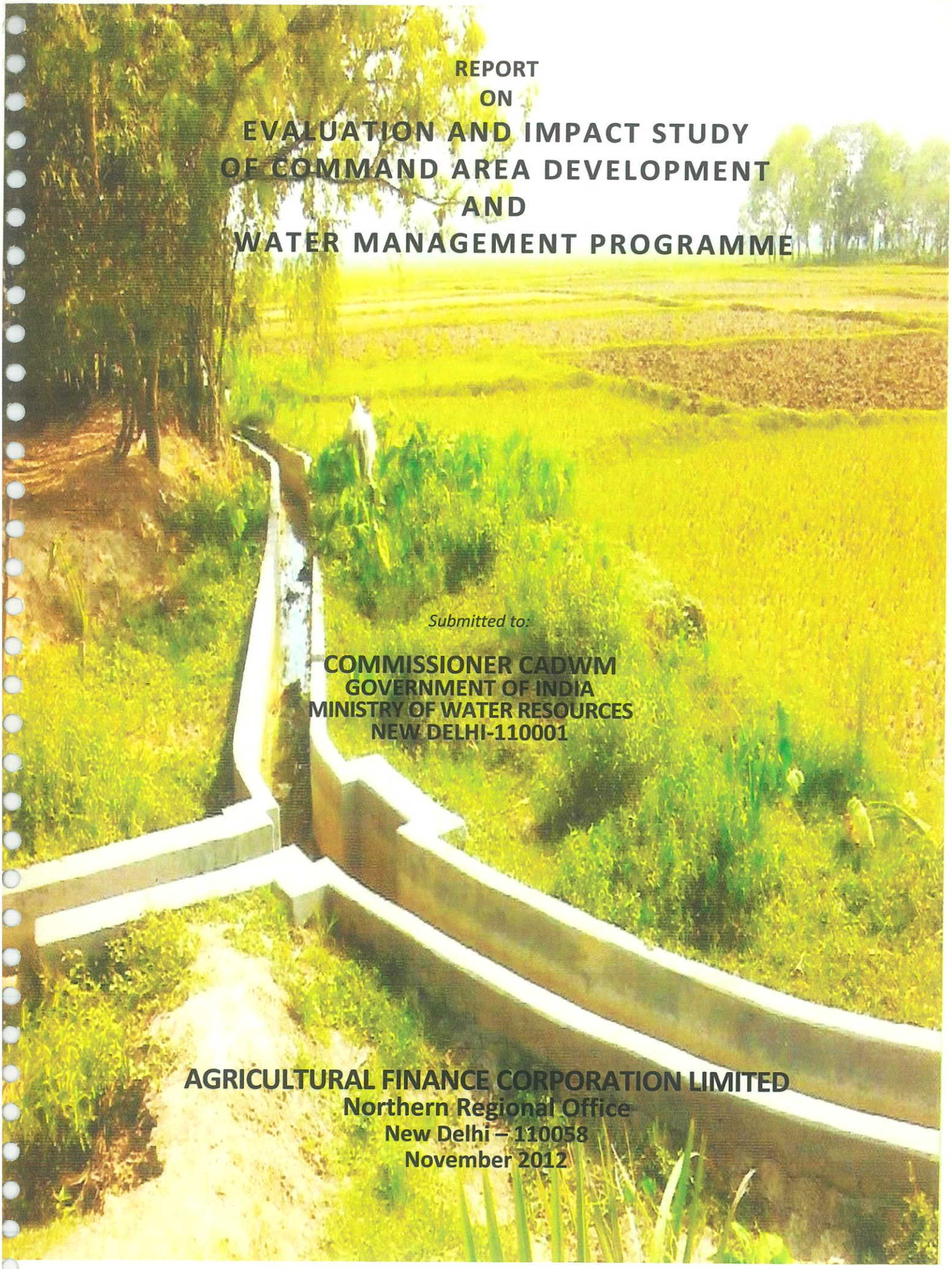


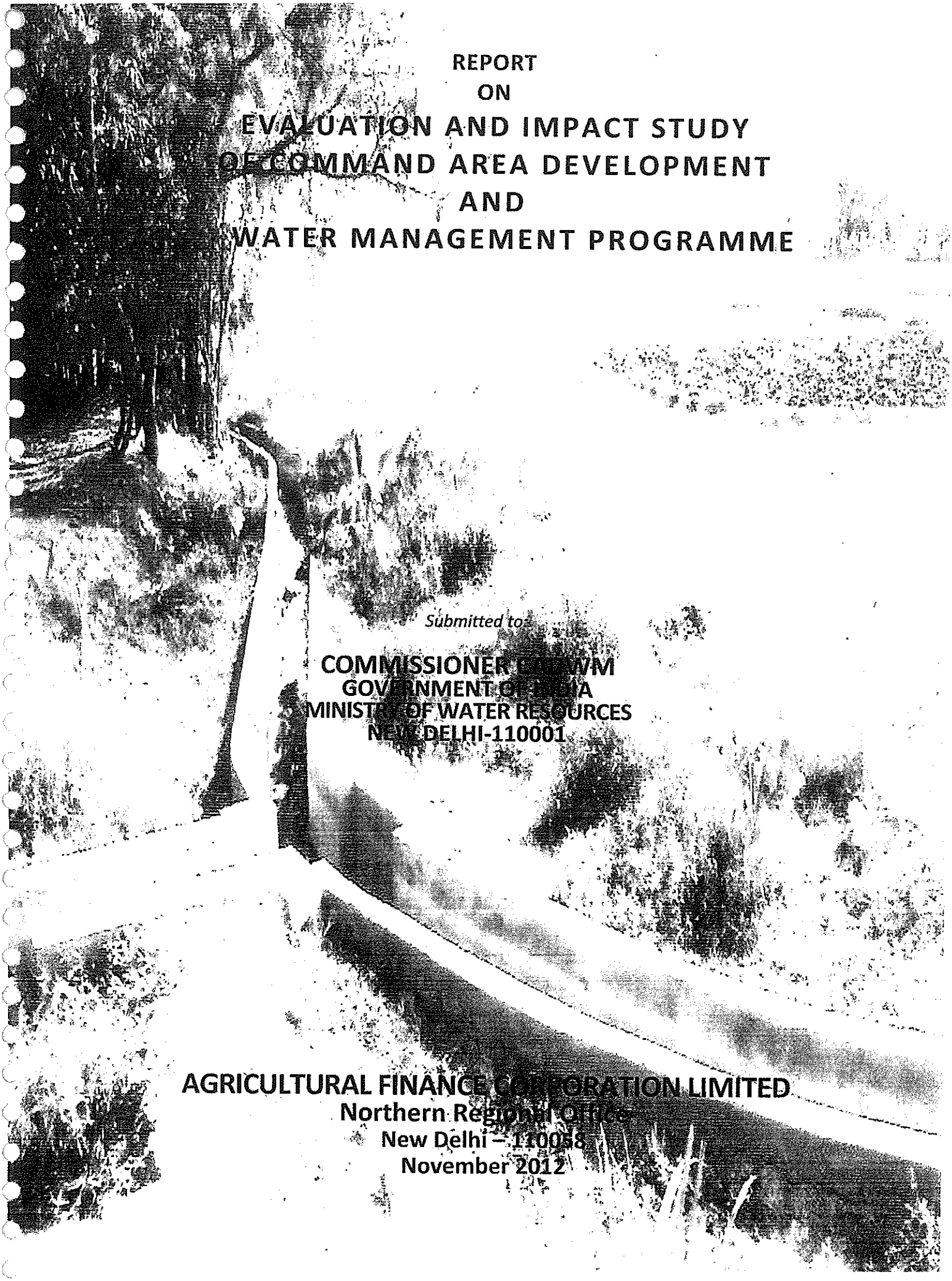
REPORT
ON
EVALUATION AND IMPACT STUDY OF COMMAND AREA DEVELOPMENT AND WATER MANAGEMENT PROGRAMME

Submitted to:

COMMISSIONER CADWM
GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
NEW DELHI-110001

AGRICULTURAL FINANCE CORPORATION LIMITED
Northern Regional Office
New Delhi – 110058

November 2012



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CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

AGM	Annual General Body Meeting
APC	Agricultural Production Commissioner
CAD	Command Area Development
CADA	Command Area Development Authority
CADWM	Command Area Development and Water management
CC	Cement Concrete
CCA	Culturable Command Area
CCSHAU	Chaudhary Charan Singh Haryana Agricultural University
CD	Community Development
CSSRI	Central Soil Salinity Research Institute
CUMEC	Cubic Meter per Second
CUSEC	Cubic Feet per Second
DC	Distributary Committee
DoWR	Department of Water Resources
FIC	Field Irrigation Channel
FO	Farmers' Organisation
GCADA	Gandak Command Area Development Authority
GCP	Gang Canal Project
GIS	Geographical Information System
GTIDC	Goa Tillari Irrigation Development Corporation
GoHP	Government of Himachal Pradesh
GoI	Government of India
Ha	Hectare
HP	Horse Power
HSMITC	Haryana State Minor Irrigation and Tube well Corporation
I&FCD	Department of Irrigation and Flood Control
I&PHD	Irrigation and Public Health Department
J&K	Jammu and Kashmir
JICA	Japan International Cooperation Agency
I&FCD	Irrigation and Flood Control Department
KVK	Krishi Vigyan Kendra
M/Ha	Metre/Hectare
MC	Management Committee
MD	Managing Director
MIS	Management Information System
MLA	Member of Legislative Assembly
MI	Minor Irrigation
MoU	Memorandum of Understanding
MoWR	Ministry of Water Resources
NGO	Non Governmental Organisation
OFD	On-Farm Development
O&M	Operation and Maintenance
PC	Project Committee
PIM	Participatory Irrigation Management

PVC	Poly Vinyl Chloride
RCC	Reinforcement Cement Concrete
RMT	Running Metre
SAU	State Agricultural University
SLMC	State Level Monitoring Committee
SKM	Square Kilometre
SNIP	Sidhmukh Nohar Irrigation Project
SOR	Schedule of Rates
SSNNL	Sardar Sarovar Narmada Nigam Limited
SRSP	Sri Ram Sagar Project
TNA	Training Needs Assessment
WALMI	Water and Land Management Institute
WRD	Water Resources Department
WUA	Water Users Association
WUCSs	Water User Cooperative Societies

EXECUTIVE SUMMARY

Project Objectives and Rationale of the Study

The Centrally Sponsored Command Area Development (CAD) programme was launched in 1974-75 with the main objective of improving the utilisation of created irrigation potential and optimising agriculture production and productivity from irrigated agriculture through a multi-disciplinary team under an Area Development Authority. The programme was restructured and renamed as Command Area Development and Water Management (CADWM) Programme with effect from 1-4-2004 aiming at enhancing agricultural production and productivity in irrigated commands by judicious and equitable distribution of the available irrigation water with active involvement of farmers through participatory irrigation management (PIM). After inclusion of new projects, deletion of completed projects and clubbing of on-going projects, there are now 151 projects under implementation in the country.

It was targeted to cover an area of 1.32 million hectare under the Programme during XI Plan (2008-09 to 2011-12). Survey, planning, design and execution of On-Farm Development (OFD) works was proposed to be carried out in the entire area of 1.32 million hectare; construction of field, intermediate and link drains in an area of 0.56 million hectare; correction of system deficiencies in an area of 0.105 million hectare; reclamation of waterlogged areas in 0.102 million hectare; software activities like training, monitoring, evaluation, demonstration and adaptive trials as and where felt necessary; providing one-time functional grant to registered Water Users Associations (WUAs) in an area of 1.32 million hectare and meeting the establishment cost on construction activities. The Ministry of Water Resources (MoWR) has released ₹ 4722.4955 crores to the State Governments till March 2011. The expenditure statement indicates that an amount of ₹ 1471.53 crores has already been spent during 2007-2008 to 2010-2011.

At the onset of XII Five Year Plan, MoWR decided to conduct an Evaluation and Impact Assessment of the CADWM Programme with a view to identify programme inadequacies including channel density and cost norms, critical appraisal of the PIM Programme along with the current status of Water Users Associations (WUAs) in terms of strength and weakness and financial sustainability, thorough assessment of the CADWM work that remains to be done in all states and study the need for extension, renovation and modernization of the CAD projects completed before 2001.

The study sample covered 151 on-going projects across 28 states and 15 completed projects from 4 states including Andhra Pradesh, Maharashtra, Uttar Pradesh and

Rajasthan. One project in each of the states was covered under intensive study. Six (6) WUAs in each of the projects covered under intensive study were interacted at head, middle and tail end of the micro-canal system. The detailed methodology adopted under the study included log frame analysis, stakeholders' analysis, designing and piloting study tools, interaction with stakeholders, data analysis and subsequently writing the report. The major findings of the study as per the terms of reference (ToR) are presented below.

ToR-1: Identify the inadequacies of the programme and give recommendations on the following:

a) Length of channel required per hectare of field (channel density) to cover each and every field

b) Suggest change of cost norms of the OFD works and other components of CADWM programme in keeping with the rise in cost of material/labour

The programme inadequacies include general aspects, channel density and cost norms separately.

a) General Programme Inadequacies

Institutional Aspects

Command Area Development Authority (CADA) set up exists in 14 states including Kerala, Karnataka, Jammu & Kashmir, Rajasthan, Haryana, Madhya Pradesh, Uttar Pradesh, Chhattisgarh, West Bengal, Bihar, Odisha, Assam, Manipur and Maharashtra. Goa Tillari Development Corporation is responsible for implementation of CADWM works in the state. The programme in other states is executed through Departments of Irrigation & Water Resources in most of the states whereas the same is executed through Agricultural Engineering Department (Tamil Nadu), Department of Soil & Water Conservation (Jammu & Kashmir), Irrigation and Public Health Department (Himachal Pradesh), Department of Minor Irrigation (Mizoram & Sikkim), Irrigation and Flood Control Department (Nagaland and Arunachal Pradesh), Punjab Tube well Corporation (Punjab) and Sardar Sarover Narmada Nigam Limited (Gujarat).

Most of the projects covered under the intensive study are adequately equipped with engineering staff. The CAD authorities and other implementing institutions hire the officials on deputation basis to support the activities related to agricultural extension and formation of WUAs. However, most of the projects claim inadequacy of the staff for carrying out agricultural extension activities. There is no provision for deploying specialists to strengthen the socio-institutional aspect which is supposed to be a critical area for strengthening the WUAs and ensuring their sustainability. Setting up and building of a strong CAD establishment in non-CADA states equipped

with specialised professionals with focus on Participatory Irrigation Management, agriculture/horticulture, agri-business, engineering and socio-institutional aspects can increase efficiency and effectiveness of CADWM programme.

Fund Flow Mechanism

Timeliness in receipt of funds is a critical input for execution of CADWM works at project level. However, the efficiency of fund flow mechanism is guided by various factors including timing of submission of the proposals from project to state to centre, quality & quantiy of information required for sanctioning the project, time taken at state level for consolidation and submission to centre, time taken at CADWM Delhi for submission to IFD, time taken at IFD level for approval and release of the funds to state treasury, time taken in receipt of funds from state treasury to the department and subsequently to the project, submission of utilisation certificate, etc.

The peak season for carrying out construction activities under CADWM varies from one location to the other depending upon seasonal variations, labour availability, festivals, etc. Threrefore the complete cycle of fund flow mechanism is corelated to achievement of physical and financial targets of the project. One of the findings from field visits to various projects across the country reflects delay in receipt of funds for execution. However, delays are procedural. If the State submits the pre-requisite documents at the end of the financial year to the Centre, fund disbursal is bound to get delayed. Also, if the State falls short of submitting the fund utilisation certificate for the current time period, fund disbursal gets delayed. Late submission of release proposals from States and proper formats not being used also account for delay in release of fund.

Physical and Financial Achievements

An area of about 19.69 million hectare has been covered under the programme since inception up to the end of March 2011, out of which an area of 1.8 million hectare has been covered during the IX Plan, 2.31 million hectare in the X Plan and 1.62 million hectare during first four years of the XI Plan. During 2011-12, more than 75% targets have been achieved by most of the states.

Most of the projects covered under intensive study carried out more than 75% work on survey, planning and design component of the scheme whereas cent percent works were completed in the North Eastern States. However, work on survey, planning and design was carried out by the Irrigation Department in the states of Andhra Pradesh, Goa, Himachal Pradesh, Gujarat and Uttarakhand.

The States namely Punjab, West Bengal, Goa, Gujarat and Maharashtra could not achieve their target in lined channel work during XI Plan. No work of construction of field channel was carried out in the States of Meghalaya, Sikkim, Uttarakhand, Jharkhand and Tripura, and limited work of construction of field channel was carried out in the States of Himachal Pradesh, Assam and Arunachal Pradesh. The unlined channels were constructed with Government of India (GoI) funds in states like Tamil Nadu, Rajasthan, Madhya Pradesh, Chhattisgarh, Odisha, Punjab, J&K, Gujarat, Mizoram and Manipur. The States namely Andhra Pradesh (30%), West Bengal (14%) and Assam are lagging behind to complete the targeted work.

The adaptive trials and demonstrations have not been taken up in most of the states using the CADWM funds. They are mostly done by the respective State Agricultural Universities (SAUs) through the Krishi Vigyan Kendras (KVKs). The Warabandi activity has been promoted in most of the States. Most of the states followed designing of the field channels varying from 1.25 to 4 cusec instead of the CADWM norm of 1 cusec discharge for 40 hectares. This results into reduction of length of channel causing reduction in coverage of area under irrigation.

Holistic, Integrated and Coordinated Approach

As a concept, the holistic approach relates to community managed command area with a view to maximise sustainable crop productivity, production and income of the beneficiaries per unit of water discharged from the outlet addressing the issues of equitable distribution of benefits and environmental sustainability. The concept of Participatory Irrigation Management emphasises on multi-faceted approach and strategy with regard to equitable water distribution through Warabandi, water use efficiency, effective crop planning in accordance with water supply, maintenance of structures created in the command area, sustainability of farmer institutions, convergence with government schemes and programmes, establishing linkages with government departments, non-government organisations (NGOs) and private agencies to enhance productivity and production and marketing.

The achievement of different projects in this regard varies from one to the other which is influenced by a number of factors such as state policies, initiatives taken at state and project levels, visioning of leadership at state and project levels, capacities of the field staff, etc. Most of the projects covered under intensive study emphasise on construction of engineering structures, crop demonstrations and training of farmer associations by hiring expertise from different departments on deputation or taking the services of line departments especially in the field of crop demonstration, WUA formation and training. However, a limited focus has been laid on integration of various interventions required to maximise production, productivity and economic returns per unit of water consumption in the command area. Also, the concept of convergence needs to be seen in broader terms involving various actors with a view

to enhance economic returns of the farming community on the basis of per unit of water delivered from the outlet and to sustain the farmer led management system of micro-canal command areas.

The approach is yet be established across the projects covered under the study to establish holistic, integrated and coordinated approach with effective planning and identification of critical needs, identification of different stakeholders, sensitisation and capacity building of stakeholders, establishing workable relationships with different stakeholders including convergence with different programmes and schemes, effective monitoring systems, etc. Therefore, success of the project requires an integrated, coordinated and holistic approach at all levels, that is, state, project and community.

Water Use Efficiency, Distribution and Measurement

Water use efficiency is an index of percentage gainful performance of irrigation water releases. It indicates how efficiently the available water supply is being used based on various methods of evaluation. Design of irrigation system, degree of land preparation and skill and care of irrigation practices are principal factors influencing irrigation efficiency or water use efficiency. The water use efficiency can be increased in the command area through various interventions including land development related activities, optimising water use in accordance with effective crop planning, land consolidation and realignment, realignment of field channels, effective water distribution and measuring systems, etc.

Enhancing water potential and creating mechanisms for optimal utilisation is one of the core objectives of CADWM programme and the projects visited are focused on this. Different projects are at different stages of managing initiatives towards efficient water use and its measurement and distribution. Water distribution measuring/control devices such as parshall flumes, notches and weirs have been installed only in Kukadi project in Maharashtra, Hasdeo Phase II Project in Chhattisgrah and Thoubal Irrigation Phase II Project in Manipur.

The concept of Warabandi exists in most of the projects. The concept of water conveyance efficiency is primarily ensured by increasing length of lined channels in the command areas in most of the projects. However, the focus on increasing water application efficiency is marginalised across the studied projects as most of the farmers use flood irrigation. The aspects related to land consolidation and realignment, realignment of field channels and effective water distribution and measuring systems have to be strengthened in the projects. Also, the prevailing concept of crop planning does not prevent the farmers at head from growing high water consuming crops leading to inequitable water use at the cost of tail enders.

Adaptive Trials and Frontline Demonstrations

Training of farmers and extension of recommended package of practices, promotion of improved and advanced technologies to enhance agricultural production and productivity is an important component of CADWM programme. Adaptive trials are conducted to verify the suitability of a particular crop variety developed by research scientists in ordinary farm conditions under the guidance of expert scientists. Demonstrations of scientific technology covering scientific water management and land development practices, introduction of suitable crops and varieties, proper dose and methods of application of fertilisers, irrigation practices, etc. on farmers' fields are very important for increasing productivity. The focus is also laid on effective crop planning, efficient water use and promotion of collective action to facilitate easy access to agricultural inputs and marketing with a view to enhance productivity, reduce cost of cultivation, reduce crop losses and increase profitability resulting in additional income.

The activities with regard to adaptive trials and crop demonstrations are being planned and executed in the projects through the existing staff within the project establishment or by converging the activity with Department of Agriculture or other agencies including SAUs and Water and Land Management Institute (WALMI). One of the major concerns with regard to adaptive trials and frontline demonstration is related to inadequacy of subject matter specialists within the project establishments and also with the supporting agencies including the line departments, WALMI and SAUs. Inadequate funds to carry out a holistic approach with regard to the activity are another factor that marginalises the intervention in most of the cases. Since the projects are coordinated by engineering professionals, they may probably need to be oriented more on importance of the concept of action research/adaptive trials and replication of the learning on larger scale in the command areas. A formal association directly with agricultural research centres and other agencies needs to be established for further innovation and replication of the same in the command areas.

Planning and Monitoring

The success of a programme has direct correlation with the active participation of all the stakeholders. WUAs are the primary stakeholders in the programme and hence, their active participation is very crucial with regard to micro-level planning, execution, monitoring and impact assessment. The planning process involved in the project emphasises on consultation with the beneficiary farmers with regard to construction of field channel. However, the planning process is largely carried out by the department itself leaving a small role for the farmer's participation. With regard to participatory monitoring, the integrated approach follows sequential steps including setting the baseline, setting the criteria and indicators, developing tools for

information collection, building capacities of staff and WUA members involved in monitoring, information communication, frequency of information communication, information compilation & analysis, use of results from information analysis by different stakeholders.

The routine monitoring system does exist in all the projects covered under the study but the same is inadequate in terms of participatory monitoring and evaluation framework that encourages involvement of WUA members and other stakeholders. The technological aids such as Management Information System (MIS) and Geographical Information System (GIS) are yet to be initiated in the projects for effective and efficient monitoring and decision making. The concept of setting the baseline and concurrent monitoring have not taken shape in CADWM in most of the states.

Staff Capacities and Motivation Level

Any expectation of having desired impacts of the CADWM programme is crucially dependent on the project staff involvement and performance and these require healthy capacity quotient and incessant high motivation levels. High motivation level of the staff plays an important role in community based project which is many a times taken as a non-rewarding function directly or indirectly. It is generally seen that the project staffs in many states are primarily committed to engineering works in accordance with their background and experience. The motivation level of the project staff with regard to CADWM work across many states is fair and the programmes are running smoothly. The text below captures the ground situations/initiatives taken up for enhancing and maintaining staff capacities and motivation levels in different states.

While in many projects covered under the study, the motivation levels of staffs are reasonably satisfactory and steps are being taken to build the capacities of the staff; some states like Kerala, Haryana, J&K, Rajasthan and Andhra Pradesh need to work more seriously on this important area. Follow up to the trainings imparted and a mechanism in place to evaluate the effectiveness of the training would help the project and their teams perform better. Inter-state trainings and the potential and role of Non Government Organisations (NGOs) for imparting such capacity building measures to WUAs and farmers associations can be explored. One aspiration of CADWM programme in states is to make it more participatory and community managed; therefore, regular and methodologically thought through investments in the staff capacities and motivational levels would be the key to realise it.

Private Sector Participation

The increased area under irrigation in the command areas leads to intensification and diversification of different crops. The production and productivity of different

crops is also supposed to be increased. There are a number of private sector agencies which require raw material from agricultural producers. On the other hand, the farmers have inadequate access to information, knowledge and skills to enhance production, processing and marketing. Also, the farmers have limited access to quality inputs including seeds, fertilisers, pesticides, equipments, crop insurance and credit facilities. In this scenario, there is a role for the private sector agencies to work with farmers and the WUAs to establish business relationship in areas of mutual interest.

For instance, the economy of Goa is primarily dependent on tourism. In command areas, some large farmers have developed their orchards and ornamental centres where they are planning to attract tourists to provide an exposure to nature and that has been possible due to the irrigation facilities developed in the area. One of such entrepreneurs shared that he would like to contribute to the local community as he is getting increased access to water.

However, the concept of private sector participation has not been initiated formally in any of the studied projects across the country. According to the State officials, poor road connectivity and lack of marketing facilities are the major hindrances for private sector participation.

b) Channel Density

The field channels under CADWM programme are expected to provide irrigation water to each of the plots in the command area. The states covered under the study have followed different types of designs of field channels depending upon the local requirement in terms of technology, material and availability of financial resources.

Andhra Pradesh follows construction of unlined channel with a cross section for conveying discharge up to 4 cusec whereas the lined channels are mainly constructed in *Karnataka* with RCC/CC material for a discharge capacity of 2 cusec. *Kerala* and *Tamil Nadu* follow lined and unlined channel both depending upon the technical and financial factors.

The major focus in *Jammu & Kashmir* has been given on construction of lined channel. In case of *Rajasthan*, the construction of channels is of stone masonry and brick masonry. The concept of circular cement concrete pipes is followed in *Himachal Pradesh*. The cement concrete field channels are constructed in *Uttarakhand*. In *Uttar Pradesh* and *Madhya Pradesh*, the rectangular 9-inch brick and cement concrete design is followed for construction of lined channels.

In *Chhattisgarh*, unlined channels with 2 cusec discharge capacity are constructed and in *Odisha*, lined channels with discharge capacity of 1 to 1.5 cusec are constructed with bricks. In *Jharkhand*, unlined channels are constructed with

2-3 cusec discharge capacity but they plan to move towards lined channel with 1 to 1.5 cusec discharge capacity. In *Bihar*, brick field channels are constructed with discharge capacity of 2 to 2.3 cusec.

In the *north-east zone*, lined and unlined channels have the same discharge capacity of 1 cusec. Due to undulated topography, the construction cost of the channels is very high; hence, they adapt only 1 cusec discharge capacity design. In case of *Arunachal Pradesh*, the lined field channels are constructed following standard rectangular cross section with cement concrete for a discharge rate varying from 2 to 4 cusec.

Due to undulated topography and high seepage losses, *Goa* adopts construction of lined channels which consist of semi circular pipes laid on pillars at different gradient to maintain the gravity flow. *Gujarat* also follows construction of lined field channels with rectangular section parallel to the minor/sub-minor in most of the cases. In case of *Maharashtra*, the focus is laid on construction of unlined field channel.

The data collected from different projects with regard to existing lined and unlined channel density has been analysed removing outliers to reach the national average figure for channel density. The approach was repeated for selected outlets with discharge capacity ranging from 0.75 to 1.25 cusec to estimate the national average figure for channel density for both lined and unlined field channels. The approach was also followed for verified outlets covered under intensive study of the projects for estimation of existing lined and unlined channel density, and to estimate the required channel density and percentage of lining of the same. The approach involved consultation with Government officials and farmers, study of chak maps from the field and other relevant study material.

The channel density in Srisailam project in *Andhra Pradesh* ranges from 55m/ha to 104m/ha whereas the same is 98m/ha in case of Sri Ram Sagar Project Stage I. Most of the projects in *Karnataka* are constructing lined channels with a figure of 90m/ha. In case of *Tamil Nadu*, the density of lined channels varies from 13m/ha to 20m/ha in different projects whereas the same ranges between 53m/ha to 63m/ha in case of unlined channels. The overall channel density followed by different projects in *Kerala* varies from 14m/ha to 29m/ha.

The density for the lined channels in most of the projects in *Jammu & Kashmir* ranges from 18m/ha to 28m/ha. The average norm followed for unlined channels across the projects in Jammu & Kashmir ranges between 8m/ha to 10m/ha except Ranbir Canal and Ferozpur Tangmarg projects where the same is 36m/ha. The channel density followed for lined channel in Bhakra canal project in *Haryana* is 40m/ha whereas the same is 18m/ha in Western Yamuna project. The overall channel density in both the projects is in the range of 35-40m/ha. In case of projects

in *Punjab*, average density for lined channels varies from 16m/ha to 23m/ha and for unlined channels 16m/ha to 33m/ha. However, the overall average channel density varies from 32m/ha to 50m/ha in the projects in Punjab. Chambal Command and Bisalpur projects in *Rajasthan* have constructed lined channels at the rate of 15m/ha and 28m/ha respectively. Jatowala and Nathuwala projects in *Uttarakhand* have constructed the lined channels at a rate of 50m/ha and 45m/ha respectively. In case of *Himachal Pradesh*, the density of lined channels in cluster of 36 MI Schemes and Cluster of 12 MI Schemes is 60m/ha and 62m/ha respectively whereas the same is 36m/ha for the unlined channels leading to overall channel density of 100m/ha. The channel density for lined channel in Harsi Project in *Madhya Pradesh* is 25m/ha whereas the same is 31m/ha in Kolar Project. The overall channel density for the projects is in the range of 50m/ha to 51m/ha. The average channel density for Sharda Sahayak Phase-2 Project in *Uttar Pradesh* is 70m/ha with the lined channel density being 30m/ha and unlined channel density being 40m/ha.

West Bengal follows overall channel density from 37m/ha in DVC canal to 74m/ha in Teesta Barrage. The density of lined channels in DVC Canal and Kangsabati projects in West Bengal is around 15-16m/ha whereas the same is 54m/ha in Teesta project. The density of unlined channels varies from 20m/ha to 31m/ha across the projects in West Bengal. The projects in *Chhattisgarh* follow more or less standard norm of 8m/ha for lined and 32m/ha for unlined channels with overall average of 40m/ha. The average channel density followed by the projects in *Odisha* varies from 9m/ha to 14m/ha for the lined channels whereas the same is 25m/ha to 29m/ha for unlined channels in most of the cases except Potteru project. The total channel density in the state varies from 34m/ha to 69m/ha. In case of *Jharkhand*, only unlined channels have been constructed with an average figure of 27m/ha. The average channel density in Gandak project in *Bihar* is 70m/ha with the channel density for lined channel and unlined channel being 25m/ha and 45m/ha respectively.

An average density of lined channels in *Nagaland* is 12m/ha whereas the same is 27m/ha in case of unlined channel. The density of lined channels ranges between 8m/ha and 11m/ha in *Assam*. The unlined channel density ranges between 22m/ha to 30m/ha in Kaldiya and Dekadong projects whereas the same is 53m/ha in Bardikarai project. The density of lined channels in *Manipur*, *Arunachal Pradesh* and *Meghalaya* varies from 8m/ha to 14m/ha except *Mizoram* where the same is 47m/ha. The density of unlined channels in these states ranges between 27m/ha to 35m/ha. The overall channel density in most of the projects in North-Eastern states varies from 32m/ha to 47m/ha except Bardikarai project in *Assam* and Cluster of 4 MI Schemes in *Tripura*.

The lined channels have an average density of 44m/ha in *Goa* and 64m/ha in *Gujarat*. In case of *Maharashtra*, the average channel density for the lined channels

varies from 8m/ha to 10m/ha and for unlined channels, it varies 40m/ha to 83m/ha. The overall channel density in Maharashtra ranges between 50m/ha to 83m/ha.

The state wise data represents a national average of 49m/ha with approximately 26m/ha for lined channels and 31m/ha for unlined channels. Karnataka, Haryana, Rajasthan, Uttarakhand, Madhya Pradesh, Himachal Pradesh, West Bengal, Goa, Gujarat and Mizoram have constructed the lined channels with density above the national average of 26m/ha whereas the other states are following the norm below national average. In case of unlined channel density, Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Chhattisgarh, Odisha, Jharkhand, Nagaland, Assam, Arunachal Pradesh, Manipur, Meghalaya and Maharashtra construct channels with density above the national average. States like Kerala and Tripura have constructed the field channels with density below the national average.

The estimation of total length was made on the basis of study of chak maps and chak plans, direct observation in the field and interaction with farmers and the project officials for the verified outlets. Consolidation of land has been taken into account as per the requirement. The lining of field channel is decided on the basis of various factors including percent of conveyance losses due to seepage, percent of conveyance losses affected due to rodents and burrowing animals, velocity of flow, presence of vulnerable portions, availability of irrigation water at the tail end, channel length in drought prone areas etc. As per the analysis of verified outlets covered under the intensive study, an average channel density of 80m/ha is required to cover each of the fields in the command area with plain to moderate slope and in case of high slope areas, the channel density is recommended at a rate of 65m/ha. About 40% of the total channel length is required to be lined to reduce losses, speed up flow velocity with a view to cover each of the fields in the command area of the outlets.

c) Expenditure Pattern

Srisailam Right Bank Canal project in *Andhra Pradesh* currently spends nearly ₹ 13,000/ha for construction of unlined channels whereas SRSP Stage I project spends over ₹ 52370/ha, ₹ 10000/ha and ₹ 40876/ha for carrying out lined and unlined field channels and other OFD works respectively. Both the projects in Andhra Pradesh spend an amount ranging from ₹ 2000/ha to ₹ 2300/ha for carrying out planning and designing aspects. All the projects in *Karnataka* incur expenditure at a uniform rate of ₹ 30,000/ha for construction of lined channels, ₹ 5000/ha for construction of field, intermediate and link drains, ₹70000/ha for reclamation of waterlogged areas and ₹ 8000/ha for correction of system deficiencies. The projects in *Tamil Nadu* spend an amount varying from ₹ 25000/ha to ₹ 75,000/ha for carrying out overall OFD works including an amount ranging from ₹ 9500/ha to ₹ 30,000/ha for construction of unlined and ₹ 15,000/ha to ₹ 30,000/ha for lined channels.

Expenditure of nearly ₹ 15,000/ha is incurred for construction of the intermediate and link drains and around ₹ 1700/ha for survey, planning and design. The state also spends an amount varying from ₹ 15,000/ha to ₹ 20,000/ha for correction of system deficiencies and an amount ranging between ₹ 75,000 to ₹ 1,50,000 for training, monitoring and evaluation activities. The projects in *Kerala* incur expenditure varying from ₹ 36,000/ha to ₹ 56,000/ha for overall OFD works including an approximate amount of ₹ 25,000/ha for lined and ₹ 12,000/ha to ₹ 16,000/ha for unlined channels. The rates for other components in the projects of Kerala include ₹ 5000/ha for intermediate and link drains, ₹ 2000/ha - ₹ 4000/ha for survey, planning & design, ₹ 37,500/ha- ₹74,000/ha for reclamation of water logged areas, ₹ 20,000/ha - ₹ 30,000/ha for correction of system deficiencies, nearly ₹ 14,000/ha for adaptive trials.

The projects in *Jammu & Kashmir* incur expenditure varying from ₹ 7000/ha to ₹ 95000/ha for carrying out overall OFD work with no expenditure being incurred for unlined channel while the same for lined channel ranging from ₹ 20000/ha to ₹ 50000/ha. A uniform rate of ₹ 5000/ha is spent for construction of field, intermediate and link drains in all the projects. The amount spent for survey, planning and design is in the range of ₹ 1000/ha to ₹ 2500/ha while the same for reclamation of water logged areas is in the range of ₹ 5000 to ₹ 15000/ha. The rates for other components in the project include ₹ 15000/ha for renovation and de-silting of tanks; ₹ 2000/ha to ₹ 15000/ha for adaptive trials and demonstrations, ₹ 10000 to ₹ 100000 per training and ₹ 4000/ha for one time grant to WUAs. Expenditure in the range of ₹ 25000/ha to ₹ 30000/ha has been incurred for construction of lined channel in the projects in *Haryana*; ₹ 15000/ha for construction of field, intermediate and link drains, and ₹ 1500/ha to ₹ 3000/ha has been incurred for survey, planning and design. For correction of system deficiencies, ₹ 10000/ha has been spent in the Bhakra Canal Project. The rates for other components in the projects are in the range of ₹ 10000/ha to ₹ 60000/ha for adaptive trials and demonstrations; ₹ 11500 to ₹ 100000 per training and ₹ 2500/ha as one-time grant to WUAs. Upper Bari Doab Canal Command in *Punjab* incurs expenditure to the extent of ₹ 40000/ha for overall OFD works. ₹ 5400/ha for construction of field, intermediate and link drains; ₹ 1400/ha for survey, planning and design and ₹ 1800 for training, monitoring and evaluation activities has been spent in the same project. Chambal Command project in *Rajasthan* has spent ₹ 60000/ha for overall OFD works including ₹ 25000/ha for construction of lined field channels. Expenditure to the tune of ₹ 8000/ha for construction of field, intermediate and link drains; ₹ 2000/ha for survey, planning and design activity and ₹ 60000/ha for reclamation of waterlogged areas has also been incurred. Similarly, the incurred expenditure for other components include ₹ 30000/ha for adaptive trials and demonstrations; ₹ 100000 for training and ₹ 2500/ha as one-time grant to WUAs.

The projects in *West Bengal* incur expenditure in the range of ₹ 25000/ha to ₹ 35000/ha for construction of lined field channels. Expenditure in the range of ₹ 1500/ha to ₹ 3000/ha has been incurred for undertaking survey, planning and design activity. Similarly, ₹ 25000 to ₹ 3 lakh has been incurred for training, monitoring and evaluation whereas the same is ₹ 2000/ha as one-time grant to WUAs. About ₹ 23576/ha has been spent by Hasdeo Phase 2 project in *Chhattisgarh* for construction of unlined field channel and the same for survey, planning and design is ₹ 1200/ha. Mahanadi, Tandula, Jonk and Kodar project in the State spend about ₹ 1000/person (Out of the state) for training and ₹ 2000/ha as one-time grant to WUAs. The projects in *Odisha* incur expenditure in the range of ₹ 70000/ha to ₹ 100000/ha for overall OFD works including ₹ 30000/ha to ₹ 50000/ha for construction of lined field channel. For construction of field drains and for survey, planning & design activity; expenditure in the range of ₹ 15000/ha to ₹ 20000/ha and ₹ 1500/ha to ₹ 10000/ha is incurred respectively. ₹ 5000/ha to ₹ 10000/ha is spent for adaptive trials while the same ranges from ₹ 1.5lakhs to ₹ 12 lakhs for training, monitoring and evaluation activities and about ₹ 2000/ha as one-time grant to WUAs. As the projects in *Jharkhand* are at the stage of survey, planning and design; hence, as of now, ₹ 887/ha is spent for the same activity. Expenditure in the range of ₹ 13000/ha to ₹ 57000/ha has been incurred for overall OFD works in the projects in *Bihar*. ₹ 4000/ha to ₹ 9000/ha has been spent for construction of field, intermediate and link drains and the same for reclamation of waterlogged areas is in the range of ₹ 15000/ha to ₹ 60000/ha. Correction of system deficiencies has been estimated at ₹ 6000/ha to ₹ 10000/ha; and ₹ 2000/ha to ₹ 20000/ha has been spent for adaptive trials and demonstrations. The existing expenditure for training, monitoring and evaluation activity has been in the range of ₹ 12000 to ₹ 100000 per training.

The projects in *Assam* incur expenditure in the range of ₹ 22000/ha to ₹ 50000/ha for overall OFD works and ₹ 5000/ha to ₹ 10000/ha for construction of field, intermediate and link drains. ₹ 500/ha to ₹ 2000/ha has been spent for survey, planning and design; and expenditure in the uniform range of ₹ 60000/ha has been spent for reclamation of waterlogged areas. Similarly, an expenditure of ₹ 100000/ha and ₹ 25000/ha has been spent for correction of system deficiencies and renovation & de-silting of tanks respectively. For adaptive trials & demonstrations; and training, monitoring & evaluation activities, expenditure to the extent of 75% of the actual expenditure as Central share has been incurred. About ₹ 63000/ha has been spent for construction of lined field channel in all the projects in *Manipur*. A uniform expenditure of ₹ 9500/ha for construction of field, intermediate and link drains; and ₹ 1900/ha for survey, planning & design activity has been incurred. Expenses in the range of ₹ 16000/ha to ₹ 63000/ha have been incurred for adaptive trials and demonstrations. Similarly, expenditure in the range of ₹ 550/ha to ₹ 9500/ha for training and ₹ 1900/ha as one-time grant to WUAs has

been incurred by the projects. Medziphema Bowl project in *Nagaland* has spent ₹ 100000/ha for overall OFD works including ₹ 50000/ha for construction of lined field channel. ₹ 2500/ha for survey, planning & design and ₹ 8000/ha for correction of system deficiencies has also been spent. The expenses for other components include ₹ 15000/ha for adaptive trials, ₹ 100000 for training & evaluation activities; and ₹ 5000/ha as one-time grant to WUAs.

Tillari Irrigation project in *Goa* has incurred expenditure of about ₹ 95600/ha for construction of lined field channel: ₹ 2500/ha for survey, planning & design activity; ₹ 50000/ha for adaptive trials & demonstrations and ₹ 4000/ha as one-time grant to WUAs. Sardar Sarovar Project Phase-1 in *Gujarat* has spent an amount of ₹ 36000/ha for overall OFD works which includes ₹ 14000/ha for construction of lined field channel and ₹ 1200/ha for construction of unlined field channel. The expenditure incurred for other components include ₹ 7300/ha for construction of field drains and ₹ 25000/ha for training, monitoring & evaluation activities. The projects in *Maharashtra* have incurred expenditure in the range of ₹ 16000/ha to ₹ 57000/ha for overall OFD works. Expenditure in the range of ₹ 3000/ha to ₹ 5400/ha for construction of field, intermediate & link drains; ₹ 700/ha to ₹ 1400/ha for survey, planning & design activity; and ₹ 600/ha to ₹ 2000/ha has been incurred for training, monitoring & evaluation activities.

ToR-2: Make a critical appraisal of the Participatory Irrigation Management programme as implemented in the states and the functioning of WUAs. Evaluate the strength and weakness of the WUAs including their financial sustainability and ascertain whether the WUAs have been able to achieve their objectives of ensuring equitable distribution of water and proper maintenance of assets.

Participatory Irrigation Management Act

Fifteen State governments, namely Andhra Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Sikkim, Tamil Nadu and Uttar Pradesh have enacted exclusive legislation for involvement of farmers in irrigation management. The legal framework created out of these acts resulted in creation of farmers' organisations at three different levels of irrigation system i.e. Water Users Association (WUA), Distributary Committee (DC) and Project Committee (PC). The major issues with regard to PIM include;

- The PIM act has been enacted only in 15 states whereas its importance is recognised at ground level across the country.
- The states where the PIM Act is in existence have yet to execute it in its true spirit with effective participation of WUAs at all three levels.

Sustainability of Water Users Associations

The sustainability of WUAs depends upon various factors including equity in water distribution to its members, effective operation and maintenance system, transparency in participatory management system, active participation of WUA members, adequate capacities of WUA office bearers and its members, ensured mechanisms for generating financial resources like water charges, collective approach to access the agricultural inputs and marketing of crops etc. The analysis of these aspects below is on the basis of a sample study of WUAs randomly selected at head, middle and tail end.

The projects across the states seem to be primarily responsible for construction and management of CADWM work marginalising focus on strengthening of WUAs. WUAs have been formed in many states but the same have yet to reach the required level to become self-reliant and sustainable. Creating sustainable and self-reliant WUA is one of the major goals to be achieved in CADWM programme. WUAs need to have clear institutional vision and mission, clear understanding on their roles and responsibilities, adequate capacities to perform their roles effectively, transparent and participatory systems and procedures, follow the concept of equity and/or equality, establish linkages with outside agencies including the government, non-government and private agencies, have access to negotiate with departments and other agencies, develop regular source of income, have capacity to deal with internal conflicts, have visionary and dynamic leadership, etc.

ToR-3: Make a thorough assessment of the CADWM work that remains to be done in all states with reference to the data available in respect of the medium and major projects of each state and quantify the funds required for completion of the work under the present cost norms.

Taking the CCA covered till 31st December 2011 for the projects in all the States, it has been found that the total area of balance CCA on which work has to be completed is 8181530 ha. The total estimated cost of the balance work as per the existing norms comes to around ₹ 1771212 lakhs whereas the total estimated cost as per the proposed rates comes to around ₹ 3621005 lakhs.

ToR-4: Study the need for extension, renovation and modernisation of the old CAD projects undertaken in the states and assess the investment required for the same.

As per the findings of the field study of the completed projects, around 40% of the channels constructed in the command area have lost their relevance due to change in field boundaries after land consolidation. In addition, the increased number of holdings due to fragmentation needs additional channel length to be irrigated. Nearly 60% structures such a culverts, foot crossing, diversion boxes, tail end boxes

have choked due to siltation or damaged by animals and agricultural operations. The field channels were constructed in the completed projects in Uttar Pradesh used 4.5" brick/slabs leading to damage of the same by around 80%. The initiatives to be taken with regard to ERM include extension, renovation & modernization field channels to irrigate each of the plots in the command, renovation of damaged structures such as culverts, foot crossing, diversion boxes, tail-end boxes and design of field channels as in case of on-going projects to renovate the field channels damaged due to inadequate design.

Key Recommendations

There is a need to influence the states to enact the PIM Act where the same is non-existent, to execute the Act in true spirit where it exists and to draw strategies to remove hurdles in its implementation on the ground.

An initiative may be taken to establish CADA or an independent agency to work exclusively on CADWM and to equip the same with required personnel in the field of institution building, agricultural extension and agri-business to take the concept of WUA managed sustainable approach in the command areas.

CADWM requires a holistic, integrated and coordinated approach at all levels across the states for planning, execution and monitoring of the programme interventions. The strategies and approach to be adopted by the states need to be developed for identification and active participation of various stakeholders including the line-departments, independent agencies in private sector and the NGOs. The concept of convergence needs to be adequately addressed at both the state and project levels.

The states need to develop approach and strategies to deal with issues related to empowerment and sustainability of WUAs. The capacity of WUAs at in-situ level is an urgent need of the projects. The states need to involve external agencies with regard to capacity building of the farmers' institutions in the framework of participatory irrigation management.

Micro Irrigation activity may be given more thrust by offering subsidy to Sprinkler and Drip Irrigation at par with Centrally Sponsored Scheme of Micro Irrigation by including Micro Irrigation component and Minor Irrigation (MI) tank in the CADWM.

The devices related to water distribution and water management need to be initiated. The concept of maintenance systems needs to be introduced in the project along with the collection of water charges. It is suggested that the states should rehabilitate the WUAs adequately before handing over the charge of micro canal system in terms of clarity of roles and responsibilities; clarity on systems for repair and maintenance; clarity on systems for water distribution and measurement; clarity

on collection of water charges; clarity on maintaining records and books of account; required capacities to perform their roles and responsibilities; etc.

Strengthening financial resources of WUCSs is essential to make them viable. It is required to emphasise on building awareness among the beneficiary communities and motivate them to contribute at a rate of 10% in the form of cash or kind. The concept of contribution is not merely a mechanical term but it is related to creating a sense of ownership of the beneficiaries on the assets created in the command area. The WUAs need to be strengthened adequately to motivate the farmers to contribute accordingly.

The states need to promote and establish collective action in the command area for increased crop production, productivity and income. The approach may focus on strengthening the WUAs for collective action with a view to reduce the cost of cultivation by establishing linkages with agricultural input suppliers, increasing production through training and extension of improved/advanced technologies, reducing losses during harvesting/threshing, storage and transportation, increasing income through improved infrastructure and developing linkages with commission agents and other market players.

It is, therefore, suggested that the projects should take up an integrated approach from setting the baseline to conducting the impact assessment in the project. All the primary stakeholders need to be involved from the planning phase itself to enhance their participation at the monitoring level.

The states need to give due emphasis on the issue of staff development with a focus on strengthening the WUAs through identification of their motivational and training needs, identification of resource persons/institutions, organising capacity building programmes and developing rewarding mechanism to address to their training and motivational needs.

It is recommended that an average channel density is ensured at a rate of 80m/ha in the command areas with plain to moderate slope upto 5%. In case of medium slope (5-10%) areas, the channel density is recommended at a rate of 65m/ha. The field density in the areas with high slope above 10% the channel density is recommended at a rate of 110 m/ha. The field channels up to the first 40% length along with turning points and vulnerable reaches (expecting more seepage losses) should be lined to reduce losses through conveyance.

Taking 2012 as a base year, the cost norms for CADWM components may be increased to ₹ 2000/ha for survey/planning & design, ₹ 948/Rmt for stone masonry lined channel, ₹ 932/Rmt for brick masonry lined channel, ₹ 783/Rmt for cement concrete lined channel, ₹ 102/Rmt for unlined channel, ₹ 200/Rmt for construction of field, intermediate and link drains, ₹ 29128/ha for surface drainage and ₹

70926/ha for sub-surface drainage under reclamation of water logged areas, ₹ 8366/ha for correction for system deficiencies.

3% of the project cost may be allocated for software activities including institution and capacity building of WUAs and front line staff, Monitoring and Evaluation and adaptive trials and front line demonstration. ₹ 2500/ha as a one-time functional grant be provided to WUAs to ensure repair and maintenance and financial sustainability of WUAs. A yearly increase may be considered according to the changing price index during the XII Five Year Plan. Cost norms for the difficult areas and the areas under special category may be increased in proportion to the existing cost norms laid down in the guidelines.

CHAPTER-1: INTRODUCTION

1.1 Background

India continues to struggle with growing financial crunch to complete its water sector infrastructure and its operation and maintenance cost. On the other hand, inadequate institutional reforms and ineffective implementation has affected its performance level. The Government of India has initiated several steps to improve investment and management of water sector, which include: Accelerated Irrigation Benefits Programme, Hydrology project, setting up of Water Quality Assessment Authority, Command Area Development Programme, and National Project for Repair, Renovation and Restoration of water bodies directly linked to Agriculture, Flood Management and River Basin Organisations. After an investment of ₹ 2290.09 crores under the X and XI Five Year Plans for command area development, the Ministry of Water Resources thought it prudent to conduct an evaluation and impact assessment on the Command Area Development and Water management (CADWM) programme.

Agricultural Finance Corporation Limited was awarded the study for evaluation and impact assessment of CADWM programme in 28 states of the country.

1.2 Objectives of the Programme

The Command Area Programme was initiated in 1974-75 for stepping up the pace of utilisation of irrigation potential created and to improve agricultural productivity and production on a sustainable basis. The programme was restructured and renamed as CAWDM from 1/04/2004 and is presently being implemented under the XI Five Year Plan. The Government of India has released ₹ 4722.4955 crores to the state governments. The expenditure statement indicates that an amount of ₹ 1471.53 crores has already been spent during 2007-2008 to 2010-2011.

1.3 Programme Components

The important components of the CADWM programme during XI plan are as under:

i) Survey, planning and designing of OFD works
ii) On farm development (OFD) works comprising of field channels, realignment of field boundaries, land levelling and shaping, where ever necessary
iii) Construction of field drains, intermediate and link drains
iv) Correction of system deficiencies in systems of capacity of 150 cusec
v) Reclamation of water logged areas
vi) Training and capacity building, adaptive trials and demonstrations, monitoring and evaluation

vii) One time functional grant for Water Users Association (WUAs)
viii) Establishment grant for items having capital expenditure

1.4 Objectives and Scope of Evaluation and Impact Study

The terms of reference for the study are as follows:

1) Identify the inadequacies of the programme and give recommendations on the following:
    a) *Length of channel required per hectare of field (channel density) to cover each and every field*
    b) *Suggest change of cost norms of the OFD works and other components of CADWM programme in keeping with the rise in cost of material/labour*

2) Make a critical appraisal of the Participatory Irrigation Management programme as implemented in the states and the functioning of WUAs. Evaluate the strength and weakness of the WUAs including their financial sustainability and ascertain whether the WUAs have been able to achieve their objectives of ensuring equitable distribution of water and proper maintenance of assets.

3) Make a thorough assessment of the CADWM work that remains to be done in all states with reference to the data available in respect of the medium and major projects of each state and quantify the funds required for completion of the work under the present cost norms.

4) Study the need for extension, renovation and modernisation of the old CAD projects undertaken in the states and assess the investment required for the same.

CHAPTER-2: APPROACH AND METHODOLOGY

2.1 Approach

A participatory approach was followed at all levels to capture in-depth information. The evaluation and impact study of CADWM programme consisted of various activities viz. study and review of project documents and literature available at different levels, study framework analysis, stakeholders' analysis, developing research tools, interaction with cross section of respondents, direct observation and field visits, information analysis, drawing conclusions and recommendations, etc.

India is a vast country with varied agro-climatic zones. Keeping the varied agro-climatic conditions in mind, the country was divided into various zones for information collection and analysis such as North, South, East, West, Central and North East. This ensured that major agro-climatic zones such as temperate, sub-tropical, tropical and arid as well as various geographical regions such as hills, plains, plateau, desert and coastal regions are covered.

2.2 Study Team Formation and Orientation

- A team consisting of professionals and research associates specialised in irrigation engineering, participatory irrigation management (PIM), agronomy, agricultural extension, social sciences, etc. was identified for conducting evaluation and impact study of CADWM programme.

- The study team was oriented with the background and objectives of the study, approach and methodology, study tools, etc. to carry out the field work as per plan. The team leaders were provided with all relevant documents, reports, formats, letters etc. to equip them with required information and materials for field work. A checklist was also shared with them to cover various aspects and collect information from different sources.

2.3 Desk Review

- The study team carried out a desk review of the project documents including the CADWM guidelines, project plan/detailed project reports, design and cost estimates, progress reports, internal monitoring reports, documented processes and field studies, PIM Acts as available, micro level plans, capacity building initiatives, operational guidelines, management systems and tools developed in the project, etc. to understand planned and implemented approach and strategies to achieve the project goals. In addition, the team also had an access to secondary information which was found useful for carrying out the evaluation and impact study.

- The desk review emphasised on developing understanding on various interventions adopted in the project such as stakeholders and their involvement in the project, project targets and physical and financial achievements, in-action and practice of PIM Acts in different states, policy concerns, channel density planned and achieved, existing monitoring systems, capacity building initiatives of staff and WUAs, etc.

2.4 Designing Study Tools and Techniques

- After completion of the desk review, the evaluation and impact study tools including the questionnaires/checklist were developed by the study team for information collection from all stakeholders at different levels; viz. beneficiaries, WUAs, non-beneficiaries, project staff, CADWM officials at state and central levels, agriculture/horticulture department, etc.
- The study tools were shared with CADWM officials in Delhi office for their review and comments and their suggestions were incorporated to finalise the same.
- Following research tools were used for information collection in the field from different sets of respondents.

    - ✓ Formal questionnaire
    - ✓ Semi-structured interviews with open ended questions
    - ✓ Structured interviews
    - ✓ Focus group discussion
    - ✓ Direct observation

2.5 Study Sample

As per the details given in the following table, the study was conducting in 28 states covering 151 on-going projects. An intensive study was carried out in one of the projects from each of the states as mentioned in the following table.

It was observed in some of the states such as Tripura, Sikkim, Uttarakhand, J&K, Tamil Nadu, Kerala, Maharashtra, Himachal Pradesh, etc. that some of the projects included in the list of on-going projects were either completed or deleted and hence, the states responded about these projects accordingly. In fact, the state department counted these projects as completed/deleted but the same have not been completed through mechanism laid down by the Ministry of Water Resources (MoWR) and hence, these projects still fall in the category of on-going projects.

Table 2.1: Study Sample of On-going Projects

S.No.	States	On-going Projects	Completed Projects	Total no. of projects	Projects Covered for Intensive Study
		1	2	(1+2)	
1	Andhra Pradesh	2	7	9	Sriramsagar Right Bank Canal
2	Karnataka	12	-	12	Upper Krishna Project
3	Tamil Nadu	8	-	8	Gundar Chittar Karruppandi
4	Kerala	4	-	4	Kanhirapuzha Project
5	Jammu & Kashmir	18	-	18	Ranbir Canal Project
6	Punjab	3	-	3	Sirhind Feeder Part 2 Command Project
7	Haryana	3	-	3	Western Yamuna Canal Phase -6
8	Himachal Pradesh	7	-	7	Clusters of 38 MI Schemes In Pandonga Haroli, Saloh Area in Tehsil Una of District Una
9	Uttarakhand	4	-	4	Jatowala and Prateetpur Canal Project
10	Uttar Pradesh	15	3	18	Sharda Sahayak Canal System Phase – 2 Project
11	Madhya Pradesh	9	-	9	Harsi Project
12	Rajasthan	5	1	6	Chambal Project
13	West Bengal	4	-	4	Damodar Valley Canal System
14	Odisha	13	-	13	Hirakud Project
15	Jharkhand	2	-	2	Kanchi Weir Scheme
16	Bihar	6	-	6	Gandak Project
17	Chhattisgarh	4	-	4	Hasdeo Phase 2
18	Assam	4	-	4	Dakadong Project
19	Nagaland	1	-	1	Medziphema Bowl project
20	Manipur	5	-	5	Thoubal Irrigation Project Ph-2
21	Mizoram	2	-	2	Cluster of 40 MI Projects consisting of 36 (29 Flow and 7 Lift Schemes) in Aizwal Districts and 4 MI Flow Schemes in Lunglai Districts
22	Arunachal Pradesh	3	-	3	Clusters of 62 MI in 4 Panchayats in districts of Papumpare, Namley, Sagalee, Megio, Balijan and Itanagar
23	Sikkim	2	-	2	Cluster of 21 MI Schemes of South & West Districts of Sikkim

S.No.	States	On-going Projects	Completed Projects	Total no. of projects	Projects Covered for Intensive Study
		1	2	(1+2)	
24	Tripura	1	-	1	Cluster of 4 MI Projects
25	Meghalaya	2	-	2	Clusters of 6 MI Schemes-Kynrut, Phudumjer, Nongtraw, Khurakol, Nekora, Madan Umtheid
26	Goa	1	-	1	Tillari Irrigation project
27	Gujarat	1	-	1	Sardar Sarovar Phase – 1
28	Maharashtra	10	4	14	Kukadi Project
	Total	**151**	**15**	**166**	**28**

(Source: CADWM, MoWR, New Delhi)

The study sample also covered 15 completed projects in 4 states with regard to need assessment on extension, renovation and modernisation.

Table 2.2: Study Sample of Completed Projects

S.No.	States	No. of Completed Projects	List of Projects
1	Andhra Pradesh	7	• Rajoli Banda Division • Tungbhadra Complex Project • KC Canal project • Gajuladinne project • Vamsadhara Stage I project • Peddavagu Project • Gandipalem Project
2	Maharashtra	4	• Itiadoh Project • Ghod Project • Bagh project • Girna Project
3	Uttar Pradesh	3	• Sharda Sahayak Project • Gandak Project • Jamranidam Canal project
4	Rajasthan	1	• Bhakra Ganga Canal project
	Total	**15**	

(Source: CADWM, MoWR, New Delhi)

2.6 Information Collection

- The project to be studied intensively was decided jointly by the Ministry of Water Resources and the state officials dealing with CADWM programme. AFC established a dialogue with the state and project officials with regard to visit plans.

- The state wise projects formats/schedules were mailed to Principal Secretary, Water Resources and Chief Engineer (CAD) of the respective States so that the State could start preparatory work for filling up the same with required information.

- The study team had introductory meetings with state level officials concerned with CADWM projects. The team also had an intensive interaction with state officials on various aspects including institutional structure for implementing CADWM works, planning and monitoring systems, capacity building initiatives, policy initiatives and concerns, etc.

- The process for data collection was carried out by the study team members in the 151 on-going projects with regard to physical and financial achievement, channel density, cost norms and pending works.

- An in-depth interaction process was adopted with project officials in the intensive study projects (1 in each state) in the visited states covering various aspects related to project plan and achievements, major interventions undertaken in the project, project planning and monitoring systems, capacity building initiatives both for staff and WUAs, water distribution management systems, initiatives taken by the project for strengthening and sustaining WUAs, etc.

- A detailed interaction was carried out with the WUA members and the farmers who have not been associated with WUAs at 6 locations, that is, 2 each at head, middle and tail levels. The interaction covered various aspects including membership pattern, water distribution and management systems, capacities of WUAs, participation of WUAs with regard to operation, maintenance and management of command area system, institutional linkages, financial sustainability, major impacts, etc. The interaction process was followed by direct observation of physical works carried out in the command area.

