95	61.63
2002-2003	3899.22	1422.34	63.52
2003-2004	3899.22	1376.57	64.69
2004-2005	3899.22	1296.31	66.75
2005-2006	3899.22	1393.45	64.26
2006-2007	3899.22	1331.45	65.85
2007-2008	3899.22	1547.94	60.30

(c) Lack of Staff

4.2.36 Sharda Sahayak is a very large irrigation system. It is spread out in 16 Districts of Uttar Pradesh. This system has large infrastructure, thousand numbers of staff working in the system, but for the last few years there is no new appointment. There are many posts lying vacant in the organization. The most number of vacant seats are in lower grade staff. A high irrigation potential utilization requires supporting staffs to maintenance and other constructive development measures. The sanctioned number of post and actual working staff are presented in Table 4.2.25, which indicates the large gap in the staffing position in the system.

Table 4.2.25: Staffing Pattern at Sharda Sahayak Pariyojana

Sanction Staff	Working Staff	Sanction Staff	Working Staff	Sanction Staff	Working Staff	Sanction Staff	Working Staff
Class 1 staff		Class 2 staff		Class 3 staff		Class 4 staff	
26	31	505	442	968	855	1749	1571

(d) Distribution Constraints

4.2.37 The canals of Sharda Sahayak are sixty years old and due to insufficient maintenance canals have been damaged. Due to lack of maintenance, the canals are not able to carry full discharge of water. They are carrying with thirty percent

less water of their capacity. This percentage is increasing with the time. The other reason is that at the head reach, farmers cut the canal and take water many times. They do not allow water to go at the tail portion. This problem creates water crisis at the tail portion. The gulls (outlets) of canal are almost not in working position.

(e) Non regular de-silting Operation of the Canals

4.2.38 In Sharda Sahayak system, siltage is a major problem. Due to insufficient budgetary provision for the maintenance of the project system, an irregular de-silting operation of the canals systems are carried out. This is an important reason for not sufficient water flow in the canal system. This leads to improper water distribution and under utilization of irrigation potential.

(f) Conversion of Agriculture Land in non-agricultural Land

4.2.39 Due to rapid growth of population, agriculture lands are converting in non agriculture areas. Urbanization and industrialization are capturing the agricultural land. That's why the command area has been reduced. According to irrigation officials, approximately ten percent of total command area has been converted in to non agriculture area.

(g) Change in Cropping Pattern

4.2.40 The cropping pattern has been changed. Now almost all the farmers are using hybrid seeds and chemical fertilizer for high production. These changes demand more irrigation water compared to assumptions made at the time of calculation of irrigation potential. So, this is another reason of gap between irrigation potential and utilization.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.2.5).

Chart 4.2.5: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Low water carrying capacity of distribution channels due to silting	1
2.	Broken field channels	4
3.	Absence of field channels	3
4.	Diversion of cultivable land to other purposes within command area	2
5.	Change in cropping pattern	5

6. Chaudhry Charan Singh Gola Pump Canal System

4.2.41 The Chaudhry Charan Singh Gola Pump Canal System is located on the left bank of River Ghghra about 7 km. upstream, of Gola Bazaar near village Baranagar in tehasil basgaon, District Gorkhpur. This project was proposed to have distribution channels of 1100 km kachhi and 173km pakki, but presently it has only 620 km kachhi and 65 km packki channels, respectively. This project essentially fulfills the irrigation demand of the catchments areas. Because of the irrigation project, the draught prone region has been transformed into foodgrain surplus region. The project has the great impact for the food security and development of the area. Initially, the project had Gross Command Area of 21060 ha, while at present, the project command area has declined to3587 hectare (Table 4.2.26). At present only 1609 hectare area is irrigated by the project in Kharif season, while the corresponding figure for Rabi season is 1723 hectares (Table 4.2.27)

Table 4.2.26: Change in Command Area of Gola Pump Canal

Season	Incepted Command Area (ha)	Present command Area (ha)
Kharif	13860	1864
Rabi	7200	1723
Total	**21060**	**3587**

Table 4.2.27: Actual Irrigated Area by Gola Pump Canal System

Year	Actual Irrigated Area (hectare)	
	Kharif	Rabi
2000-01	202	536
2001-02	476	598
2002-03	937	1100
2003-04	790	1296
2004-05	2016	1549
2005-06	1546	1690
2006-07	1964	1723
2007-08	1609	-

Reasons for Gap between Irrigation Potential and Utilization

(a) Lack of Staff

4.2.42 The project is suffering with the lack of technical and other supportive staffs. Table 4.2.28 clearly depicts that there are only 5 current working positions against proposed size of 40 staffs.

Table 4.2.28: Status of Sanctioned and Working Staff at Gola Pump Canal

Post	Proposed	Working	Vacant
Head Clerk	01	Nil	01
Clerk	08	Nil	08
Beldar	14	01	13
Gatekeeper	09	04	05
Computer Operator	05	Nil	05
Tar Babu	03	Nil	03
Total	**40**	**5**	**35**

(b) Lack of pump efficiency

4.2.43 Due to lack of proper maintenance and proposed extension, the potential efficiency of the existing pumps has not been utilized. The project has a total 5 pumps with 60 cusec discharge water capacity, while at present only two pumps are in working process.

(c) Lack of Budget

4.2.44 The efficiency of the project is declining over the time down due to lack of maintenance budget. It is biggest constraints to the project to take advantage of potential irrigation utilization. Table 4.2.29 presents the meager sanctioned amounts against the proposed budget of 40 lacks for a year.

Table 4.2.29: Proposed and Sanctioned Budget for Gola Pump Canal

Year	Proposed Amount (Lack)	Sanctioned Amount (Lack)
2004-05	40	4.6
2005-06	40	3.91
2007-08	40	4.37

Section 3: Analysis of Sample Irrigation Projects – Uttarakhand

1. Gwalakot Hydrum Scheme

4.3.1 Gwalakot Hydrum scheme was started in the year 1958-59. It is a medium sized irrigation scheme in district Almora of Uttarakhand. The source of water for this scheme is Kosi River, which is the main river in this area for irrigation as well drinking water. This is one of the oldest schemes of Hawalbagh block of district

Almora of Uttarakhand. This scheme covers only 02 villages named as Tilara and Jyula. Jyula is the tail village of the scheme while Tilara is the head village. Out of 11 hectares of Culturable Command Area (CCA), 90 % was kept as Proposed Potential Area (PPA) in Kharif and Rabi Season. Thus, it was proposed that the scheme will irrigate a total of 10 hectares of land in Kharif and Rabi Seasons, respectively. Total length of the main canal is 1.575 kms. Total discharge capacity of the scheme was 2.67 cusec with 04 pumps installed at the time of inception of the scheme.

4.3.2 The actual irrigated area from the scheme during last 10 years separately in Kharif and Rabi seasons has been presented in the Table 4.3.1. The figures of last 05 years in the Table 4.3.1 show great decrease in the actual irrigated area especially during Kharif season. In Kharif season on an average only 40% of the potential has been utilized in the years 2003-04, 2004-05, 2005-06 and 2006-07, which has further decreased to 0% in the year 2007-08. This is due to damage of the scheme during the expansion of road by Public Works Department (PWD), Uttarakhand. Later the scheme was revamped by the PWD officials costing about Rs. 31000.00. In the Rabi season, total potential utilized was 70% during last 06 years. Figures in the Table 4.3.1 show that in the year 1999-2000, the total potential utilized was decreased to just 10% in Rabi season.

Table 4.3.1: Actual Irrigated Area by Gwalakot Hydrum Scheme During 1998-2008

Year	Actual Irrigated Area (Hectares)	
	Kharif Season	Rabi Season
1998-99	7.00 (70%)	8.00 (80%)
1999-00	1.00 (10%)	5.00 (50%)
2000-01	6.00 (60%)	5.00 (50%)
2001-02	3.00 (30%)	5.00 (50%)
2002-03	8.00 (80%)	7.00 (70%)
2003-04	4.00 (40%)	7.00 (70%)
2004-05	4.00 (40%)	7.00 (70%)
2005-06	4.00 (40%)	7.00 (70%)
2006-07	4.00 (40%)	7.00 (70%)
2007-08	0.00 (0%)	7.00 (70%)

Source: Office of Executive Engineer, Kumaun Irrigation Division, Almora

Note: Figures in parentheses indicates percent utilization of irrigation potential

Reasons for Gap between Irrigation Potential and Utilization

4.3.3 A detailed discussion with officials of the scheme has revealed the following key reasons for poor performance of the project:

(a) Decreased Efficiency of the Pumps

4.3.4 The scheme has 04 pumps in all. All these were imported at the time of Britishers' from M/S Richardson Pvt Ltd., USA. These pumps were made by a John Black Private Limited, Lancashire. Both these companies are not in existence right now, therefore spare parts of the pump are not available in the market. Out of these 04 pumps only 02 pumps are working at present, rest of the pumps have gone off due to lack of spares. Efficiency of the working pumps has gone down significantly to less than 50%. The pumps are more than 60 years old, while the economic life of any pump is not more than 20 years.

(b) Damaged Pipe Line

4.3.5 This scheme has a total of 04 pipes each measuring 13.40 meters in length and 8" in diameter, while 472.50 meters of 6" diameter. These pipes are not replaced till the inception of the scheme i.e. these pipes are more than 60 years old and are not able to bear the pressure of water anymore. There are a number of holes in these pipes due to rusting and other damage by the cattle and human being. Damaged pipeline is another reason for poor performance of the scheme.

(c) Practice of Leaving Land Fallow by the Farmers

4.3.6 As per discussions with the concerned officers of the scheme, farmers of the area under this scheme follow a practice of leaving their land fallow for one season especially after harvesting of Paddy crop. This practice results in decrease in potential utilized of the scheme in Rabi season.

(d) Road Expansion Work

4.3.7 Road expansion work is being carried out by Public Works Department of Uttarakhand since last 01 year. The scheme is situated besides road, therefore lots of soil and stones every month cover the major part of pipe line of the scheme. After removing this garbage, the scheme starts working, resulting in low utilization of irrigation potential by the farmers as they do not get water when it is required by the crops.

(e) Decreasing Water Level of Source

4.3.8 Source of this scheme is Kosi River. Every year there is a decrease in water level of the river due to low rain fall in the area. Decreasing water level in this river results in poor performance of the scheme.

(f) Seepage in the Main Canal

4.3.9 Main channel of the scheme is not repaired since 1999. There is lots of seepage in this main channel of the scheme. About 200 meters of the channel has almost demolished by the villagers.

(g) Lack of Field Gools (Outlets)

4.3.10 This scheme has no field gools. When a farmer wants to irrigate his/her fields, water does not reach to tail of his/her fields. As per discussions with the officials of the project, it is found that about 2-3% of the potential is not utilized due to this particular reason.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.3.1).

Chart 4.3.1: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Decreased efficiency of pumps	1
2.	Broken water outlets	3
3.	Absence of field channels	4
4.	Practice of leaving land fallow by the farmers	2
5.	Insufficient availability of water due to decreasing water level	5

Suggestions

4.3.11 To achieve the full discharge capacity of the scheme i.e. 2.67 cusec and to utilize the 100% potential of the scheme, following measures are suggested:

- All the 04 pumps are to be replaced. Estimated cost of one pump is Rs.300000.00 i.e. a total of Rs. 12 lacs are needed for replacing these pumps.
- Replacement of old pipe line is required for using the full potential of discharged water. As per officials of the scheme a pipe 06" diameter costs about Rs. 1000/meter while 8" costs Rs. 1500/meter i.e. a total of Rs. 80400.00 for 8" pipes and Rs. 472500.00 for 6" pipes is required for the replacement of all these pipes.
- Field gools are to be constructed for full utilization of discharge capacity of the scheme.

- Open pipeline should be covered with bricks so that garbage and other external factor could not damage the pipeline.
- About 200 meters of the main canal is damaged, which is to be repaired for getting the water to be reached up to the tail of the scheme.

2. Rudrapur Canal Scheme

4.3.12 Rudrapur Canal was constructed in the year 1953-54. This scheme covers only 02 villages of Rudrapur block of district Udham Singh Nagar in Uttarakhand. Villages covered under the scheme are Fulsunga and Rudrapur. Originating from Baigul River, this canal covers a total length of 4.200 kms. This scheme was designed to cover a Culturable Command Area (CCA) of 248 hectares. Out of 248 hectares of CCA, about 69 % (171 hectares) was kept as Proposed Potential Area (PPA) in Kharif season while about 31% (77 hectares) in Rabi season. Presently the CCA of the scheme is 259 hectares. 06 hectares of land is increased in Kharif season and 05 hectares in Rabi season i.e. 177 and 82 hectares in Kharif and Rabi seasons, respectively. The total discharge capacity of the scheme was kept as 7.35 cusec.

4.3.13 The actual irrigated area from the scheme during last 09 years separately in Kharif and Rabi seasons is given in the Table 4.3.2 below. The figures in this table show that the performance of this scheme is more than 100% of PPA every year except Kharif season of 2001-02. In Rabi season it is more than 300%. Maximum performance of the scheme is recorded in the Rabi season of the year 2000-01, in this season the scheme reached about 480% of the PPA.

Table 4.3.2: Actual Irrigated Area by Rudrapur Canal Scheme during 1999-2008

Year	Actual Irrigated Area (Hectares)	
	Kharif Season	Rabi Season
1999-00	225.00 (127.11%)	329.00 (401.21%)
2000-01	195.00 (110.16%)	393.00 (479.26%)
2001-02	176.00 (99.43%)	305.00 (371.95%)
2002-03	196.00 (110.73%)	298.00 (363.41%)
2003-04	197.00 (111.29%)	302.00 (368.29%)
2004-05	194.00 (109.60%)	302.00 (368.29%)
2005-06	229.00 (129.37%)	314.00 (382.92%)
2006-07	232.00 (131.07%)	296.00 (360.97%)
2007-08	223.00 (125.98%)	--

Source: Office of Assistant Engineer, Kumaun Irrigation Division, Udam Singh Nagar

Note: Figures in parentheses indicates percent utilization of irrigation potential

Reasons for utilizing more than 100% Potential of the Scheme

4.3.14 A detailed discussion with officials of the scheme has revealed the following key reasons for good performance of the project:

(a) Crop Rotation

4.3.15 In Tarai region main crops taken by the farmer are Paddy and Wheat. During Kharif season, Paddy crop is taken by the farmers, which requires more water as compared to other crops. Sometimes farmers take 02 crops of short duration paddy in a season. During Rabi season, Sugarcane and Wheat are the main crops which are to be irrigated by the farmers. Irrigation potential utilized in Rabi season is more than Kharif season due to rainfall during Kharif season.

(b) Development of Barren Land

4.3.16 At the time of inception of the scheme, most of the land in nearby areas of the canal was barren, which is now developed by the farmers for cultivation. This is the main reason for good performance of the scheme. No data of developed land is available with the concerned authorities of the department regarding developed land after the inception of the scheme.

(c) Use of Pump Sets for Water Lifting

4.3.17 Farmers use pumps sets for lifting water from the source to increase the discharge into the canal. Most of the farmers of the area practice this technique of water lifting during Rabi season especially. As per discussions with the officials of the scheme, revenue charged from those farmers who use water lifting technique is half from the other farmers who use direct water from the canal.

(d) Maintenance of the Canal

4.3.18 Canal was restructured by the concerned authorities of the department for good performance of the canal.

3. Supakot Canal Scheme

4.3.19 Supakot canal was constructed in the year 1983-84. It is one of the major schemes of district Almora. This scheme covers 12 villages of Takula block of district Almora in Uttarakhand. Villages covered under the scheme are as follows:

1. Jhaloli
2. Surmafi
3. Bhanarat
4. Raturat
5. Arjunrat
6. Papaira
7. Tana
8. Lachhampur

9. Supakot
10. Kharikhet
11. Talla Bagania
12. Sajoli

4.3.20 Originating from River Kosi, total length of the canal is 7.145 kms. This scheme was designed to cover a Culturable Command Area (CCA) of 121 hectares. Out of 121 hectares of CCA, 70 % was kept as Proposed Potential Area (PPA) in Rabi and Kharif seasons, respectively. The total discharge capacity of the scheme was kept as 5.25 cusec which is now reduced to 2.5 cusec as recorded on 12.03.08. The actual irrigated area from the scheme during last 10 years separately in Kharif and Rabi seasons is given in the Table 4.2.3 below. The figures in this table show that this scheme had never reached near to its PPA. In the year 1998-99, the actual irrigated area reduced to 26 hectares in Kharif season and 21 hectares in Rabi season i.e. only 31% and 25% of PPA in Kharif and Rabi seasons, respectively. During the year 1999-2000, it was 7.14% and 1.1% in Kharif and Rabi seasons, respectively due to renovation of the canal. In the year 2000-01 actual irrigation in Rabi season reduced to 21.4%, which shows very poor performance of the scheme. If we look at the figures of last 05 years, performance of the scheme if very poor in Kharif season as compared to Rabi season.

Table 4.2.3: Actual Irrigated Area by Supakot Canal Scheme during 1998-2008

Year	Actual Irrigated Area (Hectares)	
	Kharif Season	Rabi Season
1998-99	26.00 (31%)	21.00 (25%)
1999-00	6.00 (7.14%)	1.00 (1.1%)
2000-01	26.00 (31%)	18.00 (21.42%)
2001-02	28.00 (33.3%)	62.00 (73.8%)
2002-03	50.00 (59.5%)	56.00 (66.6%)
2003-04	41.00 (48.8%)	51.00 (60.7%)
2004-05	41.00 (48.8%)	52.00 (61.9%)
2005-06	41.00 (48.8%)	53.00 (63%)
2006-07	42.00 (50%)	53.00 (63%)
2007-08	47.00 (55.9%)	57.00 (67.8%)

Source: Office of Executive Engineer, Kumaun Irrigation Division, Almora

Note: Figures in parentheses indicates percent utilization of irrigation potential

4.3.21 Tana and Sajoli are tail villages of the scheme where irrigation potential has not been utilized since inception of the scheme. Total command area which is

not utilized yet is 4.36 acres and 2.5 acres in Tana and Sajoli villages respectively. As per the officials of the scheme, both these villages are situated on higher altitude as compares to other villages of the scheme.

Reasons for Gap between Irrigation Potential and Utilization

4.3.22 A detailed discussion with officials of the scheme has revealed the following key reasons for poor performance of the project:

(a) Decreasing Water Level in Source River

4.3.23 This is one of the major reasons for poor discharge in the canal. As measured on 12.03.08 discharge of the river at the head of the canal was meager 23 cusec, which is too low to reach to the head of the canal. This water discharge of the river should be at least 50 cusec for achieving the canal its full capacity.

(b) Construction of other Schemes in Nearby Areas

4.3.24 Construction of too many lift schemes (no data available regarding number of schemes) for drinking water on Kosi River is another reason for decreasing discharge capacity of the canal.

(c) Removal of Stones from the River

4.3.25 Removal of stones by the nearby villagers from the river at the head of the canal decreases level of water. This results in lower pressure of water at the head of the scheme.

(d) Lack of Maintenance

4.3.26 The canal was renovated in the year 1999-2000, till then no other work has been done by the department. This resulted into seepage of water from the main canal.

(e) Construction of Houses

4.3.27 Villagers have constructed houses in the potential irrigated areas of the scheme. This resulted in decreased actual irrigates area.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.3.3).

Chart 4.3.3: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Lack of maintenance	2
2.	Diversion of cultivable land for other purposes	3
3.	Insufficient availability of water due to decreasing water level	1

Suggestions

4.3.28 To utilize full fledged potential of the scheme following measures are suggested:

- Renovation of the canal is necessary after every 5 years so that flow of water can be maintained up to the tail of the canal.
- Removal of stones from the river at the head of the canal should be stopped up with the help of Gram Pradhans and Patwari of the concerned area.
- A small dam wall should be constructed in the river near the head of the canal to increase the water level in the river.
- Construction of distributaries is necessary for last 500 meters of the canal so that water can reach to the utmost farmers of the canal.

4. Lower Bhakhra Canal Scheme

4.3.29 Lower Bhakhra Canal was constructed in the year 1953-54. It is one of the major irrigation schemes of district Udham Singh Nagar. This scheme covers 11 villages of Gadarpur block of district Udham Singh Nagar in Uttarakhand. Villages covered under the scheme are as follows:

1. Dhanpur
2. Vijaypur
3. Narayanpur
4. Bari Rai
5. Pipaliya
6. Mahtosh
7. Alakhdeva
8. Alakhdevi
9. Ratanpura
10. Ratanpuri
11. Lambakhera

4.3.30 Haripura Sluice of Haripura Dam is the source of water for this canal. Total length of the canal is 12.200 kms. This scheme was designed to cover a Culturable Command Area (CCA) of 1619 hectares. Out of 1619 hectares of CCA, 70 % was kept as Proposed Potential Area (PPA) in Kharif season while 30% in Rabi season. The CCA of the scheme is now increased to 1620 hectares. Maximum area irrigated by the scheme in a season is 1643 hectares, which is 24 hectares more than the CCA. The total discharge capacity of the scheme was kept as 101.00 cusec. The actual irrigated area from the scheme during last 09 years separately in Kharif and Rabi seasons is given in the Table 4.3.4 below. Data for Rabi season of 2007-08 is not recorded yet. The figures in this table show that this scheme is showing more than 100% utilization of PPA in the last 09 years. The maximum performance of the scheme recorded in the Rabi season of 2000-01, which was about 338% of the PPA i.e. 1643 hectares land was irrigated in this season.

Table 4.3.4: Actual Irrigated Area by Lower Bhakhra Canal Scheme during 1999-2008

Year	Actual Irrigated Area (Hectares)	
	Kharif Season	Rabi Season
1999-00	1395.00 (123.15%)	1631.00 (335.59%)
2000-01	1447.00 (127.71%)	1643.00 (338.06%)
2001-02	1398.00 (123.38%)	1446.00 (297.53%)
2002-03	1424.00 (125.68%)	1296.00 (266.6%)
2003-04	1397.00 (123.30%)	1289.00 (265.22%)
2004-05	1408.00 (124.27%)	1146.00 (235.80%)
2005-06	1290.00 (113.85%)	1054.00 (216.87%)
2006-07	1285.00 (113.31%)	1084.00 (223.04%)
2007-08	1283.00 (113.13%)	--

Source: Office of Assistant Engineer, Kumaun Irrigation Division, Udam Singh Nagar
Note: Figures in parentheses indicates percent utilization of irrigation potential

Reasons for utilizing more than 100% Potential of the Scheme

4.3.31 A detailed discussion with officials of the scheme has revealed the following key reasons for good performance of the project:

(a) Use of Lift Pumps by the Farmers

4.3.32 If water level decreases in the source, farmers use pump sets for lifting water. This results in good performance of the scheme during shortage of water

in Haripura Sluice. In the Kharif season of 2007-08, total potential utilized was 1283 hectares, out of which 46 hectares was utilized by water lifting technique and rest 1237 by direct flooding from the canal.

(b) Crop Rotation

4.3.33 Farmers in the area of the canal harvest 02 crops of Paddy in a season from the same field i.e. cropped area is double than the actual cultivable area. This results in increasing the performance of the scheme.

5. Bullawala Canal Scheme

4.3.34 Bullawala Canal was constructed in the year 1972. This scheme covers 04 villages of Doiwala block of district Dehradun in Uttarakhand. Villages covered under the scheme are as follows:

1. Bullawala
2. Kurkawala
3. Jhabrawala
4. Teliwala

4.3.35 Bullawala is the head village while Jhabrawala is the tail village of the scheme. Right bank of Susua River is the source of this canal. Total length of the canal is 9.65 kms. This scheme was designed to cover a Culturable Command Area (CCA) of 401 hectares. Out of 401 hectares of CCA, 291 hectares was kept as Proposed Potential Area (PPA) in Kharif season and same in the Rabi season. Maximum area irrigated by the scheme in a season is 622 hectares, which is more than double of the CCA. Presently the scheme is irrigating 605 hectares of area in Kharif season and 406 hectares in Rabi season. Designed discharge of the scheme was kept as 25 cusec. First 4.5 kms of the scheme falls under Rajaji National Park and this zone is a silted zone. First distributary of the canal starts after 4.0 kms. Total discharge of this canal was 17.85 cusec in the month of May, 2008.

4.3.36 The actual irrigated area from the scheme during last 07 years separately in Kharif and Rabi seasons is given in the Table 4.3.5 below. Data for Kharif and Rabi season of 2007-08 is not compiled yet. The figures in this table show that this scheme is showing more than 100% utilization of PPA in the last 07 years except Kharif season of 2001-02. The maximum performance of the scheme recorded in the Kharif season of 2002-03, which was about 214% of the PPA i.e. 622 hectares land was irrigated in this season.

Table 4.3.5: Actual Irrigated Area by Bullawala Canal Scheme during 2000-2007

Year	Actual Irrigated Area (Hectares)	
	Kharif Season	Rabi Season
2000-01	495.00 (170.10%)	504.00 (173.19%)
2001-02	231.00 (79.38%)	327.00 (112.37%)
2002-03	622.00 (213.75%)	344.00 (118.21%)
2003-04	607.00 (208.59%)	367.00 (126.11%)
2004-05	599.00 (205.84%)	389.00 (133.67%)
2005-06	600.00 (206.18%)	408.00 (140.20%)
2006-07	602.00 (206.87%)	402.00 (138.14%)

Source: Office of Superintending Engineer, Irrigation Division, Dehradun
Note: Figures in parentheses indicates percent utilization of irrigation potential

Reasons for Utilizing more than 100% Potential of the Scheme

4.3.37 A detailed discussion with officials of the scheme has revealed the following key reasons for good performance of the project:

(a) Renovation of the Canal

First 4.5 kms of this canal falls under Rajaji National Park and this zone is a silted zone. Due to this silted zone there was damage of the canal due to forest wastes and soil during monsoon season. This canal was renovated in the year 2003-04 and raised along these 4.5 kms of Rajaji National Park. After this work, performance of the canal has increased.

(b) Crop Rotation

4.3.38 Farmers in the area of the canal harvest sugarcane, paddy, wheat, berseem, jowar and vegetable. All these crops are water intensive crops and farmers are very hard worker. Farmers of this reason are well aware of the use of water and used to do maintenance of the canal for timely irrigation of their fields.

Section 4: Analysis of Sample Irrigation Projects – M.P.

1. Chambal Canal System

Reasons for Gap between Potential and Actual Irrigated Area

(a) Less Release of Water from Rajasthan

4.4.1 The Chambal canal system is a joint venture between the states of Madhya Pradesh and Rajasthan, on the condition that both the states would bear equal expenditure as well as benefits. The project was started in 1954 and was completed in 1975. The project has three dams and one barrage. The Gandhisagar dam is located in Madhya Pradesh, while the Rana Pratap sagar dam, the Jawahar sagar dam and the Kota barrage are located in Rajasthan. Every year between 9000 to 11,500 cusecs of water is released from the Gandhi sagar dam for generation of electricity. After generation of electricity, this water goes to the Maharana Pratap sagar, the Jawahar sagar and the Kota barrage located in Rajasthan. Even if 5 percent water loss due to evaporation and seepage in transition is taken into account, this would still leave 3900 cusec water available to Rajasthan and Madhya Pradesh each, as per the original agreement.

4.4.2 However, the Kota barrage (Rajasthan) does not release 3900 cusec water to Madhya Pradesh. To this day, the average release of water has been between 2000 to 2200 cusecs, which is much lower than the agreed quantity and this affects Madhya Pradesh's achievement adversely, while Rajasthan always over achieves its target of potential irrigation. This shows that Rajasthan takes away major share of water from the Chambal project and does not give Madhya Pradesh, its share.

(b) Lack of Maintenance of Main Canal in Rajasthan

4.4.3 The right main canal, through which Madhya Pradesh receives water, travels 124 kms in Rajasthan before entering Madhya Pradesh at the Partbati River. The Rajasthan Government is responsible for the maintenance of this portion of the canal. However, the canal is not maintained as per the norms. The canal is broken at various places and a lot of weeds grow in the canal area. The Rajasthan Government does not permit the Madhya Pradesh irrigation department to maintain this part of the canal.

(c) Water used for Industrial Purposes in Rajasthan

4.4.4 After completion of the Chambal canal system, large scale industrialization took place in the Kota and Bundi districts of Rajasthan. In fact, the major source of water for these industries was the Chambal canal system. So, while, the Chambal canal system was constructed for providing water for irrigation in the dry areas of Rajasthan and Madhya Pradesh, the Rajasthan Government used this water for industrial purpose, resulting in a drop in the quantity of available water for irrigation in Madhya Pradesh.

(d) Non Construction of one Canal as per Design

4.4.5 Initially, the potential irrigated area (designed project area) was 2,83,500 hectares, but later it was curtailed by 10,200 hectares, due to non construction of TRD (Tail Right Distributory).

(e) Unaccounted Area

4.4.6 Along on both sides of each canal, about 2 to 8 meters area -depending on water discharge and width of the canal- is left empty for maintenance. The farmers whose land fell under this area got compensation. Yet, these farmers continued to cultivate and irrigate this area. However, this area does not get represented in the official records, under the total area irrigated by the canal. In the non-command area, from where canal flows, the water from canal is lifted through water lifting pumps for irrigation purpose. This area does not get counted under irrigated area through canal.

(f) Water Lifting by Farmers of Non-command Area

4.4.7 In the main canal system, owing to a slope pattern, irrigation distribution channels are constructed on one side (usually on the right bank), while on the other side of the canal which falls in the non-command area, distribution channels are not constructed. Since water flows closer to their fields, farmers cannot resist the temptation of irrigating their fields, by directly lifting the water from the canal. In order to do this, farmers cut the canal bank to fix the lifting pump and insert a pipe to transport the water to their field. However, after transporting the water, they do not repair that portion of the canal and that portion of the canal remains damaged. This happens on several places, on other side of the canal. This causes severe damage to the canal, and in turn results in loss of water through seepage. Thus, lifting of water by the farmers from the non command area and the damaging the canal are the main causes for shortage of water in the areas at the tail end of the command area.

(g) Kutcha (un-lined) Canals

4.4.8 Majority of canals are kutcha (unlined) and do not have appropriate slope/gradient. This causes loss of water on the way, through seepage and a shortage of water in the areas at the tail end of the command area. Due to the improper gradient, the rate of siltation in the kutcha canals is high, which reduces the water holding capacity of the canal and ultimately results in a low supply of water for irrigation. Unlined canals also cause low velocity of water, which in turn create a water logging problem in the upstream reaches of the canal and a shortage of water in the areas at the tail end of the command area. Wherever, lining work is undertaken, the performance has improved significantly.

(h) Substandard Lining Work

4.4.9 The majority of canals where lining work was done were not up to the mark. The material used was of low grade quality and the construction was not technically sound. This resulted in rapid deterioration of the canal and ultimately heavy water losses on the way. Because of the frequent damage in the main canal, priority for repair was given to the main canal and budget for repair and lining of minor canals was diverted, as a result the minor canals never got upgraded.

(i) Change in Cropping Pattern

4.4.10 In the project design, the irrigation potential was calculated on the basis of depth and the number of watering for the cropping pattern of the area existing at the time of design of the project. However, over a period of time, the cropping pattern of the area changed from low water requiring crops to high water requiring crops. The farmers at head reach had changed the cropping pattern from wheat, jowar, bajara, and maize to sugarcane and paddy which need more water. Moreover, farmers began using HYV seeds. The use of HYV seeds leads to the use of high doses of chemical fertilizers and also a greater consumption of water. HYV seeds need much more water than traditional seeds. Almost all farmers of head reach use HYV seeds and high doses of chemical fertilizer. Since these farmers use more water than allocated for them in the original design, those in the area at the tail end do not get enough water. Since the tail end area does not get irrigated by the canal system, it results in lesser irrigation in the command area and in turn low performance.

(j) Uncertainty of Water Release in the Canal

4.4.11 As a result of irregular water supply in the canal, farmers of head reach tend to over irrigate their fields, neglecting to take precautionary measures of releasing water following watering in their area. As a result, there is often a shortage of water for those in tail end area. So, on the one hand the use of access water cause the problem of water logging at many head reaches of the canal, on the other hand, the tail end areas do not get water for irrigation.

4.4.12 Water is released at any odd time, even between 12 midnight and 2 a.m. during the Rabi season in winter. During this period, farmers open the field channel to irrigate their field, but neglect to close it at night.

4.4.13 Taking advantage of the uncertainty over water, elite and powerful farmers channel the water into the fields of their relatives. In being able to do so, they are able to collect a higher depth of water than required by a particular crop. For example, if a wheat crop requires 2 inches of water, these farmers are able to get 4 inches water.

(k) Lack of Awareness among Farmers

4.4.14 Due to lack of awareness, farmers leave the channel open in their fields and do not bother to close it, even after irrigating their fields. This results in water logging in their fields. The excess water is then released into a near by stream, which is used by the farmers of non command area, while the farmers in the tail areas do not get water.

(l) Low Provision of Funds for Maintenance

4.4.15 Rs.20 per hectare for the main dam and Rs 60 per hectare for distributaries have been provided as funds for the maintenance. According to the officials of irrigation department, the maintenance fund amount for distributaries is not adequate and should be minimum Rs. 250. Due to a steep rise in the price of construction material and labour charges managing the repair and maintenance within the allocated budget proved difficult. Due to this, repair of the canals was not done regularly.

(m) Political Interference

4.4.16 Political interference is one of the major reasons for the low performance of canal irrigation system. When ever farmers were caught on the spot for illegally lifting water from the canal, officials of the irrigation department invariably fined them and lodge an (FIR) complaint against them in the police station. However, within few hours after lodging complaint, a local politician (MLA or MP) invariably asked the police to withdraw their FIR. If the police refused, objecting that it was an offence to lift/steal water from canal, they would invariably get transferred from that area. As a consequence, field level officials of the irrigation department face a lot of difficulty lodging complaints in the police station.

(n) Injudicious Use of Water

4.4.17 Farmers tend not to make judicious use of water. When water is available in the canal it is invariably completely used without consideration for downstream (tail end) farmers. Farmers rarely, if ever, construct systematic channels for equal distribution of water in their fields, which hold the potential of irrigating more area with less water. Absence of channels in the field leads to flood irrigation and excess use of water. It would seem that the agriculture department does not make the command area farmers aware of the value and the methods of the judicious use of water. When water is available, head reach farmers tend to grow high water requiring crops and use a larger share of water than allocated to them. Farmers are also not made aware of the benefits of adopting appropriate crop rotation and balance cropping pattern. Farmers grow sugarcane in the large areas and ignore other crops. Even for the sugarcane crop, which requires 8 to 10 watering cycles of depth of 6 inches, farmers give 12 to 16

watering cycles of 7 to 8 inches. Farmers seem either unaware or ignore the fact that lesser irrigation levels also give them the same amount of production.

(o) Safety of Irrigation Field level Officials

4.4.18 Dams and main canal systems are located in remote areas, where safety of irrigation officials demands active support of police. For instance, the Harsi and Chambal dams and canal systems are located in the Bundekhand region of Madhya Pradesh, which are dacoit prone. In these regions, there have been reported cases of dacoits kidnapping irrigation officials and demanding huge ransoms in exchange of their release. For these reasons, field staffs find it difficult to go for supervision of canals during night time and this result in stealing and lifting water from the canal and difficulty in repairing canals in time, in case of breach.

(p) Lack of Field Staff

4.4.19 There is not enough field staff for supervision of the operation of canal. Therefore, head reach farmers take/lift water as they feel fit without any external control. Currently, in these regions, many staff personnel of the irrigation department have retired while new staff has not yet been appointed.

(q) Responsibility of Collection of Water Charges

4.4.20 In Madhya Pradesh, collection of water charges in the command area is the responsibility of irrigation department, while in other states like Uttar Pradesh and Punjab, the revenue department is responsible for this task. The officials of irrigation department face a lot of difficulty collecting water charges because they do not have any command or control over farmers. For instance, if farmers refuse to make payment, irrigation officials are not empowered to take any action against them. In the case of revenue department, on the other hand, if farmers do not pay water charges, officials can take action against them, because they handle farmers land records and charge taxes. Therefore, the task of collection of water charges can be done more efficiently by the revenue department, rather than the irrigation department. The task of collection of water charges distracts the officials of irrigation department from their primary responsibilities of increasing efficiency of canal and ensuring equal distribution of water through regular repair and maintain of canal systems.

(r) Lack of Coordination between the Irrigation and other Relevant Departments

4.4.21 There is a lack proper coordination between irrigation and agriculture Department. Formally, at the beginning of each season, a between two departments is held during which the irrigation department informs the agriculture Department about availability of water for that season and asks the agriculture department to ensure that farmers use balance cropping pattern, as

per the availability of water. But in practice, farmers sow crops as per their wish and the agriculture Department does not take any action to remedy this. Considering the growing problem of over use of chemical fertilizer and the consequent need for more water, the agriculture Department needs to encourage farmers of command areas to make more use of organic manure and reduce their use of chemical fertilizer. But this is not happening. On the contrary, the agriculture department is promoting more HYV seeds and use of chemical fertilizer.

4.4.22 The irrigation Department does not educate farmers in the command areas growing high water consuming crops on how to introduce high value but low water consuming crops. In the areas where water logging takes place due to over irrigation, the agriculture department does not introduce balanced cropping pattern and crop rotation.

4.4.23 Subsequent to the introduction of irrigation canal system, land development activities were not carried out extensively in the command areas, by the land development department. It is vital to carry out land leveling activities, in order to make proper use of water, through equal distribution in all the areas.

4.4.24 Once, during the construction of roads by the PWD of the Panchayat, the canal was damaged, but the irrigation Department was not informed. It is important to take up the construction of canal side roads in the summer and the damage should be repaired by the irrigation Department.

(s) Politics in WUA

4.4.25 The concept of Water Users' Association (WUA) is very good provided it works as per the pre-determined norms. In the Chambal and Harsi areas, most of the WUAs have been taken over by elite influential communities, who do not allow any representation of underprivileged communities. In the name of people's participation, they divert water in their fields and take away a major share of the canal water. They also control finance and do not provide enough financial support for maintenance of canals. Even though they do not possess basic technical financial knowledge, they have still been given financial powers which leads to many erroneous decisions. The main objective of the WUA is to manage the canal system by timely repair and maintenance and to ensure equal distribution of water, from the head reach till the tail end of the canal. However, in practice, most WUA members use WUA to promote their own ends, such as contesting election of MLA and MP. Since they usually belong to the elite class and have an assured supply of canal water, they rarely show any interest in management of canal system. If officials of irrigation department make efforts to regularize the water distribution, these very same people object to it and do not let them take any action. It maybe concluded that the socio-cultural environment in these areas does not favor participatory approach. Until the elite amongst the community are sensitized towards the up-liftment of the underprivileged, such social inequity is likely to persist.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.4.1).

Chart 4.4.1: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Insufficient availability of water	1
2.	Non-completion of construction of field channels as per design	2
3.	Non-reporting of irrigated area by farmers/Irrigation Dept.	7
4.	Earthen distribution and field channels	3
5.	Change in cropping pattern	8
6.	Over utilization of irrigation water by farmers	4
7.	Lack of awareness among farmers about use of water	5
8.	Non-maintenance of canals	6

Suggestions

1. The Madhya Pradesh irrigation department should be given the responsibility for the maintenance of the 124 KM main canal which flows in Rajasthan, so that large water losses are minimized.
2. The Rajasthan government should release Madhya Pradesh's share of water, that of 3900 cusec per year, without further delay.
3. Enough budgets should be allocated for timely repair and maintenance of the canals.
4. High priority should be given to the task of lining of the whole canal system, including main medium and minor canals, along with a provision of appropriate slope. High quality technical work should be ensured in this regard. In addition, contractors and field staff of irrigation department should be trained to deliver technical work of a sound quality.
5. Since it is very difficult to stop farmers from lifting water, it is better to install a lift irrigation system on the bank of canals. In this way, farmers

can be charged for the amount of water they collect. As per the suggestion of the officials of irrigation department, lift irrigation through the main canal should be legalized and that area should be converted into a command area. This would help eliminate the frequent damage to the canal undergone during lifting water by the farmers.

6. Restructuring of the WUA should be carried out. This should be followed by aggressive training for organizational development, leadership, maintenance of, financial and operational records, training in the basic technical components of canal system and in the methods of monitoring technical work. Instead of vesting WUA with financial clout, it should be given a management and supervisory role, so that wastage of water can be prevented and equity in distribution of canal water can be ensured. WAU should be given enough power to monitor the construction and repair work of canals and if they do not find work done as per the norms, they should have power to get the modifications done. Field level irrigation officials should be given enough financial power, so that they can implement corrective measures in time to save the canal from further damage.
7. As per the suggestion of the officials of the irrigation department, the responsibility of collection of water charges should be transferred to the revenue department of the state, so that they are able to concentrate on maintaining and improving the technical performance of the canal system, which is really their domain.
8. Physical safety of the field staff (sub engineer and field personnel) of the irrigation department should be ensured, by providing them appropriate police security, so that they are able to supervise the canal operation even during night and thus prevent wastage of water resulting from damage to canal during peak irrigation season.
9. There is a need to develop a mechanism for proper coordination between relevant government departments, such as the irrigation, agriculture, revenue and the land development department. Perhaps a committee consisting of representatives from the relevant departments can be formed, to look at the holistic development of the command area.
10. The agriculture department should make sincere effort to reduce the use of chemical fertilizers and should maximize the use of organic manure. There is evidence that organic manure/compost helps in the increasing water retention capacity of the land and in turn reduces the requirement of water for irrigation.
11. A policy needs to be formed to make farmers to adopt appropriate cropping pattern for optimum use of water. A balanced ratio has to be introduced between high, medium and low water consuming crops. This will help maximize the benefits of canal water and at the same time protect head reach land from water logging and ultimately prevent it from becoming infertile land. Some mechanism is needed to be developed to

impose fine on the farmers who disproportionately grow high water consuming crops. Growing high water consuming crops continuously makes the land water logged and saline and ultimately makes it unsuitable for cultivation. It is in the interests of the farmers to adopt balanced cropping pattern. There are many examples in India where highly fertile agriculture land has turned infertile because of excess use of water and imbalance cropping pattern. Farmers need to make aware of this.

2. Kerwa Medium Irrigation Project

4.4.26 Kerwan dam was constructed on Kerwan River during 1973-1977 to irrigate 3967 hectares. Kerwan River is a tributary to Kaliasote River and is a part of Betwa river basin. The dam can be approached from Bhopal and is located 12 kms away on Bhopal- Kerwan road. The gross command area is 6840 hectare, and culturale command are is 5350 hectares. The project is designed to proved annual flow irrigation for 4047 hectares, which includes 80 hectares Kharif and 3967 hectares of Rabi irrigation in Bhopal and Raisen districts through canal systems. The main canal 14.2 kms long takes off from left bank of pick up weir, which is 1.5 kms down stream of main dam. The work was completed in the year 1977 and irrigation started since 1976. The canal system of the project was partially lined during initial construction with flag stone lining, which was disturbed and damaged in most of the reaches during last 30 years.

4.4.27 The command area has deep black cotton soil under lain by yellow soil. Soyabean is the main crop in kharif which does not require irrigation in case of normal rainfall. Very small area is covered under rainfed Kharif crops of maize, jowar urad and mung. HYV wheat, local variety of wheat and gram are grown under Rabi crops.

Salient features:

Year of inception: 1973 Completed: 1977
Number of villages covered: 35
Length of main canal: 13.04 km
Number of sub canals: 0
Number of distributaries: 2; Number of minors: 20

4.4.28 The potential irrigated area of the project has been shown in Table 4.4.1, which reveals that the project has been designed basically to provide irrigation in Rabi season. The designed cropping pattern on the basis of which the potential was calculated has been presented in Table 4.4.2. It is quite clear that at present, the irrigation potential in Rabi has reduced to 3604 hectares as compared to originally proposed to 3967 hectares. Even this potential area has not been utilized efficiently as the actual irrigated area by the project stands about 60 percent of the potential area in Rabi season (Table 4.4.3). The reasons for change in potential irrigated area since inception are as follows:

- Kharif crop was never irrigated since the inception of the project.
- About 443 hectares of land has been converted in to residential area near Bhopal.