- The team also visited the 15 completed projects (in 4 states) and collected information with regard to the current status of the projects. Like some projects have been included under other schemes or taken over by externally funded agencies whereas in the others, their respective need for Extension, Renovation and Modernisation has been assessed both in terms of physical and financial requirements.

- The steps involved in estimating the channel density included;
    - ✓ Studying the command area map to understand the culturable

command area planned to be covered under irrigation and the area actually being irrigated

- ✓ Interaction with the project staff on adequacy of the field channel
- ✓ Interaction with farmers including the WUA members and non-WUA members on additional channel length required to deliver water to each of the plots under command area
- ✓ Direct observation of physical works carried out in the command area to triangulate the understanding of the project officials and farmers
- ✓ Building consensus on additional channel density required in the command area

- The designs and cost estimates were collected from the project officials for different components undertaken in the project. A detailed interaction process was followed up with the project officials on requirement of design and cost estimates of the project components. The alternate solutions were also shared with them in case of expensive cost norms if they could be considered in future.

2.7 Monitoring and Quality Control

- A project unit was set up in Delhi office to coordinate the project centrally and liaison with CADWM offices on periodic basis. A senior level irrigation engineer specialised in Participatory Irrigation Management (PIM) was deployed to manage the project.

- A back support was provided to the field team by a core team of highly qualified and experienced professionals to ensure quality of data collection, analysis and documentation processes.

- An efficient communication system was established for timely flow of information and tracking the problematic issues and deciding the corrective measures.

2.8 Documentation and Reporting

- The information collected through all sources has been compiled, analysed, documented and submitted to the CADWM office, Ministry of Water Resources, New Delhi in form of the draft report.

- The study team will make a presentation of the draft report to the CADWM office and the suggestions will be incorporated in the final report.

2.9 Deliverables

The following deliverables have been submitted to the CADWM office, MoWR:

- Inception report
- Fortnightly Feedback reports
- Monthly Progress Reports
- Representative Report of Channel Density and Cost Norms
- Interim Report
- Draft Final Report

2.10 Log Frame

Log frame of the Project Linking Methodology with Project Objectives

Terms of Reference	Narrative Description	Key indicators	Means of verification	Implementation Strategy
1) Identify the inadequacies of the programme and give recommendations on the following: *a) Length of channel required per ha of field (channel density) to cover each and every field.* *b) Suggest change of cost norms of the OFD works and other components of CADWM programme in keeping with the rise in cost of material/labour*	1.1 Assess physical achievement	• Planned OFD works and other components of the programme completed • System deficiencies identified and corrected • Water logged areas reclaimed • Area brought under irrigation • Farmers covered under programme • WUAs formed	• Project plan – physical works • Progress reports • Staff meeting • WUA meetings	Will visit **all 151 on-going projects to** collect information on physical achievement. Will interact project officials and WUAs in **28 projects to be visited** (1 in each of 28 states) to assess reasons for non-achievements

Terms of Reference	Narrative Description	Key indicators	Means of verification	Implementation Strategy
	1.2 Assess financial achievement	• Financial targets achieved • Cost sharing by stakeholders	• Project plan-financial • Progress reports • Staff meeting	Will visit **all 151 on-going projects to** collect information on financial achievement. Will interact project officials and WUAs in **28 projects to be visited** (1 in each of 28 states) to assess reasons for non-achievements
	1.3 Identify policy concerns	• Approval and sanction procedures • PIM norms • Design norms • Cost norms • Funds flow mechanism • Financial management aspects • Stakeholders' participation	• MoU • Operational guidelines • PIM acts in the states • Cost norms • Grants records to WUAs • Financial procedures • Design and cost estimates • Interaction with stakeholders	Will study and analyse policy framework and will interact with all stakeholders in **28 projects to be visited** to identify critical operational issues concerning to policy aspects.
	1.4 Assess channel density	• Channel density achieved • Channel density required	• Project plan • Project records • Design & cost estimates • Staff meetings • WUA meetings • Direct observation	Will study and analyse channel density achieved in different **agro-ecological regions** (high slope, medium slope, low slope, plains) from official records and will also interact with staff and WUAs in **28 projects to be visited** to identify critical gaps with regard to inadequacy in channel density

Terms of Reference	Narrative Description	Key indicators	Means of verification	Implementation Strategy
	1.5 Assess cost norms of OFD works and other components of CADWM programme	• Cost norms planned for various activities • Cost norms required for various activities	• Design and cost estimates of various interventions • Operational guidelines • Existing rates human/material resources from primary and secondary resources	Will study and analyse existing cost norms adopted by projects in **different agro-ecological regions** (high, medium and low slopes and plains) from official records and will also interact with stakeholders in 28 **projects to be visited** to collect required information to estimate cost.
	1.6 Assess stakeholders' capacities	• Roles and responsibilities of stakeholders decided • Training needs of stakeholders assessed • Capacity building individuals/institutions identified • Training conducted and exposure visits organized • Training modules and reading material developed	• Capacity building plan • Progress reports • Training modules/ material developed • Interaction with staff • Interaction with training institutions • Interaction with WUA members	Will analyse stakeholders' roles & responsibilities and will assess capacity building initiatives taken from the official records. Will also interact with key stakeholders in **28 projects to be visited** to assess their capacities

Terms of Reference	Narrative Description	Key indicators	Means of verification	Implementation Strategy
	1.7 Assess Monitoring and Evaluation framework	• Baseline established • MIS developed and on-line web based monitoring followed • Remote sensing and GIS techniques adopted • Con-current evaluation by independent agency • Impact studies conducted • WUA participation in monitoring and evaluation	• Progress reports • Baseline reports • Evaluation and impact assessment reports • Process documentation reports/case studies • MIS system adopted for monitoring • Interaction with all stakeholders	Will study and analyse existing monitoring and evaluation system, identify stakeholders' participation in M&E and will identify critical gaps in **28 projects to be visited.**
	1.8 Sustainability and Replicability	• WUAs fulfill collective needs of the members • Linkages established with various agencies/departments • Mechanism developed to ensure sustainable financial resources	• Evaluation study reports • Systems and procedures of WUAs • Interaction with WUAs • Interaction with other stakeholders • Interaction with project staff	Will interact with WUAs and will assess their capacities, institutional linkages and their financial resources to assess sustainability aspects in **28 projects to be visited.**

Terms of Reference	Narrative Description	Key indicators	Means of verification	Implementation Strategy
2) Make a critical appraisal of the Participatory Irrigation Management programme as implemented in the states and the functioning of WUA's. Evaluate the strength and weakness of the WUA's including their financial sustainability and ascertain whether the WUA's have been able to achieve their objectives of ensuring equitable distribution of water and proper maintenance of assets.	1. Make a critical appraisal of the PIM programme and the functioning of WUA's.	• WUAs formed-plan & achievement • Legal status of WUAs and/Bye laws of WUA framed and registered. • WUA-systems and procedures • Norms on social and gender equity • Norms to ensure transparency • Norms to ensure participatory decision making and conflict resolution • Repair and maintenance of assets created • Equitable water distribution mechanism • Capacities of WUAs • Strength and weakness of WUA's • WUAs-Funds generation, management and utilization	• Project documents and records • Project implementation plan • Progress reports • Interaction with project staff • WUA records-constitution, systems & procedures, operational guidelines, accounts records, meeting minutes, registers, income expenditure statements, etc. • Interaction with WUA executive members • Interaction with cross section of beneficiaries • Direct observation to field structures • Water tariff-Payment schedules • Interaction with other stakeholders including the line departments	Will study state PIM Acts and will assess existing PIM practices through interaction with different stakeholders and WUAs to identify critical gaps covering **6 WUAs** (2 each head, middle and tail levels) in each of 28 projects to be visited

Terms of Reference	Narrative Description	Key indicators	Means of verification	Implementation Strategy
3) Make a thorough assessment of the CADWM work that remains to be done in all states with reference to the data available in respect of the medium and major projects of each state and quantify the funds required for completion of the work under the present cost norms.	2. Make a thorough assessment of the CADWM work that remains to be done in all states with reference to the data available in respect of the medium and major projects of each state and quantify the funds required for completion of the work under the present cost norms.	• Pending activities identified as against the plan • Quantum of pending works under each components • Quantum of funds required for completion of pending works	• Project plan – physical works • Progress reports • Design and cost parameters followed for pending activities in the project • Interaction with project staff • Current human and material costs from primary and secondary sources	Will visit and collect information for **all on-going 151 projects** and will interact with respective officials to assess quantum of pending work and cost estimates to complete the works. Will collect details of medium and major projects from the state to assess the quantum of works and fund needed to take up CADWM works in these projects.
4) Study the need for extension, renovation and modernisation of the old CAD projects undertaken in the states and assess the investment required for the same.	3. Study the need for extension, renovation and modernisation of the old CAD projects undertaken in the states and assess the investment required for the same.	• Identify and quantify activities for extension, renovation and modernisation • Estimate cost for extension, renovation and modernization	• Interaction with project staff • Interaction with WUA members/ farmers • Records on design and cost estimation of works • Current human/material rates from primary and secondary sources	Will visit, collect information and interact with respective officials in **all 15 projects completed before 2001** to identify, quantify and estimate cost for extension, renovation and modernisation of the structures

2.11 Structure of the Report

Chapter-1 covers the background information and objectives of the programme. Approach and Methodology followed in the study is covered in Chapter-2. The programme inadequacies are covered in Chapter-3 in the name of programme review and analysis. Channel Density is covered in Chapter-4. The cost norms and the related designs and estimates have been presented in Chapter-5 and Chapter-6 respectively. Participatory Irrigation Management and Sustainability of Water Users Associations have been covered in Chapter-7. The major impacts and case studies have been covered in Chapter-8. Chapter-9 covers the balance work to be completed along with the fund required and Chapter-10 captures extension, renovation and modernisation of completed projects. Chapter-11 talks about the uncovered projects along with the related estimated cost whereas Chapter-12 provides issues related to policy aspects. The Terms of Reference of the study have been reiterated in Chapter-13 and the conclusions and recommendations have been provided in chapter-14.

The additional information has been provided in annexures as follows:

- Annexure Volume 1
  - ✓ Annexure-1: Existing Channel Density for 1 cusec discharge outlets
  - ✓ Annexure-2: Designs and Estimates
  - ✓ Annexure-3: Balance Work and Quantum of Fund Required
  - ✓ Annexure-4: Uncovered Projects
  - ✓ Annexure-5: Project wise status of WUAs formed during XI Five Year Plan
- Annexure Volume 2 on State PIM Acts
- Annexure Volume 3 on Detailed Analysis of WUAs
- Data Volume giving the project and outlet wise Channel Density

CHAPTER-3: PROGRAMME REVIEW AND ANALYSIS

The programme review relates to observations and analysis with regard to institutional framework for execution of CADWM works, project interventions, physical and financial achievement, approach and strategies adopted for project planning, implementation and monitoring, capacity building initiatives, initiatives taken up for enhancing water use efficiency and formation and strengthening of water user associations.

3.1 Institutional Structure

Delivery against expectations set for any programme requires a robust institutional structure in place which is adequately manned by people with necessary skills, capacities, technical competence, administrative control and decision making. While CADA set up is seen in most of the north, east and south zone states, it is seen in selective states of west zone and north east zone. The study exclusively focused on the prevalent institutional structure amongst various states – a descriptive account of each zone is reported as below:

South Zone

In South Zone states like Kerala and Karnataka, Command Area Development Authority (CADA) has been formed whereas in Andhra Pradesh and Tamil Nadu, CADA has not been formed.

- In *Kerala*, the Secretary to Government, Water Resources (CAD) Department is the Chairman of the Kerala Command Area Development Authority. The Authority consists of 2 Members of the Legislative Assembly and 10 representatives of farmers of the Command Area in addition to the Government officials and representatives of credit agencies. The Administrator (Chief Engineer) is the Chief Executive Officer of the Authority. Nucleus staff functions at the Government Secretariat level.

- In *Karnataka*, the Command Area Development authorities were given Statutory backing from December 1979 with the enactment of the Karnataka Command Area Development Act, 1980 which is functioning as a mediator between the users and project authority.

- In *Andhra Pradesh*, the Principal Secretary to the Government and Commissioner is responsible for the Irrigation Department as well as CADA and looks after both sets of work.

- In *Tamil Nadu*, CAD work is looked after by the Agriculture Engineering Department (AED). At the State level, Chief Engineer is the Controlling Officer of the entire Scheme Works. At the Project level, the Superintending Engineer is in-charge of the entire Scheme operation and guidance to subordinates. The Executive Engineer is the Controlling Officer of the Sub-Divisions under his jurisdiction. Besides, he has to technically scrutinise and sanction the Plans and estimates, monitor the targets assigned to each sub-division. The Assistant Executive Engineer is the unit officer for the entire sub-division and in charge of implementation of CADA programme in his jurisdiction. He looks after the design and execution of works. Assistant Engineer is responsible for planning, designing and execution of works in the field level. He is also responsible for measurement, preparation of work bill for the payment and completion reports.

North Zone

In North Zone states like Jammu and Kashmir, Rajasthan, Haryana, Uttar Pradesh and Madhya Pradesh; Command Area Development Authority (CADA) has been formed that aims at enabling the project to be executed and managed in an organised way. In states like Uttarakhand, Punjab and Himachal Pradesh, CADA is yet to be set up.

- CADA, *Jammu* through its Soil and Water Conservation, and Water and Agriculture Wings is presently looking after the execution of CADWM works. The CADA is headed by the Director. The overall technical supervision is undertaken by Chief Agriculture Officer, CAD, Jammu. The project officers liaison with other departments like Agriculture, Horticulture, Irrigation, and Revenue to accomplish the various activities.

- In *Rajasthan*, there is a Principal Secretary having Technical officer as Officer on Special Duty (OSD). At the Project Level, Super Time IAS as Commissioner has unit heads of Irrigation Department and Agriculture Engineering for OFD, Agriculture Extension, Agriculture Research and Training. However, in Chambal and to some extent in Indira Gandhi Nahar Project (IGNP), the same system should be adopted for other CADA also.

- Command Area Development Authority was set up in *Haryana* in the year 1974 under a Centrally Sponsored Scheme on matching basis, that is, 50:50 by the Government of India and the State Government to promote optimum utilisation of irrigation potential on selected projects. For implementing CAD Programme, "Command Area Development Authority, Haryana" was established at Hisar in 1974 with the Commissioner, Hisar Division as

ex-officio Chairman of the Society and Administrator of the Authority. This society was registered under the Societies Registration Act, 1860 on 19th August 1974. To further give an impetus to CAD activities, a separate Commissioner has been posted by the Haryana Government w.e.f. 01.04.1983.

- In *Madhya Pradesh*, initially, the CAD programme was implemented by General and Agriculture Department. In 1980, a separate Department 'Ayakat Vibhag' was constituted and Agriculture Production Commissioner (APC) was head of that Department and under that, 7 CAD authorities were created. In 2002, the entire work of CAD was handed over to the newly created Department of Water Resources (DoWR). In 2007, the Government of Madhya Pradesh created Directorate of CAD under the DoWR. Under that Directorate, 8 CADWM divisions namely Bhopal, Gwalior, Seoni, Jabalpur, Riwa, Sagar, Indore and Datia were created which are functioning and implementing the projects. Each CADWM division is headed by the Executive Engineer and Superintendent Engineer at the State level. The overall CADWM is headed by Commissioner, CAD.

- In *Uttarakhand*, the Department of Irrigation with 1 Chief Engineer, 3 Superintending Engineers and Assistant Engineers/field staff administer the project. While the Chief Engineer is the Head of the Department, the entire team reports to the Secretary, Irrigation Department through Chief Engineer.

- In *Punjab*, Punjab State Tubewell Corporation (now Punjab Water Resources Management and Development Corporation Limited - PWRMDC) was incorporated in December 1970 with the main objective of utilisation of ground water resources in the State thereby providing irrigation facilities to the farmers through installation of deep Tubewells in the most backward area of the State which is devoid of other means of irrigation due to deep water table and difficult underground geological formations.

  In order to give further boost to the agricultural production in the State, the work of lining of watercourses was also entrusted to the Corporation by the Government in the year 1974-75 under the various schemes with refinance made available from NABARD, World Bank etc. and since 1998, under the Centrally sponsored CADWM Project and this activity is being continuously pursued by the Corporation.

- In *Himachal Pradesh*, the Irrigation and Public Health Department (I&PHD) is responsible for executing CAD work in the state. I&PHD is headed by the Principle Secretary, Government of India (GoI) who is assisted by Engineer-in-

Chief. For administrative convenience, the State is divided into 4 zones and zones are further divided into circles. Each zone is headed by the Chief Engineer who is assisted by the Superintendent Engineer of respective circles. The Superintendent Engineer has a team of Executive Engineers, Assistant Engineers and Junior Engineers to execute the programme.

East Zone

In East Zone states like Chhattisgarh, West Bengal, Bihar and Odisha, Command Area Development Authority (CADA) has been formed whereas in Jharkhand, CADA has not been formed.

- In *Chhattisgarh*, Hasdeo Ayacut Development Authority, Bilaspur which is responsible for Minimata Hasdeo Bango Project, is headed by the Chairman who is assisted by a Project Administrator. There are 3 Executive Engineers who execute the programme through a team of Assistant Engineers and Junior Engineers.

- In *West Bengal*, as per the Notification of the Department of Agriculture and Community Development, Credit and Project Branch, Government of West Bengal; Damodar Valley Command Area Development Authority, Burdwan was set up in 1974 with its headquarter located at Burdwan. It was set up to bring about integrated rural development of the command area for full utilisation of irrigation resources already created by exploitation of underground water where necessary and by arranging for its conjunctive use along with surface water, by evolving and popularising crop patterns and agronomic practices most suitable for the areas in order to maximise crop production, by supporting all other activities like animal husbandry, dairy, poultry development, pisciculture etc. by taking necessary steps for infrastructural development like markets, warehouses, road etc. and for the overall development of the rural areas. There are 4(four) CAD Authorities in the State viz. Damodar Valley CADA, Kangsabati CADA, Mayurakshi CADA which were constituted during 1974-75 and Teesta CADA which was constituted during 1999-2000. The Authorities are headed by the Administrators with their respective jurisdictions and are in the rank of Superintending Engineer, Water Resources Department (WRD) except Teesta CADA where the Administrator is in the rank of Chief Engineer, WRD.

- In *Bihar*, the Gandak Command Area Development Authority (GCADA) was formed in 1973 with the responsibility of executing CAD works in the state. There is an exclusive set-up for CADWM project implementation and management in the state. GCADA is headed by the Kshetriya Vikas Aayukt

Sah-Adhyaksh/Divisional Commissioner who is assisted by 2 Superintendent Engineers, 1 Financial Advisor, 1 Joint Registrar (Cooperative Societies), 4 Deputy Directors (Agriculture, Statistics, Ground water, Soil conservation and land Development). Financial Advisor has an Accounts Officer in his team. At the sub-division level are the Executive Engineers who are supported by 2 Assistant Engineers. GCADA is adequately equipped with engineering staff. Multi-disciplinary staff is in position to take up the assigned work. It has reasonable number of staff for agricultural extension and strengthening WUAs. The Superintendent Engineers and Executive Engineers are on deputation from WRD of the State and Assistant Engineers (AEs) as well as staff working under them are on the roll of CADA.

- In *Odisha*, there are 4 Command Area Development Authorities (CADAs) in the State located at Cuttack, Sambalpur, Berhampur and Jeypore to carry out the programme in the 14 irrigation commands.

- In *Jharkhand*, the Water Resources Department, Government of Jharkhand undertakes the implementation of CADWM works in the State. The implementation of CADWM scheme is being done through the concerned project Chief Engineer and his Superintendent Engineer and the Executive Engineer in charge of the project; and there is no exclusive set-up for CADWM project implementation. Multiple efforts are taken for State co-operation from the concerned department to enable the multi-disciplinary staff to take up the assigned work.

North-East Zone

In the North-East Zone, states like Assam, Manipur have CADA while in states like Nagaland, Meghalaya, Mizoram, Tripura, Arunachal Pradesh and Sikkim, CADA is yet to be set up.

- In *Manipur*, there is an exclusive set-up for CADWM project implementation and management in the state which is being done through CADA, Manipur. The multi-disciplinary staff is in a position to take up the suitable assigned work, both at state and project levels.

- In *Assam*, the Additional Chief Engineer is the Head of Department and is supported by 1 Superintending Engineer at CADA Level and 3 Execution Engineers at Project level. The Executive Chief Engineer (Minor Irrigation), both the Chairman-cum-Managing Directors of Upper Assam & Lower Assam CADA and the Additional Chief Engineer (Inspection & Quality Control) administer independently under the Secretary, Irrigation

Department. It consists of Agricultural Staff in the form of Deputy Agronomist, Water User Specialist, Agriculture Extension Officers, Village Level Extension Workers, Mandals and Chairman. It also includes other official staff in the form of assistant engineer, sub-engineer, superintendent, senior and junior assistant, stenographer, peon and driver. Engineers are assisted by 7 Assistant Engineers, 10 Superintending Officers (SOs) and 7 supervisors. The Additional Chief Engineer is separately supported by 2 Deputy Directors (Agriculture) for the executive and revenue functions. These Deputy Directors are assisted by Agriculture Officers, Assistant Agriculture Officers (AAOs) and Field Assistants (FAs).

- In *Nagaland*, the CAD work is implemented through the Department of Irrigation and Flood Control (I&FCD) under the control of Directorate of Irrigation and Flood Control headed by Chief Engineer, with necessary support and cooperation from Agriculture and Allied Departments. All the CAD works are under the administrative control of the Secretary, I&FCD, Government of Nagaland. Execution of the project is carried out by the Executive Engineer of Investigation Cell, I&FCD, with 1 Sub Divisional Officer-in charge of CADWM and supporting technical staffs.

- In *Meghalaya*, Department of Water Resource (DoWR) is exclusively responsible for executing CAD works in the state. The Department of Water Resources was created out of the Directorate of Irrigation, which was under the Agriculture Department in 2009. DoWR is headed by the Chief Engineer who is assisted by the Additional Chief Engineer at the State Level, 2 Superintendent Engineers at the Circle level and 7 Executive Engineers at the division level. There are 13 Sub-Divisions under the 7 Divisional offices in the State. However, during 2010, 10 (ten) additional posts were created.

- In *Mizoram* too, it is the Department of Minor Irrigation which implements the programme of the CADA. The Chief Engineer is the head of the organisations that is supported by 1 Deputy Director, 2 Superintendent Engineers, a team of 8 Executive Engineers and 3 Assistant Engineers.

- In *Tripura*, the responsibility of implementing the CADWM in the State lies on the Public Works Department under Department of Water Resources. Engineer in Chief is the Managing Director (MD) who is assisted by 3 Executive Engineers who are supported by Assistant Engineers.

- Irrigation and Flood Control Department (I&FCD) in *Arunachal Pradesh* is exclusively responsible for executing CAD works in the state. I&FCD is headed by the Chief Engineer who is assisted by the Superintendent Engineer (CAD).

The Superintendent Engineer has a team of Executive Engineers, and Assistant Engineers to carry out the activities. All the CAD work is under the administrative control of the Secretary, I&FCD, Government of Arunachal Pradesh. I&FCD is adequately equipped with engineering staff but has inadequate staff for agricultural extension and strengthening WUAs.

- The Minor Irrigation Department was responsible for the implementation of CADWM work in *Sikkim*. Since work on the Manpur-Kitam scheme in South District (out of 21 MI Scheme Project) was completed in November 2001, now the I&FCD does not look after the respective command area. At present, the farmers themselves manage the distribution of water in the area. Normally, agriculture is rain-fed and during the rainy season, the water reservoir gets filled and the stocked water flows to the fields through the field channels constructed during CADWM implementation in the area during 2000-2001.

West Zone

In West Zone states, while CADA exists in Maharashtra, it is yet to be formed in states like Goa and Gujarat.

- In *Maharashtra*, CADA is headed by the Secretary who is assisted by the Joint Director and Deputy and Secretary. The work is then looked after by the Chief Engineer who is assisted by the Executive Engineer, Deputy Engineer and Assistant Engineer. The State Government has constituted 8 Command Area Development Authorities.

- The Goa Tillari Irrigation Development Corporation (GTIDC) is an independent agency exclusively responsible for executing CAD works in *Goa*. GTIDC is headed by the Managing Director who is assisted by the Superintendent Engineer Circle-2. The Superintendent Engineer has a team of 3 Executive Engineers, 1 Deputy Director-Agriculture (DD-A) and 1 Assistant Director, Cooperatives. The Executive Engineers execute the programme through a team of Assistant Engineers and Junior Engineers whereas the DD-A is assisted by Agricultural Officers. Agricultural and Cooperative officials are hired from the parent departments respectively on deputation. GTIDC is adequately equipped with engineering staff but has faced problems in the past with regard to deputation of officials from other department.

- Sardar Sarover Narmada Nigam Limited (SSNNL), a wholly owned Government of Gujarat Undertaking agency, is exclusively responsible for executing CAD works in *Gujarat*. SSNNL is headed by the Managing Director

who is assisted by the Superintendent Engineer. The Superintendent Engineer has a team of Executive Engineers. The Executive Engineers execute the programme through a team of Assistant Engineers and Junior Engineers. The entire command area has been divided into 6 divisions (Dam and Vadodara, Ahmadabad, Mehsana, Rajkot, Patan, Kutch) headed by Chief Engineer. The Chief Engineer is responsible for both dam and CADWM.

Conclusion

Institutional structure varies from state to state. 14 states have CADA and in the remaining states, the Irrigation and other Departments/Corporations like Agriculture, PWD, Soil Conservation, Agricultural Engineering, Tube well, I&PH, I&FC are responsible for execution of the CADWM works.

Most of the projects covered under intensive study are adequately equipped with the engineering staff. The CAD authorities and other implementing institutions hire the officials on deputation basis to support the activites related to agricultural extension and formation of WUAs. However, most of the projects claim inadequacy of the staff for carrying out agricultural extension activities.

There is no provision for deploying specialists to strengthen the socio-institutional aspect which is supposed to be a critical area for strengthening of WUAs and ensuring their sustainability. While in terms of overall management, adequacy of staff, competence, inter-departmental liaison; the situation per se can be termed satisfactory in some states, many of the projects need a setting up and building of strong CADA establishment which should include specialised professionals with focus on Participatory Irrigation Management, agriculture/horticulture, agri-business, engineering and social work.

There are states like J&K where CADA is in place but various departments like Soil and Water Conservation and Agriculture Wings run the show and officials are posted on deputation for a fixed period. Change of departments is also noticed in some states like Madhya Pradesh. Such practices restrict the building up process of a robust and exclusive institutional structure of CADA and could adversely impact the delivery in the long run.

The purpose of setting up Command Area Development Authority (CADA) was to ensure that development of irrigation projects was not just restricted to being an engineering concept; rather it should be promoted based on the multi-disciplinary approach. The existence of CADA assures that there is a single window approach to deal with issues related to CADWM. The states where CADA does not exist have to depend upon convergence with the line departments and research and extension

agencies for development of a joint action plan and execution of the same accordingly, which is many times impractical to achieve the integrated and coordinated results. It is, therefore, suggested to create a single window approach, that is, establishment of CADA in the remaining 14 states.

3.2 Physical Achievements

South Zone

The details given in Table 3.1 below provide a cumulative achievement of physical works undertaken by the projects in the South Zone states during the XI Five Year Plan as against the planned targets.

i) Survey, Planning and Design Activity

The survey, planning and design activity for CADWM works in Sriramsagar Project in Andhra Pradesh and Upper Krishna Project in Karnataka is carried out along with the main project by State Irrigation Department and hence, details for the same have not been given in Table 3.1. Gunder Chittar Karruppandi Project in Tamil Nadu and Kanhirapuzha Project in Kerala achieved the planned target of survey, planning and design by 95% and 78% respectively.

ii) OFD Works

The unlined field channels were constructed in Sriramsagar Project in Andhra Pradesh with an achievement of 51% of the planned targets whereas the activity was not taken in other states.

With regard to lined channels, 45% of the work was completed in Upper Krishna Project in Karnataka whereas the same was 95% in case of Gunder Chittar Karruppandi Project in Tamil Nadu. No other activities could be initiated across the states related to OFD works. 28% of the OFD work could be achieved as against the planned target in Kanhirapuzha Project in Kerala.

iii) Construction of Field, Intermediate and Link Drains

Nearly 6330 ha of the command area was covered under construction of field, intermediate and link drains in Upper Krishna Project in Karnataka followed by 1540 ha in Kahirapuzha Project in Kerala and 706 ha in Gunder Chittar Karruppandi Project in Tamil Nadu. This activity was not initiated in the Sriramsagar Project in Andhra Pradesh.

iv) Warabandi

The concept of Warabandi has been taken up covering 42% of the command area in Upper Krishna Project in Karnataka whereas the same is above 95% in case of Gunder Chittar Karruppandi Project in Tamil Nadu. However, the activity is not applicable in Sriramsagar Project in Andhra Pradesh and in Kahirapuzha Project in Kerala.

v) Agriculture Extension Activities

Adaptive Trials were conducted on 200 plots covering 13 ha of cultivable land in Kanhirapuzha Project in Kerala. They were not planned for Upper Krishna Project in Karnataka. In Sriramsagar Project in Andhra Pradesh and Gunder Chittar Karruppandi Project in Tamil Nadu, adaptive trials are done by the State Agriculture Department.

The demonstration activity in Upper Krishna Project in Karnataka was carried out on 5733 plots covering 2360 ha of cropped area whereas the same could be achieved above 68% in Kanhirapuzha Project in Kerala. In case of Sriramsagar Project in Andhra Pradesh and Gunder Chittar Karruppandi Project in Tamil Nadu, frontline demonstrations are carried out by the state agriculture departments and hence, not mentioned in the table.

vi) Capacity Building Programmes

Around 102 project officials in Upper Krishna Project in Karnataka, 26 officials in Gunder Chittar Karruppandi Project in Tamil Nadu and 81 officials in Kanhirapuzha Project in Kerala were provided with opportunity of training and exposure. However, even though the target was set, no officials could be trained in Sriramsagar Project in Andhra Pradesh during the XI Five Year Plan.

The number of farmers trained was 33516 during the XI Five Year Plan in Upper Krishna Project in Karnataka whereas the same was 350 in case of Gunder Chittar Karruppandi Project in Tamil Nadu. No target was set for training farmers in Kanhirapuzha Project in Kerala and in Sriramsagar Project in Andhra Pradesh, no farmers could be trained despite a target being set for this activity.

vii) One-time Functional Grant to WUAs

An amount of ₹458000 has been provided to WUAs in Kanhirapuzha Project in Kerala as one time functional grant but the process has not been initiated yet in the

other states. Around 61 WUAs have been registered in Upper Krishna Project in Karnataka which is followed by 27 WUAs in Gunder Chittar Karruppandi Project in Tamil Nadu and 12 WUAs in Kanhirapuzha Project in Kerala. No WUAs have been registered in Sriramsagar Project in Andhra Pradesh.

Around 52 WUAs in Upper Krishna Project in Karnataka covering an area of 25420 ha have been handed over the charge of water distribution and management whereas 27 WUAs have been handed over charge in Gunder Chittar Karruppandi Project in Tamil Nadu. The activity could not be achieved in Sriramsagar Project in Andhra Pradesh and target was not set for the same in Kanhirapuzha Project in Kerala.

viii) Monitoring and Evaluation Studies

The monitoring studies have been conducted only in Gunder Chittar Karruppandi Project in Tamil Nadu across the southern states. No target was set for the same for projects in other states.

ix) Reclamation of Waterlogged Areas

The physical achievement with regard to reclamation of water logged areas in Krishna project include 10972.37 ha whereas the same has not been initiated other projects covered under intensive study in southern zone.

x) Correction of System Deficiencies

An area of 7822 ha was covered under correction of system deficiencies in Gunder Chittar Karruppandi Project in Tamil Nadu whereas the same was non-existent in remaining projects covered under intensive study

Table 3.1: Project wise Cumulative Physical Achievement of XI Five Year Plan till December 2011 (South Zone)

S. No.	Components	Andhra Pradesh		Karnataka		Tamil Nadu		Kerala	
		Sriramsagar Project		Upper Krishna Project		Gunder Chittar Karruppandi		Kanhirapuzha Project	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
1	Survey, Planning and Design (ha)	Done by the State Irrigation Department with the main project		Done by the State Irrigation Department with the main project		15000	14327	3720	2935
2	OFD Works (ha)								
	a. Unlined	48335	24732	0	0	0	0	3180	889
	b. Lined	Distributaries work is under progress		188703	85953	15000	14327		
	c. Land Levelling			0	0	0	0		
	Total of OFD works (ha)	48335	24732	188703	85953	15000	14327		
3	Construction of field, intermediate and link drains (ha)	0	0	29455	6330	1500	706	2475	1540
4	Warabandi (ha)	NA	NA	117267	50003	15000	14327	NA	NA
5	Adaptive Trials								
	a. No. of Trials	Done by the State Agriculture Department		0	0	Done by the State Agriculture Department		250	200
	b. Area covered (ha)			0	0			17	13
6	Demonstration program								
	a. No. of plots	Done by the State Agriculture University and Krishi Vigyan Kendra (KVK)		6356	5733	Done by the State Agriculture University and Krishi Vigyan Kendra (KVK)		1277	871
	b. Area covered (ha)			2573	2360			363	209
7	Trainings conducted								
	a. No. of officials trained	100	0	119	102	0	26	73	81
	b. No. of farmers trained	150	0	41740	33516	0	350	0	0
8	One-time functional grant to WUAs (₹)	0	0	0	0	0	0	458000	458000
	a. No. of WUAs registered	272	0	111	61	41	27	12	12

S. No.	Components	Andhra Pradesh		Karnataka		Tamil Nadu		Kerala	
		Sriramsagar Project		Upper Krishna Project		Gunder Chittar Karruppandi		Kanhirapuzha Project	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
	b. Area covered under the WUAs (ha)	351862	0	98130	29890	15000	10500	0	0
	c. No. of WUAs which have been handed over to the system	272	0	85	52	27	27	0	0
	d. Area covered under such WUAs (ha)	351862	0	41650	25480	0	10500	0	0
9	Monitoring and Evaluation studies conducted for the project (No.)	0	0	0	0	1	1	0	0
10	Reclamation of waterlogged areas (Ha)	0	0	0	0	0	0	810	Sanction to be received for revised target
	a. No. of schemes approved by GoI	0	0	34	9	0	0	0	0
	b. Area reclaimed (ha)	0	0	9039	2737	0	0	0	0
11	Correction of Conveyance System Deficiencies above the outlet up to distributaries of 150 cusec capacity (ha)	0	0	0	0	7824	0	960	Estimates under preparation

(Source: Project Offices in the Respective States)

**NA-Not Applicable*

* *Plan-Planned, Ach-Achieved*

North Zone

The details given in Table 3.2 below provide a cumulative achievement of physical works undertaken by the projects in the North Zone states during the XI Five Year Plan as against the planned targets.

i) Survey, Planning and Design Activity

The projects like Ranbir Canal in Jammu and Kashmir and Sirhind Feeder Part-2 Command Project in Punjab have achieved the target on survey, planning and design ranging from 85% to 94% whereas the same is bit higher as compared to the planned targets in Western Yamuna Canal Phase-6 Project in Haryana, Sharda Sahayak Canal System Phase-2 Project in Uttar Pradesh and Chambal Project in Rajasthan. The activity was not planned in Harsi Project in Madhya Pradesh yet has been carried on 5582 ha. No work could be taken with regard to the activity in Cluster of 38 MI Schemes of District Una in Himachal Pradesh. The activity is carried out along with the main project by the State Irrigation Department in Jatowala & Prateetpur Canal Project in Uttarakhand.

ii) OFD Works

Nearly 44% of the planned target for construction of unlined channels in Sharda Sahayak Canal System Phase-2 Project in Uttar Pradesh and 85% of the planned target for the same activity in Chambal Project in Rajasthan has been achieved whereas the other states in northern zone did not construct the unlined channels.

The targets with regard to construction of lined channel were achieved in Ranbir Canal Project in J&K, Sirhind Feeder Part-2 Command Project in Punjab, Western Yamuna Canal Phase-6 Project in Haryana, Cluster of 38 MI Schemes of District Una in Himachal Pradesh, Jatowala & Prateetpur Canal Project in Uttarakhand, Sharda Sahayak Canal System Phase-2 Project in UP, Chambal Project in Rajasthan and Harsi Project in Madhya Pradesh by 75%, 85%, 94%, 100%, 100%, 28% and 118% and 102% respectively.

iii) Construction of Field, Intermediate and Link Drains

The construction of field, intermediate and link drains was carried out on 8083 ha in Ranbir Canal Project in J&K, on 16537 ha in Western Yamuna Canal Phase-6 Project in Haryana, on 35600 ha in Sharda Sahayak Canal System Phase-2 Project in Uttar Pradesh and on 4425 ha in Chambal Project in Rajasthan. The activity was not taken up in Harsi Project in Madhya Pradesh and it is not applicable in Sirhind Feeder

Part-2 Command Project in Punjab and Jatowala & Prateetpur Canal Project in Uttarakhand.

iv) Warabandi

The concept of Warabandi was taken up covering an area of 1285 ha in Ranbir Canal Project in J&K, 1468 ha in Cluster of 38 MI Schemes of District Una in Himachal Pradesh and 907 ha in Sharda Sahayak Canal System Phase-2 Project in UP. The activity was not taken up in Western Yamuna Canal Phase-6 Project in Haryana, Chambal Project in Rajasthan and Harsi Project in Madhya Pradesh. It is not applicable in Sirhind Feeder Part-2 Command Project in Punjab and Jatowala & Prateetpur Canal Project in Uttarakhand.

v) Agriculture Extension Activities

The figures in the following Table 3.2 indicate that target was set for conducting adaptive trials in Western Yamuna Canal Phase-6 Project in Haryana and Chambal Project in Rajasthan but could not be achieved. The activity was not taken up in Harsi Project in Madhya Pradesh and it is not applicable in projects in the remaining states in the north zone.

The frontline demonstration activity was taken up on 1358 plots in Ranbir Canal Project in J&K and 1301 plots in Western Yamuna Canal Phase-6 Project in Haryana. The activity was planned for Sharda Sahayak Canal System Phase-2 Project in UP but could not be achieved. It was not taken up in Cluster of 38 MI Schemes of District Una in Himachal Pradesh, Chambal Project in Rajasthan and Harsi Project in Madhya Pradesh. The activity was not applicable in Sirhind Feeder Part-2 Command Project in Punjab and Jatowala & Prateetpur Canal Project in Uttarakhand.

vi) Capacity Building Programmes

Around 113 project officials in Ranbir Canal Project in J&K and 125 officials in Western Yamuna Canal Phase-6 Project in Haryana were trained in the northern zone. Target for training officials was set in Sharda Sahayak Canal System Phase-2 Project in UP but could not be achieved. The activity was not planned for projects in other states in the north zone.

The number of farmers trained includes 5650 in Ranbir Canal Project in J&K, 2647 in Western Yamuna Canal Phase-6 Project in Haryana, 8619 in Chambal Project in Rajasthan and 2227 farmers in Harsi Project in Madhya Pradesh. The activity was not planned for projects in other states in the north zone.

vii) One-time Functional Grant to WUAs

The number of registered WUAs includes 798 in Sirhind Feeder Part-2 Command Project in Punjab, 200 in Western Yamuna Canal Phase-6 Project in Haryana and 1410 in Chambal Project in Rajasthan covering an area of 112112 ha, 24078 ha and 1495000 ha respectively. No WUAs could be registered in Harsi Project in Madhya Pradesh despite a target being set for it. The activity was not planned for Jatowala & Prateetpur Canal Project in Uttarakhand. In projects of other states, the activity was not applicable.

The numbers of WUAs which have been handed over to the system include 798 WUAs in Sirhind Feeder Part-2 Command Project in Punjab and 1410 WUAs in Chambal Project in Rajasthan covering an area of 110312 ha and 1495000 ha respectively. No WUAs could be handed over in Harsi Project in Madhya Pradesh despite a target being set for it. The activity was not planned for Western Yamuna Canal Phase-6 Project in Haryana and Jatowala & Prateetpur Canal Project in Uttarakhand. In projects of other states, the activity was not applicable.

viii) Monitoring and Evaluation Studies

14 Monitoring and Evaluation Studies have been conducted for the Western Yamuna Canal Phase-6 Project in Haryana. The Ranbir Canal Project in J&K is in the initial stage, hence, monitoring and evaluation could not be conducted. The activity was not planned for projects in other states.

ix) Reclamation of Waterlogged Areas

An area of 1000 ha was covered under reclamation of waterlogged areas in Western Yamuna Canal Phase-6 Project in Haryana state. The activity was not applicable in Ranbir Canal Project in J&K and Sirhind Feeder Part-2 Command Project in Punjab. It was not planned for projects in other states in the north zone.

x) Correction of System Deficiencies

The activity was not applicable in Ranbir Canal Project in J&K and Sirhind Feeder Part-2 Command Project in Punjab. It was not planned for projects in other states in the north zone.

Table 3.2: Project wise Cumulative Physical Achievement of XI Five Year Plan till December 2011 (North Zone)

S. No.	Components	J&K		Punjab		Haryana		Himachal		**Uttarakhand		UP		Rajasthan		MP	
		Ranbir Canal		Sirhind Feeder Project Part -2		Western Yamuna Canal Phase – 6		Cluster of 38 MI Schemes in Una District		Jatowala and Prateetpur canal		Sharda Sahayak Canal System Phase-2		Chambal Command Area		Harsi Project	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
1	Survey, Planning and Design (ha)	17330	16295	144200	123911	73500	75030	0	0	Done by the state irrigation department with the main project		29000	30083	42000	54965	0	5582
2	OFD Works																
	a. Unlined	0	0	0	0	0	0	0	0	0	0	2420000	1295562	5152	4425	0	0
	b. Lined	20560	15526	144200	123911	70800	66791	1468	1468	799.5	799.5	484000	135802	15268	18152	12836	13136
	c. Land Levelling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total of OFD works (ha)	20560	15526	144200	123911	70800	66791	0	0	799.5	799.5	2904000	1431364	25562	27002	12836	13136
3	Construction of field, intermediate and link drains (ha)	10240	8083	NA	NA	3000	16537	0	0	NA	NA	116000	35600	5152	4425	0	0
4	Warabandi (ha)	1434	1285	NA	NA	0	0	1468	1468	NA	NA	18000	907	0	0	0	0
5	Adaptive Trials																
	a. No. of Trials	NA	NA	NA	NA	8	0	0	0	NA	NA	NA	NA	200	0	0	0

S. No.	Components	J&K		Punjab		Haryana		Himachal		**Uttarakhand		UP		Rajasthan		MP	
		Ranbir Canal		Sirhind Feeder Project Part -2		Western Yamuna Canal Phase – 6		Cluster of 38 MI Schemes in Una District		Jatowala and Prateetpur canal		Sharda Sahayak Canal System Phase-2		Chambal Command Area		Harsi Project	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
	b. Area covered (ha)					3	0	0	0					20	0	0	0
6	Demonstration programmes																
	a. No. of plots	1522	1358	NA	NA	165	1301	0	0	NA	NA	56	0	0	0	0	0
	b. Area covered (ha)	761	679			66	521	0	0			11.2	0	0	0	0	0
7	Trainings conducted																
	a. No. of officials trained	142	113	0	0	135	125	0	0	0	0	132	0	0	0	0	0
	b. No. of farmers trained	7100	5650	0	0	2300	2647	0	0	0	0	1360	0	0	8619	0	2227
8	Onetime functional grant to WUAs (₹)	NA	NA			0	0	0	0	NA	NA	NA	NA			0	0

S. No.	Components	J&K		Punjab		Haryana		Himachal		**Uttarakhand		UP		Rajasthan		MP	
		Ranbir Canal		Sirhind Feeder Project Part -2		Western Yamuna Canal Phase – 6		Cluster of 38 MI Schemes in Una District		Jatowala and Prateetpur canal		Sharda Sahayak Canal System Phase-2		Chambal Command Area		Harsi Project	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
	a. No. of WUAs registered			1130	798	323	200	0	0					1410	1410	26	0
	b. Area covered under WUAs (ha)			167200	112112	63962	24078	0	0					114500	1495000	44354	0
	c. No. of WUAs which have been handed over to the system			1130	798	0	0	0	0					1410	1410	26	0
	d. Area covered under such WUAs (ha)			167200	110312	0	0	0	0					114500	1495000	44354	0
9	Monitoring and Evaluation studies conducted for the project (No.)	Project is in initial stage		0	0	02	14	0	0	0	0	0		0	0	0	0
10	Reclamation of waterlogged areas (Ha)																

S. No.	Components	J&K		Punjab		Haryana		Himachal		**Uttarakhand		UP		Rajasthan		MP	
		Ranbir Canal		Sirhind Feeder Project Part -2		Western Yamuna Canal Phase – 6		Cluster of 38 MI Schemes in Una District		Jatowala and Prateetpur canal		Sharda Sahayak Canal System Phase-2		Chambal Command Area		Harsi Project	
		P an	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
	a. No. of schemes approved by GoI	NA	NA	NA	NA	NA	1	0	0	0	0	0	0	0	0	0	0
	b. Area reclaimed (ha)					1451	1000	0	0	0	0	0	0	0	0	0	0
11	Correction of Conveyance System Deficiencies above the outlet up to distributaries of 150 cusec capacity	NA	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0	0

(Source: Project Offices in the Respective States)

**NA-Not Applicable*
** Plan-Planned, Ach-Achieved*

*****Uttarakhand** - All the projects in the state are completed; however, there is no on-going project in XI Five Year Plan. The representative figures shown in the table above are for the IX and X Five Year Plan period (2001-2004).*

East Zone

The details given in Table 3.3 below provide a cumulative achievement of physical works undertaken by the projects in the East Zone states during the XI Five Year Plan as against the planned targets.

i) Survey, Planning and Design Activity

The achievement as compared to the planned targets was around 76% of the work with regard to survey, planning and design in Damodar Valley Canal System Project in West Bengal whereas the same was 100%, 32% and 99% in case of Kanchi Weir Scheme in Jharkhand, Gandak Project in Bihar and Hasdeo Phase-2 Project in Chhattisgarh respectively. The activity is done along with the main project by the State Irrigation Department in Hirakud Project in Odisha.

ii) OFD Works

The percentage of achievement of planned target for construction of unlined channels in Damodar Valley Canal System Project in West Bengal was 14% whereas the same was nearly 99% in Hasdeo Phase-2 Project in Chhattisgarh. The activity was not taken up in projects other states.

The achievement in case of construction of lined channel was 23% in Damodar Valley Canal System Project in West Bengal, 65% in Gandak Project in Bihar and above 100% in Hasdeo Phase-2 Project in Chhattisgarh.

The achievement in case of OFD works was 85% in Hirakud Project in Odisha. Since the Kanchi Weir Scheme in Jharkhand is at the stage of survey, planning and design, hence, no OFD works could be taken up.

iii) Warabandi

The concept of Warabandi is not applicable in projects of the east zone states.

iv) Construction of Lined, Intermediate and Link Drains

The construction of field, intermediate and link drains was carried out on 6093 ha in Hirakud Project in Odisha and 54000 ha in Gandak Project in Bihar. The activity was not applicable for projects in other states.

v) Agriculture Extension Activities

Adaptive Trials are not applicable in projects of all the states in the east zone except Hasdeo Phase-2 Project in Chhattisgarh where trials are done by the State Agriculture Department.

The demonstration activities were taken up on 1042 plots covering 639 ha of land in Gandak Project in Bihar, 23 plots covering 940 ha of land in Hirakud Project in Odisha and 2142 plots/chaks covering an area of 85167 ha in Hasdeo Phase-2 Project in Chhattisgarh. The activities are not applicable for projects of other states.

vi) Capacity Building Programmes

Around 36 officials in Kanchi Weir Scheme in Jharkhand and 19 officials in Gandak Project in Bihar got an opportunity to enhance their capacities with regard to CADWM. No officials could be trained in Damodar Valley Canal System Project in West Bengal and Hirakud Project in Odisha. Trainings of officials in Hasdeo Phase-2 Project in Chhattisgarh are done by the State Agriculture Department.

The number of farmers who received training inputs was 2000 in Damodar Valley Canal System Project in West Bengal, 12100 in Hirakud Project in Odisha, 75 in Kanchi Weir Scheme in Jharkhand, 5139 in Gandak Project in Bihar and 4276 in Hasdeo Phase-2 Project in Chhattisgarh.

vii) One-time Functional Grant to WUAs

The process of providing one time functional grant has not been initiated in the eastern zone.

Around 328 WUAs in Hirakud Project in Odisha and 79 WUAs in Hasdeo Phase-2 Project in Chhattisgarh have been registered covering an area of 157018 ha and 81195 ha respectively whereas all registered WUAs in Hirakud Project in Odisha and 18 WUAs in Hasdeo Phase-2 Project in Chhattisgarh have been handed over the charge of the micro-canal system. The same has not been initiated in Damodar Valley Canal System Project in West Bengal and Kanchi Weir Scheme in Jharkhand.

viii) Monitoring and Evaluation Studies

The number of monitoring and evaluation studies includes 14 in Damodar Valley Canal System Project in West Bengal and 18 in Hirakud Project in Odisha. It is done

by the State Agriculture Department in Hasdeo Phase-2 Project in Chhattisgarh. The activity was not planned for Gandak Project in Bihar and it is not applicable for Kanchi Weir Scheme in Jharkhand.

ix) Reclamation of Waterlogged Areas

The activity of reclamation of water logged areas was carried out on 169 ha of land in Hirakud Project in Odisha and on 2000 ha of land in Gandak Project in Bihar in the eastern zone. The activity is not applicable for projects in other states.

x) Correction of System Deficiencies

The activity was planned for Gandak Project in Bihar but could not be completed, and it is not applicable in Damodar Valley Canal System Project in West Bengal. For projects in other states, the activity could not be initiated.

Table 3.3: Project wise Cumulative Physical Achievement of XI Five Year Plan till December 2011 (East Zone)

S. No	Components	West Bengal		Odisha		**Jharkhand		Bihar		Chhattisgarh	
		DVC		Hirakud		Kanchi Weir Scheme		Gandak		Hasdeo Phase-2	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
1	Survey, Planning and Design (ha)	213000	164000	Done by the State Irrigation Department with the main project survey		200	200	59000	19000	85500	84731
2	OFD Works (ha)										
	a. Unlined	32142	4714	11317	9618	NA	NA	0	0	68400	68135
	b. Lined	16037	3814					61000	40000	17100	17122
	c. Land Levelling	0	0					0	0	0	0
	Total of OFD works (ha)	48179	8528					61000	40000	85500	85167
3	Construction of field, intermediate and link drains (ha)	NA	NA	7071	6093	NA	NA	122000	54000	NA	NA
4	Warabandi (ha)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5	Adaptive Trials										
	a. No. of Trials	NA	NA	NA	NA	NA	NA	NA	NA	Done by the State Agriculture Department	
	b. Area covered (ha)										
6	Demonstration programmes										
	a. No. of plots	NA	NA	25	23	NA	NA	4245	1042	2137	2142
	b. Area covered (ha)			1000	940			849	639	85500	85167
7	Trainings conducted	63	34	138	128	2	2				
	a. No. of officials trained	29	0	0	0	36	36	580	19	Done by the State Agriculture Department	
	b. No. of farmers trained	3480	2000	12600	12100	75	75	6740	5139	4850	4276
8	One-time functional grant to WUAs (₹)	NA	NA	0	0	NA	NA	0	0		

S. No	Components	West Bengal		Odisha		**Jharkhand		Bihar		Chhattisgarh	
		DVC		Hirakud		Kanchi Weir Scheme		Gandak		Hasdeo Phase-2	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
	a. No. of WUAs registered			328	328			86	86	79	79
	b. Area covered under the WUAs (ha)			57018	157018			0	0	138000	138000
	c. No. of WUAs which have been handed over to the system			328	328			0	0	322	18
	d. Area covered under such WUAs (ha)			57018	157018			0	0	82200	81195
9	Monitoring and Evaluation studies conducted for the project (No.)	23	14	18	18	NA	NA	0	0	Done by the State Agriculture Department	
10	Reclamation of waterlogged areas (Ha)	NA	NA	169	169	NA	NA		0	NA	NA
	a. No. of schemes approved by GoI			1	1			4	0		
	b. Area reclaimed (ha)			169	169			5000	2000		
11	Correction of Conveyance System Deficiencies above the outlet up to distributaries of 150 cusec capacity	NA	NA	0	0	0	0	9	0	0	0

(Source: Project Offices in the Respective States)

**NA-Not Applicable*

**Plan-Planned, Ach-Achieved*

****Jharkhand*** - In the state, the project is in the Survey, planning and design stage.

North East Zone

The details given in Table 3.4 below provide a cumulative achievement of physical works undertaken by the projects in the North-East Zone states during the XI Five Year Plan as against the planned targets.

i) Survey, Planning and Design Activity

As per the details given in the Table 3.4 below, cent percent physical target was achieved for survey, planning and design activity in Medziphema Bowl Project in Nagaland, Thoubal Irrigation Phase-2 Project in Manipur, Cluster of 62 MI Schemes in Arunachal Pradesh and in Cluster of 6 MI Schemes in Meghalaya. The activity could not be completed in Cluster of 4 MI Schemes in Tripura since no funds have been received by the State after 2006-07. The activity was not planned for Dakadong Project in Assam. It could not be done in Cluster of 40 MI Projects in Mizoram as the project has already been completed in 2006-07. There is no on-going project in Sikkim, hence, no survey, planning and design activity for Cluster of 21 Schemes in Sikkim.

ii) OFD Works

The unlined channel was constructed in Medziphema Bowl Project in Nagaland and Cluster of 6 MI Schemes in Meghalaya with 100% and 80% achievement respectively. The activity was initiated in projects of other states.

The percent achievement of construction of lined channel was 100% in Dakadong Project in Assam, 117% in Medziphema Bowl Project in Nagaland, 65% in Thoubal Irrigation Phase-2 Project in Manipur and 21% in Cluster of 40 MI Projects in Mizoram. No field channels were constructed in Cluster of 21 MI Schemes in Sikkim and Cluster of 4 MI Schemes in Tripura.

Land levelling activity was done in Cluster of 40 MI Projects in Mizoram with 35% achievement.

The achievement of total OFD works in Cluster of 6 MI Schemes in Meghalaya was 80%. No targets were set for OFD works in Cluster of 62 MI Schemes in Arunachal Pradesh but due to the availability of funds, OFD works have been completed on 2806 ha of land.

iii) Construction of Field, Intermediate and Link Drains

The field, intermediate and link drains were constructed achieving the target by 100% in Dakadong Project in Assam, 94% in Medziphema Bowl Project in Nagaland, 68% in Thoubal Irrigation Phase-2 Project in Manipur, 100% in Cluster of 40 MI Projects in Mizoram and 100% in Cluster of 62 MI Schemes in Arunachal Pradesh. The activity was planned for Cluster of 4 MI Schemes in Tripura and Cluster of 6 MI Schemes in Meghalaya but could not be achieved. There is no on-going project in Sikkim, hence, no survey, planning and design activity for Cluster of 21 Schemes in Sikkim.

iv) Warabandi

Warabandi activity was promoted covering an area of 94% of the planned target in Medziphema Bowl Project in Nagaland, 100% in Cluster of 40 MI Projects in Mizoram and 100% in Cluster of 62 MI Schemes in Arunachal Pradesh with no focus on the activity in the remaining states of the zone.

v) Agriculture Extension Activities

Adaptive trials were not taken up across the projects in the states. Though it was planned for Medziphema Bowl Project in Nagaland and Cluster of 6 MI Schemes in Meghalaya, the target could not be achieved.

In Thoubal Irrigation Phase-2 Project in Manipur, demonstration activities were taken up on 181 ha of land. However, the state agricultural universities and Krishi Vigyan Kendra along with agricultural/horticultural departments are involved in carrying out the adaptive trials and frontline crop demonstrations in the north eastern zone.

vi) Capacity Building Programmes

3300 farmers in Medziphema Bowl Project in Nagaland and 2085 farmers in Thoubal Irrigation Phase-2 Project in Manipur were involved in training and orientation programme No capacity building programmes were planned for projects of the remaining states in the north east zone.

vii) One-time Functional Grant to WUAs

The number of WUAs registered includes 23 WUAs in Medziphema Bowl Project in Nagaland, 18 WUAs in Cluster of 62 MI Schemes in Arunachal Pradesh and 6 WUAs

in Cluster of 6 MI Schemes covering areas of 3151 ha, 2509 ha and 537 ha respectively. The activity was not initiated in projects of other states in the north east zone.

All the registered WUAs in Medziphema Bowl Project in Nagaland have been given the charge of the system for management and utilisation of water.

viii) Monitoring and Evaluation Studies

The monitoring study was conducted only in Medziphema Bowl Project in Nagaland across the region, with projects in other states not having initiated this activity.

ix) Reclamation of Waterlogged Areas

This activity was not initiated in any project across the states of the north-east zone.

x) Correction of System Deficiencies

This activity was not initiated in any project across the states of the north-east zone.

Table 3.4: Project wise Cumulative Physical Achievement of XI Five Year Plan till December 2011 (North East Zone)

S. No	Components	Assam		Nagaland		Manipur		**Mizoram		Arunachal		**Sikkim		**Tripura		**Meghalaya	
		Dakadong		Medziphema Bowl		Thoubal Irrigation Project Phase-2		Cluster of 40 MI Schemes		Cluster of 62 MI Schemes		Cluster of 21 MI Schemes		Cluster of 4 MI Projects		Cluster of 6 MI Schemes	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
1	Survey, Planning and Design (ha)	0	0	3325	3325	2485	2485	0	0	2756	2756	No on-going project in the state		1064	0	231	231
2	OFD Works																
	a. Unlined	0	0	17	17	0	0	0	0	0	2806			0	0	225	179
	b. Lined	2977	2977	7.4	8.7	2485	1621	1088	233	0				1044	0		
	c. Land Levelling	0	0	0	0	0	0	1088	380	0				0	0		
	Total of OFD works (ha)	2977	2977	24.3	25.7	2485	1621	2176	613	0				1044	0		
3	Construction of field, intermediate and link drains (ha)	1343	1343	3325	3151	1800	1230	1088	1088	2194	2194			784	0	108	0
4	Warabandi (ha)	0	0	3325	3151	NA	NA	1088	1088	700	700			0	0	0	0
5	Adaptive Trials																
	a. No. of Trials	0	0	16	0	0	0	0	0	0	0			0	0	2	0
	b. Area covered (ha)	0	0	16	0	0	0	0	0	0	0			0	0	62	0
6	Demonstration programmes																
	a. No. of plots	0	0	33	0	200	160	0	0	0	0			0	0	0	0
	b. Area covered (ha)	0	0	3325	0	197	181	0	0	0	0			0	0	0	0
7	Trainings conducted													218	0		
	a. No. of officials trained	0	0	10	0	20	0	0	0	0	0			0	0	0	0

S. No	Components	Assam		Nagaland		Manipur		**Mizoram		Arunachal		**Sikkim		**Tripura		**Meghalaya	
		Dakadong		Medziphema Bowl		Thoubal Irrigation Project Phase-2		Cluster of 40 MI Schemes		Cluster of 62 MI Schemes		Cluster of 21 MI Schemes		Cluster of 4 MI Projects		Cluster of 6 MI Schemes	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
	b. No. of farmers trained	0	0	3325	3300	2485	2085	0	0	0	0			0	0	0	0
8	Onetime functional grant to WUAs (₹)					NA	NA							240	0	0	
	a. No. of WUAs registered	0	0	23	23			0	0	18	18			0	0	6	6
	b. Area covered under the WUAs (ha)	0	0	3325	3151			0	0	2509	2509			0	0	537	537
	c. No. of WUAs which have been handed over to the system	0	0	23	23			0	0	0	0			0	0	0	0
	d. Area covered under such WUAs (ha)	0	0	3325	3151			0	0	0	0			0	0	0	0
9	Monitoring and Evaluation studies conducted for the project (No.)	0	0	1	1	0	0	0	0	0	0			0	0	0	0
10	Reclamation of waterlogged areas (ha)	0	0	0	0	0	0		0	0	0			0	0	0	0

S. No	Components	Assam		Nagaland		Manipur		**Mizoram		Arunachal		**Sikkim		**Tripura		**Meghalaya	
		Dakadong		Medziphema Bowl		Thoubal Irrigation Project Phase-2		Cluster of 40 MI Schemes		Cluster of 62 MI Schemes		Cluster of 21 MI Schemes		Cluster of 4 MI Projects		Cluster of 6 MI Schemes	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
	a. No. of schemes approved by GoI	C	0	0	0	0	0	0	0	0	0			0	0	6	0
	b. Area reclaimed (ha)	0	0	0	0	0	0	0	0	0	0			0	0	296	0
11	Correction of Conveyance System Deficiencies above the outlet up to distributaries of 150 cusec capacity	0	0	0	0	0	0	0	0	0	0			0	0	0	0

(Source: Project Offices ir the Respective States)

**NA-Not Applicable*

**Plan- Planned, Ach-Achieved*

****Mizoram - The representative figures are only for one year because the project was completed in 2006-07.**

****Sikkim - No On-going project in the state.**

****Meghalaya - The project was included in the CADWM programme in 2010-11. The representative figures are from 2010 to Sep 2011 only.**

****Tripura - No funds received after 2006-07.**

West Zone

The details given in Table 3.5 below provide a cumulative achievement of physical works undertaken by the projects in the West Zone states during the XI Five Year Plan as against the planned targets.

i) Survey, Planning and Design Activity

The survey, planning and design activity was completed by achieving the target with 100% in Tillari Irrigation Project in Goa and 90% in Kukadi Project in Maharashtra whereas the activity was carried out by State Irrigation Department in Sardar Sarovar Phase-1 Project in Gujarat.

ii) OFD Works

The construction of unlined channels was done in Kukadi Project in Maharashtra with 84% achievement. This activity was not undertaken in projects of other states in the zone.