Table 4.4.1: Potential Irrigated Area of the Project

Season	Potential irrigated area (in ha.)	
	Beginning	Present
Kharif	80	nil
Rabi	3967	3604
Total	4047	3604

Table 4.4.2: Assumptions (Designed Cropping Pattern) for calculating Command Area

Crops	Area (in ha.)
Kharif	
Soyabean	80
Total Kharif	80
Rabi	
Wheat HYV	650
Local wheat	2631
Gram	80
Vegetables	202
Fodder	202
Sunflower	202
Total	3967
Grand total	**4047**

Table 4.4.3: Actual Irrigated Area during Last Ten Years

Year	Kharif	Rabi Irrigation (in ha)	% to Rabi Potential
1998-99	0	2686	75%
1999-00	0	2026	56%
2000-01	0	1447	40%
2001-02	0	1020	28%
2002-03	0	1470	41%
2003-04	0	1574	44%
2004-05	0	2374	66%
2005-06	0	2243	62%
2006-07	0	2351	65%
2007-08	0	2182	61%

Reasons for Gap between Potential and Actual Irrigation

(a) Social Issues

- Farmers of head reach of the canal over irrigated their fields, assuming that they may not get water for the following irrigation, this make canal water not to reach at the tail end of the main and minor canal and this area remains un-irrigated.

- Farmers at reservoir rim and those at idle reaches of canal systems lift water through pump and irrigate their fields located at higher levels and out of command area. This causes less availability of water for the tail end farms as well as damage to the canal, which results into increase in seepage and further loss of water on the way.

- Use of a large number of lift irrigation pumps submerged in the canal by farmers of idle reaches of canal obstruct the flow of canal water and reduces velocity of water and ultimately less supply and delay of water supply at the tail ends.

- Surrounding residents remove flag stones used for the lining of main canal for their domestic use. Frequent removal of flag stones causes severe damage to the main canal, and in turn high ration of seepage and less supply of water towards tail reaches.

(b) Technical Issues

- Because of weeds and siltation in the canal, water bearing capacity of canals is reducing.
- Non-provision of micro distribution (field channels and water course) network in original project plan led to inefficient use of canal water.
- Top bank level of entire canal section as exists, is lower than that designed, results in low discharge capacity of canal.
- Leakage of irrigation water through irrigation sluices reservoir basin causes less storage of water for irrigation.

(c) Management Issues

- Shortage of staff in irrigation department to maintain the canal system, leads continuous deterioration of canals. Old staff was retired and new staff was not recruited because of ban on new appointments. It was difficult to hire daily wage labour, because of legal issue of taking work above 89 days.

- Lack of vehicles (four wheels) on the field for carry out regular patrolling during the irrigation season. Without four wheel vehicle it is very difficult to carry out the regular patrolling in the peak winter of Rabi season, to restrict wastage of water and damage of canal.

- According to the chief engineer, now responsibility of maintenance is given to the 'Water Users' Associations'. They have power to get the work done, with approval of irrigation department. WUA gets money for maintenance of canal at the rate of Rs. 100 for minor irrigation project, Rs. 80 for medium irrigation project, and Rs. 60 for major irrigation project. Depended on area WUA get financial power between Rs. 1.5 lacs to 10 lacs.

- WUAs had been given financial power, without preparing them for performing their role. WUA members neither have technical knowledge, nor perception for the community work. If the Irrigation Department does not approve the canal work done by WUA, the members specially chairman make it political issue and get the approval forcefully done through local MLA or MP. Therefore, maintenance of canal work gets done without technical parameters, which leads to poor performance of canal system.

- WUA has become political body. All the committee members of WUA are influential farmers from head reaches of the canal. There is almost nil representation of tail end farmers and underprivileged class in the WUA committee. Only one woman in each WUA committee was nominated as a member, but she did not play any active role. In reality her husband or son

acts behalf of her. The influential members get the canal water diverted in their fields and do not leave sufficient water for the tail-enders.

- There is lack of clarity of the role of WUA, to the staff of irrigation department as well as members of WUA. Irrigation staff members at the field level assume that Water Users' Association is only of twelve members, while they are only committee members. In reality WUA consists of all the farmers' of command area who use canal water. Usually irrigation staff members focus on participation of only committee members, while they should ensure participation of all the members, and try to empower them.

(d) Change in Land Use Pattern

- Cultivated area in the head reaches had been converted into urbanized residential area. This changed the focus of use of canal water from irrigation to domestic purpose. Indirect effect of this change is that tail end of these colonies also do not get water because of obstacle created in the minors by these colonies.

- As per instruction of district administration of Bhopal, 5.0 cubic meter of the water has to be reserved for domestic supply of Bhopal city.

- Adoption of HYV wheat by farmers of command area, which requires more water. On the other hand water for kharif crop is not used at all

(e) Natural Phenomenon

- Being earthen canal section, it is susceptible to excessive weed growth thus reducing the velocity of water.

- The analysis of rainfall pattern of last 52 years shows negative change in rainfall in the command area of Kerwa.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.4.2).

Chart 4.4.2: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Low water carrying capacity of distribution channels due to silting	3
2.	Lack or effective WUAs	2
3.	Diversion of water for other purposes	4
4.	Change in cropping pattern	5
5.	Over utilization of irrigation water by farmers	1
6.	Diversion of cultivable land to other purposes within command area	6

Suggestions

1. Equal benefit of canal water to whole hinterland area (including non-command area), so that non-beneficiaries do not damage the canal.

2. Sensitization of water users for judicious use of water. There are evidences that whenever, only required amount of water was given, and access watering to crops was avoided, farmers got higher yields.

3. Precautions should be taken to protect lining of canal system, so that people should not damage them for their personal benefits.

4. Intensive training should be given to the farmers of command area for adoption of balanced cropping pattern and use of proper doses of fertilizer.

5. For improving water retention capacity of soil, agriculture department should give training to farmers of command area for maximum use of organic manure. Agriculture department should also encourage farmers to make maximum use of organic manure, by providing them some incentives.

6. Tail end farmers should have maximum representation in the WUA, so that they will ensure that water reaches at the last end of the tail.

7. WUA members should be given quality training in technical, financial and management aspects of the canal. They should also be sensitized towards issues of community development, keeping canal system as a property of public/community in mind.

8. Field level staff of irrigation department should be given intensive good quality training in the issues of community participation. In Satak Canal project Mr. Abhay Shukla (sub-engineer) had experimented participatory approach (PIM) and got very good results. He over achieved the potential irrigation.

9. Systematic cement concrete lining of main canal, distributaries and minor with proper technical specifications should be given priority.

10. Construction of field channels till the tail end of the main canal.

11. Regular patrolling is required during the irrigation period, especially during four months of rabi irrigation, so that equitable water distribution could be ensured and waste of water can be avoided. Since irrigation department does not have enough staff to do patrolling, it is suggested to higher local youth only during the irrigation season. In satak project, this experiment proved very successful.

12. Sensitization and awareness building of the field staff of irrigation department regarding PIM (participatory irrigation management) and role of WUA should be given priority. Regular training programs in PIM should be organized by qualified trainers for the irrigation officials. Capacity of irrigation staff should be built in participatory techniques.

3. The Rangawa Major Canal Project

4.4.29 The Rangawa high level canal project is situated in the Rajnagar block of Chhatarpur District .The length of the main canal is 24 km and the total length of its 9 distributaries is 102 km.The Rangawa reservoir was constructed by the Uttar Pradesh Government during 1949 to1957 to provide irrigation to the Banda district of Uttar Pradesh. In 1972, the Government of Madhya Pradesh and Uttar Pradesh made an agreement for the distribution of water from the Rangawa reservoir between their states. As per the agreement, up until 31st October each year, Madhya Pradesh could use 2 T.M.C water from the reservoir. The available balance storage on 1st November would then be divided between Uttar Pradesh and Madhya Pradesh, in the ration of 36:15 (approx. 72% for U.P and 28 % for M.P).

4.4.30 In 1972, the estimated cost of construction of the Rangawa high level canal was Rs. 198 lacs which irrigated 15182 hectares (Kharif 6178 hectares and Rabi 87041 hectares). In 1976, the Rangawa high level canal project was modified cost of Rs. 377 lacs, to increase the irrigated area of Banisagar project command by linking the Rangawa canal with the Banisagar left bank canal (LBC) through a siphon across the Khadar nala. As per the revised plan, the potential irrigated area through Rangwa dam was 17085 hectares (Kharif 10607 hectares and Rabi 6478 hectares).

Salient Features of Rangawa Canal System

- *Year of inception*:1977
- *Year of Completion*:1993
- *Number of villages covered*: 26

- *Length of main canal*: 24 km
- *Number of sub channels*: Nil
- *Number off distributaries*:19
- *Length of distributaries*:102 km

4.4.31 The irrigation potential and its utilization in different seasons since 1997-98 have been presented respectively, in Tables 4.4.4 and 4.4.5. In Kharif, the utilization is nil whereas, in Rabi season, it was around 70 percent till 2005-06. However, during last years the utilization of irrigation potential in Rabi season was meagerly 6 to 14 percent.

Table 4.4.4: Potential Created by Rangawa Canal System

Season	Potential irrigated area
Kharif	10607
Rabi	6478
Total	**17085**

Table 4.4.5: Irrigated Area by the Rangawa Canal System

Year	Kharif	Rabi	% of Rabi Potential
1997-98	0	4472	69%
1998-99	0	3805	59%
1999-00	0	4102	63%
2000-01	0	1616	25%
2001-02	0	4011	62%
2002-03	0	3763	58%
2003-04	0	4623	71%
2004-05	0	4353	67%
2005-06	0	4672	72%
2006-07	0	906	14%
2007-08	0	388	6%

Reasons for Low Achievement of Irrigation Potential

(a) Farmers do not use Water for Kharif Irrigation

4.4.32 Farmers of the command area have not changed their cropping pattern from Rabi. They do not use irrigation for kharif crop such as soyabean, green gram (mung).

(b) Unavailability of Seeds

4.4.33 For the adoption of new variety of crops in Kharif and low water consuming crops in Rabi, farmers do not have access (availability and affordability) to seeds in time. Therefore, they sow seeds of only those crops which are available to them. Somewhere, the agriculture extension system has failed to provide seeds of various crops for adoption of diversification of cropping pattern and so resulted in failure to make best use of available irrigation facility.

(c) Unorganized Cropping Pattern causes Anomalies in Water Requirement

4.4.34 If upstream farmers grow gram and masoor which require less water and downstream farmers grow HYV wheat which requires more water, it creates water anomalies among the farmers. This is because water has to flow through upstream fields of garm and masoor which require less water and downstream to HYV wheat fields that require high water quantities. In this process down stream wheat farmers do not get water for thier crops need. This causes less achievement of potential irrigation.

(d) Wastage of Water

4.4.35 In order to release more water in their field before their turn, farmers tend to remove the gates and do not fix them back after getting water. This causes unnecessary flow of water in the minors of up streams and shortage or non-availability of water at the tail end. Because of a lack of field channels and water courses, the discharge of water from minor and sub-minors is more than the double. For example, where one cusec water should be released, more than two cusec water is released. This causes wastage of water at head reach and non-availability of water at tail reach of the canal.

(e) In-appropriate Construction

4.4.36 At the initial stage of the main canal and 1.5 km approach channel inside the dam, due to the presence of hard rock, there is improper section in the dam construction. As a consequence, only 160 cusec is released instead of 292 cusec water as intended. This slows down the velocity of water and as a result water does not reach at the tail end in time.

(f) Over Irrigation

4.4.37 Due to low velocity of water in the canal, head farmers over irrigate (4-5 watering cycles against prescribed 2-3 watering cycles) and water does not reach the tail reach fields.

(g) Difficulty in Maintaining the Canal

4.4.38 Due to the sandy soil nature of the area, there is frequent damage to the canals. This makes the maintenance of canals within available budget very difficult.

(h) Difficulty in De-silting

4.4.39 For a distance of about 10 kms, the Rangawa main canal flows through a hilly area, which has box type cutting. To de-silt the main canal in this area, within the available budget is very difficult. This causes low velocity of water flow in the canal.

(i) Inadequate Fund for Maintenance

4.4.40 For maintaining the Rangawa canal system as per the required norm, Rs. 500 per hectare is required, while only Rs. 100 is available. Due to the sandy soil nature of the command area and construction of main canal in the hilly area, maintenance of the canal within the allocated funds proves difficult.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.4.3).

Chart 4.4.3: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Low water carrying capacity of distribution channels due to silting	2
2.	Non-completion of construction of field channels as per design	4
3.	Non-adoption of recommended cropping pattern	3
4.	Over utilization of irrigation water by farmers	1

4. Kulgarhi Canal System

4.4.41 The Kulgarhi canal scheme was constructed in year 1970. The dam is situated on the Durha nalla, which is tributary to Satana River and is a part of Tons River sub-basin of Ganga River basin. The catchment area of Kulgarhi canal scheme is 27.68 sq. km and is situated in the Unchehra block of Satna. The

catchment area is fan shaped with a steep slope. 75 % of the area is covered with fairly dense jungle. The length of nalla up to the dam site is 19.30 km.

Salient Features of Kulgarhi Canal System

- *Year of inception*: 1959 and year of completion 1969
- *Number of villages covered*: 14 but water is supplied to only 7 villages
- *Length of main canal*: 8.2 kms
- *No. of sub canals*: 0 (no)
- *No. of distributaries*: 0
- *No. of minors*: 10

4.4.42 The potential irrigated area of the project is 2226 hectares. Out of this, 1012 hectares has been designed for Kharif season, whereas 1214 hectares has been kept for Rabi season (Table 4.4.6). The actual irrigation by the project has been shown in Table 4.4.7 indicating a very dismal performance of the system.

Table 4.4.6: Present Command Area of the Project

Season	Potential Irrigated Area in hectares.
Kharif	1012
Rabi	1214
Total	**2226**

Table4.4.7: irrigated Area by the Kulgadi Canal System

Year	Kharif	Rabi	% of Rabi Potential
1997-98	0	678	55.85
1998-99	0	732	60.29
1999-00	0	708	58.32
2000-01	0	581	47.85
2001-02	0	580	47.78
2002-03	0	527	43.41
2003-04	0	563	46.37
2004-05	0	623	51.31
2005-06	0	647	53.29
2006-07	0	464	38.22
2007-08	0	388	31.96

Reasons for Low Achievement of Irrigation Potential

- Improper maintenance of canal system in the past years has led to its deterioration and inefficient functioning and consequently less or virtually no supply of irrigation water to the tail end minors.

- Lack of provision of a micro distribution network in the original project report has led to inefficient use of irrigation water.

- Top bank level of canal section through out its length is lower than that of designed level and this situation leads to over topping of canal bands. This causes frequent breach of canal and resulting in loss of water.
- The approach channel to the head sluice is full of silt and choked due to silt falling from the slopes.

- The sluice gate's skin plate has not been painted since a long time and shows signs of corrosion. The hoisting arrangement is in a need of maintenance. The gate seal has lost it properties and is giving way to water resulting in water loss.

- The top slab of sluice barrel is damaged and reinforcement is exposed.

- No trash rack is provided on the U/S opening of the sluice barrel in order to prevent the entry of heavy floating material into the barrel.

- Presence of shrubs, weeds, herbs or other vegetation growth on the up stream, down stream slopes and top width of the dam

- Presence of crab holes/rodent holes and colonies of white ants on the up-stream slope of the dam and canals.

- Down stream longitudinal drain is choked with silt, weed and other rubbish.

- Unauthorized cutting of canal banks to irrigate crops has led to the reduction of irrigation in project command area.

- There is no coordination between irrigation and agriculture department. The agriculture department does not provide guidance for adoption of cropping pattern. Neither does it give guidance for optimal use of water for good harvesting. Farmers are under the illusion that if they give more

water they will get a better yield. In the process. they over irrigate their fields. They do not understand that over irrigation may spoil their crop. In the case of the Tawa canal project (another project of Madhya Pradesh), it was found that between 1998-2000 despite the Tawa reservoir not being full due to low rainfall, the harvest was good.

- Farmers in initial reach over draw irrigation water which leads to reduction in irrigated land.

- Farmers with clout and influence grab major portion of the water. They divert the channels in their fields out of their turns.

- The WUA was formed to encourage people participation. However, all the members of WUA are elite and powerful farmers who make and mould policies and rules for their own benefits.

- Farmers do not use canal water for kharif crop. Thus, the potential created for the kharif crop remained unused.

- During years of low rainfall, water of the Kulgadi dam was reserved to be used as drinking water for the Satana city. Thus, the full irrigation potential is not achieved. In 1997, 2001, and 2006, the dam water was diverted for drinking and domestic purposes. During 1997, the last two watering cycles and in 2001, the one watering cycle was not possible for irrigation.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.4.4).

Chart 4.4.4: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Non-maintenance of canals	1
2.	Low water carrying capacity of distribution channels due to silting	2
3.	Non-adoption of recommended cropping pattern	3
4.	Diversion of water for other purposes	4

Suggestions

- Coordination between irrigation and agriculture department needs to improve
- Watershed of the dam area should be maintained, so that enough water gets fed into the dam.
- Tail end farmers and small and marginal farmers should have maximum representation in WUA. They should be empowered by giving them training and authority. They should get support from the police department in case the elite farmers threaten them.
- Regular removal of shrubs and weeds from the dam and canal slops should be done.
- Protection of canals from crabs, rodent holes and white ants should be done.
- Awareness amongst farmers for optimal use of water should be raised.
- Maintenance and cement concretization of canals should be done.
- Direct lifting of water should be prevented.

5. Segwal Medium Irrigation Project

4.4.43 The Segwal medium irrigation project is an old irrigation project, located near the Segwal village in Thikari block of Barwani district. The project was proposed in the first Five Year Plan and was completed in 1975. In the beginning of 2006, the Segwal project was selected under the ICEF (Indo-Canada Environment Project) for renovation. The following activities were proposed under the ICEF project:

- Earthwork for re-sectioning of the canal network to allow designed discharge
- Repair of existing canal structures
- Canal lining in problematic filling reaches to avoid seepage
- Construction of gated outlets.
- Construction of new canals structures.

4.4.44 The estimated cost of the ICEF project was 79.90 lacs. Of this amount, 10 percent contribution was made by the farmers of the command area. Prior to the renovation work, social processes were carried out. A village meeting was organized by the WUA with the support of the field level officials of irrigation

department and ASA (NGO) to motivate farmers to pay their contribution for the technical and physical works as well as to participate in PIM activities. The renovation work to be done was identified by conducting a PWT (Participatory Walk Through) for one week, in which the WUA members, farmers of command area, officials of irrigation department, and ASA (NGO) workers participated. Through this joint effort, the priority areas for the renovation work were decided and the financial sanction was taken from the irrigation department. People's participation was further ensured by forming a construction committee called the 'Nirman' committee which consisted of local farmers. The members of Nirman committee were trained by the officials of Irrigation Department. WUA was given responsibility to execute the work under the supervision of Nirman committee, officials of Irrigation Department and workers of ASA NGO. In the period of two years that followed, renovation activities were completed successfully with active participation of farmers of the command area.

Salient Features of the Segwal Project

- *Year of inception of the project*: Started under first Five Year Plan in 1955 and completed in 1975
- *Number of villages covered*: 10
- *Length of main canal*: 8.80 km
- *Number of sub canals*: 1 and length 14.9 km
- *Number of Distributaries*: Nil
- *Number of Minors*: 4 and length 12.2 kms

4.4.45 The potential irrigated area of the project is 1200 hectares, equally divided between Kharif and Rabi seasons (Table 4.4.8). The actual irrigation by the project has been shown in Table 4.4.9 indicating that the project has been able to utilize only two third of its potential.

Table 4.4.8: Present Command Area

Season	Potential Irrigated Area in hectares
Kharif	600
Rabi	600
Total	**1200**

Table 4.4.9: Irrigated Area by the Segwal Canal System

Year	Kharif	Rabi	% of Rabi Potential
1997-98	0	478	79.66
1998-99	0	432	72.00
1999-00	0	308	51.33
2000-01	0	221	36.83
2001-02	0	328	54.66
2002-03	0	427	71.16
2003-04	0	463	77.17
2004-05	0	323	53.83
2005-06	0	347	57.83
2006-07	0	464	77.33
2007-08	0	451	75.16

Reasons for Low Achievement of Irrigation Potential

- The cropping pattern has changed from local cotton, maize, jowar, and pigeon pea to sugar cane and BT cotton.

- Irrigation is not used for kharif crop because it is a rain-fed crop. Moreover the rabi crop is the main crop of this area. Therefore the area covered under kharif crop is quite low. Farmers prefer wheat rabi crop because it provides good fodder.

- Because of the irregularity and uncertainty of the water supply through the canal system, farmers have developed their own irrigation sources.

- Lack of field channels leads to low use of irrigation water from canal

- Upstream farmers do not want to construct field channels in their fields. They are reluctant to loose their cultivated land under field channels, for which they do not get any compensation.

- The old field staff of the irrigation department has retired and new staff has not yet been employed. Therefore, patrolling of the canal during the irrigation season is extremely difficult. Although, the WUA has been formed to provide support to the irrigation department, their services are not utilized because of lack of skills of WUA members, a lack of orientation towards participatory approach and as well a lack of feeling of ownership towards the canal as their own asset.

- Given the lack of staff for management of canal and monitoring of water distribution, a high level of people's participation is needed. Irrigation

department's field level staff is not oriented towards participatory approaches. In addition, catalyzing social processes is not a part of job description of the field level staff (assistant engineer and below). Social processes such as efficient management of conflicts, addressing equity issues, involvement of local people in patrolling, supervising water distribution and decision on adoption of cropping pattern as per availability of water had shown significant results in improving irrigation potentials. These processes have been carried out, albeit, in the interests of specific persons, and not as a part of job. Therefore, there is no uniformity found in adoption of participatory approaches through out the state. Also, officials who try social techniques do not get special recognition for their efforts in terms of promotion or increase in salary.

- Participatory methods carried out in the Satak project were not widely shared with the irrigation officials of other areas. Possibly because this work was carried out by a sub-engineer, who is at the lower end of the hierarchy of the irrigation department, and his work was not discussed in high level official meetings for replication.

- Performance indicators are based on only technical and financial completion of targets. The indicators for performance appraisal of social processes have not yet been developed. Irrigation is treated as a pure technical field, while it is directly related to human behavior and social dynamics. Implementation of technology is effective, only if people realize its benefits. In Madhya Pradesh; surface irrigation is seen as only construction of dams and canal. The human component is missing from the scope of the department. From top to bottom, majority officials feel that participatory approaches are creating problems in their work. Enough thought has not been given as to why WUA are not working successfully and why they have not been able to built cordial relationship with the officials of the irrigation department.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.4.5).

Chart 4.4.5: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Lack of supervision by Irrigation Dept. due to lack of staff	2
2.	Lack of field channels	3
3.	Change in cropping pattern	1
4.	Adoption of own irrigation sources by farmers	4

Suggestions

- Uncertainty of water supply through canal should be reduced. This will stop farmers from making excess use of water.

- Enough staff should be provided for patrolling of canal system during rabi season, which is the peak irrigation season.

- A higher budget should be allocated for the repair and maintenance of the canals.

- Tail end farmers should have a higher representation in WUA.

- WUAs should be empowered through various training programmes and exposure visits so that they are better prepared to perform their roles successfully.

- Although an expensive proposition, but it is important to construct field channels through underground pipe lines so that farmers do not loose the cultivated land. It is really difficult for small and marginal farmers to loose even a small portion of their cultivated land for construction of field channels.

- From top to bottom of the hierarchy, all official of the irrigation department should be oriented towards participatory approaches, social processes and techniques of community development.

- Social processes should be incorporated in the job description of the field staff

- Performance indicators for adoption of social processes should be developed for the review of performance of the field staff.

6. Satak Project

4.4.46 The Satak tank is an old irrigation project built on the Satak River, a tributary of the Narmada River. The dam is situated near Bamandi, in the Kasrawad block of Khargone district. The project was started in 1955 under the fist Five Year plan and completed in 1966. Mr. Abhay Shukla, sub- engineer of the irrigation department was posted there during 1994 to 2007. During this period, he used various community participatory method and made remarkable improvement in the irrigation performance of the canals. In 2000, when government grant for patrolling was reduced, through mutual consent with WUA, he collected Rs. 75000, at the rate of Rs.50 per hectare from all the water users of command area. He appointed 15 young boys (20-25 years old) for four months and paid them between Rs. 1500 to Rs. 2000 per month, depending their area and skill. The remaining amount was used for repair and maintenance of the

canal. Since then the WUA is responsible to pay salary of patrolling personnel. Owing to the regular contribution, at present, Satak WUA has total fund of Rs. 5 lacs. In 2003, the Satak project was selected under the Indo-Canada Environment Facility Project (ICEF) to renovate its canal system. The total cost of the ICEF project was Rs. 138.40 lacs, of which Rs. 14.35 lacs were contributed by the farmers of command area.

4.4.47 The performance of the project in terms of utilization of irrigation potential is shown in Table 4.4.10. It indicates that whenever the water is available, the project has been able to achieve quite near to its potential target.

Table 4.4.10: Actual Irrigation against Potential in Satak Canal Project

Year	% of Live Storage Available	Designed Potential Irrigation	Actual Irrigation	Actual Irrigation as % of Potential irrigation
1995-96	33%	1457	836	57%
1996-97	100%	1457	1540	105%
1997-98	100%	1457	1287	88%
1998-99	100%	1457	1471	100%
1999-00	75%	1457	1676	115%
2000-01	12%	1457	218	15%
2001-02	100%	1457	1842	126%
2002-03	100%	1457	1546	106%
2003-04	100%	1457	1258	86%
2004-05	100%	1457	1380	94%
2005-06	17%	1457	274	18%
2006-07	100%	1457	1172	80%
2007-08	100%	1457	882	60%

Section 5: Analysis of Sample Irrigation Projects – Chhattisgarh

1. Tandula Reservoir Project

4.5.1 Tandula complex consists of four reservoirs - Tandula, Kharkhara, Gondli and Khapri – situated in Durg district of Chhatisgarh. Tandula twin reservoirs were constructed in 1921 followed by Khapri (1928) and Kharkhara & Gondli (1967). Tandula and Khapri tanks were constructed mainly for irrigation purposes and Kharkhara and Gondli tanks were constructed for meeting the demand or the Bhilai Steel Plant. Tandula reservoir was initially constructed to provide irrigation to 56070 hectares of Kharif paddy and an equal area of Rabi crops. As Rabi irrigation could not be developed, the scope of Kharif irrigation was raised to 68,220 hectares. Tandula reservoir caters the irrigation requirement of 500 villages through its 68.80 miles length of main canal, 15 distributaries and 36 minors. Considering the irrigation demand potential, at present the scope of irrigation from Tandula reservoir has increased to 97896 hectares.

4.5.2 The irrigated area from the project during last 8 years separately in Kharif and Rabi seasons has been presented in Table 4.5.1 below.

Table 4.5.1: Irrigated Area (hectare) under Tandula Canal System

Year	Kharif	Rabi
2000-01	16490	NA
2001-02	87694	NA
2002-03	19460	NA
2003-04	53711	NA
2004-05	84055	NA
2005-06	85046	NA
2006-07	88598	3084
2007-08	96700	NA

Reasons for Gap between Irrigation Potential and Utilization

4.5.3 There are numerous reasons which affect the performance of canal system. Some of the major issues are discussed as follows:

a) Inadequate Rainfall

4.5.4 Over past couple of years, it has been observed that the monsoon fails once in every two to three years thereby causing severe draught conditions.

b) Old Canal Structure

4.5.5 Old canal structure and low discharge capacity provide challenges to field staff and officials during peak season. Because of this very reason, it became essential to remodel the Tandula canal system so that it can carry over maximum required discharge.

c) Lack of Budget for Maintenance

4.5.6 Main canal and its distributaries need de-silting at regular interval. It is not possible due to lack of budget for maintenance purpose. Channel section of system has been deteriorated because of non-availability of sufficient maintenance fund. Different canal regulating structures like gates, gauge pillars, and tail gulls have either been damaged or are not available.

d) Distribution Constraints

4.5.7 Expansion of irrigated area at tail ends of distributaries and minors is putting heavy strain on the canal system and it is not possible to ensure uniform distribution of water for irrigation until a systematic distribution network is created. The tail area is always subjected to delayed supplies of irrigation water as cultivators at the head do not allow water to pass below, unless they get full irrigation water in their fields. Losses of water in transit, mainly due to percolation, seepage, weed growth etc can be reduced through proper interventions. The transit loss in the Tandula system is estimated to be 15% from the main canal, 10% from distributaries and minors and about 15% from smaller channels. The aggregate transit losses could be realistically assumed as 40% at canal head.

e) Increase in Area under Paddy Cultivation

4.5.8 The original designed area of irrigation under Tandula canal was 56070 hectare which has increased over time and at present it has gone upto 97896 hectares. Due to increase in area under paddy cultivation and Rabi cropping, the demand for water has increased tremendously.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.5.1).

Chart 4.5.1: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Increase in area under irrigation (area expansion under paddy cultivation & Rabi cropping)	1
2.	Old canal structure/Kachhi	2
3.	Distribution constraints (Losses of water in transit, mainly due to percolation, seepage, weed growth etc.)	3

2. Kodar Reservoir Project

4.5.9 The Kodar Reservoir Project is located in tehsil and District Mahasamund of the State. The Project was originally classified as Medium Project. Latterly, this project has reclassified as major project vide M.P. Irrigation Department No. 1/2/MPS/33/79/89 dated 17/03/1979 with associated objectives to develop industries such as rice mills, fertilizer plants etc. lead to larger income in other sector in the region. Thus, the project proposed to no only provide the employment to the population of this area but also result in a permanent improvement of agricultural income and consequent industrial development of the area. This project is cleared by CWC. The final potential of the project is to irrigate 23472 hectare, comprising 16754 hectare of Kharif and 6718 hectare of Rabi.

4.5.10 The irrigated area from the project during last 7 years separately in Kharif and Rabi season is tabulated below (Table 4.5.2). During the initial first four consecutive years (2001-2004), a very dismal and inconsistent performance was shown by the project to irrigate both the Kharif and Rabi season crops in the command area. However, in the last four years (2004-2008), the performance improved to irrigate on an average 95% of its command area during Kharif season. The status for Rabi seems to constant dismal.

Table 4.5.2: Irrigated Area (hectare) under Kodar Canal System

Year	Kharif	Rabi
2000-01	5893(35.17)	NA
2001-02	15906(94.94)	17(0.25)
2002-03	11687(69.76)	NA
2003-04	4554(27.18)	1932(28.76)
2004-05	16018(95.61)	118(1.76)
2005-06	15870(94.72)	205(3.05)
2006-07	16006(95.54)	1636(24.35)
2007-08	16022(95.63)	NA

Note: Figures in parentheses indicate percentage utilization of irrigation potential.

Reason for Gap between Irrigation Potential and Utilization

(a) Inconsistency in Reservoir Efficiency

4.5.11 Table 4.5.3 intended to inconsistency in the reservoir efficiency. During last eight years, the average water discharge during Kharif season has been 5819 MCFT, fluctuated between minimum 2301 MCFT to a maximum of 9655 MCFT. This inconsistence in efficiency to water discharge from the reservoir strains farmers in their crop planning in a particular year of concerned. This lead to create a gap between potential irrigation and actual utilization of irrigation water during a year of concerned.

Table 4.5.3: Monthly Discharge of Water

Month	Year							
	2000	2001	2002	2003	2004	2005	2006	2007
Kharif								(MCFT)
April	969.5	--	969.53	650.27	5074.84	693.85	1814.13	5784.91
May	3432.8	--	2787.86	--	2238.73	1006.91	1170.77	--
June	--	--	--	--	406.216	25185.4	1252.80	--
July	--	--	2488.34	--	2624.5	--	--	841.48
August	9600.4	6903.0	2935.87	2345.39	9761.41	4676.08	9371.99	10901.7
September	4003.6	13929.9	5204.63	2708.6	14770.04	26680.39	20010.22	12478.81
October	2102.8	5605.4	6229.01	4704.6	5607.84	8954.13	11264.39	12720.22
November		87.14		1097.90		394.25		738.06
Mean	4021.82	6631.36	3435.87	2301.36	5783.37	9655.86	7480.72	7244.20
Rabi								
January	--	--	578.37	--	1853.6	3640.40	648.88	2951.95
February	--	--	274.69	--	2207.61	2447.89	1768.28	3009.23
March	--	--	647.83	--	3997.28	2551.88	558.71	3863.24
Mean			500.30		2686.16	2880.06	991.96	3274.81

(b) Lack of Distribution Canal

4.5.12 Canal distribution system is an important aspect of efficient water flow and proper distribution of irrigation water. Maintenance and efficient operations of the distribution canal system helps to prevent water logging, seepage and associated problems, improved efficiency to many fold. The distribution canals under the project have been created to its original proposed length of 380 km. The efficiency to run water in the canal system is still required to gain its full

potential, as only 70% achievement has been made in completion of pacci canal (Table 4.5.4).

Table 4.5.4: Status of Canal Distribution System

	Kacchi (km)	Pakki (km)
Purposed	380.94	34.00
Completed	380.94	24.00

(c) Lack of Staff

4.5.13 A high irrigation potential consistency requires supporting technical staffs to maintenance and other constructive development measures to its efficiency improvements. Any reduce size of irrigation department's staffs, including field and technical staffs affect functioning and efficiency of the whole project system. Table 4.5.5 clearly mentioned that only 402 current working positions against to approved 648, shows a 62% manpower level. This may constraints even to maintain the present efficiency level of the project.

Table 4.5.5: Status of Staff Position in the Kodar System

S.No.	Designation	Approved	Working
1.	Engineer	25	19
2.	D.A	01	01
3.	S.A.C.	01	01
4.	Sahayak Grade II	08	05
5.	Draftman	02	02
6.	Asst. Draftman	04	02
7.	Sahayak Grade III	12	06
8.	Fiter Asst.	32	16
9.	Ameen	32	17
10.	Post information	02	02
11.	Peon	12	05
12.	Gaizreader	01	
13.	Guard	01	06
14.	Meth	15	70
15.	Permanent laborer	500	250

(d) Inadequate Rainfall

4.5.14 The rainfall of this project area is erratic and inadequate a result of which the water storage capacity of the project is not fully utilized. From the records, famine conditions in this area can be noticed and it has become almost regular feature which put dismal impact on farmer's livelihood in the area.

(e) Non De-silting Operations of the Canals

4.5.15 Though regular and sufficient budgetary provisions for the maintenance of the project system are there, an irregular de-silting operation of the canals system is carried out. This is an important reason to not sufficient water flow in the canal system and water logging in some areas. This leads to improper water distribution and under utilization of irrigation potential.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.5.2).

Chart 4.5.2: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Inadequate rainfall	1
2.	Inconsistency in reservoir efficiency/water discharge	2
3.	Lack of distribution canal/Kachhi	3
4.	Irregular desilting operation of the canals	4
5.	Lack of staff	5
6.	Lack of communication between farmers and the project staffs about the availability of irrigation water leads poor crop planning	6

3. Maroda Jalasya

4.5.16 The Maroda Jalasya was incepted in 1909. The project has a total potential to irrigate 445 hectare available mainly to Kharif season. A very dismal performance made by the project during last 8 years has been presented in Table 4.5.6. During Kharif season, on an average 46% of the potential has been utilized which has further gone down to a little 36% in the ongoing year of 2007-08. The data set is not available to explain the performance during Rabi season.

Table 4.5.6: Irrigation area (hectare) by Maroda Jalasya during 2001-08

Year	Kharif	Rabi
2000-01	151(33.93)	NA
2001-02	286(64.27)	NA
2002-03	266(59.78)	NA
2003-04	190(42.70)	NA
2004-05	213(47.87)	NA
2005-06	197(44.27)	NA
2006-07	172(38.65)	NA
2007-08	164(36.85)	NA

Note: Figures in parentheses indicate percentage utilization of irrigation potential.

Reason for Gap between Irrigation Potential and Utilization

(a) Lack of Budget

4.5.17 Due to lack of budget provision to maintenance of the canal system, the original efficiency has goes down. However, some budgetary provision has been made during 2005-06 and 2006-07, but it is very meager amount to complete the necessary maintenance works (Table 4.5.7).

Table 4.5.7: Sanctioned funds for Maintenance

Year	Sanctioned Amount (Lakh)
2001-02	NIL
2002-03	NIL
2003-04	NIL
2004-05	NIL
2005-06	0.25
2006-07	1.70

(b) Irregular De-silting Operation of the Canal System

4.5.18 The irregular de-silting operation of the canal system has resulted heavy strain to proper distribution and management of irrigation water. The rainfall flows the soils into the canal and drainage system drawn it shallow. In the absence of cleaning and maintenance operations, over-flow of irrigation water in some areas leads to water logging and seepage. On the other hand, in some command areas, water is not reached at tail end. This finally limits to potential utilization of irrigation water due to water losses.

(c) Lack of Farmers' Interest in Rabi Cultivation

4.5.19 At the village level, the farmers in the command area have switched over mono cropping. Lack of proper irrigation water even during Kharif season forced them to shift over single crop system (Table 4.5.8).

Table 4.5.8: Change in Cropping Pattern

Crops	During Construction of Dam	At Present
Kharif	Rice	Rice
Rabi	Wheat	Nil

(d) Decreased Efficiency of Project

4.5.20 Year wise look into average monthly water discharge during Kharif irrigation reveals that the efficiency goes down year by year with a minimum of 29 cusec in 2003. However, in 2007, the efficiency improved with average 43.9 cusec water discharge. Most concerning aspect is the decreasing water discharge during peak requirement for Paddy cultivation (Table 4.5.9).

Table 4.5.9: Monthly Discharge of Water

Month	2000	2001	2002	2003	2004	2005	2006	2007
Kharif (Cusec)								
April								
May								
June								
July	57.5	48.9	30.7	-	27.5	50.7	21.9	26.5
August	51.5	47.9	31.5	30.5	-	27.8	30.7	25.7
September	25.5	-	20.8	27.6	-	30.5	35.5	31.9
October	61.5	51.9	37.8	28.9	37.6	37.5	38.5	91.5
November								
Mean	***49.0***	***49.6***	***30.2***	***29.0***	***32.6***	***36.6***	***31.7***	***43.9***

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.5.3).

Chart 4.5.3: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Lack of Farmers interest (farmers switched over mono cropping)	1
2.	Irregular desilting operation of the canal system	2
3.	Lack of budget provision to maintenance of the canal system	3

4. Matiamoti Nalla Project

4.5.21 The Matia Moti Nalla Project, a medium irrigation project, is located in tehsile and District Rajnandgaon of the State. The water supply source for the project has its ongoing in the Satpura hills from there it runs about 35.5 km to the dam site and eventually joints Shivnath River, a tributary of Mahanadi River. The site can be located on toposheet No. 64 D/13 with latitude 28°53'12" & 80°56'30". The site is situated between two small hillocks in either side of the Moti Nala. A right bank main canal and distribution system irrigates a CCA of 5714 ha (5000 ha net CCA). This scheme also provides 300 Mcft. drinking water to Rajnandgaon Municipal Corporation. The project comprises to 18.6 km long main canal and three distributaries with distribution systems to irrigate 5000 ha Kharif and 1500 ha Rabi crops.

4.5.22 A substantial performance observed during the last seven years in the project with an average of 87% of the irrigation potential utilization and a marginal fluctuation over the years particularly during Kharif season (Table 4.5.10). During 2002-03, least irrigation potential utilized, as reported to 3239 ha irrigated by the project comprising to a potential of 5000 ha during Kharif season. In the absence of data set for potential irrigation utilization duriing Rabi season; the overall irrigation performance can not be measured. However, no changed has been observed in the command area (potential irrigated area) at the time of inception of the project and present command area under the project.

Table 4.5.10: Irrigation Area (hectare) by the Matia Moti Nalla Project during 2001-08

Year	Kharif	Rabi
2000-01	4730(94.60)	NA
2001-02	4873(97.46)	NA
2002-03	3239(64.78)	NA
2003-04	3979(79.58)	NA
2004-05	4642(92.84)	NA
2005-06	4596(91.91)	NA
2006-07	4486(89.72)	NA
2007-08	NA	NA

Source: Sub Divisional Officer, Matiamoti Nalla W/R Canal, Sub-division No.3 Sambalpur

Note: Figures in parentheses indicate percentage utilization of irrigation potential.

Reasons for Gap between Irrigation Potential and Utilization

(a) Irrigation water Utilization for Drinking Purposes

4.5.23 The water utilization from the project for drinking purposes to Rajnandgaon Municipal Corporation is a major reason to not provide potential irrigation to its command area. To remind, the scheme provides 300 Mcft. drinking water to the Municipal Corporation of the District.

(b) Lack of Water Storage

4.5.24 The already limited water supply for irrigation water from the project gets further depleted with lack of proper rainfall in the area. Improper water storage planning and distribution system result in lack of water storage required for irrigation need.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.5.4).

Chart 4.5.4: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Utilization of irrigation water for drinking purposes	1
2.	Decrease in rainfall	2
3.	Lack of Farmers Interest (farmers have switched over mono cropping and not interested particularly to Rabi crops)	3
4.	Lack of maintenance of reservoir	4
5.	Improper water storage planning and distribution system	5

5. Kunwarpur Project

4.5.25 Kunwarpur Project is located in Lakhanpur block near Kunwarpur village in Surguja District of the state. The site is located on toposheet No. 64 M with longitude 83° 2'0" and latitude 22°58'5". The catchments area of the project reported to 44.85 sq km. The gross command area under the project is 6726.40 ha with annual irrigation potential 4250 ha for Kharif season, while no such estimation has been made for Rabi season.

4.5.26 Table 4.5.11 represents the performance made by the project during last 10 years separately for Kharif and Rabi seasons. The project fails even to meet quarter of the irrigation potential. During Kharif season, on an average 22% of the potential has been utilized, with least 11% during 1999-00 and a maximum 42% in the ongoing period of 2007-08. However, farmers also made use of the

irrigation water from the project for growing Rabi crops in the command area, intended to more demand for irrigation water. Recent measure has been taken though NREGS to maintenance the canal system to obtain the effectiveness in the system.

Table 4.5.11: Irrigation Area by Kunwarpur Project during 1998-2008

Year	Kharif	Rabi
1998-99	1500(35.29)	680
1999-00	500(11.76)	594
2000-01	884(20.80)	524
2001-02	660(15.53)	310
2002-03	800(18.82)	625
2003-04	530(12.47)	370
2004-05	920(21.65)	NA
2005-06	1000(23.53)	67
2006-07	868(20.42)	486
2007-08	1805(42.47)	NA

Note: Figures in parentheses indicate percentage utilisation of irrigation potential.

Source: office of Chief Enginee, Water resource deppt. No-1, Ambikapur

Reasons for Gap between Irrigation Potential and Utilization

(a) Decreased Efficiency of Project

4.5.27 The water discharge and efficiency of the project have gone down significantly. The average discharge of water during Kharif season has been 18 cusec (Table 4.5.12), a very little to actual discharge capacity. The same fate has been occurred during Rabi season too, where the average water discharge reported to a little 14 cusec. The declined efficiency of the project associated with many problems such as lack of maintenance, technical staff and financial provisions.

Table 4.5.12: Monthly Discharge of Water

Month	Year							
	2000	2001	2002	2003	2004	2005	2006	2007
Kharif								(Cusec)
June	--	--	--	--	--	--	--	--
July	17.7	15.9	17.5	22.2	24.00	17.00	20.3	21.53
August	13.6	21.00	13.3	23.5		21.00	40.5	38.8
September	26.9	17.9		21.7	3.5	28.5	7.4	10.2
October	21.9	11.00	9.5	15.3	7.00	20.00	11.7	9.18
Mean	20.03	16.45	13.43	20.68	11.50	21.63	19.98	19.93
Rabi								
November	7.5	11.9	8.00	13.7	5.6	13.3	7.5	12.3
December	15.6	23.6	17.9	21.7	19.3	12.00	13.5	18.3
Mean	11.55	17.75	12.95	17.7	12.45	12.65	10.5	15.3

(b) Lack of Distribution Canal

4.5.28 Table 4.5.13 reports only 16% of main canal distribution are pacci. It constrains efficiency of water flow through the canal system to reach a more than 23 km distance. Moreover, in the absence of regular maintenance of canal, the situation depicts more worsen. Due to reduction in the distribution efficiency, the water at the end of canal is not adequate.

Table 4.5.13: Status of Canal Distribution System

	Main Canal (pakki)	Minor (kacchi)
Purposed (km.)	23.3 km.	23.58 km.
Completed	3.7 km.	23.58 km.

(c) Lack of Budget for Maintenance

4.5.29 Lack of budget provision for maintenance of the project system limits to take advantage of potential irrigation utilization. The efficiency of reservoir and canal system goes down due to inadequate maintenance.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.5.5).