The construction of lined channels was achieved with a target of 58% in Tillari Irrigation Project in Goa and 13% in Sardar Sarovar Phase-1 Project in Gujarat. No lined channels were constructed in Kukadi Project in Maharashtra.

iii) Construction of Field, Intermediate and Link Drains

This activity was completed with 100% achievement in Sardar Sarovar Phase-1 Project in Gujarat. However, it was not initiated in projects in the other states.

iv) Warabandi

The concept of Warabandi has not been initiated in any project across the states in the west zone.

v) Agriculture Extension Activities

The adaptive trials were not taken up across the projects in the states of the west zone.

However, demonstrations were taken up in Tillari Irrigation Project in Goa covering 58 plots on 11 ha of land whereas the same are non-existent in Sardar Sarovar Phase-1 Project in Gujarat and Kukadi Project in Maharashtra.

vi) Capacity Building Programmes

The numbers of officials involved in capacity building activities include 700 in Tillari Irrigation Project in Goa, 899 in Sardar Sarovar Phase-1 Project in Gujarat and 665 in Kukadi Project in Maharashtra.

Around 3520 farmers in Tillari Irrigation Project in Goa and 16764 farmers in Sardar Sarovar Phase-1 Project in Gujarat were covered under training programmes whereas no farmers in Kukadi Project in Maharashtra could be covered under the training programmes.

vii) One-time Functional Grant to WUAs

The concept of giving one time functional grant has not been initiated across the projects in the states. The number of registered WUAs includes 20 in Tillari Irrigation Project in Goa and the charge of the system has been handed over to 3 WUAs. The activity could not be initiated in projects of other states.

viii) Monitoring and Evaluation Studies

Monitoring and Evaluation Studies were not conducted for any project across the states in the zone.

ix) Reclamation of Waterlogged Areas

This activity was not initiated in any project across the states of the west zone.

x) Correction of System Deficiencies

Around 919 ha of land in the Kukadi Project command area in Maharashtra has been covered under correction of system deficiencies. The activity was not initiated in Sarovar Phase-1 Project in Gujarat and it was not applicable in Tillari Irrigation Project in Goa.

Table 3.5: Project wise Cumulative Physical Achievement of XI Five Year Plan till December 2011 (West Zone)

S. No	Components	Goa		Gujarat		Maharashtra	
		Tillari Irrigation Project		Sardar Sarovar Phase – 1		Kukadi Project	
		Plan	Ach	Plan	Ach	Plan	Ach
1	Survey, Planning and Design (ha)	8918	8918	Done by the state irrigation department with the main project		29000	26200
2	OFD Works						
	a. Unlined	0	0	0	0	51000	43005
	b. Lined	4517	2641	363987	46440	0	0
	c. Land Levelling	0	0	0	0	0	0
	Total of OFD works (ha)	4517	2641	363987	46440	51000	43005
3	Construction of field, intermediate and link drains (ha)	0	0	2.73	2.73	0	0
4	Warabandi (ha)	0	0	0	0	0	0
5	Adaptive Trials						
	a. No. of Trials	0	0	0	0	0	0
	b. Area coverec (ha)	0	0	0	0	0	0
6	Demonstration programmes				0		0
	a. No. of plots	107	58	0	0	0	0
	b. Area covered (ha)	21.4	11.6	0	0	0	0
7	Trainings conducted						0
	a. No. of officials trained	42	14	899	899	910	665
	b. No. of farmers trained	1000	700	16764	16764	0	0
8	One-time functional grant to WUAs (₹)	0	0	0	0	0	0
	a. No. of WUAs registered	22	20	0	0	0	0
	b. Area covered under the WUAs (ha)	3268	2868	0	0	0	0

S. No	Components	Goa		Gujarat		Maharashtra	
		Tillari Irrigation Project		Sardar Sarovar Phase – 1		Kukadi Project	
		Plan	Ach	Plan	Ach	Plan	Ach
	c. No. of WUAs which have been handed over to the system	6	3	0	0	0	0
	d. Area covered under such WUAs (ha)	0	0	0	0	0	0
9	Monitoring anc Evaluation studies conducted for the project (No.)	0	0	0	0	0	0
10	Reclamation of waterlogged areas (Ha)	0	0	0	0	0	0
	a. No. of schemes approved by GoI	0	0	0	0	0	0
	b. Area reclaimed (ha)	0	0	0	0	0	0
11	Correction of Conveyance System Deficiencies above the outlet up to distributaries of 150 cusec capacity	NA	NA	0	0	1140	919

(Source: Project Offices in the Respective States)

**NA-Not Applicable*

**Plan-Planned, Ach-Achieved*

3.3 Financial Achievements

South Zone

i) Survey, Planning and Design Activity

The financial achievement for carrying out survey, planning and design activity was achieved by 95% in Gunder Chittar Karruppandi Project in Tamil Nadu and 13% in Kanhirapuzha Project in Kerala as against the planned targets. The survey, planning and design activity in Sriramsagar Project in Andhra Pradesh and Upper Krishna Project in Karnataka is carried out along with the main project by State Irrigation Department and hence, expenditure is not incurred by the project.

ii) OFD Works

In case of OFD works covering lined and unlined channels, achievement has been 30% in Sriramsagar Right Bank Canal Project in Andhra Pradesh, 55% in Upper Krishna Project in Karnataka, 119% in Gunder Chittar Karruppandi Project in Tamil Nadu and 35% in Kanhirapuzha Project in Kerala.

iii) Construction of Field, Intermediate and Link Drains

The financial targets with regard to construction of field, intermediate and link channels was achieved by 63% in Upper Krishna Project in Karnataka, above 90% in Gunder Chittar Karruppandi Project in Tamil Nadu and 58% in Kanhirapuzha Project in Kerala. This activity was not initiated in the Sriramsagar Project in Andhra Pradesh, hence, no expenditure incurred on it.

iv) Agriculture Extension Activities

Around 43% of the planned target was achieved with regard to adaptive trials in Kanhirapuzha Project in Kerala whereas the same was 71% for carrying out demonstration activities in Upper Krishna Project in Karnataka and 52% in Kanhirapuzha Project in Kerala. Adaptive Trials were planned for Upper Krishna Project in Karnataka but could not be conducted, hence, no expenditure incurred. In Sriramsagar Project in Andhra Pradesh and Gunder Chittar Karruppandi Project in Tamil Nadu, adaptive trials are done by the State Agriculture Department.

Similarly, in case of Sriramsagar Project in Andhra Pradesh and Gunder Chittar Karruppandi Project in Tamil Nadu, the works related to frontline demonstrations are carried out by the state agriculture departments.

v) Capacity Building Programmes

An amount of about ₹ 102 lakh was spent on capacity building of project officials and farmers in Upper Krishna Project in Karnataka whereas the same was ₹ 11.53 lakh and ₹ 4.92 lakh in case of Gunder Chittar Karruppandi Project in Tamil Nadu and Kanhirapuzha Project in Kerala. No officials could be trained in Sriramsagar Project in Andhra Pradesh during the XI Five Year Plan, hence, no expenditure incurred on the activity.

vi) One-time Functional Grant to WUAs

Upper Krishna Project in Karnataka spent above ₹ 373 lakh over one time functional grant to WUAs followed by ₹ 93 lakh in Gunder Chittar Karruppandi Project in Tamil Nadu and ₹ 4.27 lakh in Kanhirapuzha Project in Kerala. No WUAs have been registered in Sriramsagar Project in Andhra Pradesh, hence, no expenditure incurred on the same.

vii) Monitoring and Evaluation Studies

About ₹ 2 lakh has been spent on monitoring studies conducted in Gunder Chittar Karruppandi Project in Tamil Nadu across the southern states. No target was set for the same for projects in other states, hence, no expenditure incurred.

viii) Reclamation of Waterlogged Areas

An amount of above ₹ 636 lakh was also spent only in Upper Krishna Project in Karnataka region on reclamation of waterlogged areas. Target for the same was set for Kanhirapuzha Project in Kerala but since sanction is yet to be received for the revised target, no expenditure was incurred during the XI Five Year Plan period. The activity has not been initiated in Sriramsagar Project in Andhra Pradesh and Gunder Chittar Karruppandi Project in Tamil Nadu.

ix) Correction of System Deficiencies

Target was set but could not be achieved in Gunder Chittar Karruppandi Project in Tamil Nadu, hence, no expenditure. Similarly, target was set for Kanhirapuzha Project in Kerala and estimates are under preparation for its completion. The activity was not planned for Sriramsagar Project in Andhra Pradesh and Upper Krishna Project in Karnataka during the XI Five Year Plan, hence, no expenditure incurred.

Table 3.6: Project wise Cumulative Financial Achievement of XI Five Year Plan till December 2011 (South Zone) (₹ In Lakhs)

S.No	Components	Andhra Pradesh		Karnataka		Tamil Nadu		Kerala	
		Sriramsagar Project		Upper Krishna		Gunder Chittar Karruppandi		Kanhirapuzha	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
1	Survey, Planning and Design	0	0	0	0	150	143	10.8	1.34
2	OFD Works	4833	1466	19659	10859	1500	1794	285	102
3	Construction of field, intermediate and link drains	0	0	930	253	30	28	103	59.1
4	Adaptive Trials	0	0			20	0	3.25	1.41
5	Demonstration programmes	0	0	288	206	0	0	53.49	28.75
6	Trainings conducted	0	0	193	102	15	11.53	11.27	4.92
7	One-time functional grant to WUAs	0	0	445	373	90	93	13.6	4.27
8	Monitoring and Evaluation studies conducted for the project	0	0	0	0	0	2	0	0
9	Reclamation of waterlogged areas	0	0	3819	636	0	0	98.85	0
10	Correction of Conveyance System Deficiencies above the outlet up to distributaries of 150 cusec capacity	0	0	0	0	313	0	57	0

(Source: Project Offices in the Respective States)

**Plan-Planned, Ach-Achieved*

North Zone

i) Survey, Planning and Design Activity

A total expenditure incurred on survey, planning and design activity in Ranbir Canal Project in J&K, Sirhind Feeder Part-2 Command Project in Punjab, Western Yamuna Canal Phase-6 Project in Haryana, Sharda Sahayak Canal System Phase-2 Project in Uttar Pradesh and Chambal Project in Rajasthan was ₹ 48 lakh, ₹ 963 lakh, ₹ 468 lakh, ₹ 299 lakh and ₹ 81 lakh respectively. No work could be taken with regard to the activity in Cluster of 38 MI Schemes of District Una in Himachal Pradesh. The activity is carried out along with the main project by the State Irrigation Department in Harsi Project in Madhya Pradesh and Jatowala & Prateetpur Canal Project in Uttarakhand.

ii) OFD Works

The percent financial achievement for carrying out OFD works was 77% in Ranbir Canal Project in J&K, 100% in Sirhind Feeder Part-2 Command Project in Punjab, 83% in Western Yamuna Canal Phase-6 Project in Haryana and 95% in Harsi Project in Madhya Pradesh. The expenditure incurred on OFD works include ₹ 179 lakh in Cluster of 38 MI Schemes in Himachal Pradesh, ₹ 137 lakh in Jatowala and Prateetpur Canal project in Uttarakhand, ₹ 1944 lakh in Sharda Sahayak Canal System Phase-2 Project in UP and ₹ 3121 lakh in Chambal Project in Rajasthan.

iii) Construction of Field, Intermediate and Link Drains

About ₹ 361 lakh was spent on construction of field, intermediate and link drains in Ranbir Canal Project in J&K, ₹ 179 lakh in Cluster of 38 MI Schemes in Himachal Pradesh, ₹ 170 lakh in Chambal Project in Rajasthan and ₹ 2.7 lakh in Sharda Sahayak Canal System Phase-2 Project in Uttar Pradesh. In Western Yamuna Canal Phase-6 Project in Haryana, the expenditure incurred is ₹ 661 lakh which exceeds the planned target set for the same activity at ₹ 120 lakh. The activity was not taken up in Harsi Project in Madhya Pradesh, Sirhind Feeder Part-2 Command Project in Punjab and Jatowala & Prateetpur Canal Project in Uttarakhand, hence, no expenditure incurred.

iv) Agriculture Extension Activities

No expenditure was incurred on conducting adaptive trials in the projects across the states in the zone. An expenditure of ₹ 28.57 lakh and ₹ 30.41 lakh was incurred in carrying out crop demonstration in Ranbir Canal Project in J&K and in Western

Yamuna Canal Phase-6 Project in Haryana respectively whereas the same is non-existent in projects of other states.

v) Capacity Building Programmes

The figures in Table 3.7 indicate no expenditure on training of project officials and the farmers across the states except in Chambal Project in Rajasthan and Western Yamuna Canal Phase-6 Project in Haryana where an amount of ₹ 33.9 lakh and ₹ 25.91 lakh respectively, was spent on the activity.

vi) One-time Functional Grant to WUAs

An amount of above ₹ 3.65 lakh in Ranbir Canal Project in J&K and ₹ 190.55 lakh in Western Yamuna Canal Phase-6 Project in Haryana was given to WUAs as one time functional grant.

vii) Monitoring and Evaluation Studies

An amount of ₹ 11.85 lakh was spent on conducting monitoring and evaluation studies in Western Yamuna Canal Phase-6 Project in Haryana. The activity was not planned for projects in other states, hence, no expenditure.

viii) Reclamation of Waterlogged Areas

Expenditure to the tune of ₹ 149.15 lakh was incurred on reclamation of waterlogged areas in Western Yamuna Canal Phase-6 Project in Haryana. It was not planned for projects in other states in the north zone, hence, no expenditure.

ix) Correction of System Deficiencies

An expenditure of above ₹ 7238 lakh was also incurred on correction of system deficiencies in Chambal Project in Rajasthan only.

Table 3.7: Project wise Cumulative Financial Achievement of XI Five Year Plan till December 2011 (North Zone) (₹ In Lakhs)

SN	Components	J&K		Punjab		Haryana		Himachal		*Uttarakhand		UP		Rajasthan		MP	
		Ranbir Canal		Sirhind Feeder Project Part -2		Western Yamuna Canal Phase – 6		Cluster of 38 MI Schemes in Una District		Jatowala and Prateetpur canal		Sharda Sahayak Canal System Phase-2		Chambal Command Area		Harsi Project	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
1	Survey, Planning and Design	69.05	48.89	963.7	963.70	606.90	468.11	0	0	0	0	299.56	299.56	95.20	81.12	0	0
2	OFD Works	3469.69	2690.75	15939.7	15939.7	10411.00	8723.91	179.5	179.5	137.6	137.6	1944.27	1944.27	3259.9	3121.6	1643.84	1562.88
3	Construction of field, intermediate and link drains	482.89	361.07	0	0	120.00	661.30	0	0	0	0	2.73	2.73	189.26	170.02	0	0
4	Adaptive Trials	0	0	0	0	0	0	0	0	0	0	0	0	NA	NA	0	0
5	Demonstration programmes	39.44	28.57	0	0	33.00	30.41	0	0	0	0	0	0	0	0	0	0
6	Trainings conducted	0	0	0	0	45.50	25.91	0	0	0	0	0	0	51	33.9	0	0
7	Onetime functional grant to WUAs	4.45	3.65	0	0	468.48	190.55	0	0	0	0	0	0	0.08	0	0	0
8	Monitoring and Evaluation studies conducted for the project	0	0	0	0	15.60	11.85	0	0	0	0	0	0	0	0	0	0

SN	Components	J&K		Punjab		Haryana		Himachal		*Uttarakhand		UP		Rajasthan		MP	
		Ranbir Canal		Sirhind Feeder Project Part -2		Western Yamuna Canal Phase – 6		Cluster of 38 MI Schemes in Una District		Jatowala and Prateetpur canal		Sharda Sahayak Canal System Phase-2		Chambal Command Area		Harsi Project	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
9	Reclamation of waterlogged areas	0	0	0	0	217.50	149.15	0	0	0	0	0	0	0	0	0	0
10	Correction of Conveyance System Deficiencies above the outlet up to distributaries of 150 cusec capacity	0	0	0	0	0	0	0	0	0	0	0	0	7954	7238.02	0	0

(Source: Project Offices in the Respective States)

**Plan-Planned, Ach-Achieved*

******Uttarakhand*** *- All the projects in the state are completed; however, there is no on-going project in XI Five Year Plan. The representative figures shown in the table above are for the IX and X Five Year Plan period (2001-2004).*

East Zone

i) Survey, Planning and Design Activity

An amount of ₹ 248.71 lakh was spent on carrying out survey, planning and design works in Damodar Valley Canal System Project in West Bengal whereas the same was ₹ 1.1 lakh in Kanchi Weir Scheme in Jharkhand and ₹ 43.66 lakh in Gandak Project in Bihar.

ii) OFD Works

An expenditure of above ₹ 664 lakh was incurred on OFD works in Damodar Valley Canal System Project in West Bengal, ₹ 1129 lakh in Hirakud Project in Odisha, ₹ 4934 lakh in Gandak Project in Bihar and ₹ 9402 lakh in Hasdeo Phase-2 Project in Chhattisgarh.

iii) Construction of Field, Intermediate and Link Drains

The expenditure incurred on construction of field, intermediate and link drains was above ₹ 244 lakh in Hirakud Project in Odisha and ₹ 1355.98 lakh in Gandak Project in Bihar.

iv) Agriculture Extension Activities

No expenditure has been incurred on adaptive trials across the states. However, an amount of ₹ 12.84 lakh was incurred as against the planned target of ₹ 57.09 lakh in Gandak Project in Bihar for carrying out demonstration activities.

v) Capacity Building Programmes

An expenditure of ₹ 3.25 lakh incurred on capacity building of project officials and the farmers in Damodar Valley Canal System Project in West Bengal whereas the same was ₹ 3.74 lakh in Kanhci Weir Scheme in Jharkhand, ₹ 13.46 lakh in Gandak Project in Bihar and ₹ 23.4 lakh in Hasdeo Phase-2 Project in Chhattisgarh.

vi) One-time Functional Grant to WUAs

An amount of ₹ 585 lakh was given as one time functional grant to WUAs only in Hasdeo Phase-2 Project in Chhattisgarh.

vii) Monitoring and Evaluation Studies

Above ₹ 40 lakh were spent in Gandak Project in Bihar for conducting monitoring and evaluation studies whereas the same is insignificant in the remaining states.

viii) Reclamation of Waterlogged Areas

An amount of above ₹ 185 lakh was spent in Gandak Project in Bihar for reclamation of waterlogged areas.

ix) Correction of System Deficiencies

No expenditure was incurred on this activity in the projects across the states in the zone.

Table 3.8: Project wise Cumulative Financial Achievement of XI Five Year Plan till December 2011 (East Zone) (₹ In Lakhs)

SN	Components	West Bengal		Odisha		Jharkhand		Bihar		Chhattisgarh	
		Damodar Valley Corporation		Hirakud		Kanchi Weir Scheme		Gandak		Hasdeo Phase-2	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
1	Survey, Planning and Design	248.71	248.71	0	0	1.10	1.10	419.56	43.66	0	0
2	OFD Works	664.12	664.12	1129.5	1129.5	0	0	8344.78	4934.51	9720	9402
3	Construction of field, intermediate and link drains	0	0	244.52	244.52	0	0	4138.6	1355.98	0	0
4	Warabandi	0	0	0	0	0	0	0	0	0	0
5	Adaptive Trials	0	0	0	0	0	0	0	0	0	0
6	Demonstration programmes	0	0	0	0	0	0	57.09	12.84	0	0
7	Trainings conducted	7.07	3.25	0	0	3.74	3.74	40.36	13.46	53	23.4
8	Onetime functional grant to WUAs	0	0	0	0	0	0	0	0	585	585
9	Monitoring and Evaluation studies conducted for the project	2.05	0.255	0	0	0	0	35.94	40.37	0	0
10	Reclamation of waterlogged areas	0	0	0	0	0	0	837.34	185.51	0	0
11	Correction of Conveyance System Deficiencies above the outlet up to distributaries of 150 cusec capacity	0	0	0	0	0	0	0	0	0	0

(Source: Project Offices in the Respective States)

**Plan-Planned, Ach-Achieved*

North East Zone

i) Survey, Planning and Design Activity

Medziphema Bowl Project in Nagaland, Cluster of 62 MI Schemes in Arunachal Pradesh and Thoubal Irrigation Phase-2 Project in Manipur spent cent percent amount as planned for carrying out survey, planning and design activities whereas the same was insignificant in the remaining states.

ii) OFD Works

In case of OFD works, 40% of the planned budget was realized in Dakadong Project in Assam whereas the same was 93% in Medziphema Bowl Project in Nagaland, 58% in Thoubal irrigation Phase-2 Project in Manipur, 100% in Cluster of 62 MI Schemes in Arunachal Pradesh and 66% in Cluster of 6 MI Schemes in Meghalaya. No expenditure was incurred in Cluster of 21 MI Schemes in Sikkim, Cluster of 4 MI Projects in Tripura and Cluster of 40 MI Projects in Mizoram with regard to OFD works.

iii) Construction of Field, Intermediate and Link Drains

The expenditure incurred on construction of field, intermediate and link drains was about ₹ 71 lakh in Dakadong Project in Assam, ₹ 106 lakh in Medziphema Bowl Project in Nagaland, ₹ 61 lakh in Thoubal irrigation Phase-2 Project in Manipur and ₹ 44 lakh in Cluster of 62 MI Schemes in Arunachal Pradesh.

iv) Agriculture Extension Activities

Above ₹ 15 lakh in Thoubal Irrigation Phase-2 Project in Manipur was spent for carrying out the demonstration activities where as the same was non-existent in projects in other states.

v) Capacity Building Programmes

An expenditure of about ₹ 3.32 lakh in Medziphema Bowl Project in Nagaland and ₹ 8.57 lakh in Thoubal Irrigation Phase-2 Project in Manipur was incurred on capacity building of the project officials and the farmers whereas the same was not incurred in the remaining states.

vi) One-time Functional Grant to WUAs

Around ₹ 18.9 lakh in Medziphema Bowl Project in Nagaland and ₹ 12.40 lakh in Cluster of 62 MI Schemes in Arunachal Pradesh was given to WUAs as one time functional grant.

vii) Monitoring and Evaluation Studies

About ₹ 3.5 lakh was spent on conducting monitoring and evaluation studies in Medziphema Bowl Project in Nagaland, with projects in the other states not having initiated this activity.

viii) Reclamation of Waterlogged Areas

No expenditure was incurred on this activity in the projects across the states in the zone.

ix) Correction of System Deficiencies

No expenditure was incurred on this activity in the projects across the states in the zone.

Table 3.9: Project wise Cumulative Financial Achievement of XI Five Year Plan till December 2011 (North-East Zone) (₹ in Lakhs)

S. No	Components	Assam		Nagaland		Manipur		**Mizoram		Arunachal		**Sikkim		**Tripura		**Meghalaya	
		Dakadong		Medziphema Bowl		Thoubal Irrigation Project Phase-2		Cluster of 40 MI Schemes		Cluster of 62 MI Schemes		Cluster of 21 MI Schemes		Cluster of 4 MI Projects		Cluster of 6 MI Schemes	
		Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach	Plan	Ach
1	Survey, Planning and Design	0	0	22.17	22.17	24.85	24.85	0	0	8.27	8.27			0.372	0	2.62	2
2	OFD Works	1178.7	478.5	436.16	409.6	546.7	317.5	0	0	319.9	319.9			32.40	0	66.75	43.29
3	Construction of field, intermediate and link drains	70.90	70.90	66.5	106.1	90	61.5	0	0	43.89	43.89			12	0	6.92	0
4	Adaptive Trials	0	0	1.49	0			0	0	0	0			2.24	0	13.74	0
5	Demonstration programmes	0	0	3.086	0	12.33	15.07	0	0	0	0			0	0	0	0
6	Trainings conducted	0	0	6.65	3.32	9.44	8.57	0	0	0	0			1.10	0	0	0
7	Onetime functional grant to WUAs	0	0	14.96	18.90	24.84	0	0	0	12.40	12.40			0.508	0	2.42	0
8	Monitoring and Evaluation studies conducted for the project	0	0	4.9	3.5	0	5	0	0	0	0			0	0	0	0
9	Reclamation of waterlogged areas	0	0	0	0	0	0	0	0	0	0			0	0	2.06	0
10	Correction of Conveyance System Deficiencies above the outlet up to distributaries of 150 cusec capacity	0	0	0	0	0	0	0	0	0	0			0	0	16.64	0

(Source: Project Offices in the Respective States)

**Plan-Planned, Ach-Achieved*

****Mizoram: The representative figures are only for one year because the project was completed in 2006-07.**

****Sikkim: No On-going project in XI Five Year Plan in the state.**

****Tripura: No funds received after 2006-07.**

****Meghalaya: The project was included in the CADWM programme in 2010-11. The representative figures are from 2010 to Sep 2011 only.**

West Zone

i) Survey, Planning and Design Activity

The percent achievement as against the planned targets was 100% in Tillari Irrigation Project in Goa for carrying out survey, planning and design activity whereas the same was 89% in case of Kukadi Project in Maharashtra. The activity was carried out by State Irrigation Department in Sardar Sarovar Phase-1 Project in Gujarat, hence, no expenditure incurred by the project.

ii) OFD Works

The OFD works completed with an achievement of 100% in Tillari Irrigation Project in Goa, 105% in Sardar Sarovar Phase-1 Project in Gujarat and 78% in Kukadi Project in Maharashtra.

iii) Construction of Field, Intermediate and Link Drains

The financial achievement with regard to construction of field, intermediate and link drains was 100% in case of Sardar Sarovar Phase-1 Project in Gujarat.

iv) Agriculture Extension Activities

An expenditure of ₹ 5.88 lakh was incurred on adaptive trials and demonstration in Tillari Irrigation Project in Goa whereas the activities were not taken up in Sardar Sarovar Phase-1 Project in Gujarat and Kukadi Project in Maharashtra.

v) Capacity Building Programmes

The achievement in case of training of project officials and farmers was around 100% in Tillari Irrigation Project in Goa, 106% in Sardar Sarovar Phase-1 Project in Gujarat and 88% in Kukadi Project in Maharashtra.

vi) One-time Functional Grant to WUAs

An amount of about ₹ 49 lakh and ₹ 177 lakh was given to WUAs as one time functional grant in Tillari Irrigation Project in Goa and in Sardar Sarovar Phase-1 Project in Gujarat respectively.

vii) Monitoring and Evaluation Studies

No expenditure was incurred on this activity in the projects across the states in the zone.

viii) Reclamation of Waterlogged Areas

No expenditure was incurred on this activity in the projects across the states in the zone.

ix) Correction of System Deficiencies

An amount of ₹ 32 lakh was spent on correction of system deficiencies in Kukadi Project in Maharashtra. The activity was not initiated in Sarovar Phase-1 Project in Gujarat and it was not applicable in Tillari Irrigation Project in Goa, hence, no expenditure incurred on them.

Table 3.10: Project wise Cumulative Financial Achievement of XI Five Year Plan till December 2011 (West Zone) (₹ In Lakhs)

S. No.	Components	Goa		Gujarat		Maharashtra	
		Tillari Irrigation Project		Sardar Sarovar Phase – 1		Kukadi Project	
		Plan	Ach	Plan	Ach	Plan	Ach
1	Survey, Planning and Design	97.71	97.71	0	0	299	268.42
2	OFD Works	4451.18	4451.18	12098.39	12735.5	4800	3756.54
3	Construction of field, intermediate and link drains	NA	NA	21.88	21.88	0	0
4	Adaptive Trials	0	0	0	0	0	0
5	Demonstration programmes	9.88	5.88	0	0	0	0
6	Trainings conducted	35.43	35.43	65.66	71.61	49.5	44.46
7	Onetime functional grant to WUAs	49.84	49.84	176.21	177.69	0	0
8	Monitoring and Evaluation studies conducted for the project	0	0	0	0	0	0
9	Reclamation of waterlogged areas	0	0	0	0	0	0
10	Correction of Conveyance System Deficiencies above the outlet up to distributaries of 150 cusec capacity	0	0	0	0	37	32

(Source: Project Offices in the Respective States)

**Plan-Planned, Ach-Achieved*

3.4 Expenditure Pattern

Cost sharing is an important part of CADWM programme. In addition to the central and state governments, the beneficiary farmers are also expected to share towards the project cost in form of cash or kind. The concept of beneficiary contribution is linked to create a sense of ownership of the project and subsequently maintain the structures and the systems created in the command area with a view to ensure sustainability.

As per the details given in Table 3.11 below, the utilisation pattern of the central share by the projects varies from 18% in Uttarakhand to 74% in Himachal Pradesh. The share of state government in CADWM varies from 8% in Mizoram to 82% in Uttarakhand. The farmers' contribution ranges from 2% to 5% in Karnataka, Uttar Pradesh, West Bengal, Bihar and Nagaland. The farmers have contributed in the range of 8-10% in Tamil Nadu, Kerala, Jammu & Kashmir and Punjab whereas the same is 28% in case of Mizoram. The concept of farmers' contribution has not been initiated in the remaining states. Since the project in Jharkhand is at the stage of survey, planning and design activity, the work has been contracted out to WAPCOS for which State funds have been utilised, hence, no Central Assistance has been utilised.

Table 3.11: Expenditure Pattern for the XI Five Year Plan till December 2011

S. No	State	Project	Total Expenditure* (₹ In Lakhs)	% Cost Sharing		
				GoI	State	Community
1	Andhra Pradesh	Sriramsagar Right Bank Canal	1515.67	50	50	0
2	Karnataka	Upper Krishna Project	59895.7	50	40	10
3	Tamil Nadu	Gundar Chittar Karruppandi	2813.59	48	42	10
4	Kerala	Kanhirapuzha Project	1000	45	45	10
5	Jammu & Kashmir	Ranbir Canal Project	3527.494	45	45	10
6	Punjab	Sirhind Feeder Part 2 Command Project	20244.22	50	42	8
7	Haryana	Western Yamuna Canal Phase -6	509.73	56	44	0
8	Himachal Pradesh	Clusters of 38 MI Schemes in Pandonga Haroli, Saloh Area in Tehsil Una of District Una	292.50	74	26	0
9	Uttarakhand	Jatowala and Prateetpur Canal Project	137.75	18	82	0
10	Uttar Pradesh	Sharda Sahayak Canal System Phase – 2 Project	2746.52	33	62	5
11	Rajasthan	Chamba Project	10644.68	50	40	10
12	Madhya Pradesh	Harsi Project	3326.32	50	40	10
13	West Bengal	Damodar Valley Canal System	1207.86	50	48	2
14	Odisha	Hirakud Project	2967.74	54	46	0
15	*Jharkhand*	Kanchi Weir Scheme	*0*	*0*	*0*	*0*
16	Bihar	Gandak Project	11207.5	34	62	4
17	Chhattisgarh	Hasdeo Phase 2	10207.56	55	45	0
18	Assam	Dakadorg Project	627.95	50	50	0

S. No	State	Project	Total Expenditure* (₹ In Lakhs)	% Cost Sharing		
				GoI	State	Community
19	Nagaland	Medziphema Bowl project	664.34	49	47	4
20	Manipur	Thoubal Irrigation Project Ph-2	462	22	78	0
21	Mizoram	Cluster of 40 MI Projects consisting of 36 (29 Flow and 7 Lift Schemes) in Aizwal Districts and 4 MI Flow Schemes in Lunglai Districts	23.31	64	8	28
22	Arunachal Pradesh	Clusters of 62 MI in 4 Panchayats in districts of Papumpare, Namley, Sagalee, Megio, Balijan and Itanagar	438.14	50	50	0
23	Sikkim	Cluster of 21 MI Schemes of South & West Districts of Sikkim	0	0	0	0
24	Tripura	Cluster of 4 MI Projects	0	0	0	0
25	Meghalaya	Clusters of 6 MI Schemes-Kynrut, Phudumjer, Nongtraw, Khurakol, Nekora, Madan Umtheid	45.29	64	36	0
26	Goa	Tillari Irrigation project	3472.61	50	40	10
27	Gujarat	Sardar Sarovar Phase – 1	3702.6	51	49	0
28	Maharashtra	Kukadi Project	5649.31	43	51	6

(Source: Project Offices in the Respective States)

** Total Expenditure includes the expenditure incurred on CAD Establishment*

3.5 Activity wise Achievement of CADWM Components

The physical achievement of the various CADWM components like On Farm Development (OFD) works, Correction of System Deficiencies, Construction of Field Drains and Reclamation of Waterlogged Areas has been analysed below for on-going projects.

Table 3.12: Cumulative Achievement of OFD works (South Zone)

S. No	Projects	Physical Achievement (Ha)
	Andhra Pradesh	
1.	Sriramsagar Project	426009
2.	Srisailam R.B.C Project	40940
	Karnataka	
3.	Tungabhara	354615
4.	Upper Krishna	567260
5.	Bhadra Resevior	92196
6.	Malaprabha	193588
7.	Ghataprabha	261909
8.	Karanja Irrigation project	20922
9.	Anarja	35
10.	Bennithora	19891
11.	Upper mullamari	3279
12.	Gondhorinalla	8094
13.	Lower Mullamari	9713
14.	Chlkinalla	4047
	Tamil Nadu	
15.	Vaigai Project	22485
16.	Kodangar Reservoii	2748
17.	Wellington Reservoir	9650
18.	Gunder-Chittar-Karuppanadi	15002
19.	Kodiveri Anicut	8884
20.	Thirukoilur Anicut	9466
	Kerala	
21.	Kallada Irrigation Project	225
22.	Kanhirapuzha	7229
23.	Pazhassi Irrigation Project	1882
24.	Muvatumujha Valley Irri. Project	113
	Total	**2080182**

(Source: Project Offices in the Respective States)

The figures in Table 3.12 indicate physical achievement of OFD works carried out in 2 2 projects in Andhra Pradesh, 12 projects in Karnataka, 6 projects in Tamilnadu and 4 projects in Kerala. The cumulative physical achievement with regard to OFD works ranges between 1 to 5.7 lakh ha in case of Sriram Sagar project in AP and Tungbhadra, Upper Krishna, Malaprabha and Ghataprabha projects in Karnataka. Srisailam project in AP and Bhadra Reservoir in Karnataka achived their targets in the range varying from 40 thousand to 1 lakh ha. Two projects each in Karnataka and Tamilnadu carried out OFD work on command area ranging between 15,000 ha to 23,000 ha. OFD work was taken up on command area varying from 1,882 ha to 9,713 ha by 40% of the projects covering 4 each in Karnataka and Tamilnadu followed by 2 projects in Kerala. The projects like Kallada and Muvattupuza Valley projects in Kerala carried out OFD works on less than 250 ha whereas the same was on 35 ha only in case of Amarja project in Karnataka.

Table 3.13: Cumulative Achievement of OFD works (North Zone)

S. No	Name of State/Project	Physical Achievement (ha)
	Jammu & Kashmir	
1.	Zainageer Canal	4044
2.	Duchnipora Rajpora-Tral	4321
3.	Kahmil-Kupwara	1826
4.	Tongri	97
5.	Ganderbal	0
6.	Dehgam-Veerinag	2256
7.	Arin Bandipora	1586
8.	Ferozpora-Tangmarg	857
9.	Uri-Narvaw	0
10.	Ahaji-Beerwah	1250
11.	Vaishow	0
12.	Kargil	0
13.	Ranbir Canal	16134
14.	Doda-Sangaldhan Gool-Rajouri Cluster	3121
15.	Sonawari	97
16.	New Pratap Canal Project of Jammu CADA	250
17.	Ego-Phey Canal	873
	Punjab	
18.	Upper Bari Doab canal command	32127
19.	Srihind feeder part-II command	95654
20.	Bhatinda Br Part II	58694
	Haryana	
21.	Bhakra canal project phase-II	65325
22.	Western Yamuna canal phase-VI	56257
23.	JLN canal phase-II	5667
	Himachal Pradesh	
24.	Cluster of 12 Nos MI Schemes (Shimla)	232

S. No	Name of State/Project	Physical Achievement (ha)
25.	Cluster of 27 MI Schemes (Solan)	260
26.	Shah Nahar Project, Kangra	0
27.	Cluster of 42 MI Scheme Teshil Sarkaghat of District Mandi	870
28.	Cluster of 40 MI schemes in Dang and Sardar Block of District Mandi	1300
29.	Cluster of 38 MI schemes in Pandonga Haroli, Saloh area in Tehsil Una of Dist Una	1108
30.	Cluster of various MI schemes in Paonta & Shillai tehsil in distt. Sirmour	0
	Uttarakhand	
31.	Laster canal's Offshoots	0
32.	Jatowala & Prateetpur Canal	262
33.	Tumaria Dam Canal System	2094
34.	Nathuwala & Balawala Canals	1605
	Uttar Pradesh	
35.	Sirsee dam Canal	0
36.	Sharda Canal system	913000
37.	Sharda Sahayak Phase-2	27000
38.	Saryu Phase 2	12000
39.	Tumaria Dam Canal System	23010
40.	East Gang Canal	73970
41.	Lower Rajghat	11000
42.	Betwa & Gursarai Canal	262640
43.	Ken Canal System	108240
44.	Belan Pump Canal System	42540
45.	Tons Pump Canal System	26940
46.	Jakhloun Pump Canal System	10000
47.	Son Pump Canal System	48600
48.	Upper Ganga Canal	363510
49.	Madhya Ganga	73550
	Rajasthan	
50.	Amar Singh Sub Branch and jassana district of Bhakra Canal System(ASSBP)	26230
51.	Sidhmukh Nohar Irrigation Project (SNIP)	94539
52.	Gang Canal Project (G.C.P)	0
53.	Chambal	115411
54.	Bisalpur Project	31605
	Madhya Pradesh	
55.	Kolar	10721
56.	Rani Avanti Bai (Bargi)	31004
57.	Upper Wainganga	93087
58.	Bagh	14782

S. No	Name of State/Project	Physical Achievement (ha)
59.	Harsi	36193
60.	Kunwar Chain Sagar	2026
61.	Rajghat Canal Project	0
62.	Bariyarpur Left Bank Canal	0
63.	Bansagar Project	0
	Total	**2809765**

(Source: Project Offices in the Respective States)

Table 3.13 indicates the cumulative physical achievement of OFD works across the on-going projects falling under north zone. Out of 63 projects, 4 projects in Uttar Pradesh and Chambal project in Rajasthan have carried out OFD works over 1 lakh ha with a maximum coverage in Sharda Sahayak Phase-II (9,13,000 ha). Nearly 16% of the projects in Punjab (2), Haryana (2), Uttar Pradesh (5), Rajasthan (1) and Madhya Pradesh (1) carried out OFD work on command area varying from 40,000 ha to 1 lakh ha. The command area covered under OFD work varies from 10,000 ha to 40,000 ha by around 22% of the projects mainly in Jammu Kashmir (1), Punjab (1), Uttar Pradesh (6), Rajasthan (2) and Madhya Pradesh (4).

Less than 21% of the projects achieved the physical targets ranging from 1,000 ha to 10,000 ha especially in Jammu & Kashmir (7) followed by 2 projects each in Himachal Pradesh and Uttarakhand and 1 project each in Haryana and Madhya Pradesh. Slightly above 14% of the projects covered command area under OFD works with a figure varying from 97 ha to 873 ha mainly in Jammu & Kashmir (5), Himachal Pradesh (3) and 1 each in Uttarakhand and Madhya Pradesh. OFD work could not be undertaken by 19% of the projects in Jammu & Kasmir (4), Madhya Pradesh (3) and 2 each in Uttarakhand and Himachal Pradesh followed by 1 each in Uttar Pradesh and Rajasthan.

Table 3.14: Cumulative Achievement of OFD works (East Zone)

S.No.	Name of State/Project	Physical Achievement (ha)
	West Bengal	
1.	D.V.C System	47711
2.	Kangsabati	71979
3.	Mayurakshi	30616
4.	Teesta Barrage	4361
	Odhisa	
5.	Sunie Irrigation Project	1850
6.	Jaimangla	1852
7.	Hirakud	141355
8.	Mahanadi delta	24179
9.	Rushikulya	15695
10.	Rengali Irrigation Project, Phase –I	0
11.	Salandi Right	11137
12.	Baitarani	8395
13.	Potteru	15663
14.	Upper Kolab	16808
15.	Gohira irrigation project	1600
16.	Upper Indrawati major irrigation project	2004
17.	Remal irrigation project	1650
	Jharkhand	
18.	Kanchi Weir Irrigation Scheme	0
19.	Mayurakshi left bank canal system	0
	Bihar	
20.	Gandak	611596
21.	Badua and Chandan	64475
22.	Lower Kuil	13874
23.	Kosi	417350
24.	Sone	468000
25.	North Koel Project	3503
	Chhattisgarh	
26.	Ballar	4362
27.	Khapri irrigation project	0
28.	Hasdeo Phase –II	91770
29.	Mahanadi, Tandula, Kodar and Jonk	217087
	Total	**2288872**

(Source: Project Offices in the Respective States)

Table 3.14 provideds the physical achievement with regard to 29 projects under east zone covering 3 projects in West Bengal, 13 in Orissa, 2 in Jharkhand, 6 in Bihar and 4 projects in Chhattisgarh. Bihar has 3 projects covering above 1 lakh ha of command area under OFD works which is followed by 1 project each in West Bengal and

Chhattisgarh. The command area ranging between 40,000 ha and 1 lakh ha is covered under 2 projects in West Bengal followed by 1 project each in Bihar and Chhattisgarh. Nearly one-fourth of the projects covering an area between 10,000 ha and 40,000 ha fall in West Bengal (1), Odhisa (5) and Bihar (1) whereas the same is in around one-third of the projects rangeing between 1,000 ha and 10,000 ha in 6 projects in Odhisa followed by 1 project each in West Bengal, Bihar and Chhattisgarh. Both the projects in Jharkhand and 1 project each in Odhisa and Chhattisgarh could not initiate OFD work in their command areas.

Table 3.15: Cumulative Achievement of OFD works (North-East Zone)

S.No.	Name of State/Project	Physical Ach. (ha)
	Assam	
1.	Dakadong	3250
2.	Bardikarai Irrigation	296
3.	Kaldiya	7310
4.	Pahumara Irrigation	0
	Nagaland	
5.	**Cluster of 13 MI Projects at Changki Valley	0
	Manipur	
6.	Cluster of 21 M.I. Schemes under Dist. Bishnupur	4746
7.	Cluster of 28 M.I. Schemes (Imphal East & West)	5743
8.	Khuga Multipurpose Project	0
9.	Cluster of 37 M.I. Schemes (Thoubal, Ukhrul Chandel)	4624
10.	Thoubal Irrigation Project, Ph-II	0
	Mizoram	
11.	**Cluster of 5 MI Projects	0
12.	**Cluster of 60 MI Schemes-II (Aizawl, Lunget)	0
	Arunachal Pradesh	
13.	Cluster of 102 MI Schemes (Daporijo & Itanagar)	4032
14.	Cluster of 62 MI Schemes	2760
15.	Cluster of 39 MI schemes under Namsai circle	1835
	Sikkim	
16.	Cluster of 17 MI of North & East districts	0
17.	Cluster of 21 MI schemes of South & West district	107
	Tripura	
18.	Cluster of 4 Minor irrigation projects	168
	Meghalaya	
19.	Cluster of 10 MI schemes viz. Tienglam, Pdern etc.	1354
20.	Cluster of 6 MI schemes (Kynrut, Phudumjer, etc.)	120
	Total	**36345**

*(** **Progress up to December 2011);** Source: Project Offices in the Respective States)*

The progress of OFD works in North-East is presented in Table 3-15 for 20 projects. Around one-fourth of the projects in Assam (2), Manipur (3) and Arunchal Pradesh (1) have made a progress on OFD works covering a command area varying from 3250 ha to 7310 ha. The Cluster of 62 MI Scheme, Cluster of 39 MI schemes (Namsai circle) in Aruncahl Pradesh and Cluster of 10 MI schemes (Tienglam) in Meghalaya have achived their targets with 2760 ha, 1835 ha and 1354 ha respectively. The progress of OFD works in remaining projects is less than 170 ha. As indicated in the table, 7 projects in North-East have not initiated OFD works in their respective areas.

Table 3.16: Cumulative Achievement of OFD works (West Zone)

	Name of State/Project	Physical Achievement (ha)
	Goa	
1.	Tillari Irrigation	3501
	Gujarat	
2.	Sardar Sarovar Phase-I	264836
	Maharashtra	
3.	Chaskaman	34660
4.	Khadakwasla	46457
5.	Surya	1100
6.	Krishna	72849
7.	Upper Penganga	81254
8.	Lower Wunna	17361
9.	Nandur Madumeshwar canal	6900
10.	Bhima	111063
11.	Kukadi	138361
12.	Dhombalkawadi Irrigation Project	50
	Total	**778392**
	GRANT TOTAL	**7993556**

(Source: Project Offices in the Respective States)

As per the details given in Table- 3.16, Sardar Sarovar in Gujarat and Bhima & Kukadi in mharastra have covered an area above 1 lakh ha under OFD works. Only 3 projects in Maharastra and 1 in Goa have covered less than 4,000 ha of command area under OFD works whereas Dhombalkawadi Irrigation Project has covered only 50 ha.

Table-3.17: Cumulative Achievement of Correction of System Deficiency (CSD), Field Drains and Reclamation of Waterlogged Areas in 11th Five Year Plan

S. No	States	Field Drains (ha)	CSD Works (ha)	Waterlogged Areas (ha)
1.	Arunachal Pradesh	716	0	0
2.	Bihar	13820	0	14415
3.	Gujarat	451	0	0
4.	Haryana	16979	0	0
5.	Jammu & Kashmir	24255	0	4914
6.	Karnataka	82137	10381.86	13152.54
7.	Kerala	3422	0	0
8.	Madhya Pradesh	0	11451	0
9.	Maharastra	2933	5985.69	3546
10.	Manipur	16133	5421	0
11.	Mizoram	545	0	0
12.	Orissa	14644	0	1100
13.	Rajasthan	5178	154672.47	0
14.	Tamilnadu	124907	24022	0
15.	Uttar Pradesh	43517	0	5321
	Total	**349637**	**211934**	**42448.54**

As per the details given in Table-3.17, the construction of field drains has been reported in 15 states whereas the activities with regard to correction of system deficiency and reclamation of waterlogged areas was taken in 6 states each. Andhra Pradesh, Assam, Chhattisgarh, Goa, Himachal Pradesh, Jharkhand, Punjab, Sikkim, Meghalaya, Nagaland, Tripura, Uttarakhand and West Bengal did not report on progress of these activities.

3.6 Fund Flow Mechanism

The broad framework within which the fund flow mechanism works nationwide involves the Centre, State and the Project offices. A Memorandum of Understanding (MoU) is signed between the Central and State Governments. Based on the MoU, proposals and annual budget plans are submitted by respective projects to the State offices for consolidation which are then forwarded to CADWM Division MoWR Delhi. The consolidated proposals are submitted to the CADWM office, MoWR, Delhi. The respective Joint Commissioners review the proposals before forwarding it to the Internal Finance Department (IFD) for approval. IFD scrutinises the proposals and puts forward queries to CADWM-Delhi, if any. If CADWM does not have a satisfactory response to the raised query, it gets back to the respective State Offices for addressing to the quenry. Once the query is responded and IFD is satisfied, IFD

sends it back to CADWM from where the work order is released. After the release of work order, funds are disbursed accordingly to the respective State Governments which in turn release the same to the CADWM on instalment basis. The utilisation certificate is sent to the MoWR for receiving the next instalment.

Timeliness in receipt of funds is a critical input for execution of CADWM works at project level. However, the efficiency of fund flow mechanism is guided by various factors including timing of submission of the proposals from project to state to centre, quality & quantiy of information required for sanctioning the project, time taken at state level for consolidation and submission to centre, time taken at CADWM Delhi for submission to IFD, time taken at IFD level for approval and release of the funds to state treasury, time taken in receipt of funds from state treasury to the department and subsequently to the project, submission of utilisation certificate, etc.

The peak season for carrying out construction activities under CADWM varies from one location to the other depending upon seasonal variations, labour availability, festivals, etc. Threrefore the complete cycle of fund flow mechanism is corelated to achievement of physical and financial targets of the project. The findings from field visists to various projects across the country refelect the key concerns with regard to timely receipt of funds for execution.

The state office in Andhra Pradesh does not wait for reciept of central share and goes ahead with disbursement of state funds to the projects for execution. Kerala and *Tamil Nadu* claim to follow the laid procedures and are satisfied with receipt of funds from Government of India on time. The state officials in Karnataka feel that they may be given the liberty to utilise Central assistance, without waiting for the formal approval from MoWR in respect of the centrally sponsored schemes like land reclamation, correction of system deficiencies etc; within the upper ceiling limits

In northern states, the funds from the Central Government are transferred to the state treasury from where it flows to CADA. CADA transfers the funds to the project without any delay. According to the state officials, there is no delay in funds flow from the state office to the project work. However, the same is delayed from CADWM office, MoWR, GoI. In Himachal Pradesh, there is a delay from the state office due to the State's inability to put the matching share. In *Haryana*, as per officials, no funds have been received till date for the project.

In Odhisa, West Bengal, Chhattisgarh and Bihar, there is no delay in funds flow either from the Centre or from the State Government. However, sometimes the delay occurs due to reconciliation of grants-in-aids. According to officials in Jharkhand, no

Central fund has been provided till date by the Government of India. The delay has been in the time period from 2006-07 to 2008-09 and the reason for the same is the delay in signing of MoU between the MoWR, GoI and Water Resources Department for completion of Kanchi CADWM Project.

In *Assam*, the fund from the Central Government is routed through Department of Planning & Development and Department of Finance before it is sent to the Irrigation Department which leads to delay. In *Nagaland, Manipur and Meghalaya*, the funds from the Central Government are transferred to the state treasury from where it flows to Department. According to the state officials, the funds at all the levels are transferred on time. In *Sikkim and Arunachal Pradesh*, the states receive funds from the GoI on time and subsequently, disburse funds to the projects on time.

In *westernzone*, the funds from the Central Government are transferred to the state treasury from where it flows to GTIDC. GTIDC transfers the funds to the project without any delay. According to the state officials, there is no delay in funds flow from the state office to the project work. However, the same is delayed from CADWM office, MoWR, GoI. The experience of officials in Gujarat and Maharastra is quite similar to as in Goa.

Conclusions

As mentioned above, some of the projects claim delayed receipt of funds. However, delays are procedural. If the State submits the pre-requisite documents at the end of the financial year to the Centre, fund disbursal is bound to get delayed. Also, if the State falls short of submitting the fund utilisation certificate for the current time period, fund disbursal gets delayed. Late submission of release proposals from States and proper formats not being used also account for delay in release of fund.

3.7 Holistic, Integrated and Coordinated Approach

The holistic approach relates to community managed command area with a view to maximise sustainable crop productivity, production and income of the beneficiaries per unit of water discharged from the outlet addressing the issues of equitable distribution of benefits and environmental sustainability. The concept of Participatory Irrigation Management (PIM) emphasises on multi-faceted approach and strategy with regard to equitable water distribution through Warabandi, water use efficiency, effective crop planning in accordance with water supply, maintenance of structures created in the command area, sustainability of farmers' institutions, convergence with government schemes and programmes, establishing linkages with government departments, non-government organisations (NGOs) and private

agencies to enhance productivity, production and marketing. The approach primarily relates with effective planning & identification of critical needs, identification of different stakeholders, sensitisation and capacity building of stakeholders, establishing workable relationships with different stakeholders including convergence with different programmes and schemes, effective monitoring systems, etc. Therefore, success of the project requires an integrated, coordinated and holistic approach to be adopted at all levels, that is, state, project and community level. The achievement of different projects in this regard varies from one to the other which is influenced by a number of factors such as state policies, initiatives taken at state and project levels, visioning of leadership at state and project levels, capacities of the field staff, etc.

South Zone

- With regard to integrated, holistic and coordinated approach, Sriramsagar Project in *Andhra Pradesh* follows construction of unlined field channel only marginalising other components of CADWM. The only activity implemented in the project requires engineering inputs in which the department itself is very competent and does not require coordination with other agencies or departments. However, the project has shown an interest to promote integrated and coordinated approach towards CADWM through building capacities of the staff and re-structuring the organisationsal structure suiting to the CAD works in the project.

- *Karnataka* follows multiple activities including construction of lined channels, crop demonstration/adaptive trials and training of the farmers and WUA members, etc. In addition to the existing staff, the project has involved other agencies in conducting training programmes for WUAs.

- In *Kerala* also, the CADA accesses the agricultural department for carrying out frontline demonstrations on farmers' fields.

- In case of *Tamil Nadu*, the WUAs are consulted with and their views are taken into account in all development activities such as construction, water distribution, agricultural activities and soil conservation work etc. The co-ordination of canal committees, ensuring equitable and efficient distribution of irrigation water in the command area, fixing the date of releasing the water from the barrage, fixing the allocation of water in each branch canal according to the crop requirement, recommendations for the overall development of the project etc. comes under the powers of this committee. Agricultural Department is involved in activities including supply of good variety of seeds, plants, etc. Agricultural Engineering Department offers subsidy for replacement of fold pump

sets, tractors, power tillers etc. Under the decentralised planning system, the three tier Panchayats are undertaking various activities meant for the overall development of the Panchayats.

North Zone

- The projects visited in *J&K, Punjab, Haryana, Himachal Pradesh, Uttarakhand, Uttar Pradesh* and *Rajasthan* indicate that the activities such as crop demonstrations and training of farmers have been undertaken either by hiring the officials from agriculture, horticulture, irrigation and cooperative departments or have been deployed as part of the project team. The projects also approach the State Agricultural Universities and Krishi Vigyan Kendras for frontline demonstrations across the zone. The Department of Irrigation and Public Health Engineering in *Himachal Pradesh* carries out agricultural extension activities by liaisoning with the line departments. However, the department is not seeking any cooperation from NGOs in coordinating registration and operation of WUAs in the command area.

East Zone

- The PIM Act in *West Bengal* has not been enacted but it is guided by the Operation and Management Rules for Minor Irrigation Schemes-2011. The initiatives have been taken by Irrigation and Waterways Departments (I&WD) to form state and project coordination with various departments such as Department of Agriculture, Water Resources Investigation & Development Department (WRI&DD), Cooperation Department. However, the impact of the initiative is not visible at the field level.

- CADA in *Odisha* has taken initiatives to adopt a convergence approach by extending CADWM activities in other Irrigation Projects with funds from Rastriya Krishi Vikas Yojana (RKVY). Similarly, On-Farm Water Management and CAD activities under participatory mode are to be taken up in command areas of 18 irrigation projects, covered under "Odisha Integrated Irrigated Agriculture and Water Management Investment Programme (OIIAWMP)" with financing from the Asian Development Bank (ADB).

- The Kanchi Irrigation Project in *Jharkhand* is in the process of deploying a multi-disciplinary team of professionals from different fields like agriculture, soil conservation, and involving the University and the NGOs, in activities related to CADWM.

- In case of *Bihar*, the State Irrigation Policy emphasises the need for Farmer's Organisations to take over the management of irrigation systems. It has decided

to hand over deep tube wells and lift irrigation schemes to these organisations. Action research, publicity and mass awareness programs have been launched to involve farmers in participatory irrigation management. Training programmes for the farmers are being arranged through WALMI (Water and Land Management Institute) and WAPCOS (Water and Power Consultancy Services). PIM is slowly picking up in the state; although lack of financial support, lack of inter-departmental coordination, systems of land tenure and a general resistance to change, are few bottlenecks that the government is dealing with.

- *Chhattisgarh* also hires the specialists from line departments as in other states.

North East Zone

- In *Assam*, CADA is equipped with the professionalism in the field of irrigation, agricultural extension; water use etc. Most of the activities, therefore, are planned and executed by the authority itself. However, in some cases, convergence is created with line departments and agricultural universities for carrying out activities related to adaptive trials and frontline demonstrations. As far as integrated, coordinated and holistic approach is concerned, the approach is based on the needs and priorities of command area, the interventions are planned and convergence is created with the external agencies including Government and Non-government sector. This approach is yet to be penetrated at the project level.

- In *Meghalaya*, DoWR is yet to develop itself to follow integrated, coordinated and holistic approach with regard to command area development and water management. The projects in *Sikkim* and *Tripura* have not carried out the physical works, however, they are in the process of moving towards a holistic approach.

West Zone

- The initiatives in *Goa* involve hiring the officials from agriculture and cooperative departments to focus on crop demonstration and farmers training programmes and coordinating registration and operation of WUAs in the command area.

- The projects in *Gujarat* and *Maharashtra* have taken initiatives to involve NGOs in addition to cooperation from Line departments.

Conclusion

As per the details mentioned above, most of the projects covered under the study emphasise on construction of engineering structures, crop demonstrations and training of farmer associations by hiring expertise from different departments on deputation or taking the services of line departments especially in the field of crop

demonstration, WUA formation and training. However, a limited focus has been laid on integration of various interventions required to maximise production, productivity and economic returns per unit of water consumption in the command area. Also, the concept of convergence needs to be seen in broader terms involving various actors with a view to enhance economic returns of the farming community on the basis of per unit of water delivered from the outlet and to sustain the farmer led management system of micro-canal command areas.

Integration of various technological interventions including construction of field channels has been done in all the states except Sikkim; correction of system deficiencies has been done in 6 states (Karnataka, Tamil Nadu, Rajasthan, Madhya Pradesh, Manipur, Maharashtra); field, intermediate and link drains have been constructed in 15 states (Arunachal Pradesh, Assam, Bihar, Gujarat, Haryana, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh) and reclamation of waterlogged areas has been undertaken in 4 states (Karnataka, Orissa, Bihar, Maharashtra). However, on-farm development works like land levelling, shaping etc. have not been taken up in any of the states under CADWM. Adaptive trials and frontline demonstrations have been carried out in all the states either under CADWM programme or through concerned state departments.

The concept of holistic, integrated and coordinated approach requires effective participatory planning process at command area level with a view to identify the critical needs, identify and involve the primary stakeholders (directly involoved in the implementation process) & secondary stakeholders (indirectly contributing to the project) to enhance integration of interventions and convergence with different programmes and schemes and to execute the same through an effective coordination mechanism.

3.8 Water Use Ffficiency, Distribution and Measurement

Water use efficiency is an index of percentage of gainful performance of irrigation water released. It indicates how efficiently the available water supply is being used based on various methods of evaluation. Design of Irrigation system, degree of land preparation and skill and care of irrigation practices are principal factors influencing irrigation efficiency or water use efficiency. The water use efficiency can be increased in the command area through various interventions including land development related activities, optimising water use in accordance with effective crop planning, land consolidation and realignment, realignment of field channels, effective water distribution and measuring systems, etc. A descriptive account of State specific scenario in water use efficiency, distribution and measurement under CADWM Programme is as follows:

South Zone

- The water distribution measuring/control devices such as measuring flumes, gauge recorders and cross regulators have not been been installed in Sriramsagar project in *Andhra Pradesh,* Upper Krishna Project in *Karnataka,* Gunder Chittar Karruppandi Project in *Tamil Nadu* and Kanhirpuzha Project in *Kerala.*

- Auto-transmitters coupled with gauge recorders for speedy and reliable transmission of gauges to the control stations have not been installed by any agency in *Andhra Pradesh*, *Karnataka*, *Tamil Nadu* and *Kerala.*

- The benchmarking and water auditing, and the concept of smart card has not been initiated in Andhra *Pradesh*, *Karnataka*, *Tamil Nadu* and *Kerala.*

- In *Andhra Pradesh*, there is a provision of micro irrigation in the various projects in the State; however, micro irrigation has not been initiated in the Sriramsagar project. There is no concept of Smart Card for water use system in the State/project. However, innovative initiatives have been taken up to increase water use efficiency like wastage/leakage of water has been minimized and emergency repairs in the irrigation canal system are undertaken timely. Warabandi system is followed in the project. Availability of water reserves in the dams and effective water management to minimize water usage results in higher crop productivity in the command area. Diversification of cropping pattern, preparation of water release table following the ON/OFF system, minimising of transmission losses during water regulation and deployment of required staff for water regulation results in Warabandi system being effective in the command area. About 90% of the total water potential created is being utilised and the irrigation potential is being increased by effective water regulation. According to the officials, during the lean season, 60% of ayacut will be served with the help of ground water. Based on the water auditing and ayacut particulars submitted to the Revenue Department, the irrigation charges vary from ₹ 100 for rain-fed crops like cotton, chilli, tuar dal to ₹ 200 for irrigation fed crops like paddy. Farmers at the upper reach grow paddy which requires huge quantities of water due to which the flow of water to the lower reaches is less. The WUAs are not authorized to assess, collect and retain water charges. As has been mentioned before, with the change of Government in the State, the responsibility of collection of water charges was taken over by the Revenue Department, Government of Andhra Pradesh.

- In *Tamil Nadu*, the situation is not as satisfactory. Due to heavy rainfall and consequent silting of bed and scouring of side and improper maintenance and upkeep of canal system, the conveyance efficiency has come down gradually and has significantly reduced the discharge capacity. The canal system has reached

such peculiar condition that it is not able to meet the demands of its beneficiaries. The project was designed to feed its complete command but it has failed to irrigate the designed ayacut effectively in course of time. Even this system could not function properly due to the dilapidated condition of the conveyance system. The major portion of the length of branch and distributaries in the state are unlined. This has added to the erosion and deformation of canal especially in embankment portion. The aqueducts and community development (CD) work are leaving outer bunds eroded, toe walls damaged due to several years of flow of irrigation and flood water. In general, the canals and structures are in a pitiable state. Losses in major conveyance system could not be controlled due to paucity of the project funds for maintenance and CD works.

- In case of *Karnataka*, more or less similar conditions are prevailing with regard to water use efficiency. The concept of Warabandi has been initiated, the process of handing over charge of the micro-canal system has been initiated in the state, the focus is laid on construction of lined field channels only to reduce the conveyance losses, the farmers have been motivated for efficient use of water, the farmers have been motivated to smooth/level their field to increase water application efficiency in the command areas, etc.

- In *Kerala*, broadly flood irrigation method is adopted in the command area which leads to over or under irrigation. The total potential of water is yet to be utilised. The major reason cited in the project on low utilisation pattern is that the small & marginal farmers are not coming forward for paddy cultivation as the same is not economical to them. However, the existing rate of water supply can increase the area under irrigation.

North Zone

- The concept of Warabandi has been initiated in *Jammu and Kashmir, Haryana, Uttarakhand and Rajasthan.*

- The concept of smart card is not prevalent in the states of *J&K, Haryana, Uttarakhand* and *Rajasthan*. However, the state and project officials seem to be excited about possibility of using Smart Card in the years to come.

- In *Jammu and Kashmir*, the concept of efficient water management and utilisation is an important aspect in Ranbir Canal Command Area because the withdrawal of water is guided by Indus Water Treaty of 1960. The project cannot withdraw more than 1000 cusec of water for agriculture use during Kharif season and 350 cusec in Rabi seasons. The water is supplied on a rotation basis on a predetermined date and time in proportion to the land holding. The water is available once in 8 days and charges are levied on the basis of area. The

promotion of micro-irrigation systems has not been initiated as yet. The water distribution measuring/control devices such as parshall flumes, notches and weirs have not been installed in the command area. Auto-transmitters coupled with gauge recorders for speedy and reliable transmission of gauges to the control stations have not been installed by WALMI, Central/State agency or any other agency. The benchmarking and water auditing have also not taken off as yet. The innovative initiatives are yet to be seen in the project to increase water use efficiency.

- In *Haryana*, the on-farm development works such as land levelling/shaping, realignment and consolidation of agricultural plots has not been taken up. On Western Jamuna Canal (WJC) system, Warabandi is framed under canal Act by Zilladar of revenue Zilladari Section. He takes into consideration the suggestion and requirement of each Irrigator and recommends a comprehensive Warabandi schedule to Deputy Collector; who considers it and Warabandi is announced and implemented. Appeal against warabandi is with Divisional canal officer. Warabandi may vary to the extent that it may be village-wise, group wise (thok) or individual turn-wise on the same outlet.

- In *Uttarakhand*, distribution of water is done by the WRD of the State. However, it is proposed in the Command area for fair and equitable distribution of water amongst the farmers which will issue timings for distribution of water. The technical support to the farmers and officials is provided by Govind Ballabh Pant University. The University also conducts demonstrations on the farmers' field.

- In *Rajasthan*, the designed duty envisaged in the project report is 6 cusec per 1000 ha area for irrigation and accordingly, intensity of irrigation for rabi and kharif were envisaged at 55% and 21% respectively, totalling to 76%. However, from the data, the average conveyance efficiency for the projects works out to be 37%. WUAs regulate Warabandi in the command area. This has helped in delivery of water in time, that is, announcement of canal scheduling dates well before sowing is done and their predicted rotational turns are known to them in advance. Besides, PIM Act has ensured providing some services in the form of arrangement of inputs like seeds, fertiliser, pesticides etc.

East Zone

- The water distribution measuring/control devices such as parshall flumes, notches and weirs have been installed at the head works of Main Canal Branch Canal and distributaries in *Jharkhand* but the same are awaited in the command area. They have been installed in Hasdeo Phase II Project in *Chhattisgarh* whereas they have not been installed in *Bihar* and *Odisha*..

- Auto-transmitters coupled with gauge recorders for speedy and reliable transmission of gauges to the control stations have not been installed by WALMI, Central/State agency or any other agency in the states of *Odisha, Jharkhand* and *Bihar.* They have been installed and are being used in *Chhattisgarh.*

- There is a provision of benchmarking and water auditing but it has not yet taken off in the project area in *Odisha* and *Jharkhand.* The provision is prevalent in *Bihar* and *Chhattisgarh.*

- The state/project officials are unaware of the concept of Smart Card for water use system. In *Odisha, Jharkhand, Bihar* and *Chhattisgarh* but the officials seem to be excited about its usage in the near future.

- According to the state and project officials, in *West Bengal*, no field test for computation of losses has been conducted in the command area. However, test conducted under similar conditions in Kangsabati project shows rate of losses to be 2.44 cumec per sq.mt. of wetted area. The total wetted area of Damodar Valley (DV) Project from 0 to 2800 is 4211788 sq.mt. Assuming the same rate of seepage in the DV Command area, the losses come to 10.28 cumec. Broadly, flood irrigation method is adopted in the command area.

- In *Odisha*, the promotion of micro-irrigation systems has been initiated. However, they seem to be excited about possibility of using Smart Card in the state in the years to come. The innovative initiatives are yet to be seen in the project to increase water use efficiency.

- In *Jharkhand*, the project is still at the stage of survey, planning and design; hence, OFD works like land levelling/shaping, construction of field channels have not yet started. The provision of micro-irrigation systems has not been initiated as yet. The innovative initiatives are yet to be seen in the project to increase water use efficiency. The concept of Warabandi has not been initiated till now, however, the Warabandi schedules will be prepared and the system will be followed after regular water is made available. The utilisation of total potential of water will happen only after field channels are made and water is supplied to the farmers throughout the irrigation system. The potential created can be utilised after the system deficiencies at the banks of branch canals are taken care of, and before Kanchi Weir Irrigation Project is installed, the damaged structures should be repaired and constructed in order to provide water in the distributaries and outlets. The water is not being supplied for any Agriculture/Horticulture or multi-purposes work for the last 4-5years due to repair and reconstruction of the Kanchi Weir Irrigation Project.

- In *Bihar*, efficient water management and utilisation is an integral component of the program in the state. At the project level, productivity from agriculture is seen as one of the main determinants of irrigated farm efficiency. Water is mostly used for agriculture and horticulture crops. It is estimated that nearly 30% of the area will remain fallow during lean season. The total potential of water in the project, at present, however, is under-utilised. The existing rate of water supply can increase more area under irrigation. Lack of improved culture of irrigation and mutual understanding are constraints in optimal utilisation of the potential. The concept of Warabandi as a mechanism to distribute water has not been introduced. Awareness creation and intensive training is needed to promote water usage up to its full potential. These coupled with on-farm development works such as land levelling/shaping, realignment and consolidation of agricultural plots can help. Innovative initiatives that may increase water use efficiency are yet to be undertaken. The state has provisions for micro irrigation systems and these are functional.

- In *Chhattisgarh*, there is a wide gap between potential created and actual irrigation in the state mainly due to inadequate beneficiary participation in design and maintenance of irrigation projects, infrastructure deterioration due to low allocations in maintenance and inadequate double cropping. Many of the projects are designed for kharif as well as some for rabi irrigation and this rabi potential is highly unutilised. The promotion of micro-irrigation systems has been initiated in the state. The innovative initiatives are yet to be seen in the project to increase water use efficiency. The project officials feel that water use efficiency can be increased by increasing channel length, converting unlined channels to lined; and renovation work of the damage portion.

North East Zone

- Auto transmitters coupled with gauge recorders for speedy and reliable transmission of gauges to the control stations have not been installed by any agency in *Nagaland, Manipur, Meghalaya* and *Arunachal Pradesh*.

- The water distribution measuring/control devices such as parshall flumes, notches and weirs have not been installed in the command area in the states of *Meghalaya, Sikkim, Assam* and *Arunachal Pradesh*. However, they have been installed in Thoubal Irrigation Phase II Project in *Manipur*.

- The benchmarking and water auditing have not taken off as yet in *Nagaland, Meghalaya, Assam, Arunchal Pradesh* and *Sikkim*.

- The concept of Smart Card has not been adopted in the projects in *Nagaland, Manipur* and *Meghalaya*. However, in *Arunchal Pradesh,* the state/project

officials are aware of the concept of Smart Card for water use system but according to them, it is too premature at this stage because farmers have not developed a mind set for paying water charges and even the State Water Policy and Irrigation Act are also yet to be introduced in the State.

- In *Nagaland*, the concept of Warabandi has been initiated in the state for efficient operation and management. The water from the field channel is delivered at common point from where the farmers as per their convenience construct their own unlined/temporary channels to convey water to their respective fields. No irrigation charges are imposed on the users. According to the state and project officials, no innovative measures have been adopted for efficient water management and utilisation. The same was tried to achieve through imparting training for better management. Only portable measuring devices are used for measurement. The seepage loss is significantly high from the crop field where the irrigation is provided to rice crop and submergence is also needed for such crops. However, such loss is high in monsoon seasons when contribution of natural water is high in the project area. Such losses during the monsoon season can be taken positively to recharge the ground water. If the ground water is replenished, the same can be used during dry season to meet the deficit water requirement of the crops, if grown in dry season.

- In *Manipur*, efficient water management and utilisation is a central component of the program in the state. At the project level, water is mostly used for agriculture and horticulture purposes. It is estimated that the water potential for irrigation is 500 ha and nearly 1985 ha will remain fallow during lean season. There are provisions of water distribution measuring / control devices in the project and these are functional. The total potential of water in the project, at present, however, is underutilised. Less percentage of lining and non revision of cost norms were cited as two major constraints for more utilisation of water potentlal. Project officials suggested that a revision of cost norms will help improving this utilisation. Neither the state nor the project has any provisions for micro irrigation systems. Innovative initiatives have been taken to increase water use efficiency. These include farmers training program for adoption of new methods of cultivation and cropping pattern. Awareness creation and intensive training is needed to promote water usage up to its full potential. These coupled with on-farm development works such as land levelling/shaping, realignment & consolidation of agricultural plots can help.

- In *Mizoram*, owing to hilly terrain, contour farming is followed. The distribution of water is largely governed by gravity and once the field is irrigated, the outlet for another field is opened. The demonstration is done by the Agriculture, Horticulture, Fisheries and Soil Conservation Departments of the State.

- In *Meghalaya*, according to the state and project officials, broadly gravity flow method of irrigation is adopted in the command area. There is no mechanism for water distribution such as Warabandi and no charge is applicable for water. The total potential of water is yet to be utilised. The existing rate of water supply can increase more area under irrigation. The major reason cited for low utilisation of the water in the project is setback in the system like absence of field channels and proper distribution system to cover the entire area. The promotion of micro-irrigation systems has not been initiated as yet. The innovative initiatives are yet to be seen in the project to increase water use efficiency.

- In *Sikkim*, there is a provision of micro-irrigation in the State and it is functional.

- In *Assam*, there is currently no provision of micro irrigation in the projects. In one project of Assam, however, an initiative has been taken up at the project level to provide a water distribution measuring/control device which is fully functional.

- In *Arunachal Pradesh*, broadly, gravity flow method is adopted in the command area. The promotion of micro-irrigation systems has not been initiated as yet. The innovative initiatives are yet to be seen in the project to increase water use efficiency.

West Zone

- The water distribution measuring/control devices such as parshall flumes, notches and weirs have been installed at distributary level in *Goa* but the same is awaited in the command area. They have been installed and are being used in Kukadi Project in *Maharashtra* but they have not been installed in *Gujarat*.

- Auto-transmitters coupled with gauge recorders for speedy and reliable transmission of gauges to the control stations have not been installed by WALMI, Central/State agency or any other agency in *Goa* and *Gujarat*.

- The benchmarking and water auditing have also not taken off as yet in *Goa* and *Gujarat*.

- The state/project officials are unaware of the concept of Smart Card for water use system in *Goa* and *Gujarat*. However, they seem to be excited about possibility of using Smart Card in the state in the years to come.

- In *Goa*, the concept of efficient water management and utilisation is probably a plan for future in the state. According to the state and project officials, less than 30% of CAD work is completed in the project and a lot more is to be done in the years to come. The on-farm development works such as land leveling/shaping, realignment and consolidation of agricultural plots has not been taken up. The

concept of Warabandi has not been initiated. The water from the field channel is delivered at a common point from where the farmers construct their own unlined/temporary channels to convey water their respective fields. Broadly, flood irrigation method is adopted in the command area which leads to over or under irrigation as the topography is undulated. It was observed in the command area that most of the farmers provide water to paddy and orchards frequently. This is primarily because of more or less regular water supply, high percolation rate due to soil porosity, no mechanism for water distribution such as Warabandi and no charge applicable for water. The total potential of water is yet to be utilised. The existing rate of water supply can increase the area under irrigation. The major reason cited in the project on low utilisation pattern is that the small and marginal farmers are not coming forward for paddy cultivation as the same is not economical to them. The cost of cultivation comes around ₹ 1000/ha and the price of crop is just ₹ 650/qtl whereas the BPL families get 1 quintal rice per month @ ₹ 3/kg. Secondly, the canal system is still not fully operational and CAD works are yet to be completed and hence, may take time to reach full utilisation of water supply. The provision of micro-irrigation systems has not been initiated as yet. The innovative initiatives are yet to be seen in the project to increase water use efficiency.

- In *Gujarat*, the on-farm development works such as land levelling/shaping, realignment and consolidation of agricultural plots has not been taken up in the large area. The channels are not constructed up to each farm and there are missing links in some minors as farmers do not provide land for the construction of Sub Minors and channels. The concept of Warabandi has not been initiated. The canal system distributaries, minors and sub minors were constructed long back, also irrigation in the canal started since 2002-03. At present, the systems are not working to its full design capacity due to lack of proper operations and maintenance (O&M). To undertake the repair or restoration work, a proposal has to be submitted to State Level Committee, which after review, will sent it to Regional Office of CWC and to the Ministry of Water Resources. As this is a long and tedious process and O&M is an unavoidable activity in any irrigation project, it is suggested that some fixed amount on per hectare basis may be granted under CADWM scheme on yearly basis for undertaking repair and restoration work. The promotion of micro-irrigation systems has not been initiated as yet. The innovative initiatives are yet to be seen in the project to increase water use efficiency.

- In case of *Maharashtra*, the project officials are of the view to construct lined channels so as to reduce conveyance losses. Other conditions are more or less similar to Goa and Gujarat.

Conclusion

Enhancing water potential and creating mechanisms for optimal utilisation is one of the core objectives of CADWM programme and the projects visited are focused on this. Different projects are at different stages of managing initiatives towards efficient water use and its measurement and distribution. Water distribution measuring/control devices such as parshall flumes, notches and weirs have been installed only in Kukadi project in Maharashtra, Hasdeo Phase II Project in Chhattisgrah and Thoubal Irrigation Phase II Project in Manipur.

The concept of Warabandi exists in most of the projects. The concept of water conveyance efficiency is primarily ensured by increasing length of lined channels in the command areas in most of the projects. However, the focus on increasing water application efficiency is marginalised across the studied projects as most of the farmers use flood irrigation. The aspects related to land consolidation and realignment, realignment of field channels and effective water distribution and measuring systems have to be strengthened in the projects. Also, the prevailing concept of crop planning does not prevent the farmers at head from growing high water consuming crops leading to inequitable water use at the cost of tail enders. The use of smart cards was not found in any states albeit the team is quite excited and optimistic on the prospects.

3.9 Adaptive Trials and Frontline Demonstrations

Training of farmers and extension of recommended package of practices, promotion of improved and advanced technologies to enhance agricultural production and productivity is an important component of CADWM programme. Adaptive trials ascertaining suitability of newly developed varieties of different crops have to be made on farmers' field by scientists. Demonstrations of scientific technology, covering scientific water management and land development practices, introduction of suitable crops and varieties, proper dose and methods of application of fertilisers, irrigation practices, etc. on farmers' fields are very important for increasing productivity. The focus is also laid on effective crop planning, efficient water use and promotion of collective action to facilitate easy access to agricultural inputs and marketing with a view to enhance productivity, reduce cost of cultivation, reduce crop losses, increase profitability resulting in additional income.

South Zone

- Adaptive trials and frontline demonstration activities have not been taken up in the project covered under the study in *Andhra Pradesh*.
- However, adaptive trials and crop demonstrations in *Karnataka* were taken up in association with the Department of Agriculture.

- Tamil Nadu Agricultural Department in association with Tamil Nadu Agriculture University carries out the frontline crop demonstrations in *Tamil Nadu* especially related to horticultural crops including orchards development.

- More or less similar approach was adopted in *Kerala*. The demonstration activities across the zone primarily focused on improved or hybrid varieties.

North Zone

- CADA in *J&K* has been involved in frontline crop demonstration especially related to cereals and vegetables. The subject matter specialist, mainly Agronomists, take care of adaptive trials and demonstrations wherever lined channels have been constructed.

- In case of *Punjab*, adaptive research and trials are carried out to generate much valuable information on various aspects of water management and cropping system in collaboration with the Regional Centres of Punjab Agriculture University (PAU), Ludhiana and Adaptive Research Centres of Agriculture Department.

- However, under WJC in *Haryana*, very little work has been undertaken during the XI Plan period and so is the training programme for farmers and officials.

- CADA in Chambal project in *Rajasthan* established Chambal Krishi Kendra in 1965. The Centre undertakes adaptive trials, training to farmers and innovation programmes.

- The adaptive trials in *Uttarakhand* are not being conducted. However, the GB Pant University of Agriculture and Technology as well as State Department of Agriculture can be entrusted with the job to lay out demonstration and adaptive trials in the command area of CADA.

- In *Himachal Pradesh*, Agriculture Department is involved in frontline crop demonstration especially related to horticultural crops including orchards development. Adaptive trials and demonstration are done by the Agriculture department in the command area. The department is promoting organic farming and poly-house farming.

- In other states like *Uttar Pradesh* and *Madhya Pradesh*, the frontline demonstrations are carried out by the line departments. Sometimes the project officials also approach the line departments for the purpose of crop demonstrations.

East Zone

- There is a separate office in *West Bengal* exclusively responsible for Soil and Water Management and conducting Adaptive Trials. The objective of setting of this office was to demonstrate to the farmers of the area about the most suitable water management practices as well as the adoption of multiple cropping for optimum use of soil and water resources. At present, a new approach to field demonstrations has been undertaken by the Agriculture Department. Farmers' problems in the crop-fields are collected through the extension workers, tested in various Government Farms, results analysed and recommendations, thereof, are released to the farmers. All these works are done under the guidance and overall supervision of the Chief Agronomist and Ex-officio Joint Director of Agriculture, Burdwan. Since 1998-1999, West Bengal Agro Industries Corporation Ltd. has been entrusted to conduct some Adaptive Research / Trial / Crop Demonstration work under the Command.

- CADA in *Odisha* has been involved in frontline crop demonstration especially related to high yielding variety crops and plant protection measures. In addition, the farmers are supported with ₹5000/ha for improved seeds, fertilisers, pesticides, etc. for adoption of improved agricultural practices.

- Adaptive trials and crop demonstration have been taken up in the project in *Bihar* mostly through the CADA staffs. These services have been broadly rated as satisfactory by the project officials.

- Since the project is still at the stage of survey, planning and design; adaptive trials/demonstration activities have not yet been undertaken in the command area in *Jharkhand*.

- Department of Agriculture in *Chhattisgarh* has been involved in frontline crop demonstration. The officials of the agriculture department make visits to the field and provide technical inputs to the farmers.

North East Zone

- Since agriculture contributes significantly towards the economy of *Nagaland* and 70% of the population is engaged in agriculture activities, it is important to adopt diversified and multiple cropping system. Therefore, Adaptive Trials and Demonstrations of the major cereals and vegetables in the command area become imperative. Within the Command Area, various agencies namely School of Agricultural Science and Rural Development, Nagaland University, ICAR, State Horticultural and Agriculture Department are providing extension services for better agriculture practices and improving crop productivity.

- Adaptive trials and crop demonstration have been taken up in the project mostly through the agricultural wing of CADA, *Manipur* that manage agricultural extension activities. This has been mainly through demonstration of high yield varieties of crops. The services offered to this end have been rated as satisfactory.

- In *Mizoram*, the Department imparted trainings to farmers on improved farming practice, operation of farm machineries and improved implements. Cultivation of Rabi crops is still a new practice to most farmers; hence, demonstration of rabi crops was conducted within the command area of all the projects covered under the CADWM project.

- In *Arunachal Pradesh*, I&FCD has involved Agriculture Research Institute, ICAR of West Siang, Horticulture and Agriculture Department of Arunachal Pradesh for frontline crop demonstration especially related to double cropping. However, the agricultural section of the department needs more professionals to cover the large number of WUAs in the command area.

- Adaptive Trials and demonstration have not been initiated in *Meghalaya* but agriculture extension services are provided by the Agriculture Department and other research institutes in the area. Despite having a large potential for agriculture growth and conducive agro climatic conditions, the State is not self sufficient in food grains. Therefore, it is critical to promote increased productivity and diversification of crops to monetise all sections of the economy and generate surpluses.

- In *Mizoram*, the demonstration is outsourced and done by the Agriculture, Horticulture, Fisheries and Soil Conservation Departments, experts from Central Agriculture University, Imphal and North Eastern Regional Institute of Water and Land Management (NERIWALM), Dolabari, Tezpur. The funds for demonstration are managed from State funds.

- In *Assam*, no adaptive trials/demonstration activities were taken up in the project. However, the Agricultural Department of the State has been taking up agricultural extension activities which have proved satisfactory. Besides, experts from Assam Agriculture University regularly visit the area and provide information to the farmers.

West Zone

- GTIDC in *Goa* has been involved in frontline crop demonstration especially related to horticultural crops including orchards development. The corporation was facing staffing problem for a long time and now, initiatives seem to be initiated with regard to crop demonstrations and farmers training. However, the

agricultural section of the corporation needs more professionals to cover the large number of WUAs in the command area.

- Adequate Trials and Demonstration activities are yet to take place in the project in *Gujarat*. WALMI has been entrusted with this responsibility along with the Department of Agriculture. The WALMI does not have adequate number of staff to cover such a large command area. State Government has appointed a Deputy Director, Agriculture to provide assistance to farmers. However, the agricultural section of the WALMI needs more professionals to cover the large number of WUAs in the command area.

- In *Maharashtra*, the project officials have access to WALMI and externally aided projects to learn to carry out crop demonstrations. In addition, the State Agriculture Department is involved for carrying out the demonstration activities.

Conclusion

The activities with regard to adaptive trials and crop demonstrations are being planned and executed in the projects through the existing staff within the project establishment or by converging the activity with department of agriculture or other agencies including state agricultural universities and water and land management institutes. One of the major concerns with regard to adaptive trials and frontline demonstration is related to inadequacy of subject matter specialists within the project establishments and also with the supporting agencies including the line departments, WALMI and SAUs. Inadequate funds to carry out a holistic approach with regard to the activity are another factor that marginalises the intervention in most of the cases. Since the projects are coordinated by engineering professionals, they may probably need to be oriented more on importance of the concept of action research/adaptive trials and replication of the learning on larger scale in the command areas. A formal association directly with agricultural research centres and other agencies needs to be established for further innovation and replication of the same in the command areas.

3.10 Technical Up-gradation

The projects are expected to upgrade the technical interventions in the command area as per the field conditions and community requirements. The up-gradation may be multi-faceted in nature with regard to field channel, diversion structures, land development activities etc.

South Zone

- The micro canal system in Nagarjuna Sagar Project in *Andhra Pradesh* has been modernised with World Bank Assistance whereas 20 medium irrigation projects

are being modernized under JICA Assistance in the state. The system in Krishna Delta and Godavari Delta are also under for modernisation. However, since the Sriramsagar project is nearing completion, the project does not feel a need for technical up gradation.

- The other states in southern zone like *Kerala, Tamil Nadu* and *Karnataka* did not feel a need for technical up-gradation in the studied projects.

North Zone

- In case of *J&K*, since the Ranbir Canal project is expected to be completed in 2013-14, the state does not feel a need to upgrade the technicality of the field channel as of now. However, they would like to convert all the unlined channels to be lined to avoid water seepage and losses.

- The water measuring devices have been installed in the Sirhind Feeder project in *Punjab*. In addition, the field channels have been plastered to prevent any seepage.

- Since the project (WJC Phase-6) in *Haryana* is at infant stage, the state does not feel a need to upgrade the technicality of the field channel as of now.

- The states like *Rajasthan, Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Uttarakhand*, do not feel a need to upgrade the micro canal system in their projects.

East Zone

- In case of *Bihar*, different project activities are technically upgraded through training, evaluation and monitoring.

- States in the East zone like *West Bengal, Odisha, Jharkhand* and *Chhattisgarh* do not feel a need to technically upgrade the micro canal system in their projects.

North East Zone

- The state officials in *Assam* feel a strong need for technical up-gradation of the projects under CADWM.

- In case of *Nagaland*, though the CAD activities are completed but the officials feel that canal lining gets damaged because of the adversities of climate in the state. Large particles are carried down by the stream water to the canals during flash flood period. Therefore, additional safety and technical measures need to be incorporated so that the canal lining can withstand such adversities. It was also suggested that attempts should be made to simplify

the infrastructure and defined operations technology by converting to fixed and automatic controls that need less human intervention.

- In the state of *Manipur*, at the project level, different project activities are technically upgraded. The same at the state level are, however, expected to be technically upgraded during the implementation of the CADWM program.
- In case of *Meghalaya*, the projects were completed earlier, and the present activities are the extension of project to bridge the gap between the irrigation potential created and utilised. Therefore, state does not feel a need to upgrade the technicality of the project as of now.
- In *Mizoram*, from time to time, up-gradation programme is taken by State MI Department under which channels are given uniform slope to maintain discharge and removal of silt.

West Zone

- In case of *Goa*, construction of lined channel is the only OFD activity which has been undertaken in the project. Since the project is at infant stage, the state does not feel a need to upgrade the technicality of the field channel as of now.
- Similarly, *Gujarat* and *Maharashtra* do not feel a need to upgrade the technicality of the field channel as of now.

3.11 Planning and Monitoring

The success of a programme has direct correlation with active participation of all the stakeholders. WUAs are the primary stakeholders in the programme and hence, their active participation is very crucial with regard to micro-level planning, execution, monitoring and impact assessment. The planning process involved in the project emphasises on consultation with the beneficiary farmers with regard to construction of field channel. However, the planning process is largely carried out by the department itself leaving a small role for the farmer's participation.

With regard to participatory monitoring, the integrated approach follows sequential steps including setting the baseline (the existing information on identifying indicators before implementation of the project), setting the criteria & indicators, developing tools for information collection, building capacities of staff and WUA members involved monitoring, information communication, frequency of information communication, information compilation & analysis, use of results from information analysis by different stakeholders.

South Zone

- The concept of concurrent monitoring (measuring changes in the progress on periodic basis) & evaluation has not been carried out by an independent agency in *Andhra Pradesh* and *Kerala*. *Karnataka* has followed an evaluation study of the CADWM programme and in *Tamil* Nadu, the State Department of Evaluation and Applied Research is entrusted with the evaluation of the impact of CADWM programme in ongoing projects.

- The concept of online web based monitoring system and Geographical Information System (GIS) techniques to monitor progress and assess the impacts of project achievement is followed in the states of *Karnataka* and *Tamil Nadu* whereas it is not followed in *Andhra Pradesh* and *Kerala.*

- In *Andhra Pradesh*, the State level Monitoring Committee/Multi-disciplinary Committee was constituted in November 2005 to review the performance of CADWM programme in the state. The monitoring committee includes the representatives from Irrigation Department, Central Water Commission, Central Ground Water Development Board, Department of Soil & Water Conservation, Regional Agricultural Research Station, WALMI along with CADWM. The committee meets twice a year and the monitoring system followed is as per the guidelines of the CADWM programme. The projects are monitored regularly by the state officials and reports are shared with the respective shareholders. Circle level consolidation of divisions is done and performance is analysed at the Division level by the Superintending Engineer. Annual water account is prepared at the Division level and submitted to the Chief Engineer and who submits the report to CADA/SCIWAM Committee. To ensure quality of physical works in the project, quality aspect is separately looked after by the Quality Control Wing in the Irrigation Department. The baseline has been set in the project; however, the impact study has not been conduced so far.

- More or less similar situation prevails in *Karnataka* with regard to monitoring and evaluation activities. However, the state has followed an evaluation study of the programme.

- In *Tamil Nadu*, a State Level Monitoring Committee (SLMC) under the Chairmanship of the Agricultural Production Commissioner and Secretary to Government, Agriculture Department has been constituted and it meets once a year. Periodical review meeting at Project head quarters and at division head offices are being held for reviewing the progress and monitoring. Progress reports, field visits are also done for monitoring the work progress.

- The formal structure for programme monitoring is existent in *Kerala*. There is a State Level Monitoring Committee under the Chairmanship of Secretary in charge (CAD). The committee meets twice a year and monitors/reviews the performance of CADWM programme. The impact study has also not been conduced so far. The state level initiatives are inadequate to promote adoption of these concepts so far. The state seems to be interested in these activities in future.

North Zone

- The concept of concurrent monitoring and evaluation has not been carried out by an independent agency in the states of *J&K, Himachal Pradesh, Punjab, Haryana, Uttarakhand, Rajasthan, Uttar Pradesh* and *Madhya Pradesh*.

- Similarly, the concept of online web based monitoring system and GIS techniques have not been used in the projects in the north zone states to monitor progress and assess the impacts of project achievement except in case of *Himachal Pradesh.*

- The impact study has also not been conducted in any of the projects across the states in the north zone.

- In J&K, the formal structure for programme monitoring is non-existent. However, the CADA officials monitor the programme using information communication through the existing channel and the field visits. To monitor the quality of OFD works at various levels, it is mandatory for the Soil Conservation Assistant to check 100% of the work, for Assistant Soil Conservation Officer to check 75% of the work and for Chief Agriculture Officer to check 20% of the work done. The state level initiatives are inadequate to promote adoption of these concepts so far. The state seems to be interested in these activities in future.

- The formal structure for programme monitoring is non-existent in *Punjab*. At present, the Irrigation Department and Punjab State Tube Well Corporation have the Evaluation & Monitoring Units to monitor CADWM works. These units have also been involved in monitoring the irrigation projects executed with the help of World Bank Aid.

- In *Haryana*, the Monitoring Committee exists in the State which meets once a year. The physical and financial achievements are monitored through formats at sub-division level and are shared with the higher offices accordingly. The state level initiatives are inadequate to promote adoption of these concepts so far. The state seems to be interested in these activities if future.

- The formal structure for programme monitoring is in place since October 2004 in the project in *Rajasthan*. Secretary is the Chairperson of State Level Committee for Monitoring and Implementation. The Committee consists of officials representing different Departments. The Committee also reviews the progress of CADWM program and makes suggestions for improving its performances. It also decides upon the evaluation studies to be undertaken at the State level. The Committee reviews and recommends project proposals to be sent to Government of India for approval. The Committee meets twice a year, once before Rabi and another before Kharif season.

- Evaluation and monitoring is carried out periodically by the Planning & Monitoring circle of Irrigation Department in *Uttarakhand*. The Committee is headed by Superintending Engineer, Executive Engineer and other staff as per guidelines of Ministry of Water Resources.

- The planning and monitoring system in other states including *Uttar Pradesh* and *Madhya Pradesh* follow a routine monitoring frame work as it exists in Irrigation Departments.

East Zone

- The concept of concurrent monitoring and evaluation has been carried out by an independent agency in *Odisha* and *Bihar* whereas the same has not been done in *Jharkhand, Chhattisgarh* and *west Bengal.*

- The concept of online web based monitoring system is under process in *Odisha* whereas it has not been used in the projects of other states. Similarly, no GIS techniques have been used in the states to monitor progress and assess the impacts of project achievement; however, the States are planning to use it in near future.

- The impact study has also not been conduced so far in the projects in the states.

- *Odisha* follows a formal structure for programme monitoring. Monitoring is done at two levels. At the State level, there is a State Level Monitoring Committee headed by Principal Secretary, DoWR who is also Commissioner of CAD. The Project Level Monitoring Committee which is headed by Revenue Divisional Commissioner–cum Chairman CADA monitors work at the project level. The physical and financial achievements are monitored through monthly progress report and quarterly progress report which is submitted to CADA and MoWR. Directorate of CAD also monitors the programme using information communication through the existing channel and the field visits. The state level

officials visit the project twice a year, whereas the project officials make frequent visits.

- The formal structure for programme monitoring is existent in *Jharkhand*. The State Level Monitoring Committee/ Multi-disciplinary Committee exists in the State headed by the Secretary WRD and representatives from CADWM, CWC, GCWB, ICAR, Birsa Agricultural University, progressive farmers, CADWM Delhi, PRADAN (NGO) and WALMI. The officials from MoWR normally visit once in a year, those from the state level implementing authority visit the project site quarterly and also as per requirement and the district level implementing authority officials visit on fortnightly/monthly basis. The Committee is scheduled to meet every three months, or as per the requirement as felt and decided by the Chairman of the Committee. Monitoring of the project is being done as per the format prescribed by the CADWM Wing, MoWR, GoI and the projects are monitored by the State officials on quarterly and need based basis. However, since the project is at the stage of survey, planning and design, it is monitored regularly by the WRD officials with regular tours and inspections. After the completion of survey, planning and design, baseline will be set to measure and evaluate the progress in future. Only after CADWM work begins in the command area, progress will be evaluated and accordingly the impact study will be conducted.

- In *Bihar*, there is a State Level Monitoring Committee/Multi-disciplinary Committee that meets for review every quarter. The physical and financial progress of all projects is reported and regular field visits are undertaken by CADA officials. The monitoring reports are shared with the respective stakeholders. An impact study on the project was conducted by AFCL in 1986. There exists no review/monitoring/or evaluation committee. Officers of state level implementing committee visit annually while those from the district level implementing authority visit every quarter to review the project. Physical and financial achievements on the project are reported every month and problems identified at project and state level for corrective actions. Regular quality control testing is conducted at the project level to ensure quality of the physical works.

- *Chhattisgarh* follows a formal structure for programme monitoring. Monitoring is done at two levels. At the State level, there is a State Level Monitoring Committee headed by Principal Secretary, DoWR. Department also monitors the programme using information communication through the existing channel and the field visits. The state level officials visit the project twice a year, whereas the project officials make frequent visits.

North East Zone

- In *Assam* and *Nagaland*, monitoring and evaluation has been carried out by an independent agency North Eastern Regional Institute of Water and Land Management (NERIWALM). In projects of other states like *Manipur*, *Meghalaya*, *Arunachal Pradesh*, *Sikkim*, *Tripura* and *Mizoram*, concurrent monitoring & evaluation has not been carried out by an independent agency.

- The concept of online web based monitoring has been initiated in *Nagaland* and *Manipur;* and in *Assam,* it is under way with support from National Informatics Centre. It is non-existent in the projects in other states of the zone.

- The GIS techniques have not been adopted in the projects of all the states in the north-east zone mainly due to lack of in-house capacities, lack of resources, non-availability of competent staff and technical support system.

- The senior level officials in *Assam* are of the view to modernise and upgrade the project interventions technically to enhance water use efficiency at conveyance and application levels. In fact, the senior officials shared to take up the activities for technical up-gradation for which they planned to seek technical assistance from external agency provided the financial resources are available. The projects are monitored by State officials from the State Irrigation Departments who visit the sites regularly up to two times in a year. There are quarterly progress reports submitted for the same. The baseline of the project has been set up but the impact study is yet to be conducted.

- In case of *Nagaland*, the formal structure for programme monitoring is non-existent in the state. However, the I&FCD officials monitor the programme through physical verification. They conduct test check of quality and quantity of work during the execution of the project. The small size of the state enables the officials for more frequent visits to the field. The physical and financial achievements are monitored through various formats and are shared with the higher offices accordingly.

- *Manipur* has a State Level Monitoring Committee that meets twice a year. Monitoring of the project is being done by the state officials on a quarterly basis, who follow the format prescribed by the CADWM wing of MoWR, GoI. Monitoring reports are developed and shared with the respective stakeholders. At the project level, a baseline has been set up in the state and an impact study will be conducted at the completion stage. State Level Monitoring Committee monitors the project and officers from state level and district level implementing agencies visit the sites twice a year. In addition, representatives from Ministry of Water Resources' visit annually. The project follow online web

based monitoring system. To ensure quality of physical works in the project, field staffs are made to monitor the physical works at the time of execution.

- In *Meghalaya*, DoWR officials monitor the programme using information communication through the existing channel and the field visits. The works at the District level and at circle level are monitored by Executive Engineer and superintending Engineer respectively. At the State level, the work is monitored by the Chief Engineer. The impact study has also not been conduced so far.

- The formal structure for programme monitoring is non-existent in *Arunachal Pradesh*. However, the I&FCD officials monitor the programme using information communication through the existing channel and the field visits. The physical and financial achievements are monitored through formats at sub-division level and are shared with the higher offices accordingly. The small size of the state enables the officials for more frequent visits to the field. The state level officials visit the project twice a year and the sub-divisional officials on fortnightly basis. The impact study has also not been conduced so far. The state level initiatives are inadequate to promote adoption of these concepts so far. The state seems to be interested in these activities in future.

- In *Sikkim*, the project during implementation was monitored by the Department field officers. In case of MI Schemes, monitoring was done by CWC (Central Water Commission) officers and in case of FMP (Flood Management Programme), monitoring was done by Brahmaputra Board officers. The project was monitored on a quarterly basis.

- In *Mizoram*, NGOs like All Mizoram Farmers' Union (AMFU), Young Mizo Association (YMA) were involved in primary level monitoring of CADA works in the command area. No impact study has been conducted so far as the state feels that this is not the right time for assessing the impacts as the physical works have been completed recently.

West Zone

- The concept of concurrent monitoring and evaluation has not been carried out by an independent agency in the projects in *Goa, Gujarat* and *Maharashtra.*

- Similarly, the concept of online web based monitoring system and GIS techniques have not been initiated in the studied projects, though, they plan to do so in the near future.

- The impact study has also not been conduced so far in the studied project areas as the projects are on-going.

- GTIDC officials in *Goa* monitor the programme using information communication through the existing channel and the field visits. The physical and financial achievements are monitored through formats at sub-division level and are shared with the higher offices accordingly. The small size of the state enables the officials for more frequent visits to the field. The state level officials visit the project once a month and the sub-divisional officials on weekly to fortnightly basis. The existing monitoring system marginalises the role of WUAs. The state level initiatives are inadequate to promote adoption of these concepts so far. The state seems to be interested in these activities in future.

- The formal structure for programme monitoring is non-existent in *Gujarat* and *Maharashtra*. The physical and financial achievements are monitored through progress formats and are shared with the higher offices accordingly. The state level officials visit the project area as and when required. The SSNNL's initiatives are inadequate to promote adoption of these concepts so far. The state seems to be interested in these activities in future.

Conclusion

The routine monitoring system does exist in all the states but the same is inadequate in terms of participatory monitoring and evaluation framework that encourages involvement of WUA members and other stakeholders. The technological aids are yet to be initiated in the projects for effective and efficient monitoring and decision making. The concept of setting the baseline and concurrent monitoring have not taken a shape in CADWM in most of the states.

3.12 Staff Capacities and Motivation Level

Any expectation of having desired impacts of the CADWM programme is crucially dependent on the project staff involvement and performance which requires capacity and incessant high motivation levels. High motivation level of the staff plays an important role in community based project which many a times is taken as a non-rewarding function directly or indirectly. It is generally seen that the project staffs in many states are primarily committed to engineering works in accordance with their background and experience. The motivation level of the project staff with regard to CADWM work, across many states is fair and the programmes are running smoothly. The text below captures the ground situations/initiatives taken up for enhancing and maintaining staff capacities and motivation levels in different states.

South Zone

- In *Andhra Pradesh*, in-house training has been given to the engineering staff by Water and Land Management Training and Research Institute (WALAMTARI) in the State. Trainings on water management and exposure visits to various project

sites are conducted periodically by WALAMTARI. No NGOs have been involved in facilitating WUA related work in the State.

- In *Tamil Nadu*, during the period 2009-11, the Irrigation Management Training Institute, Trichy conducted a number of trainings related to crop water requirements and scheduling of irrigation, volumetric supply of irrigation water and flow measurement, water management for sustainable agriculture etc.

- In *Karnataka*, the project officials have been trained through WALMI and State Agricultural Universities. The project officials in Karnataka had access to training and exposure to WALMI and state agriculture university with regard to water management and crop planning. Initiatives to increase motivation level and to enhance capacities of the staff need to be given due focus.

- In *Kerala*, almost all the staff in the CADWM programme is drawn from deputation that seriously affects the motivation level. Secondly, without any agricultural background, they fail to understand the problems at the grassroots level. The Staff are not trained and capacity building of the Staff is the necessity of the hour and should be accorded high priority.

North Zone

- In *Punjab*, the staff is highly motivated owing to motivational steps taken by the State CADA. The employees get timely promotion and allowances besides they are provided travelling and mobile conveyances which raises the motivation of the Staff. However, the staff needs to be trained on newer techniques. As of now, the State Agriculture University provides training to the Staff of the Department.

- In *Jammu & Kashmir*, project officials were covered under capacity building programs within and outside the state. Designation by which the officers are called and monetary incentives play a great role in encouraging them to perform their duties with zeal. But in case of J&K, the Class-II gazetted officers in CADA are designated as Soil Conservation Assistants whereas in other neighbouring state like *Uttar Pradesh*, they are designated as Soil Conservation Officers which seems to be more charming. The J&K State Government may like to look into the same and get it done by just passing a government order which entails no monetary requirements. Secondly, the staff in J&K has been taken from State Agricultural Department on deputation for which they do not feel very happy and want to go back to their parent department for apparent reasons. A little incentive in shape of deputation allowance may boost their morale and let them feel homely while working in CADA. There should not be any problem in it as the staff of Agriculture Department working in CADA has been found very popular

and farmer friendly during field visit of the team. *J&K* and *Rajasthan* staffs have little training and exposure to work with community institutions.

- In *Uttarakhand*, there is no dedicated Staff under CADA programme in the State. The Department of Irrigation implements the programmes of CADA in the State.

- In *Himachal Pradesh*, the project staff in the state is primarily committed to engineering works in accordance with their background and experience. They have little training and exposure to work with community institutions. The project officials were covered under capacity building programmes. The staff members were sent to training institute where they were oriented to the basic approach to work in command area development works.

- In *Haryana* and *Rajasthan*, the initiatives with regard to boosting motivation level and to enhance capacities of the staff have not been given due focus in the state so far. It is important that the project carries out a motivational and training need assessment and have a mechanism in place to address to those needs of the staffs.

East Zone

- In *Odisha*; trainings, seminars and exposure visits are key methods of building staff capacities and motivation. The project staffs were sent to WALMI in Cuttack where they were oriented with the basic approach to work in command area development works. For the seniors officials, technical session and seminars are conducted for cross learning exercise.

- In *West Bengal*, some of the officers/specialists were sent to training for extension work and to enhance awareness of modern technology in extension work but there is no arrangement for training of staff of the authority. Regular trainings to the Agricultural Extension Staff are, however, arranged by Agriculture Department, Government of West Bengal.

- In *Jharkhand*, the motivation levels of the staff with regard to CADWM work is good. No project staff under CADA is working exclusively under Kanchi CADWM Project; which is being implemented by the regular staff of Water Resources Department of the State and their motivation level is very high. In order to further boost the motivation level of the staff, incentives in terms of recognition and awards are being contemplated. Although no formal training need assessment was done for the staff and committees in the field, initiatives are being taken in the form of providing exclusive training and exposure visit to the officials and farmers to the CADWM Project sites. Training program on implementation and funding was conducted during 2009-10 and in 2011-12, training on Participatory Irrigation Management was conducted for the project

engineers and the farmers associations. However, no NGOs have been involved for facilitating WUA related works in the State. The impact of capacity building inputs can be evaluated once the CADWM works are implemented in the field and the farmers start receiving benefits from them.

- In *Bihar*, the motivation level of project staff at the state and project level with regard to CADWM work was rated as 'good', as reflected by the regular progress in the work, farmer's satisfaction and a positive team spirit. Although there are no specific initiatives to boost the motivation level of the staff, regular trainings are provided to enhance their capacities. Staffs are also sent for training programs and exposure visits to WALMI and interactions with various universities. As Assistant engineers/SDOs and JEs in the State are CADA employees and Executive Engineers and above are on deputation from WRD of the State, the AEs/SDOs are not hopeful to get promotions as Executive Engineers and above even after long periods of service. Therefore, some percentage of posts may be reserved for them to get posting and promotions to Class-I (as Executive Engineers) to keep their spirits high. So far, no NGOs have been involved for facilitating WUA related works in the state. At the project level, training needs assessment is carried out for staff and committees by CADA officers and monthly review of staff performance, training at work, interface with technical scientists and interactions with university scientists are regularly organised for the project staffs. At WALMI Bihar, the staffs receive training regularly and exposure visit is part of this training. One of the impacts of these trainings has been that there is a team of multi-disciplinary staff to take up any assigned work and they are well versed with the use of latest technology. A number of training programs have been organised for the WUAs on the themes of farm management, water management and SHRI method of cultivation. WALMI, scientists from Rajendra Agriculture University (RAU), Pusa and Department of Agriculture have been the main resource support for these trainings. The project, however, is yet to initiate training and exposure visits for farmers.

- In *Chhattisgarh*, initiatives that boost motivation level and enhance capacities of the staff have been given due focus. The project does try to address to the issue of staff development through identification of their motivational and training needs, identification of resource persons/institutions and to address to their training and motivational needs. The staff members were sent to Divisional Training Academy, Raipur where they were oriented towards basic approach to work in command area development works.

North East Zone

- In *Manipur*, the motivation level of project staff at the state and project level with regard to CADWM work was rated as 'good'. This is mainly because of the mutually cooperative relationships between the project officials and farmer community, farmers support to the program and the overall satisfactory impact of CADWM. Incentives and awards are being introduced in the state to boost the motivational level of the staff. State has taken up several initiatives to enhance the capacities of the staff including those in the project. These are in the form of trainings and exposure visits to CADWM projects. Training is imparted to the middle level officers as well as farmers from time to time. At present, no NGOs are involved for facilitating WUA related works in the State. At the project level, training needs assessment are carried out for staff by the department from time to time. Regular group discussions with panchayats and WUAs are organised to enhance the capacities of the staffs. The Project staffs were given training by North Eastern Regional institute for Water and Land Management (NERIWALM). Trainings for WUAs have been organised by CADA with the help of resource persons from other institutions. Farmers and staff members were taken to Kakching for an exposure visit to visualize the completed projects. These have enhanced understanding and motivation levels.

- In *Assam*, the motivational level of the project staff with regard to CADWM work is good the reason being availability of trained staff and the eagerness of farmers about new technologies. Staff training was conducted by WAPCOS at New Delhi. However, inadequate inputs have gone to the project officials on institution building and the issues related to sustainability of WUAs. Currently, no NGOs have been involved for facilitating WUA related works in the State.

- In *Nagaland*, the staff members were provided training on PIM, CADWM Program and Activities and Survey, Planning and Design. All the trainings were conducted by NERIWALM in the state itself.

- In *Mizoram*, the training is generally provided by the KVKs. No Inter-state training for the officials or farmers has been organised till date.

- In *Sikkim*, the multi-disciplinary staff has a fairly good motivation level and they are technically sound. Various field trainings have been conducted for the field staff.

- In *Arunachal Pradesh*, project officials were covered under capacity building programs. The staff members were sent to NERIWALM, Tezpur, Itanagar Headquarter and to WAPCOS India Limited where they were oriented to the basic approach to work in command area development works.

- In states like Nagaland, Meghalaya, Mizoram, Arunachal Pradesh and Tripura project staffs are primarily committed to engineering works in accordance with their background and experience and have little training and exposure to work with community institutions. States are yet to take up methodical initiatives that specifically enhance the motivation level and capacities of the staffs. However, farmers and members of WUAs shows faith and interest in the project activities which keeps the motivation level high among the officials. The traditional hospitality and support system of the tribal communities of the State renders a greater sense of moral responsibility towards the project beneficiaries.

West Zone

- In *Goa*, around 33% of project officials were covered under capacity building programs.

- The staff members were sent to WALMI Aurangabad in *Maharashtra* and Anand, *Gujarat* where they were oriented to the basic approach of working in command area development works. In *Gujarat* and *Maharashtra*, the project officials are covered under capacity building programs. Staff members were sent to various training centres where they were oriented basic approach to work in command area development works.

- However, in both the states of *Goa* and *Gujarat*, though the project staffs have some training and exposure of working with the community institutions, they are primarily committed to engineering works in accordance with their background and experience. There is a need to scientifically identify the training and motivational needs of these staffs and organise effective programs around those needs in order to have a better equipped team to execute the CADWM programme in the states.

Conclusion

While in many states, the motivation levels of staffs are reasonably satisfactory and steps are being taken to build the capacities of the staff, some states like Kerala, Haryana, J&K and Rajasthan need to work more seriously on this important area. Follow up to the trainings imparted and a mechanism in place to evaluate the effectiveness of the training would help the project and their teams perform better Inter-state trainings and the potential and role of NGOs for imparting such capacity building measures to WUAs and farmers associations can be explored. One aspiration of CADWM programme in states is to make it more participatory and community managed; therefore, regular and methodically thought through investments in the staff capacities and motivational levels would be the key to realise it.

3.13 Private Sector Participation in CADWM

The increased area under irrigation in the command areas leads to intensification and diversification of different crops. The production and productivity of different crops is also supposed to be increased. There are a number of private sector agencies which require raw material from agricultural producers. On the other hand, the farmers have inadequate access to information, knowledge and skills to enhance production, processing and marketing. Also, the farmers have limited access to quality inputs including seeds, fertilisers, pesticides, equipments, crop insurance and credit facilities. In this scenario, there is a role for the private sector agencies to work with farmers and the WUAs to establish business relationship in areas of mutual interest.

For instance, the economy of Goa is primarily dependent on tourism. In command areas, some large farmers have developed their orchards and ornamental centres where they are planning to attract tourists to provide an exposure to nature and that has been possible due to the irrigation facilities developed in the area. One of such entrepreneurs shared that he would like to contribute to the local community as he is getting increased access to water.

However, the concept of private sector participation has not been initiated formally in any of the studied projects across the country. According to the State officials, poor road connectivity and lack of marketing facilities are the major hindrances for private sector participation.

CHAPTER-4: CHANNEL DENSITY

4.1 Channel Density

Channel Density defined as the length of channel required per hectare of field to cover each and every field has been analysed on the basis of data collected from the field. The country has been divided into 5 zones representing major agro-climatic and geographical conditions to analyse the existing pattern of channel density followed by different projects in the representative states. The zone wise analysis has been adopted in the report for effective presentation of the data and its analysis. The representatives states include as mentioned in the table below.

Table 4.1: Zone wise Representative States

Zone	Representative States
South Zone	• Andhra Pradesh • Karnataka • Tamil Nadu • Kerala
North Zone	• Jammu & Kashmir • Haryana • Punjab • Rajasthan • Uttarakhand • Himachal Pradesh • Madhya Pradesh • Uttar Pradesh
East Zone	• West Bengal • Chhattisgarh • Odisha • Jharkhand • Bihar
North-East Zone	• Assam • Manipur • Nagaland • Arunachal Pradesh • Mizoram • Meghalaya • Sikkim • Tripura

West Zone	• Goa • Gujarat • Maharashtra

4.2 Design Pattern

The field channels under CADWM programme are expected to provide irrigation water to each of the plots in the command area. The states covered under the study have followed different types of designs of field channels depending upon the local requirement in terms of technology, material and availability of financial resources. The specific designs followed for construction of field channels in different zones are as mentioned below.

South Zone

Andhra Pradesh follows construction of unlined channel with a cross section for conveying discharge upto 4 cusec whereas the lined channels are mainly constructed with RCC/CC material for a discharge capacity of 2 cusec. Kerala and Tamil Nadu follow lined and unlined channel both depending upon the technical and financial requirements. Kerala uses brick whereas the same is CC/RCC in case of Tamil Nadu. Karnataka and Tamil Nadu are constructing channels conveying a discharge of 1 to 1.23 cusec. In few cases in Tamil Nadu where slope is more than 5%, they construct field irrigation channels-cum-field drainage channels.

North Zone

The major focus in Jammu & Kashmir has been given on construction of lined channel. The designs of lined field channels in the state follow rectangular shape with 10 inches side walls constructed with brick, stone, cement, concrete as per the local conditions. In Haryana, rectangular shaped brick channels are constructed using polythene in base to minimise seepage losses. The outside of the channels are plastered whereas the inside of the channels remain un-plastered. The farmers are keen to get the inside of the channels to be plastered to avoid growth of weeds in the channel. In case of Rajasthan, the construction of channels is of stone masonry and brick masonry. The concept of circular cement concrete pipes is followed in Himachal Pradesh as far as lined field channels are concerned. The cement concrete field channels are constructed in Uttarakhand In Uttar Pradesh and Madhya Pradesh, the rectangular 9-inch brick and cement concrete design is followed for construction of lined channels.

East Zone

In Chhattisgarh, unlined channels with 2 cusec discharge capacity are constructed and in Odisha, lined channels with discharge capacity of 1 to 1.5 cusec are

constructed with bricks. In Jharkhand, unlined channels are constructed with 2-3 cusec discharge capacity but they plan to move towards lined channel with 1 to 1.5 cusec discharge capacity. In Bihar, brick field channels are constructed with discharge capacity of 2 to 2.3 cusec.

North East Zone

In this zone, lined and unlined channels have the same discharge capacity of 1 cusec. Due to undulated topography, the construction cost of the channels is very high; hence, they adapt only 1 cusec discharge capacity design. In case of Arunachal Pradesh the lined field channels are constructed following standard rectangular cross section with cement concrete for a discharge rate varying from 2 to 4 cusec.

West Zone

Due to undulated topography and high seepage losses, Goa adopted construction of lined channels which consist of semi circular pipes laid on pillars at different gradient to maintain the gravity flow. Gujarat also follows construction of lined field channels with rectangular section parallel to the minor/Sub-minor in most of the cases. In case of Maharashtra, the focus is laid on construction of unlined field channel.

4.3 Existing Channel Density

The data collected from different projects with regard to existing lined and unlined channel density has been analysed using outliers to reach the national average figure for channel density.

The approach was repeated for selected outlets with discharge capacity ranging from 0.75 to 1.25 cusec to estimate the national average figure for channel density for both lined and unlined field channels.

The approach was also followed for verified outlets covered under intensive study of the projects for estimation of existing lined and unlined channel density, and to estimate the required channel density and percentage of lining of the same. The approach involved consultation with Government officials and farmers, study of chak maps from the field and other relevant study material.

4.3.1 Project wise Existing Channel Density

The existing channel density varies from outlet to outlet, project to project and state to state. The channel density in the command areas of some of the outlets is very low whereas the same is very high in the others resulting to misleading averages at the project level. The low channel density in these outlets is due to a number of reasons including the pending works in the command areas. The analysis, therefore,

follows sorting the outlet wise data for channel density which is more commonly adopted removing outliers.

South Zone

As indicated in Table 4.2, both Srisailam Right Bank Canal and Sri Ram Sagar Project Stage I projects in Andhra Pradesh construct only unlined channels. The channel density in Srisailam project ranges from 55m/ha to 104m/ha with an average figure of 67m/ha. Sri Ram Sagar Project Stage I project constructs the unlined channel at a rate of 98m/ha.

Most of the projects in Karnataka are constructing lined channels except Bennithora, Karanja and Lower Mullamari irrigation projects where unlined channels are also constructed. Bennithora, Karanja and Chulkinala projects have achieved maximum overall channel density with a figure of 90m/ha. The channel density in Amejra, Upper Krishna and Tungbhadra project varies from 75m/ha to 80m/ha. The channel density in the remaining projects ranges between 28m/ha to 44m/ha.

In case of Tamil Nadu, there is a pattern of constructing both lined and unlined channels. The density of lined channels varies from 13m/ha to 20m/ha in different projects whereas the same ranges between 53m/ha to 63m/ha in case of unlined channels. The average overall channel density in the projects varies from 68m/ha to 80m/ha.

The overall channel density followed by different projects in Kerala is lower as compared to the other states in south zone varying from 14m/ha to 29m/ha. The farmers normally do not appreciate more land covered under channel construction due to small holding, high cost of land and inadequate returns from paddy cultivation.

Table 4.2: Project wise Existing Channel Density (South Zone)

SN	State/Projects	CCA * (ha)	Channel Length (metre)			Channel Density - Lined (m/ha)			Channel Density - Unlined (m/ha)			Channel Density - Total (m/ha)		
			Lined	Unlined	Total	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
	Andhra Pradesh													
1	Sri Shai am RBC Project	299	0	20180	20180	-	--	-	67	55	104	67	55	104
2	SRSP- Stage-I Project	351862	0	34773000	34773000	-	--	-	98	69	107	98	69	107
	Karnataka													
1	Upper Mullamari Project	544	20307	0	20307	44	30	78		-	-	44	30	78
2	Amarja Project	1743	141137	0	141137	80	50	90	-	-	-	80	50	90
3	Upper Krishna Project	622000	36981000	0	36981000	70	45	85	-	-	-	70	45	85
4	Tungbhadra Project	357427	38379	0	38379	75	45	86				75	45	86
7	Bennithora Project	20234	505850	1315210	1821060	25	20	30	65	50	80	90	70	100
8	Karanja Irrigation Project	35614	890350	2314910	3205260	25	22	30	65	50	80	90	70	100
9	Chulkinala	1821	45525	118365	163890	25	22	30	65	60	70	90	80	100
10	Ghataprabha	10171	233520	0	233520	29	18	56	-	-	-	29	18	56
11	Mallaprabha Project	16696	377202	0	377202	28	18	55	-	-	-	28	18	55
12	Lower Mullamari	12150	364500	0	364500	30	20	45	-	-	-	30	20	45
13	Bhadra Reservoir Project	10557	381000	0	381000	30	20	46	-	-	-	30	20	46
	Tamil Nadu													
1	Vaigai Project	7012	91121	419520	510641	13	12	17	60	40	80	73	52	97
2	Gundar Chittar Karuppaanathi	6869	103507	363585	467092	15	14	20	53	40	70	68	54	90
3	Kodanagar Reservoir	1002	17710	56438	74148	18	14	22	56	40	62	74	58	82
4	Kodiveri Anicut	4747	69209	296310	365519	15	12	30	62	45	80	77	57	110
5	Thirukoilur Anaicut	7803	161030	587710	748740	20	15	26	63	35	76	80	60	96

SN	State/Projects	CCA* (ha)	Channel Length (metre)			Channel Density - Lined (m/ha)			Channel Density - Unlined (m/ha)			Channel Density - Total (m/ha)		
			Lined	Unlined	Total	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
6	Willngdon Reservoir	187	2585	13760	16345	13	12	14	59	32	75	72	44	89
	Kerala													
1	Pazhassi Irrigation Project	622	8708	0	9522	14	10	24	-	-	-	14	10	24
2	Kanjirappuzha Project	1991	13739	44000	57739	8	7	9	22	17	28	29	22	32

(Source: Project Offices in the Respective States)

**CCA – sum of CCA of considered outlet commands*
Avg - Average, Min - Minimum, Max - Maximum

North Zone

The states in the north zone represent scenario for high slope areas in the Himalayas, Tarai regions in the foothills and the Gangetic planes, as has been shown in Table 4.3 below. All these regions in the north zone show different patterns of channel density followed under different projects. Almost all the projects construct both lined and unlined channels except Bhakra Canal Command project in Haryana where only lined channels are constructed.