Chart 4.5.5: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Inadequate budget for proper maintenance	1
2.	Lack of proper distribution channels	2
3.	Lack of technical staff	3

6. Paralkot Project

4.5.30 The Paralkot project is incepted in 1966. The live storage capacity of the Dam is 63.69 M. cum while the gross storage lies to 66.30 M. cum. The site is located on toposheet No. 64 D/12 with longitude 80° 38'0" and latitude 20°08'0". The catchments area of the project reported to 146 sq km. The potential irrigated area (command area) at the time of inception of the project was 14575 ha, comprising 9717 ha of Kharif and 4858 ha of Rabi. However,

current potential irrigation area (command area) revised to a total 5805 ha, comprising 3195 ha of Kharif and 2610 ha of Rabi.

4.5.31 The irrigated area from the project during last 10 years separately in Kharif and Rabi seasons has been presented in Table 4.5.14. The overall performance over the years in Kharif season can be explained in two time segments. In first duration of segment (1997-05), a very dismal performance can be observed, as on an average about 50 percent potential had been utilized. In the last segment of years (2004-07), a full potential has been utilized; even beyond full potential (3200 ha against 3195 ha) during 2005-06.

Table 4.5.14: Irrigated Area (hectare) by the Paralkot Project during 2001-08

Year	Kharif	Rabi
1997-98	1858(58.15)	806(30.88)
1998-99	1542(48.26)	900(34.48)
1999-00	1542(48.26)	792(30.34)
2000-01	1482(46.38)	NA
2001-02	2126(66.54)	530(20.31)
2002-03	2738(85.70)	243(9.31)
2003-04	1700(53.21)	1313(50.31)
2004-05	1220(38.18)	1030(39.46)
2005-06	3200(100.16)	1800(68.97)
2006-07	3195(100.00)	2610(100)

Note: Figures in parentheses indicate percentage utilization of irrigation potential.
Source: Executive Eng., Water Resource Division, Kanker, (CG)

Reason to Gap between Irrigation Potential and Utilization

(a) Fluctuation in Water Availability

4.5.32 Consistency in availability of water over the year and season is a prime determinant of potential irrigation efficiency. The water discharge efficiency from the project over the year and by season is presented in Table 4.5.15. During last seven years (200-07), the average discharge of water from the project during Kharif has been 26 Mcum against designed discharge 63 Mcum. Thus the system is running at less than 50% efficiency level. The problem has further worsened in the months of Rabi season when the average monthly discharge of water has been 24 Mcum with hardly 38 percent efficiency level. The efficiency has been goes

down due to improper planning of storage to a significant amount of water along with inefficient distribution system and Irrigation scheduling may lead to maximize the gap between actual utilization of irrigation water and potential irrigation capacity.

Table 4.5.15: Fluctuation in Water Availability over the Years and by Seasons

Month	Year							
	2000	2001	2002	2003	2004	2005	2006	2007
Kharif								(Mcum)
April	17.13	6.05	9.23	3.99	25.05	5.56	21.48	6.80
May	4.21	3.06	1.64		10.30		7.55	
June	0.50				11.96		4.16	
July	0.53	13.23	2.78	1.82	7.64	2.64	4.14	5.56
August	30.51	33.63		22.70	7.35	17.91	34.52	15.42
September	36.57	63.55	21.18	59.85	48.57	45.32	63.55	43.69
October	37.73	34.00	30.29	57.55	48.30	63.55	63.55	55.65
November	22.42	41.80	15.31	63.55	36.52	59.85	47.99	46.2
Mean	18.70	27.90	13.41	34.91	24.46	32.47	30.87	28.89
Rabi								
December	16.74	32.31	13.54	61.19	33.40	56.28	44.27	41.00
January	47.43	14.14	26.07	11.79	52.85	25.20	18.03	35.60
February	36.52	11.79	21.38	9.23	46.67	17.99	39.09	24.68
March	32.07	8.24	16.35	6.36	38.82	14.66	29.85	16.22
April	17.13	6.05	9.23	3.99	25.03	5.56	21.48	6.80
Mean	29.98	14.51	17.31	18.51	39.35	23.94	30.54	24.86

Source: office of Chief Enginee, Water resource deppt. Kanker, Noth Baster, Kanker (CG).

(b) Lack of Budget for Maintenance

4.5.33 A progressive decline in budgetary provision over a period is a major concern for financial support to maintenance and new constructive interventions for efficiency development of the project. Table 4.5.16 below shows gradually decline in the sectioned amount over the years.

Table 4.5.16: Budget Provision made to Maintenance (2000-08)

Year	Demand	Sanction (Lakh)
2000-01	NA	--
2001-02	NA	24.00
2002-03	NA	48.00
2003-04	NA	41.50
2004-05	NA	36.00
2005-06	NA	31.54
2006-07	NA	19.65
2007-08	NA	28.71

Source: office of Chief Engineer, Water resource deptt. Kanker, Noth Baster, Kanker (CG).

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.5.6).

Chart 4.5.6: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Change in cropping pattern (crop diversification largely towards high value crops resulting in increased demand for irrigation water in the area)	4
2.	Insufficient availability of water due to inadequate rainfall	1
3.	Inadequate budget for maintenance	2
4.	Inadequate planning during water storage and inefficient distribution system/scheduling	3

Section 6: Analysis of Sample Irrigation Projects – Orissa

1. Hirakud Dam

4.6.1 Hirakud Dam Major Irrigation Project is located in Sambalpur district in western part of Orissa. The project was constructed in the year 1957. This is a large project having two main canals of 84.28km and 21.80 Km respectively, 2 nos sub-canals, 32 nos distributary and 141 nos minors. The project is extended over 698 nos villages. The initial potential irrigated area was fixed (at the time of

inception) as 1, 59,106.46 Ha in kharif and 96,345.08 Ha in Rabi. Subsequently this potential irrigated area is revised to 159,106.46 Ha in Kharif (unchanged) and 1, 10,092.48 Ha in Rabi. This additional potential was on account of conversion of unsuitable waste land to agricultural land and conversion of Govt. land into agricultural land. The irrigated area from the project during last 10 yrs both in Kharif and Rabi is illustrated in Table 4.6.1. It is seen that the project is covering 100 per cent potential area during Kharif. In Rabi, there is slight fluctuation. The gap in Rabi is almost nil except in 2 to 3 years during last 10 years and is above 90%. Similarly in some years the utilization is more than 100 per cent. The overall performance of the project on utilization is good and over 90% to 110% during last 10 yrs.

Table 4.6.1: Irrigated area by Hirakud Dam Project during 1997-98 to 2006-07

Year	Actual Irrigated Area (Ha)	
	Khariff	Rabi
1997-98	1,59,095.79 (100)	96887.26 (88)
1998-99	1,59,095.79 (100)	1,10,796.00 (100.63)
1999-2000	1,59,106.46 (100)	1,10,410.00 (100)
2000-2001	1,59,106.46 (100)	91,392.16 (83)
2001-2002	1,59,106.46 (100)	1,08,553.82 (98.6)
2002-2003	1,59,106.46 (100)	99589.11 (90.45)
2003-2004	1,59,106.46 (100)	1,03,724.71 (94.21)
2004-2005	1,59,106.46 (100)	1,16,187.94 (105.53)
2005-2006	1,59,106.46 (100)	1,20,723.32 (109.65)
2006-2007	1,59,106.46 (100)	1,21,359.53 (110.23)

Source: Office of the Executive Engineer, Sambalpur Irrigation Davison, Burla and Canal division, Bargarh.

Note: Figures in the parentheses indicates percent utilization of irrigation potential.

Suggestions:

4.6.2 Since the canal system has worked for more than 50 years, it has deteriorated and carries less water resulting shortage of water in tail end. Hence renovation of canal system is required.

2. Rushikulya Irrigation System

4.6.3 Rushikulya Irrigation System is situated in Ganjam district of Orissa and was constructed in pre-independence period in the year 1884. It is extended as a

network of irrigation system with numbers of diversion weirs, reservoirs and canals. There are two irrigation divisions under the jurisdiction of this project. Under the project there are 200 villages under Bhanjanagar division and 286 nos under Berhampur division, thus making total villages to 486 nos. The project has 14 nos distributors and 92 nos minors and subminors. The length of main canal of the project is as follows:

Gallery Canal = 10.34 Km

Girisola Canal = 31.00 Km

Mahanadi Canal = 30.50Km

Rushikulya Canal = 87.417Km.

4.6.4 The project was designed for a potential command area of 30,796Ha in Kharif at the time of inception. The potential for Rabi irrigation was nil. The project was initially started by constructing major diversion waives and anicuts e.g Gallery (Sarismuli) and Madhabarida Anicut across River Badanadi and Janivilly across River Rushikulya. Two reservoirs at Bhanjanagar and Sorada were built for supplementation during scarcity for irrigation for Kharif and Rabi crops. The basins of River Badanadi and Rushkulya have been linked by constructing two canals namely Gallery canal Ex-Gallery Anicut and Mahanadi canal Ex-Mahabarida Anicut. These two canals have some individual ayacut in Kharif only. In addition to above two canals certain other distribution canals have also been constructed during the period. However basing on growing public demand the canal system have been extended from time to time and the total command area (potential) has increased up to 61282 Ha.

4.6.5 Out of above, 1160 Ha of command area is reduced due to land acquisition by TATA for industrial purpose since 2000. Hence the present potential irrigated area is 60,122 Ha. For Rabi, the potential irrigated area is fixed at 500 Ha. The actual irrigated area of the project for last 10 years for Kharif and Rabi is illustrated in Table 4.6.2. From the figures, it reveals that the present utilization is Kharif is cent percent. Rabi irrigation was possible since the year 2003 for 200 Ha only and from 2004-06 it was increased to designed area of 500Ha. During 2007, this has increased to 1400Ha. Hence there is no gap between potential and actual utilization.

Table 4.6.2: Irrigated Area by the Rushikulya Irrigation Project during 1998-2007

Year	Actual Irrigated Area	
	Kharif	Rabi
1998	61282 (100)	--
1999	61282 (100)	----
2000	60122 (100)	----
2001	60122 (100)	----
2002	60122 (100)	----
2003	60122 (100)	200 (40%)
2004	60122 (100)	500 (100%)
2005	60122 (100)	500 (100%)
2006	60122 (100)	500 (100%)
2007	60122 (100)	1400 (280%)

Source: Office of the Chief Engineer & Basin Manager. Berhampur.

Note: Figures in parenthesis indicate percent utilization of irrigation potential.

4.6.6 The gap between irrigation potential and utilization is nil. The system is constructed in such a manner that each drop of water is utilized. Rotation system of irrigation is adopted as a result of which supply is made available in the system for entire period in Kharif. Even after improvement of the system under NWMP and SIFT component of WRCP, further scopes of improvement is there in order to improve irrigation efficiency.

Suggestions

4.6.7 To improve the system efficiency, it is highly essential to provide c.c.lining in main canal. Distributaries in patches and the minors, sub-minors, irrigation channels in entire length. By providing lining, system can be made fully functional.

3. Bahuda Medium Irrigation Project

4.6.8 Budha Medium Irrigation Project located in Ganjam Districts of Orissa, was constructed in the year 1968. At the time of inception the project was designed to irrigate 4221 Ha fully and 3114 Ha partially in Kharif. But subsequently after canal development, the irrigation potentially was revised to 6569 Ha in Kharif. Rabi potential was nil. The project caters to the need of people of 111 villages. There are 8 distributaries and 16 minors covering these villages. The project has two main canals. The right main canal is 16.12km long while left main canal is 18 km long. The actual irrigated area from the project during last 10 years in Kharif and Rabi is presented in Table 4.6.3 below. The figure shows that the project does not cater any irrigation during Rabi because of insufficient flow in River. During Kharif, the utilization is almost 100 percent except in years 1999, 2000 and 2001 with 2552 Ha, 4598 Ha and 4598 Ha, respectively.

Table 4.6.3: Irrigated Area by the Bahuda Irrigation Project during 1998-2007

Year	Actual Irrigated Area (Ha)	
	Khariff	Rabi
1998	6569 (100)	---
1999	2552 (38.85)	----
2000	1598 (67)	----
2001	4598 (67)	---
2002	6569 (100)	---
2003	6569 (100)	---
2004	6569 (100)	---
2005	6569 (100)	---
2006	6569 (100)	---
2007	6569 (100)	---

Source: Office of the Chief Engineer and Basin Manager, RVN Basin, Berhampur.

Note: Figures in parentheses indicate percent utilization of irrigation potential.

Reasons for gap between Irrigation and Utilization

4.6.9 Out of performance of last 10 yrs, except above mentioned three years, the utilization was 100%. During the three years during 1999 to 2001, the utilization fell down because of following reasons:

(a) In-sufficiency of Canal System

4.6.10 The canal system was not fully extended to properly distribute design discharge of 2.77 cumic in left canal side and 2.88 cumecs in right canal. The canal length was extended in 1999 and the utilization was improved and stabilized. Similarly the renovation of critical zones of the canal reaches have already taken and some patches are still in progress.

(b) Insufficient Rains

4.6.11 The mean average rainfall is 1202 mm and during those three years, the rainfall was less resulting in deficit inflow of water in the River. As a result discharge of water to canal system was less and the coverage of irrigation was less.

4. Pitamahal Irrigation Project

4.6.12 Pitamahal medium irrigation project is situated in Sundargarh District of Orissa and was constructed during the period 1969-1976. The project caters the need of 10 villages. There are two nos. distributaries with a total length of 19.55 Km. There are 15 minor and 4 sub-minors. At the time of inception the potential irrigated area was 2630 Ha in Kharif and 189 Ha in Rabi. Subsequently, it was

revised to 2654 Ha in Kharif and 776 Ha in Rabi. The irrigated area from the project since last 10 yrs both for Kharif and Rabi is given in Table 4.6.4. It is seen that the utilization is 100 per cent in Kharif every year. But in Rabi there is some fluctuation, particularly in 2004-05 and 2005-06. In other years the performance in Rabi was good.

Table 4.64: Irrigated Area by Pitamahal Irrigation Project during 1997-98 to 2006-07.

Year	Actual Irrigated Area (Ha)	
	Khariff	Rabi
1997-98	2654 (100)	450 (57.98)
1998-99	2654 (100)	600 (77.32)
1999-2000	2654 (100)	769 (99.09)
2000-2001	2654 (100)	520 (67.01)
2001-2002	2654 (100)	686.59 (88.47)
2002-2003	2654 (100)	469.45 (60.49)
2003-2004	2654 (100)	632.97 (81.56)
2004-2005	2654 (100)	81.10 (10.45)
2005-2006	2654 (100)	162.40 (20.92)
2006-2007	2654 (100)	775.86 (100)

Source: Office of the Executive Engineer (Irrigation), Sundargarh.

Note: Figures in parentheses indicate percent utilized of irrigation potential.

Reasons for Gap between Irrigation Potential & Utilization

4.6.13 The gap between irrigation potential and utilization is nil in Kharif since 1997-98. During Rabi, the coverage is fluctuating and in 2004-05 and 05-06 was 81Ha and 162Ha. This is because of less inflow of water in the river.

5. Ramiala Medium Irrigation Project

4.6.14 Ramiala medium irrigation project is situated in Angul District of Orissa and was constructed in the year 1985. Originally the project was designed to provide irrigation to 7325.56Ha in Kharif and 6000 Ha in Rabi. This potential Irrigated area was subsequently revised and reduced to a level of 6128.94Ha in Kharif because 1196.62 Ha of ayacut area was overlapped with another major irrigation project i.e., Rengali left bank canal which was constructed later. Similarly Rabi potential area was reduced drastically to 1831.07Ha. The actual irrigated area for last 10 years both in Kharif and Rabi is given below at Table 4.6.5. From the table it is revealed that the potential utilization in Kharif is in an average 60% over last 7-8 years and in Rabi it is 100% since last four years only. Thus the project is incapable of providing irrigation as per the designed command area.

Table 4.6.5: Irrigated Area by Ramiala Irrigation Project during 1997-98 to 2006-07.

Year	Actual Irrigated Area (Ha)			
	Khariff		Rabi	
1998	2534	(41)	1072.21	(58.5)
1999	2504	(41)	1423.33	(77.7)
2000	2488	(41)	1205.16	(65.8)
2001	3897	(63)	Nil	(0)
2002	3828.94	(62)	1497.21	(21.75)
2003	3808.04	(62)	963.39	(52.6)
2004	3778.07	(62)	1898.37	(103.66)
2005	3684.87	(60)	2185.33	(119.33)
2006	3557.87	(58)	1883	(102.83)
2007	3437.2	(56)	1831.07	(100)

Source: Office of the Executive Engineer, Angul Irrigation division.

Note: Figures in parentheses indicate percent utilization of irrigation potential.

Reasons for Gap between Irrigation Potential and Utilization

(a) Efficiency of Canal Carrying Capacity

4.6.15 It is said that the canal does not permit to carry the design discharge to the tail and large scale sliding in heavy cutting zone obstructing free flow of water. Further the irrigation official observed that the canal is mostly on laterite and morum base for which heavy percolation and seepage are observed. This has affected canal conveyance efficiency drastically.

(b) Cropping Pattern

4.6.16 Farmers of the ayacut have not yet adopted the formulated cropping pattern. Since they are adopting crops requiring more water, the crop coverage area is reducing. Farmers have now adopted sugarcane crop which is a high water requirement crop.

(c) Unauthorized Cropping Area in Upper End

4.6.17 Illegal agricultural land is created in the upper reach by converting forest land and unauthorized outlets were created on both sides of canal. This has reduced water flow to the tail end. At the same time this illegal coverage area is not reflected in the figure of irrigated area by the project.

(d) Damage in Distribution System

4.6.18 In some cases the canal is destroyed by the local people and encroached. The well and collar joint of canal siphons and cross drainage work at some places are tampered and damaged by people. In some places the shutters from the structure of the canal is stolen. It is not possible on the part of irrigation officials to guard all these things always. This poses a real threat to them to manage the irrigation activity and services. This is due to lack of time available to the existing staff for proper monitoring of distribution of water on one hand and their inability to control the dominant socio-political group of farmers on the other.

Suggestions

4.6.19 The following suggestions are made for reducing the gap between irrigation potential and utilization.

i. In seepage zones, canal should be lined with cement concrete. This will reduce the seepage loss considerably.
ii. The canal structure be repaired and reconstructed as per necessity.
iii. Re-sectioning of the canal is required to maintain designed velocity.
iv. Pani panchayat officials should be active enough to create awareness among people for guarding as well as for equitable distribution. They should be treated as legal entity to deal with miscreants who are damaging or tampering structures including theft.
v. Legal reformation and OFD (On Farm Development) may be done.

6. Sunei Medium Irrigation Project

4.6.20 Sunei medium irrigation project in Mayurbhanj District of Orissa was constructed in the year 1987 to provide irrigation facilities to tribal farmers of the district. The project initially was proposed to cover a command area of 7200 Ha in Kharif and 3960 Ha in Rabi. Subsequently the potential command area was increased to 9825Ha in Kharif and 5200Ha in Rabi due to extension of Berhampur distributary in the year 1990. The project was meant to cover 135 villages of Mayurbhanj and Balasore Districts. The length of the main canal is 23.57 Km. There are 71 sub-canals, 2 distributaries and 11 minors. The actual irrigated area for last 10 years in Kharif and Rabi separately is given below at Table 4.6.6. It is evident that about 6624 Ha of area is being utilized in Kharif every year except 20044, when it was 8100 Ha. Similarly in Rabi, against present irrigation potential of 5200 Ha, the actual irrigation since last 10 years is dismal. It is hardly 10—15% of present potential command area.

Table 4.6.6: Irrigated Area by Sunei Irrigation Project during 2000-2008

Year	Actual Irrigated Area (Ha)			
	Khariff		Rabi	
2000-01	6624.59	(67.4)	510.79	(9.8)
2001-02	6624.59	(67.4)	519.79	(100)
2002-03	6648.00	(67.5)	683.85	(13)
2003-04	6723.00	(68.42)	729.87	(14)
2004-05	8120.00	(82.64)	1075.85	(20.67)
2005-06	6624.59	(67.4)	1002.09	(19.27)
2006-07	6624.59	(67.4)	706.42	(13.57)
2007-08	6624.59	(67.4)	706.42	(13.57)

Source: Office of the Executive Engineer, Mayurbhanj irrigation Division, Baripada.

Note: Figures in Parentheses indicate percent utilization of irrigation potential.

Reasons for Gap between Irrigation Potential and Utilization

4.6.21 A detail discussion with officials of the project revealed the following key reasons for such poor performance of the project.

(a) Damage of Canal System

4.6.22 During the super cyclone occurred in Orissa in 1999, a portion of canal system in the tail of Patsanipur sub-minor was washed away completely depriving an area of 235 Ha land irrigation facility. Hence irrigation to these areas has been discontinued since then. Structures, especially the well type falls provided in the canals are damaged and huge quantity of water is wasted at upper end and making acute shortage of water at tail end areas. Most of the outlet structures are damaged by miscreants. Many farmers also make breaches in the minor officials are not to effectively monitor the distribution from head to tail because of lack of sub-minor system.

Suggestions:

4.6.22 The following suggestions are made for reducing the gap between irrigation potential and utilization:

i. Repair of damaged structures

ii. De-silting of minors and sub minors.

iii. Providing concrete guard walls in the curve portion of the canals which has been eroded heavily.

iv. Providing adequate fund for maintenance of all thee works.

Section 7: Analysis of Sample Irrigation Projects – Bihar

1. Eastern Kosi Project

4.7.1 Kosi barrage also called Bhimnagar barrage after the name of place where it was built between the year 1959 and 1963 straddles the Indo – Nepal border in Nepal. It is irrigation, flood control and hydropower generation project on the Kosi River built under a bilateral agreement between Nepal and India. The entire cost of the project was borne by India. Two main Canal, Eastern Canal and Western Canal taking off from the barrage had been designed for a discharge capacity of 455 cumecs to irrigate 612500 hectare and 210 cumecs to irrigate 356610 hectare, respectively. The system serves with 90.80 km main canal; 31.10 km length in Nepal portion and 56.70 km in India, respectively. For the present exercise, focus has been made on Birpur Division for deep study of system regarding potential crated and utilized.

4.7.2 Birpur Division system has been working with 41.3 km length of main canal, 6 numbers of sub canal, 27 numbers of distributaries and 76 numbers of minor. Total command area of the division is 425688 hectare area comprising 325526 hectare area in Kharif and 100162 hectare area in Rabi season, respectively. Last ten years actual irrigated area from the project has been presented in the Table 4.7.1 below. The figures in Table 4.7.1 show a dismal performance of system. On an average in Kahrif 17 % of potential has been utilized and in Rabi, this percentage is only 10 % of the created potential.

Table 4.7.1: Actual Irrigated Area during last 10 years

Year	Actual Irrigated Area in hectare			
	Kharif		Rabi	
1998-99	42307	(87)	20969	(79.06)
1999-00	46126	(85.83)	147	(99.85)
2000-01	61772	(81.02)	229	(99.77)
2001-02	81768	(74.88)	25203	(74.83)
2002-03	57617	(82.30)	1042	(98.95)
2003-04	48658	(85.05)	19458	(80.57)
2004-05	48834	(84.98)	Nil	
2005-06	54384	(83.29)	19199	(80.83)
2006-07	48976	(84.95)	20721	(79.31)
2007-08	50213	(84.57)	Nil	

Note: Figure in parentheses indicate percentage gap between potential and utilization

Reasons for Gap between Irrigation Potential and Utilization

4.7.3 There are numerous reasons which affect the performance of system. Some of the major issues are discussed as follows.

(a) Lack of Water Discharge

4.7.4 The ideal discharge of Eastern Kosi main canal is 15000 cusec but system doesn't get full discharge. Due to less discharge, water does not reach at the tail portion of system. Last four year head discharge in Kharif and Rabi season, separately has been presented in the Table 4.7.2 below. Figures clearly reveal on an average 80 % less water discharge in Kharif and 86 % less water discharge in Rabi season. This is a major cause of huge gap between irrigation potential and utilization.

Table 4.7.2: Monthly Water discharge (in cusec)

Month	Year			
Kharif	**2003**	**2004**	**2005**	**2006**
April	Nil	590.90 (96.06)	Nil	Nil
May	Nil	1338.70 (91.07)	Nil	Nil
June	2034.48 (86.43)	1001.66 (93.32)	2785.71 (81.42)	2176.47 (85.49)
July	3785.71 (74.76)	1000 (93.33)	5724 (61.84)	6847 (54.35)
August	5189.65 (65.40)	2303.66 (84.64)	8999.66 (40)	11629.33 (22.47)
September	9153.33 (38.97)	5456.33 (63.62)	90.46 (39.69)	9307.33 (37.95)
Rabi				
October	4344.33 (71.03)	4248.33 (71.67)	9482 (36.78)	4822 (67.85)
November	Nil	1500 (90)	3857 (74.28)	Nil
December	1111.11 (92.59)	Nil	2333.33 (84.44)	Nil
January	2064.51 (86.23)	2403.22 (83.97)	Nil	5169.33 (65.53)
February	2375 (84.16)	3629.62 (75.80)	Nil	7041.66 (53.05)
March	2533.33 (83.11)	4016 (73.22)	Nil	5000 (66.66)

Note: Figure in parentheses indicate percentage gap between ideal and actual water discharge.

(b) Distribution Constraints

4.7.5 Total command area of system was 425688 hectare at the time of inception. To cover all command area there is need for huge distribution network. Due to non maintenance, all distribution channels are in very bad condition. In Kosi system, siltage is a major problem and it demands regular de-silting operations. Though regular and sufficient budgetary provisions for maintenance of the system are there, irregular de-silting operations of the canal system are carried out. This is an important reason for not sufficient water flow in the canal system and water logging in some area. This leads to improper water distribution and under utilization of irrigation potential

(c) Lack of Staff

4.7.6 An irrigation potential and utilization consistency requires adequate supporting staff to maintenance and other construction development measures. Any reduce size of staff affects Irrigation Department functioning and efficiency of the whole project system. Table 4.7.3 clearly mentions that only 865 current working positions against to approved 1254 position resulting that system is working at 69 percent man power level. This is a major cause of low performance of system.

Table 4.7.3: Status of Staff Position

Total Sanctioned Post	Total Working Staff	Requirement
1254	865	389

(d) Political Influence

4.7.7 Political influence to illegal use to irrigation water and improper distribution of water has been reported in canal system. It limits to meet irrigation water need on equality basis and leads to injustice with several poor farmers. Lack of staff to supervise the water distribution system has made the situation much serious. It is observed that farmer of initial reach over draw irrigation water and do not allow the water to tail reach. This leads to reduction in irrigated area.

(e) Un-utilized Budget for Maintenance

4.7.8 The availability of funds for maintenance of the system is presented in Table 4.7.4 below. It is clear that sufficient fund were made available for maintenance of the system, but approximately 60 % of allotted fund has remained idle. According to officials, budget was received in the last financial year at a time when there was very short time for work. They could not use full money and work remained uncompleted.

Table 4.7.4: Fund Received and Expenditure Amount during last Four Years

Year	Allotment Amount (Lakh)	Expenditure Amount (Lakh)
2004-05	172.75	87.30 (50.5)
2005-06	220.6	75.75 (34.3)
2006-07	147.67	65.02 (44)
2007-08	127.74	50.05 (39.1)

Note: Figures in parentheses indicate percent utilization of allotment amount.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.7.1).

Chart 4.7.1: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Insufficient availability of water	1
2.	Low water carrying capacity of distribution channels due to silting	2
3.	Absence of proper field channels	3

2. Western Kosi Project

4.7.9 Kosi barrage also called Bhimnagar barrage after the name of place where it was built between the year 1959 and 1963 straddles the Indo – Nepal border in Nepal. It is irrigation, flood control and hydropower generation project on the Kosi River built under a bilateral agreement between Nepal and India. The entire cost of the project was borne by India. Two main Canal, Eastern Canal and Western Canal taking off from the barrage had been designed for a discharge capacity of 455 cumecs to irrigate 612500 hectare and 210 cumecs to irrigate 356610 hectare, respectively. The system serves with 90.80 km main canal; 31.10 km length in Nepal portion and 56.70 km in India, respectively. For the present exercise, focus has been made on Khutana Division for deep study of system regarding potential crated and utilized.

4.7.10 In the Khutana Division, system works with 12 distributaries, 42 minor and 52 sub minor. Total command area of this division is 14281 hectare. It was designed to cover 13766 hectare in Kharif and 515 hectare in Rabi, respectively. Last six years actual irrigated area from the system has been tabulated in Table

4.7.5, which shows a dismal performance of system. In Kharif season, its performance is average but in Rabi the performance is very poor Due to non availability of water in Rabi season, command area of Rabi is very less against Kharif.

Table 4.7.5: Actual Irrigated Area during last 6 Years

Year	Actual irrigated area hectare	
	Kharif	Rabi
2002-03	9462 (31.27)	143 (72.23)
2003-04	6817 (50.47)	184 (64.27)
2004-05	6960 (49.44)	Nil
2005-06	7070 (48.64)	240 (53.39)
2006-07	10180 (26.04)	345 (33)
2007-08	12030 (12.67)	Nil

Figure in parentheses indicate percentage gap between potential and utilization

Reasons for Gap between Irrigation Potential and Utilization

4.7.11 There are numerous reasons which affect the performance of system. Some of the major factors are discussed as follows.

(a) Lack of Water Availability at Head Point

4.7.12 The ideal discharge of Khutauna division main canal is 604 cusec, but system does not get full discharge of water. Due to less discharge water does not reach at the tail portion of the system. Last four year head discharge of water in Kharif season has been presented below in Table 4.7.6. It clearly indicates that in Kharif season on an average 25 percent less water has been received during last few years. This is a reason which creates a gap between irrigation potential and utilization.

Table 4.7.6: Monthly Discharge of Water (in cusec)

Month	(Year) 2004-05	2005-06	2006-07	2007-08
June	Nil	Nil	Nil	140 (76.82)
July	450 (25.50)	375 (37.91)	580 (3.97)	475 (21.36)
Aug	425 (29.64)	450 (25.50)	450 (25.50)	375 (37.91)
Sep	450 (25.50)	450 (25.50)	530 (12.25)	325 (46.19)
Oct	480 (20.53)	520 (13.91)	430 (28.81)	370 (38.74)

Note: Figure in parentheses indicate percentage gap between ideal and actual discharge of water.

(b) Lack of Distribution Channels

4.7.13 Total command area of the Khutauna division was 14281 hectare at the time of inception. In order to cover full command area, it was proposed to have12 distributaries, 42 minor and 52 sub minor. But out of them, only 9 distributaries, 34 minors and 42 sub minors have been completed (Table 4.7.7) resulting in approximately 20 percent lack in distribution network which is a major cause of gap between irrigation potential and utilization. Siltage is also a major problem of this system. The main canal is actually 16 feet deep but due to silt, it is hardly 9 feet deep now. Due to heavy siltage, canal does not flow with full capacity. Non maintenance is also a major cause and according to project officials, 40% distribution channels are in very bad shape.

Table 4.7.7: Status of Distribution Channels

Channels	Total	Complete	Incomplete
Distributaries	12	9	3
Minors	42	34	8
Sub Minors	52	42	10

(c) Lack of Staff

4.7.14 An irrigation potential and utilization consistency requires adequate supporting staff to maintenance and other construction development measures. Any reduce size of staff affects Irrigation Department functioning and efficiency of the whole project system. Table 4.7.8 clearly mentions that only 22 current working position against to approved 41 resulting in operation of the system at 50% man power level. This is a major cause of low performance of system.

Table 4.7.8: Status of Sanctioned and Working Staff

Staff	Sanctioned	Working	Requirement
J.E.	16	8	8
IV class Employee	25	14	11
Total	41	22	19

(d) Budget for Maintenance

4.7.15 The availability of funds for maintenance of the system is presented in Table 4.7.9 below. It is clear that sufficient fund were made available for maintenance of the system, but approximately 15 % of allotted fund has remained idle. According to officials, budget was received in the last financial year at a time

when there was very short time for work. They could not use full money and work remained uncompleted.

Table 4.7.9: Fund Received and Expenditure Amount during last Five Years

Year	Requirement	Allotment	Expenditure
2003-04	3785200	3785200	2044345
2004-05	4376500	4376500	3754300
2005-06	2686000	2686000	2375891
2006-07	2673920	2673920	2085939
2007-08	4634000	4634000	4361980

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.7.2).

Chart 4.7.2: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Insufficient availability of water	1
2.	Low water carrying capacity of distribution channels due to silting	3
3.	Non-completion of construction of field channels as per design	2

3. Orni Reservoir Scheme

4.7.16 Orni Reservoir is a medium irrigation scheme which was built in 1978 in Bhagalpur District of Bihar. The system has two main canals with length 40.42 km., one sub canal of 6 distributaries and 5 minor. Total command area of the project is 9717 hectare, out of which 6478 hectare was designed for Kharif and 3239 hectare for Rabi, separately. The irrigated area from project during last five year separately in Kharif and Rabi seasons has been presented in Table 4.7.10 below. The figures show a very dismal performance of system.

Table 4.7.10: Actual Irrigated Area during Last Five Years

Year	Actual Irrigated Area (in hectare)	
	Kharif	Rabi
2003-04	1076 (83.83)	414 (87.21)
2004-05	1119 (82.72)	521 (83.91)
2005-06	1043 (83.89)	545 (83.17)
2006-07	1044 (83.88)	547 (83.11)
2007-08	1623 (66.61)	630 (77.30)

Note: Figure in parentheses indicate percentage gap between irrigation potential and utilization

Reasons for Gap between Irrigation Potential and Utilization

4.7.17 There are numerous reasons which affect the performance of system. Some of the major reasons are discussed as follows:

(a) Distribution Constraints

4.7.18 Distribution channel is an important aspect of efficient water flow and proper distribution of irrigation water. System was designed to cover 9719 hectare area with two main canal, one sub canal, six distributaries and five minors. But only one distributary has been completed. Due to non availability of distributaries, system is not able to cover all command area. Main canal is also damaged due to heavy rains. Total length of main canal is 780 chains but water reaches up to 340 chains only because cross drainage constructed at 173 chains was damaged in 1995 due to heavy rainfall. It has not been repaired yet. As a result, even reservoir is full of water but water is not being released. Due to improper maintenance of system, there exists siltation of canal bed in several places. Earth work has not been completed.

(b) Inconsistency of Discharge

4.7.19 Monthly water discharge for the last eight year has been presented below in the Table 4.7.11. Figures show a dismal performance of system. It can be seen that on an average 20 percent potential has been utilized. This is a major cause of huge gap between irrigation potential and utilization

Table 4.7.11: Monthly Discharge of Water

Design discharge - 192 Cusec

(in cusec)

Month	2000	2001	2002	2003	2004	2005	2006	2007
Kharif								
June	27.39 (85.73)	18.30 (90.47)	24.52 (87.73)	28.23 (85.30)	15.23 (92.07)	20.48 (89.33)	10.32 (94.63)	15.33 (92.02)
July	20.98 (89.07)	25.22 (86.86)	20.92 (89.10)	10.55 (94.51)	20.60 (89.27)	27.36 (85.75)	10.48 (94.54)	22.42 (88.32)
Aug	52.35 (72.73)	32.48 (83.08)	32.98 (82.82)	30.52 (84.10)	50.98 (73.45)	35.78 (81.36)	20.56 (89.29)	35.60 (81.46)
Sep	47.67 (75.17)	63.28 (87.04)	25.05 (86.95)	45.60 (76.25)	50.98 (73.45)	45.92 (76.08)	40.36 (78.98)	50.48 (73.71)
Rabi								
Oct	18.34 (90.54)	25.56 (86.69)	20.26 (89.45)	50.84 (73.52)	45.73 (76.18)	45.08 (76.52)	40.69 (78.81)	30.24 (84.25)
Nov	22.40 (88.33)	18.56 (90.33)	30.05 (84.35)	45.50 (76.30)	42.15 (78.05)	62.56 (67.42)	45.75 (76.17)	32.33 (83.16)
Dec	24.25 (87.37)	25.05 (86.95)	22.60 (88.23)	38.36 (80.02)	30.65 (84.04)	52.52 (72.65)	40.15 (79.09)	30.25 (84.24)
Jan	19.20 (90.00)	20.65 (89.24)	28.33 (85.24)	40.26 (79.03)	28.33 (85.24)	55.05 (71.33)	50.66 (73.61)	35.45 (81.54)
Feb	25.50 (86.72)	24.86 (87.05)	25.00 (86.98)	35.69 (81.41)	40.44 (78.94)	36.66 (80.91)	35.25 (81.64)	22.24 (88.42)
March	-	-	-	-	-	-	-	-

Note: (-) stands for data not available

Figure in parentheses indicate percentage gap between ideal and actual water discharge.

(c) Lack of Staff

4.7.20 A high irrigation potential and utilization consistency requires adequate supporting staff to maintenance and other constructive development measures. Any reduced size of staff including field and technical staff affect the functioning and efficiency of the whole system. The sanction number of post and actual working staff are presented in Table 4.7.12 below. The data show that there is major shortage of staff (approximately 50%) in the system.

Table 4.7.12: Status of Sanctioned and Working Staff

Staff	Sanctioned	Working	Requirement
Total	96	46	50

(d) Inadequate Rainfall

4.7.21 The rainfall of this area is erratic and inadequate as a result of which the water storage capacity of the project is not utilized. Table 4.7.13 indicates that in the year 2007, the actual rainfall was about 30 percent less than average ideal rainfall in the area.

Table 4.7.13: Actual Rainfall during Last Nine Years

(in mm)

Year	Average Ideal rainfall	Yearly Average Rainfall
1999	969.70	879.80 (9.27)
2000	969.70	623.70 (35.68)
2001	969.70	226.80 (76.61)
2002	969.70	1133.80
2003	969.70	1043.40
2004	969.70	1016.10
2005	969.70	368.50 (62.00)
2006	969.70	1016.00
2007	969.70	675.20 (30.37)

Note: Figures In Parentheses indicate percent gap of required rainfall

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.7.3).

Chart 4.7.3: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Insufficient availability of water	1
2.	Non-maintenance of canals	3
3.	Non-completion of construction of field channels as per design	2

4. Khadagpur Lake Scheme

4.7.22 Kharagpur lake scheme is located in Khadagpur District of the State Bihar. It was classified as medium project constructed by Raja Darbhanga in 1876. It was rehabilitated in 1954 by State Government of Bihar and this system was developed to provide irrigation water in 8451 hectare area, comprising of 5851 hectare area in Kharif season and 2600 hectare area in Rabi season, respectively in 50 villages. The system covers all command area by two main canals, five distributaries and two minors. The irrigated area from the project during last five years separately in Kharif and Rabi seasons has been presented in Table 4.7.14 below. The gap between irrigation potential and utilization is of about 15 percent both in Kharif and Rabi seasons.

Table 4.7.14: Actual Irrigated Area during Last Five Years

Year	Actual Irrigated Area (in Hectare)	
	Kharif	Rabi
2003-04	4584 (21.65)	2495 (4.04)
2004-05	4790 (18.13)	2350 (9.62)
2005-06	4975 (14.98)	2270 (12.69)
2006-07	4810 (17.92)	2215 (14.81)
2007-08	4875 (16.68)	2215 (14.15)

Note: Figure in parentheses indicate percentage gap between irrigation potential and utilization

Reasons for Gap between Irrigation Potential and Utilization

4.7.23 There are numerous reasons which affect the performance of system. Some of major issues are discussed as follows:

(a) Fluctuation of Water

4.7.24 Consistency in availability of water over the years and across the season is a prime determinant of potential irrigation efficiency. The water discharge efficiency from both main canals of the project over the year and by season is presented in Table 4.7.15 below. The table clearly shows that water discharge is very low in Rabi. During Kharif, it is some better but overall water discharge of both the canals is very less.. The system is running at less than 70% efficiency level.

Table 4.7.15: Monthly Water Discharge

South Main Canal Design discharge -106 cusec
North Main Canal Design discharge - 96 cusec

Month	2003-04		2004-05		2005-06		2006-07		2007-08	
Kharif	**South**	**North**	**South**	**North**	**South**	**North**	**South**	**North**	**South**	**North**
April	-	-	-	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-	-	-	-
July	-	-	31.75 (70.05)	22.25 (76.82)	06.77 (93.61)	08.77 (90.86)	14.12 (86.68)	12.96 (82.50)	16.32 (90.60)	07.93 (87.74)
Aug	70.06 (33.91)	45.87 (52.22)	67.74 (36.09)	90.64 (5.58)	44.32 (58.19)	43.87 (54.30)	75.87 (28.42)	54.19 (39.55)	28.64 (78.98)	29.03 (65.76)
Sep	94.66 (10.70)	67.46 (29.73)	32.26 (69.57)	44.73 (53.41)	69.00 (34.91)	37.20 (61.25)	45.40 (57.17)	31.20 (63.50)	41.26 (67.08)	31.13 (63.57)
Rabi										
Oct	54.96 (48.15)	41.93 (56.32)	49.83 (52.99)	41.29 (56.99)	73.93 (30.25)	54.38 (43.35)	43.35 (59.10)	25.16 (69.79)	69.48 (40.45)	33.87 (60.72)
Nov	-	03.20 (96.67)	03.16 (97.02)	03.33 (96.53)	17.80 (83.21)	14.20 (85.21)	10.83 (89.78)	16.83 (78.74)	09.83 (96.73)	15.83 (29.51)
Dec	15.09 (85.76)	05.41 (94.36)	16.93 (84.03)	07.25 (92.45)	08.32 (92.15)	08.32 (91.33)	10.48 (90.11)	09.61 (85.49)	10.48 (96.11)	10.48 (85.08)
Jan	16.45 (84.48)	23.22 (75.81)	16.06 (84.85)	21.77 (77.32)	40.45 (61.84)	27.09 (71.78)	20.80 (80.38)	25.32 (69.63)	23.54 (83.79)	27.74 (67.10)
Feb	28.67 (72.95)	12.14 (87.35)	28.39 (73.22)	19.64 (79.54)	30.78 (70.96)	22.50 (76.56)	16.96 (84.00)	21.60 (73.50)	08.92 (97.58)	25.89 (69.03)
March	33.74 (68.17)	10.38 (89.19)	10.48 (90.11)	12.90 (86.56)	06.29 (94.07)	09.87 (89.72)	07.25 (93.16)	10.80 (84.75)	08.87 (97.63)	13.06 (82.40)

Note: Figures In Parentheses indicate percent of required water discharge.

(b) Water Availability

4.7.25 The availability of water in the system during the last six years has been presented in Table 4.7.16 below. Figures show that on an average there is 10 % less water storage against 13380 acre Feet full water capacity.

Table 4.7.16: Actual Availability of Water

Year	Capacity (Acre Feet)	Availability (Acre Feet)
2003-04	13380	12150 (9.19)
2004-05	13380	10780 (19.43)
2005-06	13380	12670 (5.31)
2006-07	13380	11825 (11.62)
2007-08	13380	13350 (0.22)

Note: Figures in parentheses represent percent gap from full water capacity

(c) Distribution Constraints

4.7.26 Improper and non maintenance of canal system in past years has lead to its deterioration and inefficient performance, which consequently resulted in less or nil irrigation to area situated at tail. There is lot of silt in the canal. With water logging in some areas also leads to improper water distribution and under utilization of irrigation potential.

(d) Lack of Rainfall

4.7.27 The rainfall during last six year has been presented in the Table 4.7.17. It shows a dismal behavior of nature of rainfall. During last six years, rainfall is less to assume average rainfall of 990.20 mm. Due to erratic and inadequate rainfall, water storage capacity of the project is not fully utilized. This generates a gap between actual irrigation and potential utilized in the command area.

Table 4.7.17: Annual Rainfall during Last Five Years

Year	Actual Rainfall
2003-04	488.80 (50.64)
2004-05	940.30 (05.04)
2005-06	825.60 (16.62)
2006-07	625.0 (36.88)
2007-08	547.30 (44.73)

Note: Figures in parentheses indicate gap between actual rainfall and assumed rainfall

(e) Lack of Staff

4.7.28 A high irrigation potential and utilization consistency requires adequate supporting staff to maintenance and other constructive development measures. Any reduced size of staff including field and technical staff affect the functioning and efficiency of the whole system. The sanction number of post and actual working staff are presented in Table 4.7.18 below. The data show that there is major shortage of staff (approximately 70%) in the system.

Table 4.7.18: Status of Sanctioned and Working Staff

Staff	Sanctioned	Working	Requirement
Total	31	9	22

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.7.4).

Chart 4.7.4: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Insufficient availability of water	1
2.	Non-maintenance of canals	2

5. Sone Canal System (Dehari Zone)

4.7.29 The Sone project is a river diversion scheme built on River Sone in State of Bihar. Sone irrigation system is the oldest (more then 120 years old) irrigation system in country. The River is a tributary of the Ganga. The project irrigates about 400000 hectare during the mansoon (Kharif season) and 210000 during the winter (Rabi season). Agriculture is the main occupation of people of Bihar. Cultivation is practiced in the two cropping season i.e. Rabi and Kharif in its net cultivated area. Paddy is the main crop grown in the area in Kharif season. The irrigation system has been operated since 1876. Sone irrigation system was developed to provide irrigation water to 612783 hectare area, out of which 399015 hectare area was proposed in Kharif and 213768 hectare in Rabi, respectively. The canal network consists of two main canals; each main canal has a network of several branch canals, distributaries and minors. Actual irrigated area has been presented in the Table 4.7.19. The data clearly shows inconsistent performance of the system during last nine years.

Table 4.7.19: Actual Irrigated Area since 1999-2000

Year	Actual Irrigated Area (hectare)	
	Kharif	Rabi
1999-2000	336885 (15.6)	104063 (51.3)
2000-2001	349675 (12.4)	195354 (08.6)
2001-2002	371472 (06.9)	196883 (07.9)
2002-2003	352097 (11.8)	196952 (07.9)
2003-2004	359168 (10.0)	204149 (04.5)
2004-2005	346336 (13.2)	176263 (17.5)
2005-2006	374554 (06.2)	193207 (09.6)
2006-2007	374382 (06.2)	206884 (03.2)
2007-2008	379065 (05.0)	Nil

Figure in parentheses indicate percentage gap between potential and utilization

Reasons for Gap between Irrigation Potential and Utilization

4.7.30 There are numerous reasons which affect the performance of system. Some of major issues are discussed as follows.

(a) Lack of Water Availability

4.7.31 The ideal discharge of western link canal is 9800 cusec. But the system does not get full discharge due to less discharge of water from the main canal. Water does not reach at the tail portion of the system. Last five year head discharge of Kharif and Rabi season has been presented separately in the Table 4.7.20. This clearly shows the inconsistent discharge of main canal. This inconsistent in discharge create gap between potential and utilization.

Table 4.7.20: Monthly Actual water Discharge in Cusec

Month	Year				
Kharif	**2004**	**2005**	**2006**	**2007**	**2008**
April	1852.66 (81.9)	2153 (78.03)	876.9 (91.05)	1000(91.05)	NA
May	3883.25 (60.37)	3712.91 (62.11)	1959.46 (80.00)	3008.9(69.29)	NA
June	6350(35.20)	5339.73 (45.5)	5518.8 (43.48)	3819.63(61.02)	NA
July	8947.35 (8.70)	8981.77 (8.33)	2197.02 (24.45)	9760(0.40)	NA
August	9660.64 (1.42)	9411.25 (3.96)	9211.5 (6.00)	3990.3(15.30)	NA
September	9798 (0.02)	9220.96 (5.90)	8365.83 (14.63)	3914.8(9.2)	NA

Rabi	2004	2005	2006	2007	2008
October	8977.16 (8.39)	8831.6 (9.88)	9282.8 (5.27)	9225(5.86)	NA
November	5428.6 (44.60)	5205 (46.87)	4592.86 (53.13)	7212.2(26.40)	NA
December	2645.4 (73.00)	3243.11 (66.90)	3810.52 (61.11)	3348.5(65.80)	NA
January	6156.90 (37.17)	2553.83 (73.94)	5928.6 (39.50)	7094.2(27.60)	6062.5(38.13)
February	5674.27 (42.09)	2418 (75.32)	5530.87 (43.5)	4609.2(52.90)	4001.3(59.17)
March	5678.41 (42.05)	3143.7 (67.92)	4754.7 (51.48)	2232.86(77.20)	5745.4(41.37)

Note: Figures In Parentheses indicate percent of required water discharge.

(b) Distribution Constraints

4.7.32 The canals of Sone canal system is about 120 year old and due to insufficient maintenance, canals have been damaged, and are not able to carry full discharge of water .They are flowing with thirty percent of less water of their capacity . This percentage is increasing with the time. The other reason is the head reach farmers cut the canal and take water many times and they do not allow water to go at the tail portion. This problem creates water crisis at the tail portion. The tail area is always subject to delayed and less amount of water supply. The gulls (outlet) of canal are almost not in working position.

(c) Lack of Budget

4.7.33 The availability of fund for maintenance of the system is presented in the Table 4.7.21 below. It is clear that available funds are very less in comparison of requirement of funds for proper maintenance of the system. On an average it was 28 % less in last two years. All distribution networks need maintenance at regular interval. It is not possible due to lack of fund for maintenance purpose.

Table 4.7.21: Status of Maintenance Fund

Year	Demand (Rs. Lakh)	Allotment (Rs. Lakh)
2005-2006	193.23	122.14
2006-2007	170.93	104.92

(d) Lack of Staff

4.7.34 A high irrigation potential and utilization consistency requires adequate supporting staff to maintenance and other constructive development measures. Any reduced size of staff including field and technical staff affect the functioning and efficiency of the whole system. The sanction number of post and actual

working staff are presented in Table 4.7.22 below. The data show that there is major shortage of staff (approximately 32%) in the system.

Table 4.7.22: Status of Sanctioned and Working Staff

Sanctioned Post	Working Staff	Requirement
676	402	274

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.7.5).

Chart 4.7.5: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Reason for Gap Between IPC and IPU	Rank
1.	Insufficient availability of water	1
2.	Non-maintenance of canals	2
3.	Broken field channels	3

Section 8: Analysis of Selected Sample Irrigation Projects – Jharkhand

1. Kanchi Irrigation Scheme (Subarnarekha River Basin)

4.8.1 The Kanchi Irrigatron Project was formulated during the second five year plan (1956-61), taken up in 1958 and completed in 1966 at a cost of Rs. 152 lakhs. This is the only major irrigation project in Jharkhand. This project provided a diversion weir with its allied head work in the river Kanchi near village Churki, Aradih in Ranchi district and a network of canal system spread over in Tamar, Sonahatu, Arki and Ichagarh blocks of Ranchi and Saraikela district in the state of Jharkhand. It covers 125 villages. The length of the main canal is 18.29 km with 4 sub-canals, 26 distributaries and 11 minor canals. The main canal was originally designed to take 480 cusecs of water.

4.8.2 As per project provision, Gross Command Area (GCA) of the scheme is 34210 ha and designed to cover a culturable command area (CCA) 17105 ha with 106.5% irrigation intensity. The project annual irrigation was of the order of 18633 ha (16000 ha of Kharif and 2833 ha of Rabi) irrigation from the project started from 1966-67. However, the actual irrigated area during the last few years are as in Table 4.8.1.

Table 4.8.1: Actual Irrigated Area under Kanchi Irrigation Scheme

Year	Actual Irrigated Area (Ha)	
	Kharif	Rabi
2000-01	12965	-
2001-02	13560	-
2002-03	14950	-
2003-04	14950	11
2004-05	14960	10
2005-06	11310	-
2006-07	12085	-
2007-08	4900	-

Source: The Executive Engineer, Irrigation Division, Bunde, Ranchi

Reasons for Gap between Irrigation Potential and Utilization

4.8.3 The main reasons for large gap between irrigation potential and utilization are: lack of command area development programme in Kanchi command, siltation in the bed of canal, insufficient fund for maintenance of the system, damage of weir crest and less number of staffs compared to the sanctioned staff strength.

(a) Lack of Command Area Development

4.8.4 The command area development programme has not yet taken off in the Kanchi command. In order to improve efficient and optimum utilization of this is very much required on urgent basis. At the same time re-sectioning of canal network is required so that the irrigation facilities are equally available to the beneficiaries of head reach, middle reach and tail reach. The strategy may be chalked out in such a way that the necessary planning, survey and designing of structural components under on-field-development (OFD) works could be taken up on priority basis. Some of the major components of OFD works are as listed below:

i. Resectioning of canal works to restore the canal efficiency up to water courses.

ii. Development of field channels and field drain.

iii. Land leveling

iv. Re-alignment of field boundaries.

v. Enforcement of a proper system of Warabandi and fair distribution of water to individual field.

vi. Strengthening of extension services.

vii. Selection and introduction of suitable cropping pattern.

viii. Development of ground water to supplement surface irrigation.

(b) Insufficient Capacity of Distributaries and Minors

4.8.5 The main canal was originally designed to take 480 cusecs of water. The length and discharge capacity of main and branch canals are presented in Table 4.8.2.

Table 4.8.2: Length and Discharge Capacity of Main and Branch Canals

Name of Canal	Length (km.)	Discharge (cusecs)
Main Canal	18.29	480
Baranda Branch Canal	28.29	390
Adradih Branch Canal	26.13	225
Tamar Branch Canal	13.26	59
Ichagarh Branch Canal	28.72	82

4.8.6 However, the present capacity of existing distributaries/ minor/ water course is insufficient with parent canal / branch canal to take the full design discharge. The present peak requirement of different minor canals and their present average capacity (based on 5 years data during 1999 to 2003) are indicated in Table 4.8.3. It can be seen that the sum of total designed discharge capacity of minor/distributaries is much less than the capacity of the parent canal. For example, although the discharge capacity of Tamar branch canal is 59 cusecs, the total designed capacity of all the distributaries/ minors for which Tamar branch is the parent canal (i.e., distributaries/ minor no. 9 to 12) is 38.14 cusecs only.

Table 4.8.3: Present Capacity of Minor and Distributaries

S No	Name of Minors/Distributaries	Designed		Achievement		Intensity of irrigation (%)	Name of parent canal
		Discharge in cusecs	Culturable command area (ha)	Discharged	Irrigated area in ha		
1	Jojhatu Minor	2.60	89.6	2.50	80	89.3	Kanchi main
2	Gurubera Minor	2.00	64	1.88	60	93.75	Kanchi main
3	Ganjhari Minor	1.50	48	1.47	47	97.9	Kanchi main
4	Belalong Minor	1.50	48	1.25	40	83.3	Kanchi main
5	Jojohatu Minor	5.00	160	4.31	138	86.25	Kanchi main
6	Balalong Minor	5.00	160	4.44	142	88.75	Kanchi main
7	Murpa Minor	4.00	128	3.50	112	87.5	Kanchi main
8	Saragia Minor	2.20	70	1.81	58	82.85	Kanchi main
9	Nawadih Distributary	10.39	332	10.13	324	97.59	Tamar branch
10	Arnlesha Distributary	12.62	404	9.63	308	76.24	Tamar branch
11	Konkadih Distributary	7.13	228	6.84	219	96.05	Tamar branch
12	Buba Kundi	8.00	256	6.94	222	86.72	Tamar branch
13	Peraidih Minor	11.50	368	9.90	317	86.14	Baranda branch
14	Dimbujarda Minor	13.75	440	11.50	368	83.64	Baranda branch
15	Dimbudih Distributary	8.50	272	5.90	189	69.48	Baranda branch
16	Ulibohar Distributary	3.60	115	3.31	106	92.17	Baranda branch
17	Sosodih Distributary	11.20	358	5.96	191	53.35	Baranda branch
18	Landupdih distributory	19.00	608	11.69	374	61.51	Baranda branch
19	Karmadil Minor	4.00	128	3.28	105	82.00	Baranda branch
20	Kutidih Distributary	16.05	514	14.28	457	88.91	Baranda branch
21	Pandadih Distributary	19.00	608	8.15	261	42.93	Baranda branch
22	Garadih Distributary	27.85	891	2.15	69	7.74	Baranda branch
22	Dhanvadin Distrihutory	16	512.00	11	35.20	68.75	Adradih canal
24	Hesadih Distributary	22.00	704	10.59	339	48.15	Adradih canal

(c) Problems with Irrigation Structures

4.8.7 Existing Section of left and right-bank of different canal and the different reaches at many places the top level of bank is 0.6 M to 0.75 M lower than the design formation level. Existing bed of canal also reveals considerable siltation of the bed in several reaches, especially in distributaries and near tail end of canal. At canal reaches in the filling portion it is evident that a many places earth from the side slope of the bank has slipped down or there are heavy rain cuts. This has reduced the necessary soil cover over the hydraulic gradient also. Whenever discharge at the head of canal exceeds 11.30 cumecs against the design discharge of 13.62 cumecs, somewhere or the other it tends to over top its bank.

4.8.8 To effectively control and manage the water distribution, 3 numbers of C/R, 91 numbers of head regulator and 3 numbers of escape were constructed but

at present only 3 head regulators: one in Tamar branch canal, one in Adradih branch canal and another at Ichargarh branch canal are under operation. Remaining ones are completely damaged and cannot be in operation. Besides head regulator, rolls and bridge, proper discharge measuring device through branch canal and its distributaries are not there. Lack of this vital information reduces the scope of proper water management by employing rotational irrigation system.

(d) Other Causes of Deficiencies in the Supplies

4.8.9 Main canal and branch canals of Kanchi weir scheme were modernized in the year 1987- 1989 and thus about 20 years have passed since its modernization and 32 years have passed since completion of the scheme. All the canals under this scheme are unlined *kutcha* canals except the main canal, which has been lined in heavy filling reaches. Hence lots of repair work is involved after every rainy season to up keep the canal in good condition. But with the little maintenance and repair fund received against this scheme, repair and maintenance of the canal every year has become very difficult. This has resulted in silting of canal sections in filling portion. The banks have also settled down and eroded away, leaving short sections due to which the canal section has become insufficient to carry designed full discharge.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.8.1).

Chart 4.8.1: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Factor	Rank
1	Lack of Command Area Development	1
2	Insufficient capacity of distributaries and minors	6
3	Broken canal structures at several places	2
4	Seepage from unlined minor canals	4
5	Lack of sufficient fund availability for repair and maintenance	3
6	Siltation in canal beds	5

Suggestions

4.8.10 All the problems mentioned earlier should be targeted for better distribution and water management of canal water. Entire watercourses and distributaries with their structures should be renovated. The traditional concept and conviction are in favour of water adequacy for farmers. Farmers should be motivated to get involved and seek their participation for promoting economy in water use and preservation of distribution system.

2. Latratu Reservoir Scheme (South Koel River Basin)

4.8.11 Latratu Reservoir Scheme is situated in the village Latratu and Dumargerhi under Lapung and Karra at a distance of km from Ranchi on Ranch Lodhma Dumargerhi Road. The village Lodhma is situated at a distance of about 40 km from Ranchi. Head work site is 16 km from Lodhma village connected by project road. The lengths of left and right main canals are 21.50 km and 20.19 km respectively. There are 9 minor canals on the left main canal and 7 on right main canal. The irrigation potential of kharif and rabi are 5161 ha and 2580 ha respectively. As per the original project report the GCA of the scheme is 9837 ha, out of which 7377 ha is CCA.

4.8.12 As against the 5161 ha potential irrigated area in kharif and 2580 ha in rabi season, the actual irrigated area over the years is much less in the scheme. In fact, the targeted area for providing irrigation is much less than the actual potential and actual achievement is even further low. The targeted and actual irrigated are during kharif and rabi seasons during the last ten years are given in Table 4.8.4.

Table 4.8.4: Targeted and Actual Irrigated Area under the Latratu Reservoir Scheme

Year	Kharif (Ha)		Rabi (Ha)	
	Target	Achievement	Target	Achievement
1996-1997	2500	1375	-	-
1997-1998	3500	1800	1500	600
1998-1999	3500	3094	700	241
1999-2000	3405	2958	900	350
2000-2001	3250	3140	600	600
2001-2002	3500	2900	600	500
2002-2003	4000	1470	600	396
2003-2004	4000	1355	1000	498
2004-2005	4000	1173	1000	550
2005-2006	4000	1289	-	491.58

Source: Office of the Executive Engineer, Ranchi Division

Reasons for Gap between Irrigation Potential and Utilization

4.8.13 Based on questionnaire survey and detailed discussion with different stakeholders, the main reasons for not achieving the full potential in this scheme are damage of canal structures, canal bank, canal outlets, minor, water course and partially due to accumulation of silt in canal bed.

(a) Problem in Canal Structures

4.8.14 The scheme has become old, which was executed about 20 years earlier. There are several problems in the canal and canal structures, which require complete restoration work for achieving the full created potential. A list of existing problems in this canal structure is given below whose restoration is very much essential for narrowing the gap between the created irrigation potential and actually utilized:

i. Restoration of the failed main structure (aqueduct) at chainage 423.8 in left main canal.
ii. Need for repairing of left and right outlet tunnels with trash arch and operation chamber.
iii. Complete replacement of outlet gates (mechanical) is required.
iv. Repairing of still-in-basin in left main canal is needed.
v. There is heavy leakage in conduits (barrel) at Ch. 16 to 21 in left main canal. This should be properly examined and repaired.
vi. Aquaduct at ch. 423 of left main canal has collapsed.
vii. Aquaduct at ch. 326 of right main canal is damaged and leaking.
viii. Thorough repair of escape and its C.D. at Ch. 11 of Right Main Canal.
ix. Desilting of canal (main and distributaries) in cutting zone with providing term and providing pitching at vulnerable points.
x. E/W in filling in canal (main and distributaries) in filling zone. Provision of lining in heavy filling zone.
xi. Repair of almost all fully and partly damaged structures of both the main canal and distributaries.
xii. Repair of rain cuts, slope drain etc. in D/S of dam. Top surface of dam to be repaired with repair of Rip-Rap in U/S as well.

(b) Other Problems

4.8.15 There is heavy siltation in heavy cutting zone. According to the project office, although there is regular budget provision each year for the maintenance of the irrigation system, the budget provision is quite insufficient for the job. There is also lack of sufficient number of staffs as per the sanctioned strength. In many villages farmers have also switched over to mono cropping.

4.8.16 In 830 ha of land (695 under left main canal and 135 ha under right main canal), irrigation utilization has been discontinued over time due to several reasons such as: weak canal bank, siltation of canal, damage of the irrigation structures, leakage of aquaduct at ch. 242 in left main canal and heavy siltation between ch 252 to ch 295. The condition of minors and water courses is even worse than the main canal.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.8.2).

Chart 4.8.2: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Factor	Rank
1	Severe problem in canal structures at several places	1
2	Siltation of canal beds	3
3	Lack of sufficient fund availability for repair and maintenance	2
4	Lack of sufficient number of staffs	4

3. Malay Reservoir Project (North Koel River Basin)

4.8.17 Malay Reservoir Scheme is situated at Palamu district in Jharkhand. The irrigation potential created through this project during kharif and rabi seasons are 7860 ha and 400 ha respectively. The designated peak discharge of this project is 29400 cusecs. The length of the main canal is 1400 ch., length of branch canal is 1054 ch. and length of distributaries is 1455 ch. (44.35 km).

4.8.18 As against the designated potential irrigated area in kharif and rabi seasons, the actual irrigated area over the years was much less during 2004-05 and 2005-06 due to lack of water. However, the situation has improved during the years 2006-07 and 2007-08 in which actual irrigated area was as high as 75 percent and 57 percent of the designated irrigation potential area under the scheme. The targeted and actual irrigated are during kharif and rabi seasons during the last ten years are given in Table 4.8.5.

Table 4.8.5: Target and Actual Irrigated Area under Malay Reservoir Scheme

Year	Kharif (Ha)		Rabi (Ha)	
	Target	Achievement	Target	Achievement
1998-1999	-	2825	-	-
1999-2000	-	2838	-	483
2000-2001	-	2395	-	256
2001-2002	-	3197	-	-
2002-2003	-	2424	-	-
2003-2004	5410	2792	-	-
2004-2005	9000	345	-	-
2005-2006	9000	1500	-	-
2006-2007	8000	5870	400	200
2007-2008	7750	4450	400	200

Source: Office of the Executive Engineer, Ranchi Division

Reasons for Gap between Irrigation Potential and Utilization

4.8.19 Based on interaction with different stakeholders, the main reasons for not achieving the full potential in this scheme are siltation of the canal, heavy seepage from unlined portion of canal, lack of proper field channels and lack of sufficient budget for maintenance of the canal system.

(a) Problem in Canal Water Flow

4.8.20 Although the length of the main canal is ch. 1400, at present water flow in main canal is only about 130 cusecs from ch. 0.00 to ch. 531 and about 60 cusec from ch. 531 to ch. 846. There is no flow of water beyond ch. 846 in the main canal. The Malay main canal was restored from 0.00 to 107 ch. during 2002-03 but now this portion is again in bad condition due to heavy filling (which goes up to 12 feet in certain places) and heavy seepage. Although, the main canal was restored from ch. 107 to ch. 531 during 2006-07, water is not available in downstream portion of main canal (beyond ch. 531) due to problem in upstream end (up to ch. 107).

4.8.21 Lesliganj branch canal is at ch. 531 on main canal. The length of this branch canal is ch. 1200 but water is available only up to ch. 300 because designed volume of water is not available at upstream. There is a proposal by the irrigation department to renovate the main canal from ch. 531 to ch. 1400 and the Lesliganj branch canal from ch. 600 to 1200. Apart from this there is also a proposal for lining of main canal up to ch. 131. These provisions may increase the

availability of water in downstream portion of main and branch canals. There are also problems in several irrigation structures in several parts of the canal system, which have become broken and defunct due to lack of proper maintenance. With the restoration of main and branch canals as well as repairing/building of defunct irrigation structures, the irrigation department is quite hopeful to achieve up to 100 percent of the designed irrigation potential under this scheme.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.8.3).

Chart 4.8.3: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Factor	Rank
1	Heavy siltation in main and branch canals	1
2	Heavy seepage from unlined portion of canals	2
3	Lack of proper field channels	4
4	Lack of sufficient budget for repair and maintenance	3

4. Mayurakshi Left Bank Canal (Mayurakchi River Basin)

4.8.22 The Mayurakshi Left Bank Canal (MLBC) irrigation scheme is a part of the Mayurakshi Reservoir Project on river Mayurakshi in Bihar. This project was planned and construct by the West Bengal Government for providing irrigation benefits specially to the farms of Birbhum district of West Bengal by constructing a barrage across river Mayurakshi near Sisal, at downstream of dam. Since the dam is situated at Masanjore in the district of Dumka (Santhal Parganas) in Bihar and the reservoir area submerged about 100 villages in Bihar, affecting about 15000 persons who had to be rehabilitated, the Governrrent of Bihar faced a very tough and sensitive problem with regard to the resettlement programme of the people without any tangible benefits to the people of the state of Bihar. The Mayurakshi Irrigation scheme consists of Mayurakshi Left Canal Irrigation System for providing irrigation facilities to areas under Dumka and Raneshwar blocks of the districts of Dumka (Santhal Parganas) in Bihar, where the ousted people due to dam have been resettled.

4.8.23 The Mayurakshi Reservoir Project was planned to be constructed through Canadian Aid Programme. The Government of Bihar under pressure from Government of India and Government of West Bengal agreed to the construction of Mayurakshi dam which is now known as Canada Dam. The construction of the Reservoir Project was completed in 1955. Faced with the task

of resettlement of about 15000 displaced persons, mostly tribal, due to construction of Mayurakshi Reservoir Project, the Government of Bihar decided to construct an irrigation scheme to utilize water of Canada Dam for providing irrigation facilities to the resettlement areas lying on the left side of the river Mayurakshi downstream of the Darm, at the cost of West Bengal.

4.8.24 Generally, the areas in the vicinity of a reservoir project have such topography that, normally it is not possible to plan a conventional irrigation scheme. In case of the Canada Dam also, the land in its vicinity is very high at certain places and low at other locations. The undulating topography of the area thus posed serious problems in planning a good irrigation scheme. However, after detailed investigations, Mayurakshi Left Bank Canal Irrigation Scheme was planned and approved for construction by the Government of Bihar. The construction of the scheme was reportedly completed in 1955-56 and irrigation started in the year 1957-58.

4.8.25 The Mayurakshi Irrigation Scheme consists of 20 km of Left Bank Main Canal (LBMC) and 44 kms of 8 distributaries and 4 sub-distributaries covering 95 villages. The main canal takes off from the left flank of Canada Dam. A regulator is provided in the masonry dam for this purpose. Though one outlet has been provided at the right flank of the darn also, yet there is no canal distribution system existing at present. The main canal is a contour canal and comprising high filling reaches up to 9.00 m and reaches in heavy cutting ranging up to 10.00 m. The entire command area is on the right side of the main canal. The distributaries and sub-distributaries more or less follow the ridge lines in the command area. Frequently, during the peak demand, in Kharif, the water level in the Canada Dam Reservoir goes below EI 108.00 m which is the sill level of the head regulator for Mayurakshi Left Bank Irrigation Scheme. In order to obviate this difficulty, four diesel pumping sets of total capacity of 2.16 cumec (72 cusec) gifted by the Hungarian Government, were installed on a floating barge, in the year 1967-68. These pumping sets are operated to lift water from the reservoir into LBMC, whenever the reservoir water level is not adequate above the sill level to supply water into the canal.

4.8.26 As stated earlier, the Mayurakshi irrigation project was planned primarily to provide assured irrigation facilities to the lands on which the persons displaced from the reservoir area were resettled. There were some high patches of cultivable land in the area where also some displaced persons were resettled. In order to provide irrigation facilities to some high patches of land, 10 electric lift pumps were also installed in the LBMC with capacity from *5* HP to *25* HP. Being hilly terrain, the command area comprises ridges and valleys. Therefore, 250 nos. of water courses were also constructed for better distribution of canal water in the command area.

4.8.27 At the time of inception, the original command area was 6072 ha for kharif season and 2024 ha for rabi season. But due to renovation and other

development activities performed in this scheme, the present command area has even increased to 9500 ha and 3000 ha for kharif and rabi seasons respectively.

4.8.28 The actual irrigated area under this scheme during the last ten years is presented in Table 4.8.6. MLBC is one of very few irrigation schemes in the country in which there is no gap between the irrigation potential created and irrigation potential utilized. Its potential irrigated area was increased from its original designed irrigated area and the present irrigated area matches with the extended potential irrigated area. Water reaches up to the tail end of the scheme and the main canal never dries.

Table 4.8.6: Actual Irrigated Area under Mayurakshi Left Bank Canal Scheme

Year	Actual Irrigated Area (Ha)	
	Kharif	Rabi
1998-1999	6100	1700
1999-2000	6131	1721
2000-01	7000	2100
2001-02	7000	1200
2002-03	6890	-
2003-04	6850	2700
2004-05	7600	2700
2005-06	8800	3000
2006-07	9000	3000
2007-08	9500	3000

Source: CEWRD, Deoghar

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.8.4).

Chart 4.8.4: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Factor	Rank
1	Occasional defects in certain irrigation structures	1
2	Occasional cutting or obstruction in flow of distributaries at night by villagers	2
3	Insufficient number of staffs	3

Suggestions

4.8.29 The good performance achieved in this scheme is worth emulating in other irrigation projects. However, some specific problems which are faced by this scheme are silting in main and distribution canal, occasional defects in certain irrigation structures and less number of project staffs. Some of the staffs are temporary, which also creates problem in proper management of the scheme. Sometimes, the villagers cut/ obstruct the flow in distributaries at night to prevent flow of water in the downstream so that they may use more water in the middle of the flow. Farmers' related problems may be solved by involving them in the decision making process on relevant important issues. They should also be properly made aware of the problems involved in both under and over irrigation. The left part of the canal is not able to get the benefit of the scheme as it is located at lower side. This part should also be brought under irrigation by the use of siphoning and other techniques etc. The main canal should also be properly lined to reduce conveyance losses and increase its capacity further.

5. Sona Irrigation Scheme (Kharkai River Sub-Basin)

4.8.30 The weir axis of Sona Weir Scheme is situated at village Karketta of Kuchai block in west Singhbhum district at about 32 km south from Chaibasa town. The main canal originates from kuchai canal at about 10 km west of the existing weir site covered with dense forest, hill, fertile lands etc. flowing from west to east. It is tributary of river Kharkai. The catchment area of the scheme is 86 sq. miles. The project was started in year 1962, got completed in 1969 and covers 76 villages. There are one main canal, one 1 sub-canal, 10 distributaries and 2 minors. The length of main canal and branch canal is 16.62 km and 16.80 km respectively. Total number of structures in main and branch canal is 59 and 53 respectively. Total potential irrigated area created by the project is 5200 ha during kharif and 30 ha during rabi season.

4.8.31 The actual irrigated area under this scheme during the last ten years is presented in Table 4.8.7.

Table 4.8.7: Actual Irrigated Area under Sona Irrigation Scheme

Year	Actual Irrigated Area (Ha)	
	Kharif	Rabi
1998-1999	2100	-
1999-2000	2780	20
2000-01	3100	20
2001-02	1800	-
2002-03	1300	-
2003-04	2619	-
2004-05	3001	-
2005-06	2850	-
2006-07	3600	-
2007-08	4466	-

Source: Executive Engineer, Waterways Division, Chaibasa, Jharkhand

4.8.32 At present, the main canal water flows at full rate up to 12.30 km but only partially from 12.30 km to 16.62 km. Although after renovation work during 2004-05 and 2007-08, there has been an increase in actual irrigated area through this scheme, it is still less than the designed potential. In Kendua, Hathiya, Mahalimurup and Santari distributaries water flows only at partial rate. Simla sub-distributary also gets partial water.

Reasons for Gap between Irrigation Potential and Utilization

4.8.33 The major reasons for gap between irrigation potential and irrigation utilized in Sona Irrigation Scheme are presented as follows.

(a) Loss of Water due to Seepage

4.8.34 Due to the increasing seepage losses and irregular maintenance, the irrigation capacity was decreasing; therefore, PCC lining work was introduced in this canal system. At present, the lining work has been undertaken only in main and kharsawan branch canal. The lining work of main canal has been completed up to 12.30 km out of 16.62 km whereas lining of Kharsawan branch canal is still under progress. The result of lining has been satisfactory the present irrigated area has also increased during the last couple of years due to this reason. But since a large portion of canal is still earthen structure without lining, lots of water is lost due to seepage. As per one estimate about 20 percent of water is lost due to seepage only significantly affecting the performance of the system.

(b) Lack of Repairing and Maintenance of Irrigation Structures

4.8.35 From 112 irrigation structures present in main and distributaries canals, there is huge loss of water due to leakage, which adversely affects in achieving the irrigation target. According to an estimate about 20 percent of water also gets wasted due to these damaged structures.

(c) Lack of Sufficient Number of Staffs and Proper Budget

4.8.36 There is shortage of staffs in project office. At present, out of the total 17 sanctioned positions, only 9 people are available. Lack of proper number of staffs affects the proper maintenance of the canal system. Money available for maintenance of the system is very erratic and there is lots of mismatch between the actual amount demanded and supplied for the purpose. The amount demanded and amount supplied during the last several years are presented in Table 4.8.8.

Table 4.8.8: Amount Demanded and Amount Supplied for the Project

Year	Amount Demanded (Rs. Lakh)	Amount Supplied (Rs. Lakh)
1999-2000	2.00	1.81
2000-01	-	3.24
2001-02	1.00	0.66
2002-03	3.00	2.48
2003-04	-	9.85
2004-05	1.20	0.99
2005-06	1.50	1.33
2006-07	-	1.68
2007-08	-	2.00

(d) Lack of Water Availability

4.837 Another reason for water not reaching up to the tail end of the main and distributaries canal are siltation in main and distributaries canal beds. Further, there is also lack of availability of sufficient water in the reservoir due to errant rainfall occasionally. The volume of water available at the end of each month for use of irrigation is presented in Table 4.8.9. Although the maximum reservoir

capacity of dam is 33540 acre-ft, the maximum volume of water available in the system was 33540 acre.

Table 4.8.9: Water Available in Reservoir for the use of Irrigation

(in acre-ft)

Months	Year 2006	Year 2007
June	2310	1587
July	24790	8140
August	33540	30220
September	33540	33540
October	31585	32110
November	n.a.	25780
December	n.a.	18120
January	n.a.	14160
February	n.a.	n.a.
March	n.a.	n.a.
April	n.a.	n.a.
May	n.a.	n.a.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.8.5).

Chart 4.8.5: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Factor	Rank
1	Loss of water through seepage due to unlined canals	1
2	Lack of repair and maintenance due to lack of fund	2
3	Insufficient number of staffs	3
4	Less volume of water availability due to errant rainfall	4

Suggestions

4.8.38 To reach the maximum potential, the remaining part of canal system should be lined on an urgent basis. This will reduce lots of water losses due to seepage. De-siltation activities should be undertaken on regular interval so as to avoid the decrease in irrigation capacity. All gates and old irrigation structures should be repaired and renovated properly. This will save a large volume of water from leakages. Sufficient number of staffs should be made available for maintenance of the irrigation system which should be accompanied by availability of sufficient amount of resources in terms of budget etc. as per the actual requirements.

6. Sunder Reservoir Scheme (Belasi Chandan Chir River Basin)

4.8.39 The construction of Sunder Reservoir Scheme was started in 1968-69 on Sunder river and irrigation started from this scheme in year 1978. There is a dam outlet from the reservoir with discharge capacity of 300 cusecs. There are two canals on the left and right side. The length of right and left main canals are 19.04 km and 12.05 km respectively. There are four distributaries in right canal and left canal each.

4.8.40 Total designed potential for the scheme was 8500 ha during kharif season and 2000 during rabi season. This scheme has a catchment area of 36 sq. miles at the dam site and 58.3 sq. km at the weir site. Its maximum water level upstream is 238 ft and 229 ft at pond level. After its initial construction, the scheme has been renovated first time in year 2004-05 and 2005-06 at the cost of Rs 97.39 lakh.

4.8.41 The actual irrigated area under this scheme during the three years is presented in Table 4.8.10. The performance of this scheme is much less than its designed capacity. The left canal and all its four distributaries are almost not in use due to several reasons as discussed in the next section.

Table 4.8.10: Actual Irrigated Area Sundar Reservoir Scheme

Year	Actual Irrigated Area (Ha)	
	Kharif	Rabi
2000-01	8026	1000
2001-02	5825	1000
2002-03	7895	1000
2003-04	8000	1200
2004-05	7600	1000
2005-06	3500	715
2006-07	4065	750
2007-08	4043	Nil

Reasons for Gap between Irrigation Potential and Utilization

4.8.42 Despite the recent renovation of the project, the present status of scheme is quite pathetic. The main reasons highlighted for the poor performance of the scheme are presented below.

(a) Problems in Irrigation Structures

4.8.43 There have been several problems in canal and water distribution structures, which result in loss of water at different places. There has been leakage in the gate of the main outlet of the dam itself. Check dam structures are also broken at pipe bed resulting in leakage of water. The cross section width of the left main canal is unusually wide in certain places and siltation take place in such places up to 2.5 to 3.00 feet depth.

4.8.44 In filling zone, the canals bank is quite weak in many places and sufficient free board is not available. Due to this during the supply of water through the canal, there is always possibility of water overflow from sideways at those places.

4.8.45 The canal bed has both soft and hard rocks. In certain places, the canal bed has become higher than downstream side, thereby obstructing the natural flow of water. This also results in reverse flow, adversely affecting the canal dam structures.

4.8.46 All the check dam structures in the four distributaries of the left canal are completely damaged and the entire bed of these distributaries are covered with wild plants and trees as they have not been in use for a long duration. In certain places, the farmers have filled in the water closet area and are using the canal area for housing, farm or road purposes.

(b) Less Volume of Monthly Discharge of Water

4.8.47 Although the scheme was designed with the 300 cusecs of water discharge, the monthly discharge of water during the last three years has been much below the designed capacity as shown in Table 4.8.11.

Table 4.8.11: Volume of Monthly Discharge of Water (in cusecs)

Month	Year		
	2005	2006	2007
Jan	Nil	Nil	Nil
Feb	70	72	Nil
March	62	74	Nil
Apr	Nil	Nil	Nil
May	Nil	Nil	Nil
June	175	205	205
July	180	210	210
Aug	170	205	208
Sept	172	212	210
Oct	178	218	212
Nov	60	70	Nil
Dec	65	75	Nil

(c) Lack of Fund

4.8.48 Based on the discussion with officials of irrigation department, it was found out that one of the most important reasons for not working of the project as per the designed capacity is the lack of proper maintenance. The reservoir and the canals are not getting proper maintenance in absence of the sufficient fund availability. The mismatch between the fund requirement and the fund allotment can be seen in Table 4.8.12

Table 4.8.12: Fund Requirement and Fund Availability for the Project

Year	Requirement in Lac	Allotment in Lac	Expenses in Lac
2005-06	Nil	5,70000	3,95,814
2006-07	Nil	4,38,000	4,38,000
2007-08	30,00,000	5,00,000	5,00,000

(d) Erratic Rainfall in Catchments of the Project

4.8.49 Sunder Scheme is essentially a reservoir based scheme and the water availability depends mostly on the volume of rainfall in its catchments area. However, the rainfall has been quite erratic in the area, which also results in less availability of water as shown in Table 4.8.13.

Table 4.8.13: Rainfall in Catchments of Sunder Reservoir Project

Month	Year		
	2005	2006	2007
Jan	13.4	Nil	Nil
Feb	9.00	Nil	27.00
March	2.2	Nil	17.00
Apr	00	28.00	23.00
May	20.4	133.00	153.00
June	85.2	298.2	215.00
July	341.3	339.4	593.1
Aug	338.5	344.00	200.00
Sept	117.00	518.00	432.9
Oct	131.00	Nil	95.00
Nov	Nil	Nil	Nil
Dec	Nil	Nil	Nil

(e) Insufficient Staff Strengths

4.8.50 According to the officials, it was pointed out that there has always been less number of staffs available for the project, which results in poor maintenance and supervision of the scheme. Based on the detailed exploration of the sanctioned and the working positions, it was found out that about 32 percent of the positions are vacant under the project compared to the sanctioned number of positions. The number of sanctioned positions and the vacant positions are presented in Table 4.8.14.

Table 4.8.14: Sanctioned and Vacant Positions under the Sunder Scheme

Sl. No	Designation	Sanctioned Posts	Existing Personnel	Vacant Position
1	Executive Eng.	1	1	0
2	Assistant Eng.	5	5	0
3	Junior Eng.	13	13	0
4	Divisional Accountant	1	0	1
5	Head Clerk	1	0	1
6	Accountants Clerk	4	4	0
7	Correspondent	6	4	2
8	Typist	2	0	2
9	Steno Typist	1	0	1
10	Draftsman	1	0	1
11	Architect	1	1	0
12	Storekeeper	1	0	1
13	Designer Series -1	1	0	1
14	Designer Series -2	1	0	1
15	Cashier	5	3	2
16	Attendant	1	0	1
17	Follower	2	0	2
18	Guard	1	1	0
19	Peon	20	13	7
20	Electrician	1	1	0
21	Pump Operator	2	2	0
TOTAL		**71**	**48**	**23**

(f) Other Reasons

4.8.51 Although Sunder project relatively a new project. However, in some parts, distributary's canals have not been built due to various reasons discussed earlier. For example, Dighi distributary canal with a proposed length of 5.02 km could not be completed because farmers have been opposing the construction of canals. Farmers are not getting money in time for their land that they have to give to the government for the canal purpose. Due to this the required land could not be acquired for distributaries purpose.

4.8.52 There has been in lack of proper supervision of the project due to certain administrative difficulties. Sunder reservoir scheme is located near Mahgama. However, its project office was transferred to Madhupur, under the supervision of Dumka office, which is quite far from the project site. Although later on, the project office was again shifted back from Dumka to the nearby places, the project could not be monitored properly during the transition period. These back and forth movements of the office have also resulted in loss of important information related to the canal and its structures.

Ranking of the Reasons for Gap between Irrigation Potential and Utilization:

Based on the available data and discussion with project officials, the above factors responsible for gap between irrigation potential and its utilization can be ranked or prioritized as follows (Chart 4.8.6).

Chart 4.8.6: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU

Sl.	Factors	Rank
1	Severe problems in irrigation structures at different places	1
2	Lack of sufficient fund for repair and maintenance	2
3	Insufficient staff strength	3
4	Less volume of monthly discharge of water due erratic rainfall	4
5	Problem in acquiring of land from farmers for certain distributaries	5
6	Lack of proper monitoring due to shift in project office to distant place	6

Suggestions:

4.8.53 Proper budget for repair and maintenance of the canals and its timely availability is very much required for success of this scheme. The incomplete canals should be completed as early as possible. For this the required land should be acquired after proper compensation to the farmers. The damaged outlets and other irrigation structures should also be repaired and preventive maintenance including desiltation should be given more thrust in the whole scheme. All these will save a large volume of water from getting wasted and would increase significantly the actual area of irrigated land.

4.8.54 The irrigation department has initiated proposal for complete restoration of right main canal, left main canal and distributaries of both these canals with an estimated budget of Rs. 389.85 lakh. It is expected that this restoration work will be able to reclaim 4500 ha area under irrigation in kharif season and 1000 ha area in rabi season. But before undertaking such restoration project it should be kept in mind that the project should be undertaken in totality. Partial restoration in bits and pieces would not be of much help.

Chapter 5

Minor Irrigation Schemes

Section 1: Introduction

5.1.1 All ground water schemes and surface water schemes (both flow and lift) having culturable command area up to 2000 hectares individually are classified as Minor Irrigation (MI) Schemes. Ground water schemes comprise of dug wells, dug-cum-bore wells, borings, private shallow tubewells, filter points and deep tubewells. The State Governments provide assistance in installation of such schemes which confines mainly to technical guidance, custom service for boring and arrangements for credit facilities at reasonable rates of interest. The deep tubewells which extend up to the depth of 200 metres or more are designed to give a discharge of 100 to 200 cubic metres per hour. The surface water schemes comprise of surface flow schemes and surface lift irrigation schemes. The surface flow schemes typically consist of tanks, check dams, structures and can serve as water conservation cum ground water recharge scheme. The small storage tanks are owned by community or local bodies and generally have command areas up to 40 hectares. The large storage tanks along with the distribution system having command area varying from 40 to 2000 hectares are constructed by State Government Department. Implementation of minor irrigation works in States is done by various departments and organizations under different developmental programs. Generally dugwells, shallow tubewells and installation of pump-sets are taken up by individual farmers.

5.1.2 Ground water schemes constitute the major share in minor irrigation as evident from the report of 3rd M.I. Census conducted by Ministry of Water Resources, Government of India. As per the Census, out of total 19.7 million Minor Irrigation Schemes in the country, 18.5 million (94 percent) are ground water schemes. On the other hand, surface water schemes constitute only 1.2 million. MI schemes in general are privately owned and very few (only 6 percent) are owned by public Institutions. As per the MI Census, a total of 74.3 million hectare of irrigation potential is created through minor irrigation schemes in the country. Out of this 62.4and 11.9 million hectare of irrigation potential has been developed through ground and surface water schemes, respectively. The Census further points out that 72 percent of the potential created in ground water is utilized, while the percentage utilization in respect of surface water is only 58 percent.

Section 2: State-wise Irrigated Potential Created and Utilized by different MI Schemes

5.2.1 Secondary data on irrigation potential created and utilization by various MI schemes in different cropping seasons for the selected 7 States was collected from the 3rd M.I. Census. The different M.I. schemes are:

- Surface Lift Schemes
- Surface Flow Schemes

- Shallow Tubewells Schemes
- Deep Tubewell Schemes
- Dugwell Schemes

5.2.2 Table 5.1 presents data on state-wise irrigation potential created and its utilization by surface lift irrigation schemes. It is evident from the figures given in Table 5.1 that Chattisgarh, Bihar, Jharkhand and Orissa are the states, where more than 50 percent of potential irrigated area has not been utilized under surface lift irrigation schemes. U.P. stands at the bottom among these 7 states where one fourth of the potential irrigated area remained un-utilized due to one or other reason. On the other hand, it is surprising to note the loss of about two third of irrigation potential under this category of schemes in Orissa State. The under-utilization of irrigation potential is more in Kharif as compared to that in Rabi in the States of U.P., M.P. and Chhatisgarh. In rest of the States, the gap between IPC and IPU is more or less same between the two seasons.

Table 5.1: Irrigation Potential Created (PC) and Utilized (PU) by Surface Lift Irrigation System

(Area in hect.)