The density for the lined channels in most of the projects in Jammu & Kashmir ranges from 18m/ha to 28 m/ha. The average norm followed for unlined channels across the projects in Jammu & Kashmir ranges between 8m/ha to 10m/ha except Ranbir Canal and Ferozpur Tangmarg projects where the same is 36m/ha. On an average, overall channel density across the projects in the state ranges between 22m/ha and 64m/ha.

The channel density followed for lined channel in Bhakra canal project in Haryana is 40m/ha whereas the same is 18m/ha in Western Yamuna project. The overall channel density in both the projects is in the range of 35-40m/ha.

In case of projects in Punjab, average density for lined channels varies from 16m/ha to 23m/ha and for unlined channels 16m/ha to 33m/ha. However, the overall average channel density varies from 32m/ha to 50m/ha in the projects in Punjab.

Chambal Command and Bisalpur projects in Rajasthan have constructed lined channels at the rate of 15m/ha and 28m/ha respectively.

Jatowala and Nathuwala projects in Uttarakhand have constructed the lined channels at a rate of 50m/ha and 45m/ha. The unlined channels have also been constructed in Nathuwala project at a rate of 12 m/ha resulting in 57m/ha as overall channel density.

In case of Himachal Pradesh, the density of lined channels in cluster of 36 MI Schemes and Cluster of 12 MI Schemes is 60m/ha and 62m/ha respectively whereas the same is 36m/ha for the unlined channels leading to overall channel density of 100m/ha.

The channel density for lined channel in Harsi Project in Madhya Pradesh is 25m/ha whereas the same is 31m/ha in Kolar Project. The overall channel density for the projects is in the range of 50m/ha to 51m/ha.

The average channel density for Sharda Sahayak Phase 2 Project in Uttar Pradesh is 70m/ha with the lined channel density being 30m/ha and unlined channel density being 40m/ha.

Table 4.3: Project wise Existing Channel Density (North Zone)

SN	State/Projects	CCA* (ha)	Channel Length (metre)			Channel Density_ Lined (m/ha)			Channel Density_ Unlined (m/ha)			Channel Density_ Total (m/ha)		
			Lined	Unlined	Total	Av	Min	Max	Av	Min	Max	Av	Min	Max
	Jammu and Kashmir													
1	Ranbir canal	7367	179629	1274700	1454329	28	20	47	36	32	38	64	52	85
2	Zainageer	4106	82736	23754	106490	20	20	22	10	9	11	30	29	33
3	Duchnipora Rajpora-Tral	17600	352000	140800	492800	20	20	20	8	8	8	28	28	28
4	Ganderbal Ji	97	2231	-	2231	23	20	26	-	-	-	23	20	26
5	Ahaji-Beerwah	275	5500	3300	8800	20	18	23	12	10	16	32	28	39
6	Tongri	752	14924	-	18064	24	20	28	-	-	-	24	20	28
7	Dehgam-Veerinag	2584	51130	20672	64490	20	20	20	8	7	9	28	27	29
8	Arin-Bandipora	2116	41943	21823	63766	20	20	20	10	9	12	30	29	32
9	Kahmil-Kupwara	2526	47994	20208	68202	19	17	22	8	7	9	27	34	41
10	Sonawari	752	15040	-	16304	22	20	28	-	-	-	22	20	28
11	Ferozpur Tangmarg	1260	17640	45360	63000	14	11	19	36	23	63	50	34	82
	Haryana													
1	Bhakra Canal Command	351853	14424300	0	14424300	40	18	60	-	-	-	40	18	60
2	Western Jamuna	23880	432460	384460	816920	18	13	26	17	12	43	35	30	69
	Punjab													
1	Bhatinda Br Part 2	99078	1585248	1585248	3170496	16	13	22	16	14	19	32	27	41
2	Upper Bari Doab Canal Command	3735	85905	52290	138195	23	12	34	14	13	15	37	25	49
3	Sirihind Feeder Part 2 Command Project	5365	91205	177045	268250	17	12	27	33	23	49	50	35	76

SN	State/Projects	CCA* (ha)	Channel Length (metre)			Channel Density_ Lined (m/ha)			Channel Density_ Unlined (m/ha)			Channel Density_ Total (m/ha)		
			Lined	Unlined	Total	Av	Min	Max	Av	Min	Max	Av	Min	Max
	Rajasthan													
1	Chambal Command Area	491	27987	-	27987	57	33	80	-	-	-	57	33	80
2	Bisalpur Project	36989	1035692	-	1035692	28	20	40	-	-	-	28	20	40
	Uttarakhand													
1	Jatowala Project	159	7950	-	7950	50	22	83	-	-	-	50	22	83
2	Nathuwala Project	240	10800	2880	13680	45	20	70	12	10	13	57	32	83
	Madhya Pradesh													
1	Harsi Project	50	750	1300	2050	25	17	32	26	23	39	51	40	71
2	Kolar project	29	900	800	1700	31	27	35	28	25	33	50	52	68
	Himachal Pradesh													
1	Cluster of 38 MI Schemes	1468	88080	--	88080	60	45	70	-	-	-	60	45	70
2	Cluster of 12 MI Schemes	651	43617	18879	62496	62	35	76	34	30	65	96	65	100
	Uttar Pradesh													
1	Sharda Sahayak Phase 2	27000	810000	1080000	1890000	30	18	42	40	20	60	70	19	102

(Source: Project offices in the Respective States)

**CCA – sum ofCCA of consicered outlet commands*
Avg - Average, Min - Minimum, Max - Maximum

East Zone

As per the details given in Table 4.4, the projects in West Bengal follow overall channel density from 37m/ha in DVC canal to 74m/ha in Teesta barrage. The density of lined channels in DVC Canal and Kangsabati projects in west Bengal is around 15-16m/ha whereas the same is 54m/ha in Teesta project. The density of unlined channels varies from 20 to 31m/ha across the projects in the State.

The projects in Chhattisgarh follow more or less standard norm of 8m/ha for lined and 32m/ha for unlined channels with overall average of 40m/ha.

The average channel density followed by the projects in Odisha varies from 9m/ha to 14m/ha for the lined channels whereas the same is 25m/ha to 29m/ha for unlined channels in most of the cases except Potteru project. The channel density in the state varies from 34m/ha to 69m/ha.

In case of Jharkhand, only unlined channels have been constructed with an average figure of 27m/ha.

The average channel density in Gandak project in Bihar is 70m/ha with the channel density for lined channel and unlined channel being 25m/ha and 45m/ha respectively.

Table 4.4: Project wise Existing Channel Density (East Zone)

SN	State/Projects	CCA* (ha)	Channel Length (Metre)			Channel Density_ Lined (m/ha)			Channel Density_ Unlined (m/ha)			Channel Density_ Total (m/ha)		
			Lined	Unlined	Total	Av	Min	Max	Av	Min	Max	Av	Min	Max
	West Bengal													
1	D.V. C. Canal Project	1294	19410	28468	47878	15	13	21	22	19	27	37	32	48
2	Kangsabati Project	1175	166680	333360	50040	16	13	19	31	27	36	47	40	55
3	Teesta Barrage	224	7441	2000	9441	54	37	64	20	17	23	74	54	84
	Chhattisgarh													
1	Mahanadi, Tandula, Jonk and Kodar Project	2925	23449	9307	32756	8	8	8	34	32	41	42	39	51
2	Hasdeo Phase 2 Project	85111	680888	2723552	3404440	8	8	8	32	18	52	40	26	60
	Odisha													
1	Mahanadi Delta Project	224	2016	6272	8288	9	8	10	28	17	38	37	27	48
2	Hirakud Project	106	1166	3074	4240	11	9	12	29	22	38	40	31	50
3	Rushkuliya Project	1200	16800	32400	49200	10	8	12	27	22	30	37	30	42
4	Potteru Project	2101	29414	115555	144969	14	12	19	55	40	62	69	52	81
5	Upper Indrawati Major Irrigation Project	760	9880	21280	31160	13	11	16	28	22	31	41	33	44
6	Gohira Irrigation Project	14	126	350	476	9	8	10	25	19	39	34	27	49
	Jharkhand													
1	Mayurakshi Left bank Project	1300	-	35100	35100	-	-	-	27	20	47	27	20	47
	Bihar													
1	Gandak	597061	14926525	26867745	417942	25	15	35	45	25	65	70	40	100

(Source: Project Offices in the Respective States)

**CCA – sum of CCA of considered outlet commands; Avg - Average, Min - Minimum, Max - Maximum*

North East Zone

As indicated in Table 4.5, average density of lined channels in Nagaland is 12m/ha whereas the same is 27m/ha in case of unlined channel.

The density of lined channels ranges between 8m/ha and 11m/ha in Assam. The unlined channel density ranges between 22m/ha to 30m/ha in Kaldiya and Dekadong projects whereas the same is 53m/ha in Bardikarai project.

The density of lined channels in Manipur, Arunachal Pradesh and Meghalaya varies from 8m/ha to 14 m/ha except Mizoram where the same is 47m/ha. The density of unlined channels in these states ranges between 27m/ha to 35m/ha.

The overall channel density in most of the projects in North-Eastern states varies from 32m/ha to 47m/ha except Bardikarai project in Assam and Cluster of 4 MI Schemes in Tripura.

Table 4.5: Project wise Existing Channel Density (North-East Zone)

SN	Projects	CCA* (ha)	Channel Length (Metre)			Channel Density_ Lined (m/ha)			Channel Density_ Unlined (m/ha)			Channel Density_ Total (m/ha)		
			Lined	Unlined	Total	Av	Min	Max	Av	Min	Max	Av	Min	Max
	Nagaland													
1	Clusters of M. I. Projects (Medziphema Bowl)	1652	19824	44604	64428	12	9	17	27	22	34	39	31	51
	Assam													
1	Kaldiya Project	11398	56891	136436	193327	10	12	14	22	12	27	32	18	41
2	Dakadong Project	2105	16840	63150	79990	8	8	8	30	19	33	38	27	41
3	Bardikarai Project	300	3300	15900	19200	11	10	14	53	40	57	64	50	71
	Manipur													
1	Cluster of 21 MI Schemes Under Bishnupur District	9600	76800	259200	336000	8	8	8	27	18	37	35	26	45
2	Cluster of MI Schemes in Thoubal, Ukrul, Chandel, Churanchandpur District	6420	57780	179760	237540	9	9	9	28	23	34	37	32	43
3	Cluster of MI Schemes in East and west Districts of Imphal	6665	66650	233275	299925	10	10	10	35	20	37	45	30	47
	Arunachal Pradesh													
1	Cluster of 62 MI Scheme	2486	19888	74580	94468	8	8	8	30	29	33	38	37	41
	Mizoram													
1	Cluster of 40 MI Scheme	1088	51136	-	51136	47	32	58	-	-	-	47	32	58

SN	State/Projects	CCA* (ha)	Channel Length (metre)			Channel Density_ Lined (m/ha)			Channel Density_ Unlined (m/ha)			Channel Density_ Total (m/ha)		
			Lined	Unlined	Total	Av	Min	Max	Av	Min	Max	Av	Min	Max
	Meghalaya													
1	Cluster of 6 MI Scheme	200	2600	5400	8000	13	10	19	27	20	33	40	30	52
	Tripura													
1	Cluster of 4 Minor Scheme	435	6090	-	6090	14	12	20	-	-	-	14	12	20
	Sikkim	*There is no on-going project in the State*												

(Source: Project Offices in the Respective States)

**CCA – sum of CCA of considered outlet commands*
Avg - Average, Min - Minimum, Max - Maximum

West Zone

As shown in Table 4.6 below, the lined channels have an average density of 44m/ha in Goa and 64m/ha in Gujarat.

In case of Maharashtra, an average channel density for the lined channels varies from 8m/ha to 10m/ha and 40m/ha to 83m/ha for unlined channels. The overall channel density in Maharashtra ranges between 50m/ha to 83m/ha.

Table 4.6: Project wise Existing Channel Density (West Zone)

SN	State/Projects	CCA* (ha)	Channel Length (Metre)			Channel Density_ Lined (m/ha)			Channel Density_ Unlined (m/ha)			Channel Density_ Total (m/ha)		
			Lined	Unlined	Total	Av	Min	Max	Av	Min	Max	Av	Min	Max
	Goa													
1	Tillari Irrigation Project	2771	122838	0	122838	44	38	70	0	0	0	44	38	70
	Gujarat													
1	Sardar Sarovar NP	123552	7946000	0	7946000	64	40	70	0	0	0	64	40	70
	Maharashtra													
1	Krishna	75798	757980	3031920	3789900	10	8	12	40	32	48	50	40	60
2	Dhombalkawadi	7050	70500	282300	352500	10	8	12	40	32	48	50	40	60
3	Kukadi	198204	1783836	14461892	16252728	9	8	12	73	67	80	80	71	89
5	Nandur MMC	208	2288	13104	15392	11	10	14	63	51	74	72	57	85
6	Upper Pen Ganga	71	5893	-	5893	-	-	-	83	46	90	83	46	90

(Source: Project Offices in the Respective States)

**CCA – sum of CCA of considered outlet commands*
Avg - Average, Min - Minimum, Max - Maximum

4.3.2 State wise Existing Channel Density

The details in Table 4.7 indicate state averages of lined and unlined channels summarised from the above mentioned tables. The state wise data represents a national average of 49m/ha with approximately 26m/ha for lined channels and 31m/ha for unlined channels. Karnataka, Haryana, Rajasthan, Uttarakhand, Madhya Pradesh, Himachal Pradesh, West Bengal, Goa, Gujarat and Mizoram have constructed the lined channels with density above the national average of 26m/ha whereas the other states are following the norm below national average. In case of unlined channel density, Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Chhattisgarh, Odisha, Jharkhand, Nagaland, Assam, Arunachal Pradesh, Manipur, Meghalaya and Maharashtra construct channels with density above the national average. States like Kerala and Tripura have constructed the field channels with density below the national average.

Table 4.7: State Level Channel Density

S. No.	State	Average Existing Channel Density-Lined (m/ha)	Average Existing Channel Density-Unlined (m/ha)	Average Existing Channel Density-Total (m/ha)
1	Andhra Pradesh	NA	83	83
2	Karnataka	42	18	60
3	Tamil Nadu	16	59	75
4	Kerala	11	11	22
5	J&K	21	12	33
6	Haryana	29	9	38
7	Punjab	19	21	40
8	Rajasthan	43	NA	43
9	Uttarakhand	48	6	54
10	Uttar Pradesh	30	40	70
11	Madhya Pradesh	28	27	55
12	Himachal Pradesh	61	17	78
13	West Bengal	28	24	52
14	Chhattisgarh	8	33	41
15	Odisha	11	32	43
16	Jharkhand	NA	27	27
17	Bihar	25	45	70
18	Nagaland	12	27	39
19	Assam	10	35	45
20	Manipur	9	30	39
21	Arunachal Pradesh	8	30	38
22	Sikkim	NA	NA	NA
23	Mizoram	47	NA	47
24	Meghalaya	13	27	40

S. No.	State	Average Existing Channel Density-Lined (m/ha)	Average Existing Channel Density-Unlined (m/ha)	Average Existing Channel Density-Total (m/ha)
25	Tripura	14	NA	14
26	Goa	44	NA	44
27	Gujarat	64	NA	64
28	Maharashtra	8	60	68
National Average (Approx.)		**26**	**31**	**49**

4.3.3 Channel Density for 1 Cusec Discharge

As mentioned earlier, different projects construct the field channels for different discharges varying from 0.75 to 4 cusec according to the local conditions and the finance available of the implementing agencies. CADWM normally follows a discharge of 1 cusec covering a command area of approximately 40 hectares. An analysis was carried out for selecting the outlets covering an area varying from 35 ha to 50 ha with a discharge rate ranging from 0.75 to 1.25 cusec, the details of which have been given in Annexure-1 of the Annexure Volume 1.

The figures in Table 4.8, therefore, represent the state wise summary of density for lined and unlined channels for a discharge rate of 0.75 to 1.25 cusec. The figures indicate that the total channel density maintained for 1 cusec of discharge covering an area of 35 to 50 ha is more or less similar to the national averages for lined and unlined channel densities both.

Table 4.8: State Wise Channel Density for 1 Cusec Discharge

S.No.	State	Channel Density_ Lined (m/ha)	Channel Density_ Unlined (m/ha)	Channel Density_ Total (m/ha)
1.	Karnataka	40	0	40
2.	Tamil Nadu	12	53	65
3.	Jammu & Kashmir	13	31	43
4.	Rajasthan	40	0	40
5.	Uttarakhand	22	8	30
6.	Madhya Pradesh	27	26	53
7.	Chhattisgarh	8	33	41
8.	Jharkhand	0	30	30
9.	Arunachal Pradesh	8	30	38
10.	Nagaland	28	19	47
11.	Mizoram	37	0	37
12.	Goa	63	0	63
Average (Approx.)		**25**	**23**	**48**

(Source: Project Offices in the Respective States)

4.4 Field Observations

4.4.1 Verification of Outlets

The study team covered one project in each of 28 states under the intensive study. The team verified some of the outlets in each of the projects to assess the existing and required channel lengths to irrigate each of the plots in the command area. Along with this, the team also had an intensive interaction with farmers and the project officials on chak maps to assess the required channel lengths and lining of the same.

4.4.1.1 Additional Channel Density Required

Standard Methodology for Design of Field Channels:

- The chak area has been taken as 40 ha for a discharge of 1 cusec; however, the chak area may differ based on the topography and type of soil.
- The designed plot length (length of the field of the farmer) in clay soil is 250 metres whereas the same is 100 metre in case of sandy soil.
- The field channels need to be constructed on ridge line to provide irrigation to each of the fields.
- The branches of field channels are extended according to the field conditions considering the plot length.
- If the farmer's field length is less than the designed plot length, the branches of the field channel are extended to irrigate each field.

The figures in Table 4.9 indicate the additional channel density required for covering each and every field under irrigation. The total length of field channels has been estimated by extending the channels to the uncovered fields. The estimation of total length was made on the basis of study of chak maps and chak plans, direct observation in the field and interaction with farmers and the project officials. A map showing the estimation of total channel length on the basis of above mentioned methodology has been attached after the case study below.

CASE STUDY: Jamit pura Kherla B Catchment, Chambal Command, Rajasthan

- Catchment Area - 198 ha.
- The topographical survey at 30 m grid is done by total station, contours at 10 cm contour interval are drawn and the existing features of field are recorded.
- The field irrigation channels are planned in such a way that each and every field is directly irrigated by the field irrigation channel. There are 9 existing outlets in this catchment. In this system, they cannot be reduced since the farm boundaries are not disturbed. The chak boundary of each outlet is marked. The field irrigation channel shown in red colour will be lined where as the additional length required to irrigate each field has been shown in dotted blue colour lines. The length of plot has been kept 100 to 250 metre and accordingly, field irrigation channels are provided. The chak area of one outlet varies from 07 ha to 60 ha. The total length of the watercourse comes out to be 16315 mt and the length per ha is 82 mt, out of this 6085 mt is proposed for lining. The cost of lining is ₹ 760 per metre.

Table 4.9: Existing and Required Total Channel Density of Verified Outlets

S. No.	Name of Outlet	Area	Total Length Required	Total Channel Density Required	Existing Channel length	Existing Channel Density	Additional Channel Length Required	Additional Channel Density Required
		Ha	M	m/ha	M	m/ha	M	m/ha
	Tamil Nadu: Gundar Chittar Karrupandi Project							
1.	Alangulam-CAD	38.09	3640	95.55	2060	55.07	1580	41.47
2.	Melamori-Kulum	32.57	3040	93.33	2000	61.40	1040	31.93
3.	Sluice-2 of puliyur-periyakulan	25.11	2110	84.4	1853	74	257	10.28
4.	Sluice of 3 L of Vadakala of thalai anicut	45.20	3717	82.6	2345	53	1372	30.48
5.	Sluice 3R of Surikari-Kudikulam of Idaikal	22.10	1930	87.7	1450	67	480	21.8
6.	Sluice No 1 &2 of Thenkal Ch Ayiraperi	28.14	3820	135.74	1540	54.72	2280	81.02
	Rajasthan: Chambal Command Area							
7.	Jamitpura Kherla-B Catchment	198	16315	82.39	13171	66.52	3144	15.88
8.	Makhida B-4	165	11109	67.32	9085	55.06	2024	12.26
9.	Khat Thar 1D2	180	14818	82.32	12178	67.65	2640	14.66
10.	Makhida B-5	192	14431	75.16	9991	52.03	4400	23.50
11.	Manas gaon-A catchment	160	12934	80.81	10004	62.52	2930	18.31
12.	Kheda Bhopal II C catchment	120	7090	57.06	4450	37.08	2640	22.00
	Haryana: Western Yamuna Canal Phase-6							
13.	RD 37000/L Israna disty Western jamuna canal-VI	230.36	20280	88.03	5120	22.18	15160	65.81
14.	RD 25475/L Bhatla Minor in Hissar Dit	184.21	15454.2	83.89	9845.12	53.45	5609.09	30.44
15.	RD 1280-L of Puthi Minor of Hissar	230.25	18760.3	82.0	12601.8	54.73	6158.53	26.74
16.	RD 25075-R of Zind dist-6-A	138.86	11536.5	83.11	6048.8	43.82	5487.8	39.53

S. No.	Name of Outlet	Area	Total Length Required	Total Channel Density Required	Existing Channel length	Existing Channel Density	Additional Channel Length Required	Additional Channel Density Required
		Ha	M	m/ha	M	m/ha	M	m/ha
	Punjab: Sirhind Feeder Part 2 Command Project							
17.	Outlet RD 24579 of Malout distributary	281.78	22717	80.61	18434	65.41	4283.05	15.20
18.	RD 116447-R of Lambi distributary	200.23	15789	78.85	1733	8.65	14056	70.19
19.	Outlet RD 28690-L of Malout distributary	332.39	26943.3	81.06	18268	54.96	8675.38	26.10
	Gujarat: Sardar Sarovar Phase-1							
20.	Pala VSA Block-2 Vadodra	186	17085	91.85	5120	27.52	11965	64.32
21.	Nimelta VSA Block 9A-2, Vadodra	234	24234	103.5	7620	32.56	16614	71.0
22.	Alindra Minor Vadodra	176	17220	97.84	5490	31.19	11730	66.6
	Maharashtra: Kukadi Project							
23.	Shiv shakti panivyapan sansthan no.60	379	23300	61.5	3800	10.02	19500	51.45
24.	WUA(110) Vignahar WUA belwandi	205	13000	63.43	4600	22.43	8400	41.00
25.	Kharrifnath at Minor 37 of KLBC	230	13903	60.45	5600	79	8300	36.01
	Madhya Pradesh: Harsi Project							
26.	RD 1410 M of Dy 3120 M of Tejpura dist	46.67	3630	77.7	2050	43.9	1580	33.8
27.	RD 200 M of D/O 4710 Minor Chakldi	28.89	2380	82.36	1700	58.83	680	23.53
28.	D 1A, d 1B, d 2 distributory	50.65	4018	79.34	2050	51	1968	38.86
	Odisha: Hirakud Project							
29.	FC of Chunarpur-Hirakud	59.20	4850	82.20	2390	40.37	2460	41.55
30.	Hirakud FC NO3	15.0	1179	78.6	542	36.13	637	42.6
31.	Hirakud FC-10	20.84	1708	82.0	830	39.82	878	42.17

S. No.	Name of Outlet	Area	Total Length Required	Total Channel Density Required	Existing Channel length	Existing Channel Density	Additional Channel Length Required	Additional Channel Density Required
		Ha	M	m/ha	M	m/ha	M	m/ha
32.	Hirakud FC-7	18.42	1497	81.3	859	46.63	638	34.63
33.	Hirakud FC 129	15.71	1269	80.8	517	32.90	752	47.89
34.	Hirakud FC-9	13.28	1015	76.5	424	31.92	591	48.57
	Karnataka: Upper Krishna Project							
35.	OR-7 of BD-1 of Dist 14	28.34	2790	98.44	1570	55.4	1220	43.08
36.	Budinal (3 A of NLBC)	35.46	2936	82.8	2100	60	836	24.19
37.	Gullel(D-5, NLBC)	45.23	4039	89.3	2200	49	1839	40.65
38.	Kawadimatti-2(SBC shahapur Br. Canal	40.60	3678	90.6	2600	65	1078	26.56
39.	Dornalli-4(D-14 shahapur Br. Canal)	35	2835	81.0	2500	74	335	9.57
	Andhra Pradesh: SRSP Project							
40.	D P 1A/Lateral of sub-minor/1L-26 R/DBM 38	39.69	3303	83.21	2450	61.72	853	21.5
	Arunachal Pradesh: Cluster of 62 MI Schemes							
41.	Ganga outlet-1	30	1794	59.8	1080	36	714	23.8
42.	Poma outlet-2	60	3822	63.7	2160	36	1662	27.7
43.	Banbari-outlet-4	100	6122	61.22	3200	32	2922	29.22
	Goa: Tillari Irrigation Project							
44.	Shri Baradi Devi PVYS Samiti dw2l	17.0	1299	76.44	1020	60.0	279	16.0
45.	Mae De Deus PVYS Samiti DWC 6L	7.02	570	81.50	476	68.0	94	13.5
46.	Mae De Deus PVYS Samiti DWC 4L	7.12	568	79.8	450	64.28	118	15.52
47.	Mae De Deus PVYS Samiti DOL	8.09	659	82.42	500	60.25	159	22.17
48.	Sateri Ghodedev PVYS Samiti DWC	7.5	605	80.76	469	62.53	136	18.23
49.	Bhumika Devi PVYS Samiti DWC-5R	13.02	1079	83.04	868	66.76	211	16.28
50.	Sateri Siddheshwar PVYS Samiti DWC 2R	11.13	888	80.80	746	67.8	142	13.0

S. No.	Name of Outlet	Area	Total Length Required	Total Channel Density Required	Existing Channel length	Existing Channel Density	Additional Channel Length Required	Additional Channel Density Required
		Ha	M	m/ha	M	m/ha	M	m/ha
	Himachal Pradesh: Cluster of 38 MI Schemes							
51.	KVK-Tube Well NO-76	2.0	205	102.5	200	100	2.5	1
52.	KVK Tube Well NO-62	2.5	260	104	245	98	15	3
53.	KVK Tube Well NO-17	2.5	245	98	245	98	0	0
54.	KVK-Tube Well NO-27	3.0	289	96.3	303	101	0	0
55.	K.V.K Tube Well NO-38	1.5	160	106	150	100	10	6
56.	Krishak Vikas Sangh Tube Well NO-41	2.5	260	104	250	100	10	4
	Jammu and Kashmir: Ranbir Canal Project							
57.	2300L of TAWI Feeder	26.2	1949	74.4	680	26	1269	48.23
58.	650L DSA	27.5	2167	78.8	637	24	1530	55.63
59.	1250LD 1	22.32	1778	79.7	460	21	1318	59.1
60.	1250LD2	39.62	3260	82.3	830	22	2430	61.35
	Uttarakhand: Jatowala and Prateetpur canal							
61	Jatowala K-3	20.4	1433	70.25	500	25	933	45.7
62.	Jatowala K-14	17.6	1188	67.48	400	24	788	44.72
63.	Jatowala K-15	16.7	1262	75.60	400	24	862	51.64
64.	Jatowala K-17	15.25	973	63.80	500	34	473	30.01
	Chhattisgarh: Hasdeo Phase 2 project							
65.	Karhi Outlet WUA O/L 1	50.83	4251	83.65	2005	40.0	2246	44.20
66.	Ghogri WUA-O/L-2	56.54	4951	87.57	2370	43.0	2581	45.62
	Nagaland: Medziphema Bowl Project							
67.	Upper Molvum	19.3	1301	67.45	1007	53.0	294	15.27
68.	Lower Molvum 1	44.5	3116	70.04	1760	40.0	1356	30.48
69.	Lower Molvum 2	21.7	1379	63.57	996	47.01	383	17.67

S. No.	Name of Outlet	Area	Total Length Required	Total Channel Density Required	Existing Channel length	Existing Channel Density	Additional Channel Length Required	Additional Channel Density Required
		Ha	M	m/ha	M	m/ha	M	m/ha
	Assam: Dekadong Project							
70.	Charaimari	26.42	2037	77.12	1118	43	919	34.80
71.	Naharbari	38.90	2938	75.53	1748	46	1190	30.59
	Meghalaya: Cluster of 6 MI Schemes							
72.	Nekora Farmers Association	41.2	2727	66.20	1440	36	1287	31.42
73.	Madan Umthied Farmer Association	32.9	2117	64.37	1426	44	691	21.06
74.	Phudumjer Water User association	31.5	2206	70.04	1100	36	1106	35.11
	Mizoram: Cluster of 40 MI Schemes							
75.	Biakinlui-WUA	60.7	3871	63.78	1500	25	2371	39.08
76.	Lungzawn-WUA	45.45	2912	64.08	1800	40	1112	24.47
77.	Kawrthindeng	55.32	3844	69.50	1500	28	2344	42.38
	Average	**72**	**5648**	**80**	**2928**	**49**	**2719**	**32**

(Source: Primary Data from Field Visit)

4.4.1.2 Bifurcation of Channel Density

Based on the slope of the area, channel density can be bifurcated into 2 categories:

- Channel Density for command area with plain to moderate slope (Table 4.10)
- Channel Density for command area with high slope (Table 4.11)

Table 4.10: Channel Density for Command Area with Plain to Moderate Slope

S.No.	Name of Outlet	Area	Total Length Required	Total Channel Density Required	Existing Channel length	Existing Channel Density	Additional Channel Length Required	Additional Channel Density Required
		Ha	M	m/ha	M	m/ha	M	m/ha
	Tamil Nadu: Gundar Chittar Karrupandl Project							
1.	Alangulam-CAD	38.09	3640	95.55	2060	55.07	1580	40.48
2.	Melamori-Kulum	32.57	3040	93.33	2000	61.4	1040	31.93
3.	Sluice-2 of puliyur-periyakulan	25.11	2110	84.4	1853	74	257	10.4
4.	Sluice of 3 L of Vadakala of thalai anicut	45.2	3717	82.6	2345	53	1372	29.6
5.	Sluice 3R of Surikari-Kudikulam of Idaikal	22.1	1930	87.7	1450	67	480	20.7
6.	Sluice No 1 &2 of Thenkal Ch Ayiraperi	28.14	3820	135.74	1540	54.72	2280	81.02
	Rajasthan: Chambal Command Area							
7.	Jamitpura Kherla-B Catchment	198	16315	82.39	13171	66.52	3144	15.87
8.	Makhida B-4	165	11109	67.32	9085	55.06	2024	12.26
9.	Khat Thar 1D2	180	14818	82.32	12178	67.65	2640	14.67
10.	Makhida B-5	192	14431	75.16	9991	52.03	4440	23.13
11.	Manas gaon-A catchment	160	12934	80.81	10004	62.52	2930	18.29
12.	Kheda Bhopal II C catchment	120	7090	57.06	4450	37.08	2640	19.98
	Haryana: Western Yamuna Canal Phase-6							
13.	RD 37000/L Israna disty Western jamuna canal-VI	230.36	20280	88.03	5120	22.18	15160	65.85
14.	RD 25475/L Bhatla Minor in Hissar Dit	184.21	15454.2	83.89	9845.12	53.45	5609.08	30.44

S.No.	Name of Outlet	Area	Total Length Required	Total Channel Density Required	Existing Channel length	Existing Channel Density	Additional Channel Length Required	Additional Channel Density Required
		Ha	M	m/ha	M	m/ha	M	m/ha
15.	RD 25075-R of Zind dist-6-A	138.86	11536.5	83.11	6048.8	43.82	5487.7	39.29
	Punjab: Sirhind Feeder Part 2 Command Project							
16.	Outlet RD 24579 of Malout distributary	281.78	22717	80.61	18434	65.41	4283	15.2
17.	RD 116447-R of Lambi distributary	200.23	15789	78.85	1733	8.65	14056	70.2
18.	Outlet RD 28690-L of Malout distributary	332.39	26943.3	81.06	18268	54.96	8675.3	26.1
	Gujarat: Sardar Sarovar Phase-1							
19.	Pala VSA Block-2	186	17085	91.85	5120	27.52	11965	64.33
20.	Nimelta VSA Block 9A-2, Vadodra	234	24234	103.5	7620	32.56	16614	70.94
	Maharashtra: Kukadi Project							
21.	Shiv shakti panivyapan sansthan no.60	379	23300	61.5	3800	10.02	19500	51.48
22.	WUA(110) Vignahar WUA belwandi	205	13000	63.43	4600	22.43	8400	41
23.	Kharrifnath at Minor 37 of KLBC	230	13903	60.45	5600	49	8303	11.45
	Madhya Pradesh: Harsi Project							
24.	RD 1410 M of Dy 3120 M of Tejpura dist	46.67	3630	77.7	2050	43.9	1580	33.8
25.	RD 200 M of D/O 4710 Minor Chakldi	28.89	2380	65.6	1700	58.83	680	6.77
26.	D-1A, d-1B, d-2 distributory	50.65	4018	79.34	2050	51	1968	28.34
	Odisha: Hirakud Project							
27.	FC of Chunarpur-Hirakud	59.2	4850	76.2	2390	40.37	2460	35.83

S.No.	Name of Outlet	Area	Total Length Required	Total Channel Density Required	Existing Channel length	Existing Channel Density	Additional Channel Length Required	Additional Channel Density Required
		Ha	M	m/ha	M	m/ha	M	m/ha
28.	Hirakud FC-10	20.84	1708	65	830	39.82	878	25.18
29.	Hirakud FC-7	18.42	1497	73.2	859	46.63	638	26.57
30.	Hirakud FC-129	15.71	1269	72.33	517	32.9	752	39.43
31.	Hirakud FC-9	13.28	1015	76.5	424	31.92	591	44.58
	Karnataka: Upper Krishna							
32.	OR-7 of BD-1 of Dist 14	28.34	2790	80.23	1570	55.4	1220	24.83
33.	Budinal (3 A of NLBC)	35.46	2936	82.8	2100	60	836	22.8
34.	Gullel(D-5, NLBC)	45.23	4039	89.3	2200	49	1839	40.3
35.	Kawadimatti-2(SBC shahapur Br. Canal	40.6	3678	80.7	2600	65	1078	15.7
36.	Dornalli-4(D-14 shahapur Br. Canal)	35	2835	81	2500	74	335	7
	Andhra Pradesh: SRSP Project							
37.	D P 1A/Lateral of sub-minor/1L-26 R/DBM 38	39.69	3303	83.21	2450	61.72	853	21.49
	Goa: Tillari Irrigation Project							
38.	Shri Baradi Devi PVYS Samiti dw2l	17	1299	76.44	1020	60	279	16.44
39.	Mae De Deus PVYS Samiti DWC 6L	7.02	570	81.5	476	68	94	13.5
40.	Mae De Deus PVYS Samiti DOL	8.09	659	80.25	500	60.25	159	20
41.	Sateri Ghodedev PVYS Samiti DWC	7.5	605	80.76	469	62.53	136	18.23
42.	Bhumika Devi PVYS Samiti DWC-5R	13.02	1079	75.35	868	66.76	211	8.59
43.	Sateri Siddheshwar PVYS Samiti DWC 2R	11.13	888	74.55	746	67.8	142	6.75

S.No.	Name of Outlet	Area	Total Length Required	Total Channel Density Required	Existing Channel length	Existing Channel Density	Additional Channel Length Required	Additional Channel Density Required
		Ha	M	m/ha	M	m/ha	M	m/ha
	Chhattisgarh: Hasdeo Phase 2 project							
44.	Karhi Outlet WUA O/L-1	50.83	4251	83.65	2005	40	2246	43.65
45.	Ghogri WUA-O/L-2	56.54	4951	87.57	2370	43	2581	44.57
	Average	**99**	**7983**	**80**	**4246**	**50**	**3736**	**31**

(Source: Primary Data from Field Visit)

Table 4.11: Channel Density for Command Area with High Slope

S.No.	Name of Outlet	Area	Total Length Required	Total Channel Density Required	Existing Channel length	Existing Channel Density	Additional Channel Length Required	Additional Channel Density Required
		Ha	M	m/ha	M	m/ha	M	m/ha
	Arunachal Pradesh: Cluster of 62 MI Schemes							
1.	Ganga outlet-1	30	1794	59.8	1080	36	714	23.8
2.	Poma outlet-2	60	3822	63.7	2160	36	1662	27.7
3.	Banbari-outlet-4	100	6122	61.22	3200	32	2922	29.22
	Jammu and Kashmir: Ranbir Canal Project							
4.	2300L of TAWI Feeder	26.2	1949	70.7	680	26	1269	44.7
5.	650L DSA	27.5	2167	65.6	637	24	1530	41.6
	Uttarakhand: Jatowala and Prateetpur canal							
6.	Jatowala K-3	20.4	1433	55.5	500	25	933	30.5
7.	Jatowala K-14	17.6	1188	60.3	400	24	788	36.3
8.	Jatowala K-17	15.25	973	63.8	500	34	473	29.8
	Nagaland: Medziphema Bowl Project							
9.	Upper Molvum	19.3	1301	67.45	1007	53	294	14.45
10.	Lower Molvum 1	44.5	3116	70.04	1760	40	1356	30.04
11.	Lower Molvum 2	21.7	1379	63.57	996	47.01	383	16.56

S.No.	Name of Outlet	Area	Total Length Required	Total Channel Density Required	Existing Channel length	Existing Channel Density	Additional Channel Length Required	Additional Channel Density Required
		Ha	M	m/ha	M	m/ha	M	m/ha
12.	Charaimari	26.42	2037	77.12	1118	43	919	34.12
13.	Naharbari	38.9	2938	75.53	1748	46	1190	29.53
	Meghalaya: Cluster of 6 MI Schemes							
14.	Nekora Farmers Association	41.2	2727	66.2	1440	36	1287	30.2
15.	Madan Umthied Farmer Association	32.9	2117	64.37	1426	44	691	20.37
16	Phudumjer Water User association	31 5	2206	60.2	1100	36	1106	24.2
	Mizoram: Cluster of 40 MI Schemes							
17.	Biakinlui-WUA	60.7	3871	63.78	1500	25	2371	38.78
18.	Lungzawn-WUA	45.45	2912	64.08	1800	40	1112	24.08
19.	Kawrthindeng	55.32	3844	69.5	1500	28	2344	41.5
	Average	**37**	**2521**	**65**	**1192**	**35**	**1229**	**30**

(Source: Primary Data from Field Visit)

4.4.1.3 Lining of Field Channels

The lining of field channel is decided on the basis of various factors including percent of conveyance losses due to seepage, percent of conveyance losses affected due to rodents and burrowing animals, velocity of flow, presence of vulnerable portions, availability of irrigation water at the tail end, etc.

The full supply level in the unlined channels should be such that all the fields in the command area are irrigated through gravity flow. An excessive velocity of flow may cause erosion in loose soils whereas the low velocity may not deliver water at the tail end adequately. Therefore, if the slope is higher, then the velocity should not exceed 1.5 m/sec to avoid scouring. The permissible velocity of the flow is normally maintained in the earthen channels in different soil conditions as below.

Soil Type	Maximum Velocity (cm/sec)	Maximum Velocity (ft/sec)
Loamy Sand	45	1.50
Sandy Loam	60	2.0
Loam, Silt Loam	75	2.5
Clay Loam	90	3.0
Gravely Clay	100	3.5

The side slope of the earthen channel should be designed in such a way that it is steeper than the angle of repose of the soil type. It was observed in the earthen channels that starting portion where it is off taking from the water course or minor or the main canal are damaged due to higher velocity. Therefore, initial portion of the earthen channels needs to be lined.

The vulnerable portions, turning points and the locations affected by burrowing animals also lead to damage of the earthen channels that need to be lined. It was also experienced in the field that the tail-enders do not get the required amount of water on time. It is, therefore, required to increase lining of the field channels to a certain percentage to reduce conveyance losses and increase flow velocity so as to deliver required water at the tails ends in time.

The increased extension and awareness of the farming community and initiatives of the state and national governments, corporate agencies and non-governmental organisations is likely to promote shifting of crop cultivation from traditional food grains like wheat and paddy to high value cash crops with a focus on vegetable cultivation during Rabi season. As per the details given in the table below, the vegetable crops such as tomato, onion, cauliflower, cabbage and chilly require 2 to 2.5 times of number of irrigation. The head and middle level farmers in the command area may try to take a major share of the water at the cost of tail-enders until and unless the water user associations are strong enough to manage equity in water distribution system.

Table: Number of Irrigation Required

	Tomato	Brinjal	Okra	Potato	Onion	Cauliflower	Cabbage
Number of Irrigation Required	18-25	8-10	8-10	5-6	15-16	15-18	10-12
	Chilli	**Carrot**	**Cucumber**	**Peas**	**Wheat**	**Paddy**	
Number of Irrigation Required	12-15	7-8	6-7	4-5	6	**Shallow water**- depth of water below 50 cm. **Semi deep water** depth of water between 50 cm-100 cm. **Deep water** - depth of water is more than 100 cm.	

The figures in Table 4.12 below present the lining of field channels required for the sampled outlets on the basis of above mentioned criterion. The percentage of lining of the field channels has been estimated on the basis of following factors:

- Length of Main Channel up to Bifurcation including diversion boxes and turns
- Length of Vulnerable Portion (length of the water course which is under filling, passing through the saline and alkaline soils, passing through the area affected by rodents, passing through the passage of movement of animals and people etc.)

The estimation of these factors was done on the basis of study of chak maps and chak plans, direct observation in the field and interaction with farmers and the project officials.

As has been shown in the map above and in Table 4.12 below, the requirement of lining indicates that 35 – 40 % of the overall length of the field channel in the catchment area should be lined. If 40% length of the field channel is lined, then the tail ender farmers which are not getting water in time and in required quantity due to roughness coefficient of earthen field channel (which adversely affect the velocity of flow) will also get irrigation in time.

Table 4.12: Requirement of Lining of Verified Outlets

S.No.	Name of Outlet	Area	Total length Required	Length of Main Channel up to Bifurcation including diversion boxes and turns	% of Main Channel	Length of Vulnerable Portion	% of Vulnerable Length	% Lining Required
		Ha	m	m	%	m	%	%
	Tamil Nadu: Gundar Chittar Karrupandi Project							
1.	Alangulam-CAC	38.09	3640	1280	35.16	124	3.4	38.56
2.	Melamori-Kulum	32.57	3040	980	32.23	109	3.6	35.83
3.	Sluice-2 of puliyur-periyakulan	25.11	2110	755	35.80	82	3.9	39.70
4.	Sluice of 3 L of Vadakala of thalai anicut	45.20	3717	1180	31.76	137	3.7	35.46
5.	Sluice 3R of Surikari-Kudikulam of Idaikal	22.10	1930	566	29.34	77	4.0	33.34
6.	Sluice No 1 &2 of Thenkal Ch Ayiraperi	28.14	3820	1320	34.55	116	3.03	37.58
	Rajasthan: Chambal Command							
7.	Jamitpura Kheria-B Catchment	198	16315	5400	33.1	685	4.20	37.3
8.	Makhida B-4	165	11109	3610	32.5	470	4.23	36.73
9.	Khat Khar 1D2	180	14818	4593	31.0	578	3.1	34.9
10.	Makhida B-5	192	14431	4800	33.26	540	3.74	37
11.	Manasgaon-A	260	12934	4424	34.2	505	3.9	38.10
12.	Kheda Bhopal II C	120	7090	2517	35.5	319	4.5	40.0
	Haryana: Western Jamuna Canal-VI							
13.	RD 37000/L Israna disty	230.36	20280	6410	31.68	850	4.19	35.81
14.	RD 25475/L Bhatla Minor in Hissar Dit	184.21	15454.2	5115	33.09	417	2.7	35.96

S.No.	Name of Outlet	Area	Total length Required	Length of Main Channel up to Bifurcation including diversion boxes and turns	% of Main Channel	Length of Vulnerable Portion	% of Vulnerable Length	% Lining Required
		Ha	m	m	%	m	%	%
15.	RD 1280-L of Puthi Minor of Hissar	230.25	18760.3	7008	37.35	391	2.01	39.36
16.	RD 25075-R of Zind dist-6-A	138.86	11536.5	3510	30.42	470	4.0	34.42
	Punjab: Sirhind Project							
17.	Outlet RD 24579 of Malout distributery	281.78	22717	8015	35.28	915	4.0	39.28
18.	RD 116447-R of Lambi distributery	200.23	15789	5700	36.0	418	2.64	38.74
19.	Outlet RD 28690-L of Malout disty	332.39	26943.3	9750	36.18	1150	4.26	40.44
	Gujarat_SSNNP							
20.	Pala VSA Block-2 Vadodra	186	17085	4720	2762	690	4.03	30.65
21.	Nimelta VSA Block 9A-2, vadodra	234	24234	7990	32.96	751	3.1	36.0
22.	Alindra Minor Vadodra	176	17220	5720	33.21	570	3.31	36.52
	Maharashtra: Kukadi Project							
23.	Shiv shakti panivyapan sansthan no.60	379	23300	7700	33.04	967	4.15	37.19
24.	WUA(110) Vignahar WUA belwandi	205	13000	4500	34.67	494	3.8	38.47
25.	Kharrifnath at Minor 37 of KLBC	230	13903	4871	35.04	576	4.15	39.19
	Madhya Pradesh: Harsi Project							
26.	RD 1410 M of Dy 3120 M of Tejpura dist	46.67	3630	1200	33.04	112	3.10	36.15

S.No.	Name of Outlet	Area	Total length Required	Length of Main Channel up to Bifurcation including diversion boxes and turns	% of Main Channel	Length of Vulnerable Portion	% of Vulnerable Length	% Lining Required
		Ha	m	m	%	m	%	%
27.	RD 200 M ® of D/O 471C Minor Chakldi	28.89	2380	760	31.93	88	3.7	35.63
	Odisha-Hirakuc Project							
28.	FC of Chunarpur-Hirakud	59.20	4850	1440	29.69	228	4.7	34.39
29.	Hirakud FC NO3	15.0	1179	375	31.89	49	4.2	36.09
30.	Hirakud FC-10	20.84	1708	599	35.08	64	3.8	38.88
31.	Hirakud FC-7	18.42	1497	550	36.76	68	4.6	41.36
32.	Hirakud FC-129	15.71	1269	426	33.56	54	4.3	37.86
	Karnataka: Upper Krishna Project							
33.	OR-7 of BD-1 of Dist 14	28.34	2790	940	33.69	107	3.85	37.54
34.	Budinal (3 A of NLBC)	35.46	2936	1478	37.58	89	3.75	41.33
35.	Gullel(D-5, NLBC)	45.23	4039	1454	36.60	157	3.9	39.90
36.	Kawadimatti-2(SBC shahapur Br. Canal	40.60	3678	1320	35.89	154	4.2	40.09
	Andhra Pradesh: SRSP Project							
37.	FC of DP1A/1L-26R-DBM-38	39.69	3903	1120	33.9	96	2.9	36.8
	Arunachal Pradesh: Cluster of 62 MI Schemes							
38.	Ganga outlet-1	30	1794	458	25.56	68	3.8	29.36
39.	Poma outlet-2	60	3822	1022	26.76	164	4.3	31.03
40.	Banbari-outlet-4	100	6122	1885	30.80	239	3.9	34.70
	Goa: Tillari Irrigation Project							
41.	Shri Baradi Devi PVYS Samiti dw2L	17.0	1299	491	37.8	52	4.02	41.82
42.	Mae De Deus PVYS Samiti DWC 6L	7.02	570	228	40.06	23	3.97	44.03

S.No.	Name of Outlet	Area	Total length Required	Length of Main Channel up to Bifurcation including diversion boxes and turns	% of Main Channel	Length of Vulnerable Portion	% of Vulnerable Length	% Lining Required
		Ha	m	m	%	m	%	%
43.	Mae De Deus PVYS Samiti DWC 4L	7.12	568	229	38.90	21	3.7	42.60
44.	Mae De Deus PVYS Samiti DOL	8.09	659	254	38.6	27	4.10	40.70
45.	Sateri Ghodedev PVYS Samiti DWC 13 L	7.5	605	221	36.68	26	4.30	40.98
	Himachal Pradesh: Cluster of 38 MI Schemes							
46.	KVK-Tube Well NO-76	2.0	205	78	37.89	9	4.12	42.01
47.	KVK Tube Well NO- 62,	2.5	260	74	28.54	10	3.84	32.38
48.	KVK Tube Well NO- 17,	2.5	245	74	30.34	9	3.67	34.01
	Jammu and Kashmir: Ranbir Canal Project							
49.	KVK-Tube Well NO-27,	3.0	289	77	26.89	10	3.56	30.45
50.	2300L of TAWI Feeder	26.2	1949	752	38.6	73	3.76	42.36
51.	650L DSA	27.5	2167	873	40.30	77	3.58	43.88
52.	1250LD 1	22.32	1778	613	34.5	75	4.20	39.70
53.	1250LD2	39.62	3260	1234	37.86	134	4.11	41.97
	Uttarakhand: Jatowala and Prateetpur canal							
54.	Jatowala K-3	20.4	1433	482	33.65	56	3.9	37.55
55.	Jatowala K-14	17.6	1188	433	34.33	49	4.10	38.43
56.	Jatowala K-15	16.7	1262	426	33.76	15	3.5	37.26
57.	Jatowala K-17	15.25	973	360	37.0	37	3.78	40.78
	Chhattisgarh: Hasdeo Phase 2 project							
58.	Karhi Outlet WUA O/L-1	50.83	4251	1509	35.50	181	4.25	39.75
59.	Ghogri WUA-O/L-2	56.54	4951	1925	38.9	203	4.21	43.11

S.No.	Name of Outlet	Area	Total length Required	Length of Main Channel up to Bifurcation including diversion boxes and turns	% of Main Channel	Length of Vulnerable Portion	% of Vulnerable Length	% Lining Required
		Ha	m	m	%	m	%	%
	Nagaland: Medziphema Bowl Project							
60.	Upper Molvum	19.3	1301	380	29.25	55	4.2	33.45
61.	Lower Molvum 1	44.5	3116	89	28.48	109	3.5	31.98
62.	Lower Molvum 2	21.7	1379	360	25.80	56	4.01	29.81
	Assam: Dekadong Project							
63.	Charaimari	26.42	2037	721	35.43	35	3.4	38.83
64.	Naharbari	38.90	2938	1077	36.67	117	3.98	40.65
	Meghalaya: Cluster of 6 MI Schemes							
65.	Nekora Farmers Association	41.2	2727	914	33.5	98	3.6	37.10
66.	Madan Umthied Farmer Association	32.9	2117	642	30.34	68	3.2	33.54
67.	Phudumjer Water User association	31.5	2206	730	33 12	86	3.9	37.02
	Mizoram: Cluster of 40 MI Schemes							
68.	Biakinlui-WUA	60.7	3871	1333	34 34	128	3.32	37.66
69.	Lungzawn-WUA	45.45	2912	817	28 05	107	3.67	31.72
70.	Kawrthindeng	55.32	3844	1065	27 70	136	3.53	31.23
	Average	**79**	**6081**	**2030**	**73**	**224**	**4**	**37**

(Source: Primary Data from Field Visit)

4.4.2 General Observations

Size of Outlet:

The states like Haryana, Punjab, Jammu & Kashmir, Nagaland, Assam, Karnataka, Goa, Uttarakhand and others are not very much clear about the concept of OFD; even 2-3 cusec water courses/field channels are being constructed by OFD budget whereas outlets covering 20-30 ha area should be served by 0.9 to 1 cusec water course. Field channels are constructed for discharge of around 1.5 to 2 cusec whereas states like Andhra Pradesh go up to 4 cusec of discharge to construct the unlined channels. However, in some of the projects such as Chambal command, Rajasthan; the watercourses are designed for 1 cusec capacity. Of course depending on soil type, topography, rainfall and cropping pattern etc. in OFD works of CADWM programme, the capacity of water courses/field channels cannot be more than 1 cusec or so, however in various states, the sections of water courses/field channels are constructed bigger than this which causes a significant reduction in the length of the water courses/field channels due to which every field is not covered.

Unplanned Construction:

In few states, the watercourses were constructed earlier than the construction of distribution system and release of water in the command; therefore, by the time water was released in the system, there were various damages in the watercourses/field channels/sub-minors and without the repair, it cannot serve the purpose.

Maintenance of Outlet:

In several cases, watercourses/field channels were built up on rectangular section made of PCC or bricks which were damaged by the farmers by their tractors or by animals etc. which could not be repaired because of non-availability of budget and inactive involvement of water user associations in the command area for repair and maintenance, moreover, also the repair of PCC section is not always successful.

Compensation:

There is lack of effective provision of land compensation for the construction of such watercourses/field channels/sub-minors due to which many farmers do not allow watercourses to pass through their field. These missing links adversely affect the coverage of area under irrigation in the command area and all the farmers are not able to get water. Therefore, the potentials created could not be fully utilised.

- In various cases, the designed L-section and X-section of lined and unlined watercourses/field channels/sub-minors were not part of micro level detailed project reports. No proper turn outs were provided.

- In few states, the watercourses/field channels/sub-minors were constructed on a higher earthen embankment whereas as these micro level irrigation systems should be mostly designed on half cutting and half filling basis, for better economy and durability and minimizing seepage losses.

Obstructing States:

It was observed by some states that as per the guidelines of MoWR, it was different exercise to obtain the funds and project sanction. Many details are to be collected for preparing detailed estimates and DPRs and by the time it is sanctioned, the scenario changes due to heavy rains or some other reasons. Therefore, the command remains un-irrigated/under-irrigated.

In many states like J&K, Uttarakhand, Arunachal Pradesh, Assam, Meghalaya, Manipur Goa, Haryana, Rajasthan, Bihar and southern states; the threat of wild animals, land levelling etc. is a factor restricting farmers from double crop. In Arunachal Pradesh, water is available but there is no fencing which is essential to protect the crop from Elephant, Blue Bull and Wild cows (Mithun). In few cases, solar fencing is provided but it is not sufficient.

Factors like non-availability of CADA, insufficient agricultural research and agricultural extension and lack of capacity building of staff, WUAs and farmers; are also adversely affecting creation of irrigation potentials.

In various states like Gujarat, Arunachal Pradesh, Assam, Meghalaya there is no CADA so far created. There for no coordinated efforts to increase the crop production by optimum utilization of available irrigation water and adopting new high yield varieties and other inputs like Farm yard Manure, Chemical fertiliser and advanced farm practices like how to Irrigated and at what stage of crops growth.

4.5 Conclusions and Recommendations

Existing Channel Length

The average channel density estimated from outlet wise data analysis for 1 cusec discharge is 48m/ha with 25m/ha for unlined and 23 m/ha lined channels.

Length of channel required per hectare of field (channel density) to cover each and every field:

As per the analysis of verified outlets covered under the intensive study as mentioned above in Table 4.9, the average channel density of 80m/ha is required to cover each of the fields in the command area of the outlets

- It is recommended that an average channel density is ensured at a rate of 80m/ha in the command areas with plain to moderate slope (upto 5%).
- In case of medium slope (5-10%) areas, the channel density is recommended at a rate of 65m/ha.
- The channel density in the areas with high slope (above 10%) is recommended at a rate of 110 m/ha.

As per the analysis of verified outlets covered under the intensive study as indicated above in Table 4.12, nearly 37% (Say 40%) of the total channel length is required to be lined to reduce losses, speed up flow velocity with a view to cover each of the fields in the command area of the outlets

- *It is, therefore, recommended that 40% (nearly) of the total channel length is lined starting from the outlet to cover each field in the command area.*

CHAPTER-5: COST NORMS

5.1 Cost Norms

The approach adopted for cost estimation and recommendations include collection of data for carrying out the planned activities during the current year, analysis of the more commonly used cost rates for averaging, selecting the most appropriate models, working on the cost estimates and rate analysis and accordingly making recommendations.

5.2 Project Level Component wise Current Expenditure Pattern

South Zone

As has been shown in Table 5.1 below, Srisailam Right Bank Canal project in *Andhra Pradesh* currently spends nearly ₹ 13,000/ha for construction of unlined channels whereas SRSP Stage I project spends over ₹ 52370/ha, ₹ 10000/ha and ₹ 40876/ha for carrying out lined and unlined field channels and other OFD works respectively. Both the projects in Andhra Pradesh spend an amount ranging from ₹ 2000/ha to ₹ 2300/ha for carrying out planning and designing aspects.

All the projects in *Karnataka* incur expenditure at a uniform rate of ₹ 30,000/ha for construction of lined channels, ₹ 5000/ha for construction of field, intermediate and link drains, ₹ 70000/ha for reclamation of waterlogged areas and ₹ 8000/ha for correction of system deficiencies.

The projects in *Tamil Nadu* spend an amount varying from ₹ 25000/ha to ₹ 75,000/ha for carrying out overall OFD works including an amount ranging from ₹ 9500 to ₹ 30,000/ha for construction of unlined and ₹ 15,000/ha to ₹ 30,000/ha for lined channels. Expenditure of nearly ₹ 15,000/ha is incurred for construction of the intermediate and link drains and around ₹ 1700/ha for survey, planning and design. The state also spends an amount varying from ₹ 15,000/ha to ₹ 20,000/ha for correction of system deficiencies and an amount ranging between ₹ 75,000 to ₹ 1,50,000 for training, monitoring and evaluation activities.

The projects in *Kerala* incur expenditure varying from ₹ 36,000/ha to ₹ 56,000/ha for overall OFD works including an approximate amount of ₹ 25,000/ha for lined and ₹ 12,000/ha to ₹ 16,000/ha for unlined channels. The rates for other components in the projects of Kerala include ₹ 5000/ha for intermediate and link drains, ₹ 2000/ha-₹ 4000/ha for survey, planning & design, ₹ 37,500/ha - ₹ 74,000/ha for reclamation of water logged areas, ₹ 20,000/ha-₹ 30,000/ha for correction of system deficiencies, nearly ₹ 14,000/ha for adaptive trials.

Table 5.1: Project Level Component wise Current Expenditure Pattern (South Zone)

State/ Project	Field Channel/OFD Work			Construction of Field, Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation and Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Lined Channel (₹/Ha)	Unlined Channel (₹/Ha)	OFD (₹/Ha)								
South Zone											
Andhra Pradesh											
Sri Sailam RBC	NA	13143	NA	NA	2000	NA	NA	NA	NA	NA	NA
SRSP- Stage-I	52370	10000	40876	NA	2343	NA	NA	NA	NA	NA	NA
Karnataka											
Upper Krishna Project	30000	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA
Tungbhadra Project	30000	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA
Amarja	30000	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA
Upper Mullamari	30000	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA
Bhadra Reservoir Project	30000	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA
Ghataprabha	30000	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA
Malaprabha	30000	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA
Bennithora	30000	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA
Karnaja Irrigation Project	30000	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA

State/ Project	Field Channel/OFD Work			Construction of Field, Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation and Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Lined Channel (₹/Ha)	Unlined Channel (₹/Ha)	OFD (₹/Ha)								
Gandorinala	30000	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA
Lower Mullamari	30000	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA
Chulkinala	30000	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA
Tamilnadu											
Vaigai Project	24500	15000	15000	15000	1500	NA	20000	NA	NA	150000	NA
Willngdon Reservoir	15000	10000	9500	NA	2000	NA	15000	NA	NA	100000	NA
Thirukoilur Anaicut Project	14958	9991	NA	NA	1500	NA	15000	NA	NA	100000	NA
Kodiveri Anicut	30000	15000	30000	NA	2000	NA	12000	NA	NA	75000	NA
Kodanagar Reservoir	24500	15000	15000	15000	1500	NA	20000	NA	NA	50000	NA
Gundar Chittar Karuppaanathi	24930	10000	NA	15000	4000	NA	7500	NA	NA	75000	NA
Kerala											
Pazhassi Irrigation Project	24534	12000	NA	5000	2000	NA	30000	34676	NA	75000	NA
Kanjirappuzha	24500	15000	11700	NA	2000	37500	20000	NA	13540	15741	NA
Kallada Project	24500	16000	16000	NA	4000	74000	30000	NA	NA	NA	NA

(Source: Project Offices of the respective states)

**NA- Not Applicable*

North Zone

As has been shown in Table 5.2 below, the projects in *Jammu & Kashmir* incur expenditure varying from ₹ 7000/ha to ₹ 95000/ha for carrying out overall OFD work with no expenditure being incurred for unlined channel while the same for lined channel ranging from ₹ 20000/ha to ₹ 50000/ha. A uniform rate of ₹ 5000/ha is spent for construction of field, intermediate and link drains in all the projects. The amount spent for survey, planning and design is in the range of ₹ 1000/ha to ₹ 2500/ha while the same for reclamation of water logged areas is in the range of ₹ 5000/ha to ₹ 15000/ha. The rates for other components in the project include ₹ 15000/ha for renovation and de-silting of tanks; ₹ 2000/ha to ₹ 15000/ha for adaptive trials and demonstrations, ₹ 10000 to ₹ 100000 per training and ₹ 4000/ha for one time grant to WUAs.