	Kharif	Rabi	Perennial	Other	Total
Uttar Pradesh					
Potential Created	10312	22598	5139	403	38452
Potential Utilized	6431	18116	4114	203	28864
Gap between PC & PU	3881(37.63)	4482(19.83)	1025(19.94)	200(49.62)	9588(24.93)
Uttarakhand					
Potential Created	7511	7041	966	940	16458
Potential Utilized	5443	5015	748	283	11489
Gap between PC & PU	2068(27.53)	2026(28.77)	218(22.56)	657(69.89)	4969(30.192)
Madhya Pradesh					
Potential Created	105234	646604	2849	11161	765848
Potential Utilized	33973	460792	1787	8733	505285
Gap between PC & PU	71261(67.71)	185812(28.73)	1062(37.27)	2428(21.75)	260563(34.02)
Chhattisgarh					
Potential Created	48835	36133	285	194	85447
Potential Utilized	16003	19483	68	88	35642
Gap between PC & PU	32832(67.23)	16650(46.07)	217(76.14)	106(54.63)	49805(58.28)
Bihar					
Potential Created	28069	33176	3219	2231	66695
Potential Utilized	14214	15731	1205	954	32104
Gap between PC & PU	13855(49.36)	17445(52.58)	2014(62.56)	1277(57.23)	34591(51.86)
Jharkhand					
Potential Created	25605	20993	1428	613	48635
Potential Utilized	11118	9940	523	260	21841
Gap between PC & PU	14487(56.5)	11053(52.6)	905(63.3)	353(57.5)	26794(55)
Orissa					
Potential Created	174860	122993	4729	715	303297
Potential Utilized	54812	45638	2260	358	103068
Gap between PC & PU	120048((68.65)	77355(62.89)	2469(52.20)	357(49.93)	200229(66.01)

Notes: (1) Figures in parentheses indicate percentage of gap between PC and PU.
(2) Analysis is based on the data given in 3rd Minor Irrigation Census, MoWR, GoI.

5.2.3 A further analysis of data given in Table 5.2 reveals that in the States of Bihar and Orissa, a substantial area of 39 and 31 percent of irrigation potential, respectively has been lost due to non-operational of large number of schemes. However, in case of Chhattisgarh and Jharkhand, a large gap between IPC and IPU clearly indicate the under utilization of the operational schemes as loss of irrigation potential as percentage of non-operational schemes is not very high. This raises a serious concern about the management of the existing operational schemes in these two States. The State of M.P can also be put in the same category as only 4 percent of irrigation potential is lost due to non-operation of the schemes, whereas the gap between IPC and IPU rests about 34 percent (as given in Table 5.1). One disturbing feature emerging out from this analysis is that in all the States, except M.P., Uttarakhand and Jharkhand, more than 20 percent of surface lift irrigation schemes are out of order.

Table 5.2: Surface Lift Schemes not in Use and Loss of Potential Irrigated Area

Sl. No.	State	No. of Schemes not in Use	Irrigation Potential Lost (Hectare)
1.	Uttar Pradesh	1496 (22.86)	6503 (16.92)
2.	Uttarakhand	97 (13.70)	2010 (12.22)
3.	Madhya Pradesh	11602 (05.92)	31554 (04.12)
4.	Chhatisgarh	5780 (22.73)	15227 (17.82)
5.	Bihar	580 (20.90)	26165 (39.23)
6.	Jharkhand	1480 (12.33)	7830 (16.09)
7.	Orissa	6728 (20.46)	95790 (31.58)

Notes: (1) For column 4, figures in parentheses indicate percentage of irrigation potential created by surface lift irrigation schemes.

(2) For column 3, figures in parentheses indicate percentage of total surface lift schemes.

(3) Analysis is based on the data given in 3rd Minor Irrigation Census, MoWR, GoI.

5.2.4 Table 5.3 depicts data on state-wise irrigation potential created and its utilization by surface flow irrigation schemes. The results show that M.P., Chattisgarh, and Orissa are the States, where about 50 percent of potential irrigated area has not been utilized under these schemes. M.P. and Orissa are also the States, where gap between irrigation potential and its utilization is more in Rabi as compared to that in Kharif season. Uttarakhand stands at the bottom among these 7 states where about one fourth of the potential irrigated area remained un-utilized due to one or other reason.

5.2.5 Analysis of data in Table 5.4 brings the loss of irrigation potential due to non-operation of surface flow schemes in different States. This loss is the maximum in Bihar where about 24 percent area of irrigation potential created is lost due to non-functional of the schemes. Interestingly, this loss of irrigation potential created is not too much in the States of M.P., Chhattisgarh and Orrissa

(Table 5.4), where the total gap between IPC and IPU has been found quite large (refer to Table 5.3). In terms of non-functional of the schemes, maximum percentage has been observed in Uttarakhand with one fourth of total surface flow schemes are not in use. Orissa ranks second in this ladder followed by Chhattisgarh and U.P.

Table 5.3: Irrigation Potential Created (PC) and Utilized (PU) by Surface Flow Irrigation Schemes

(Area in hect.)

	Kharif	Rabi	Perennial	Other	Total
Uttar Pradesh					
Potential Created	19546	20292	10135	1406	51379
Potential Utilized	12732	15109	7101	1225	36167
Gap between PC & PU	814 (34.86)	5183 (25.54)	3034 (29.93)	181 (12.87)	15212 (29.60)
Uttarakhand					
Potential Created	135669	126275	27153	7592	296689
Potential Utilized	98806	91414	19933	4977	215130
Gap between PC & PU	36863 (27.17)	34861 (27.60)	7220 (26.59)	2615 (34.44)	81559 (27.48)
Madhya Pradesh					
Potential Created	96413	283201	420	20972	401006
Potential Utilized	60339	144510	196	7022	212067
Gap between PC & PU	36074 (37.41)	138691 (48.97)	224 (53.33)	13950 (66.51)	188939 (47.11)
Chhattisgarh					
Potential Created	216073	69009	1176	230	286488
Potential Utilized	103442	37616	38	12	141108
Gap between PC & PU	112631 (52.12)	31393 (32.69)	1138 (96.76)	218 (94.78)	145380 (50.74)
Bihar					
Potential Created	451631	96162	7450	8900	564143
Potential Utilized	289196	69232	4823	1778	365029
Gap between PC & PU	162435 (35.96)	26930 (28.00)	2627 (35.26)	7122 (80.02)	1199114 (35.29)
Jharkhand					
Potential Created	116851	37980	3549	2136	160516
Potential Utilized	86729	25034	2007	1112	114882
Gap between PC & PU	30122 (25.70)	12946 (34.00)	1542 (43.4)	1024 (27.9)	45634 (28.4)
Orissa					
Potential Created	573711	112887	2122	779	689499
Potential Utilized	328648	34750	957	235	364590
Gap between PC & PU	245063 (42.71)	78137 (69.10)	1165 (54.90)	544 (69.83)	324909 (47.12)

Notes: (1) Figures in parentheses indicate percentage of gap between PC and PU.
(2) Analysis is based on the data given in 3rd Minor Irrigation Census, MoWR, GoI.

Table 5.4: Surface Flow Schemes not in Use and Loss of Potential Irrigated Area

Sl. No.	State	No. of Schemes not in Use	Irrigation Potential Lost (Hectare)
1.	Uttar Pradesh	895 (14.21)	9470 (18.43)
2.	Uttarakhand	6523 (25.57)	38656 (13.03)
3.	Madhya Pradesh	6223 (10.97)	36042 (08.98)
4.	Chhatisgarh	7563 (14.70)	36901 (12.88)
5.	Bihar	3422 (15.41)	137729 (24.41)
6.	Jharkhand	4260 (09.85)	9883 (06.16)
7.	Orissa	4922 (17.39)	65429 (09.48)

Notes: (1) For column 4, figures in parentheses indicate percentage of irrigation potential created by surface flow schemes.

(2) For column 3, figures in parentheses indicate percentage of total surface flow schemes.

(3) Analysis is based on the data given in 3rd Minor Irrigation Census, MoWR, GoI.

5.2.6 Table 5.5 depicts data on state-wise irrigation potential created and its utilization by shallow tubewell schemes. These schemes are in very pathetic condition in the States of Chhattisgarh and Orissa as more than 50 percent of irrigation potential is un-utilized. The results show that in all the States the under utilization of irrigation potential is substantially more in Kharif than that in Rabi season. U.P. stands at the bottom among these 7 states where about twenty percent of the potential irrigated area remained un-utilized due to one or other reason.

Table 5.5: Irrigation Potential Created (PC) and Utilized (PU) by Shallow Tubewell Schemes

(Area in hect.)

	Kharif	Rabi	Perennial	Other	Total
Uttar Pradesh					
Potential Created	5728069	6707387	2092634	1003590	15531680
Potential Utilized	4260328	5678256	1622192	610351	12171127
Gap between PC & PU	1467741 (25.62)	1029131 (15.34)	470442 (22.48)	393239 (39.18)	3360553 (21.63)
Uttarakhand					
Potential Created	87939	81969	62352	10518	242778
Potential Utilized	69076	63817	44863	6856	184612
Gap between PC & PU	18863 (27.3)	18152 (22.14)	17489 (28.04)	3662 (34.81)	58166 (23.95)
Madhya Pradesh					
Potential Created	66566	1038488	10190	14118	1129362
Potential Utilized	22360	667914	7384	8214	705872
Gap between PC & PU	44206 (66.40)	370574 (35.68)	2806 (27.53)	5904 (41.81)	423490 (37.49)
Chhattisgarh					
Potential Created	229854	110561	2562	6340	349317
Potential Utilized	101122	61027	1495	3936	167580
Gap between PC & PU	128732 (56.0)	49534 (44.8)	1067 (41.64)	2404 (37.91)	181737 (52.02)
Bihar					
Potential Created	1182710	1598129	148311	128917	3058067
Potential Utilized	818626	1294114	95477	79027	2287244
Gap between PC & PU	364048 (30.78)	304015 (19.02)	52834 (35.62)	49890 (38.69)	770823 (25.20)
Jharkhand					
Potential Created	1640	1871	138	55	3704
Potential Utilized	1072	1368	79	38	2557
Gap between PC & PU	568 (34.6)	503 (26.8)	59 (42.7)	17 (30.9)	1147 (30.9)
Orissa					
Potential Created	63152	85463	3046	1102	152763
Potential Utilized	18137	45179	2319	677	66312
Gap between PC & PU	45015 (71.28)	40284 (47.13)	727 (23.86)	425 (38.56)	86451 (56.59)

Notes: (1) Figures in parentheses indicate percentage of gap between PC and PU.

(2) Analysis is based on the data given in 3rd Minor Irrigation Census, MoWR, GoI.

5.2.7 Analysis of data in Table 5.6 brings the loss of irrigation potential due to non-operation of shallow tubewell schemes in different States. This loss is the maximum in Orissa where about 20 percent area of irrigation potential created is lost due to non-functional of the schemes. Interestingly, Orissa also takes the honor of maximum percentage of shallow tubewell (19.33) as non-functional. The percentage of shallow tubewells not in use is also quite high in M.P. In rest of the States, the incidence of non-functioning of shallow tubewells is not very high and subsequently marginal loss of irrigation potential created due to this reason. Since the gap between irrigation potential and its utilization is quite high in these States (as shown in Table 5.5), it clearly demonstrate the under-utilization of the functional shallow tubewells due to various reasons.

Table 5.6: Shallow Tubewells not in Use and Loss of Potential Irrigated Area

Sl. No.	State	No. of Schemes not in Use	Irrigation Potential Lost (Hectare)
1.	Uttar Pradesh	43364 (01.23)	196090 (01.26)
2.	Uttarakhand	683 (01.31)	3816 (01.57)
3.	Madhya Pradesh	42260 (15.15)	123909 (10.97)
4.	Chhatisgarh	9713 (11.22)	27728 (07.93)
5.	Bihar	31247 (04.79)	138806 (04.53)
6.	Jharkhand	46 (04.09)	215 (05.80)
7.	Orissa	8483 (19.33)	30935 (20.25)

Notes: (1) For column 4, figures in parentheses indicate percentage of irrigation potential created by shallow tubewell schemes.
(2) For column 3, figures in parentheses indicate percentage of total shallow tubewell schemes.
(3) Analysis is based on the data given in 3rd Minor Irrigation Census, MoWR, GoI.

5.2.8 Table 5.7 depicts data on state-wise irrigation potential created and its utilization by deep tubewell schemes. These schemes are in very pathetic condition in the States of Bihar and Orissa as more than 80 percent of irrigation potential is un-utilized. These are also the two States, where majority of the deep tubewells are not in use (Table 5.8). The results show that in all the States the under utilization of irrigation potential is substantially more in Kharif than that in Rabi season. Uttarakhand stands at the bottom among these 7 states where about twenty percent of the potential irrigated area remained un-utilized due to one or other reason. The under utilization of irrigation potential of the functional

deep tubewells may be due to either inadequate power availability or mechanical breakdown.

Table 5.7: Irrigation Potential Created (PC) and Utilized (PU) by Deep Tubewell Schemes

(Area in hect.)

	Kharif	Rabi	Perennial	Other	Total
Uttar Pradesh					
Potential Created	907135	1067482	296813	155454	2426884
Potential Utilized	519613	733434	212200	88085	1553332
Gap between PC & PU	387522 (42.71)	334048 (31.29)	84613 (28.50)	67369 (43.33)	873552 (35.99)
Uttarakhand					
Potential Created	30011	30514	12205	3435	76165
Potential Utilized	23271	24303	9352	2462	59388
Gap between PC & PU	6740 (22.45)	6211 (20.35)	2853 (23.37)	973 (28.32)	16777 (22.2)
Madhya Pradesh					
Potential Created	36106	122041	2255	2287	162689
Potential Utilized	20824	76693	1664	577	96758
Gap between PC & PU	15282 (42.32)	45348 (37.15)	591 (26.20)	1750 (74.77)	65931 (40.25)
Chhattisgarh					
Potential Created	13146	6843	427	40	20456
Potential Utilized	7169	5134	269	15	12587
Gap between PC & PU	5977 (45.46)	1709 (24.97)	158 (37.0)	25 (62.5)	7869 (38.46)
Bihar					
Potential Created	111394	146987	14742	16908	289031
Potential Utilized	21047	30273	2522	2384	56226
Gap between PC & PU	90347 (81.10)	115714 (79.26)	12220 (82.89)	14524 (85.90)	232805 (80.54)
Jharkhand					
Potential Created	146	115	0	0	261
Potential Utilized	79	58	0	0	137
Gap between PC & PU	67 (45.8)	57 (49.5)			124 (47.5)
Orissa					
Potential Created	44877	48584	617	137	94215
Potential Utilized	3262	7617	313	34	11226
Gap between PC & PU	41615 (92.73)	40967 (84.32)	304 (49.27)	103 (75.18)	82989 (88.08)

Notes: (1) Figures in parentheses indicate percentage of gap between PC and PU.
(2) Analysis is based on the data given in 3rd Minor Irrigation Census, MoWR, GoI.

Table 5.8: Deep Tubewells not in Use and Loss of Potential Irrigated Area

Sl. No.	State	No. of Schemes not in Use	Irrigation Potential Lost (Hectare)
1.	Uttar Pradesh	1764 (05.03)	150835 (06.21)
2.	Uttarakhand	26 (02.94)	2263 (02.97)
3.	Madhya Pradesh	5914 (16.25)	19531 (12.00)
4.	Chhatisgarh	86 (01.64)	1101 (05.38)
5.	Bihar	2778 (44.88)	197715 (68.46)
6.	Jharkhand	1 (03.57)	20 (07.66)
7.	Orissa	2883 (62.78)	62157 (65.97)

Notes: (1) For column 4, figures in parentheses indicate percentage of irrigation potential created by deep tubewell schemes.

(2) For column 3, figures in parentheses indicate percentage of total deep tubewell schemes.

(3) Analysis is based on the data given in 3rd Minor Irrigation Census, MoWR, GoI.

5.2.9 Table 5.9 depicts data on state-wise irrigation potential created and its utilization by dugwell schemes. These schemes are in very pathetic condition in the States of Chhattisgarh and Orissa as 59 percent or more of irrigation potential is un-utilized. Bihar and Orissa are the two States, where majority of the dugwells are not in use (Table 5.10). The results show that in all the States the under utilization of irrigation potential is substantially more in Kharif than that in Rabi season. Uttarakhand stands at the bottom among these 7 states where about twenty percent of the potential irrigated area remained un-utilized due to one or other reason. Although, the gap between irrigation potential and its utilization is the maximum in Chhatissgarh, this gap can not be explained due to non-use of dugwells. The under utilization of irrigation potential of the functional deep tubewells may be due to either inadequate power availability or mechanical breakdown.

Table 5.9: Irrigation Potential Created (PC) and Utilized (PU) by Dugwell Schemes

(Area in hect.)

	Kharif	Rabi	Perennial	Other	Total
Uttar Pradesh					
Potential Created	117005	212608	26873	10450	366936
Potential Utilized	63371	189287	22427	6670	285755
Gap between PC & PU	53634 (45.83)	23321(10.96)	4446 (16.54)	3780 (36.17)	81181(22.12)
Uttarakhand					
Potential Created	4476	4364	2779	317	11936
Potential Utilized	3953	3880	2439	254	10526
Gap between PC & PU	523 (11.68)	484 (11.09)	340 (12.23)	63 (20.18)	1410 (11.81)
Madhya Pradesh					
Potential Created	444017	2910169	42435	57600	3454221
Potential Utilized	188599	1740157	25630	25498	1979884
Gap between PC & PU	255418 (57.75)	1170012 (40.20)	16805 (39.60)	32102 (55.73)	1474337 (42.68)
Chhattisgarh					
Potential Created	106091	108954	3126	826	218997
Potential Utilized	22882	29707	1963	489	55041
Gap between PC & PU	83209 (78.43)	79247 (72.73)	1163 (37.20)	337 (40.79)	163956 (74.86)
Bihar					
Potential Created	112889	116677	12119	8005	249690
Potential Utilized	66277	69311	7061	3193	145842
Gap between PC & PU	46612 (41.29)	47366 (40.59)	5058 (41.73)	4812 (60.11)	103848 (41.59)
Jharkhand					
Potential Created	92083	99564	11472	5550	208669
Potential Utilized	62094	77429	8151	3657	151331
Gap between PC & PU	29989 (32.5)	22135 (22.23)	3321 (28.94)	1893 (34.10)	57338 (27.47)
Orissa					
Potential Created	123049	62762	3834	1353	190998
Potential Utilized	49228	24551	2359	905	77043
Gap between PC & PU	73821 (59.93)	38211 (60.88)	1475 (38.47)	448 (33.11)	113955 (59.66)

Notes: (1) Figures in parentheses indicate percentage of gap between PC and PU.

(2) Analysis is based on the data given in 3rd Minor Irrigation Census, MoWR, GoI.

Table 5.10: Dugwells not in Use and Loss of Potential Irrigated Area

Sl. No.	State	No. of Schemes not in Use	Irrigation Potential Lost (Hectare)
1.	Uttar Pradesh	11817 (09.50)	31366 (08.55)
2.	Uttarakhand	38 (04.54)	251 (02.10)
3.	Madhya Pradesh	230380 (18.04)	423050 (12.25)
4.	Chhatisgarh	22614 (11.03)	38323 (17.50)
5.	Bihar	43922 (32.49)	68293 (27.35)
6.	Jharkhand	16942 (05.24)	10794 (05.17)
7.	Orissa	94861 (25.07)	44888 (23.50)

Notes: (1) For column 4, figures in parentheses indicate percentage of irrigation potential created by dugwell schemes.

(2) For column 3, figures in parentheses indicate percentage of total dugwell schemes.

(3) Analysis is based on the data given in 3rd Minor Irrigation Census, MoWR, GoI.

5.2.10 Besides the macro analysis of minor irrigation sector with the help of secondary data as reported above, 4-5 minor irrigation projects of different categories were selected from each State for in depth examination of factors responsible for gap between irrigation potential created and its utilization. Minor irrigation schemes in the States are dealt by different Departments and therefore, there has not been a single nodal agency in the State to collect and compile the data on such schemes. For each of the selected project, the team collected detailed information in order to understand the relevance of defined potential as well as the factors affecting supply of irrigation water. Not surprisingly, quantitative information for some of the selected projects, in spite of prolonged and repeated efforts, has been found to be very scanty in some places. Still, no stone is left unturned to make the best possible use of the available and even fragmented pieces of data.

Section 3: Analysis of Sample Minor Irrigation Projects – U.P.

1. Badagaon Pump Canal System

5.3.1 Badagaon pump canal, one of the minor lift irrigation systems of Uttar Pradesh, was constructed on the left bank of river Betwa in the year 1978 with 75 cusec water capacity. It was designed to cover 5543 hectare command area in Jhansi district. Out of 5543 hectare command area, 80 % was proposed in Rabi (4435 hectare), and remaining 20 % of CCA (1108 hectare) was kept in Kharif.

This system is working with 4 pumps each with 25 cusec discharge. One pump has been kept as stand by. The irrigated area from the project during last 10 years separately in Kharif and Rabi season has been presented in Table 5.11 below. The figures show that during Kharif season, on an average about 90 percent of the irrigation potential has not been utilized, whereas in Rabi season, the un-utilization is near about 60 percent.

Table 5.11: Irrigated Area by Badagaon Pump Canal during 1997-98 to 2006-07

(area in hectare)

Year	Kharif	Rabi
1997-98	NA	1562 (64.80)
1998-99	NA	2232 (49.68)
1999-00	NA	1904 (57.07)
2000-01	NA	1919 (56.74)
2001-02	112 (89.90)	2402 (45.80)
2002-03	74 (93.23)	2420 (45.44)
2003-04	102 (90.80)	2519 (43.21)
2004-05	90 (91.88)	2519 (43.21)
2005-06	66 (94.05)	2572 (42.01)
2006-07	67 (93.96)	1786 (59.73)

Note: Figures in parentheses indicate percent gap between irrigation potential and utilization.

5.3.2 There are numerous reasons which affect the performance of system. Some of major causes are discussed as follows:

(a) Decreased Pump Efficiency

5.3.3 The discharge and efficiency of pumps have gone down. The maximum average discharge of water from all three pumps at the present time is 58 cusec against 75 cusec designed discharge. The pumps are about 30 years old; the average life of a pump is 12 years. At present, these pumps are in very bad condition. According to the officials of Irrigation Department, it is necessary to change all pumps and main pipe line for better performance. These assets have completed their economic life.

(b) Inadequate Power Supply

5.3.4 Inadequate power supply and low voltage is a major cause of bad performance of system. According to officials, the average electric supply is 8 to 10 hours per day; even this supply is not continuous. The main feeder for electric

supply of pumps is 13 km far from pump office. Due to long distance of electric feeder, there is a consistent low voltage problem. Due to low voltage, all three pumps are not able to run together resulting in decreased water discharge.

(c) Distribution Constraints

5.3.5 System has 7.44 Km main canal & 46.93 km is length of minor. This system is about 30 year old. Due to lack of maintenance, distribution channels are in very bad shape. This is important cause for insufficient water flows in canal system and water logging in some area. This leads to improper water distribution and under utilization of irrigation potential.

(d) Lack of Budget

5.3.6 Lack of budget for maintenance of the project system limits the utilization of irrigation potential. The efficiency of pump and distribution channels goes down due to lack of proper maintenance. This also causes to low discharge of water from pumps and improper distribution. Demand and received amount for operation and maintenance of system has been presented in the Table 5.12 below.

Table 5.12: Demand and Availability of Funds

Year	Demand (Rs.)	Actual Received (Rs.)	Lack of Funds (%)
2000-01	1318000	930000	29.4
2001-02	1318000	930000	29.4
2002-03	1318000	930000	29.4
2003-04	1318000	930000	29.4
2004-05	1318000	930000	29.4
2005-06	1318000	930000	29.4
2006-7	1318000	318000	75.87

(e) Lack of Staff

5.3.7 A high irrigation potential consistency requires supporting staff to maintenance and other construction development measure to its efficiency improvement. Any reduction in the strength of irrigation department staffs including field and technical staffs affect functioning and efficiency of the whole project system. Table 5.13 clearly mentions that only 11 current working position

against approved 23 sanctioned positions, resulting a 47 % man power level. This is also a major cause of low performance of system.

Table 5.13: Manpower Availability for Badagaon Pump Canal

Designation	Working Staff	Sanctioned Staff	Required Staff
J.E	1	1	
A.E	1	1	
Machanic	2	2	
Helper	4	9	5
Operator	1	3	2
Seenchpal	2	4	2
Watchman	0	3	3
Total	**11**	**23**	**12**

(f) Lack of Rainfall

5.3.8 The rainfall of this project area is erratic and inadequate. Due to insufficient rainfall, system does not get water. Due to lack of water, system does not run properly. In last few years rainfall became very low (less then 50% of assumed rainfall). Last ten year total rainfall has been presented in Table 5.14 below.

Table 5.14: Status of Rainfall during last Eleven Years

Average Rainfall: 781 mm

YEAR	Actual Rainfall (mm)	Actual Rainfall as percentage of Average Rainfall
1996-97	807.10	103.3
1997-98	979.20	125.35
1998-99	571.20	73.11
1999-00	795.40	101.79
2000-01	567.80	72.5
2001-02	842.22	107.81
2002-03	638.24	81.69
2003-04	1153.00	147.63
2004-05	623.57	79.76
2005-06	523.04	66.96
2006-07	332.12	42.52
2007-08	342.74	43.79

2. Check Dam Mauranipur

5.3.9 Mauranipur check dam is located in village Maurnipur, block Mauranipur, district Jhansi . It was built on 2006. This system was made on sukahi River. The main objective of this check dam was to arrest water in the particular area in rainy season for the irrigation and drinking purposes. Total proposed command area of dam is 869 hectares, 348 hectare in Kharif and 521 hectare in Rabi under 5 villages. According to irrigation officials, presently only 30 percent of Kahrif potential and 40 percent of Rabi potential is being utilized (Table 5.15).

Table 5.15: Status of Irrigation Potential Created and Utilization

	Potential Created (ha)	Potential Utilized (ha)
Kharif	348	105
Rabi I	521	209
Total	869	314

5.3.10 For the proper function of the dam, maintenance is essential. According to department officials, for the optimum use of check dam, de-silting operations are essential in every five year, requiring approximately Rs. 25000 for this purpose. However, at present time there is no budget provision for dam maintenance.

3. Shallow Tubewell

5.3.11 This shallow tubewell was built in 1994-95 in village Nomoni, Block Mauranipur of District Jhansi. This system has one 27 HP electric motor. The total command area of system is 70 hectare. The irrigated area from the system during last 8 years separately in Kharif and Rabi season has been presented below in the Table 5.16. The figures show the dismal performance of system. There is more than 90 percent gap in the irrigation potential created and its utilization.

Table 5.16: Irrigated Area by Shallow Tubewell during 2000-01 to 2006-07

(Area in hectare)

Year	Kharif	Rabi
2000-01	8 (88.57)	16 (77.14)
2001-02	3 (95.7)	12 (82.85)
2002-03	12 (82.85)	18 (74.28)
2003-04	7 (90.00)	13 (81.42)
2004-05	5 (92.85)	16 (77.14)
2005-06	6 (91.42)	12 (82.85)
2006-07	3 (95.70)	10 (85.7)

Note: Figure in parentheses indicate percentage gap between irrigation potential and its utilization.

5.3.12 There are numerous reasons which affect the performances of system. Some of the major issues are discussed as follows.

(a) Decreased Pump Efficiency

5.3.13 The discharge and efficiency of pump have gone down significantly. The maximum discharge of water at the time of inception was 28371 g.p.h, whereas, presently it is 24371 g.p.h. Thus, 15 % efficiency has been reduced.

(b) Lack of Distribution Channels

5.3.14 Presently there are no field channels for water distribution. Farmers take water by using plastic pipes as temporary field channels. Due to lack of maintenance, field channels have been destroyed and only few farmers who are near to pump are able to take water from system. At the time of inception there were 40 benefited farmers but at present only 7 farmers are benefited.

(c) Inadequate Power Supply

5.3.15 Inadequate power supply is a major cause for dismal performance of system. Average power supply is 10 -11 hours per day but not in continuous form. It comes in two or three hours slot. This short duration of supply increase water losses.

(d) Inadequate Maintenance budget

5.3.16 The annual budget for maintenance of system is Rs. 12000, which is very less for maintenance of system. This amount is not sufficient for pump and channel maintenance. Due to less budget provision field channels have been destroyed and system is not able to irrigate all its command area.

4. Deep Tubewell

5.3.17 Many deep tubewells have been established by the Government in different villages. One of these deep tubewell is established in village Raipur, block Chinhat, District Lucknow. This tubewell was built in 1956. This tubewell was established for provide irrigation water to 60 hectares area of Siris village. Due to many reasons, system is not able to provide sufficient water. The poor performance of tubewell has been presented in the Table 5.17.

Table 5.17: Irrigated Area by Deep Tubewell during 1994-95 to 2007-08

Year	Rabi (In Hectares)	Kharif (In Hectares)
1994 -1995	57 (05.00)	39 (35.00)
1995 -1996	37 (38.33)	26 (56.66)
1996 -1997	54 (10.00)	25 (58.33)
1997 -1998	25 (58.33)	30 (50.00)
1998 -1999	53 (11.66)	05 (91.66)
2006 -2007	08 (86.66)	Nil
2007 -2008	11 (81.66)	05 (91.66)

Note:-1. Figures in parentheses indicate percent gap between irrigation potential and utilization.

2. During the years 2000-2006 system was in control of panchayat

5.3.18 There are so many reasons of gap between potential created and utilization. Some reasons are given below:

(a) Reduced Efficiency of Pump

5.3.19 At the time of inception, water discharge capacity was 41450 GPH but at present time water discharge is 26438 GPH (Table 5.18). Due to lack of maintenance of pumps, efficiency has been reduced. As a result, pumps are running with 40% less discharge.

Table 5.18: Water Discharge in Gallon/Hour

Year	Water Discharge
1987-1988	39145 (5.56)
1994-1995	36813 (11.18)
1999-2000	28371 (31.55)
2007-2008	26438 (36.21)

Note: Figures in parentheses show the percent gap in pump efficiency

(b) Lack of Electric Supply

5.3.20 The main cause of non performance of tubewell is inadequate power supply. For the last four years, power supply hour has been presented in Table 5.19 below which shows the power supply condition in both Rabi and Kharif seasons separately.

Table 5.19: Status of Availability of Electric Power

Year	Rabi (In Hours)	Kharif (In Hours)
1994 -1995	1600	760
1995 -1996	835	443
1996 -1997	1234	718
1997 -1998	411	1048
1998 -1999	1087	822
2006 -2007	435	Nil
2007 -2008	588	588

Without proper electric supply, system cannot cover its total command area.

(c) Lack of Budget

5.3.21 Due to lack of budget provision for the maintenance of the system, the original efficiency of the system has gone down. No money has been issued for maintenance during last few years.

(d) Distribution Constraints

5.3.22 All channels have been destroyed and new channels are not constructed. Due to lack of proper field channels, water does not reach at the end portion. Tail ender farmers do not get water for irrigation.

Section 4: Analysis of Sample Minor Irrigation Projects – Uttarakhand

1. Dug Well (Artisan Well)

5.4.1 This well is situated in Kulha village of Gadarpur block of district Udham Singh Nagar of Uttarakhand. This well was established in the year 2008 under Tribal Sub Plan Scheme of Government of India. Total cost of this scheme was

Rs. 10.47 lacs. A total of 1.5 kms of channel is associated with this well including the boundary walls of the well. This well is presently irrigating around 20 hectares of land in this area, while PPA of a dug well is 25 acres of land. A main crop of this area is Paddy. Villagers harvest 02 crops of paddy, which requires more water as compared to other crops. After finishing construction work, this well is handed over to Gram Panchayat. Gram Panchayat is now responsible for maintenance and other related work of the well for its better performance.

5.4.2 As per discussion with the concerned officials of the department, following problems are arising in performance of this well:

- Land, in which well is established belong to the villagers, who used to create problems in doing regular monitoring and construction work of the scheme. Villagers used to demand for compensation of their land. There is no provision of compensation under the government assisted schemes.
- Lack of supervisory staff is another major problem in performance of the scheme.

2. Deep Tubewell

5.4.3 This deep tubewell is situated in Chhatarpur village of Gadarpur block of district Udham Singh Nagar of Uttarakhand. This well was established in the year 1998 with an assistant of Rs. 01 lac to the farmer from the government. Rest of the construction amount was spent by the beneficiary farmer. Total depth of this well is 500 feet with 06 inches bore. PPA of this well was kept as 12 hectares. Presently this well is irrigating only 8.8 hectares of land. Main crops harvested by the farmer under this well are paddy, sugarcane and wheat. This farmer harvests 02 crops of paddy in a season, which requires more water as compared to other crops.

5.4.4 As per discussion with the concerned officials of the department and the farmer, following reason are there for poor performance of this well:

- Decreasing ground water level is the main problem for poor performance of this well. As per the farmer, he never used water lifting devices during initial 3-4 years of the scheme, but later on as water level decreases in the well he started using water lifting pump for irrigation. The beneficiary farmer told that during monsoon season water level increases and performance of the well too.
- Cleaning of the well is another reason for the poor performance of the well. As per the department officials, cleaning of the well with powerful water lifting device is necessary after every 5-6 years.

3. Gated Weir of Bhattbhoj Lachhi (Surface Flow)

5.4.5 This scheme was constructed by the minor irrigation division of district Udham Singh Nagar in the year 2008. This scheme is constructed on a waste water source from the forest and other nearby villages. Most of the land irrigated by this scheme is of Bhattbhoj Village of Gadarpur block of district Udham Singh Nagar. PPA of this scheme was kept as 40 hectares while presently this scheme is irrigating more than 100 hectares of land. Total cost of this scheme was 34.70 lacs including 1250 meters of main channel and 500 meters of distributaries. A water user's association headed by the Gram Pradhan; is formed in the village to look after the performance of the scheme. After finalizing the construction work, this scheme was handed over to the above mentioned water user's association.

5.4.6 As per discussion with the concerned officials of the department and water user's association members, following problems are there:

- Muster roll based work is the main problem in the construction and maintenance of the channels and weir. As per the concerned villagers and officials, daily labor charge taken by a laborer is Rs. 120.00 while in the muster roll it is to be mentioned as Rs. 73.00. This creates problem with the laborer and officials of the scheme.
- A part of the land of the scheme is under railway department, which is not permitting for construction of channels in that part of the land. This part is affecting the performance of the scheme.

Section 5: Analysis of Sample Minor Irrigation Projects – Bihar

1. Manikpur Lift Irrigation System

5.5.1 This system is situated in village Manikpur, block Obara district Aurangabad. It was built in the year 1946. This system mainly provides irrigation water in kharif season. Manikpur L.I. System was initially constructed to provide irrigation to 50 hectares kharif area of Manikpur village. There is much fluctuation in actual irrigated area. The irrigated area from the project during last 9 years separately in Kharif and Rabi seasons has been presented in Table 5.20 below. It is clear from the data that the system has not been able to meet the target irrigated area over the years and presently there exists a gap of 42 percent between the target and actual irrigated area.

Table 5.20: Irrigated Area by Manikpur Lift Irrigation System during 1999-2000 to 2007-08

Year	Rabi (In Hectares)		Kharif (In Hectares)	
	Target	Achievement	Target	Achievement
1999-2000	Nil	Nil	30	12 (60)
2000-2001	10	03 (70)	32	10 (68.75)
2001-2002	Nil	Nil	32	12 (62.5)
2002-2003	Nil	Nil	32	13 (59.37)
2003-2004	Nil	Nil	Nil	Nil
2004-2005	Nil	Nil	32	03 (90.62)
2005-2006	Nil	Nil	32	05 (84.37)
2006-2007	Nil	Nil	32	06 (81.25)
2007-2008	Nil	Nil	25	14.5 (42)

Note: Figures In parentheses indicate percent gap between target and actual irrigated area.

5.5.2 There are numerous reasons which affect the performance of system.

Some of the major issues are discussed as follows:

(a) Non-availability of Electric Power

5.5.3 The major reason of gap is irregular electric supply. Present scenario of electric supply is 2-3 hours per day. Sometime it does not come continuously one or more days.

(b) Lack of Budget for Maintenance

5.5.4 System needs regular maintenance for better performance but there is no sufficient budget for maintenance. According to officials, budget does not come for a particular system; rather annual budget comes for all systems of district. Due to this, budget is not provided at the time of requirement and system does not work.

(c) Distribution Constraints

5.5.5 There are so many problems in distribution of water. The farmers at the head do not allow water to pass below until they get full irrigation water in their fields. They choke pipe line or break the pipes.

2. Flow Irrigation System

5.5.6 This system was made on River Budhi in the year 1975. This system is established in village Chand, block Obara, District Aurangabad. This system was made to provide irrigation water mainly in Kharif season. Total command area of the system is 600 hectares. Due to erratic behavior of rains, system is not able to provide sufficient water, and that's why very less area has been covered by the system. Last eight years actual irrigated area in Rabi and Kharif seasons is given below (Table 5.21).

Table 5.21: Irrigated Area during 1999-2000 to 2007-08

Year	Rabi (In Hectares)		Kharif (In Hectares)	
	Target	Achievement	Target	Achievement
1999-2000	80	10 (87.5)	180	110 (38.88)
2000-2001	Nil	Nil	100	75 (25)
2001-2002	Nil	25	100	105 (-5)
2002-2003	Nil	18	150	190 (-26.67)
2003-2004	Nil	Nil	150	150 (0.00)
2004-2005	Nil	Nil	200	185 (7.5)
2005-2006	Nil	Nil	200	190 (5)
2006-2007	Nil	Nil	200	180 (10)
2007-2008	Nil	Nil	250	200 (20)

Note:- Figures In parentheses indicate percent gap between target and actual irrigated area.

5.5.7 Some of the major issues for such a dismal performance of the system are given below:

(a) Rainfall

5.5.8 Over the years, it has been observed that monsoon fails once in every two to three years that's why system is not getting sufficient water. Due to lack of water, canal head discharge has been reduced.

(b) Lack of Budget

5.5.9 System needs regular maintenance to perform properly. Due to lack of fund, field channels, canals have damaged.

(c) Distribution Constraints

5.5.10 The channels and canals are not in proper condition. In some cases, the channels have been destroyed by the farmers.

3. Dugwell

5.5.11 Government has constructed lot of dug wells for irrigation purpose in the State. Five dug wells have been constructed in Yari village District Aurangabad in the year 1990. At the time of inception, the command area of one dug well was 2 hectare. The farmers lift water from well by using pumps. Due to insufficient rainfall, at the present time very little amount of water remains available in the well. If farmers try to lift water, it is exhausted in just half an hour, so dug well is not able to provide water for irrigation in this condition.

4. Deep Tubewell

5.5.12 Deep tubewell is a minor irrigation system to provide irrigation water of those areas which are not covered by canal systems. Many Deep tubewells have been established by the Government in different villages. One of the deep tubewell is established in village Siris, block Barun, District Aurangabad. This tubewell was built in 1994. This tubewell was established to provide irrigation water to 40 hectares area of Siris village. Due to many reasons, system is not able to provide sufficient water. The performance of the tubewell can be understood easily by the figures given in Table 5.22 below.

Table 5.22: Irrigated Area during 2004-05 to 2007-08

Year	Rabi (In Hectares)		Kharif (In Hectares)	
2004-2005	Nil	(100)	03	(92.5)
2005-2006	06	(85)	13.70	(65.75)
2006-2007	5.10	(87.25)	04	(90)
2007-2008	2.27	(94.32)	07	(82.5)

Note: Figures In parentheses indicate percent gap between potential and actual irrigated area.

5.5.13 It is evident that during last few years, tubewell is providing water in very less area in both the seasons. The main cause of non performance of tubewell is inadequate power supply. Last four years power supply hour has been presented in Table 5.23 below which shows the poor power supply condition in both Rabi and Kharif seasons. Without proper electric supply system cannot cover total command area.

Table 5.23: Status of Availability of Electric Power

Year	Rabi (In Hours)	Kharif (In Hours)
2004-2005	Nil	32
2005-2006	83	180
2006-2007	59	50
2007-2008	21	25

5.5.14 All channels have been destroyed and new channels are not constructed. Due to lack of proper field channels, water does not reach at the end portion. Tail end farmers do not get water for irrigation.

Section 6: Analysis of Minor Irrigation Projects – Jharkhand

5.6.1 The irrigation potential created through minor irrigation schemes (including schemes undertaken by other government agencies and private agencies) in Jharkhand was 463.151 thousand hectare in 2006-07 (as shown in Table 5.24), which is almost double the irrigation potential created through major and medium irrigation projects (229.72 thousand ha). However, the actual performance of minor irrigation schemes has not been very satisfactory.

Table 5.24: Created Irrigation Potential and Actual Irrigation through Minor Irrigation Projects in Jharkhand (including private and other agencies)

Year	Created Irrigation Potential (thousand ha)
2004-05	442.658
2005-06	446.830
2006-07	463.151

Source: Department of Irrigation, Government of Jharkhand

5.6.2 The total number of minor irrigation schemes in government sector at the time of creation of Jharkhand state was 2,476 with a total irrigation potential of 92,284 ha. With the addition of new minor irrigation schemes the total number

of schemes reached to 5,252 by 2005-06 and the created irrigation potential increased to 1,17,334 ha during the same period. However, the actual irrigated area is much lower than the created potential area. The minor irrigation department prepares target area for irrigation each year, which is much less than the potential irrigated area. However, the actual irrigated area (in kharif and rabi seasons taken together) has been varying from 41 percent to 75 percent of the targeted area during the period 2001-02 to 2007-08. The targeted and actual irrigation area through government minor irrigation projects are presented in Table 5.25.

Table 5.25: Irrigation Area Targeted and Actual Irrigation through Government Owned Minor Irrigation Projects in Jharkhand

Year	Kharif		Rabi	
	Target (ha)	Achievement (ha)	Target (ha)	Achievement (ha)
2001-02	38779	24666	10555	5286
2002-03	42216	18974	6157	3586
2003-04	43967	19333	8223	2024
2004-05	--	15249	--	--
2005-06	--	--	--	--
2006-07	39326	24636	11415	5663
2007-08	40334	31972	10057	5924

Source: Chief Engineer's Office, Department of Minor Irrigation, Govt. of Jharkhand

5.6.3 A cluster of minor irrigation projects in Ranchi and Lohardagga districts of Jharkhand were taken to find out the reasons for the large gap between the created potential and the actual irrigation. The details about the total potential created in Ranchi district through various types of minor irrigation schemes are presented for Kharif and Rabi seasons in Table 5.26. The largest potential created in Ranchi district was through MI (referred as medium irrigation) scheme projects, having about 42 percent of total potential under the minor schemes. Although the potential through these MI schemes are generally 100-200 ha, they are referred as MI schemes as they are relatively larger schemes under minor irrigation department. The actual irrigation area through MI schemes is merely 37 percent of the total created potential.

Table 5.26: Irrigation Potential Created and Actual Irrigation through Selected Categories of Minor Irrigation Projects in Ranchi Division of Jharkhand

Year/Season		MI scheme	Check-dam scheme	20' dia Well scheme	Pond scheme	Lift irrigation scheme	Micro-lift scheme	Total
Potential Created (ha)								
Kharif (K)		2334	410	27.5	469	2098	390	*5729*
Rabi (R)		994	113	12.5	203	740	156	*2219*
Total (Kharif + Rabi)		*3328*	*523*	*40*	*672*	*2838*	*546*	*7948*
Percentage (of total potential)		*41.87*	*6.58*	*0.50*	*8.45*	*35.71*	*6.87*	*100*
Actual Irrigated Area (ha)								
2001-02	K	714	-	-	-	215	-	*929*
	R	241	-	-	-	204	-	*445*
2002-03	K	721	50	-	-	191.5	-	*963*
	R	275	9	-	-	177	-	*461*
2003-04	K	601	100	-	-	257	-	*958*
	R	151	-	-	-	130	-	*281*
2004-05	K	431	44	5.2	24.6	123.2	197.8	*826*
	R	107.2	11.2	1.6	4	24.6	55.6	*204*
2005-06	K	474	54.5	10	72	82	145.8	*838*
	R	108	8.5	5.5	25	29	51.5	*228*
2006-07	K	1027	93	8.5	216	228	232	*1805*
	R	190	22	3	42	36	23	*316*
2007-08	K	1086	262	18.5	349	320	275	*2311*
	R	151	70	8.5	87	35	96	*448*
Percentage (of total potential in 2007-08)		*37.17*	*63.48*	*67.50*	*64.88*	*12.51*	*67.95*	*34.71*

Source: Adapted from Data obtained from Department of Minor Irrigation, Govt. of Jharkhand

5.6.4 The lift irrigation scheme is the next important cluster of schemes in Ranchi contributing to about 36 percent of total irrigation potential through the minor irrigation schemes. However, actual irrigation through these schemes is very poor compared to the created potential. During the year 2007-08, only 12.51 percent of the irrigation potential through the lift irrigation (under government sector) could be achieved. Almost similar situation is prevalent in most of the other districts in the state. More than 90 percent of the lift irrigation schemes are

not functioning in the state. The performance of lift irrigation schemes in different districts of Jharkhand are presented in Table 5.27. There are four districts where 100 percent of the lift irrigation schemes are not functioning. All these contributed to lower irrigation potential achievement compared to the created potential.