Expenditure in the range of ₹ 25000/ha to ₹ 30000/ha has been incurred for construction of lined channel in the projects in *Haryana*; ₹ 15000/ha for construction of field, intermediate and link drains, and ₹ 1500/ha to ₹ 3000/ha has been incurred for survey, planning and design. For correction of system deficiencies, ₹ 10000/ha has been spent in the Bhakra Canal Project. The rates for other components in the projects are in the range of ₹ 10000/ha to ₹ 60000/ha for adaptive trials and demonstrations; ₹ 11500 to ₹ 100000 per training and ₹ 2500/ha as one-time grant to WUAs.

Upper Bari Doab Canal Command in *Punjab* incurs expenditure to the extent of ₹ 40000/ha for overall OFD works. ₹ 5400/ha for construction of field, intermediate and link drains; ₹ 1400/ha for survey, planning and design and ₹ 1800 for training, monitoring and evaluation activities have been spent in the same project.

Chambal Command project in *Rajasthan* has spent ₹ 60000/ ha for overall OFD works including ₹ 25000/ha for construction of lined field channels. Expenditure to the tune of ₹ 8000/ha for construction of field, intermediate and link drains; ₹ 2000/ha for survey, planning and design activity and ₹ 60000/ha for reclamation of waterlogged areas has also been incurred. Similarly, the incurred expenditure for other components include ₹ 30000/ha for adaptive trials and demonstrations; ₹ 100000 for training and ₹ 2500/ha as one-time grant to WUAs.

Table 5.2: Project Level Component wise Current Expenditure Pattern (North Zone)

State/Project	Field Channel/OFD Work			Construction of Field, Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation anc Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Lined Channel (₹/Ha)	Unlined Channel (₹/Ha)	OFD (₹/Ha)								
North Zone											
Jammu and Kashmir											
Ranbir canal	50000	NA	45000	NA	2500	NA	12000	NA	15000	100000	4000
Doda Bangaldari Good Rajonri	22000	NA	22000	5000	1000	NA	NA	NA	NA	NA	NA
New Pratap Canal	22000	NA	NA	5000	1000	5000	NA	NA	NA	NA	NA
Ahaji –Beerwah	22000	NA	NA	5000	NA	15000	6000	NA	2000	10000	NA
Zainageer	19800	NA	NA	5000	NA	NA	6000	15000	2000	10000	NA
Duchnipora Rajpora-Tral	NA	NA	22000	5000	1000	15000	4000	15000	2000	10000	NA
Ganderbal	NA	NA	19800	5000	NA	NA	6000	NA	2000	10000	NA
Tongri	NA	NA	22000	5000	1000	15000	6000	NA	2000	10000	NA
Dehgam-Veerinag	NA	NA	22000		1000	15000	4000	15000	2000	10000	NA
Arin-Bandipora	NA	NA	19800	5000		15000	4000	NA	2000	10000	NA

State/Project	Field Channel/OFD Work			Construction of Field, Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation and Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Lined Channel (₹/Ha)	Unlined Channel (₹/Ha)	OFD (₹/Ha)								
Vashow	NA	NA	22000	5000	1000	NA	NA	NA	2000	10000	NA
Kargil	NA	NA	19800	5000	NA	NA	4000	NA	2000	10000	NA
Uri-Narvaw	NA	NA	6770	5000	NA	15000	6000	NA	2000	10000	NA
Ferozpra-Tangmarg	NA	NA	19800	5000	NA	15000	6000	NA	2000	10000	NA
Sonawari	NA	NA	15248	5000	NA	15000	4000	NA	2000	10000	NA
Haryana											
Bhakra Canal	25000	NA	NA	1000	1500	NA	NA	NA	60000	11500	NA
Western Jamuna	30000	NA	25000	15000	3000	NA	10000	NA	10000	100000	2500
Punjab											
Bhatinda Br Part 2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Upper Bari Doab Canal Command	15000		25300	5400	1400	NA	NA	NA	NA	1800	
Sirihind Feeder Part 2 Command Project	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rajasthan											
Chambal Command Area	25000	NA	35000	8000	2000	60000	NA	NA	30000	100000	2500
Uttar Pradesh											
Sharda Sahayak Phase-2	24000	10000	35000	6000	1500	20000	7000	NA	2500	10000/ farmer	3000

State/Project	Field Channel/OFD Work			Construction of Field, Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation and Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Lined Channel (₹/Ha)	Unlined Channel (₹/Ha)	OFD (₹/Ha)								
Madhya Pradesh											
Harsi	25000	7000	36000	5000	1000	15000	6000	NA	NA	8000/ farmer	2000
Himachal Pradesh											
Cluster of 38 MI Schemes in Una District	55000	15000	80000	6000	2000	NA	8000	20000	NA	15000/ farmer	2500
Uttarakhand											
Jatowala and Prateetpur Canal	*All the projects in the State are completed, hence, there is no on-going project in XI Five Year Plan.*										

(Source: Project Offices of the respective states)

**NA-Not Applicable*

East Zone

As has been shown in Table 5.3 below, the projects in *West Bengal* incur expenditure in the range of ₹ 25000/ha to ₹ 35000/ha for construction of lined field channels. Expenditure in the range of ₹ 1500/ha to ₹ 3000/ha has been incurred for undertaking survey, planning and design activity. Similarly, ₹ 25000 to ₹ 3 lakh has been incurred for training, monitoring and evaluation whereas the same is ₹ 2000/ha as one-time grant to WUAs.

About ₹ 23576/ha has been spent by Hasdeo Phase 2 project in *Chhattisgarh* for construction of unlined field channel and the same for survey, planning and design is ₹ 1200/ha. Mahanadi, Tandula, Jonk and Kodar projects in the State spend about ₹ 1000/person for training and ₹ 2000/ha as one-time grant to WUAs.

The projects in *Odisha* incur expenditure in the range of ₹ 70000/ha to ₹ 100000/ha for overall OFD works including ₹ 30000/ha to ₹ 50000/ha for construction of lined field channel. For construction of field drains and for survey, planning & design activity, expenditure in the range of ₹ 15000/ha to ₹ 20000/ha and ₹ 1500/ha to ₹ 10000/ha is incurred respectively. ₹ 5000/ha to ₹ 10000/ha is spent for adaptive trials while the same ranges from ₹ 1.5lakhs to ₹ 12 lakhs for training, monitoring and evaluation activities and about ₹ 2000/ha as one-time grant to WUAs.

As the projects in *Jharkhand* are at the stage of survey, planning and design; hence, as of now, ₹ 887/ha is spent for the same activity.

Expenditure in the range of ₹ 13000/ha to ₹ 57000/ha has been incurred for overall OFD works in the projects in *Bihar*. ₹ 4000/ha to ₹ 9000/ha has been spent for construction of field, intermediate and link drains and the same for reclamation of waterlogged areas is in the range of ₹ 15000/ha to ₹ 60000/ha. Correction of system deficiencies has been estimated at ₹ 6000/ha to ₹ 10000/ha; and ₹ 2000/ha to ₹ 20000/ha has been spent for adaptive trials and demonstrations. The existing expenditure for training, monitoring and evaluation activity has been in the range of ₹ 12000 to ₹ 100000 per training.

Table 5.3: Project Level Component wise Current Expenditure Pattern (East Zone)

State/Project	Field Channel/OFD Work			Construction of Field, Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation and Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Linec Channel (₹/Ha)	Unlined Channel (₹/Ha)	OFD (₹/Ha)								
East Zone											
West Bengal											
D.V. C. Canal	33000	NA	NA	NA	3000	NA	NA	NA	NA	25000	NA
Kangsabati	35000	NA	NA	NA	1500	NA	NA	NA	NA	3.05 lac	2000
Teesta Barrage	35000	NA	34000	NA	1500	NA	NA	NA	NA	NA	2000
Mayurakshi	25000	NA	NA	NA	1500	NA	NA	NA	NA	3.04 lac	2000
Chhattisgarh											
Mahanadi, Tandula, Jonk and Kodar	NA	NA	44113	NA	1205	NA	NA	NA	NA	1000 per person (Out of the state)	2000
Hasdeo Phase 2	23567	NA	NA	NA	355.13	NA	NA	NA	NA	NA	NA
Odisha											
Sunie Irrigation Project	32763	NA	47763	NA	1500	NA	NA	NA	NA	NA	2000
Jaimangla	40000	NA	40000	15000	10000	NA	NA	NA	NA	1.38 lac	2000
Hirakud	31050	NA	40050	15000	1500	NA	NA	NA	NA	1.40 lac	2000
Mahanadi Delta 1974-75	40000	NA	40000	15000	1500	25000	NA	NA	NA	NA	2000
Rushkuliya	40000	NA	40000	15000	10000	NA	NA	NA	5000	723600	2000
Salandi Right	34275	NA	49275	15000	1500	NA	NA	NA	NA	NA	NA
Baitrani	32650	NA	47640	1500	1500	NA	NA	NA	NA	NA	2000
Potteru	50000	NA	50000	20000	2000	NA	NA	NA	NA	NA	2000
Upper Kolab	50000	NA	50000	20000	1500	NA	NA	NA	10000	12.09 lac	2000

State/Project	Field Channel/OFD Work			Construction of Field, Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation and Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Lined Channel (₹/Ha)	Unlined Channe (₹/Ha)	OFD (₹/Ha)								
Gohira Irrigation Project	31050	NA	32000	15000	1500	NA	NA	NA	NA	84000	2000
Upper Indrawati Major Irrigation Project	50000	NA	50000	20000	1500	NA	NA	NA	10000	1.08 lac	2000
Remal Irrigation project	34906	NA	49906	NA	1500	NA	NA	NA	NA	NA	2000
Jharkhand											
Mayurakshi Left bank, Dumka	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Kanchi Weir Irrigation Scheme	NA	NA	NA	NA	887	NA	NA	NA	NA	NA	NA
Bihar											
Gandak	25000	NA	25000	7000	2000	60000	10000	NA	10000	100000	2500
Badua	28617	NA	28617	4000	1000	NA	6000	NA	2000	12000	NA
Kiul	13884	NA	13884	4000	1000	NA	6000	NA	2000	12000	NA
Chandan	31607	NA	15000	4000	1000	NA	6000	NA	2000	12000	NA
Gandak	25250	NA	NA	9066	759	15000	6000	NA	NA	NA	NA
Badua & Chandan	28617	NA	28617	4000	1000	NA	6000	NA	2000	12000	NA
Sone	20600	NA	13593	NA	631	NA	6000	NA	19572	72000	NA
North Koel	NA	NA	24461.265	NA	631	NA	25440	NA	5000	72000	NA

(Source: Project Offices of the Respective States)

** NA-Not Applicable*

North-East Zone

As has been shown in Table 5.4 below, the projects in *Assam* incur expenditure in the range of ₹ 22000/ha to ₹ 50000/ha for overall OFD works and ₹ 5000/ha to ₹ 10000/ha for construction of field, intermediate and link drains. ₹ 500/ha to ₹ 2000/ha has been spent for survey, planning and design; and expenditure in the uniform range of ₹ 60000/ha has been spent for reclamation of waterlogged areas. Similarly, an expenditure of ₹ 100000/ha and ₹ 25000/ha has been spent for correction of system deficiencies and renovation & de-silting of tanks respectively. For adaptive trials & demonstrations; and training, monitoring & evaluation activities, expenditure to the extent of 75% of the actual expenditure as Central share has been incurred.

About ₹ 63000/ha has been spent for construction of lined field channel in all the projects in *Manipur*. A uniform expenditure of ₹ 9500/ha for construction of field, intermediate and link drains; and ₹ 1900/ha for survey, planning & design activity has been incurred. Expenses in the range of ₹ 16000/ha to ₹ 63000/ha have been incurred for adaptive trials and demonstrations. Similarly, expenditure in the range of ₹ 550/ha to ₹ 9500/ha for training and ₹ 1900/ha as one-time grant to WUAs has been incurred by the projects.

Medziphema Bowl project in *Nagaland* has spent ₹ 100000/ha for overall OFD works including ₹ 50000/ha for construction of lined field channel. ₹ 2500/ha for survey, planning & design and ₹ 8000/ha for correction of system deficiencies has also been spent. The expenses for other components include ₹ 15000/ha for adaptive trials, ₹ 100000 for training & evaluation activities; and ₹ 5000/ha as one-time grant to WUAs.

Table 5.4: Project Level Component wise Current Expenditure Pattern (North-East Zone)

State/Project	Field Channel/OFD Work			Construction of Field, Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation and Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Lined Channel (₹/Ha)	Unlined Channel (₹/Ha)	OFD (₹/Ha)								
North East Zone											
Assam											
Bordkarai	NA	NA	22000	5000	500	NA	6000	NA	1000	NA	NA
Kaldiya	NA	NA	50000	10000	2000	60000	100000	25000	75% of the actual expenditure as Central Share	75% of the actual expenditure as Central Share	NA
Dekadong	NA	NA	50000	10000	2000	60000	100000	25000	75% of the actual expenditure as Central Share	75% of the actual expenditure as Central Share	NA
Pahumara Irrigation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manipur											
Cluster of 21 MI Schemes Under Bishnupur District	62934	NA	62934	9500	1900	NA	NA	NA	16400	550	NA
Cluster of 37 MI Schemes in Thoubal, Ukrul, Chandel, Churanchandpur District	62934	NA	62934	9500	1900	NA	NA	NA	16400	550	NA

State/Project	Field Channel/OFD Work			Construction of Field, Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation and Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Lined Channel (₹/Ha)	Unlined Channel (₹/Ha)	OFD (₹/Ha)								
Cluster of 28 MI Schemes in East and west Districts of Imphal	62934	NA	NA	9500	NA	NA	1900	NA	16400	550	NA
Khuga Multipurpose Project	62934	9500	1900	NA	NA	NA	16400	550	62934	9500	1900
Thoubal Irrigation Project Phase 2	62934	9500	1900	NA	NA	NA	16400	550	62934	9500	1900
Nagaland											
Clusters of 11 M. I. Projects (Medziphema Bowl)	50000	NA	50000	NA	2500	NA	8000	NA	15000	100000	5000
Mizoram											
Cluster of 40 MI Schemes	*The project was completed in 2006-07.*										
Meghalaya											
Cluster of 6 MI Schemes	45000	NA	65000	NA	2000	NA	10000	NA	NA	NA	4000
Arunachal Pradesh											
Cluster of 62 MI Schemes	65000	NA	80000	NA	1500	NA	12000	NA	NA	NA	2000

State/Project	Field Channel/OFD Work			Construction of Field, Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation and Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Lined Channel (₹/Ha)	Unlined Channel (₹/Ha)	OFD (₹/Ha)								
Sikkim											
Cluster of 21 MI Schemes	*No on-going project in the State.*										
Tripura											
Cluster of 4 MI Schemes	*No funds received after 2006-07.*										

(Source: Project Offices of the respective states)

**NA-Not Applicable*

West Zone

As has been shown in Table 5.5 below, Tillari Irrigation project in *Goa* has incurred expenditure of about ₹ 95600/ha for construction of lined field channel: ₹ 2500/ha for survey, planning & design activity; ₹ 50000/ha for adaptive trials & demonstrations and ₹ 4000/ha as one-time grant to WUAs.

Sardar Sarovar Project Phase-1 in *Gujarat* has spent an amount of ₹ 36000/ha for overall OFD works which includes ₹ 14000/ha for construction of lined field channel and ₹ 1200/ha for construction of unlined field channel. The expenditure incurred for other components include ₹ 7300/ha for construction of field drains and ₹ 25000/ha for training, monitoring & evaluation activities.

The projects in *Maharashtra* have incurred expenditure in the range of ₹ 16000/ha to ₹ 57000/ha for overall OFD works. Expenditure in the range of ₹ 3000/ha to ₹ 5400/ha for construction of field, intermediate & link drains; ₹ 700/ha to ₹ 1400/ha for survey, planning & design activity; and ₹ 600/ha to ₹ 2000/ha has been incurred for training, monitoring & evaluation activities.

Table 5.5: Project Level Component wise Current Expenditure Pattern (West Zone)

State/Project	Field Channel/OFD Work			Construction of Field, Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation and Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Lined Channel (₹/Ha)	Unlined Channel (₹/Ha)	OFD (₹/Ha)								
West Zone											
Goa											
Tillari Irrigation Project	95600	NA	NA	NA	2500	NA	NA	NA	50000	NA	4000
Gujarat											
Sardar Sarovar NP	14070	1190	20865	7311	609	NA	NA	NA	NA	25000	NA
Maharashtra											
Krishna	42000	NA	15750	4200	1148	NA	NA	NA	NA	2000	NA
Dhombalkawadi	15750	NA	15750	4200	1148	NA	NA	NA	NA	2000	NA
Kukadi	16700	NA	16700	NA	735	NA	915	NA	NA	NA	NA
Chaskaman	16700	NA	16700	NA	772	NA	NA	NA	NA	NA	NA
Nandur MMC	16250	NA	NA	3000	870	NA	NA	NA	NA	566	NA
Upper Pen Ganga	15000	NA	25300	5400	1400	NA	NA	NA	NA	1800	NA

(Source: Project Offices of the respective States)

**NA-Not Applicable*

5.3 State Level Component wise Current Expenditure Pattern

As shown in Table 5.6 below, the average costs for the components have been estimated for the states having commonality in figures outlining specific costs followed or proposed by the concerned states due to specific reasons. The figures highlighted in Table 5.6 below, therefore, are not included in estimating the average cost as these figures are either too low or too high, hence, will disturb the average.

The field channels under CADWM programme are expected to provide irrigation water to each of the plots in the command area. The states covered under the study have followed different types of designs of field channels depending upon the local requirement in terms of technology, material and availability of financial resources. The specific designs followed for construction of field channels in different zones along with the proposed cost estimates are as mentioned below.

South Zone

All states in south zone except Andhra Pradesh have asked for funds for lined channel varying between ₹ 22000/ha to ₹ 28000/ha.

For construction of unlined channel and OFD works, the states have incurred expenditure in the range of ₹ 12000/ha to ₹ 14000/ha. However, for OFD works, the expenditure ranges between ₹ 14000/ha to ₹ 41000/ha. The cost estimates for construction of link drains ranges from ₹ 5000/ha to ₹ 15000/ha and the same for survey activity ranges from ₹ 2000/ha to ₹ 2600/ha. For reclamation of water logged areas, the incurred expenditure is in the range of ₹ 55000/ha to ₹ 70000/ha whereas the same for correction of system deficiencies is in the range of ₹ 8000/ha to ₹ 26000/ha. The states in south zone have spent about ₹ 4000/ha as one-time grant to WUAs.

West Zone

Due to undulated topography and high seepage losses, Goa adopted construction of lined channels which consist of semi circular pipes laid on pillars at different gradient to maintain the gravity flow. It has incurred expenditure in the range of ₹ 95000/ha to ₹ 120000/ha for construction of lined field channel in order to follow the mentioned design. The expenditure incurred by Gujarat and Maharashtra for the same component varies from ₹ 14000/ha to ₹ 20000/ha.

For OFD works, expenses range from ₹ 17000/ha to ₹ 21000/ha; and for construction of link drains, expenditures are in the range of ₹ 4000/ha to ₹ 7500/ha.

All states except Gujarat have incurred expenditure in the range of ₹ 1000/ha to ₹ 2500/ha for undertaking the survey, planning & design activity whereas Gujarat has spent only ₹ 600/ha for the same.

North Zone

All states in the North Zone have incurred expenditure in the range of ₹ 15000/ha to ₹ 27000/ha for construction of lined field channel. Similarly, for OFD works, the incurred expenditures are in the range of ₹ 20000/ha to ₹ 35000/ha.

For correction of system deficiencies, the expenditure ranges from ₹ 5000/ha to ₹ 8000/ha, for survey, planning & design activity it ranges from ₹ 1200/ha to ₹ 2200/ha and the same as one-time grant to WUAs for their sustainability is in the range of ₹ 2500/ha to ₹ 4000/ha.

East Zone

The expenditure incurred for construction of lined field channel in the East Zone ranges from ₹ 25000/ha to ₹ 38000/ha except in Chhattisgarh. For overall OFD works, the incurred expenditure is in the range of ₹ 22000/ha to ₹ 44000/ha.

The states are uniformly incurring expenditure as one-time grant to WUAs in the range of ₹ 2000/ha to ₹ 2500/ha.

North East Zone

The expenditure incurred for construction of lined field channel ranges from ₹ 50000/ha to ₹ 63000/ha; and the same for OFD works ranges from ₹ 32000/ha to ₹ 50000/ha. In this zone, lined and unlined channels have the same discharge capacity of 1 cusec. Due to undulated slope, the construction cost of the channels is very high; hence, they adapt only 1 cusec discharge capacity design.

The National average of expenditure pattern for construction of lined channel comes to around ₹ 25,000/ha whereas the same is around ₹ 12,000/ha for the unlined channels. The average expenditure on survey, planning and design is around ₹ 2000/ha whereas a national average of ₹ 8000/ha seems to be more commonly adopted expenditure for construction of field, intermediate and link channels in the command area. The expenditure pattern emerging at national level for reclamation of waterlogged areas comes out as ₹ 41,000/ha. However, there are two types of interventions in the command areas. The cost norm for sub-surface drainage is coming at a rate of around ₹ 60,000/ha whereas the same may be considered as ₹ 25,000/ha for surface drainage, bio drainage, etc. Similar to reclamation of water logged areas, intensity of system deficiencies varies from one situation to the other emerging an average figure of ₹ 12,000/ha at national level.

Table 5.6: State Level Component wise Current Expenditure Pattern

Zone/State	Field Channel/OFD Work			Construction of Field, Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation and Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Lined Channel (₹/Ha)	Unlined Channel (₹/Ha)	OFD (₹/Ha)								
Southern Zone											
Andhra Pradesh	NA	11572	40876	NA	2172	NA	NA	NA	NA	NA	NA
Karnataka	27750	NA	NA	5000	NA	70000	8000	NA	NA	NA	NA
Tamil Nadu	22315	12499	17375	15334	2084	NA	14917	NA	NA	91667	NA
Kerala	24512	14334	13850	5000	2667	55750	26667	34676	14630	45371	NA
Western Zone											
Goa	95600	NA	NA	NA	2500	NA	NA	NA	5000	NA	4000
Gujarat	14070	2190	20865	7311	609	NA	NA	NA	NA	25000	NA
Maharashtra	20400	NA	17659	4200	1013	NA	915	NA	NA	1592	NA
Northern Zone											
Jammu and Kashmir	27160	NA	21352	5000	1215	13889	5667	10000	3000	16924	4000
Haryana	27500	NA	25000	8000	2250	NA	10000	NA	35000	55750	2500
Punjab	15000	NA	25300	5400	1400	NA	NA	NA	NA	1800	NA
Rajasthan	25000	NA	35000	8000	2000	60000	NA	NA	30000	100000	2500
Eastern Zone											
West Bengal	32000	NA	34000	NA	1875	NA	NA	NA	NA	21134	2000
Chhattisgarh	3236	NA	44113	NA	781	NA	NA	NA	NA	1000	2000
Orissa	38892	NA	44720	15150	2959	25000	NA	NA	8334	400434	2000

Zone/State	Field Channel /OFD Work			Construction of Field Intermediate and Link Drains (₹/Ha)	Survey, Planning & Design (₹/Ha)	Reclamation of Waterlogged Areas (₹/Ha)	Correction of System Deficiencies (₹/Ha)	Renovation and Desilting of Tanks (₹/Ha)	Adaptive Trials and Demonstrations (₹/Ha)	Training, Monitoring and Evaluation (₹/Training)	One Time Grant to WUAs (₹/Ha)
	Lined Channel (₹/Ha)	Unlined Channel (₹/Ha)	OFD (₹/Ha)								
Jharkhand	NA	NA	NA	NA	887	NA	NA	NA	NA	NA	NA
Bihar	25545	NA	22597	4600	1038	6000	9907	NA	3834	29600	2500
North east zone											
Assam	NA	NA	40667	8334	1500	60000	68667	25000	1000	NA	NA
Manipur	62934	9500	32417	9500	1900	NA	11567	550	35014	4130	1900
Nagaland	50000	NA	50000	NA	2500	NA	8000	NA	15000	100000	5000
Average	25440	11976	31208	7756	1938	41519	11840	23225	–	58327	3100
Say	25000	12000	31000	8000	2000	41000	12000	23000	–	58000	3000

(Source: Project offices of the respective states)

**NA-Not Applicable*

Table 5.7: Comparison of SOR

S.No.	State	Dag Belling (In ₹)	Earth work excavation (In ₹)	Cement concrete 1:3:6 (In ₹)	Cement concrete 1:2:4 (In ₹)	Cement concrete 1:4:8 (In ₹)	Filling of available soil on both sides of field channel (In ₹)	Jungle Clearance with shurb removal (In ₹)	Random rubble masonry (In ₹)	Stone masonry (In ₹)	Stone pitching (In ₹)	Brick masonry (In ₹)
		Rmt	Cum	Cum	Cum	Cum	Sqm	Sqm	Cum	Cum	Cum	Cum
1	Andhra Pradesh	0.9	35	5057	5118	4233	69	4	265	-	1078	-
2	Karnataka	0.6	55	2584	2250	1910	182	6	-	910	657	-
3	Tamil Nadu	0.8	52	2743	3240	2260	56	4	-	-	-	-
4	Goa	1.5	168	3308	4062	2984	182	3.5	624	-	-	-
5	Gujarat	1.3	76	2484	3651	2110	69	3.35	-	-	-	2525
6	Jammu & Kashmir	1.5	111	2560	3920	1930	47	4	-	-	-	-
7	Punjab	0.7	35	2700	3120	3470	33	2.5	-	-	-	1805
8	Rajasthan	0.7	36	2632	3041	2375	45	1.7	1512	-	-	-
9	Himachal Pradesh	1	209	3724	4205	2732	132	3	-	-	-	6263
10	Chhattisgarh	0.8	71	3007	2598	2270	96	2.5	-	-	-	-
11	Orissa	0.9	60	1725	4939	2477	30	2	-	1725	-	-
12	Manipur	1.5	60	2010	2430	1680	72	5	-	-	-	-
13	Meghalaya	1.8	71	2344	3717	2673	64	4	-	1148	512	-
14	Arunachal Pradesh	1.4	80	2780	3405	2294	80	4	-	-	-	-

5.4 Proposed Rates for Different CADWM Components

The recommendations have been made on the basis of median rates in the Schedule of Rates (SoR) of states (Table 5.7) taking 2012 as a base year.

- A yearly increase may be considered according to the changing price index during the XII Five Year Plan.
- The cost norms for the difficult areas and the areas under special category should be increased in proportion to the existing cost norms laid down in the guidelines.
- The designs, cost estimates and rate analysis for the recommended cost norms have been given in the following chapter (Chapter-6) of the report. Additional designs and estimates have been given in Annexure-2 of the Annexure Volume 1.
- The proposed rates for the different components are as follows:

Survey, Planning and Design

✓ ₹ 2000/ha (Refer Chapter 6, Section 6.1, Table 6.1 for Estimate)

OFD Works

❖ **Lined Field Channel**

✓ ₹ 783/Rmt for Cement Concrete (Refer Chapter 6, Section 6.2.1 for Design and Estimate)

✓ ₹ 948/Rmt for Stone Masonry (Refer Chapter 6, Section 6.2.2 for Design and Estimate)

✓ ₹ 932/Rmt for Brick Masonry (Refer Chapter 6, Section 6.2.3 for Design and Estimate)

❖ **Unlined Field Channel**

✓ ₹ 102/Rmt (Refer Chapter 6, Section 6.3 for Design and Estimate)

Construction of Field, Intermediate and Link Drains

✓ ₹ 200/Rmt (Refer Chapter 6, Section 6.4 for Design and Estimate)

Reclamation of Waterlogged Areas

✓ ₹ 29128/ha for surface drainage (Refer Chapter 6, Section 6.6.1 for Design and Estimate)

✓ ₹ 70926/ha for sub-surface drainage (Refer Chapter 6, Section 6.6.2 for Design and Estimate)

Correction of System Deficiencies

✓ ₹ 8366/ha (Refer Chapter 6, Section 6.5 for Estimate)

- 3% of the project cost may be allocated for **Software Activities** including institution and capacity building of WUAs and frontline staff; Monitoring and Evaluation; and Adaptive Trials and Frontline Demonstrations.

- ₹ 2500/ha as a **one-time functional grant be provided to the WUAs** to ensure repair and maintenance and financial sustainability of WUAs.

The above mentioned proposed rates when compared with the existing cost norms, present a picture as shown in Table 5.8 below:

- The existing cost norms are being followed since 2003-04. The data collected during the study was analysed and it was observed that the cost of material has almost doubled and there has been an increase of about 60% in the cost of labour.

- The proposed cost for survey, planning and design activity and construction of field, intermediate and link drains is 100% more than the existing norms and the proposed increase in the cost of OFD works is 99%.

- The increase in the proposed cost for reclamation of waterlogged areas is in the range of 78% to 93%. The proposed cost for correction of system deficiencies is 40% more than the existing norms.

- The increase in the proposed cost for other components like software activities, one-time functional grant to WUAs and CAD Establishment cost is in the range of 118% to 150% over the existing norms for them.

Table 5.8: Component wise Existing Norms and Proposed Cost

S.No.	Activities	% area/Work covered	Existing		Proposed		% Increase
			Unit Rate/ha (₹)	Cost/ha (₹)	Unit Rate/ha (₹)	Cost/ha(₹)	
1	Survey, Planning and Design	100	1000	1000	2000	2000	100
2	OFD Works	100	15000	15000	29900	29900	99
	i) FIC – Lined				25000	25000	
	ii) FIC – Unlined				490C	4900	
3	Field, Intermediate and Link Drains	10	4000	400	800C	800	100
4	Reclamation of Waterlogged Areas						
	i) Surface Drainage System	2	15000	300	29000	580	93
	ii) Sub-surface Drainage System	0.2	40000	80	71000	142	78
5	Correction of System Deficiencies	3	6000	180	840C	252	40
6	Software Activities (3% of Sr. No. 2,3 4 and 5)	3	16040	481	34994	1050	118
7	One-Time Functional Grant to WUAs	100	1000	1000	250C	2500	150
8	CAD Establishment Cost (20 % of Sr. No. 2,3,4 and 5)	20	16040	3208	34994	7000	118
	Cost per ha			**21649**		**44224**	**104**

CHAPTER-6: DESIGNS AND COST ESTIMATES

6.1 Survey, Planning and Design

Table 6.1: Cost of Survey and Planning For 1 Hectare

S.No.	Item	Unit Rate (in ₹)	Amount (in ₹)
1	Collection of maps, field measurement book and sketches	2 Nos x 150/day	300.00
2	Charges for field survey and identification of field channel boundaries	3 Nos x 150/day Field Staff (local)	450.00
3	Conveyance charges to levelling instrument, staff and other materials	1 Nos x 150/day	150.00
4	Charges to taking levels and marking	4 Nos x 150/day	600.00
5	Material charges , photocopy, tracing paper, Ammonia print, colour sketches and other stationery materials	--	100.00
6	Charges for preparation of Plan and estimates , drawing, typing and printing	--	400.00
		TOTAL	**₹ 2000.00**

6.2 Field Irrigation Channel-*Lined*

6.2.1 Field Irrigation Channel - Cement Concrete

Figure 6.2: Cross Section of Earthen Levee and Section Cutting

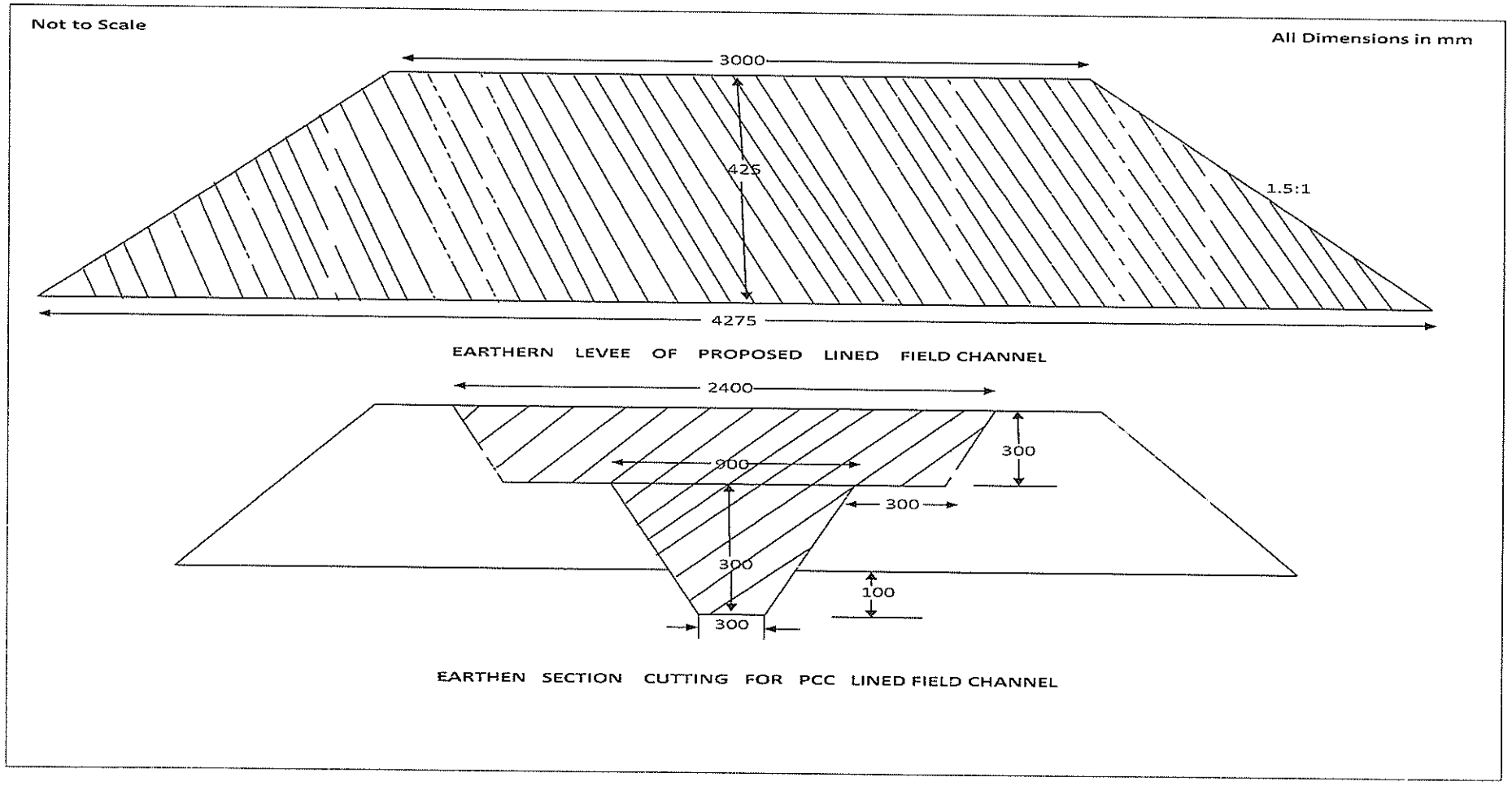


Figure 6.2: Cross Section of FIC – Cement Concrete

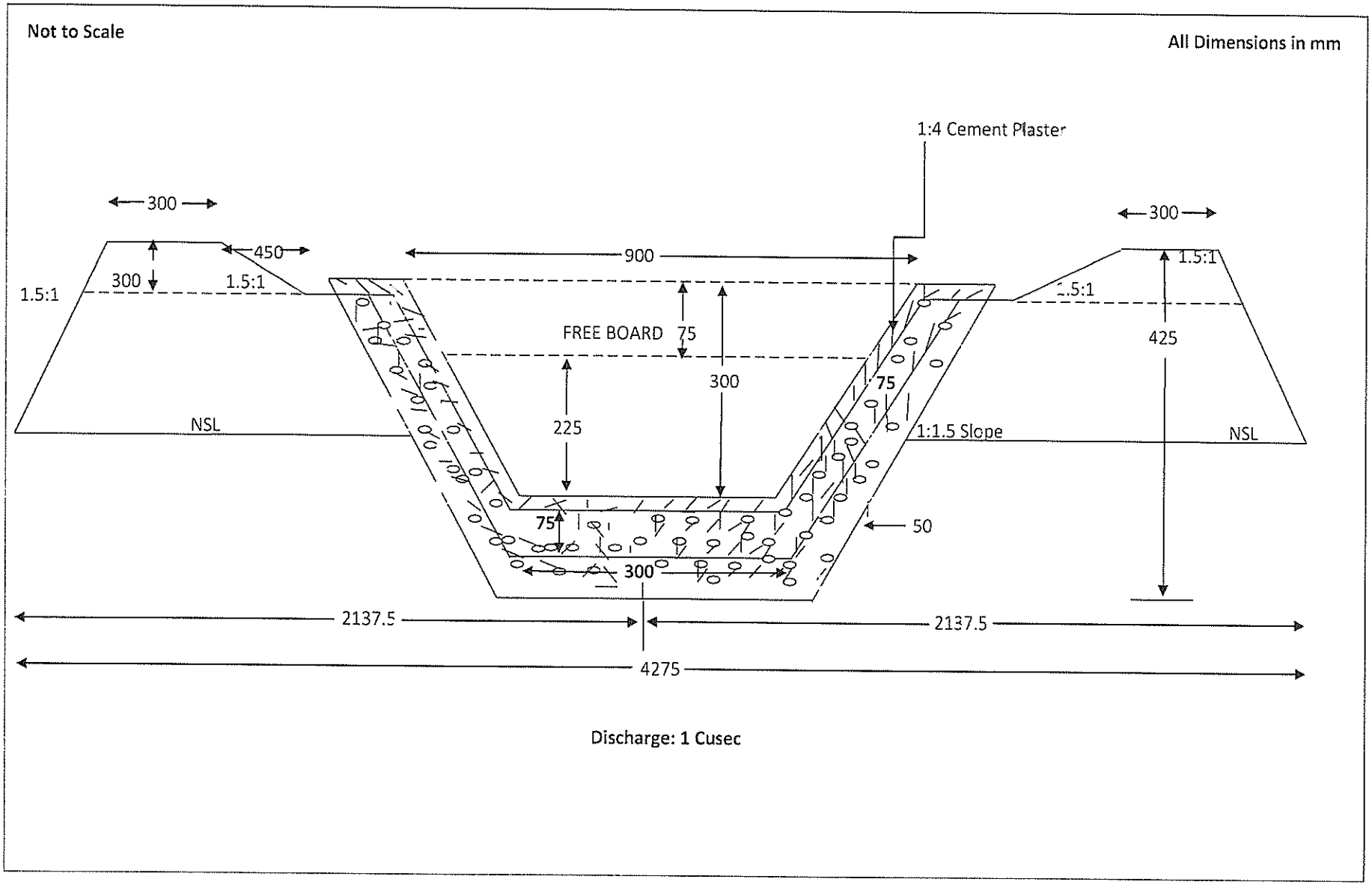


Table 6.2: Detailed Cost Estimate of Lined FIC - Cement Concrete (Discharge = 1Cusec)

S.No.	Name of Item	No.	Length	Width	Height/ Depth	Quantity	Rate (₹)	Unit	Amount (₹)
1	Dag belling 7.5 cm to 1C cm deep	1	1.00			1.00	11.00	10 M	1.10
2	Cutting & clearance of jungle bushes, shrubs Ankra/Ipomoea, Julieflora typha etc. on canals and bunds in dry/moist/slushy conditions including disposal	1	1.00	4.28		4.280	3.50	Sqm	14.98
3	Earth work in excavation including loading, unloading, disposal and dressing of excavated earth within initial lead of 50m and lift up to 1.5 m in dry or moist including dressing of excavated area With cost of dewatering wherever required, and all applicable taxes and levies etc Complete in all respect.	1	1.00	3.63	0.425	1.540	47.00	Cum	72.38
4	Earth work in excavation including loading, unloading, disposal and dressing of excavated earth within initial lead of 50m and lift up to 1.5m in dry or moist including dressing of excavated area With cost of dewatering wherever required, and all applicable taxes and levies etc Complete in al respect.	1	1.00	0.83	0.325	0.270	47.00	Cum	12.69
5	Supplying and laying sand in required profile including all lead & lifts.	1	1.00	1.34	0.05	0.070	590.00	Cum	41.30
6	Cement concrete(1:3:6) M-10 well mixed and laid in position complete including all leads of all construction materials including curing and finishing having well graded crusher and finishing having graded crusher broken stone aggregate of maximum size up to 20 mm.	1	1.00	1.240	0.08	0.090	2661.00	Cum	239.49
7	Wire Mesh	1	1.00			1.000	45.00	Rmt	45.00

S.No.	Name of Item	No.	Length	Width	Height/ Depth	Quantity	Rate (₹)	Unit	Amount (₹)
8	Plaster in cement sand mortar 1:4 including racking of joints, smooth finishing & curing etc. Complete including all leads of construction materials; of thickness: 12mm.								
	Inner	2	1.00		1.14	**2.280**		Sqm	
	Outer	2	1.00		0.10	**0.200**		Sqm	
	Total					**2.480**	**130.00**	Sqm	**322.40**
								Total	**₹ 749.34**
								Add Contingency 3 %	22.48
								Work establishment charges @ 1.5 %	11.24
								Grand Total	**₹ 783.06**

6.2.2 Field Irrigation Channel lined - Stone Masonry

Figure 6.3: Cross Section of FIC - Stone Masonry

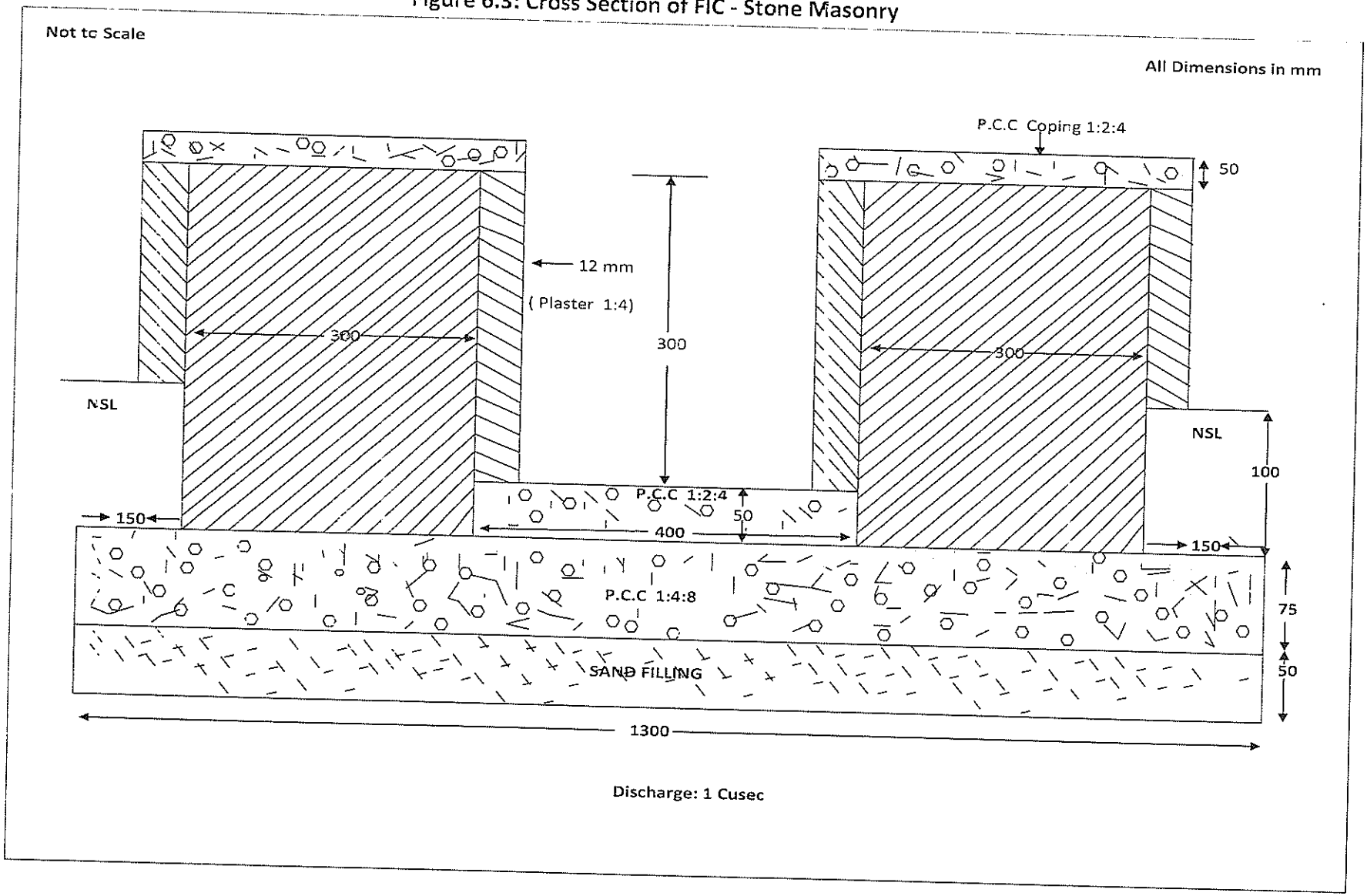


Table 6.3: Detailed Cost Estimate of L ned FIC with Stone Masonry (Discharge = 1Cusec)

S.No.	Name of Item	No.	Length	Width	Height/Depth	Quantity	Rate(₹)	Unit	Amount(₹)
1	Dag belling 7.5 cm to 10 cm deep	1	1.00			1.00	11.00	10 M	1.10
2	Cutting & clearance of jungle, bushes, shurbs Ankra/Ipomoea, Julieflora typha etc on canals and bunds in dry/moist/slushy condit ons including.	1	1.00	4.00		4.000	3.50	Sqm	14.00
3	Earth work in excavation including loading, unloading, disposal and dressing of excavated earth within initial lead of 50m and lift up to 1.5m in dry or moist including dressing of excavated area With cost of dewatering wherever required, anc all applicable taxes and levies etc Complete in all respect.	1	1.00	1.30	0.225	0.290	47.00	Cum	13.63
4	Supplying and laying sand in required profile including all lead & lifts	1	1.00	1.30	0.05	0.070	590.00	Cum	41.30
5	Cement concrete (1:4:8) M-7.5 well mixed and laid in position complete including all leads of all construction materials ncluding curing and finishing having well graded Crusher broken stone aggregate of maximum size upto: 20mm.	1	1.00	1.30	0.075	0.100	2397.00	Cum	239.70
6	Random rubble stone masonry (using R.R. stones where 75% stones to be not less than 15 cm in size in any direction and weighing not less than 23 Kg.) for super structure including curing all leads of construction materials ,&all taxes and with initial lift / de-lift of 5m from ground level etc complete in cement sand mortar 1:6	2	1.00	0.300	0.30	0.180	1650.00	Cum	297.00
7	Cement concrete (1:2:4) M-15 well mixed and laid in position complete including all leads of all construction materials including curing and finishing having well graded crusher broken stone aggregate of maximum size upto: 20mm.	1	1.00	0.400	0.05	0.020	3303.00	Cum	66.06

S.No.	Name of Item	No.	Length	Width	Height/Depth	Quantity	Rate(₹)	Unit	Amount(₹)
8	Plaster in cement sand mortar 1:4 including racking of joints, smooth finishing & curing etc complete including all leads of construction materials ; of thickness: 12mm.								
	Inner	2	1.00		0.25	0.500		Sqm	
	Outer	2	1.00		0.20	0.400		Sqm	
	Total					0.900	130.00	Sqm	117.00
9	Providing and laying cement concrete coping in (1:2:4) with maximum size of crusher broken aggregate upto 20mm, including shuttering etc. with all leads of material complete in all respect in thickness of : 50mm.	2	1.00	0.324		0.650	160.00	Sqm	104.00
10	Re-handling excavated material including loading unloading and dressing within initial lead of 50m and lift 1.5m With cost of dewatering wherever required, and all applicable taxes and leveies etc complete in all respect Earth/Soil.	Quantity as per Item no -1				0.290	45.00	Cum	13.05
								Total	₹ 906.84
								Contingency charges @ 3 %	27.21
								Work establishment charge @ 1.5 %	13.60
								Grand Total	₹ 947.65

6.2.3 Field Irrigation Channel lined - Brick

Figure 6.4: Cross Section of FIC – Brick

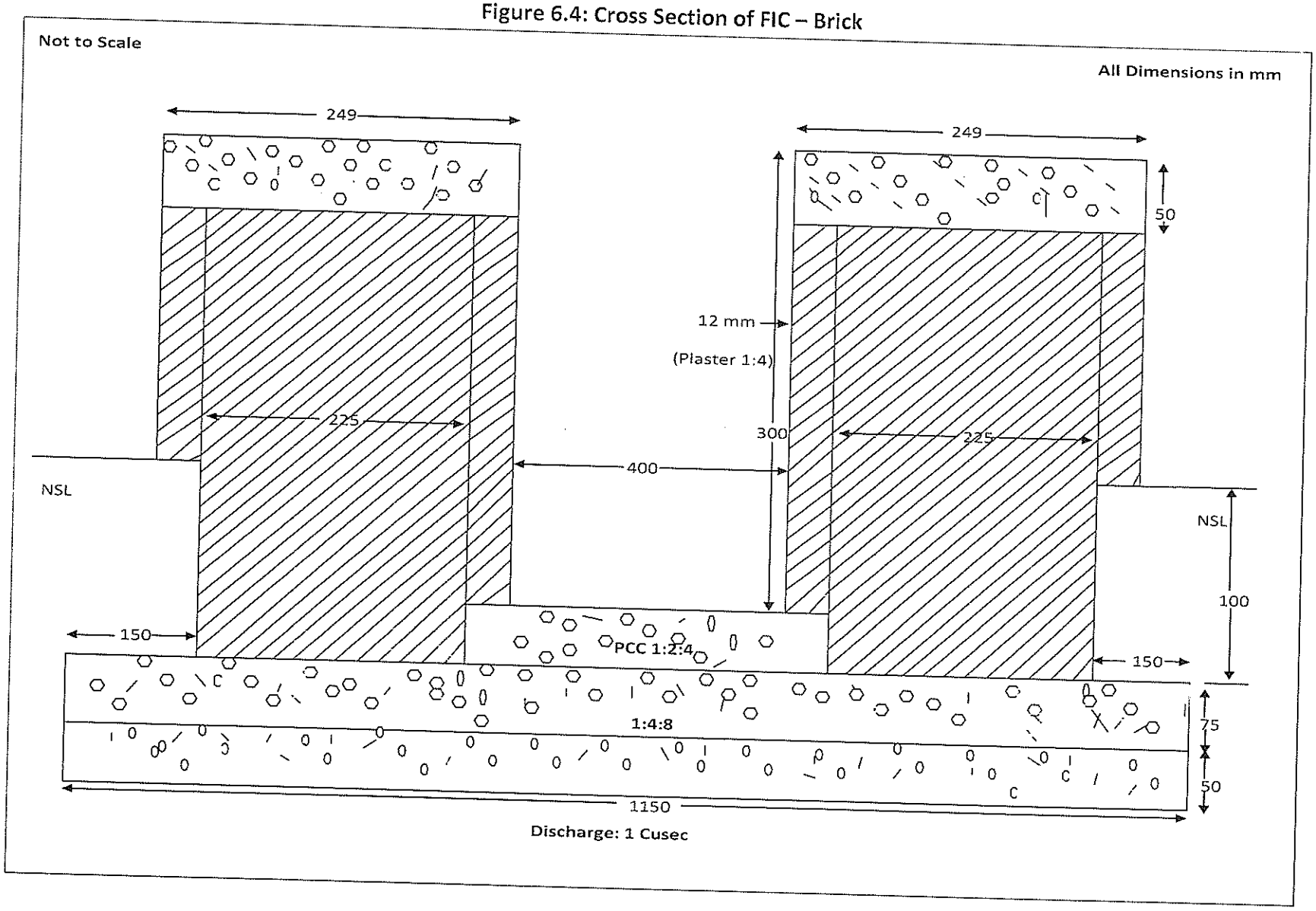


Table 6.4: Detailed Cost Estimate of Lined Field Irrigation Channel-Brick (Discharge = 1Cusec)

S.No.	Name of Item	No.	Length	Width	Height/Depth	Quantity	Rate(₹)	Unit	Amount(₹)
1	Dag belling 7.5 cm to 10 cm deep.	1	1.00			1.00	11.00	10 M	1.10
2	Cutting & clearance of jungle, bushes, shurbs Ankra/ pomoea, Julieflora typha etc on canals and bunds in dry/ moist/ slushy conditions inclucing disposal.	1	1.00	4.00		4.000	3.50	Sqm	14.00
3	Earth work in excavation including loading, unloading, disposal and dressing of excavated earth within initial lead of 50m and lift up to 1.5m in dry or moist including dressing of excavated area With cost of dewatering wherever required, and all applicable taxes and levies etc. complete in all respect.	1	1.00	1.15	0.225	0.260	47.00	Cum	12.22
4	Supplying and laying sand in requires profile including all lead & lifts.	1	1.00	1.15	0.05	0.060	590.00	Cum	35.40
5	Cement concrete (1:4:8) M-7.5 well mixed and laid in position complete including all leads of all construction materials inclucing curing and finishing having well graded Crusher broken stone aggregate of maximum size upto: 20mm.	1	1.00	1.15	0.075	0.090	2397.00	Cum	215.73
6	Brick Masonry	2	1.00	0.225	0.30	0.140	2421.00	Cum	338.94
7	Cement concrete (1:2:4) M-15 well mixed and laid in position complete including all leads of all construction materials including curing and finishing having well graded crusher broken stone aggregate of maximum size upto: 20mm.	1	1.00	0.400	0.05	0.020	3303.00	Cum	66.06

S.No.	Name of Item	No.	Length	Width	Height/Depth	Quantity	Rate(₹)	Unit	Amount(₹)
8	Plaster in cement sand mortar 1:4 including racking of joints, smooth finishing & curing etc Complete including all leads of construction materials ; of thickness 12mm.								
	Inner	2	1.00		0.25	0.500		Sqm	
	Outer	2	1.00		0.20	0.400		Sqm	
	Total					**0.900**	**130.00**	Sqm	**117.00**
9	Providing and laying cement concrete coping in (1:2:4) with maximum size of crusher broken aggregate upto 20mm, including shuttering etc with all leads of material complete in all respect in thickness of : 50mm.	2	1.00	0.249		**0.500**	**160.00**	Sqm	**80.00**
10	Re-handling excavated materia including loading unloading and dressing within initial lead of 50m. and lift 1.5m With cost of dewatering wherever required, and all applicable taxes and leveies etc Complete in all respect.	Quantity as per Item no -1				**0.260**	**45.00**	Cum	**11.70**
								Total	**₹ 892.15**
								Add Contingency @ 3 %	26.76
								Work establishmert charges @ 1.5 %	13.38
								Total	**₹ 932.30**

6.3 Field Irrigation Channel-*Unlined*

Figure 6.5: Cross Section of FIC – Unlined

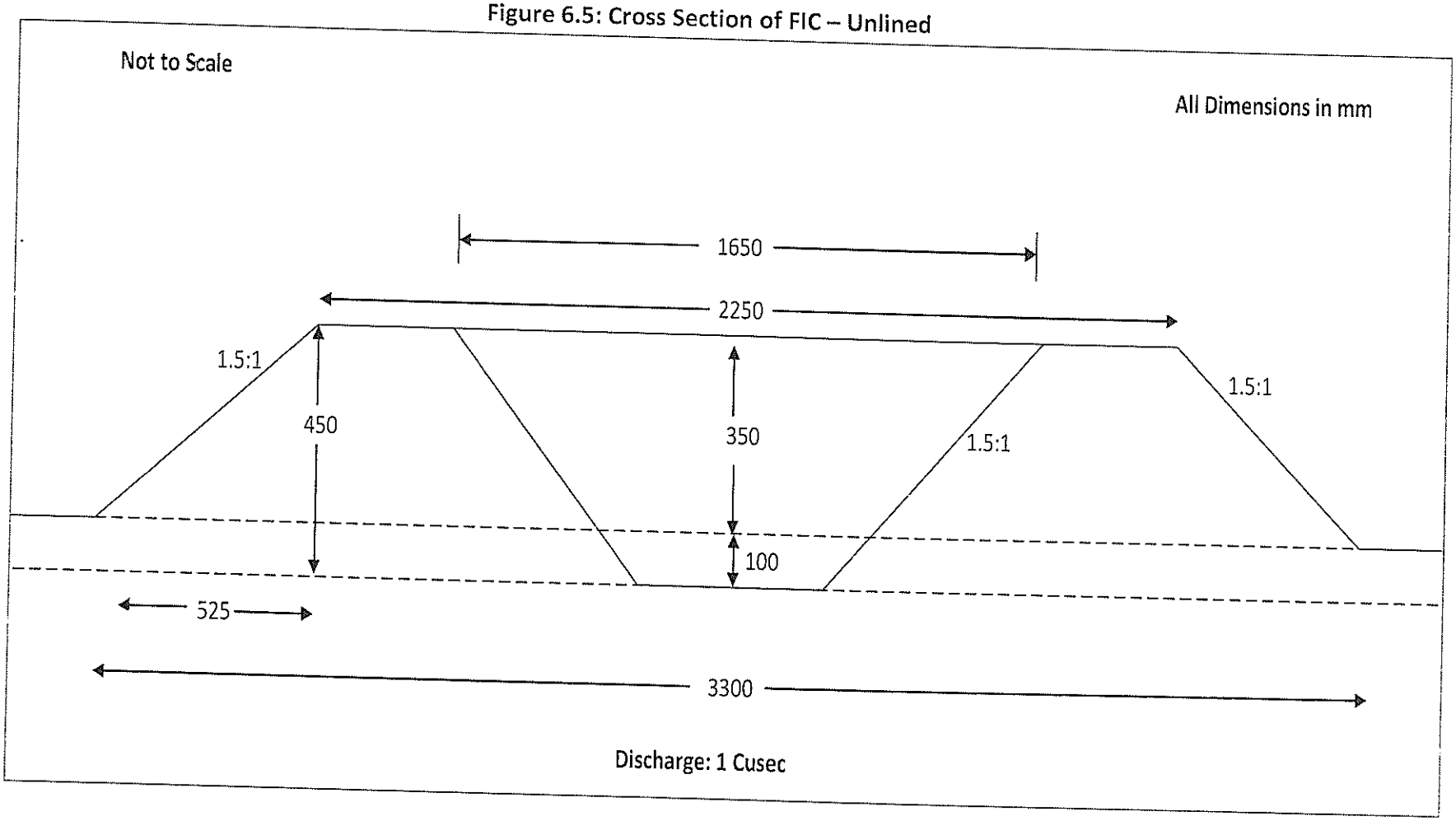


Table 6.5: Detailed Cost Estimate of Unlined Field Irrigation Channel (Discharge = 1 Cusec)

S.No.	Name of Item	No.	Length	Width	Height/ Depth	Quantity	Rate(₹)	Unit	Amount (₹)
1	Dag belling 7.5 cm to 10 cm deep.	1	1.00			1.000	11.00	10 M	1.10
2	Cutting & clearance of jungle, bushes, shurbs Ankra/ Ipomoea, Julie flora typha etc on canals and bunds in dry/ moist/ slushy conditions including disposal.	1	1.00	4.00		4.000	3.50	Sqm	14.00
3	Scrapping of grass and shrubs	1	1.00	4.00		4.000	1.50	Sqm	6.00
4	Ploughing surface of embankment	2	1.00	1.00		2.000	5.30	Sqm	10.60
5	Earth work in excavation including loading, unloading, disposal and dressing of excavated earth within initial lead of 50m and lift up to 1.5m. in dry or moist including dressing of excavated area With cost of dewatering wherever required, and all applicable taxes and levies etc.	1	1.00	2.77	0.35	0.970	47.00	Cum	45.59
6	Supplying and laying sand in required profile including all lead & lifts.	1	1.00	0.98	0.45	0.440	47.00	Cum	20.68
								Total	₹ 97.97
								Add Contingency @ 3 %	2.94
								Work charge establishment @ 1.5 %	1.47
								Grand Total	₹ 102.38