Table 5.27: Performance of Lift Irrigation Schemes in Different Districts of Jharkhand

District	Total completed Schemes	Working schemes	Non-working schemes	Percentage of non-working schemes
Ranchi	90	15	75	83.33
Khunti	76	13	63	82.89
Lohardaga	25	02	23	92.00
Gumla	84	02	23	27.38
Simdega	64	11	53	82.81
Chaibasa	105	--	105	100.00
Saraikela	54	06	48	88.89
Jamshedpur	67	02	65	97.01
Medininagar	21	02	19	90.48
Garhwa	43	14	29	67.44
Latehar	85	11	74	87.06
Hussainabad	16	01	15	93.75
Hazaribagh	55	09	46	83.64
Giridih	15	04	11	73.33
Koderma	14	2	12	85.71
Dhanbad	39	02	37	94.87
Bokaro	15	-	15	100.00
Chatra	11	--	11	100.00
Dumka	129	04	125	96.90
Jamtara	32	--	32	100.00
Sahebganj	28	02	26	92.86
Pakud	19	--	19	100.00
Godda	67	--	67	100.00
Deoghar	55	--	55	100.00
Total	*1209*	*102*	*1107*	*91.56*

Source: Department of Minor Irrigation, Govt. of Jharkhand

5.6.5 According to the 3rd Minor Irrigation Census, only 31.1 percent of the minor irrigation schemes were working in India without any constraint. About 29.3 percent minor irrigation schemes were having less water discharge, 7.5 percent were plagued with inadequate power and 4.5 percent were not working due to mechanical breakdown. To find out the actual problems with minor irrigation schemes in Jharkhand for not reaching the expected irrigation

potential, visits to several minor irrigation schemes under government sector were undertaken in the state. The reasons for non-functioning of various schemes or functioning below their created potential are discussed below.

5.6.5 One of the major reasons for underperformance of the minor irrigation schemes has been the problem in the various structures related to mechanical, civil, electrical and combined nature. For example, the nature of structure related problems in lift irrigations schemes in various districts of the state are given in Table 5.28. Due to these mechanical and civil related problems a large volume of water gets drained away from storage type irrigation schemes resulting in less water discharge.

Table 5.28: Problem Areas related to Structure related Problems in Lift Irrigation Schemes in Different Districts of Jharkhand

District	No. of Non-working Lift Irrigation Schemes	Problem Areas
Ranchi	75	18 Mechanical plus civil, 57 combined
Khunti	63	11 mechanical plus civil, 7 incomplete plus broken structure, 15 combined
Lohardaga	23	6 mechanical plus civil, 17 combined
Gumla	23	30 mechanical plus civil, 52 combined
Simdega	53	17 mechanical plus civil, 38 combined
Chaibasa	105	6 mechanical plus civil, 94 combined, 11 without power
Saraikela	48	6 mechanical plus civil, 42 combined
Jamshedpur	65	65 combined
Medininagar	19	2 mechanical, 17 combined
Garhwa	29	5 mechanical, 24 combined
Latehar	74	3 mechanical plus civil, 71 combined
Hussainabad	15	1 mechanical plus civil, 14 combined
Hazaribagh	46	14 mechanical plus civil, 32 combined
Giridih	11	1 mechanical plus civil, 10 combined
Koderma	12	12 mechanical plus electrical
Dhanbad	37	4 mechanical plus civil, 33 combined
Bokaro	15	3 mechanical, 12 combined
Chatra	11	3 mechanical plus civil, 8 combined
Dumka	125	5 mechanical plus civil, 120 combined
Jamtara	32	2 mechanical plus civil, 30 combined
Sahebganj	26	26 combined
Pakud	19	19 combined
Godda	67	6 mechanical plus civil, 6 incomplete and broken, 52 combined
Deoghar	55	5 mechanical plus civil, 50 combined

Source: Chief Engineer's Office, Department of Minor Irrigation, Govt. of Jharkhand

5.6.6 The major reason for mechanical and civil related problems with minor irrigation structures are the poor maintenance of the structures. Except for MI Schemes, which are relatively larger in size under minor irrigation schemes, most of the other minor irrigation schemes are handed over to the Water Users Association (WUA) for their security, collection of revenue and regular maintenance. However, the water users' associations have been grossly inactive in Jharkhand. There have been attitudinal problems regarding use and pay system of these schemes. As most of the villagers are small and marginal farmers, they are not willing to pay for used water. Hence, the collection of revenue by the users' association is highly erratic. This affects the regular maintenance of the structures either by the association or by the irrigation official keeping in view that the fund availability for the maintenance of old schemes are also not available to the minor irrigation department on regular basis at appropriate time.

5.6.7 The safety and security of the irrigation structure has been a major concern in Jharkhand state. As long as people use these irrigation facilities, they are also concerned about their safety and security. Once the irrigation structure remains out of use for one or two seasons for any reason, the villagers lose interest in the project and security of the structure becomes a problem. In many places it was found out that iron and wooden part of the irrigation structures (such as sluice gates in check dams) are stolen away and the entire command area loses the irrigation facility through those schemes. Regular maintenance and supervision of the structures are also hampered due to naxalite movement, which is very common in many districts in Jharkhand state.

5.6.8 During the initial part of the rainy season when the flow of water is more in streams, the irrigation structure such as sluice gates in dams are raised up so that silt is drained away and later on, the gates are brought down for water storage for future irrigation purposes. However, in many schemes such gates have been either stolen away or not working due to poor maintenance of the structures. As iron gates are costlier and easily get noticed by anti-social elements, the minor irrigation department staffs have devised an innovative way to use two parallel sheets of wooden planks filled with sand and soil as regulating gates in place of iron gates. But these wooden gates also have to be removed and taken away at safer place at the end of every season as some people find even these wooden planks as lucrative option for fuel purpose.

5.6.9 One of the major reasons for not using some of the minor irrigation schemes has been the increasing cost of watering. In villages where electricity is available, people use electric power for pumping etc. to irrigate their crops. However, in many villages there is no electricity facility available due to various reasons such as non-electrification of the villages, electric cables getting stolen away by unsocial elements etc. In many minor irrigation schemes, the project were conceptualized with the assumption that pumping will be done using diesel power. However, due to rocketing price of diesel it has become extremely costly

for the farmers to use diesel for food grains. Although some of the large farmers do depend on diesel pumps especially for cash crops such as vegetables, in general, people do not find it remunerative to depend on it for irrigation.

5.6.10 In minor irrigation schemes such as ponds, check-dams etc. where rainwater or stream water get stored for irrigation purposes, problem of siltation is also quite common, which reduces the irrigation capacity of the scheme. However, the problem of siltation in minor irrigation schemes is less severe compared to major and medium irrigation schemes.

Section 7: Analysis of Minor Irrigation Projects – Orissa

1. Chadakmara MIP

5.7.1 This project is located in Parsurampur village of Banki Sub-division in Cuttack District. This project was constructed in the year 1975 to provide irrigation to 25 hectares of land in the downstream pertaining to the farmers of Parsurampur village only. Subsequently, the project was improved to irrigate 47 hectares land. The ayacut area submerges every year in Kharif due to flood and no crop is raised in Kharif. In Rabi, the designed area is irrigated from this project to raise light duty crop as the storage capacity of the project is insufficient. Farmers take vegetable crops during early Rabi season till the water from the project is exhausted. Therefore, it is difficult to manage water throughout the crop season. The embankment made for storage of water facilitates storage up to the end of February or mid March. The department provides supplementary water for late kharif which is actually utilized by the farmers for vegetable cultivation in early Rabi.

5.7.2 Salient Features:

- The catchment area of this project is about 1.30 Sq Kms.
- The length of the earthen dam is 700mtrs.
- No of head regulators – 2 (Two)
- Size of the vent – 450mm dia hume pipe.

5.7.3 The irrigate area from the project during last 10 years is given in Table 5.29 below. It is seen that the irrigated area during the period from 1999 to 2005 was in between 53 to 74 percent of designed area.

Table 5.29: Area Irrigated by Chadakmara MIP during 1998 to 2005

Year	Area actually irrigated (Ha.)	% of actual to design area
1998	47	100
1999	28	60
2000	28	60
2001	26	55
2002	25	53
2003	25	53
2004	35	63
2005	35	74

5.7.4 The reasons for the gap between irrigation potential created and its utilization could be as follows:

- Damage of structures in 1999 super cyclone
- The area is most affected by flood every year in river Mahanadi.

2. Kamedibandha MIP

5.7.5 This project is located in Parsurampur village of Banki Sub-division in Cuttack District. This project was constructed in the year 1975 to provide irrigation to 22 hectares of land in the downstream pertaining to the farmers of Madhuapali, Baghei and Khaliapali village. Subsequently, the project was improved to irrigate 41 hectares of land. The ayacut area submerges every year in Kharif due to flood and no crop is raised in Kharif. In Rabi the designed area is irrigated from this project to raise light duty crop as the storage capacity of the project is insufficient. Farmers cultivate vegetable crops during early Rabi season till the water from the project is exhausted. Therefore, it is difficult to manage water throughout the crop season. The embankment made for storage of water facilitates storage up to the end of February or mid March. The department provides supplementary water for late kharif which is actually utilized by the farmers for vegetable cultivation in early Rabi.

5.7.6 Salient Features:

- The catchment area of this project is about 1.30 Sq Kms.
- The length of the earthen dam is 610 mtrs.

5.7.7 The irrigate area from the project during last 10 years is given in Table 5.30 below. It is seen that the irrigated area during the period from 1999 to 2005 was only in between 54 to 63 percent of designed area.

Table 5.30: Area Irrigated by Kamedibandha MIP during 2000 to 2005

Year	Area actually irrigated (Ha.)	% of actual to design area
2000	25	61
2001	22	54
2002	22	54
2003	25	61
2004	26	63
2005	24	58

5.7.8 The reasons for the gap between irrigation potential created and its utilization are as follows:

- Damage of structures in 1999 super cyclone
- The area is most affected by flood every year in river Mahanadi.

3. Lift Irrigation Projects (Tubewell)

5.7.9 Ground water is an assured and potential source of irrigation. Coastal tract of Orissa is rich in ground water potential and hence large numbers of filter point shallow/medium depth tubewells are installed for irrigation individual/group of farmers and also by Government Corporations. Visits to 4 villages in Cuttack District of Orissa were made, where Orissa Lift Irrigation Corporation (OLIC) has installed medium depth filter point tube wells for irrigation. Project wise details are given in Table 5.31. The average depth of the tube wells are 60 meters and diameter of the well are of 200 mm. Projects were installed during 1970 to 1996. Out of total 17 numbers of projects, two numbers of old projects installed in the early 70's (Chanduli – II and Tainkana – I) are non-functional due to sand filling.

Table 5.31: Detailed Information on Lift Irrigation Projects in Cuttack Sadar Block, Cuttack District, Orissa

Sl No	Block	Name of the LI Project	Type	Design Ayacut in Ha.	Present status of the Project	Reasons for defunct	Area Irrigated in Ha
1	Cuttack Sadar	Bantunia-I	TW	24	Operable		15
2	Cuttack Sadar	Bantunia-II	TW	24	Operable		16
3	Cuttack Sadar	Bantunia-III	TW	20	Operable		13
4	Cuttack Sadar	Chanduli-I	TW	24	Operable		16
5	Cuttack Sadar	Chanduli-II	TW	24	Defunct	TW choked. No Power supply	-
6	Cuttack Sadar	Chanduli-III	TW	24	Operable		15
7	Cuttack Sadar	Chanduli-IV	TW	12	Operable		14
8	Cuttack Sadar	Barala-I	TW	24	Operable		18
9	Cuttack Sadar	Barala-II	TW	24	Operable		14
10	Cuttack Sadar	Barala-III	TW	24	Operable		13
11	Cuttack Sadar	Barala-IV	TW	24	Operable		12
12	Cuttack Sadar	Barala-V	TW	16	Operable		10
13	Cuttack Sadar	Barala-VI	TW	16	Operable		10
14	Cuttack Sadar	Barala-VII	TW	20	Operable		13
15	Cuttack Sadar	Taikana-I	TW	24	Defunct	TW choked. No Power supply	-
16	Cuttack Sadar	Taikana-II	TW	24	Operable		12
17	Cuttack Sadar	Taikana-III	TW	16	Operable		12

Source: Orissa Lift Irrigation Corporation

5.7.10 As per the report of the OLIC, 15 projects are operable and have been handed over to the concerned pani-panchayat (water user's association) for operation and maintenance. In our field visits, it was noticed that out of these 15 projects, 3 projects were not functional. A village-wise detail is given in Table 5.32 below.

Table 5.32: Status of Lift Irrigation Projects in District Cuttack, Orissa

Village	No. of projects installed (OLIC report)	No. of operating projects (as reported by OLIC)	No. of operating project (as notices in field visit)
Bantunia	3	3	3
Chanduli	4	3	2
Baral	7	7	5
Tainkana	3	2	2
Total	**17**	**15**	**12**

5.7.11 The designed ayacut and the actual irrigated area under these projects differ significantly, as may be seen in the Table 5.31. It is clear that about 60 percent of the designed ayacut is being irrigated. The reasons for such gap are enumerated below:

- The design has been made of light/ medium duty crops for Rabi crops whereas farmers prefer to take up paddy cultivation in Rabi, causing low coverage area.
- There are no field channels in the command ayacut resulting in seepage and conveyance losses of water.
- Efficiency both in tubewell and pumping system has reduced over the years.

Section 8: Analysis of Sample Minor Irrigation Projects – Chhatissgarh

1. Chandkhuri Lift Irrigation Scheme

5.8.1 The Chandkhuri Lift Irrigation scheme is situated on left bank of Shivnath River, near village Chandkhuri, in Durge district. This minor irrigation scheme was incepted in 1974 and completed in the year 1978 at a cost of Rs. 42.79 lakhs. It presently covers only two villages, namely Chandrakhuri and Konari. The length of the main canal is 240 meter that had 2 minors. The main canal was originally designed to take 4.12 cusecs of water with a total lift of 11.45 meters. Initially, the project had gross command area of 254 ha, while at present, the project command area has declined to 101.18 ha. The irrigated area from the project during last few years is shown in Table 5.33 below.

Table 5.33: Irrigated Area by Chandkhuri Lift Irrigation Scheme during 2000-01 to 2007-08

Year	Kharif (ha)	Rabi (ha)
2000-01	33.51	NA
2001-02	35.21	NA
2002-03	121.4	NA
2004-05	NA	NA
2005-06	NA	NA
2006-07	NA	NA
2007-08	NA	NA

5.8.2 The Chandkhuri Lift Irrigation scheme is suffering from poor performance in physical and financial measures. The poor performance of the scheme is attributed to insufficient fund for maintenance, lack of coordination between existing departments, interrupted power supply and decline in water discharge efficiency. Moreover, damage of original structures, leakages in distribution chamber and silting are some other reasons for deteriorating conditions of the irrigation system. It is necessary to restore the storage capacity of water body with the purpose of recovering their lost irrigation potential.

(a) Decrease in Pumps Efficiency

5.8.3 The scheme had 2 Nos. of 50 HP V.T. pumps with water discharge capacity of 7 Cusec, which has gone down to 6 Cusec. Presently both pumps are out of order and reported to be under repair. At present, the irrigation potential is nil.

(b) Decrease in Command Area

5.8.4 The urbanization pattern largely affected the agricultural land in the area for non-agricultural purposes. About 250 acres of land of the project command area has been converted to urban and industrial areas.

(c) Lack of Budget for Maintenance

5.8.5 Due to lack of yearly budgetary provision for the maintenance of damages in structures like distribution chambers, canal outlets and minor, the overall irrigation potential of the scheme has declined over the years.

2. Tubewell Project-C2 DRG (C-II) -117

5.8.6 C2 DRG (C-II) 117 is a minor irrigation project situated in Latabod village of the block Baload in Durg district. It was incepted in 1986, and covers only one village with initial command area of 35 acres. It has drainage to cover 300 meters length. The incepted command area of the project was 14.17 ha for Kharif and 8.1 ha for Rabi. However, the maximum irrigation potential utilized at 91.95 percent for Kharif irrigation during 2007-08, while maximum 76 percent Rabi irrigation was recorded during 2004-05. The actual irrigated area during the last five years has been presented in Table 5.34.

Table 5.34: Actual irrigated area (ha) during last five years.

Year	Kharif (ha)	Rabi (ha)
2003-04	9.25	2.5
2004-05	8.04	6.15
2005-06	8.46	4.75
2006-07	8.95	5.48
2007-08	13.03	5.49

(a) Decline in Ground Water Table

5.8.7 The water table in this area has witnessed a steady decline due to excessive exploitation of groundwater largely due large number of private tubewell in around areas of the project. Moreover, the ground water quality has also declined, and the situation has worsen more during dry season.

(b) Decline in Water Discharge Capacity

5.8.8 The ideal water discharge capacity of the pump was initially 10000 GPH (gallon per hours) that has declined to 8000 GPH. In the essence of declining ground water table, the problem has become more acute.

(c) Insufficient Budget for Maintenance

5.8.9 Year wise allocation of funds for the maintenance of the tubewell and electricity expenses since last five years is presented in Table 5.35 below. It reveals that maximum budget allocated was Rs. 8000, during 2005-06, for the maintenance of tubewell. During the last year it declined to Rs. 4800 only.

Table 5.35: Year wise allocation of funds for maintenance and power Expenditure

Year	Exp. on maintenance of tubewell (Rs.)	Exp. on Electricity (Rs.)
2003-04	4550	7580
2004-05	6575	7965
2005-06	8000	8100
2006-07	5500	8375
2007-08	4800	10225

3. Nawagaon Tank

5.8.10 The Nawagaon Tank project is a minor irrigation project which was incepted in 1960. The project is situated in Nawagaon village in capital district of Raipur. It covers 5 villages through 8.625 km of canal system and has single minor. The total command area of the project is 1217 hectare. Actual irrigation made by the project during last five years is presented in Table 5.36 below. A consistency in Kharif irrigation, with 91 percent potential utilization has been observed over the years. Moreover, during 2006-07, about 21 ha of Rabi irrigation was also added in the project.

Table 5.36: Irrigated Area (ha) under Nawagaon Tank

Year	Kharif (ha)	Rabi (ha)
2002-03	1108.06	NA
2003-04	1108.06	NA
2004-05	1108.06	NA
2005-06	1108.06	NA
2006-07	1108.06	21.04

Decrease in Storage Capacity of Tank

5.8.11 Initially, the tank was designed with live storage capacity of 3.68 M Cum which presently has declined to 2.75 M Cum i.e. by 25 percent. It has affected the potential irrigation efficiency of the scheme that declined the command area.

4. Kurud Tank II

5.8.12 The Kurud Tank incepted in 1909 is one of the oldest irrigation schemes in the state. It covers 8 villages through 12.42 Km. canal system with 5 minors. The present irrigation potential of Kharif and Rabi are 1388 ha and 101 ha, respectively. As against the 1388 ha potential irrigated area in Kharif and 101 ha in Rabi season, the actual irrigated area over the years is significantly higher in the scheme. It justified with the significant change in cropping pattern in the command areas, where farmers are shifting over multi-cropping farming system. Moreover, most of the barren land has been converted into cultivable land which slightly increased the actual irrigated area under the project. The actual irrigated area during Kharif and Rabi seasons during the last five years are given in Table 5.37.

Table 5.37: lrrigated area under Kurud Tank II

Year	Kharif (ha)	Rabi(ha)
2002-03	1574	NA
2003-04	1223	166
2004-05	1573	04
2005-06	1570	06
2006-07	1569	NA

(a) Insufficient Budget for Maintenance

5.8.13 Likewise other project, the scheme is also suffering from insufficient budget for the maintenance. However, yearly provisions of budget are made for the repair and maintenance works but it is meager amount as compared to actual requirements.

(b) Lack of Regular De-silting Operations

5.8.14 Due to lack of irregular de-silting operation of the canal system, the problems of water logging and overflow of waters is common. The rainfall flows the soils into the canal and drainage system drawn it shallow. Moreover, in some command areas water does not reach at tail end. This finally limits to potential utilization of irrigation water due to water losses.

Section 9: Analysis of Sample Minor Irrigation Projects – M.P.

1. Shallow Tubewell

5.9.1 This shallow tubewell was built in 1987-88 in village Sumawali Block, Jora District of Gwalior. System has one 15 HP electric motor. The total command area of this system is 40 hectare. The irrigated area from the system during last 5 years separately in Kharif and Rabi season has been presented below in the Table 5.38. The figures of Table 5.38 show the dismal performance of system. In this region paddy crop is not in practice so farmer do not demand water in Kharif season.

Table 5.38: lrrigated Area under Shallow Tubewell

(Area in hectare)

Year	Kharif	Rabi	
2003-04	Nil	12	(70.0)
2004-05	Nil	9	(77.5)
2005-06	Nil	10	(75.0)
2006-07	Nil	6	(85.0)
2007-08	Nil	8	(80.0)

Note: Figures in parentheses indicate percentage gap between potential and utilization

Reason of Gap between Irrigation Potential and Utilization

5.9.2 There are numerous reasons which affect the performance of system. Some of the major issues are discussed as follows.

(a) Decreased Pump Efficiency

5.9.3 The discharge and efficiency of pump have gone down significantly. According to WUA members, 40 percent efficiency of the pumps has been reduced.

(b) Lack of Distribution Channels

5.9.4 This system was established in 1988-89 and it is twenty years old now. Due to non maintenance, all channels have destroyed. Presently there are no field channels for water distribution. Farmers take water by temporary field channels only. Few farmers who are near to pump are able to take water from system. These things create a huge gap between potential and utilization.

(c) Inadequate Power Supply

5.9.5 Inadequate power supply is a major cause for dismal performance of system. Average power supply is 3 -4 hours per day. Even these hours of supply is not in continuous form. This short duration of power supply does not allow to proper utilization of system and increases water losses also.

(d) Lack of Budget for Maintenance

5.9.6 The annual budget for maintenance of system is Rs. 4000. According to officials, it is very less for maintenance of system. This amount is not sufficient for pump and channel maintenance. Due to less provision of funds, field channels have been destroyed and system is not able to irrigate all of its command area.

2. Dhanela Lift Irrigation Scheme

5.9.7 Dhanela pump canal one of the minor lift irrigation systems of Madhya Pradesh, was constructed on the River Sank in the year 1993. It has a pump house with 4.31cusec water capacity. It was designed to cover 243 hectare command area in Morrana District. Out of 243 hectare command area, 146 hectare was proposed in Rabi and 97 hectare in Kharif. This system is working with 3 pumps of 25H.P. One pump is as stand by. The irrigated area from the project during last 5 years separately in Kharif and Rabi season has been presented in Table 5.39 below. The figures show a dismal performance of system. During Rabi season, on an average 40 percent potential has been utilized but Kharif performance is nil because in this region paddy crop is not in practice so farmers do not demand irrigation water in Kharif.

Table 5.39: Actual Irrigated Area by Dhanela Lift Irrigation Scheme during last Five Years

(Area in hectare)

Year	Kharif	Rabi
2007-08	Nil	80(45.20)
2006-07	Nil	60(59.45)
2005-06	Nil	55(62.83)
2004-05	Nil	62(58.10)
2003-04	Nil	65(56.08)

Note: Figures in parentheses indicate percentage gap between potential and utilization

Reason of Gap between Irrigation Potential and Utilization

5.9.8 There are numerous reasons which affect the performance of system. Some of the major issues are discussed as follows.

(a) Inadequate Power Supply

5.9.10 Inadequate power supply and low voltage is a major cause of bad performance of system. According to irrigation officials, the average electric supply is 3 to 4 hours per day. Electric supply with low voltage is a big cause of damage of pumps and other equipments. There is consistent low voltage problem due to which both the pumps are not able to run together. This creates low water discharge and subsequently a gap between irrigation potential and utilization.

(b) Distribution Constraints

5.9.11 System has 2235 meter main canal with two distributaries; one is 1L of 960 meter and second is 2R of 180 meter. This system is about 15 year old. Due to lack of maintenance, distribution channels are in very bad shape. At the time of inception, the main canal was cemented but at present it has been damaged due to which water does not flow properly in canal. Distributaries are also in bad condition with breakage and siltage. This leads to improper water distribution and under utilization of irrigation potential.

3. Deep Tubewell

5.9.12 This deep tubewell was built in 1989 in village Rora, block Bhind in District Bhind. The main objective of scheme was augment surface water of Chambal canal system by ground water. Additional irrigation of 14000 hectare was proposed in original scheme. There was only 192 hectare area irrigated in year 2006-07. Now only 21 tube well are in running condition. Rora deep tubewell is on of them. This system has one 10 HP electric motor, while at the time of inception it was operated with 60 HP motor. Total command area of system is 80 hectare; 40 hectare in Rabi and 40 hectare in Kharif. The irrigated area from the system during last five year has been presented below in the Table 5.40. The figures of table show a very dismal performance of system. In the kharif season system performance is nil because in this region paddy crop is not in practice so farmers do not demand irrigation water in Kharif.

Table 5.40: Actual Irrigated Area during last Five Years

(Area in Hectare)

Year	Kharif	Rabi
2006-07	Nil	3.07 (92.35)
2005-06	Nil	6.12 (84.70)
2004-05	Nil	7.30 (81.75)
2003-04	Nil	6.50 (83.75)
2002-03	Nil	8.40 (79.00)

Note: Figures in parentheses indicate percentage gap between potential and utilization

Reason of Gap between Irrigation Potential and Utilization

5.9.13 There are numerous reasons which affect the performance of system. Some of the major issues are discussed as follows.

(a) Decreased Pump Efficiency

5.9.14 The discharge and efficiency of pump have gone down significantly. At the time of inception, system was working with 60H.P. electric motor and its discharge was 45000 G.P.H. but at present system is running with 10 H.P. and its discharge is approximately 8000 G.P.H. Thus, 82 percent efficiency has been reduced. These things create a huge gap between potential and utilization.

(b) Inadequate Power Supply

5.9.15 Inadequate power supply is a major cause for dismal performance of system. Average power supply is 3 to 4 hours per day. But these hours of supply is not in continuous form. This short duration of supply increase water losses. During peak load in irrigation season the required input voltage 33KV / 11KV are very low which correspondingly reduce supply to motor incoming, result less operational hours of augmentation tubewell and damages to equipments.

(c) Lack of Budget for Maintenance

5.9.16 Lack of budget is a major cause to bad performance of system. Actual fund received against demand for all 174 deep tubewells is very less (Table 5.41). Due to non availability of funds, the repair of various equipment i.e. motor pump, panel, and transformer could not be taken up timely. It has reduced numbers of operational augmentation tubewell per year. Due to insufficient budget presently 21 tubewells are in running condition.

Table 5.41: Actual Fund Received during last Five Years

(Rupees in lakh)

Year	Demand	Received	Lack of Fund (%)
2003-04	315	20	93.65
2004-05	315	20	93.65
2005-06	315	20	93.65
2006-07	315	25	92.06
2007-08	315	25	88.88

(d) Distribution Constraints

5.9.17 Improper and non maintenance of canal system in past years has lead to its deterioration and inefficient functioning which consequently lead less or nil supply of irrigation water to area situated at tail. Due to non maintenance, canals are in vary bad shape. They are not able to carry sufficient water properly. It is observed that farmers in initial reach over draw irrigation water which leads to reduction in irrigated area.

4. Surface Flow Scheme (Jakhoda Tank)

5.9.18 Jakhoda tank is one of the minor surface flow irrigation schemes of M.P. This system is situated near village Jakhoda tehsil Gwalior in District Gwalior. It was sanctioned in year 1979 but due to some administrative problem it could not

start at that time. It was constructed in 2001-02. This system is made to provide irrigation water especially in Rabi season. Total command area of project is 400 hectare. System has two main canals with the length of 9.10 k.m. Khar nala is main water source of system. The irrigated area from the system during last 5 years in Rabi season has been presented in Table 5.42 below. The figures show the dismal performance of system. During Rabi season on an average only 23 percent of the potential has been utilized.

Table 5.42: Actual Irrigated Area by Jakoda Tank during Last Five Year

Year	Area (Hectare)
2002-03	110 (72.5)
2003-04	105 (73.75)
2004-05	105 (73.75)
2005-06	73 (81.75)
2006-07	73 (81.75)

Note: Figures in parentheses indicate percentage gap between potential and utilization.

Reason of Gap between Irrigation Potential and Utilization

5.9.19 There are numerous reasons which affect the performance of system. Some of the major issues are discussed as follows.

(a) Distribution Constraints

5.9.20 System has two main canals; one is LBC with the length of 5.40 K.M. and second is RBC with the length of 2.75 K.M. These two main canals are not in proper condition. The bed level of both canals is not in good condition. This is a major cause to insufficient water flows in canal and water logging in some area. This leads to improper water distribution and under utilization of irrigation potential.

(b) Lack of Budget for Maintenance

5.9.21 The efficiency of tank and canal system has gone down due to maintenance. This also cause to inadequate water flow in canal system limit irrigation water to reach at tail portion and improper distribution of irrigation

water. In last five year no money has been received for maintenance of system. This is a major cause to cerate a gap between potential and utilization.

(c) Lack of Staff

5.9.22 A high irrigation potential consistency requires supporting staffs to maintenance and other constructive development measure to its efficiency improvement. Any reduce size of staffs including field and technical staff affects the functioning and efficiency of the whole system. The sanction number of post and actual working staff is presented in Table 5.43 below. It clearly indicates that only 3 current working position against approved 9 positions resulting in 33 percent man power level. This is a major cause of low performance of system.

Table 5.43: Status of Staff in the Jakhoda Tank Scheme

Designation	Working Staff	Sanction Staff	Required Staff
Sub Engineer	1	1	
Ameen	1	1	
Timekeeper	0	1	1
Helper	0	5	5
Peon	1	1	
Total	**3**	**9**	**6**

Chapter 6

Analysis from Farmers' Survey

Section 1: Profile of the Respondents

6.1.1 The distribution of total respondents located in different States is presented in Table 6.1. The overall distribution of these respondents along head, middle and tail side of main canal, distributory canal and minor canals are presented in Table 6.2, Table 6.3 and Table 6.4, respectively. It may be noted that the sum of total number of respondents along main, distributory and minor canals taken together is higher than total number of respondents shown in Table 1 because of overlap in location of the farmers with respect to their relative position with respect to main canal, distributory and minor canal. As can be seen from these tables, the respondents are well distributed across different states and captures people located at head, middle and tail ends of main, distributory and minor canals.

Table 6.1: Distribution of Respondents across Different States

State	Number	Percentage of Total
Chhatisgarh	338	16.85
Jharkhand	388	19.34
Madhya Pradesh (M.P.)	360	17.95
Uttar Pradesh (U.P.)	380	18.94
Uttarakhand	307	15.30
Orica	133	6.63
Bihar	100	4.99
Total	2006	100.00

Table 6.2: Distribution of Respondents along Head, Middle and Tail of Main Canals

State	Percentage Distribution			Total Number
	Head	Middle	Tail	
Chhatisgarh	44.44	30.86	24.69	324
Jharkhand	31.48	49.63	18.89	270
M.P.	39.94	14.16	45.89	353
Utter Pradesh	20.62	60.31	19.08	325
Uttarakhand	36.86	24.45	38.69	274
Orissa	0.00	72.73	27.27	132
Total	**32.06**	**38.32**	**29.62**	**1678**

Table 6.3: Distribution of Respondents along Head, Middle and Tail of Distributory Canals

State	Percentage Distribution			Total Number
	Head	Middle	Tail	
Chhatisgarh	31.13	38.91	29.96	257
Jharkhand	22.64	55.66	21.70	212
M.P.	64.43	17.45	18.12	149
Utter Pradesh	24.52	55.94	19.54	261
Orissa	16.22	16.22	67.57	74
Total	31.48	42.18	26.34	953

Table 6.4: Distribution of Respondents along Head, Middle and Tail of Minor Canals

State	Percentage Distribution			Total Number
	Head	Middle	Tail	
Chhatisgarh	43.39	8.26	48.35	242
Jharkhand	24.59	40.16	35.25	122
M.P.	48.41	3.82	47.77	314
Utter Pradesh	50.92	5.54	43.54	271
Uttarakhand	0.00	0.00	100.00	30
Orissa	17.89	34.74	47.37	95
Total	41.15	12.01	46.83	1074

6.1.2 Agriculture has been the primary occupation for most of the respondents (Table 6.5). The percentage of people reporting agriculture as primary occupation varied from 66.24 percent in Jharkhand to 97.64 percent in Orissa. Even those people whose primary occupation was not agriculture, continued to depend on agriculture as their secondary occupation. This is evident from relatively higher percentage of people reporting agriculture as their secondary occupation in the States of Jharkhand, Uttarakhand and Bihar.

Table 6.5: Percentage of Respondents reporting Agriculture as Primary and Secondary Occupation in Different States

State	Primary	Secondary
Chhatisgarh	97.64	0.89
Jharkhand	66.24	32.99
M.P.	91.67	3.89
Utter Pradesh	97.37	2.63
Uttarakhand	84.69	14.98
Orissa	97.74	1.50
Bihar	89.00	11.00

6.1.3 The average annual incomes of respondents from primary and secondary occupations in different States are presented in Table 6.6. There has been wide fluctuation in the average income of respondents across different States. The average income from primary occupations in Uttarakhand was almost four times the average income from primary occupations in Orissa. As expected, the average annual income from secondary occupation in different States is much less compared to primary occupation.

Table 6.6: Average Income from Primary and Secondary Occupations in Different States (Rs)

State	Primary	Secondary
Chhatisgarh	47206	13377
Jharkhand	35534	17751
M.P.	37714	18373
U.P.	38825	29632
Uttarakhand	89174	26018
Orissa	22988	29087
Bihar	43960	27445

6.1.4 Distributions of income in percentile form (for 25, 50 and 75 percentiles) from primary and secondary sources are presented in Table 6.7 and Table 6.8, respectively. The average income indicated against 25 percentile indicates the level of income below which 25 percent of the respondents are lying in a particular state. Similarly income level indicated against 50 and 75 percentile indicate the level of income below which 50 percent and 75 percent of respondents are lying. Looking at these tables, it is clear that not only there is wide variation in the average income from primary sources of occupation across states, but also there is wide variation in income level within certain states. For example, in Uttarakhand, 25 percent of respondents were earning less than Rs. 15000 per year through primary sources of occupation but at the same time 25 percent of respondents were earning more than Rs. 1, 50,000 per annum. In general, the variation in average annual income through secondary sources is less compared to primary sources. However, in certain states like U.P., Orissa and Bihar the fluctuation is relatively higher. In these three states, the average income from secondary sources for the 75 percentile of respondents is more than three times the average income from secondary sources for the 25 percentile of respondents.

Table 6.7: Distribution of Income from Primary Sources

	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
Mean Percentiles	47206	35534	37714	38825	89174	22988	43960
25	15000	16000	12375	18000	15000	11000	18000
50	33000	25000	24000	30000	48000	18000	36000
75	55000	40000	50000	50000	150000	29500	59000

Table 6.8: Distribution of Income from Secondary Sources

	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
Mean Percentiles	13377	17751	18373	29632	26018	29087	27445
25	6000	10000	10000	12000	12000	12000	10000
50	10000	13000	15000	21000	12000	30000	18000
75	16000	20000	20000	40000	17250	40000	37800

6.1.5 The average land holding of respondents in different States are presented in Table 6.9. It varies from 3.892 acres in Orissa to 6.069 acres in Chhattisgarh. The distribution of land holding by respondents within different States is presented in Table 6.10. It can be seen from Table 6.10 that more than 50 percent of respondents in M.P. and Uttarakhand owned less than 2 acres of land.

Table 6.9: Average Land Holding of Respondents in Different States (Acres)

State	Number of respondents	Mean
Chhatisgarh	338	6.069
Jharkhand	388	3.951
M.P.	360	4.541
U.P.	380	5.000
Uttaranchal	307	4.891
Orissa	133	3.852
Bihar	100	4.855
All States	2006	4.795

Table 10: Distribution of Total Owned Land in Acres

State	Area	Percentage of Respondents
Chhatisgarh	Up to 2 acre	27.81
	2-4 acre	24.26
	4-6 acre	20.41
	>6 acre	27.51
Jharkhand	Up to 2 acre	43.56
	2-4 acre	30.93
	4-6 acre	11.60
	>6 acre	13.92
M.P.	Up to 2 acre	51.39
	2-4 acre	14.72
	4-6 acre	12.22
	>6 acre	21.67
U.P.	Up to 2 acre	37.11
	2-4 acre	24.74
	4-6 acre	13.95
	>6 acre	24.21
Uttarakhand	Up to 2 acre	57.65
	2-4 acre	5.21
	4-6 acre	6.84
	>6 acre	30.29
Orica	Up to 2 acre	39.85
	2-4 acre	30.83
	4-6 acre	15.04
	>6 acre	14.29
Bihar	Up to 2 acre	34.00
	2-4 acre	23.00
	4-6 acre	23.00
	>6 acre	20.00

6.1.6 In all the states except Jharkhand, the area under irrigation was more than 90 percent of total owned land by respondents. The percentage shares of irrigated, non-irrigated and fallow land in total owned land by respondents are presented in Table 6.11.

Table 6.11: Percentage Share of Irrigated, Non-irrigated and Fallow Land in Total Owned Land by Respondents in Different States

State	Irrigation	Non-irrigation	Fallow
Chhatisgarh	97.88	2.12	0.00
Jharkhand	84.47	15.53	0.00
M.P.	89.38	10.62	0.00
U.P.	97.64	2.36	0.00
Uttarakhand	94.59	5.37	0.04
Orissa	90.06	9.94	0.00
Bihar	94.34	5.66	0.00

Section 2: Demand for Irrigation Water

6.2.1 One of the main reasons for underutilization of irrigation potential, as pointed out by different stakeholders, was the change in cropping pattern in command area of different projects. The mean area under different types of crops during the last five years in all project area was estimated based on users' responses. The area under major crops were calculated for all the three crop seasons, i.e. Kharif, Rabi and Summer and the results are presented in Tables 6.12, 6.13 and 6.14. It can be seen in these tables that there has been significant changes over the period of time in cropping pattern. In many projects, the demand of water for irrigation purpose has increased due to increased number of people going for specific crops (as evident from larger number of responses under different crops) and larger area under specific crop (as evident from larger mean are under such crop) during the recent period. A small portion of this increase in number of responses for different crops in recent period can be attributed to the fact some farmer could not recall the types of crops they grew during the last 4-5 years. So even if we discount this larger number of responses for the recent period, the increase is quite significant. It can also be seen from these tables that the area under water intensive crops has also grown up over the years. Hence, the available water for other crops during a specific season may be limited (at a lower level) in different project areas.

Table 6.12: Cropping Pattern over the Years in Kharif Season

Name of project	Crops	2006-07		2005-06		2004-05		2003-04		2002-03	
		N	Area	N	Area	N	Area	N	Area	N	Area
Chhatisgarh											
Kodar Jalashaya	Paddy	61.00	5.9	55.0	6.4						
	Peanuts	1.00	0.5								
Kuwarpur Jalashaya	Paddy	60.00	8.0	58.0	8.2	26.0	8.2				
	Maize	1.00	1.0								
Matiya Moti Project	Paddy	60.00	3.8	31.0	2.7						
	Wheat			1.0	3.0						
Paral Kot Dam Jalashay	Paddy	56.00	3.7	55.0	3.8	1.0	1.5				
	Maize			2.0	3.5						
Tandula Jalsahaya	Paddy	75.00	7.7	71.0	6.8	2.0	4.0	1.0	1.0		
	Vegetable	1.00	5.0								
	Lakari	1.00	3.0	1.0	3.0						
Jharkhand											
Kachi Irrigation Project	Paddy	57.00	5.1	53.0	5.1	39.0	5.7	36.0	5.1	15.0	3.3
Latratu Dam Scheme	Paddy	60.00	4.1	58.0	4.0	47.0	3.7	19.0	2.8	5.0	1.6
	Wheat			1.0	2.0						
Malay Dam Project	Wheat	1.00	1.0			2.0	2.0				
	Paddy	59.00	2.9	58.0	3.1	52.0	3.1	7.0	3.2		
	Sugarcane			1.0	2.0						
Mayurakshi Dam Project	Paddy	58.00	3.4	59.0	3.1	55.0	3.1	17.0	3.8	4.0	4.5
	Potato					1.0	4.0				

Name of project	Crops	2006-07		2005-06		2004-05		2003-04		2002-03	
		N	Area	N	Area	N	Area	N	Area	N	Area
Sona Irrigation Project	Paddy	60.00	3.3	51.0	3.3	49.0	3.4	5.0	4.5		
Sunder Dam Project	Paddy	61.00	3.5	60.0	3.4	57.0	3.3	12.0	2.0	1.0	1.0
	Gram			1.0	11.0						
M.P.											
Chambal Project	Wheat	1.00	1.0	2.0	1.0	1.0	1.0				
	Paddy	1.00	3.0								
	Bajra	48.00	3.7	42.0	3.1	32.0	3.0	15.0	2.6	11.0	2.9
	Till	11.00	2.5	12.0	4.0	8.0	1.9	6.0	1.6	3.0	1.2
	Cotton	3.00	2.3	1.0	2.0						
	Mustard					2.0	4.5	2.0	4.8	1.0	8.0
Harshi Dam	Wheat	1.00	2.0	1.0	3.0	2.0	2.0			2.0	2.0
	Soyabean	15.00	2.5	11.0	2.3	9.0	2.7	5.0	2.8		
	Kodo	1.00	1.0								
	Paddy					1.0	3.0				
Kerwa Dam	Paddy	1.00	4.0	1.0	4.0	1.0	4.0	1.0	4.0	1.0	4.0
	Soyabean	57.00	5.6	51.0	5.7	44.0	6.1	29.0	5.2	25.0	6.0
	Wheat	2.00	1.5					2.0	13.5		
	Gram			1.0	1.0						
	Kodo									1.0	3.0
Koolgarhi Dam	Paddy	58.00	3.3	3.0	4.3	57.0	3.2	1.0	1.3	41.0	3.6
	Wheat	1.00	4.5	51.0	3.3	1.0	3.0	52.0	3.5	3.0	6.1
	Soyabean	4.00	3.8	4.0	3.8	4.0	3.5	3.0	3.3		
Rangawon Dam	Wheat	1.00	35.0	3.0	2.0	2.0	2.0	2.0	3.5		
	Paddy	3.00	2.0	4.0	2.3	2.0	2.0	1.0	2.0	1.0	2.0
	Soyabean	5.00	2.4	2.0	3.0	3.0	5.0	2.0	2.0	3.0	2.7
	Urad	11.00	3.4	12.0	3.8	10.0	2.8	5.0	2.3	6.0	1.7
	Till	44.00	7.2	43.0	6.8	36.0	7.7	26.0	8.2	17.0	4.6
	Kodo	3.00	2.5	2.0	3.0	2.0	3.0				
	Sugarcane	1.00	3.0								
	Gram							1.0	1.0		
	Urad							3.0	0.7		
Sengwal Dam	Sugarcane	5.00	3.2	1.0	2.0	2.0	3.0	1.0	2.0	1.0	2.0
	Gram	1.00	2.0								
	Cotton	58.00	4.2	57.0	4.1	49.0	4.1	35.0	4.8	34.0	4.6
	Wheat	1.00	15.0	2.0	6.5	2.0	5.0	1.0	5.0	1.0	5.0
	Chilly	1.00	2.0	1.0	2.0						
	Soyabean					1.0	2.0				
	Till							1.0	3.0		
U.P.											
Dohari Ghat Pump Canal	Paddy	42.00	2.6	41.0	2.6	26.0	2.3	15.0	1.6	11.0	1.6
	Wheat									2.0	1.0
Ghaghar System	Paddy	47.00	3.0	48.0	2.5	37.0	2.6	36.0	2.7	33.0	2.7
	Tomato	14.00	3.6	5.0	3.4	1.0	1.0			1.0	1.0
	Paddy	1.00	1.0								
	Peas	1.00	5.0								

Name of project	Crops	2006-07		2005-06		2004-05		2003-04		2002-03	
		N	Area	N	Area	N	Area	N	Area	N	Area
Gola Pump Canal	Paddy	55.00	2.4	54.0	2.5	17.0	1.9	15.0	1.8	8.0	1.8
	Arhar	4.00	1.8			1.0	4.0				
Sharda Sahayak Pariyojana	Paddy	59.00	2.5	6.0	2.0						
Upper Ganga Canal	Sugarcane	74.00	5.6	66.0	5.0	36.0	3.5	37.0	3.8	37.0	3.7
	Paddy	7.00	1.0			1.0	0.8				
	Wheat	14.00	1.1	14.0	1.1						
	Chara	3.00	0.3	5.0	0.5						
	Mustard			1.0	1.0						
Uttarakhand											
Gwalakot	Paddy	60.00	0.2	59.0	0.1						
Jyoli Canal	Paddy	50.00	0.7	19.0	0.6						
	Tomato	18.00	0.3	1.0	0.2						
	Marigold	11.00	0.2								
	Vegetable	1.00	0.1								
	Chilly	5.00	0.3	1.0	0.5						
	Madwa			1.0	0.1						
Lower Bhakhar Canal	Wheat	1.00	3.0								
	Sugarcane	21.00	2.7								
	Paddy	65.00	3.0	1.0	5.0						
	Marigold	1.00	5.0								
	Jawar	8.00	0.8								
	Chara	3.00	1.2								
Rudrapur Canal	Paddy	57.00	6.6								
	Sunflower	2.00	1.5								
	Sugarcane	15.00	3.9								
	Jawar	11.00	1.8								
Supakot Canal	Paddy	59.00	0.3	59.0	0.3						
	Madwa	5.00	0.1	3.0	0.1						
Orica											
Bahuda Medium Irrigation Project	Paddy	42.00	5.6	42.0	5.6	42.0	5.6	41.0	5.6	42.0	5.6
Ramial (medium)	Paddy	21.00	2.1	21.0	2.1	21.0	2.1	20.0	2.1	21.0	2.1
Rarrial Irrigation Project	Paddy	23.00	2.8	21.0	2.8	19.0	2.6	19.0	2.9	21.0	2.8
	Wheat					1.0	7.0				
Rushkulya Major Poject	Paddy	47.00	3.4	47.0	3.4	47.0	3.4	47.0	3.4	47.0	3.4

Table 6.13: Cropping Pattern over the Years in Rabi Season

Name of project	Crops	2005-06		2006-07		2004-05		2003-04		2002-03	
		N	Area	N	Area	N	Area	N	Area	N	Area
Chhatisgarh											
Kodar Jalashaya	Paddy	1.0	6.0	1.0	2.0						
	Peanuts			1.0	2.0						
	Paddy			1.0	4.0						
Kuwarpur Jalashaya	Wheat	18.0	9.9	20.0	8.8	3.0	18.7				
	Paddy	2.0	4.0	2.0	12.5	1.0	4.0				
Matiya Moti Project	Lakari	30.0	1.9	5.0	1.7						
	Urad			1.0	2.0						
	Lakari			55.0	2.3						
	Arhar			1.0	1.0						
Paral Kot Dam Jalashay	Paddy			2.0	3.0						
	Maize	40.0	3.3	42.0	3.3	1.0	1.5				
Tandula Jalsahaya	Wheat	6.0	7.7	8.0	6.5						
	Mustard	1.0	2.0	3.0	1.4						
	Maize	15.0	5.4	15.0	5.2						
	Gram	1.0	9.0	3.0	7.7						
	Lakari	6.0	2.4	12.0	3.4	1.0	1.0	1.0	1.0		
	Masur	1.0	7.0	3.0	4.5						
Jharkhand											
Kachi Irrigation Project	Wheat			1.0	3.0	1.0	4.0				
	Potato			1.0	1.0						
Latratu Dam Scheme	Wheat	45.0	2.5	52.0	2.8	43.0	2.9	19.0	2.3	3.0	1.3
	Paddy	3.0	4.0	2.0	1.5						
	Peas	7.0	2.1	7.0	2.3	6.0	2.2	2.0	1.0		
	Potato	15.0	1.7	15.0	1.8	9.0	1.8	5.0	1.6		
Malay Dam Project	Wheat	27.0	2.1	26.0	1.8	24.0	2.1	3.0	1.7		
	Paddy			2.0	2.5						
	Potato			1.0	0.1						
	Maize	2.0	0.6	3.0	0.6	1.0	0.5				
	Sugarcane			1.0	0.5						
	Arhar	2.0	0.5	3.0	0.5	1.0	0.5				
Mayurakshi Dam Project	Wheat	42.0	1.5	39.0	1.3	33.0	1.5	11.0	1.9	2.0	2.8
	Potato	4.0	0.9	6.0	0.8	2.0	1.0				
	Mustard			2.0	0.8						
Sona Irrigation Project	Wheat	1.0	2.0	1.0	1.5	1.0	1.5				
	Paddy	1.0	5.0	1.0	4.0	1.0	1.0				
Sunder Dam Project	Wheat	45.0	1.8	42.0	1.9	40.0	1.6	6.0	0.9		
	Paddy	3.0	1.7	2.0	1.5	1.0	3.0				
	Maize	17.0	1.1	19.0	1.5	7.0	1.3	2.0	0.5		
	Gram	2.0	1.3			1.0	2.0				

Name of project	Crops	2005-06		2006-07		2004-05		2003-04		2002-03	
		N	Area	N	Area	N	Area	N	Area	N	Area
	Sugarcane					1.0	4.0				
MP											
Chambal Project	Wheat	33.0	2.3	39.0	2.7	24.0	2.5	9.0	4.9	5.0	4.4
	Mustard	25.0	2.6	20.0	2.8	28.0	4.4	14.0	4.6	10.0	7.9
	Bajra	1.0	8.0								
	Gram	2.0	1.3	2.0	1.3	1.0	2.0	2.0	1.3	1.0	2.0
	Till					1.0	0.5			1.0	0.5
Harshi Dam	Wheat	43.0	6.7	46.0	6.2	42.0	6.1	36.0	7.4	32.0	8.0
	Mustard	1.0	3.0	2.0	1.5	1.0	1.0	1.0	1.0	1.0	1.0
	Gram	3.0	1.7	3.0	1.3	4.0	1.5	2.0	1.5		
Kerwa Dam	Wheat	50.0	5.5	49.0	5.2	42.0	5.1	26.0	4.6	27.0	5.0
	Gram	20.0	1.9	18.0	2.3	10.0	2.3	9.0	1.7	7.0	2.9
	Paddy			1.0	1.0						
	Sugarcane			1.0	1.0	1.0	1.0				
	Soyabean							1.0	5.0		
Koolgarhi Dam	Wheat	55.0	3.4	56.0	3.1	55.0	3.1	52.0	3.4	41.0	3.6
	Paddy	1.0	2.0					1.0	0.5	1.0	3.0
	Gram	7.0	2.6	9.0	2.0	4.0	5.5	3.0	2.3		
	Masur	1.0	1.0	1.0	1.0						
	Barley			1.0	3.0						
	Chara					1.0	3.0				
Rangawon Dam	Wheat	43.0	7.3	33.0	7.6	39.0	7.6	34.0	7.5	22.0	6.9
	Gram	10.0	6.2	8.0	8.3	6.0	9.2			2.0	3.0
	Urad	1.0	1.0								
	Mustard			1.0	10.0						
	Soyabean			1.0	2.0						
	Paddy							1.0	2.0		
	Till							1.0	35.0		
Sengwal Dam	Wheat	58.0	4.3	61.0	4.9	51.0	4.1	37.0	4.6	35.0	4.8
	Sugarcane	5.0	3.6	2.0	3.5	4.0	3.3	1.0	3.0	1.0	3.0
	Gram	2.0	2.0	3.0	1.7	1.0	1.0				
	Cotton			1.0	5.0						
	Chilly			1.0	0.5						
U.P.											
Dohari Ghat Pump Canal	Wheat	41.0	2.3	42.0	2.3	24.0	2.1	15.0	1.3	10.0	1.3
	Peas	4.0	1.0	5.0	1.2	1.0	1.0				
	Arhar	1.0	1.0	2.0	1.5						
	Masur	2.0	1.0	4.0	1.0	1.0	1.0				
	Gram			4.0	0.8						
	Paddy									2.0	1.0
Ghaghar System	Wheat	71.0	3.9	71.0	4.0	71.0	4.1	69.0	4.0	67.0	4.2
	Potato	4.0	2.8	5.0	1.8						
	Peas	9.0	1.3	8.0	1.4	5.0	1.6	8.0	1.3	2.0	1.5
	Mustard	7.0	1.6	8.0	1.8			1.0	1.0		
	Masur	12.0	1.3	9.0	1.3	9.0	1.1	11.0	1.1	6.0	1.3
	Gram	14.0	1.1	10.0	1.3	4.0	1.8	8.0	1.4	4.0	2.0

Name of project	Crops	2005-06		2006-07		2004-05		2003-04		2002-03	
		N	Area	N	Area	N	Area	N	Area	N	Area
	Chara			1.0	1.0						
	Tomato			1.0	2.0						
Gola Pump Canal	Wheat	56.0	2.2	56.0	2.0	25.0	1.6	24.0	1.8	22.0	1.8
	Arhar	4.0	1.3	6.0	1.5	1.0	2.0				
	Gram	5.0	1.4	5.0	1.4	1.0	1.0				
	Peas	9.0	1.0	11.0	1.0	1.0	0.5	1.0	1.0		
	Mustard			1.0	0.5						
Mauranipur Canal System	Wheat	32.0	4.4	60.0	4.4						
	Sugarcane	1.0	2.0								
	Peas			4.0	2.8						
	Gram			1.0	2.0						
	Barley			1.0	1.0						
Sharda Sahayak Pariyojana	Wheat	6.0	1.6	58.0	2.5			1.0	3.7	1.0	3.7
Upper Ganga Canal	Wheat	34.0	1.5	28.0	1.6	30.0	1.5	28.0	1.5	28.0	1.5
	Sugarcane	36.0	6.6			36.0	6.8	36.0	6.8	36.0	7.0
	Mustard	4.0	0.9	5.0	0.9	3.0	1.0	2.0	1.3	1.0	0.6
	Chara	1.0	0.2	7.0	0.7	2.0	0.4	2.0	0.4	2.0	0.4
	Potato	1.0	0.6	2.0	0.7						
	Peas			1.0	0.4						
Uttarakhand											
Gwalakot	Wheat	57.0	0.2	60.0	0.2						
Jyoli Canal	Wheat	16.0	0.4	50.0	0.6						
	Onion	2.0	0.2	11.0	0.2						
	Potato	4.0	0.1	28.0	0.6						
	Tomato			1.0	0.2						
	Maize			1.0	0.2						
	Jowar			1.0	0.3						
Lower Bhakhar Canal	Wheat	2.0	3.5	66.0	3.2						
	Chara	1.0	1.0	7.0	0.8						
	Sugarcane			1.0	1.0						
Rudrapur Canal	Wheat			57.0	6.6						
	Chara			12.0	1.2						
	Oat			2.0	1.0						
Supakot Canal	Wheat	57.0	0.2	59.0	0.2						
	Mustard	3.0	0.1	2.0	0.2						
	Potato	41.0	0.1	43.0	0.1						
	Bajra	1.0	0.2	1.0	0.1						
	Chara			1.0	0.0						
	Sugarcane			1.0	0.1						
Orissa											
Bahuda Medium Irrigation Project	Paddy			1.0	4.0	30.0	3.5	28.0	3.5		
	Mung	31.0	3.5	30.0	3.4					27.0	3.6
Ramial (medium)	Paddy	15.0	2.1	16.0	1.7	16.0	2.1	16.0	2.1	16.0	2.1
	Vegetable	1.0	0.5	1.0	0.5			1.0	0.5	1.0	0.5

Name of project	Crops	2005-06		2006-07		2004-05		2003-04		2002-03	
		N	Area	N	Area	N	Area	N	Area	N	Area
Rarrial Irrigation Project	Paddy	19.0	2.7	21.0	2.6	18.0	2.7	17.0	2.6	19.0	2.6
Rushkulya Major Project	Potato	3.0	2.8	2.0	4.0	3.0	2.8	3.0	2.8	3.0	2.8
	Mung	36.0	2.3	39.0	2.2	38.0	2.2	33.0	2.2	30.0	1.9
	Barley	1.0	6.0	1.0	6.0	1.0	6.0	1.0	6.0		

Table 6.14: Cropping Pattern over the Years in Summer Season

		2006-07		2005-06		2004-05		2003-04		2002-03	
Name of project	**Crop**	**N**	**Area**	**N**	**Area**	**N**	**Area**	**N**	**Area**	**N**	**Area**
Chhatisgarh											
Kodar Jalashaya	Paddy	1.0	5.0								
Kuwarpur Jalashaya	Paddy	35.0	6.8	27.0	7.0						
Matiya Moti Project	Paddy	6.0	2.6	1.0	2.5						
Tandula Jalsahaya	Paddy	1.0	20.0								
Jharkhand											
Kachi Irrigation Project	Paddy					5.0	4.4				
Latratu Dam Scheme	Paddy	43.0	3.8	41.0	3.7	40.0	3.7	14.0	2.9	3.0	1.3
Malay Dam Project	Paddy	18.0	1.5	29.0	1.8	26.0	1.9				
Maurakshi Dam Project	Paddy	56.0	2.2	55.0	2.1	52.0	2.0	14.0	2.1	3.0	2.3
	Wheat			1.0	2.0						
	Potato			1.0	3.0	1.0	2.5				
Sona Irrigation Project	Paddy	27.0	1.8	28.0	1.7	24.0	1.7				
Sunder Dam Project	Paddy	1.0	2.0	1.0	2.0	1.0	2.0				
M.P.											
Koolgarhi Dam	Tomato	1.0	1.0								
Sengwal Dam	Sugarcane	1.0	5.0								
	Cotton	4.0	2.5	1.0	2.0						
U.P.											
Sharda Sahayak Pariyojana	Mentha	15.0	0.8	2.0	0.8						
Uttarakhand											
Jyoli Canal	Maize	4.0	0.2								
	Coriander	6.0	0.2								
	Marigold	1.0	0.2								

6.2.2 The respondents were asked about the reasons for change in cropping pattern and what have been the agents for such changes in cropping pattern. The result of such analysis is presented in Table 6.15. The Irrigation Department officials have been the major factor of influence in changes in cropping patterns in states like Chhatisgarh, Jharkhand, U.P., Orissa and Bihar. Influence of other farmers has been the major influencing factor for change in cropping pattern in M.P. and also somewhat important in Chattisgarh, Uttarakhand and Orissa. A

significant percent of people in Chattisgarh, M.P., U.P. and Uttarakhand also reported that the change in cropping pattern was due to assured purchase of their crops by processing companies such as sugar mills and oil mills.

Table 6.15: Percentage of Responses Reporting the Influence of Various Agents for Change in Cropping Pattern

Factor	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
Irrigation Department	53.46	65.70	11.78	64.67	3.50	51.15	69.72
Agricultural Department	6.37	19.65	15.79	1.90	3.96	9.16	13.76
Irrigation Ssociety	0.55	0.96	1.00		0.93	3.05	0.92
Other Farmers	22.16	2.12	54.14	5.43	32.87	28.24	
Purchasers of the Produce (Sugar mills/Oil mills)	17.17	0.96	8.77	13.04	33.33	0.76	
Any Other	0.28	10.60	8.52	14.95	25.41	7.63	15.60

6.2.3 It was assumed that if farmers get sufficient water for irrigation purposes from irrigation projects, they would not require alternative water resources. During the study, respondents were asked about how frequently they require alternative water resources for irrigation purposes. The result is tabulated in Table 6.16. A large number of respondents in Chhatisgarh (57 percent), U.P. (47.6 percent), M.P. (44.3 percent) and Bihar (63 percent) marked their answer under "always" category, indicating they always require alternative water resources. The response under "often" category was also quite high. Overall only 15 percent people reported the alternative use of water as "occasional". All these indicated that the selected irrigation projects have not been able to provide water for irrigation purposes on assured basis.

Table 6.16: Number of Respondents Considering Alternative Water Resource as Necessary

Response	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
Always	73	11	109	140		1	46
Very Often	6		18	40	1		4
Often	45	7	101	88	11	1	21
Occasionally	4	2	18	26	82	1	2

6.2.4 One of the several reasons for the irrigation projects working at sub-optimum level is lack of its regular maintenance. The irrigation department often complains about lack of fund availability at appropriate time for preventive maintenance and improvement in irrigation facilities. In many states water users groups have been created, which are supposed to help in proper utilization of

available water resources and at the same time help in collecting water user charges based on area under irrigation. But quite often it was found that such water users associations are either non-existent or not functioning as expected.

6.2.5 With an assumption that higher collection of water charges either at the water users association level or by the Revenue Department will result in availability of a higher amount of fund for regular maintenance of the projects, which in turn will result in assured water supply to the farmers, the respondents were initially asked about their willingness to pay higher for assured water supply. The result is presented in Table 6.17. Overall, more than 75 percent people were willing to pay higher for assured water supply. In Orissa and M.P. more than 90 percent showed their interest to pay higher for better irrigation facilities.

Table 6.17: Number of Respondents Willing to Pay High Rate for Assured Water Supply

	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
Yes	246	173	317	299	242	129	29
No	84	167	35	72	65	3	52

6.2.6 People who said that they willing to pay higher price for assured water supply were asked about the level of additional payment for the assured water supply. The result is presented in Table 6.18. A large number of people in all the states were willing to pay more than 100 percent (34 percent respondents) and between 50-100 percent extra (44 percent respondents) for the assured water supply. At state level, more than 60 percent respondents were willing to pay more than 100 percent for assured irrigation facility. This is a major outcome of the study, which shows that if the farmers get assured and improved water supply, they are very much willing to pay higher.

Table 6.18: Extent of Higher Payment that Respondents are Willing to Pay for Assured Water Supply

	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
>100%	29	75	66	60	143	93	23
<50-100%	142	49	166	176	52	29	7
<50%	69	50	82	60	46	7	

6.2.7 As discussed earlier, a large proportion of people are very much willing to pay higher for assured water supply. Still often there are complains by Government Departments that farmers do not pay for the services that they are

using even at a much cheaper rate. The reasons for such non-payment were explored and are presented in Table 6.19. The non-availability of water in canal (and other irrigation structures) as per the requirement of farmers, was quoted as the main reason for such non-payment in most of the states. However, in Jharkhand people reported that Revenue Department does not collect water charges and hence they are not paying. On interaction with government departments on this issue in Jharkhand, it emerged out that the Revenue Department is not able to collect irrigation charges on regular basis because of widespread naxalite movement in most of the districts in the state. People in Chattisgarh reported that the government does not charge for water services in the state, hence they do not have to pay for such services.

Table 6.19: Number of Respondents Expressing Reasons for Non-payment of Irrigation Charges

State	Non-availability of water in canal	Financial problem	No tax by government	No collection by revenue department
Chhatisgarh	4	6	16	1
Jharkhand	21	3		248
M.P.	127	1	1	
U.P.	38			
Uttarakhand	29			
Total	**219**	**10**	**17**	**249**

As discussed in earlier section, a large proportion of cultivable land owned by respondents in most of the states is under irrigated category (Table 6.11). Despite that a large part of such cultivable area remains un-irrigated over the years. The reasons were explored in different states, which are given below in Table 6.20. This table also provides the average area remaining un-irrigated due to such reasons in different states. Unlevelled land was the main reason pointed out by respondents for such problems in Jharkhand, U.P. and Uttarakhand, where significant portion of cultivable land is under hilly and plateau regions. Absence of field channels was also one of important reasons for cultivable area remaining un-irrigated in U.P. and Jharkhand as reported by large number of respondents in these states.

Table 6.20: Extent of Cultivated Area remaining Un-irrigated due to Various Reasons

State		Unlevelled Land	Absence of Field Channels	Scarcity of Water	Uncertainty about Supply of Water	Financial Incapability
Chhatisgarh	N*	6	1	11		1
	Area (acre)**	2.25	1.00	3.00		2.00
Jharkhand	N	70	20	29	2	
	Area (Acre)	1.71	1.63	2.48	3.50	
M.P.	N	4	2	8	2	3
	Area (Acre)	7.60	3.13	2.34	2.50	1.67
U.P.	N	70	69	9	2	
	Area (Acre)	0.17	0.37	3.06	6.00	
Uttarakhand	N	56	35	8	1	
	Area (Acre)	0.28	0.32	3.35	15.00	
Orissa	N	3	4	18	4	3
	Area (Acre)	1.67	1.95	2.00	1.00	1.58
Bihar	N	6	1			
	Area (Acre)	1.29	1.00			
Total	**N**	**215**	**132**	**83**	**11**	7
	Area (Acre)	**0.95**	**0.65**	**2.58**	**3.91**	**1.68**

* indicates number of respondents

** indicates average area in different categories based on number of responses.

Section 3: Irrigation Support Institutions

6.3.1 The role of support organization is quite important for success of irrigation projects. The Water Users' Association, Gram Panchayat and NGOs can take lead role in maintaining the irrigation structure at least at the local level. People have reported in Jharkhand that as long as the irrigation structures are active and being used by the people, there is larger interest of the local people to keep the structure in working condition and its maintenance. Due to any reason if there is a break in the use of irrigation structures (especially in case of minor structures), people loose interest and anti-social elements take the benefit of such condition and many times irrigation control structures are stolen away. Regular monitoring of irrigation structures by these local level organizations also put pressure on the irrigation department for its regular maintenance. People were asked about existence of local level organizations for water management. Based on their response, presented in Table 6.21, Water Users' Associations are present in Chhatisgarh, M.P., Uttarakhand and Orissa. Gram panchayat is active for water management in U.P. and Uttarakhand. The role of NGOs in water management is negligible in all the states. Many respondents were unaware of existence of such support organizations at the village level.

Table 6.21: Types of Organisations Existing in Villages for Water Management (Numbers)

	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa
Water Users' Association	183	6	177		96	47
NGOs	5		1		1	
Panchayat Control				74	203	
No information about Support Organization	88	6	90			26

6.3.2 In absence of village level support organizations, the role of farmers become very important for solving their problems related to water distribution issues. However, only 1.4 percent respondents in Jharkhand, 8 percent in M.P. and 5.4 percent in Bihar reported the holding of such meetings as shown in Table 6.22. However, such meetings are taking place at higher level in Uttarakhand (58 percent), Chattisgarh (49.7 percent), U.P. (49.83 percent) and Orissa (33.9 percent). When people were asked why such meetings are not taking place, some major reasons mentioned by people were: internal disputes of farmers; no useful discussion taking place in such meetings; lack of awareness etc. A large number of respondents could not specify any specific reason for not having such meetings regularly.

Table 6.22: Percentage of Responses Regarding Farmers' Meetings to Discuss Water Distribution

	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
Yes	49.67	1.40	7.99	49.83	58.36	33.87	5.36
No	50.33	98.60	92.01	50.17	41.64	66.13	94.64

6.3.3 People were asked about the level of responsibility that they are willing to undertake for operation of canals/tanks. A majority of people in Bihar, M.P., Chattisgarh and U.P. did not agree to undertake any responsibility. However, majority of respondents were willing to undertake up to 25 percent of operational responsibilities in Uttarakhand (68.9 percent) and Jharkhand (40.4 percent) as shown in Table 6.23.

Table 6.23: Percentage of Responses Indicating Level of Responsibilities Farmers are Willing to undertake in the Operation of Canals /Tanks

	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
25%	8.25	40.44	24.05	15.38	68.90	19.23	
50%	30.16	13.11	12.61	25.73	21.74	16.15	
75%	12.38	4.10	4.40	11.14	2.01	6.15	
100%	9.21	25.14	3.52	8.22		3.08	
No	40.00	17.21	55.43	39.52	7.36	55.38	100.00

6.3.4 In absence of local level support organizations in villages and lack of farmers' meetings on regular basis, the role of irrigation department becomes very important not only for medium and major irrigation schemes but also for minor irrigation schemes. Questions were asked about level of support from irrigation department in different states. A large percentage of people reported the lack of support from irrigation department. The percentage of such response was varying from 24.52 percent in M.P. to 81.13 percent in Bihar (Table 6.24). Some people reported that they get the desired support only when they ask or complain for certain problems. Some people also reported that help from irrigation department is person-specific, i.e., some people in the department may be cooperative but in general they do not get the desired support. A small subset of people also reported that they get all the desired support from irrigation department. The percentage of such responses varied from as low as 1.03 percent in Jharkhand to 25.63 percent in Uttarakhand.

Table 6.24: Percentage of Responses Agreeing to the Functioning of Irrigation Department

	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
We get all the help required	8.90	1.03	9.92	10.70	25.63	5.38	7.55
We get help only when we ask/complain	42.14	41.86	58.95	25.12	35.76	40.00	9.43
We get help depending on the particular person	14.54	9.04	3.03	9.20	7.91	4.62	1.89
We hardly get any help	31.75	45.99	24.52	48.26	30.06	38.46	81.13
Any other	2.67	2.07	3.58	6.72	0.63	11.54	

6.3.5 On asking about the various supports expected from irrigation department in future, the majority of people in M.P. (77.7 percent), Orissa (60.5 percent), Bihar (48.9 percent) and U.P. (37.8 percent) asked for full availability of water for irrigation (Table 6.25). Regular maintenance of irrigation system was the most importance expectation in Chattisgarh (41.3 percent) and Uttarakhand (33.5 percent). Apart from these, further extension of existing canal and irrigation facilities (in Bihar), timely information about supply of water, availability of drainage facility, regular cleaning of canals, quick settlement of internal disputes etc. are some of the other important expectations from the irrigation department in different states.

Table 6.25: Percentage of Responses Indicating Various Support Expected from Irrigation Department in Future

	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
Full availability of water	37.72	48.96	77.65	37.83	26.71	60.54	48.94
Disputes to be handled as soon as possible	11.14	2.29	6.15	11.45		2.72	
Regular maintenance of irrigation system	41.27	31.25	13.69	32.11	33.53	17.01	10.64
Timely information about supply of water	6.33	0.42	0.84	15.34	12.46	1.36	
Availability of drainage facility	3.04	9.38	0.84	3.27	5.93	16.33	6.38
Extension of canal and irrigation facilities	0.25	0.63			9.50		34.04
Water availability at field level		5.42	0.84		0.59		
Regular cleaning of canal	0.25	1.67			10.39	1.36	
Guidelines for suitable cropping					0.89	0.68	

Section 4: Equity in Water Distribution

6.4.1 When people were asked about whether there is equitable distribution of water at the project level, most of the respondents agreed to this statement indicating equitable distribution of water (Table 6.26). The percentage of favorable response was as high as 100 percent in Bihar to 67.86 percent in U.P.

Table 6.26: Percentage of Responses Reporting Equitable Distribution of Water

	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
Yes	80.07	89.77	77.18	67.86	95.68	85.34	100
No	19.93	10.23	22.15	32.14	4.32	14.66	-

6.4.2 According to most of the people that there is not much influence of specific persons or group on water distribution in all the states as can be seen in Table 6.27. Only in small cases people reported the influence of such persons/groups. However, the percentages of such minority respondents were just 7.7 percent in Jharkhand to 23 percent in U.P.

Table 6.27: Percentage of Responses Reporting Some Persons/Group Influence on Water Distribution

	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
Yes	15.56	7.71	17.73	23.00	13.95	7.63	--
No	84.44	92.29	82.27	77.00	86.05	92.37	100.00

6.4.3 The small groups of people in different states who agreed that there is some influence of specific persons/groups on water distribution were also asked to specify such persons/groups. In most of the cases, economically higher class people were found to be influencing water distribution among the farmers, especially in M.P., U.P., Uttarakhand, Orissa and Chattisgarh (Table 6.28). However, in certain cases cast-based group (as in Jharkhand) and people close to panchayat (as in Uttarakhand) were also found to influence the water distribution at a smaller level.

Table 6.28: Percentage of Responses Reporting Influence of Various Persons/Group on Water Distribution

	Chhatisgarh	Jharkhand	M.P.	U.P.	Uttarakhand	Orissa	Bihar
Economically powerful people	56.25	29.17	82.00	77.91	60.98	70.00	
Caste based people	33.33	66.67		5.81	2.44	10.00	
People close to the panchayat	8.33	4.17	2.00	10.47	26.83	10.00	
Elected representatives	2.08		4.00		4.88	10.00	
Others specify			12.00	5.81	4.88		

Chapter 7

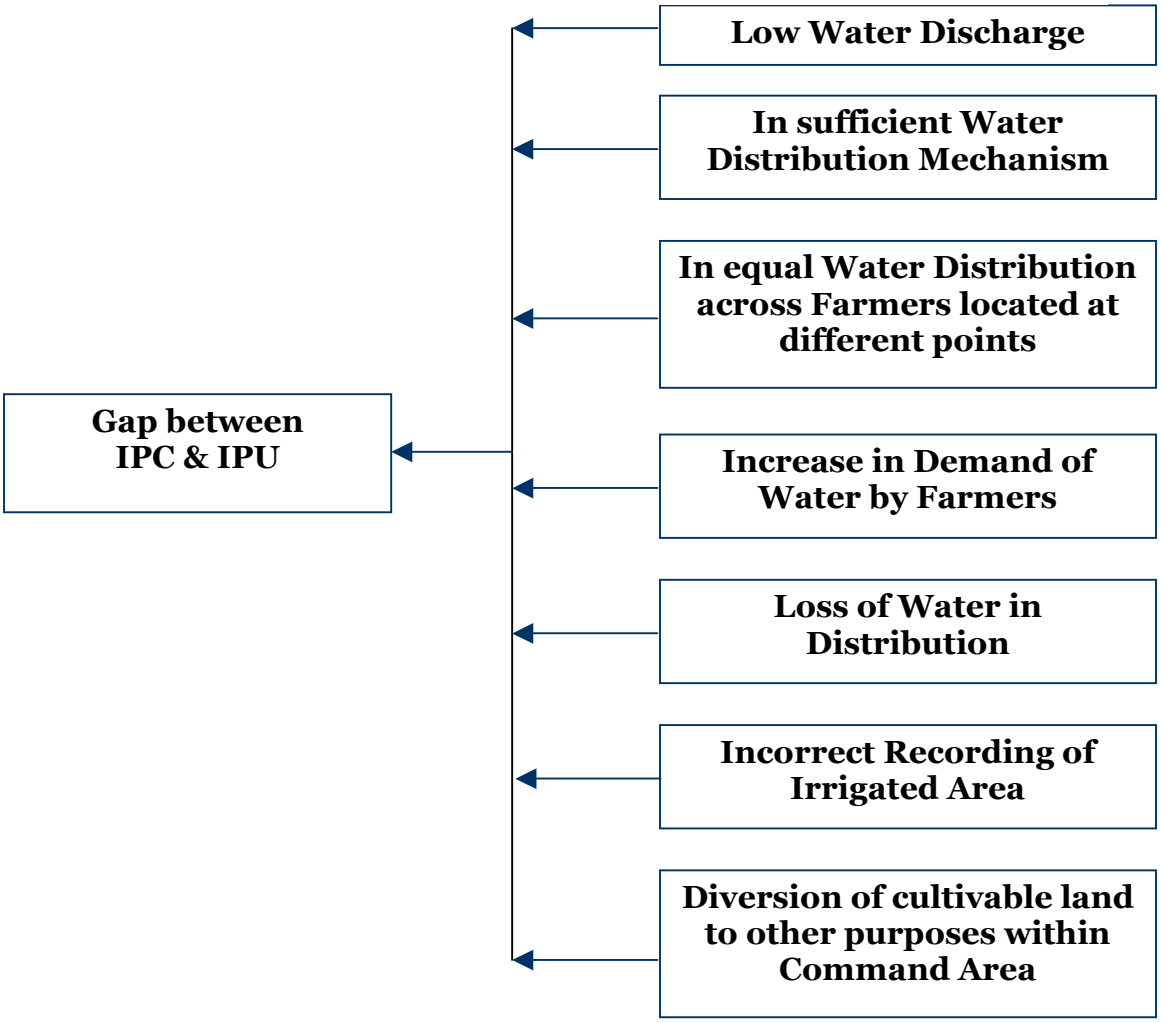
Gap between Irrigation Potential Created and Utilization – Possible Reasons and Future Actions

Section 1: Conceptualization

7.1.1 Based on the information and data collected from the irrigation projects in different States on the one hand, and detailed discussion with Chief/Executive Engineers of the irrigation projects on the other, possible reasons responsible for gap between irrigation potential created and its utilization have been outlined in Figures 7.1 to 7.6. An attempt has been made to develop a Problem Tree Analysis, which provides a systematic way of examining the problems in a project context. Most problems can generally be traced back to other problems which, in turn, could be the cause of other problems/constraints. Problem Tree Analysis visualizes such links in a Problem Tree Diagram. This consists of a diagram illustrating a set of relationship amongst the problems by fitting them in a hierarchy of cause-effect relationship. In such a diagram the causes are, conventionally, presented at lower levels and the effects are at upper level. A location of a problem in a tree diagram does not necessarily indicate its level of importance, but simply its position in the logical sequence of cause-effect linkages.

7.1.2 The underline idea in constructing a Tree Diagram is that such a process should facilitate the organization of problems into a logical sequence which, in turn, would lead to logical conclusions and eventually to the identification of cost/effective solutions.

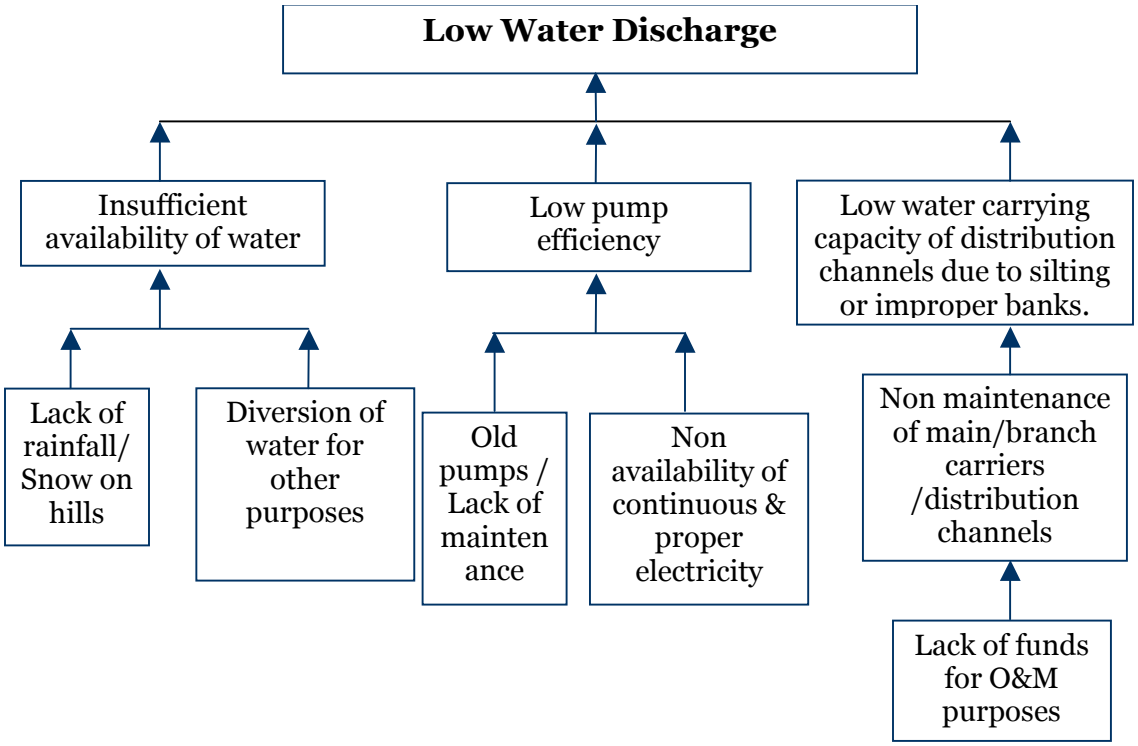
Figure 7.1: Problem Tree Diagram for Gap between IPC & IPU



Note:

IPC = Irrigation Potential Created
IPU = Irrigation Potential Utilized

Figure 7.2: Problem Tree Diagram for Low Water Discharge



Notes:

1- Distribution channels include sub-canals, distributaries and minors.

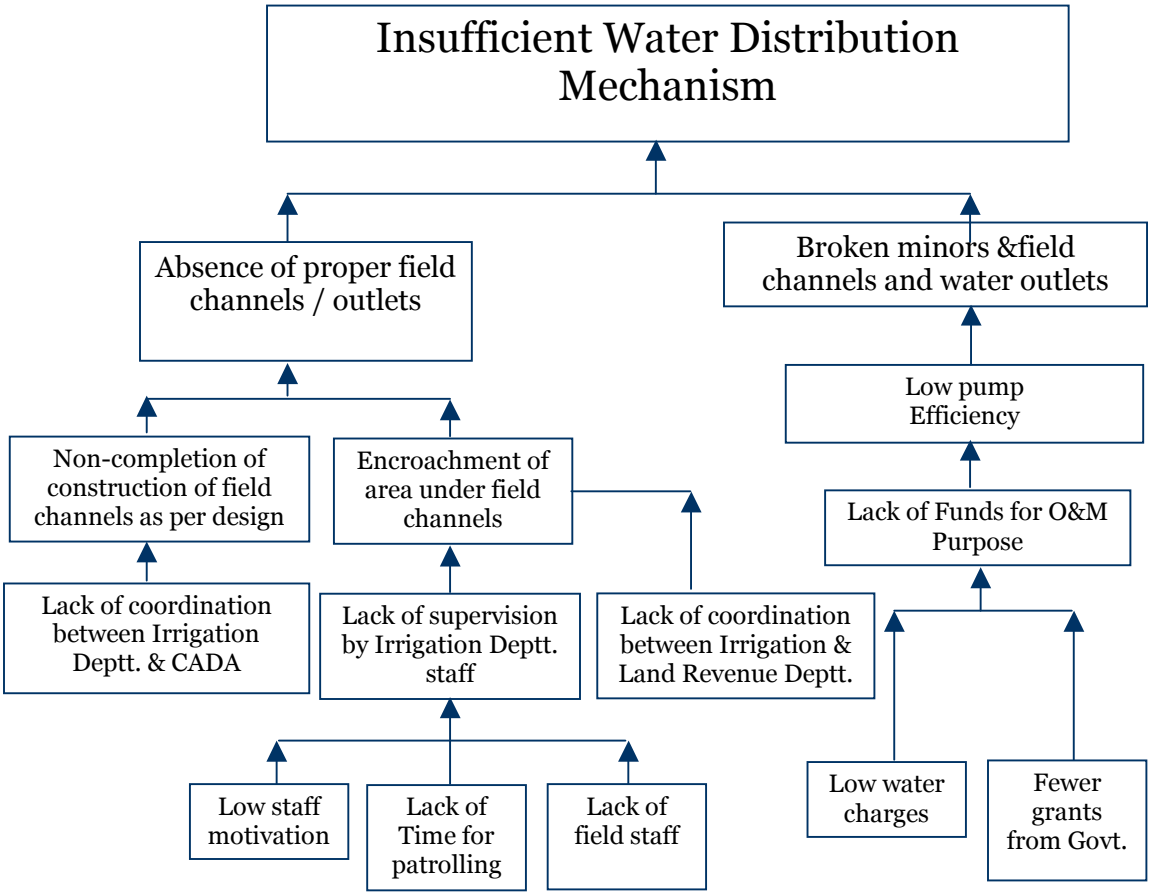
2- Main Canals and Branches are in bad shape in many systems and the too need proper maintenance/ rehabilitation Apart from silting, their banks at many places are low & weak and needs strengthening to allow full carrying capacity.

3- Apart from continuous electric supply, it needs qualitative i.e. with out interruptions and with proper voltage.

4- Mechanical and electrical faults in motors, pumps, and panels/switchyards also contribute to inefficiency. If not attended immediately, as happens normally, efficiency goes down even if pumps / motors are not very old.

5- Shortage or inadequate rainfall on hills is one of the most important factors, contributing to low water availability of water in the River source, especially during non- monsoon period.

Figure 7.3: Problem Tree Diagram for Insufficient Water Distribution Mechanism



Notes:

1- Adoption of old practice of irrigation i.e. Flood Irrigation irrespective of actual water demand. There is a need to persuade the farmers to adopt new/modern innovative techniques such as Drip and Sprinkler Irrigation, which requires much lesser water.

2- Lack of coordination & and support from law enforcing agencies, in cases of cutting of channels by farmers/miscreants.

3- Developmental activities under Local Area Development funds popularly known as MLA/MP funds. Many field channels/Guls have been obstructed or damaged due to indiscriminate construction of roads under these programs.

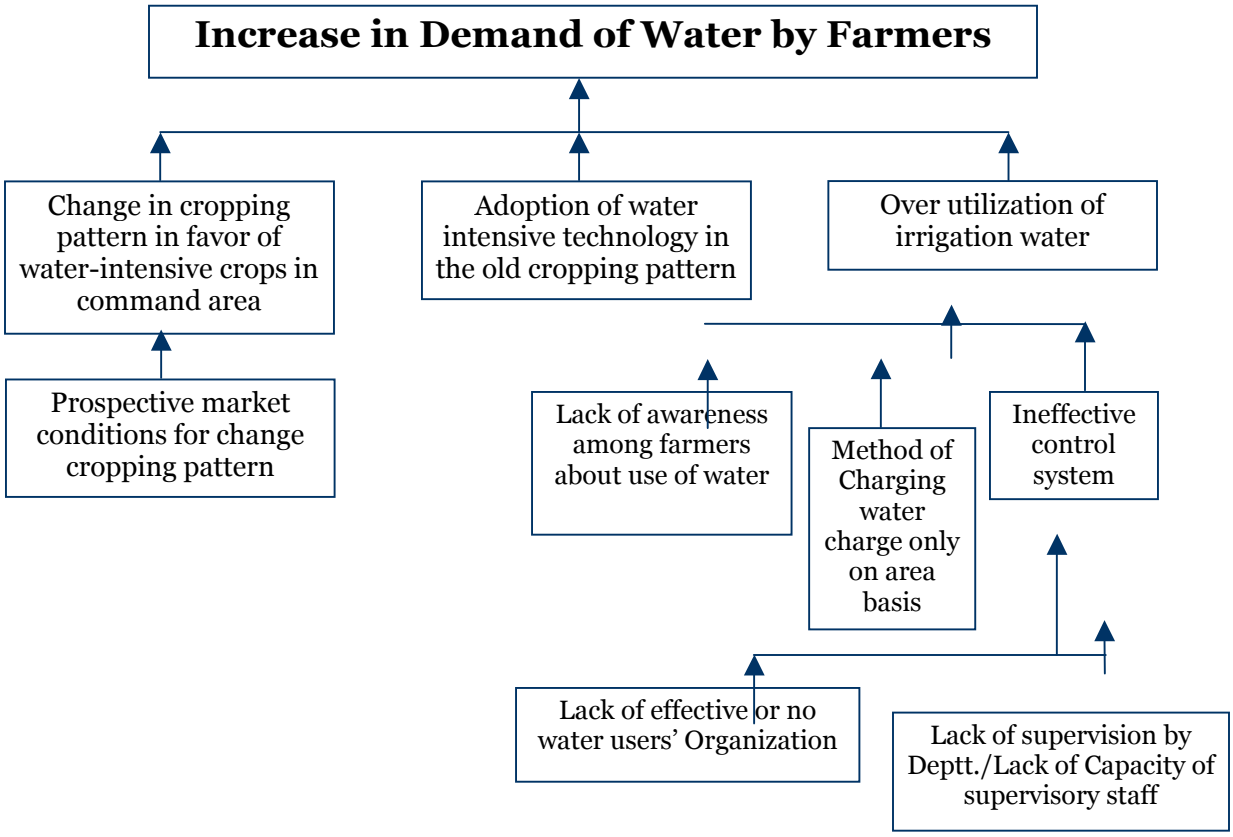
4- In many cases it has been seen that construction of guls at improper level, or not connected to the outlets, at all or not properly, has led to inefficiency & wastage of resources.

5- Now a time has come to resort to Volumetric System of water accounting as well as charges. Differential rate system is also is the need of the hour. It can be location wise and application of water.

6- Canals are also required to be redesigned in order to meet the present scenario with modern technology regarding Head/Cross Regulators, Gates, Falls & other structures

7- Although Main Canal & Branches are Designed as non silting channels, but some typical terrain, it has been observed that there is lot of silting in them thus reducing the discharge carrying capacity of the main carriers.