6.4 Field, Intermediate and Link Drains

Figure 6.6: Cross Section of Link and Intermediate Drain

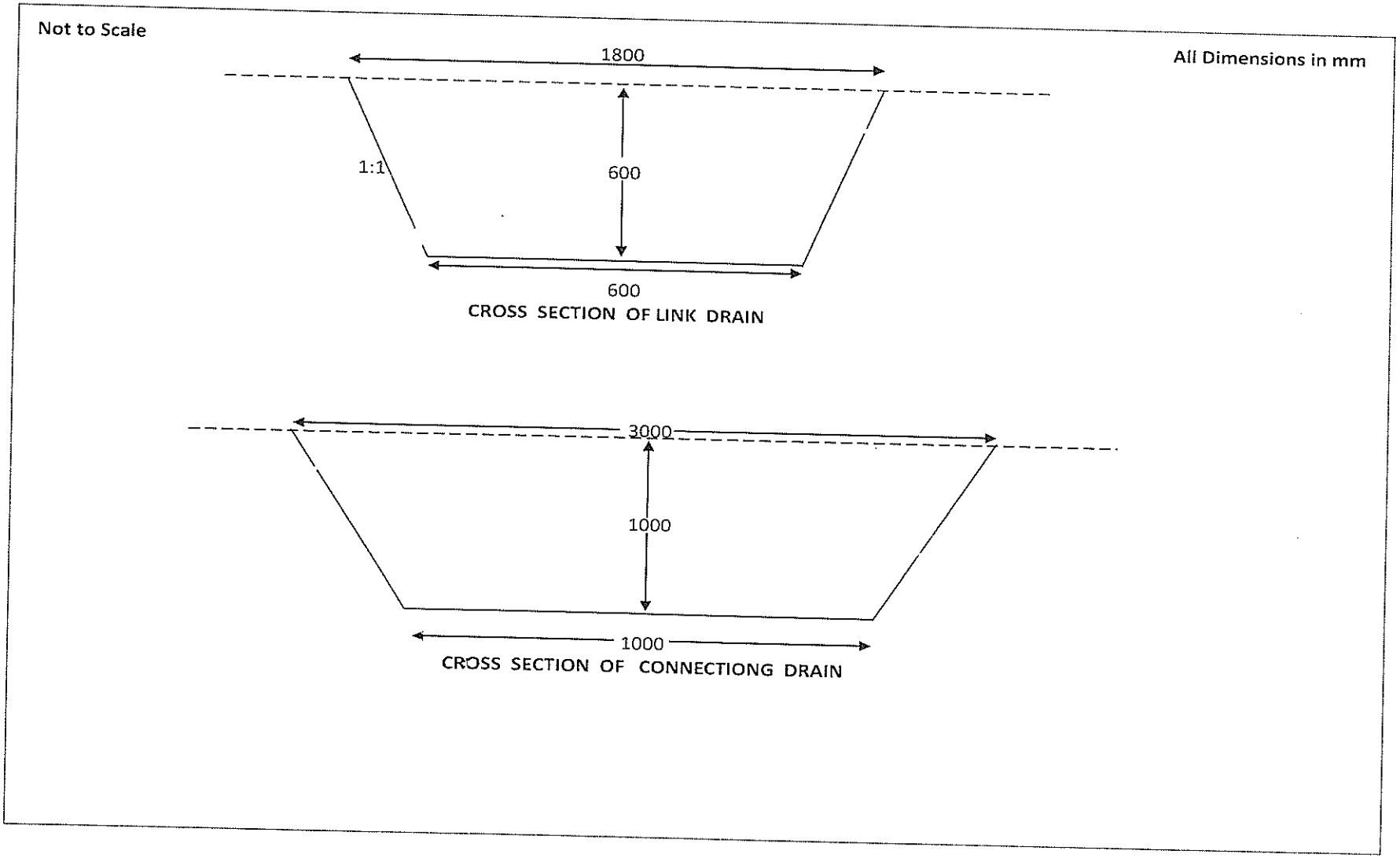


Figure 6.7: Cross Section of Main Drain

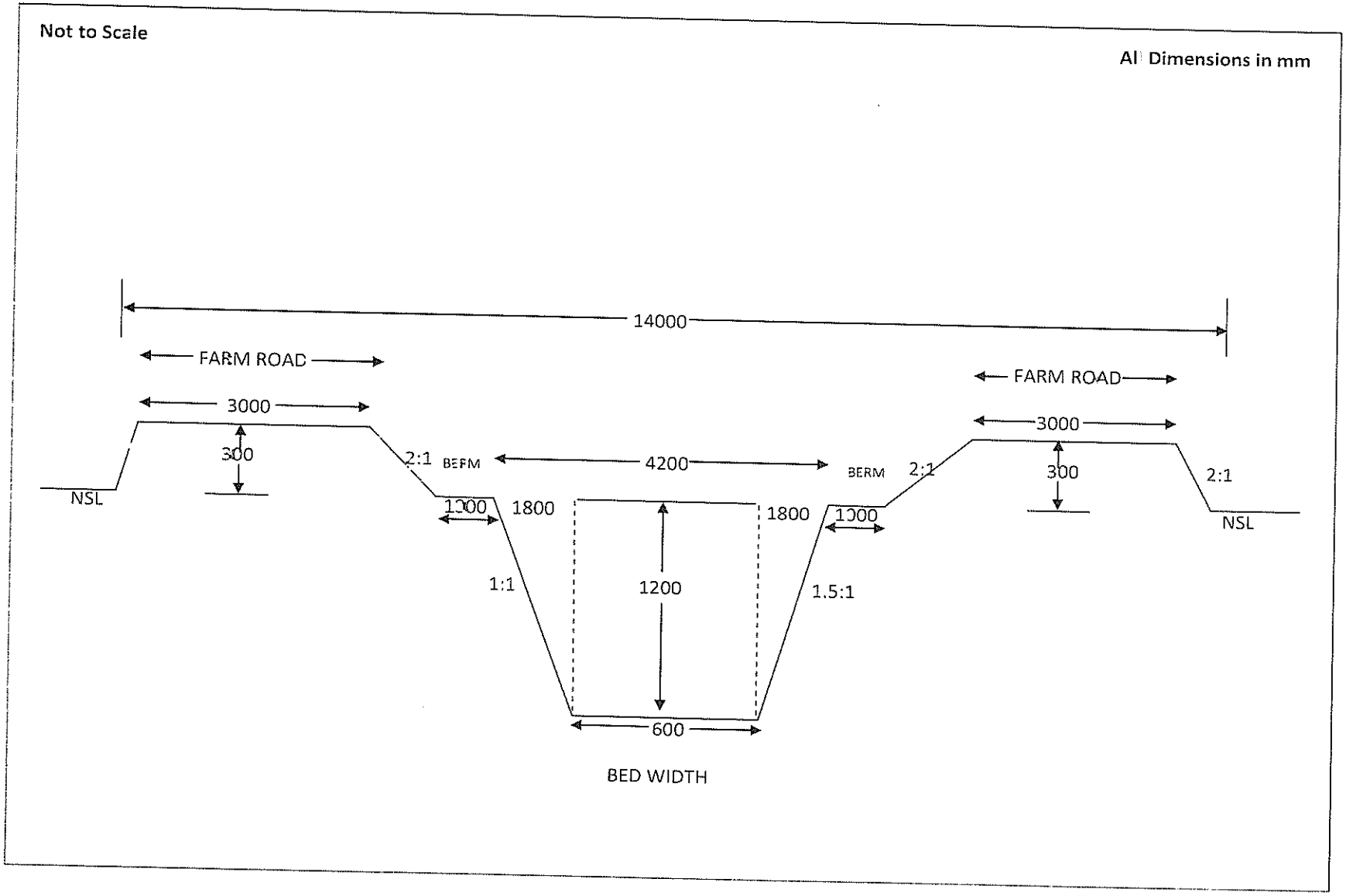


Table 6.6: Detailed Cost Estimate of Field, Intermediate and Link Drain

(Main Drain = 25m, Link Drains = 30m, Connecting Drains = 40m)

S.No.	Name of Work	Nos	Length	Width	Height\Depth	Quantity	Unit	Rate (₹)	Unit	Amount (₹)
1	Dag belling 7.5 cm to 10 cm deep.	7	1			7.00	M	11.00	10 RM	**7.70**
2	Cutting & clearance of jungle, bushes, shurbs Ankra/ Ipomcea, Julie flora typha etc on canals and bunds in dry/ moist/ slushy conditions including disposal.	1	1	14	100%	14.00	Sqm	3.50	Sqm	**49.00**
3	Earth work in excavation including loading, unloading, disposal and dressing of excavated earth within initial lead of 50m and lift up to 1.5m in dry or moist including dressing of excavated area With cost of dewatering wherever required, and all applicable taxes and levies etc complete in all respect.	1	1	2.40	1.2	2.88	Cum	47.00	Cum	**135.36**
4	Link drains	1	1	2.00	1.00	2.00	Cum	47.00	Cum	**94.00**
5	Connecting drains	1	1	1.20	0.6	0.72	Cum	47.00	Cum	**33.84**
								Total		**₹ 319.90**
								Add contingency charges @ 3 %		9.59
								Work establishment charges @ 1.5 %		4.79
								Grand Total		**₹ 334.28**

6.5 Correction of System Deficiencies

The estimate for correction of system deficiency works is prepared considering one hectare.

In the estimate, following provisions are made.

1) Jungle clearance
2) Removal of silt from the canal
3) Providing 15 cm thick CNS lining
4) Spreading and compacting 15 cm thick murrum over service roads.
5) Removal and resetting of existing slab lining.
6) Providing 10 cm thickness of RCC lining
7) Providing 10 cm thickness of CC lining.

Table 6.7: Typical Cost Estimate per ha for Correction of System Deficiencies

S. No.	Specification of Items	Unit	Qty	Unit Rate (₹)	Amount (₹)
1	Cutting removing jauliflora bushes up to 1.5 m girth removal of sumps and including burning or disposing off the material with initial lead up to 50m and all lifts	Nos	4.13	4.6	18.998
2	Excavation and removal of silt and silt mixed with sand from canal bed jack well in dry condition including disposing off the same in spoil bank or on the canal embankment inlayers as directed etc. complete with initial lead up to 50m and all lifts.	Cum	0.66	47	31.02
3	Excavation all kinds of soil including labour boulders up to 0.6m diameter (0.113cum) for canal/seating of embankment, filter drains/ catch water drains etc. including grossing bed and sides to required level and profile cost of all material, machinery, labour, placing the excavated soil neatly in dump area or for formation of service road/embankment as directed etc., complete with initial lead up to 1 km and depth of cut up to 18m.	Cum	6.23	47	292.81
4	Providing cohesive non swelling soil lining to canals using from approved borrow area including spreading clods, watering, compacting to density control of not less than 95% or as stipulated, dressing to required profile etc., complete with all lead and lifts etc., complete with lead up to 1m and all lifts.	Cum	2.62	220	576.40
5	Providing semi previous/ pervious casing embankment with soil from borrow area in layer of 250 to 300 mm before compaction including cost of all materials, machinery, labour, all operation such as excavation sorting out transporting, spreading in layers of specified thickness breaking clods, sectioning water compacting to density control of not less than 95% or as stipulated by vibrating sheep's foot roller / bas foot roller etc., complete with all leads and lifts	Cum	1.23	170	209.10
6	Removing and resetting disturbed another type of slab lining set in cm 1:3 including flush cement mortar pointing in cm 1:3 with lead up to 50m and all lifts	Sqm	2.67	35	93.45
7	Providing stones slab and fixing 25 to 40 m thick stone with pointing and finishing joints neatly in cm 1:3 proportion of canal field channels lining including cost of all materials, labour cutting slabs to required size mixing mortar checking and finishing joints curing etc. complete with lead up to 50m and all lifts.	Sqm	1.95	260	507
8	Providing, fabricating and placing in position reinforced steel bars for RCC works including cleaning, straightening, cutting, bending hooking, lapping, welding wherever required, lying with 1.25 mm dia. Soft annealed steel wire, including cost of all material, machinery, labour etc., complete with initial lead upto 50m and all lifts.	Kgs	22.68	70	1587.60

S. No.	Specification of Items	Unit	Qty	Unit Rate (₹)	Amount (₹)
9	Provid ng anc laying in-situ vibrated M-15(28 days cube compressive strength nct less than 15 N/sq mm) grade cement concrete using 20 mm down size approved ,clean, hard, graded coarse aggregate for bed lining of canal including finishing the junction of bed and sices to required curvature, cost of all material, machinery, labour, formwork including supports cleaning, batching, mixing, placing in position levelling, vibrating finishing, curing etc., complete with lead up to 50 m and all lifts(cement content270l/cum with user of super plasticizer)	Sqm	0.3	3303	990.90
10	Providing and laying in-situ vibrated M-15 (28 days cube compressive strength not less than 15 N/sqmm) grade cement concrete using 20 mm down size approved, clean, hard , graded coarse aggregate for bed lining of canal including cost of all materials, machinery, labour , formwork including supports, cleaning, batching , mixing placing in position levelling, vibrating, finishing, curing etc., complete with initial lead up to 50 m and all lifts (cement content 270 k/cum with use of super plasticizer)	Sqm	1.12	3303	3699.36
				Total	₹ 8006.63
				Add Contingency charges @ 3 %	240.19
				Work establishment charges @ 1.5 %	120.09
				Grand total	₹ 8366.93
	Cost per Hectare = ₹ 8366.93				

6.6 Reclamation of Waterlogged Area

6.6.1 Surface Drainage

Figure 6.8: Cross Section of Field Drain

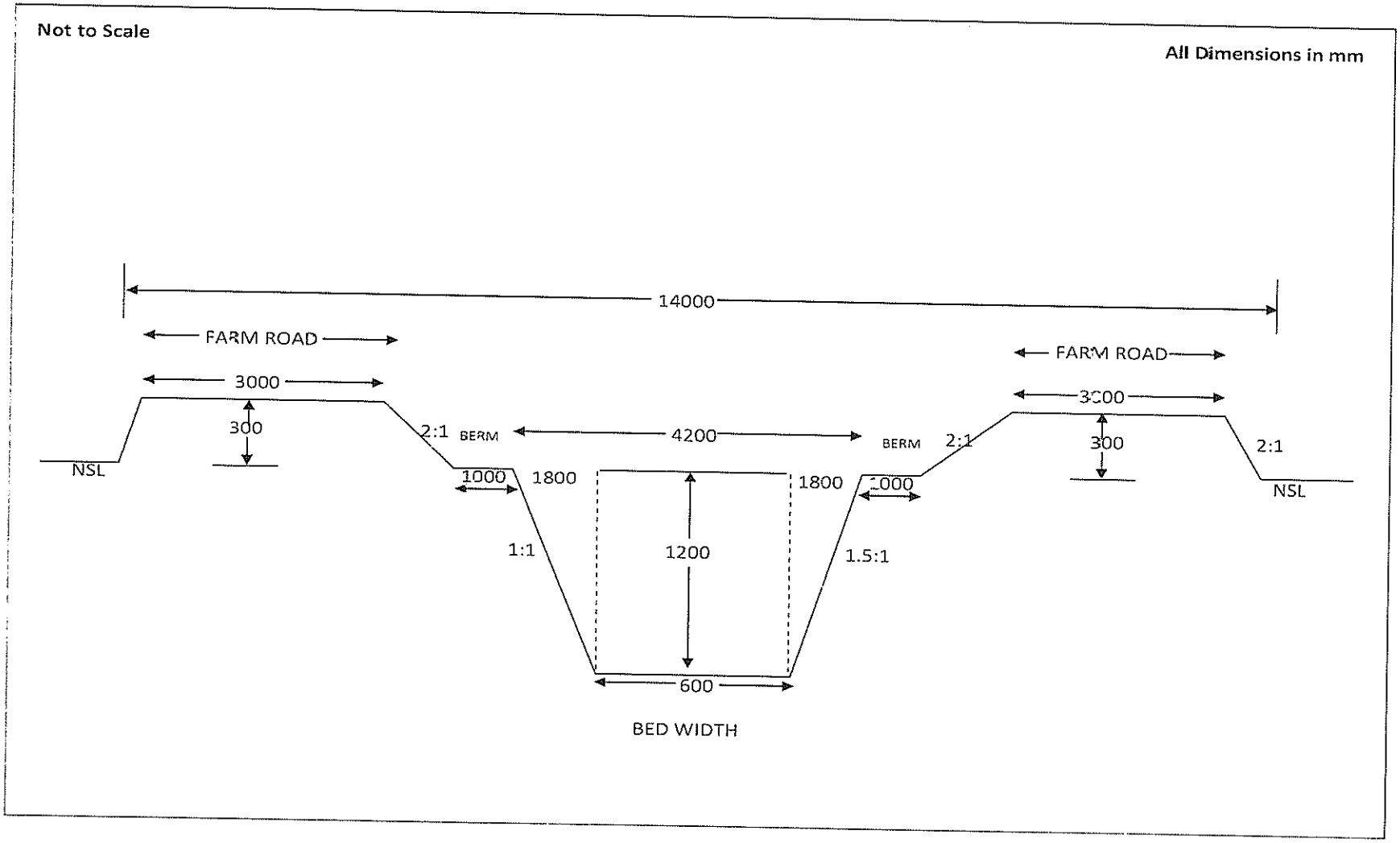


Figure 6.9: Cross Section of Main and Carrier Drain

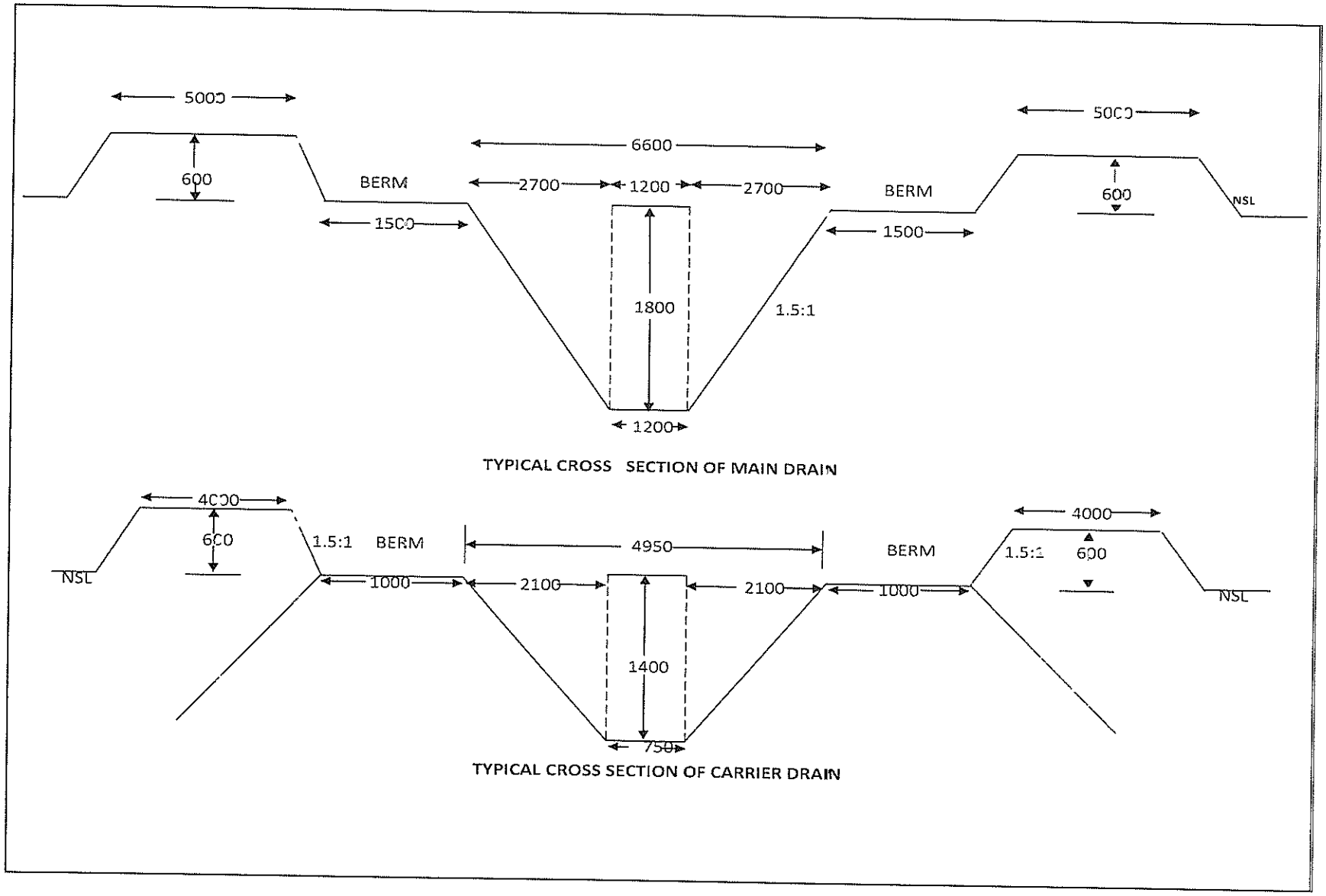


Table 6.8: Detailed Cost Estimate of Reclamation of Waterlogged Areas

(i) Field Drain

S.No.	Name of work	Nos	Length	Width	Height\Depth	Quantity	Unit	Rate (₹)	Unit	Amount(₹)
1	Dag bell ng 7.5 cm to 10 cm deep.	7	1			7.00	M	11.00	10 RM	7.70
2	Cutting & clearance of jungle, bushes, shurbs Ankra/ pomoea, Julie flora typha etc. on canals and bunds in dry/ moist/ slushy conditions including disposal.	1	1	14	100%	14.00	Sqm	3.50	Sqm	49.00
3	Earth work in excavation including loading, unloading, disposal and dressing of excavated earth within initial lead of 50m and lift up to 1.5m in dry or moist including dressing of excavated area With cost of dewatering wherever required. and all applicable taxes and levies etc Complete in a l respect.	1	1	2.40	1.2	2.88	Cum	47.00	Cum	135.36
									Total	₹ 192.06
									Add contingency charges @ 3 %	5.76
									Work establishment charges @ 1.5 %	2.88
									Grand Total	₹ 200.70

(ii) Carrier Drain

S.No.	Name of work	Nos	Length	Width	Height\Depth	Quantity	Unit	Rate (₹)	Unit	Amount(₹)
1	Dag belling 7.5 cm to 10 cm deep.	7	1			7.00	M.	11.00	10 RM.	**7.70**
2	Cutting & clearance of jungle, bushes, shurbs Ankra/ Ipomoea, Julieflora typha etc. on canals and bunds in dry/ moist/ slushy conditions including disposal.	1	1	18.55	100%	18.55	Sqm	3.50	Sqm	**64.93**
3	Earth work in excavation including loading, unloading, disposal and dressing of excavated earth within initial lead of 50m and lift up to 1.5m in dry or moist including dressing of excavated area With cost of dewatering wherever required, and all applicable taxes and levies etc Complete in all respect.	1	1	2.85	1.4	3.99	Cum	47.00	Cum	**187.53**
									Total	**₹ 260.16**
									Add contingency charges @ 3 %	7.80
									Work establishment charges @ 1.5 %	3.90
									Grand Total	**₹ 271.87**

(iii) Main Drain

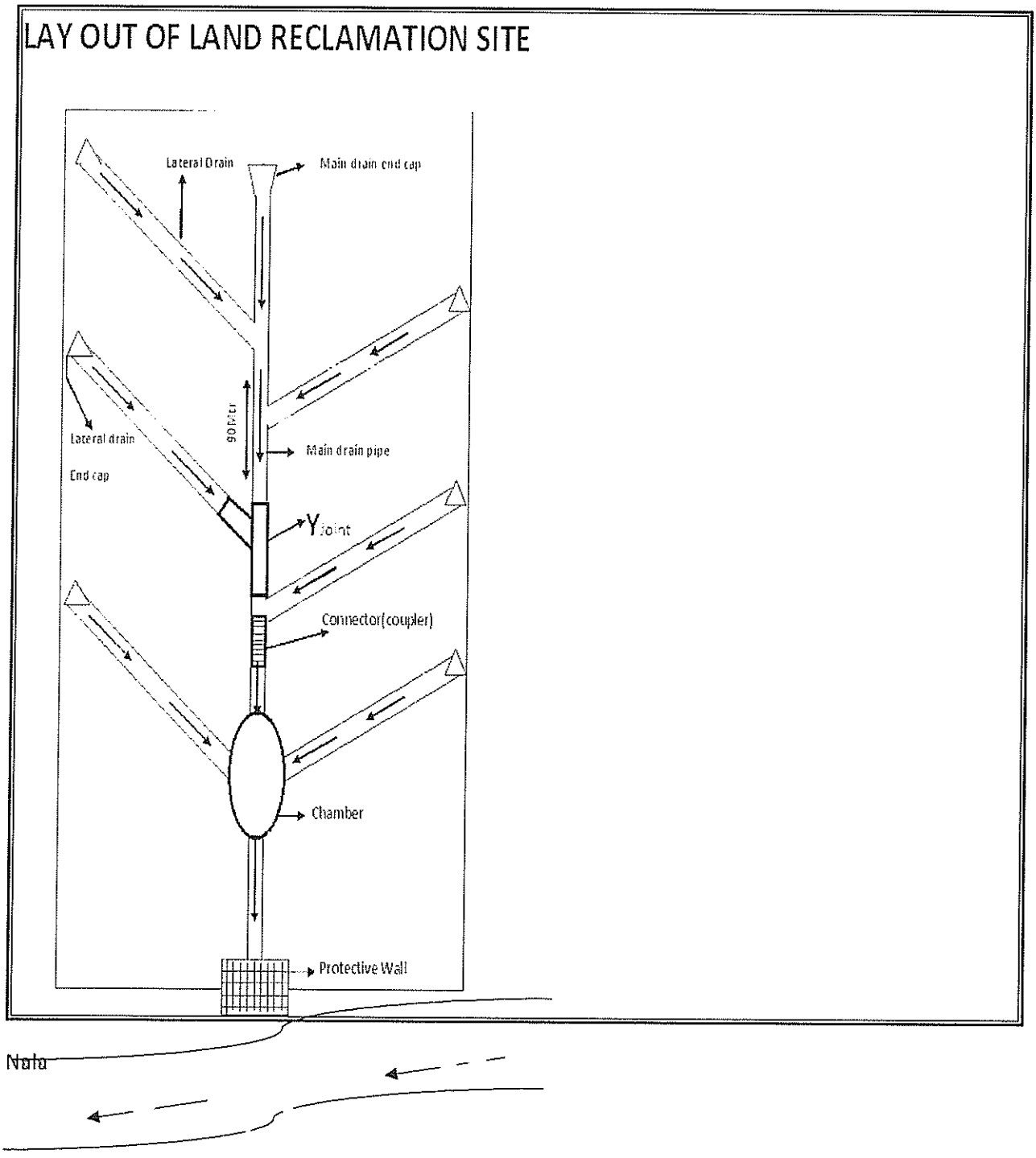
S.No.	Name of work	Nos	Length	Width	Height\Depth	Quantity	Unit	Rate (₹)	Unit	Amount (₹)
1	Dag belling 7.5 cm to 10 cm deep.	7	1			7.00	M	11.00	10 RM	**7.70**
2	Cutting & clearance of jungle, bushes, shurbs Ankra/ ipomoea. Julie flora typha etc. on canals and bunds in dry/ moist/ slushy conditions including disposal.	1	1	23.2	100%	23.20	Sqm	3.50	Scm	**81.20**
3	Earth work in excavation including loading, unloading, disposal and dressing of excavated earth within initial lead of 50m and lift up to 1.5m in dry or moist including dressing of excavated area With cost of dewatering wherever required, and all applicable taxes and levies etc Complete in all respect.	1	1	3.90	1.4	5.46	Cum	47.00	Cum	**256.62**
									Total	**₹ 345.52**
									Add contingency charges @ 3 %	10.37
									Work estab ishment charges @ 1.5 %	5.18
									Grand Total	₹ 361.07

Table 6.9: Abstract of Cost of Reclamation of Waterlogged land by Surface L

S.No.	Name of Item	Length (m)	Rate/m (₹)	Cost (₹)
1	Construction of field drain for Reclamation of Waterlogged land	30	200.7	6021.00
2	Construction of Carrier drain for draining the water from the field surface drains to the main drain	20	271.87	5437.40
3	Construction of main drain for draining the water from Carrier drain and Field drain	15	361.07	5416.05
4	Construction of inlet to drains structures for draining the water from the waterlogged fields to the field drains/Carrier drains @ 0.5 ha per no.	L.S	--	3000.00
5	Construction of Culvert on filed drains at the junction point on Carrier drains at the junction point of main drain	L.S	--	8000.00
			Total	**₹ 27874.45**
			Add Contingency @ 3 %	836.23
			Work establishment charges @ 1.5 %	418.11
			Grand Total	**₹ 29128.80**

6.6.2 Sub-Surface Drainage

Figure 6.10: Layout of Typical Sub-Surface Drainage System



1) Cost of Materials

A) Length of corrugated perforated PVC Pipes of 80/72 mm dia (Taking 25m distance between two laterals)

- Approximate length (m) - 300 mtrs
- Present Market price of 80/72 mm Corrugated pipes - ₹ 82.00 per Mtr
- Cost of lateral PVC Pipes ₹ 24600.00
- Cost of FILTER Mat ₹ 47/- X 300 per Mtr.

B) Length of collector (main) drain Corrugated Non-Perforated PVC Pipes of 100mm dia

- Approximate length (m) 90 Mtr
- Present market price - ₹ 110.00 per mtr
- Cost of main PVC pipes(90M x 110) - ₹ 9900.00

2) Cost of Fittings:

A) 'Y' or T joints 6 nos @ ₹ 280/- each - ₹ 1680.00
B) End Cap for main pipe 1 No @ ₹ 100/- each - ₹ 100.00
C) End cap for lateral pipes 6 nos @₹ 60/- each - ₹ 360.00
D) Cost of chamber 1 No @ ₹ 8100/- each - ₹ 8100.00
E) Cost of protective wall 1 No @ ₹ 3375/- each - ₹ 3375.00

3) Earth Work:

A) Earth work of Main Line

1.05 M x 0.45 x 90 Mtr = 42.525 cum
@ ₹ 47/- cum ₹ 1998.44

B) Earth work for lateral

0.90 M x 0.45M x 300mtr = 121.50 cum @ ₹ 47/- cum - ₹ 5710.50

C) Laying of pipes (Main 7 Laterals)

Refilling of earth to excavated trenches - ₹ 1003.00

Total Cost of (SSD PVC perforated Corrugated) per Hectare - ₹ 70926.94
Cost per running meter – 70926.94/90 – ₹ 788

6.7 Micro irrigation Pipes

Table 6.10: PRICE LIST FOR HDPE PIPES - PE 80

Outer Dia-mm	Working Pressure (Kgf-Cm2) - PE 80																	
	PN 2.5			PN 4			PN 6			PN 8			PN 10			PN 12.5		
	Wall Thick		Rate Per	Wall Thick		Rate Per	Wall Thick		Rate Per	Wall Thick		Rate Per	Wall Thick		Rate Per	Wall Thick		Rate Per
	Min	Max	Mtr. Rs.	Min	Max	Mtr. Rs.	Min	Max	Mtr. Rs.	Min	Max	Mtr. Rs.	Min	Max	Mtr. Rs.	Min	Max	Mtr. Rs.
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.3	2.8	25.56
25	-	-		-	-	-	-	-	-	-	-	-	2.3	2.8	32.92	2.8	3.3	38.47
32	-	-	-	-	-	-	-	-	-	2.4	2.9	42.61	3	3.5	51.19	3.6	4.2	60.1
40	-	-	-	-	-	-	2.3	2.8	52.35	3	3.5	68.62	3.7	4.3	78.95	4.5	5.2	93.41
50	-	-	-	2.3	2.8	69.53	2.9	3.4	84.82	3.8	4.4	108.13	4.6	5.3	122.07	5.6	6.4	151.7
63	-	-	-	2.5	3.0	95.22	3.6	4.2	126.33	4.7	5.4	168.16	5.8	6.6	193.02	7	7.9	237.75
75	-	-	-	2.9	3.4	130.01	4.3	5	179.27	5.6	6.4	226.91	6.9	7.8	272.48	8.4	9.5	339.62
90	2.3	2.8	128.14	3.5	4.1	188.18	5.1	5.9	267	6.7	7.6	324.64	8.2	9.3	389.59	10	11.2	483.51
110	2.7	3.2	181.46	4.3	5	281.46	6.3	7.2	400.37	8.2	9.3	508.95	10	11.2	605.33	12.3	13.8	726.82
125	3.1	3.7	237.56	4.9	5.6	361.18	7.1	8.1	512.56	9.3	10.5	654.58	11.4	12.8	784.79	13.9	15.5	931.46
140	3.5	4.1	297.34	5.4	6.2	447.17	8	9	642.12	10.4	11.7	818.55	12.8	14.3	984.33	15.6	17.4	1,170.69
160	4	4.6	384.61	6.2	7.1	585.83	9.1	10.3	837.53	11.9	13.3	1,066.95	14.6	16.3	1,283.02	17.8	19.8	1,525.03
180	4.4	5.1	478.22	7	7.9	738.5	10.2	11.5	1,054.37	13.4	15	1,352.54	16.4	18.3	1,621.22	20	22.2	1,926.11
200	4.9	5.6	587.38	7.7	8.7	903.57	11.4	12.8	1,306.13	14.9	16.6	1,667.12	18.2	20.3	1,998.86	22.3	24.8	2,387.22
225	5.5	6.3	742.63	8.7	9.8	1,145.49	12.8	14.3	1,646.01	16.7	18.6	2,102.47	20.5	22.8	2,529.18	25	27.7	3,007.07
250	6.1	7	916.09	9.7	10.9	1,418.39	14.2	15.9	2,031.40	18.6	20.7	2,600.31	22.8	25.3	3,121.79	27.8	30.8	3,714.91
280	6.9	7.8	1,151.25	10.8	12.1	1,766.47	15.9	17.7	2,540.21	20.8	23.1	3,253.99	25.5	28.3	3,911.35	31.2	34.6	4,670.32
315	7.7	8.7	1,445.31	12.2	13.7	2,247.14	17.9	19.9	3,215.00	23.4	26	4,119.28	28.7	31.8	4,948.42	35	38.7	5,888.33
355	8.7	9.8	1,837.35	13.7	15.3	2,836.39	20.1	22.4	4,074.35	26.3	29.2	5,217.03	32.3	35.8	6,278.17	39.5	43.7	7,489.79

Table-6.11: PRICE LIST OF RIGID PVC PIPES AS PER IS: 4985 SPECIFICATION

SELF SOCKET (Pipe with Built in Socket)

Rate per mtr.

OD	Nearest inch equivalent	2.5 Kgf/Cm2	4Kgf/Cm2	6Kgf/Cm2	10Kgf/Cm2	Plumbing Pipes
20mm	1/2"				14.13	28.6
25mm	3/4"				21.65	38.13
32mm	1"				32.82	57.4
40mm	11/4"			33.59		78.05
50mm	11/2"			52.45		102.09
63mm	2"		57.05	85.58	133.00	
75mm	21/2"		81.3	118.51	189.83	
90mm	3"	87.78	114.67	164.59	269.92	
110mm	4"	120.71	162.62	245.78	405.99	
140mm	5"	161.8	266.42	348.41	647.19	
160mm	6"	248.09	355.96	496.19	906.07	
180mm	7"	302.02	455.62	604.59	1,121.79	
200mm	8"	401.69	566.84	825.72	1,428.28	
225mm	9"	543.32	723.06	1,026.57	1,807.66	
250mm	10"	602.56	879.3	1,316.69	2,298.64	
280mm	11"		1,071.20	1,606.79		
315mm	12"	1,004.26	1,430.51	2,298.64		
355mm	14"		1,896.93			
400mm	16"		2,678.02	4,017.02		

EXTRA SOCKET (Plain pipe with extra Socket)

Rate per mtr.

OD	Nearest inch equivalent	2.5 Kgf/Cm2	4Kgf/Cm2	6Kgf/Cm2	10Kgf/Cm2
200mm	8"		613.72	870.36	1,807.69
225mm	9"		758.77	1,115.84	
250mm	10"	647.19	923.9	1,361.34	2,298.64
280mm	11"		1,071.20	1,606.79	
315mm	12"	1,004.26	1,430.51	2,298.64	3,481.65
355mm	14"		1,896.93		
400mm	16"		2,678.02		

6.8 Software Activities

S.No.	Item	Amount (₹)
(a)	**Institution & Capacity building (Trainings)**	
(i)	Three days training to the WUA office bearer and the staff, 50 person per 10 WUAs including boarding, lodging, resource person, training material, training aids and transportation	300000
(ii)	Exposure visit of 50 Farmers from 10 WUAs and front line officials for one week exposure visit,@10,000/farmer	500000
(iii)	One day training of farmer at site including breakfast, lunch, tea, resource person, tent, mike etc 50 farmers @ 10,000/WUA for ten WUAs	100000
	Total	900000
	Total area of 10 WUAs 3000 ha	900000/3000
	Cost per ha	**300**
(b)	**Monitoring & Evaluation**	
(i)	Bench mark survey of 10 WUA including stationery	100000
(ii)	Collection of data of 50% farmers every year for five years including resource persons, supervisors, stationery, vehicles etc	600000
(iii)	Evaluation and report writing	100000
	Total	800000
	Area covered 3000/ha of 10 WUAs	800000/3000
	Cost per ha	**266**
	Say	**300**
(c)	**Crop demonstration & Adaptive Trials**	
(i)	Distribution of mini kits, seeds, fertilizer, pesticides, farm operations, irrigation demonstration in 5 WUAs	50000
(ii)	Farmer training and exposure visit	200000
(iii)	Crop cutting and equipment	50000
	For 10 WUAs 300 ha/WUA	300000/300
	Cost per ha	**100**
	For 5 years	**500**
	Total (a+b+c)	(300+300+500)
	Grand Total	**₹ 1100**

6.9 One-time Functional Grant to WUAs

S.No.	Item	Amount (₹)
1	Audit charges	2000
2	printed stationery & Book Keeping	2000
3	Office maintenance expenses	12000
4	Local Conveyance	12000
5	Water Master	24000
6	Miscellaneous	8000
	Total	**₹ 60000**
	Total amount required to generate Rs. 60,000/year through fixed deposit @ 5%	**₹ 750000**
	Approximate Area (ha)	300
	Cost/ha	**₹ 2500**

CHAPTER-7: PIM ACT AND SUSTAINABILITY OF WATER USER ASSOCIATIONS

7.1 Participatory Irrigation Management (PIM)

Participatory Irrigation Management (PIM) has been conceived as the thrust area in effective irrigation management by involving and associating farmers in planning, operation and maintenance of the irrigation system. PIM refers to the involvement of irrigation users in all aspects and all levels of irrigation management. "All aspects" include the initial planning and design of new irrigation projects or modernisation of existing projects, as well as the construction, supervision, and financing, decision rules, operation, maintenance, monitoring, and evaluation of the system. Participatory Irrigation Management is the irrigation management by participation of the beneficiary farmers. Right from planning of irrigation in the command area to canal maintenance and repairs, actual irrigation of water to the fields, collection of water tax, maintaining water and financial accounts etc.; farmers are involved with the formation of Water User's Association (WUA).

Since 1985, Ministry of Water Resources has been inspiring farmers' participation in water distribution and management of tertiary system in the projects covered under the Centrally Sponsored Command Area Development Programme. The concept of involvement of farmers in management of the irrigation system has been accepted as a policy of the Government of India and has been included in the National Water Policy adopted in 1987. Provisions made in the National Water Policy of 1987 indicate that *"Efforts should be made to involve farmers progressively in various aspects of management of irrigation systems, particularly in water distribution and collection of water rates. Assistance of voluntary agencies should be enlisted in educating the farmers in efficient water-use and water management."*

In April 1987, the Ministry of Water Resources issued guidelines for farmers' participation in water management, primarily for areas under the Centrally Sponsored Command Area Development Programme. The guidelines covered all aspects like past experience in India and abroad, objectives of PIM, area of operation of farmers' associations in different irrigation schemes, duties and responsibilities of the farmers, training and monitoring.

Recognising the need to provide legal backup to PIM in the country, Ministry of Water Resources commissioned an NGO, 'Society for Peoples' Participation in Ecosystem Management (SOPPECOM)', Pune to suggest suitable amendments in the existing irrigation acts which could be recommended to States for incorporation in their State Irrigation Acts. 'SOPPECOM' has been in the forefront of work relating to PIM and has successfully pioneered many action research programmes on formation of WUAs. The suggestions of 'SOPPECOM' were circulated to States during June 1998.

Conferences at National, State and Project levels have been organized for creating awareness on Participatory Irrigation Management amongst farmers and officials.

The following modifications were made in the National Water Policy (2002) regarding the participatory approach to water resources management:

"Management of the water resources for diverse uses should incorporate a participatory approach: by involving not only the various governmental agencies but also the users' and other stakeholders, in an effective and decisive manner, in various aspects of planning, design, development and management of the water resources schemes. Necessary legal and institutional changes should be made at various levels for the purpose, duly ensuring appropriate role for women. Water Users' Association and local bodies such as municipalities and Gram-Panchayats should particularly be involved in the operation, maintenance and management of water infrastructure/facilities at appropriate levels progressively with a view to eventually transfer the management of such facilities to the user groups/local bodies."

Ministry of Water Resources has been organising National level training programmes on PIM in various parts of the country for CAD functionaries. In addition, matching grant is also being provided to States for organising State and project level training programmes for farmers and field functionaries.

Provisions in PIM Acts

Recognising the need for sound legal framework for PIM in the country, the Ministry brought out and circulated in 1998 a Model Act to be adopted by the State Legislatures for enacting new Irrigation Acts/amending the existing Irrigation Acts for facilitating PIM. The legal framework provides for creation of farmers organisations at different levels of irrigation system.

The associations at different levels are expected to be actively involved in

i. maintenance of irrigation system in their area of operation;

ii. distribution of irrigation water to the beneficiary farmers as per the warabandi schedule;

iii. assisting the Irrigation Department in preparation of water demand and collection of water charges;

iv. resolve disputes among the members and WUA;

v. monitoring flow of water in the irrigation system etc.

Objectives of PIM

The broad objectives covered in the model PIM act are as under:

- To create a sense of ownership of water resources and the irrigation system among the users, so as to promote economy in water use and preservation of the system.
- To improve service deliveries through better operation and maintenance.
- To achieve optimum utilisation of available resources through sophisticated deliveries, precisely as per crop needs.
- To achieve equity in water distribution.
- To increase production per unit of water, where water is scarce and to increase production per unit of land where water is adequate.
- To make best use of natural precipitation and ground water in conjunction with flow irrigation for increasing irrigation and cropping intensity.
- To facilitate the users to have a choice of crops, cropping sequence, timing of water supply, period of supply and also frequency of supply, depending on soils, climate and other infrastructure facilities available in the commands such as roads, markets cold storages, etc., so as to maximise the incomes and returns.
- To encourage collective and community responsibility on the farmers to collect water charges and payment to Irrigation Agency.
- To create healthy atmosphere between the Irrigation Agency personnel and the users.

State Level Legislations on PIM

In accordance with the Model Act, 15 State Governments (Table 7.1) namely Andhra Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Sikkim, Tamil Nadu and Uttar Pradesh have enacted exclusive legislation for involvement of farmers in irrigation management. The legal framework created out of these acts has resulted in creation of farmers' organisations at different levels of irrigation system. They are as mentioned below:

i. **Water Users' Association** (WUA): A delineated command area on a hydraulic basis covering a cluster of outlets or a minor.

ii. **Distributary Committee** (DC): It comprises of 5 or more WUAs. All the presidents of WUAs form the general body of Distributary Committee.

iii. **Project Committee** (PC): An apex committee of the irrigation system and Presidents of the Distributary Committees in the project area constitute general body of this committee.

Table 7.1: Legislations on PIM-Enactment/Amendment of New Act/Existing Irrigation Act: State-wise positions

S.No	Name of the State	Position of enactment of New PIM Act/Amendment of Irrigation Act
1.	Andhra Pradesh	Enacted "Andhra Pradesh Farmers' Management of Irrigation Systems Act, March, 1997"
2.	Assam	The Assam Irrigation Water Users' Act 2004
3.	Bihar	The Bihar Irrigation, Flood Management and Drainage Rules, 2003 under the Bihar Irrigation Act, 1997
4.	Chhattisgarh	Enacted "Chhattisgarh Sinchai Prabandhan Mei Krishkon Ki Bhagidari Adhiniyam, 2006"
5.	Goa	Enacted "Goa Command Area Development Act 1997(Goa Act 27 of 1997)"
6.	Gujarat	Gujarat Water Users Participation Management Act, 2007
7.	Karnataka	Promulgated an Ordinance on 7th June 2000 for amendment of the existing Karnataka Irrigation Act, 1965 and Irrigation (Levy of Betterment contribution and Water Rate) Act 1957
8.	Kerala	Enacted "The Kerala Irrigation and Water Conservation Act, 2003"
9.	Madhya Pradesh	Enacted " Madhya Pradesh Sinchai Prabandhan Mei Krishkon Ki Bhagidari Adhiniyam, 1999" during September 1999
10.	Maharashtra	Enacted "The Maharashtra Management of Irrigation Systems by Farmers Act, 2005"
11.	Odisha	Enacted "The Odisha Pani Panchayat Act, 2002"
12.	Rajasthan	Passed the "Rajasthan Sinchai Pranaali Ke Prabandh Mei Krishkon Ki Sahabhagita Adhiniyam, 2000 (Rajasthan Farmers' Participation in Management of Irrigation system Act, 2000)."
13.	Sikkim	"Sikkim Irrigation Water tax 2002" and "Sikkim Irrigation Water Tax Act, 2008"
14.	Tamil Nadu	Enacted the "Tamil Nadu Farmers' Management of Irrigation Systems Act, 2000"
15.	Uttar Pradesh	Enacted "The Uttar Pradesh Irrigation Management Act, 2009" and framed "The Uttar Pradesh Participatory Irrigation Management Rules, 2010"

7.2 Analysis of PIM Act

The PIM Act of 15 states has been studied, analysed and a comparison has been made on the following indicators:

- ✓ Status of the PIM Act
- ✓ Structure of WUA/FO

- ✓ Managing Committee of WUAs/FO
- ✓ Apex Committee/State Level Committee
- ✓ Competent Authority
- ✓ Objectives of WUA/FO
- ✓ Powers of WUA/FO
- ✓ Offences and Penalties

Amongst the identified indicators, common observations could be drawn which have been given below and following that, analysis of the PIM Act has been given highlighting the differences in provisions existing across the states.

The PIM Acts have been given in Annexure Volume 2.

Common points observed among the PIM Act of 15 states:

Managing Committee of WUA

➔ **Delineation of Water Users' Area and Constitution of Association**

- The District Collector may delineate every command area under each of the irrigation systems on a hydraulic basis which may be administratively viable; and declare it to be a water users' area.
- Every water users' area shall be divided into territorial constituencies, which shall not be less than 4 but not more than 10.
- There shall be a WUA called by its local distinct name for every water users' area delineated.
- Every WUA shall consist of the following members, namely:
  - all the water users who are land holders in a water users area
    all other water users co-opted in a water users' area
  - members specified above shall constitute the general body for a WUA

➔ **Election of President and Members of the Managing Committee of WUA**

- There shall be a Managing Committee for every WUA.
- The District Collector shall make arrangements for the election of President/Chairperson of the managing committee of the WUA by direct election by the method of secret ballot.

- The District Collector shall also cause arrangements for the election of a managing committee consisting of one member from each of the territorial constituencies of a water users' area, by the method of secret ballot.

➔ **Delineation of Distributory Area and Constitution of the Distributary Committee**

- The Government may, delineate every command area of the irrigation system, comprising of two or more WUAs, and declare it to be a distributary area.
- There shall be a distributary committee called by its local distinct name for every distributory area.
- All the presidents of the WUAs in the distributary area shall constitute the general body of the committee.

➔ **Election of President and Constitution of Managing Committee**

- There shall be a managing committee for every distributary committee.
- The District Collector shall cause arrangements for the election by the method of secret ballot of the President and members of the managing committee (5-15 members) from among the members of the general body of the distributary committee.

➔ **Delineation of Project area and Constitution of Project Committee**

- The Government may delineate every command area or a part thereof, and declare it to be a project area.
- There shall be a project committee called by its distinct name for every project area.
- All the Presidents and/or members of the distributary committees in the project area shall constitute the general body for the project committee.

➔ **Election of Chairman and Constitution of the Managing Committee**

- There shall be a managing committee for every project committee.
- The District Collector shall cause arrangements for election by the method of secret ballot of chairman and managing committee consisting of not more than nine members from among the members of the general body of the project committee.

Apex Committee

- The Apex Committee/State Level Committee, so constituted, may exercise such powers and functions as maybe necessary to
  - lay down the policies for implementation of the provisions of the Act
  - give such directions to any farmers' organisation in exercising their powers and performing their functions in accordance with the provisions of the Act.

Competent Authority

- The Government may by notification appoint such officer from the Irrigation Department or CAD Department or Water Resource Department or any other Department or Corporation to be the competent authority to every FO for the purposes of the Act.
- The competent authority shall be responsible to the respective FO in the implementation and execution of all decisions taken by the FO and shall provide technical advice and ensure that the work is executed in accordance with the technical parameters.

WUA/FO to be Body Corporate

- Every WUA/FO shall be body corporate with a distinct name having perpetual succession and a common seal and subject to the provisions of this Act vested with the capacity of entering into contracts and of doing all things necessary, proper or expedient for the purposes for which it is constituted and it shall sue or be sued in its corporate name represented by the chairman or the president, as the case may be.

Objectives of WUA/FO

- The objectives of the WUA/FO shall be:
  - to promote and secure distribution of water among its users,
  - adequate maintenance of the irrigation system,
  - efficient and economical utilisation of water to optimise agricultural production,
  - to protect the environment,
  - to ensure ecological balance by involving the farmers, inculcating a sense of ownership of the irrigation system in accordance with the water budget and the operational plan.

Table 7.2: Analysis of PIM Act – Status of PIM Act and Structure of WUA/FO

S.No.	State	Status of PIM Act	Structure of WUA/FO
1.	Andhra Pradesh	Andhra Pradesh Farmers' Management of Irrigation Systems Act, 1997	• Primary level (WUA) • Secondary Level (Distributary Committee) • Project Level (Project Committee)
2	Assam	Assam Irrigation Water Users' Act, 2004	• Primary Level (WUA) • Secondary Level (Distributary Committee) • Project Level (Project Committee)
3.	Bihar	Bihar Irrigation, Flood Management and Drainage Rules, 2003 under Bihar Irrigation Act 1997	• Village Irrigation Committee (Lowest Level Committee of WUA) • System Level Committee (Highest Level Committee of WUA)
4.	Chhattisgarh	Chhattisgarh Sinchai Prabandhan Me Krishkon Ki Bhagidari Adhiniyam, 2006	• Primary Level (WUA) • Secondary Level (Distributary Committee) • Project Level (Project Committee) • State Level (Federation of FO)
5.	Goa	Goa Command Area Development Act, 1997	• Water Distribution Co-operative Society • CAD Board
6.	Gujarat	Gujarat Water Users Participation Management Act, 2007	• WUA of a minor canal service area
7.	Karnataka	Ordinance in 2000 for amendment of existing Karnataka Irrigation Act 1965 and Irrigation (Levy of Betterment contribution and Water Rate) Act 1957	• Water Users Society • Water Users Distributary Level Federation • Water Users Project Level Federation • Water Users Apex Level Federation
8.	Kerala	Chapter on PIM in The Kerala Irrigation and Water Conservation Act 2003	• WUA • Water Management and the Utilisation Board
9.	Madhya Pradesh	Madhya Pradesh Sinchai Prabandhan Me Krishkon ki Bhagidari Adhiniyam 1999	• Primary level (WUA) • Secondary Level (Distributary Committee) • Project Level (Project Committee)
10.	Maharashtra	Maharashtra Management of Irrigation Systems by Farmers Act, 2005	• Land under Management of Irrigation System by Farmers - Minor Level (WUA) - Distributary Level (Distributary Level Association) Canal Level (Canal Level Association) - Project Level (Project Level Association) • WUA for Lift Irrigation
11.	Odisha	The Odisha Pani Panchayat Act 2002	• Primary level (Pani Panchayat) • Secondary Level (Distributary Committee) • Project Level (Project Committee)
12.	Rajasthan	Rajasthan Farmers' Participation in Management of Irrigation System Act, 2000	• Primary level (WUA) • Secondary Level (Distributary Committee) • Project Level (Project Committee)
13.	Sikkim	Sikkim Irrigation Water Tax Act 2002 and Sikkim Irrigation Water Tax (Amendment) Act 2008	• Primary level (WUA)
14.	Tamil Nadu	Tamil Nadu Farmer's Management of Irrigation Systems Act 2000	• Primary level (WUA) • Secondary Level (Distributary Committee) • Project Level (Project Committee)

S.No.	State	Status of PIM Act	Structure of WUA/FO
15.	Uttar Pradesh	Uttar Pradesh PIM Act 2009	• Outlet Level (Kulaba Samiti) • Minor Level (Alpika Samiti) • Distributary Level (Rajbaha Samiti) • Branch Level (Shakha Samiti) • Project Level (Pariyojana Samiti)

Table 7.3: Analysis of PIM Act – Managing Committee of WUAs

S.No.	State	Managing Committee of WUAs
1.	Andhra Pradesh	• Same as given in common observations
2.	Assam	• Every WUA shall consist of the following members, namely: - all the water users who are land holders in a water users area - 5 five ex-officio members, namely 1 Sectional Assistant and 1 Junior Engineer from the Irrigation Department, who shall act as coordinator between the Governments and the FOs and 2 from the Agriculture Department in the rank of Village Level Extension Worker (VLEW) and Agriculture Extension Officer and 1 Elected Gaon Panchayat Member/Gaon Panchayat President of the Gaon Panchayat concerned.
3.	Bihar	• Every water user of the village will be a member of the Village Irrigation Committee (VIC). The executive committee of the VIC comprises 5 to 11 members through election; this executive committee is responsible for proper management of irrigation through all the outlets within the village, in accordance to the decisions taken by the System level committee (SLC). • SLC refers to committees at distributory, sub-distributory or minor, where the management transfers of the system takes place.
4.	Chhattisgarh	• Every WUA Area shall be divided into territorial constituencies which shall be up to10 in minor irrigation systems and12 in major and medium irrigation systems. • Government may nominate one officer each from the WRD and the DoA or Ayacut Department to be the members of the WUA at all levels as advisors and without having the right to vote. • The State Government may nominate an officer at an appropriate level from the WRD without having the right to vote, to be the Secretary of the managing committee of the WUA at all levels. • The Managing Committee shall elect one Treasurer from among the members of the Managing Committee to assist the President. • For the purposes of equitable distribution of water, adequate representation shall be given in the Managing Committee, to the water users from the Head, Middle and Tail reaches of the area of operation of the WUA at all levels. • Seats shall be reserved in every Management Committee of WUA at all levels for SC, ST, OBC & women • There shall be nomination of one member from the Gram Panchayat/Janapad Panchayat/Zila Panchayat to the Managing Committee at all levels and such member shall not have the right to vote. • The FO under the Act may decide to federate and form a State Level Farmers Federation to facilitate interactions of the state government and NGOs with the farmers, to support farmers' participation in management of irrigation systems and further to coordinate and deal with allied activities relating to irrigated agriculture.

S.No.	State	Managing Committee of WUAs
5.	Goa	• Government may constitute one or more CAD Boards for the command area of each major and medium irrigation projects in the State. CAD Board shall consist of following members: - Minister in-charge of CAD Programme of the Government of Goa as Chairman - Concerned Members of the Legislative Assembly and Parliament, as members of the CAD Board - Secretary, CAD as Chief Executive of the CAD Boards - Secretary, Finance or his representative not below the rank of Joint Secretary, Finance, as member - Chief Engineer, Government of Goa, as Member - Superintending Engineer, CAD Board, as Member-Secretary - Director of Agriculture, Member - Registrar of Co-operative Societies, Member - Director of I.C.A.R., Member - Director of Veterinary Services, Member Sr Hydro geologist, Ground Water Cell, Member - Chairperson of Goa Horticulture Development Corporation, Member - Deputy Collector (Revenue) having jurisdiction in the Command Area of respective CAD Board, as Member - A representative of the GoI to be nominated by the MoWR as Member - 4 elected representatives of Panchayat Raj Institution within the Command Area of CAD Board, to be nominated by the Government, as Members; - 7 Chairman of Registered Water Distribution Co-operative Societies, formed within the jurisdiction of Command Area or CAD Board, to be nominated by the Government as Members - 2 representatives from NGOs, to be nominated by the Government as Members - An academician to be nominated by the Government as Member - 5 progressive farmers of the respective Command Area to be nominated by the Government as Members - The Director of Land Survey • CAD Circle is responsible for formation of Water Distribution Co-operative Societies
6.	Gujarat	• Managing Committee of WUA shall consist of A Chairperson and other members not exceeding 11 as may be determined by the Competent Authority - An officer not below the rank of Additional Assistant Engineer of a division in which the minor canal exists. This member shall have the right to speak and take part in the proceedings of a meeting but shall not be entitled to vote. • The members shall be elected by members of the WUA from amongst themselves in such manner as to give equal representation to all parts of the service area. • Competent Authority shall divide the service area in 3parts – head, middle and tail reach. • Election of members shall be held in accordance with rules relating to election.

S.No.	State	Managing Committee of WUAs
7.	Karnataka	• Management Committee of Water Users Apex level Federation shall consist of: - Minister-in-charge of major and medium irrigation, Government of Karnataka who shall be the Chair person - Minister-in-charge of minor irrigation, Government of Karnataka who shall be the Co-chairperson - Secretary to Government, Irrigation Department, Government of Karnataka - an expert in the field of participatory irrigation management nominated by the State Government - Chief Executive/Managing Director of the Water Users Apex Level Federation - Chair persons of all the CAD Authorities - such number of persons representing different projects of minor irrigation and lift irrigation works in the State • Vice-Chair person shall be elected from amongst the member of the Water Users Apex Level Federation.
8	Kerala	• Every association shall have an executive committee consisting of 11 members elected from among the members of the association. • The members of the executive committee shall be elected once in 3 years by the members of the association. • The Executive committee shall elect from among themselves a president, a vice president, a secretary and a treasurer. • The Government may nominate any member of the local authority or any other person, to be a member of the executive committee. • The Government may, from time to time, designate an Assistant Executive Engineer of the Water Resources Department or of the Agriculture Department to assist or supervise the activities of WUA and the executive committee.
9.	Madhya Pradesh	• The WUA consists, in addition, also consists of - 3 ex-officio members, 1 of Amin Cadre and 1 of Sub-Engineer Cadre from the WRD who will Act as Co-ordinator between the Government Departments and the Farmers' Association and the third from the Agriculture Department or Ayacut Department who will Act as Adviser. • If the Managing Committee of the WUA at all levels does not have a woman member, the Managing Committee shall co-opt a woman as a member who shall ordinarily be a resident of the farmers' organisation area. • All the Presidents of the WUA/Distributary Committee in the distributor/project area shall constitute the general body of the Distributory/Project Committee including 2 nominated official members, one of them shall be an Assistant/Executive Engineer of WRD, who will work as a Co-ordinator between the various departments and WUAs at all levels, and the second member will Act as an Advisor who will be from Agriculture or Ayacut Department. The nominated members shall not have the right to vote.

S.No.	State	Managing Committee of WUAs
10.	Maharashtra	• Delineation of area of operation of WUA at any level is done by the Canal Officer, no below the rank of an Executive Engineer. • There shall be a Managing Committee for every WUA at all levels, consisting of such number of members including Chairperson and Directors. Such Association shall have a Secretary having prescribed qualifications and the pay and allowances of such person shall be fixed by the respective WUA. • The Canal Officer shall make arrangements for the election of Directors of the Managing Committee of the WUA at all levels by direct election from amongst members/General Body of such WUAs. • All the WUAs at lower Level, represented by the members/Directors of Managing Committees of the WUAs at that Level, in the command area of a higher level WUA shall constitute the General Body of the higher level WUA and shall have right to vote and elect the Managing Committee of the higher level WUA. • Adequate representation shall be given on the Managing Committee of WUAs at all levels to the holders or occupiers of the land from Head, Middle and Tail reaches of the area of operation of WUA; and Women members. • Such Canal Officer shall make arrangements for the election of the Chairperson of the WUA at all levels.