Figure 7.4: Problem Tree Diagram for Increase in Demand of Water by Farmers

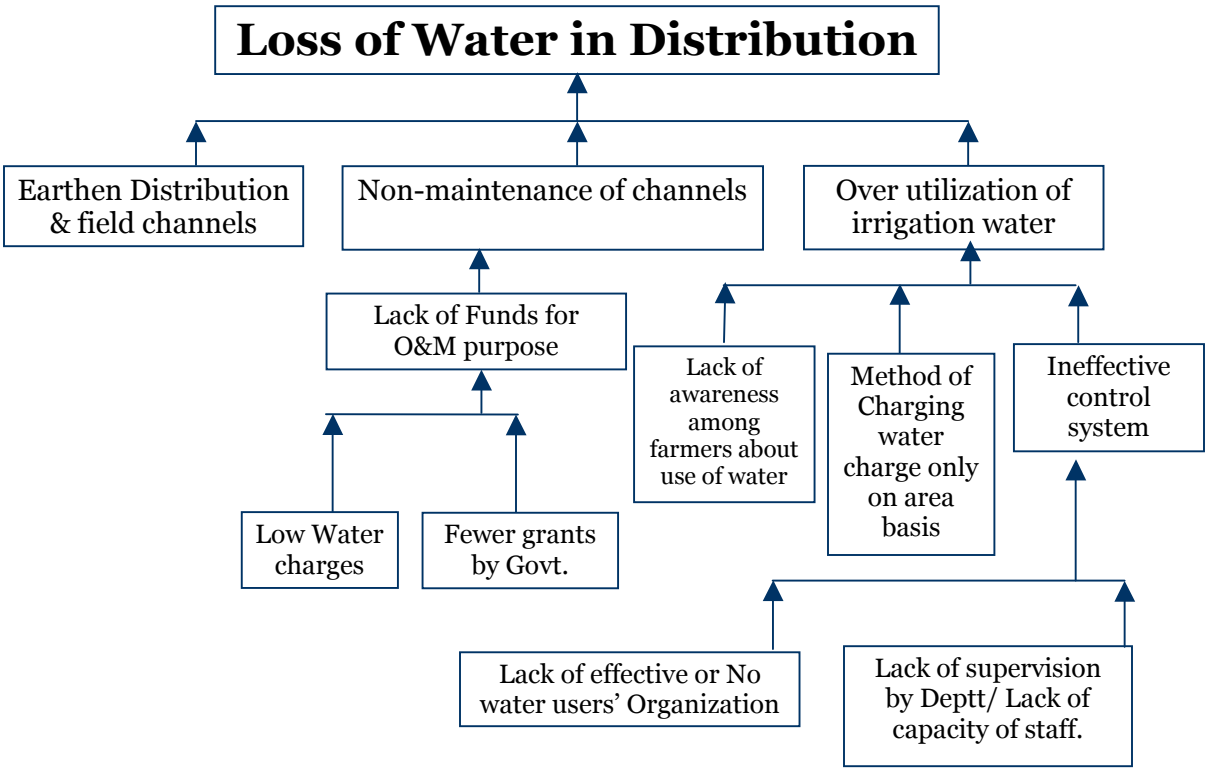


Notes:

1- Lack of capacity of the staff & officers to meet the current challenges is also one of the important aspects. Programs are required for building capacity and update their skill and knowledge.

2- Although there are User's Organizations in some areas/states, but they are ineffective.

Figure 7.5: Problem Tree Diagram for Loss of Water in Distribution

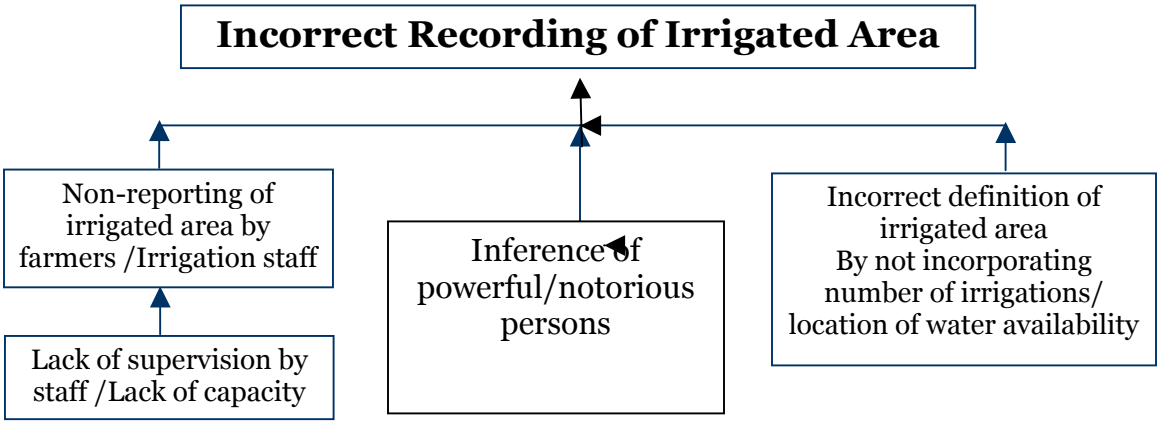


Notes:

1- We all are aware that both water & land are nowadays precious and are under great stress. Both are required to be saved as much as possible to meet the future food demands. In this perspective, canals are now required to be redesigned with lined sections, in order to save water being wasted from seepage & evaporation, and to enhance their efficiency. Much less efforts will be required in the maintenance too. It will save precious land & this can be utilized for Agricultural purposes, as there is already a great pressure on land due to various developmental activities.

2- Lot of water is wasted either due to breaches in canals owing to inadequate canal sections or due to negligence of the supervisory staff or due to cutting of canals by farmers/miscreants. Effective and continuous support from law enforcing agencies is necessary, which is seldom available in practical terms.

Figure 7.6: Problem Tree Diagram for Incorrect Recording of Irrigated Area



Section 2: Typology of Factors responsible for Gap between IPC and IPU

7.2.1 The various factors responsible for gap between irrigation potential created and its utilization as depicted in Figures 7.1 to 7.6 have been classified in the following categories as given in Table 7.1.

Table 7.1: Classification of Factors Responsible for Gap between IPC and IPU

Sl. No.	Category	Example
1.	Technical	• Low pump efficiency • Incomplete water distribution channels • Earthen distribution channels • Irregular de-silting of distribution channels • Non-availability of continuous and proper electric power • Faulty design of irrigation project
2.	Socio-political	• Encroachment of field channels by farmers • Overuse of irrigation water • Destruction of water outlets
3.	Institutional	• Non-existence of effective WUA • Low technical and managerial capacity of Irrigation Department staff
4.	Managerial	• Lack of staff • Lack of fund for O&M • Low motivation of Irrigation Department Staff • Lack of supervision by Irrigation Department Staff
5.	Natural	• Lack of rainfall • Decreased water level in the River
6.	Policy Level	• Ineffective method for charging irrigation water cost based only on acreage system • Low administrative powers given to Irrigation Department Staff • Incorrect definition of irrigated area by not incorporating the number of irrigation • Lack of coordination between Irrigation Department, Revenue Department and CADA • Diversion of water for other purposes
7.	Agrarian	• Change in demand of irrigation water due to change in cropping pattern in the command area • Increased demand of irrigation water due to use of chemical fertilizers and HYV seeds • Diversion of cultivable land for industrial and other purposes

(a) Social Issues

- Farmers of head reach of the canal over irrigated their fields, assuming that they may not get water for the following irrigation, this make canal water not to reach at the tail end of the main and minor canal and this area remains un-irrigated.

- Farmers at reservoir rim and those at idle reaches of canal systems lift water through pump and irrigate their fields located at higher levels and out of command area. This causes less availability of water for the tail end farms as well as damage to the canal, which results into increase in seepage and further loss of water on the way.

- Use of a large number of lift irrigation pumps submerged in the canal by farmers of idle reaches of canal obstruct the flow of canal water and reduces velocity of water and ultimately less supply and delay of water supply at the tail ends.

- Surrounding residents remove flag stones used for the lining of main canal for their domestic use. Frequent removal of flag stones causes severe damage to the main canal, and in turn high ration of seepage and less supply of water towards tail reaches.

(b) Technical Issues

- Because of weeds and siltation in the canal, water bearing capacity of canals is reducing.
- Non-provision of micro distribution (field channels and water course) network in original project plan led to inefficient use of canal water.
- Top bank level of entire canal section as exists, is lower than that designed, results in low discharge capacity of canal.
- Leakage of irrigation water through irrigation sluices reservoir basin causes less storage of water for irrigation.

(c) Management Issues

- Shortage of staff in irrigation department to maintain the canal system, leads continuous deterioration of canals.

- Lack of vehicles (four wheels) on the field for carry out regular patrolling during the irrigation season. Without four wheel vehicle it is very difficult to carry out the regular patrolling in the peak winter of Rabi season, to restrict wastage of water and damage of canal.

- According to the Irrigation Department, now responsibility of maintenance is given to the 'Water Users' Associations'. They have power

to get the work done, with approval of irrigation department. WUAs had been given financial power, without preparing them for performing their role. WUA members neither have technical knowledge, nor perception for the community work. If the Irrigation Department does not approve the canal work done by WUA, the members specially chairman make it political issue and get the approval forcefully done through local MLA or MP. Therefore, maintenance of canal work gets done without technical parameters, which leads to poor performance of canal system.

- There is lack of clarity of the role of WUA, to the staff of irrigation department as well as members of WUA. Irrigation staff members at the field level assume that Water Users' Association is only of twelve members, while they are only committee members. In reality WUA consists of all the farmers' of command area who use canal water. Usually irrigation staff members focus on participation of only committee members, while they should ensure participation of all the members, and try to empower them.

(d) Change in Land Use Pattern

- Cultivated area in the head reaches had been converted into urbanized residential area. This changed the focus of use of canal water from irrigation to domestic purpose. Indirect effect of this change is that tail end of these colonies also do not get water because of obstacle created in the minors by these colonies.

- Adoption of HYV wheat by farmers of command area, which requires more water. On the other hand water for kharif crop is not used at all

7.2.2 In order to prioritize the factors responsible for gap between IPC and IPU, all the sample major and minor irrigation projects have been categorized into three categories, namely flow, lift and reservoir based projects as given in Tables 7.2 and 7.3 below. This has been done because some of the factors responsible for gap between IPC and IPU for different categories of the project are different and more over their releative importance in explaining the gap may vary depending upon the nature of the irrigation projects.

Table 7.2: Categorization of Major/medium Irrigation Porjects in different States

State	River Flow	River Lift	Reservoir
U.P.	2	2	2
Uttrakhand	3	1	1
M.P.	3	-	3
Chattisgarh	2	-	4
Bihar	3	-	2
Jharkhand	3	-	3
Orissa	5	-	1
Total	21	3	16

Table 7.3: Categorization of Minor Irrigation Porjects in different States

State	Flow	Lift	Storage
U.P.	-	3	1
Uttrakhand	1	2	-
M.P.	1	3	-
Chattisgarh	-	2	2
Bihar	1	3	-
Orissa	2	1	-
Total	5	14	3

7.2.3 An exhaustive list of factors explaining the gap between IPC and IPU for river flow, river lift and reservoir based irrigation projects in different States has been summarized in Charts 7.1, 7.2 and 7.3, respectively below:

Chart 7.1: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU in River Flow Irrigation Projects

Sl.	Reason for Gap Between IPC and IPU	Rank
Supply Side Factors		
1.	Broken water outlets and minors	1
2.	Encroachment of area under field channels	6
3.	Non-maintenance of channels	2
4.	Diversion of cultivable land to other purposes within command area	10
5.	Diversion of water for other purposes	11
6.	Low water carrying capacity of distribution channels due to silting	3
7.	Seepage from unlined minor canals	8
8.	Insufficient availability of water	12
9.	Non-completion of construction of field channels as per design	4
Demand Side Factors		
10.	Change in cropping pattern	5
11.	Non-reporting of irrigated area by farmers/Irrigation Dept.	13
12.	Lack of awareness among farmers about use of water	9
13.	Over utilization of irrigation water by farmers	7

Chart 7.2: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU in River Lift Irrigation Projects

Sl.	Reason for Gap Between IPC and IPU	Rank
Supply Side Factors		
1.	Decreased pump efficiency because of old pumps	1
2.	Inadequate power supply	3
3.	Broken minors and field channels due to lack of O&M funds	2
4.	Encroachment of area under field channels	4
5.	Diversion of cultivable land to other purposes within command area	9
Demand Side factors		
6.	Change in cropping pattern	5
7.	Non-reporting of irrigated area by farmers/Irrigation Dept.	8
8.	Lack of awareness among farmers about use of water	7
9.	Over utilization of irrigation water by farmers	6

Chart 7.3: Ranking/Prioritization of the Factors Responsible for Gap between IPC and IPU in Reservoir based Irrigation Projects

Sl.	Reason for Gap Between IPC and IPU	Rank
Supply Side Factors		
1.	Insufficient availability of water due to lack of rainfall	1
2.	Broken minors and field channels due to lack of O&M funds	2
3.	Diversion of water for other purposes	3
4.	Non-construction of field channels as per design	4
5.	Non-maintenance of canals	6
6.	Siltation in distribution canals	5
Demand Side FActors		
7.	Change in cropping pattern	7
8.	Non-reporting of irrigated area by farmers/Irrigation Dept.	10
9.	Lack of awareness among farmers about use of water	9
10.	Over utilization of irrigation water by farmers	8

7.2.4 It is evident from Charts 7.1 to 7.3 that supply side factors have emerged most important factors responsible for explaining the gap between IPC and IPU. Majority of these supply side factors are caused by lack of funds for operation and maintenenace of irrigation projects. The only important demand side factor emerged in the analysis is change in cropping pattern by the farmers over time. As a result in many cases, the demand of irrigation water has increased as compared to what was planned at the time of inception of the project. In some

cases, however, because of no crop in kharif season, there is no demand of water by the farmers in Kharif season resulting in low utilization of IPC. Over utilization of water by the farmers leads not only to in-equity in water distribution but also causes non-accessibility of water to the farmers located in extreme tail end of the distribution system. As a result their area remains un-irrigated leading to gap between IPC and IPU.

7.2.5 These factors can also be grouped based on the various activities of management of irrigation resources. These activities are listed in Table 7.4 below:

Table 7.4: Irrigation Management Activities

Sl.	Activity	Action
1.	Water acquisition	capturing water for distribution
2.	Water distribution	distributing water (operations)
3.	Maintenance	repairing and maintaining the physical structures
4.	Resource mobilization	raising the resources for operation and maintenance
5.	Conflict resolution	resolving conflicts between users and system managers

7.2.6 In majority of cases, the problem lies with water distribution and maintenance, this is purely a management issue at individual project level. The problem of water acquisition is severe in those irrigation projects which do not have perennial source of water and are primarily based on rainfall for capturing water for distribution. This holds particularly for reservoir based medium irrigation projects. Raising appropriate resources for operation and maintenance require policy interventions by respective State Governments. Conflict resolution between farmers and Irrigation Department needs institutional interventions in the form of promoting effective local institutions such as Water Users' Associations.

7.2.7 Most of the irrigation projects were designed based on the notion of providing protective irrigation (not full irrigation) to the crops in case of failure of monsoon particularly in kharif season. Moreover, the irrigation potential was calculated based on a particular cropping pattern in the command area of the project, as the demand of water is based on the nature of crop under cultivation. Both these assumptions have changed over time. Based on market conditions for technological changes, cropping pattern has changed almost in all the places in favour of more water intensive crops. This has resulted in increased demand of irrigation water by the farmers. On the other hand, due to lack of effective control on the distribution of water, farmers located at head of the canal over irrigate the land leaving less water availability to the users at the tail end. With less water availability and non-existence of distribution channels, the water does not reach to the farmers at the tail end. This affects the extent of area irrigated by a

particular irrigation source. This problem become more acute when there is less water availability at the irrigation resource due to less rainfall.

Section 3: Strategies Required

7.3.1 Specific problems for individual irrigation project and subsequently the possible suggestions to address such problems have been outlined at various places in the report. However, in a broad sense the following parameters need a re-examination to reach some logic conclusions for addressing the problem of management of irrigation resources of the country on the one hand, and more importantly to resolve the gap between irrigation potential created and its utilization, on the other.

- Irrigation potential definition and methodology for its determination
- Canal discharging capacity at source
- Methodology and status of recording of actual irrigation and its credibility
- Detailed irrigation data for each branch canal, distributory and minor
- Review of present administrative system in order to bring all water and agricultural departments under one umbrella for better coordination and effective control
- Review of present system of operation and maintenance of water resources
- System of periodic assessment of irrigation potential for each water resource

Definition and Reporting of IPC and IPU

7.3.2 Following suggestion are made in order to improve the present system of defining and measuring the concept of IPC, IPU and GIA for the irrigation projects:

(a) IPC figure for each irrigation project should be periodically reassessed treating IPC as dynamic and not as a currently presumed static variable. A concern in the similar lines has been also raised in the Report of the Task Force for Preparing Guidelines for Reporting the Figures of Irrigation Potential Created and Utilized in a Uniform Manner, Central Water Commission, 2002.

(b) The working efficiency of any asset is bound to decrease continuously over time due to wear and tear. That is why the concepts of depreciation and economic life are usually applied in investment analysis. In order to maintain an asset till its economic life, regular maintenance is also undertaken and financial analysis of

the project incorporates ex-ante provision for maintenance cost. The same should be applied for irrigation projects. The irrigation potential calculated at the time of inception of the project has been reduced over the years due to reduction in water availability and loss of capacity of canals and reservoirs. But unfortunately, no depreciation has been taken in to account in reporting the figures of IPC of a particular project. Non-availability of sufficient funds for maintenance of irrigation project has been widely accepted in all forums. Therefore, assuming the constant IPC figure for a project over the years and that too without proper maintenance looks very surprising. A periodic assessment of IPC for each project is required. In the absence of such exercise, IPC figures reported presently are highly inflated and therefore, any gap between IPC and IPU becomes artificially high. Under this scenario, gap between IPC and IPU does not provide the correct signal for judging the working efficiency of an irrigation project.

(c) IPC figure is for a project is based on assumed cropping pattern at the time of inception of the project. The cropping pattern has changed over time, and thus requirement of water. Therefore, even if we take "Area Approach" for defining the IPC, at present time the same area can not be irrigated by the project given the change in water demand.

(d) The rainfall, which is a major source of water to most of the irrigation project, has changed both in terms of magnitude and time pattern. With the changes in the pattern of rainfall over time in the command area of a project, the irrigation capacity of a project should be reassessed.

(e) In some cases, in order to bring down the cost of irrigation per unit of cultivated area, the IPC figure was artificially inflated at the time of sanction of the irrigation project. Although it concealed one problem of higher cost, it created a new problem of large gap between IPC and IPU at the time of performance of the project.

(f) The definition of IPC and IPU based on "Area Irrigated" as proposed by Planning Commission in 1973 needs a fresh look by the planners and administrators as the present approach does not provide the accurate measure of these two indicators. Based on the merits and de-merits as given in Chapter 3, the concept of volumetric approach of water utilization should be debated over the "Area irrigated" approach to finalize the process of defining the IPC and IPU.

(g) Whatever the concept is used in defining these concepts, there is no doubt about the removal of dual system of reporting these figures at State level as it creates only doubts and confusion. Presently the two independent parallel institutions (Irrigation and Agriculture Departments) report these figures, but without any coordination among them. The methodology used by Agriculture/ Revenue Department (based on complete enumeration of farms in the village) looks better provided the data should be based on area actually irrigated rather than present approach of area which can be potentially irrigated. Efforts are also required that Patwaris are motivated and properly equipped to collect such data

at village level. There must be some incentive dis-incentive structure to ensure the authentication of the required data at the village level.

(d) The Task Force set up in 2002 by Govt. of India for Preparing Guidelines for Reporting the Figures of Irrigation Potential Created and Utilized in a Uniform Manner suggested for a single nodal agency in each of the State for collection of data related to irrigation resources. The Task force recommended State Agriculture Statistics Authority (SASA) functioning within the Department of Economics and Statistics may be designated as nodal agency for this purpose. But no action seems to have been taken in this regard.

(e) A periodic census of all completed major and medium irrigation projects should be undertaken as in the case of minor irrigation schemes.

Gap between IPC and IPU

7.3.3 Figures 7.1 to 7.6 clearly demonstrate the cause and effect relationship of various factors responsible for gap between IPC and IPU. Although, individually each factor may contribute to a small gap, but their cumulative impact is very high. Another interesting point of this analysis is that unless all these factors are tackled in a coordinated manner, the problem of non-utilization of IPC will not be solved.

7.3.4 The Problem Tree Analysis (performed in Section 1) and Charts 7.1 to 7.3 confirm the hypothesis made in the study that under Indian agrarian conditions, the supply side factors are more important to explain the reasons for gap between irrigation potential and its utilization. The same analysis further reinforce that Irrigation Department in all the States has been trapped in vicious circle due to non-availability of sufficient funds for maintenance of irrigation resources, leading to even further poor utilization of irrigation potential of a resource. Though there has been spectacular increase in the irrigated area, State Governments in India are increasingly under severe financial constraints as they find it difficult to finance the recurring costs of irrigation and to collect economic water charges from the farmers. As a result, not only the sustainability of government run irrigation system is in danger, but also its impact on water use efficiency and equity has been dwindling over a period of time.

7.3.5 National Water Policy, 2002 has also highlighted some of the problems and weaknesses in a large number of irrigation projects in the country.

"There have been substantial time and cost overruns on projects. In some irrigation commands, problem of water logging and soil salinity have emerged, leading to degradation of agricultural land. There are complex problems of equity and social justice in regard to water distribution. The development and exploitation of country's groundwater resources also give rise to questions of judicious and scientific resource management and conservation".

It further points out that *"As maintenance of water resource schemes is under non-plan budget, it is generally being neglected. The institutional arrangements should be such that this vital aspect is given importance equal or even more than that of new constructions"* (National Water Policy, GOI, 2002).

7.3.6 In order to make sure that sufficient funds are available for operation and maintenance of irrigation projects, a projected cash in-flow and out-flow statement for the entire life of the project should be prepared at the time of sanction of the project. This would provide a complete understanding about how much funds are required and when to maintain the irrigation project. The cash flow analysis should also provide the source of funds for this purpose.

7.3.7 Irrigation agencies often lack a service orientation. Government emphasis in the past has been on construction of new systems without much, if any, farmer participation. The need for providing sustainable service under diminishing budgets calls for radical measures in the existing irrigation agencies in terms of technology, management and personnel policies. It has been realized in both developed and developing countries all over the world that if irrigation performance is to improve, a wide range of mutually supporting interventions will be needed which include:

- Improved agronomic, maintenance and irrigation management practices;
- System modernization and promotion of advanced irrigation technologies;
- Institutional reform, including the restructuring of irrigation agencies and irrigation management transfer to farmers and private entities; and
- The creation of incentives that treat water as an economic good and promote self-financing of irrigation schemes by water users

7.3.8 Growing realization among governments that new paradigm in irrigation management is needed has ushered in a new wave of reforms in the form of Irrigation Management Transfer (IMT) in the irrigation sectors of both developed and developing countries. It has been advocated that IMT will reduce the cost burden of irrigation on the government on the one hand, and will increase the productivity and profitability of irrigated agriculture enough to compensate for any increase in the cost of irrigation to farmers, on the other. In India, a change started taking place in mid eighties when the need for introducing PIM on the lines of similar measures introduced in some foreign countries was increasingly realized by social thinkers and irrigation professionals. It was felt that complex tasks involved in water management could not be performed efficiently with cost

effectiveness by a centralized bureaucracy. Accordingly, it would be better to transfer much of the power and responsibilities to farmers, i.e. actual users of water, if the present organizational structure was not to collapse under its own weight. The priority should be to loosen the tight control of bureaucracy and give a dominant say to farmers in water management.

7.3.9 The idea received support in the sixth five-year plan 1980-85 and the National Water Policy announced in 1987. International donor agencies like the World Bank, the USAID and the Ford Foundation also came forward with funding support to initiate experiments in different parts of the country. The CAD wing of the Ministry of Water Resources assumed the leadership role in this respect, Government of India, which issued guidelines from time to time to state governments on farmers' participation in irrigation management. These guidelines impressed upon the necessity of PIM, laid down the objectives of and methodology for formation of farmers' association and indicated duties and responsibilities of the State Department of Irrigation. In 1985, each CADA was requested to introduce aspects of PIM in at least one small part of each command area as an experiment. CAD wing also offered monetary incentives to farmers for this purpose. This consisted of a management subsidy of Rs. 275/- per hectare to be provided to WUAs during a period of first three years.

7.3.10 During the last fifteen years, further support for PIM came from several other sources. Some of the donor agencies included formation of WUAs as one of the conditions for giving aid. WUAs started being set up under Water Resources Consolidation Projects implemented in Tamilnadu, Orissa and Haryana with World Bank assistance. At some places as in Parunde in Maharashtra and Lower Bhavani in Tamilnadu, initiative for forming WUA came from some enlightened officials of the Irrigation Department. Some NGOs like the Aga Khan Rural Support Programme, Samaj Parivartan Kendra, PRADAN took initiatives in setting up WUAs. Action Research Programmes taken up by WALMIs in some states also helped in the process. As a result, a number of WUAs came to be established and became functional over a period of time.

7.3.11 However, let us understand that IMT is not a panacea for solving the problem of irrigation management. There are two issues, which ought to be kept in mind while designing an appropriate IMT program.

(a) Formation of WUAs should not be treated as an end in themselves. For farmers to play a significant role in all the critical functions of irrigation management including allocation and distribution of water, operation and maintenance, water charge collection and conflict resolution, there is a need for their capacity building (such as, in book keeping, conducting meetings, preparing O & M plans, dispute resolution, water distribution methods, measuring water flows, etc.), following clear distribution of roles. Thus, most important is to provide continuous capacity building even after the implementation is over.

(b) Although the management functions which government irrigation agencies (often at the strong behest of donor agencies) are most interested in transferring

to farmers are the operation and maintenance of canals and pumps, there are other important management functions as well. In the case of new systems, or the rehabilitation / modernization of old systems, the functions of planning, design, and construction are all part of "management". And at the end of the project cycle, even the process of evaluation should be included as a management function.

7.3.12 The debate related to cost versus access for all the product and services in rural areas has established that rural people give preference to access over cost of any product. The same is true for irrigation as agricultural input. The study finding confirms the same as majority of the farmers under survey showed their willingness to pay higher prices for irrigation water so that they could get adequate quantity of water at right time. Contrary to farmers' buying behavior, all State Government consider it mandatory to supply irrigation water as a highly subsidized price as the Government think that it is the cost of irrigation, not access to irrigation services, is the major issue before the farmers. In this process, issues related to access of irrigation water are usually ignored and the consequences are very clear. Instead of treating farmers as beneficiaries, this is the right time when the Irrigation Department should consider the farmers as their clients, as the clients can pay the economic cost of resource but we can not expect the same from beneficiaries. However, when the farmers as clients will pay for irrigation water, the same farmers would also demand for better services from the irrigation Department.

7.3.13 We all are aware that both water & land are now-a-days precious and are under great stress. Both are required to be saved as much as possible to meet the future food demands. In this perspective, canals are now required to be redesigned with lined sections, in order to save water being wasted from seepage & evaporation, and to enhance their efficiency. Much less efforts will be required in the maintenance too. It will save precious land & this can be utilized for Agricultural purposes, as there is already a great pressure on land due to various developmental activities. Main Canals and Branches are in bad shape in many systems and the too need proper maintenance/ rehabilitation Apart from silting, their banks at many places are low & weak and needs strengthening to allow full carrying capacity. Canals are also required to be redesigned in order to meet the present scenario with modern technology regarding Head/Cross Regulators, Gates, Falls & other structures. Although Main Canal & Branches are Designed as non silting channels, but some typical terrain, it has been observed that there is lot of silting in them thus reducing the discharge carrying capacity of the main carriers.

7.3.14 The lift irrigation projects require continuous electric supply with out interruptions and with proper voltage. Mechanical and electrical faults in motors, pumps, and panels/switchyards also contribute to inefficiency. If not attended immediately, as happens normally, efficiency goes down even if pumps / motors are not very old.

7.3.15 There is tendency on part of the farmers to adopt old practice of irrigation i.e. Flood Irrigation irrespective of actual water demand. There is a need to persuade the farmers to adopt new/modern innovative techniques such as Drip and Sprinkler Irrigation, which requires much lesser water.

7.3.16 Developmental activities are undertaken under Local Area Development funds popularly known as MLA/MP funds. Many field channels/Guls have been obstructed or damaged due to indiscriminate construction of roads under these programs. In many cases it has been seen that construction of guls at improper level, or not connected to the outlets, at all or not properly, has led to inefficiency & wastage of resources.

7.3.17 Lack of capacity of the staff & officers to meet the current challenges is also one of the important aspects. Programs are required for building capacity and update their skill and knowledge.

7.3.18 Lot of water is wasted either due to breaches in canals owing to inadequate canal sections or due to negligence of the supervisory staff or due to cutting of canals by farmers/miscreants. Effective and continuous support from law enforcing agencies is necessary, which is seldom available in practical terms.

Suggestions:

1. Enough budgets should be allocated for timely repair and maintenance of the canals.

2. High priority should be given to the task of lining of the whole canal system, including main medium and minor canals, along with a provision of appropriate slope. High quality technical work should be ensured in this regard. In addition, contractors and field staff of irrigation department should be trained to deliver technical work of a sound quality.

3. Since it is very difficult to stop farmers from lifting water, it is better to install a lift irrigation system on the bank of canals. In this way, farmers can be charged for the amount of water they collect. As per the suggestion of the officials of irrigation department, lift irrigation through the main canal should be legalized and that area should be converted into a command area. This would help eliminate the frequent damage to the canal undergone during lifting water by the farmers.

4. Restructuring of the WUA should be carried out. This should be followed by aggressive training for organizational development, leadership, maintenance of, financial and operational records, training in the basic technical components of canal system and in the methods of monitoring technical work. Instead of vesting WUA with financial clout, it should be given a management and supervisory role, so that wastage of water can be prevented and equity in distribution of canal water can be ensured. WAU should be given enough power to monitor the construction and repair work of canals and if they do not find work done as per

the norms, they should have power to get the modifications done. Field level irrigation officials should be given enough financial power, so that they can implement corrective measures in time to save the canal from further damage.

5. Physical safety of the field staff (sub engineer and field personnel) of the irrigation department should be ensured, by providing them appropriate police security, so that they are able to supervise the canal operation even during night and thus prevent wastage of water resulting from damage to canal during peak irrigation season.

6. There is a need to develop a mechanism for proper coordination between relevant government departments, such as the irrigation, agriculture, revenue and the land development department. Perhaps a committee consisting of representatives from the relevant departments can be formed, to look at the holistic development of the command area.

7. A policy needs to be formed to make farmers to adopt appropriate cropping pattern for optimum use of water. A balanced ratio has to be introduced between high, medium and low water consuming crops. This will help maximize the benefits of canal water and at the same time protect head reach land from water logging and ultimately prevent it from becoming infertile land. Some mechanism is needed to be developed to impose fine on the farmers who disproportionately grow high water consuming crops. Growing high water consuming crops continuously makes the land water logged and saline and ultimately makes it unsuitable for cultivation. It is in the interests of the farmers to adopt balanced cropping pattern. There are many examples in India where highly fertile agriculture land has turned infertile because of excess use of water and imbalance cropping pattern. Farmers need to make aware of this.

Appendix -1

Preliminary Information about Major/medium and minor Irrigation Projects

1. State:

2. Name of the project:

3. Type of the project: Major/ Medium/ Minor

4. Year of Commencement:

5. Number of Villages Covered:

6. Name of Agro-climatic Zone:

7. Irrigation Potential and Utilization

Sl. No.	Year	Potential Irrigated Area (ha)	Gross Irrigated Area (ha)
1.	2005-06		
2.	2004-05		
3.	2003-04		
4.	2002-03		
5.	2001-02		
6.	2000-01		

Appendix -2

Information Required for Major/Medium/Minor Irrigation Project

1. Name of the Project:

2. Year of inception of the project

3. Numbers of village covered:
(Please get the map of the project and list of villages covered under the project)

4. Length of Main Canal

5. Numbers of sub Canals

6. Numbers of Distributaries

7. Numbers of Minors

8. Present command area (potential irrigated area):

Season	Potential Irrigated Area
Kharif	
Rabi	
Total	

9. Command area (potential irrigated area) at the time of inception of the project:

Season	Potential Irrigated Area
Kharif	
Rabi	
Total	

10. If there is change in command area (potential irrigated area) over time, what are the possible reasons for such change?

(a)

(b)

(c)

(d)

11. Assumptions for calculating command area (potential irrigated area)

(a)

(b)

(c)

(d)

12. Actual Irrigated Area during last ten years:

Year	Actual Irrigated Area	
	Kharif	Rabi

13. Possible reasons for gap in irrigation potential creation and its utilization

(a)

(b)

(c)

(d)

14. Possible measures for reducing the gap between irrigation potential and utilization

(a)

(b)

(c)

(d)

15. Estimate of command area (potential irrigated area) which has not been utilized at all since inception:

16. Location of area mentioned as above in terms of name of villages etc.

17. Reasons:

(a)

(b)

(c)

(d)

18. Estimate of command area (potential irrigated area) where irrigation utilization has been discontinued over time

19. Location of area mentioned as above in terms of name of villages etc.

20. Reasons:

(a)

(b)

(c)

(d)

21. Estimate of command area (potential irrigated area) where irrigation utilization has been widely fluctuating over the years:

22. Location of area mentioned as above in terms of name of villages etc.

23. Reasons:

(a)

(b)

(c)

(d)

Appendix -3

Beneficiary Response Survey

Identification No.

A. *Location details*

1. Name of the project
2. Name of the main canal
3. Name of the distributory
4. Location in the main canal H [ ] M [ ] T [ ]
5. Location in the distributory H [ ] M [ ] T [ ]
6. Location in the minor H [ ] M [ ] T [ ]

B. Details of the respondent

1. Name of the village
2. Taluk
3. District
4. Name of the respondent
5. Age (Years)
6. Caste (SC/ST/OBC/Other)
7. Literacy level

   a) Illiterate [ ] b) Literate [ ]

   c) Below JHS [ ] d) High School/Inter [ ]

   e) Graduate [ ] f) PG [ ]

   g) Diploma [ ]

   Occupation a) Primary _____b)

   Secondary_____

8. Income from different sources/occupations

Source of income	Total Annual Income
Primary	
Secondary	
Family members	

C Landholding details

Details	Area (Acres)		
Non-Agricultural land			
Barren			
Agricultural Land	**Irrigated**	**Un Irrigated**	**Fallow**
Owned			
Leased-in			
Leased-out			

D Land holding under this project and cropping pattern for the last FIVE years

Total area cultivated by you in last year (2006-07) under the above distributory:_____ acres

Type of holding in acres: a) Owned [ ] b) Leased – in [ ]
c) Leased – out [ ]

Crop details

Year: **2006-07** Season: **Kharif**

Sl.No	***Name of the crop***	***Area* (acres)**	***No. waterings***	***Alternate source of water***	***Total yield* (quintal)**	***Total value* (Rs)**	***Total cost* (Rs)**
1							
2							
3							
4							
5							
6							

Year: **2006-07** Season: **Rabi**

Sl.No	***Name of the crop***	***Area* (acres)**	***No. waterings***	***Alternate source of water***	***Total yield* (quintal)**	***Total value* (Rs)**	***Total cost* (Rs)**
1							
2							
3							
4							
5							
6							

Year: **2006-07** Season: **Summer**

Sl.No	***Name of the crop***	***Area* (acres)**	***No. waterings***	***Alternate source of water***	***Total yield* (quintal)**	***Total value* (Rs)**	***Total cost* (Rs)**
1							
2							
3							
4							
5							
6							

Year: **2005-06** Season: **Kharif**

Sl.No	***Name of the crop***	***Area* (acres)**	***No. waterings***	***Alternate source of water***	***Total yield* (quintal)**	***Total value* (Rs)**	***Total cost* (Rs)**
1							
2							
3							
4							
5							
6							

Year: **2005-06** Season: **Rabi**

Sl.No	***Name of the crop***	***Area* (acres)**	***No. waterings***	***Alternate source of water***	***Total yield* (quintal)**	***Total value* (Rs)**	***Total cost* (Rs)**
1							
2							
3							
4							
5							
6							

Year: **2005-06** Season: **Summer**

Sl.No	***Name of the crop***	***Area* (acres)**	***No. waterings***	***Alternate source of water***	***Total yield* (quintal)**	***Total value* (Rs)**	***Total cost* (Rs)**
1							
2							
3							
4							
5							
6							

Year: **2004-05** Season: **Kharif**

Sl.No	***Name of the crop***	***Area* (acres)**	***No. waterings***	***Alternate source of water***	***Total yield* (quintal)**	***Total value* (Rs)**	***Total cost* (Rs)**
1							
2							
3							
4							
5							
6							

Year: 2004-05 Season: **Rabi**

Sl.No	*Name of the crop*	*Area* (acres)	*No. waterings*	*Alternate source of water*	*Total yield* (quintal)	*Total value* (Rs)	*Total cost* (Rs)
1							
2							
3							
4							
5							
6							

Year: **2004-05** Season: **Summer**

Sl.No	*Name of the crop*	*Area* (acres)	*No. waterings*	*Alternate source of water*	*Total yield* (quintal)	*Total value* (Rs)	*Total cost* (Rs)
1							
2							
3							
4							
5							
6							

Year: **2003-04** Season: **Kharif**

Sl.No	*Name of the crop*	*Area* (acres)	*No. waterings*	*Alternate source of water*	*Total yield* (quintal)	*Total value* (Rs)	*Total cost* (Rs)
1							
2							
3							
4							
5							
6							

Year: **2003-04** Season: **Rabi**

Sl.No	*Name of the crop*	*Area* (acres)	*No. waterings*	*Alternate source of water*	*Total yield* (quintal)	*Total value* (Rs)	*Total cost* (Rs)
1							
2							
3							
4							
5							
6							

Year: **2003-04** Season: **Summer**

Sl.No	***Name of the crop***	***Area* (acres)**	***No. waterings***	***Alternate source of water***	***Total yield* (quintal)**	***Total value* (Rs)**	***Total cost* (Rs)**
1							
2							
3							
4							
5							
6							

Year: **2002-03** Season: **Kharif**

Sl.No	***Name of the crop***	***Area* (acres)**	***No. waterings***	***Alternate source of water***	***Total yield* (quintal)**	***Total value* (Rs)**	***Total cost* (Rs)**
1							
2							
3							
4							
5							
6							

Year: **2002-03** Season: **Rabi**

Sl.No	***Name of the crop***	***Area* (acres)**	***No. waterings***	***Alternate source of water***	***Total yield* (quintal)**	***Total value* (Rs)**	***Total cost* (Rs)**
1							
2							
3							
4							
5							
6							

Year: **2002-03** Season: **Summer**

Sl.No	***Name of the crop***	***Area* (acres)**	***No. waterings***	***Alternate source of water***	***Total yield* (quintal)**	***Total value* (Rs)**	***Total cost* (Rs)**
1							
2							
3							
4							
5							
6							

E Alternate Sources of Irrigation for the land under the distributor in 2006-07

1. Type of well a) Shallow [ ] b) Open Well [ ] c) Bore Well [ ]

2. Water Lifting Device a) Power [ ] b) Manual [ ]

c) Others (specify)_____

3) Ownership

a) Owned [ ]

b) Neighbors [ ]

c) Community [ ]

4) How often this requirement becomes necessary to seek alternative water resource

a) Always [ ] b) Very often [ ] b) Often [ ] c) occasionally [ ]

d) Rarely [ ]

F Water Rates payment details

1) Rate for water Rs./Acre

Crop	**Kharif**	**Rabi**	**Summer**
1.			
2.			
3.			
4.			

2) Periodicity of payment Season wise/Monthly / Installments

3) Process of payment of water charges

4) Amount paid for the water in the past three years

5) Reasons for non-payment, if any

6) Are you willing to pay extra for assured water supply?

a) Yes [ ] b) No [ ]

If Yes, How much?

a) More than 100% [ ] b) 50 to 100% [ ] c) Less than 50% [ ]

G Role of Water users Organizations

1) What type of organization exists in your village for water management?

a) Water users association [ ] b) NGO based [ ] c) Panchayat Control [ ]

2) What is the role of the existing organization? (Multiple answers acceptable)

a) Distribution of water [ ]

b) Collection of water charges [ ]

c) Advice on cropping pattern to be followed [ ]

d) Maintenance of field channels [ ]

e) Resolving the water disputes [ ]

f) Other activities (specify)

3) Are you member of the above organization?

a) Yes [ ] b) No [ ]

If No, what is the reason for not becoming a member?

If yes, did you get any benefit so far as a member and what type of benefit?

4) How do you rate/view the functioning of the organization in terms of its effectiveness?

a) Very good [ ] b) Good [ ] c) Not sure [ ] d) Poor [ ]

e) Very poor [ ]

a) How often the meetings are conducted?

a) Monthly [ ]

b) Quarterly [ ]

c) Yearly [ ]

d) Need based [ ]

e) Season wise [ ]

b) Whether discussions on members' issues take place in orderly manner?

a) Always [ ]

b) Very often [ ]

c) Often [ ]

d) occasionally [ ]

e) Rarely [ ]

c) Whether timely elections of the organization take place?

a) Yes [ ] b) No [ ]

d) When were the last elections held?

e) Do you feel that the organization is dominated by a certain group of Members only? a) Yes [ ] b) No [ ]

5) How do you rate your water user organization as compared to others in the Same distributory / panchayat / block?

a) Very useful [ ]

b) Useful [ ]

c) No difference [ ]

d) Not useful [ ]

e) Very harmful [ ]

Reasons for this rating.

6) Did you attend to any of the meetings in the past 12 months?

a) Yes [ ] b) No [ ]

7) Issues raised by the farmer in the meeting and the extent of their resolution.

No.	Issues raised in the meetings by the farmer	Solutions provided
1		
2		
3		
4		
5		

8) Criteria laid down for distribution of water

9) Whether night irrigation is practiced in your village?

a) Yes [ ] b) No [ ]

If No, reasons for not practicing

_____

10) Whether night irrigation is practiced in other villages under this distributor?

a) Yes [ ] b) No [ ] c) Do not know [ ]

Problems faced by Individual Farmers

H What are the reasons for cultivated area remaining un irrigated (completely or partially)?

	Reason	Area	No. of parcels
a.	Unleveled land		
b.	Absence of irrigation channels		
c.	Scarcity of water		
d.	Uncertainty about supply		
e.	Unresolved conflicts with fellow farmers		
f.	Bleak prospects of remunerative returns		
g.	Financial incapability		
h.	Other reasons:		

Issues and resolutions Interaction with government officials

I. What is your opinion on the functioning of the irrigation department?

(a) We get all the help required [ ]

(b) We get help only when we ask / complain [ ]

(c) We get help depending on the particular person [ ]

(d) We hardly get any help [ ]

(e) Any other (specify)

J. 1. How does the irrigation department communicate to you about water releases?
Mode and details of communication:

1.

2.

3.

4

2. Who influences your cropping pattern?

a. Irrigation department [ ]
b. Agricultural department [ ]
c. Irrigation society [ ]
d. Other farmers [ ]
e. Purchasers of the produce [ ]
(*sugar mills, oil mills, etc*)
f. Any other (specify) [ ]

K. How do you communicate to the Irrigation department the problems you face and the facilities you need?

a. Individually or collectively [ ]
b. Through a letter [ ]
c. Oral compliant to the official [ ]
d. Complaining in local society meetings [ ]
e. Through elected representative [ ]
f. Any other (specify) [ ]

L. 1) Are you satisfied with the cooperation and advice from the irrigation department?

Extremely dissatisfied [ ]
Somewhat dissatisfied [ ]
No opinion [ ]
Partly satisfied [ ]
Extremely satisfied [ ]

2) What kind of specific help do you expect from the Department in future?

1.
2.
3.
4.
5.

M. In the last two years, did you raise issues with the Department (*individually or* collectively)?

No.	Issues raised	Issues resolved	Issues not resolved
1			
2			
3			
4			
5			

N. Do you (*farmers*) have a meeting to discuss water distribution?

Yes [ ] No [ ]

If No, reasons for not meeting.

O. What sort of responsibilities can the farmers undertake in the operation of canals / tanks?

1.

2.

3.

4.

5.

P. Do you think there is equitable distribution of water?

Yes [ ] No [ ]

If no, what encouragement is needed, according to you, for the farmers to get together for equitable water distribution?

1.

2.

3.

4.

5.

Q. Water Conflicts in the distribution of water

1. Do you think someone /group influence the water distribution decisions in your area

   a) Yes [ ] b) No [ ]

2. Who are these influential persons in your opinion?

   a) Economically powerful people [ ]

   b) Caste based people [ ]

   c) People close to the Panchayat [ ]

   d) Elected representatives [ ]

   e) Others (specify) _____ .

3. Are you adversely affected by this influence?