S.No.	State	Managing Committee of WUAs
11.	Odisha	• At the primary level, the water users' area is delineated for the constitution of Pani Panchayat. • Every Pani Panchayat's area shall be comprised of several Chaks which shall as far as possible cover the area irrigated by one out let. The number of Chaks shall not be less than four. • Every Pani Panchayat shall consist of - all water users who are land holders in the area of Pani Panchayat - Government may, by notification nominate atleast one officer each from DoWR, DoA, Department of Revenue to be members of the Pani Panchayat without having the right to vote. • All the land holders in a Chak will elect three members to form a Chak Committee in such a way that there shall be one member from the upper reach, one from the middle reach and one from the lower reach within the Chak. They will also simultaneously elect one among those three to represent the Chak in the Executive Committee of the Pani Panchayat. • There shall be an Executive Committee for each Pani Panchayat consisting of the representatives of the Chaks elected by the land holders of each Chak. • There shall be an Executive Committee for every Distributary Committee which shall consist of the members elected from among the General Body of the Distributary Committee and by the method of secret ballot and shall not be more than nine. • The Superintending Engineer shall cause arrangements for the election of a member and also the President of the Executive Committee from each Chak by all the land holders of the Chak by the method of secret ballot. • The members of the Executive Committee shall elect its President from among themselves and the Chief Engineer shall make the arrangement for such election. • The Executive Committee shall elect one Secretary and one Treasurer from among the members of the Executive Committee to assist its President. • Government may nominate one officer not below the rank of Junior Engineer of the DoWR and another officer not below the rank of Junior Agriculture Officer of the DoA without having the right to vote, to be the permanent invitees to the meetings of the Executive Committee. • Delineation of area of operation of a higher level WUA is done by the Chief Engineer. • Every higher level WUA shall consist of all the Presidents, Secretaries and Treasurers of the WUAs in the lower area and shall be the General Body of the higher level WUA. • Government may nominate atleast one officer each from the DoWR, the DoA and the Department of Revenue to be the members of the higher level WUA without having the right to vote.
12.	Rajasthan	• The same procedure is followed as has been given in the common observations, the only difference being that the delineation of area of operation of a water users' area at different level and the arrangements for election are done by the Project Authority in place of the District Collector.
13.	Sikkim	• Not mentioned in the Act
14.	Tamil Nadu	• Same as given in common observations

S.No.	State	Managing Committee of WUAs
15.	Uttar Pradesh	• The delineation of area of operation of a command is done by the Competent Canal Officer. • All the water users of the outlet shall constitute the general body of the kulaba samiti and only the adult members with prescribed eligibility shall have the right to vote. • The command of an outlet shall be divided into such number of sub-commands as may be prescribed Each sub-command shall have almost equal number of landholders • There shall be a managing committee for every kulaba samiti headed by a Chairperson The committee shall have one representative each from every subcommand. • If there is no representation of person belonging to SC or ST or of women or panchayats in the managing committee of the WUAs at all levels, then one person against each unrepresented category and chairman of jal prabandhan samiti of gram panchayat shall be co-opted by the managing committee from amongst members of the general body. • All the members of the managing committee of immediate lower level WUAs in its area of operation shall constitute the general body of the respective upper level WUAs. • There shall be a managing committee for each water users' association at all levels comprising of a Secretary, a Treasurer and other members. • If there is no representation of persons belonging to the SC or ST or of women or panchayats of appropriate level situated at the tail end of canal in the managing committee, then one person against each unrepresented category shall be co-opted by the managing committee from amongst members of the general body or panchyats of appropriate level situated at the tail end of canal. • All Chairpersons of branch committee shall constitute the project committee. The members of project committee shall select a Chairperson from amongst themselves by consensus.

Table 7.4: Analysis of PIM Act - Apex Committee/State Level Committee

S.No.	State	Apex Committee/State Level Committee
1.	Andhra Pradesh	• The Government may constitute an Apex Committee with such number of members as may be considered necessary. • Functions are same as given in common observations.
2.	Assam	• The Government may constitute an Apex Committee with the following members: - Minister, Irrigation Department – Chairman - 5 persons from amongst the Chairman of the Project Committees - 2 persons from the local NGOs who are active in water management and agricultural activities - 3 persons from officers not below the rank of Secretary or Chief Engineer from the Irrigation and/or Agriculture Department - the elected Gaon Panchayat President of the Gaon Panchayat as Ex-officio Member - members may be increased by such numbers as may be considered by the Government • Functions are same as given in common observations.
3.	Bihar	• At the state level, a steering committee headed by the Chief Secretary/Development Commissioner to guide and co-ordinate the activities with the concerned departments. • At WRD level, establishment of PIM cell headed by a superintending engineer. The cell is supposed to make annual as well as a perspective programme for PIM in the state and need to ensure effective implementation. • In addition, there are - PIM advisory committee to advise PIM cell - WALMI, to provide capacity building of stakeholders - PIM Unit at the chief engineer level - Field implementation team (FIT), at the executive engineer level.

S.No.	State	Apex Committee/State Level Committee
4.	Chhattisgarh	• The State Government may be notification, constitute a State Level Policy Committee consisting of the following Members, namely: - - The Minister in charge of Water Resources Department – Chairperson - three persons from amongst the Presidents of the Project Committee - two persons from amongst the Presidents of WUAs from the minor irrigation systems two persons from NGOs including one person having knowledge in the field of PIM - three officers not below the rank of Chief Engineer or equivalent including one each from the Water Resources Department, Agriculture Department and Ayacut Department of the State Government. - at least one third women members from amongst the Presidents of the Project Committee and the Presidents of the WUAs and to the extent possible representatives of Government department and NGOs shall also have at least one third women. • Functions are same as given in common observations.
5.	Goa	• Not mentioned in the Act
6.	Gujarat	• Not mentioned in the Act
7.	Karnataka	• The Water Users Apex Level Federation shall make recommendation to the State Government on the policies to be adopted and the guidelines to be formulated regarding construction, maintenance and regulation of irrigation work and supply of water. • The Water Users Apex Level Federation may give directions to the Water Users Project Level Federation, Water Users Distributary Level Federation and the Water Users Society to carry out the purposes of this Act.
8.	Kerala	• Not mentioned in the Act
9.	Madhya Pradesh	• The State Government may constitute an Apex Committee consisting of the following Members, namely - The Minister from Water Resources Department-Chairperson - five persons from amongst the Chairperson of the Project Committee - two persons from NGOs - three officers not below the rank of Chief Engineer or equivalent from the Water Resources Department, Agriculture Department or Ayacut Department of the State Government. • Functions are same as given in common observations.
10.	Maharashtra	• Not mentioned in the Act
11.	Odisha	• The Government may constitute a State Level Committee with such number of Presidents of the Project Committees as may be considered necessary, but not exceeding 10. • The Government may nominate such number of Government officials and professionals not exceeding ten as may be considered necessary, to be the members of the State Level Committee. • Functions are same as given in common observations.
12.	Rajasthan	• The Government may constitute an Apex Committee with such number of Members as may be considered necessary. • The Government may appoint a Commissioner to exercise general control and superintendence over the competent authorities in performance of their functions under this Act or the rules made in this regard. • Functions are same as given in common observations.
13.	Sikkim	• State Level Committee for Monitoring and Evaluation
14.	Tamil Nadu	• The Government may constitute an Apex Committee with a Chairman and such number of members as may be prescribed. • Functions are same as given in common observations.

S.No.	State	Apex Committee/State Level Committee
15.	Uttar Pradesh	• The State Government may constitute a State level committee to be called the Sheersh Samiti with a Chairperson and such number of members not exceeding 20 of which half members shall be Government official having such qualifications as may be prescribed and the rest shall be the chairpersons of WUAs. • The committee shall be responsible for monitoring, evaluation and research on the PIM process in the State and shall provide necessary feedback to the State Government and advise it on policy matters.

Table 7.5: Competent Authority

S.No.	State	Competent Authority
1.	Andhra Pradesh	• Same as given in common observations
2.	Assam	• Not mentioned in the Act
3	Bihar	• Not mentioned in the Act
4.	Chhattisgarh	• Same as given in common observations
5.	Goa	• Not mentioned in the Act
6.	Gujarat	• Competent Authority in relation to a minor canal service area means such officer of the State Government as it may appoint for a service area. • It has the power to inspect - the water distribution by the WUA in the service area of the entrusted minor canal - the records maintained by the WUA in relation to such water distribution.
7.	Karnataka	• Not mentioned in the Act
8.	Kerala	• Same as given in common observations
9.	Madhya Pradesh	• Same as given in common observations
10.	Maharashtra	• Same as given in common observations
11.	Odisha	• Same as given in common observations
12.	Rajasthan	• Same as given in common observations
13.	Sikkim	• Competent Authority means the Secretary, Irrigation and Flood Control Department or any other person declared to be competent authority for the purpose of this Act.
14.	Tamil Nadu	• Same as given in common observations
15.	Uttar Pradesh	• Same as given in common observations

Table 7.6: WUA/FO to be Body Corporate

S.No.	State	WUA/FO to be Body Corporate
1.	Andhra Pradesh	• Same as given in common observations
2.	Assam	• Not mentioned in the Act
3.	Bihar	• Not mentioned in the Act
4.	Chhattisgarh	• Same as given in common observations
5.	Goa	• Same as given in common observations
6.	Gujarat	• Not mentioned in the Act
7.	Karnataka	• Not mentioned in the Act
8.	Kerala	• Same as given in common observations
9.	Madhya Pradesh	• Same as given in common observations

S.No.	State	WUA/FO to be Body Corporate
10.	Maharashtra	• Same as given in common observations
11.	Odisha	• Same as given in common observations
12.	Rajasthan	• Same as given in common observations
13.	Sikkim	• Not mentioned in the Act
14.	Tamil Nadu	• Same as given in common observations
15.	Uttar Pradesh	• Same as given in common observations

Table 7.7: Analysis of PIM Act - Objectives of WUA/FO

S.No.	State	Objectives of WUA/FO
1	Andhra Pradesh	• Same as given in common observations
2.	Assam	• Same as given in common observations
3.	Bihar	• To initiate participation of farmers in water management, irrigation scheduling, distribution and maintenance of system at micro level so as to: - to improve irrigation as well as water use efficiency or optimal production per unit volume of water; and - to make the best use of natural precipitation and groundwater in conjunction with the canal water for increasing irrigation and cropping intensity in the command". • To develop a sense of economy in water use amongst the users • To facilitate the users to have a choice in selecting crops, cropping sequence, timing of water supply and period as well as frequency depending upon the soils and availability of water, climate and other infrastructure facilities available in the commands such as roads, markets, cold storages etc., so as to maximize the incomes and profits. • To delineate responsibility of water distribution and maintenance of system between the users and the department for attaining high serviceable standards of the system. • To promote equity amongst the users both relating to allocation and actual supply of water. • To facilitate resolution of conflicts among farmers. • To entrust collective and community responsibility on the farmers to collect water charges and payment to government. • To improve and sophisticate deliveries precisely as per crop needs by the department at the supply points of the minors and thus reduce operation losses. • To create healthy atmosphere between the managers and users in the entire operation.
4.	Chhattisgarh	• In addition to the common objectives mentioned before, the additional objectives are: - The farmers' organisation may also engage into any activity of common interest of members in the command area related to irrigation and agriculture such as ▪ procurement and distribution of seeds, fertilizers and pesticides; ▪ procurement and renting of agricultural implements; ▪ marketing and processing agricultural produce from the Command Area ▪ supplementary business like dairy and fisheries.
5.	Goa	• Same as given in common observations
6.	Gujarat	• Same as given in common observations
7.	Karnataka	• Same as given in common observations
8.	Kerala	• Same as given in common observations
9.	Madhya Pradesh	• Same as given in common observations

S.No.	State	Objectives of WUA/FO
10.	Maharashtra	• In addition to the common objectives mentioned before, the additional objectives are: - The WUA may also engage into any activity of common interest of members in the command area related to irrigation and agriculture such as ▪ introduction of Drip and Sprinkler system for optimising the use of water ▪ developing farm ponds and community projects for exploiting groundwater ▪ procurement and distribution of seeds, fertilisers and pesticides ▪ procurement and renting of agricultural implements; ▪ marketing and processing agricultural produce from the Command Area ▪ supplementary business like dairy and fisheries.
11.	Odisha	• Same as given in common observations
12.	Rajasthan	• Same as given in common observations
13	Sikkim	• Same as given in common observations
14.	Tamil Nadu	• Same as given in common observations
15.	Uttar Pradesh	• In addition to the common objectives mentioned before, the additional objectives are: - to encourage conjunctive use of surface and ground water - to encourage intensified and diversified agricultural production system.

Table 7.8: Analysis of PIM Act – Powers of WUA/FO

S.No.	State	Powers of WUA/FO
1.	Andhra Pradesh	• Power to levy and collect fee
2.	Assam	• Power to levy and collect fee
3.	Bihar	Owing to severe shortages in both backward and forward linkages in irrigated areas, through government orders, the WRD is providing WUAs • powers to procure paddy on behalf of the Food Corporation of India and in turn to collect water fee from all users • provisions for input supplies • making contractors to get work completion certificate for all civil works in the command area from the concerned WUA • merging revenue wing with irrigation wings at all levels of the WRD.
4.	Chhattisgarh	• Power to remove encroachments from property attached to the canal system within its area of operation • Power to levy and collect fee
5.	Goa	The CAD Board has the following powers • CAD Board may, having regard to resources of land and water, nature of soil, climate and other technical considerations, specify for each command area, principles of localisation for the purpose of irrigation • CAD Board may, having regard to the advances in technology of land and water management and other agronomic practices, alter, from time to time, the principles of localisation so specified for any command area. • Whenever the CAD Board is satisfied that for the better cultivation of land and the optimum utilisation of water resources of an irrigation system or for accelerated land development or for any other reasons, it is expedient in the public interest to regulate the cropping pattern, the period of sowing and the duration of crop, then, it may make declaration to that effect. • Special powers of CAD Board in dealing with the cases of lands falling under command area but left fallow. • Power to levy and recover the water charges of the regulated crop for the given location. • Power to impose fine which shall be revisable every 5 years, on the land-holder and to recover the same as arrears of land revenue.

S.No.	State	Powers of WUA/FO
6.	Gujarat	• Power to recover from the member of a WUA the unpaid amount as an arrear of land revenue. • Power to issue directions to the Managing Committee.
7.	Karnataka	• Not mentioned in the Act
8.	Kerala	• Power to levy and collect fee
9.	Madhya Pradesh	• Power to levy and collect fee
10.	Maharashtra	• To charge water rates to its members, as may be approved by the General Body of the WUA • Power to levy minimum charges for the land for which water is not demanded or used for irrigation by members • Power to levy water charges for use of recycled water or ground water by members • Power to recover previous dues from its members • Power to remove encroachments from property attached to the canal system within its area of operation
11.	Odisha	• Power to levy, collect fee and water tax
12.	Rajasthan	• Power to levy and collect fee • Power to remove encroachments from property attached to the irrigation system within its area of operation
13.	Sikkim	• Not mentioned in the Act
14.	Tamil Nadu	• Power to levy and collect fee
15.	Uttar Pradesh	• To enter on any land, remove obstructions, close any channel • To cut down or/and clear away any part of any standing crop, fence or bush • To enter into any building or water-course for the purpose of inspecting or regulating the use of canal water, or for measuring the lands irrigated and chargeable with a water rate and to do all things necessary for the proper regulation and management of such, canals. • To enter in case of any accident happening or being apprehended to a canal, WUA upon any lands adjacent to such canal, and may execute all work which may be necessary for the purpose of preventing such accident.

Table 7.9: Analysis of PIM Act – Offences and Penalties

S.No.	State	Offences and Penalties
1.	Andhra Pradesh	• Whoever without any lawful authority does any of the following acts/namely:- (a) damages, alters, enlarges or obstructs any irrigation system. (b) interferes with, increases, or diminishes the water supply in, or the flow of water from, through, over or under any irrigation system; (c) being responsible for the maintenance of the irrigation system neglects to take proper precautions for the prevention of wastage of the water thereof or interferes with the authorised distribution of water there from or uses water in an unauthorised manner, or in such manner as to cause damage to the adjacent landholdings: (d) corrupts or fouls, water of any irrigation system so as to render it less fit for the purposes for which it is ordinarily used; (e) obstructs or removes any level marks or water gauge or any other mark or sign fixed by the authority of a public servant: and (f) opens, shuts, or obstructs or attempts to open, shut or obstruct any sluice or outlet or any other similar contrivance in any irrigation system, (g) violates the Warabandi or the water distribution and regulation Schedule made by the Water Users' Association or the Distributory Committee or the Project Committee shall, on conviction, be punished with imprisonment which may extend to two years or with fine which may extend to five thousand rupees or with both.

S.No.	State	Offences and Penalties
2.	Assam	• Whoever without any lawful authority does any of the following acts/namely:- (a) damages, alters, enlarges or obstructs any irrigation system: (b) interferes with, increases, or diminishes the water supply in, or the flow of water from, through, over or under any irrigation system; (c) being responsible for the maintenance of the irrigation system neglects to take proper precautions for the prevention of wastage of the water thereof or interferes with the authorised distribution of water there from or uses water in an unauthorised manner, or in such manner as to cause damage to the adjacent landholdings: (d) corrupts or fouls, water of any irrigation system so as to render it less fit for the purposes for which it is ordinarily used; (e) obstructs or removes any level marks or water gauge or any other mark or sign fixed by the authority of a public servant: and (f) opens, shuts, or obstructs or attempts to open, shut or obstruct any sluice or outlet or any other similar contrivance in any irrigation system, shall, on a complaint made by a WUA, on conviction, be punished with imprisonment which may extend to one year or with fine which may extend to five thousand rupees or with both.

S.No.	State	Offences and Penalties
3.	Bihar	• Whoever voluntarily and without proper authority, does any of the following acts: (a) damages, alters, enlarges or obstructs, or encroaches upon any irrigation work; (b) interferes with, increases, or diminishes the supply of water from, through, over or under, any irrigation work, or by any means raises or lowers the level of the water in any such work; (c) interferes with or alter the flow of water in any river, or stream, so as to endanger, damage or render less useful any irrigation work; (d) being responsible for the maintenance of a village channel, or using it, neglects to take proper cautions for the prevention of waste of the water thereof, or interferes with the authorised distribution of the water therefrom, or uses such water in an unauthorised manner, or refuses to allow the use of the channel to others, (e) corrupts or fouls the water of any canal so as to render it less fit for the purpose for which it is ordinarily used; (f) destroys, defaces or moves any level mark or water gauge fixed by the authority of a public servant; (g) destroys or removes any apparatus, or part of any apparatus for controlling or regulating the flow of water in any irrigation work; (h) causes vehicles of any type to pass in or across any of the work, banks or channel of a canal through other than the specified places, contrary to the rules made under this Act; (i) without the permission of the canal officer knowingly or willingly roots up grass or other vegetation growing on any such embankment or removes, cuts or any way injures any trees, bushes, grass or hedges intended for the protection of such embankments; (j) causes any vessel to enter or navigate on any irrigation work contrary to the rules prescribed by the State Government; (k) while navigating on any irrigation work neglects to take proper precaution for the safety of the irrigation work and of vessel thereon; (l) neglects, without reasonable cause, to carry out duties in connection with the execution of any repair or work, when lawfully bound to do; (m) grows or allows to grow any crop in contravention of a notification under the provision of the Act; (n) uses water from an irrigation work without obtaining the permission; (o) wilfully obstructs any person duly authorised under this Act, in removing and levelling any embankment houses, hut or other building, or in lawful exercises of any power in this Act; (p) violates any rule made under the Act, for breach where of a penalty may be incurred; (q) erects or causes or wilfully permits to be erected any new embankment, or adds to any existing embankment without previous permission of the Collector; (r) wilfully causes or aids in causing any obstruction to any line of navigation or damages the works of such line of navigation: shall on conviction, be liable to fine not exceeding Rs 500 or to imprisonment for a term not exceeding six months or to both.

S.No.	State	Offences and Penalties
4.	Chhattisgarh	• Whoever without any lawful authority does any of the following acts, that is to say: - (a) damages, alters, enlarges or obstructs any canal; (b) interferes with, increases or diminishes the supply of water in, or the flow of water from, through, over or under any canal; (c) interferes with or alters the flow of water in any river or stream, so as to endanger, damage or render less useful any canal; (d) being responsible for the maintenance of water course or using water course neglects to take proper precautions for the prevention of waste of water thereof, or interferes with the authorised distribution of the water there from or uses such water in an unauthorised manner; (e) receiving water in his fields for irrigation, neglects to take proper precautions for the prevention of waste of such water; (f) corrupts or fouls the water of any canal so as to render it less fit for the purposes for which it is ordinarily used; (g) being a permanent holder, occupier, cultivator or agricultural labourer, resident in a village in which a proclamation under Section 36 of the Chhattisgarh Irrigation Act, 1931 has been made, neglects to carry out the duties allotted to him; (h) destroys, injures, defaces or removes any land mark, level mark, water gauge or other apparatus fixed by the authority of a canal officer; (i) causes animals or vehicles to pass on or across any of the works, banks or channels or any canal after such passage has been prohibited by a canal officer; (j) causes or knowingly and willfully permits animals to graze or be tethered upon the bank or border of any canal after such grazing or tethering has been prohibited by a canal officer; (k) removes or injures any tree, bush, grass or other vegetation growing on any canal; or (l) cases himself on the banks or in the channel of a canal, shall on complaint made by a farmer's organisation:- - be punishable in respect of all offences mentioned in clauses (a) to (h), with imprisonment which may extend to two years, or with fine which shall not be less than one thousand Rupees but which may extend to five thousand Rupees or with both; and when the offence is a continuing one with an additional fine not exceeding twenty rupees for every day after the first during which the offence has been persisted in; and - Minimum Penalty – be punishable in respect of offences mentioned in clauses (i) to (l) with fine which shall not be less than Rupees five hundred but which may extent Rupees two thousand and if the same person is subsequently convicted for a like offence he shall be liable for imprisonment which may extend to six months for each such subsequent conviction.

S.No.	State	Offences and Penalties
5.	Goa	• Whoever, voluntarily or without proper authority,— (a) damages, alters, enlarges, or obstructs any irrigation system under a pipe outlet; (b) interferes with, increases, or diminishes the water supply in or the flow of water from, through, over or under any "irrigation" system under a pipe-outlet; (c) being responsible for maintenance of the irrigation system under a pipe outlet, neglects to take proper precautions for prevention of wastage of the water thereof or interferes with the authorised distribution of water there from or uses water in an unauthorised manner or in such manner as to cause damage to the adjacent land holding; (d) corrupts or fouls, the water of any irrigation system under a pipe-outlet so as to render it less fit for the purpose for which it is ordinarily used; (e) destroys, defaces or removes any level marks or water-gauge or any other work or sign fixed by the Command Area Development Board or a public servant; (f) opens, shuts or obstructs or attempts to open, shut, or obstruct any sluice or outlet or any other similar contrivance in any irrigation system under a pipe-outlet or drainage system; (g) uses water unlawfully or unauthorisedly or agrees to or allows to grow any crop in contravention of any notification under this Act shall, on conviction, be punished with imprisonment which may extend to two years or with fine which shall not be less than one thousand rupees, but may extend to five thousand rupees or with both: • While convicting any person under the above mentioned clauses, the Judicial Magistrate may order that the said person shall remove the obstruction or repair the damage, sluice or outlet or replace the level mark, water gauge or other work in respect of which the conviction has taken place, within a period to be specified in such order. If such person neglects or refuses to obey such orders within the period so fixed, the Command Area Development Board may carry out the work in accordance with such order and the cost thereof shall be recoverable from such person as arrears of land revenue.
6.	Gujarat	• Not mentioned in the Act

S.No.	State	Offences and Penalties
7.	Karnataka	• Whoever voluntarily and without proper authority, (i) damages, alters, enlarges or obstructs any irrigation work ; (ii) interferes with, increases, or diminishes the supply of water in, or the flow of water from, through, over, or under any irrigation work or by any means raises or lowers the level of the water in any irrigation work; (iii) opens, shuts or obstructs or attempts to open, shut or obstruct any sluice or outlet or any other similar contrivance in any irrigation work, (iv) corrupts or fouls the water of any irrigation work so as to render it less fit for the purpose for which it is ordinarily used; (v) destroys, defaces or moves any land-mark or level-mark or water guage fixed by the authority of a public servant, (vi) destroys, tampers with, or removes any apparatus, or part of any apparatus, for controlling, regulating or measuring the flow of water in any irrigation work; (vii) causes any animal or vehicle to pass on or across any of the works, banks, canals or channels of an irrigation work contrary to rules made under section 71 after he has been required to desist therefrom; (viii) causes or permits any animal to graze or be tethered upon the bank of any irrigation work; (ix) removes or injures any tree, bush, grass or other vegetation intended for the protection of any irrigation work; (x) puts up a dam across or otherwise obstructs the free course of water the right to which vests in the Government; (xi) being responsible for the maintenance of the field channel or using the field channel, neglects to take proper precautions for the prevention of waste of the water thereof, or interferes with the authorised distribution of the water therefrom or uses such water in an unauthorised manner; (xii) contravenes any provisions of this Act; (xiii) contravenes any rules, the contravention whereof is declared in the rules made under that section to be an offence punishable under this section, shall, on conviction, be punished for offences under clauses (vi), (x), (xi) with imprisonment for a term which may extend to one year or with fine which may extend to one thousand rupees or with both; and for offences under any other clause with imprisonment for a term which may extend to two months, or with fine which may extend to five hundred rupees or with both.
8.	Kerala	• Whoever, without proper authority,- (a) injures, alters, enlarges or obstructs any irrigation work; or (b) interferes with, increases or diminishes supply of water from any irrigation work ; (c) interferes with or alters the flow of water in any irrigation work so as to endanger, injure or render less useful , any such work; (d) being entitled to the use of water from an irrigation work, causes or occasions waste of water in such irrigation work or interferes with the authorised distribution of water therefrom or uses water in any unauthorised manner ; (e) intentionally corrupts or fouls water of any irrigation work so as to render it less fit for the purpose for which it is ordinarily used; (f) destroys, defaces, removes or alters any level marked or water gauge or any other mark or sign fixed in an irrigation work shall, on conviction, be punished with imprisonment for a term which may extent to one year or with fine which may extend to five thousand rupees, or with both.

S.No.	State	Offences and Penalties
9.	Madhya Pradesh	• Whoever without any lawful authority does any of the following acts, that is to say:- (a) damages, alters, enlarges or obstructs any canal; (b) interferes with, increases or diminishes the supply of water in, or the flow of water from, through, over or under any canal; (c) interferes with or alters the flow of water in any river or stream, so as to endanger, damage or render less useful any canal; (d) being responsible for the maintenance of water course or using water course, neglects to take proper precautions for the prevention of waste of the water thereof, or interferes with the authorised distribution of the water therefrom or uses such water in an unauthorised manner; (e) receiving water in his fields for irrigation, neglects to take proper precautions for the prevention of waste of such water, (f) corrupts or fouls the water of any canal so as to render it less fit for the purposes for which it is ordinarily used; (g) being a permanent holder, occupier, cultivator or agricultural labourer, resident in a village in which a proclamation under Section 36 of the Madhya Pradesh Irrigation Act, 1931 has been made, neglects to attend at the place appointed or refuses or neglects to carry out the duties allotted to him; (h) destroys, injures, defaces or removes any land mark, level mark, Water gauge or other apparatus fixed by the authority of a canal officer; (i) causes animals or vehicles to pass on or across any of the works, banks or channels or any canal after such passage has been prohibited by a canal officer; (j) causes or knowingly and willfully permits animals to graze or be tethered upon the bank or border of any canal after such grazing or tethering has been prohibited by a canal officer; (k) removes or injures any tree, bush, grass or other vegetation growing on any canal; or (l) eases himself on the banks or in the channel of a canal shall on complaint made by a Farmer's Organisation:- - be punishable in respect of offences mentioned in clauses (a) to (h), with imprisonment which may extend to two years, or with fine which shall not be less then one thousand Rupees but which may extend to five thousand Rupees or with both; and when the offence is a continuing one, with an additional fine not exceeding twenty Rupees for every day after the first during which the offence has been persisted in; and **Minimum Penalty** - be punishable in respect of offences mentioned in clauses (i) to (l) with fine which shall not be less than Rupees five hundred but which may extent Rupees two thousand and if the same person is subsequently convicted for a like offence he shall be liable for imprisonment which may extend to six months for each such subsequent conviction.

S.No.	State	Offences and Penalties
10.	Maharashtra	• Any person who without any lawful cause, sanction or authority commits any of the Acts specified in the next section, within the area operation of WUA shall be deemed to have committed an offence under this Act and shall, on conviction, be punished with imprisonment which may extend to six months or with fine which may be upto ten times the annual water charges or with both. • The acts referred to in the above section are as follows: (a) damages, alters or obstructs canal system; (b) interferes with the flow and water level in canal system; (c) pollutes or fouls the canal water so as to diminish its utility for the given purposes so as to render it less fit for the given purpose; (d) destroys, tampers with, or removes any apparatus or part of any apparatus meant for operation and maintenance of canal system, (e) obstructs the implementation of scheduled irrigation; (f) uses water in unauthorised or wasteful manner; (g) lifts water in an unauthorised manner; (h) endangers the stability of canal system; (i) obstructs the flow in the drainage system; (j) neglects the maintenance of canal system; (k) prevents the lawful use of canal system by any person authorised to use the same; (l) does not pay the water charges in time, (m) contravenes any of the provisions of this Act or Rules made thereunder;
11.	Odisha	• Whoever without any lawful authority:- (a) damages, alters, enlarges, or obstructs any irrigation system; or (b) interferes with, increases, or diminishes the water supply in, or the flow of water from, through, over or under any irrigation system; or (c) being responsible for the maintenance of the irrigation system neglects to take proper precautions for the prevention of wastage of the water thereof or interferes with the authorised distribution of water therefrom or uses water in an unauthorised manner, or in such manner as to cause damage to the adjacent landholding; or (d) corrupts or fouls, water of any irrigation system so as to render its less fit for the purposes for which it is ordinarily used; or (e) obstructs or removes any level marks or water gauge or any other mark or sign fixed by the authority of a public servant; or (f) opens, shuts, or obstructs or attempts to open, shut or obstruct any sluice or outlet or any other similar contrivance in any irrigation system, shall, on conviction, be punished with imprisonment which may extend to one month or with fine which may extend to two hundred rupees or, with both
12.	Rajasthan	• Whoever, without any lawful authority, - (a) damages, alters, enlarges or obstructs any irrigation system; (b) interferes with, increases, or diminishes the water supply in, or the flow of water from, through, over or under any irrigation system; (c) being responsible for the maintenance of the irrigation system neglects to take proper precautions for the prevention of wastage of the water thereof or interferes with the authorised distribution of water therefrom, or uses water in an unauthorised manner or in such manner so as to cause damage to the adjacent land holdings; (d) corrupts or fouls, water of any irrigation system so as to render it less fit for the purposes for which it is ordinarily used; (e) obstructs or removes any level marks or water gauge or any other mark or sign fixed by the authority of a public servant; and (f) opens, shuts or obstructs or attempts to open, shut or obstruct any sluice or outlet or any other similar contrivance in any irrigation system; shall, on conviction, be punished with imprisonment which may extend to two years or with fine which may extend to rupees five thousand or with both.

S.No.	State	Offences and Penalties
13.	Sikkim	• Not mentioned in the Act
14.	Tamil Nadu	• Whoever, without any lawful authority, does any of the following acts, namely: (a) damages, alters, enlarges, or obstructs any irrigation system; or (b) interferes with, increases, or diminishes the water supply in, or the flow of water from, through, over or under any irrigation system; or (c) being responsible for the maintenance of the irrigation system, neglects to take proper precautions for the prevention of wastage of the water thereof or interferes with the authorised distribution of water therefrom or uses water in an unauthorised manner, or in such manner as to cause damage to the adjacent land; or (d) corrupts or fouls, water of any irrigation system so as to render it less fit for the purposes for which it is ordinarily used; or (e) obstructs or removes any level marks or water gauge or any other mark or sign fixed by the authority of a public servant; or (f) opens, shuts, or obstructs or attempts to open, shut or obstruct any sluice or outlet or any other similar contrivence in any irrigation system; or (g) violates the Rotational Water Supply or water distribution and regulation made by the Water Users Association or Distributory Committee or the Project Committee; shall, on conviction, be punished with imprisonment for a term which may extend to two years or with fine which may extend to five thousand rupees, or with both.
15.	Uttar Pradesh	• Whoever, without any lawful authority does any of the following acts within the delineated area of operation of an irrigation system, that is to say:— (i) damages, alters, enlarges or obstructs any canal work or field drain; (ii) interferes with, increases or diminishes the supply of water in or the flow of water from, through, over or under, any canal or field drain; (iii) uses without authorization of competent authority, water outside the area of operation of a water users' association; (iv) neglects to take the proper precautions for the prevention of waste of water or interferes with the authorized distribution of water or uses such water in an unauthorized manner; (v) corrupts or fouls the water of any canal so as to render it less fit for the purposes for which it is ordinarily used; (vi) destroys or moves any level mark made, water-gauge or any apparatus fixed by the authority of a public servant or water users' association; (vii) passes, or causes any animals or vehicles to pass on or across any of the works, banks or channel of a canal or field drain contrary to rules except for cattle ghat wherever provided and roads designated for such use; (viii) obstructs the implementation of scheduled irrigation; (ix) encroaches upon the canal or field drain or damages the canal assets or Government property; (x) contravenes the provisions of this Act and rules made thereunder shall be punishable with imprisonment which may extend to six months or fine which shall not be less than one thousand rupees but which may extend to the cost of damage or both. Provided that an additional fine not less than one thousand rupees may be imposed for a subsequent conviction of the same person for a like offence.

7.3 Status of Water User Associations (WUAs)

The state departments of water resources development including CADWM have formed water user associations as per the PIM guidelines. The figures in table 7.10 present the status of WUAs as on March 2012.

Table 7.10: State-wise Number of WUAs Registered till March 2010

S. No.	Name of State	Status as on March, 2012		No. of WUAs Handed Over
		Area covered (th. ha)	No of WUAs	
1	Andhra Pradesh	4183.02	10872	321
2	Arunachal Pradesh	9.698	43	0
3	Assam	95.017	847	0
4	Bihar	209.5	80	53
5	Chhattisgarh	1244.56	1324	1324
6	Goa	9.54	79	3
7	Gujarat	619.729	1834	281
8	Haryana	1616.267	8490	0
9	Himachal Pradesh	140.558	1173	0
10	J&K	32.794	383	0
11	Jharkhand	0	19	0
12	Karnataka	1402.04	2752	1137
13	Kerala	189.95	4323	299
14	Madhya Pradesh	1999.635	2062	0
15	Maharashtra	1156.222	2959	266
16	Manipur	29.40	69	0
17	Meghalaya	20.17	159	0
18	Mizoram	18.228	390	0
19	Nagaland	3.44	24	23
20	Orissa	1753.52	20589	1220
21	Punjab	610.29	4845	1029
22	Rajasthan	1144.454	1994	1410
23	Sikkim	0	0	0
24	Tamil Nadu	895.24	1775	96
25	Tripura	0	0	NA
26	Uttar Pradesh	121.21	245	0
27	Uttarkhand	0	0	0
28	West Bengal	37.00	10000	0
	Total	17541.48	77330	7462

(Source: CADWM, MoWR, NewDelhi and Project Offices of the respective states)

According to the figures 77,330 WUAs covering an area of 17541.48 thousand hectare have been formed in 24 states whereas the process is of WUAs formation yet to be initiated in

Jharkhand, Sikkim, Tripura and Uttarakhand. In case of West Bengal, the state has formed 10,000 beneficiary committees however they do not follow the concept of WUAs as per the PIM guidelines. Orissa leads in forming maximum number (20,589) of WUAs which is followed by Andhra Pradesh (10,872) and Haryana (8490). The number of WUAs in remaining states ranges from 847 in Assam to 4845 in Punjab whereas the same is less than 391 in case of Arunachal Pradesh, Goa, Jammu & Kashmir, Manipur, Meghalaya, Nagaland, Mizoram, and Uttar Pradesh. The bigger states like Jammu & Kashmir and Uttar Pradesh have yet to speed up the process with regard to WUAs formation and registration.

A total number of 7462 WUAs have been handed over the charge of of micro system in 11 states for operation, repair and maintenance. Rajasthan, Orissa, Punjab and Karnataka are the leading states in handing over the charge to more than 1000 WUAs each where the same is leas than 322 WUAs in case of Andhra Pradesh, Bihar, Goa, Gujarat, Maharastra, Nagaland and Tamilnadu. The percent of WUAs handed over the charge as against the existing number of WUAs is quite low in the states like Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh, Kerala, Madhya Pradesh, Maharastra and Orissa.

7.4 PIM Act and Status of WUAs

The analysis below presents the following information:

- States where PIM Act has been enacted and the status of WUAs
- States where PIM Act has not been enacted and the status of WUAs

(i) States where PIM Act has been enacted and the Status of WUAs

Andhra Pradesh

Participatory Irrigation Management was initiated in Andhra Pradesh with the enactment of *Andhra Pradesh Irrigation Utilisation and Command Area Development Act 1984*. After series of amendments, it is called 'The Andhra Pradesh Farmers Management of Irrigation Systems (APFMIS) Act 1997'. The Act focused on the constitution of a three-tier management system controlled by water users to reduce government management of irrigation systems.

- As per the findings, 10872 WUAs have been formed in the state and the same have been registered also whereas the charge of micro system has been handed over to 321 WUAs.
- The State has taken lead for transferring the irrigation management up to the level of minors and distributaries to WUAs.

- There are 6-12 committee members in the WUAs with 3-6 members from head, 3-4 from middle and 4-6 from the tail end of the system.
- The WUAs have been involved in planning, execution, monitoring and evaluation of the project in many ways like
  - ✓ WUA level action planning, using work book
  - ✓ Water Tax assessment and collection
  - ✓ WUAs empowered to take up works up to ₹ 5 Lakhs

- The water charges were being collected by the WUAs till the year 2000. However, with the change of Government in the State, the responsibility of collection of water charges was taken over by the Revenue Department.
- The accounts have formally been audited in the visited WUAs, however, the funds are insufficient to maintain and replace the essential system.
- The question of sustainability of WUAs arises as the funds are insufficient to maintain and the replace the essential systems in all the visited WUAs.

Assam

The Irrigation Department, Government of Assam has enacted the Assam Irrigation Water Users' Act, 2004.

- A total number of 847 WUAs have been formed in the state. However, most of the WUAs do not seem to be adequately equipped with required clarity on their roles and responsibilities and the capacities to manage the system. Efforts are being made to motivate these WUAs to take responsibilities such as distribution of water, maintenance of structures, etc.
- The representation of Panchayat representatives in the WUAs is around 3% who are mainly involved in coordinating between WUAs, politicians and offices.
- There are only 2% women farmers in the WUAs who help in coordination with the staff.
- The water charges are collected by the Irrigation Department of the State. The water charges are revised every 5 years in the project with the last revision being made in 2005.
- The main financial source of the visited WUAs is the membership fee.

The major constraints experienced by the project officials in Assam with regard to formation and registration of WUAs are as below:

- Lack of will and confidence amongst the farmers to shoulder any responsibility. Prior to formation of WUAs, the maintenance of irrigation system was managed by the

Government owing to which the farmers have become so dependent on the Government that now they do not want to share the responsibility.

- Most of the WUAs are based far away from the Capital city where the registrar is based.
- The criteria for registration is found to be tough by the farmers and there is urgency to evolve easy procedure for registration

Bihar

PIM was initiated in the state with the enactment of the Bihar Irrigation Act, 1997 with an aim to establish relationship between farmers and government officials for better outcome of the irrigation projects and revenue. A year later, Water User Associations (WUAs) were provided legal status and in 2003, management of distributaries of canal system was transferred to WUAs. 2008 saw mandatory provisions and guidelines being issued on formation of WUAs in Village Level Committee (VLC) as well as in System Level Committee (SLC). Every village with a distributor or Minor has a VLC. All chairpersons of VLCs form the SLC.

One of the main objectives of PIM in Bihar is "to initiate participation of farmers in water management, irrigation scheduling, distribution and maintenance of system at the micro level."

The state has set up PIM cell attached to the Secretary, Water Resources Department, to coordinate PIM activities in the State. The cell is expected to facilitate activities related to formation, registration, and management transfer at the state level and to coordinate with the WALMI. The PIM cell with active cooperation from WALMI is currently carrying out activities related to: a) transfer all distribution system to WUAs; b) monitor the performance of WUAs; c) act as mediator to solve problems of WUA between WUAs and the state government; d) facilitate WUAs with all the facilities as per direction of the central government, e) train WUAs with the support of WALMI; and f) act as secretariat of PIM Programme in the state.

- 80 WUAs have been formed and registered in the state whereas 53 WUAs have been handed over the charge of the system for Management Operation and Maintenance (MOM). The first WUA to secure registration was in 2004.
- Water charges are applicable for the WUAs (₹ 75 per irrigation in rabi season and ₹ 88 per irrigation in kharif season) and these are collected and paid to the State Irrigation Department. In majority of the WUAs, the water charges are revised every year while in 3 of the 6 visited WUAs, charges are revised once in 1-3 years.
- The accounts have formally been audited only in one visited WUA and the reports are maintained with them.

- A number of training programs have been organized for the WUAs on the themes of farm management, water management and SRI method of cultivation. WALMI, scientists from Rajendra Agricultural University (RUA) Pusa and Department of Agriculture have been the main resource support for these trainings.
- The financial sources of WUAs consist of 70% of the revenue as collected from farmers, WUAs management grant under CADWM and internal resources as membership fees and other income from the systems.
- While there are WUAs formed so far in the state since 1997, there are few factors that inhibit momentum of the PIM execution. Farmers are found non willing, less motivated and habitually reluctant to pay for the water charges.

Chhattisgarh

For the constitution of WUAs in the State for farmers' participation in the management of irrigation system and related matters, an Act viz. *Sinchai Prabandhan mei Krishakon ki Bhagidari-2006* (Participatory Irrigation Management Act-2006) was passed. The old Act, "Chhattisgarh Sinchai Prabandhan Mei Krishakon ki Bhagidari Adhiniyam 1999" was repealed after enacting the new act. The act explains the constitution of farmers' organizations and delineation of command area, in particular the delineation of water user's area/distributor area/project area and constitution of water users association, Distributary Committee and Project committee. In order to ensure participation of the farmers in Irrigation Management, WUAs have been constituted through elections in Chhattisgarh State.

- In the state of Chhattisgarh, 1324 WUAs have been formed and registered under the Participatory Irrigation Management Act-1999 and all of them have been handed over the charge of MOM. The process of handing over started in 2007. The WUAs are maintaining the system and they are satisfied with the assistance provided to them.
- There are 10-12 executive committee members in the WUAs representing head, middle and tail end of the micro canal system.
- The WUAs visited in the project area have incurred expense on Maintenance costs including Repairs, Replacement of Infrastructure ranging from ₹ 20,000 to ₹ 43,000 in the visited WUAs.
- WUAs visited in the command area have their bank accounts in Co-operative Bank with the balance amount ranging from ₹ 1000 to ₹ 2,45,000.

Goa

The State has enacted "Goa Command area Development Act 1997 (Goa Act 27 of 1997)" where in provision has been made for Participatory Irrigation Management in the state.

- Average age of WUAs in the Goa Tillari Irrigation Project studied intensively in the State is less than 3 years. 79 WUAs have been formed in the state out of which 3 WUAs have been handed over the charge of MOM.
- All the WUAs covered under the study were registered during 2006 and 2007. Initially, the WUAs were registered under the Maharashtra State Co-operative Societies Act 1960 but later the Co-operative Act was enacted in the State and the WUAs were registered under the Goa State Co-operative Societies Act 1960.
- The project had planned to hand over the water distribution system to WUAs after 3 years of their formation. The process, therefore, started in 2011.
- The WUAs visited in the project area have got their accounts audited incurring an expenditure of ₹ 1500 - ₹ 2000.
- The state has decided that the water charges will not be applicable for 3 years after formation of the WUAs. Once the water distribution system is handed over to them, the process of collection of water charges will start. Therefore, all the farmers in all the societies are getting irrigation water free of cost.
- An amount of ₹ 55 was collected from the farmers to get the membership to WUAs. Initially, the farmers also contributed ₹ 50 per month but the same got discontinued as the farmers did not get the irrigation water as expected.
- The accounts have formally been audited in the visited WUAs and the reports are maintained with them. The visited WUAs have their bank accounts in Goa State Co-operative Bank with the balance amount ranging from ₹ 2700 to ₹ 26000.
- The question of sustainability and self-reliance appears to be immature at this stage because the WUAs have not even initiated managing the micro canal system nor do they have adequate funds to manage the system. Therefore, they may take some more time to ensure their sustainability in the long run.

Gujarat

The Government of Gujarat (GoG) has been giving high priority to PIM and has systematically promoted it by facilitating the same through government resolutions from time to time since 1980s. The state had a PIM resolution during the year 1995 based on experiences from its pilot projects. GoG enacted the Gujarat Water Users' Participatory Irrigation Management Act 2007 for scaling up PIM in the state, authorising the farmers to constitute Water Users' Associations (WUA) for management of canals handed over, after rehabilitation by the Government.

- 1834 WUAs have been formed so far in Gujarat whereas the charge for MOM has been handed over to 281WUAs. All the studied WUAs were registered by 2003 under the

Gujarat State Co-operative Societies Act 1960. Water distribution system has been handed over to all the surveyed WUAs.

- All the eligible farmers are the members of WUAs and water is delivered to the farmer's groups (WUA) and not to individual farmers.
- The micro level canal systems with appropriate structures are being designed and constructed to ensure timely and equitable distribution of water. This would guard against the most commonly observed problem of overuse of water by initial command blocks, leaving less supplies to the tail enders.
- The WUAs duly pay the water charges to the government. Though charges are to be collected by Chairman of WUA but at times, farmers pay directly to the Department.
- The water charges are determined by the SSNNL. However, it is proposed that the water charges will be based on the volumetric supply of water instead of conventional area approach.
- The WUAs mobilize their financial resources through membership fee and water charges. All the WUAs visited in the command area have their bank accounts with the balance amount ranging from ₹ 1900 to ₹ 28,950.
- The training and capacity building of the WUAs is undertaken by WALMI. The project is yet to initiate the process of WUAs training needs identification, designing and execution of capacity building inputs in holistic way so as to strengthen them and lead them towards self-reliance and sustainability.

Karnataka

Since 2000, the Government of Karnataka has initiated number of fresh measures for implementation of PIM. It had promulgated amendments to the Karnataka Irrigation Act 1965 and Irrigation (Levy of Betterment contribution and Water Rate) Act 1957 to provide the legal framework for the transfer of the management.

For implementing PIM, Government of Karnataka has made legal and policy changes in June 2000. The Irrigation Act provides for the formation of Water Users Apex Level Federation at the State Level for making recommendations to Government on policies and guidelines to be adopted. The apex federation is also empowered to give directions to other federations and societies.

- In Karnataka, 2752 WUAs have been formed and registered under the Cooperative Societies Registration Act, 1959 and Rules 1960 of which 1137 WUAs have been handed over the charge of water distribution system for MOM.

- The irrigation water charges for WUAs range from ₹ 22000 to ₹ 75000 and they are collected by the O&M wing of CADA, Krishna Bhagya Jal Nigam Limited and WUAs.
- Financial sources of the visited WUAs are membership fee, irrigation charges and one-time functional grant.
- The sustainability of WUAs is a major concern but cannot be assured as funds are a big constraint.

Kerala

An achievement in the history of PIM in Kerala is the inclusion of a chapter on PIM in the Kerala Irrigation and Water Conservation Act 2003. Based on the experiences of the pilot projects undertaken by the Centre for Water Resources Development and Management (CWRDM), the committee constituted by the Government of Kerala for suggesting modifications to the Kerala Irrigation and Water Conservation Act 2003 submitted proposals for incorporating amendments required for implementation of PIM in Kerala. These are being examined by the State Government.

- The state has been able to form 4323 WUAs of which 299 WUAs have been handed over the charge of MOM. All the WUAs covered under the study were registered during 2003 and 2011.
- No expenditure has been incurred on operation and maintenance, however, all the societies have got their accounts audited incurring an expenditure of around ₹ 3000.
- Financial sources of WUAs are membership fees and the one-time grant.

Madhya Pradesh

Instead of amending the existing State Irrigation Act 1931; a separate PIM Act called *M.P. Sinchai Prabandhan Mei Krishakon Ki Bhagidari Adhiniyam (1999)* was enacted and brought in force in the entire state with effect from 15thSeptember, 1999.

M.P. Sinchai Prabandhan Mei Krishakon Ki Bhagidari Adhiniyam, (1999) and PIM Rules 1999, with all the amendments are the guidelines to implement PIM in Madhya Pradesh. Different circulars issued by Government/Engineer-in-chief are also helpful in implementation of PIM in the State.

- 2062 WUAs have been formed and registered in the state. However, the process of handing over the charge of micro irrigation system for MOM is not initiated as yet.
- There is no reservation for woman but if the Managing Committee of WUA does not have any elected woman member, the Managing Committee shall nominate a woman

as member who shall ordinarily be a resident of the same Farmers Organization area. There is participation of woman members in each of the WUAs.

- Assistance is provided by Water Resources Department (WRD) for operation and maintenance.
- The irrigation revenue realisation is done by the WRD, and WUAs are supporting indirectly in the revenue collection. However, an amendment in the PIM Act 1999 is under consideration for fixing of water rates and its collection by WUAs.
- All the 6 WUAs studied under intensive study project have bank accounts and maintain their expenditure details.
- From 2001-02 to 2003-04, a financial grant of ₹ 40/45 per ha was provided to WUAs for their sustainability. Since the year 2004-05, this grant has been doubled to ₹ 80/90 per ha. An additional financial assistance of ₹ 5000 per year per WUA is also being provided to meet out office running expenditures

Maharashtra

The first attempt to start a WUA, with modern technical, organisational, and social considerations was made in 1989, with the establishment of a WUA on a minor on the right bank canal of Mula Irrigation Project in Ahmednagar district in the State. Since then, the PIM movement has taken firm roots in the state and has shown slow but steady expansion.

The Government of Maharashtra has enacted exclusive legislation called the Maharashtra Management of Irrigation Systems by Farmers (MMISF) Act 2005 for involvement of farmers in irrigation management.

- 2959 WUAs have been formed in the state. Earlier the WUAs were regulated under Cooperative Act, 1960. Now, they are also registered under the MMISF Act 2005. All the studied WUAs have been registered with the systems being handed over to them.
- All the farm holders are member of WUAs and are aware about the benefits of PIM and WUAs. There is participation of members from head, middle and tail end and also participation of woman members WUAs
- The WUA members have been given options for water charges and the charges are collected by WUA Secretary/chairman or authorized member.
- The studied WUAs have bank accounts and the audit is also carried out annually.
- The WUAs are also found sustainable and they are found involved in providing services such as distribution of water, canal maintenance, construction of facility, collection of fees, crop diversification, farm cooperatives, input supply etc.

Odisha

Participatory Irrigation Management was introduced in the state during 1995 on a pilot basis under Odisha Water Resources Consolidation Project (OWRCP) under the banner of Farmers' Organisation and Turn over (FOT). Experiencing its success at large, it was extended to all the commands of Major, Medium, Minor and Lift Irrigation Projects. Subsequently, during the year 2000, the WUAs were renamed as *Pani Panchayats*.

To strengthen the *Pani Panchayat* programme, it was felt that there should be a legal backing to the existence of the *Pani Panchayats*. In this regard, the Odisha Pani Panchayat Act 2002 came into force with effect from 15.11.2002 and the Odisha Pani Panchayat Rule 2003 came into force with effect from 23.04.2003. Later necessary amendments to the Pani Panchayat Act have been made and published in Orissa Gazette on 20th January 2009.

- 20589 WUAs have been formed and registered in the state of which 1220 have been handed over the charge. All the WUAs covered under the study were registered during 2006 and 2007. Initially, Pani Panchayats were formed and registered under the Societies Registration Act, 1860. Now, Pani Panchayats are formed by conducting elections as per Odisha Pani Panchayat Act, 2002 and Odisha Pani Panchayat Rule, 2003.
- The Revenue Department collects the water charges. Generally, farmers deposit the charges individually and in some cases, the charges are deposited through WUAs.
- Grant-in-aid is being given to the Pani Panchayats on achievement of 75% of membership by paying a nominal participatory fee for O&M of canals handed over to them. Initially, it was decided to give Grant-in-aid @ ₹ 35/- per hectare and later it was enhanced to ₹ 100/- per hectare for the first year and it is proportional to the percentage of the membership for subsequent three years. From fifth year onwards, the Grant in aid shall be proportional to the amount of water rate assessed and collected in the preceding financial years.
- Training Programme for Pani Panchayat office bearers' and junior level officers have been conducted by WALMI and KVKs of the state. As a factor of motivation, the best first and second Pani Panchayats (on the basis of grading of major, medium, minor Irrigation Project) were awarded with best prize and certificate by the Chief Minister.

Rajasthan

Government of Rajasthan framed the PIM Act on 20th November 2000 called the *'Rajasthan Sinchai Pranaali Ke Prabandh Mei Krishakon Ki Sahabhagita Adhiniyam, 2000'* [Rajasthan Farmers Participation in Management of Irrigation System (RFPMIS) Act 2000], to ensure involvement of farmers in irrigation development activity.

- The number of WUAs formed registered is 1994 of whom the system has been handed over is 1410.
- The financial sources of the WUAs are the irrigation charges and the one-tim grant. The WUAs have accounts in the Nationalised Banks with the amount varying from ₹ 20000 to ₹ 2.5 Lakhs.

Sikkim

In the name of PIM Act, Sikkim follows the Sikkim Irrigation Water Tax Act 2002 to provide for levy and collection of tax from the owners of the land using water from Government Irrigation Channels.

The Act was amended in 2008 and was called the Sikkim Water Tax (Amendment) Act 2008. A new section on PIM was inserted in the amended Act

In order to exercise powers conferred by this Act to collect water tax, the State government made rules called the Sikkim Irrigation Water Tax Rules 2007. These rules were also amended in 2008 to be called the Sikkim Irrigation Water Tax (Amendment) Rules 2008.

No WUAs have been formed in the state.

Tamil Nadu

To provide necessary legal support for effective functioning of the Farmers Associations, the Government of Tamil Nadu enacted the "Tamil Nadu Farmers' Management of Irrigation Systems Act, 2000".

Necessary rules for implementation of the Act were framed and the Act had been brought into force in all 21 lakh hectare of area. However, the Government decided to implement this Act first in the area of 7 lakh ha. rehabilitated under Water Resources Consolidation Project in order to expedite the realisation of increase in agricultural productivity and achievement of effective irrigation and water utilisation.

- 1775 WUAs have been formed and registered in the state of whom 96 WUAs have been handed over the charge of the command areas for MOM. Most of the WUAs covered under the study were registered during 2003 and 2004. Initially, the WUAs were registered under the Tamil Nadu Societies Registration Act 1975; now they are registered under the Tamil Nadu Farmers' Management of Irrigation Systems Act, 2000.
- The water charges are collected by the State Revenue Department. The Farmers Association may be engaged to collect the water charges in further.

- All the WUAs visited in the command area have their bank accounts in Nationalised Banks with the balance amount ranging from ₹ 2081 to ₹ 42000.
- Capacity building programmes for the WUA members have been organised with an exposure visit to Agricultural Engineering Training Centre, Trichy and Tamil Nadu Agriculture University, Coimbatore.

Uttar Pradesh

The State Government enacted 'Uttar Pradesh Participatory Irrigation Management Act - 2009' and framed rules called 'Uttar Pradesh Participatory Irrigation Management Rules - 2010'. The Rules provide that the WUAs of appropriate level (kulaba, alpika or rajwaha level) shall be constituted in a continuous area whether irrigated or capable of being irrigated by a canal either by gravity flow or by lift or by any other method within the prescribed area of operation. The provision has been made for collection of water charges by WUAs. It is the beginning phase for implementation of PIM in the State. The formation of WUAs as per provision of PIM rules framed in 2010 is at nascent stage and the state has taken steps to constitute WUAs as per the State PIM Act.

245 WUAs have been formed in the state. However the state has not taken initiative for handing over the charge of micro irrigation commands for management, operation and maintenance.

(ii) States where PIM Act has not been enacted and the Status of WUAs

Jammu and Kashmir

The PIM Act has not been enacted in the state yet. The state officials are aware of usefulness and Importance of the Act and have submitted Draft of Act to Government of Jammu and Kashmir for approval. Once the legislature approves the Act, the PIM activities in the State will have legal backup.

- The state has formed 383 WUAs. In case of CADWM, the beneficiary groups like Self-Help Groups (SHGs) have been formed who do not have any legal backing. Ad-hoc WUAs are formed at the time of construction of field channel. Many a times, these WUAs are dissolved after the completion of work. The process of registration of WUAs will take place once the draft PIM act will be passed in legislature.
- Water distribution system has not been handed over to any of the studied groups. Patwari or Nambardar manages the water distribution system, hence, no expenditure has been incurred on operation and maintenance.

- Water charges will be levied on the basis of area. At present, the charges are ₹ 20 per acre. The water charges are collected by Patwari or Nambardar of the Irrigation Department.
- The frequency of water charges revision is less than once in every 5 years. The water charges are decided by the Irrigation Department of GoJ&K.
- The ad-hoc WUAs were covered under capacity building programmes with an exposure visit to other completed projects of the State. The trainings are organized by S.M.S. (Agronomy) on water saving techniques and various cropping schemes.

Punjab

The State does not have a separate PIM Act. The Water User Associations are formed and function as per Northern India Canal and Drainage Act VIII of 1873. Action is being initiated to amend this Act to enable smooth functioning of the WUAs.

- 4845 WUAs have been formed in the state of which 1029 WUAs have been handed over the charge of command area for MOM. The WUAs covered under the study were registered since 2000 onwards till 2010 under Registration of Society Act 1860, as applicable to State of Punjab.
- The WUAs are handed over the system in its operational area for Management Operation and Maintenance within 6 months. The WUAs undertake work such as removal of silt and minor damage/ repair.
- The WUAs participate actively in planning and execution process. The WUAs are provided with one time grant which has been largely used for maintenance/ repair work of CAD. The members contribute towards WUA @10%.

Haryana

In Haryana, the Northern India Canal & Drainage Act, 1873 was in force till 1974, which regulated the irrigation system. Subsequently, Haryana Canal & Drainage Act was enacted in 1974 replacing the earlier law. Both these Acts contained essential element of participation of stakeholders in irrigation management.

The Government of Haryana issued model bye laws for Water Users Associations in the year 2000 and in order to provide legal status to WUAs, amendment of Haryana Canal and Drainage Act, 1974 has been submitted for approval of the Government.

The PIM Act has not been enacted in the state. However, a committee for submission of a proposal for framing PIM Act along the lines as enacted by other States and Model Act of

MoWR has been constituted in CADA. After the in-depth study and discussions, the proposal will be submitted by the Administrator, CADA to the Government of Haryana for approval.

- 8490 WUAs have been formed in the state. However, the process of handing over the charge of command area management, operation and maintenance is yet to be initated in the state.
- All the studied WUAs were registered during 2010 and 2011.
- No expenditure has been incurred by the WUAs on operation and maintenance of the system as the systems have been handed over to them recently and they are still in the process of running the system.
- All the WUAs visited in the command area have their bank accounts in banks with the balance amount ranging from ₹ 22800 to ₹ 182200.

Himachal Pradesh

The PIM Act has not been enacted in the state. The state officials are aware of usefulness and importance of the Act and the same is under consideration. The Irrigation and Public Health Department is of the opinion that PIM Act is the need of the time as a sound legal framework is required for WUAs to function effectively.

- In Himachal Pradesh, though 1173 WUAs has been formed and registered but they are largely non-functional. The farmer members works as individual beneficiaries rather than group.
- WUAs have been registered under Himachal Pradesh Co-operative Society Act 1968.
- The water distribution system has not been handed over to any of the WUAs.
- Though Himachal Pradesh has a traditional system of Water Management known as *Kulhs* which ensures high level of community participation but the system is not imbibed in farmers any more.
- WUA members have not made their contribution in any form as a group. However, farmers do take up minor repairing works themselves in their respective fields.

Uttarakhand

The PIM Act has not been enacted in the state. However, the Draft PIM was submitted for approval and now the Hindi version has been asked to be submitted.

The Government of Uttarakhand has taken decision for devolution of rights and duties with respect to the irrigation projects/assets, though in a phased manner, to the Users Associations for their further management. A time bound transfer of the completed projects to the user groups is being followed up.

- WUAs do not exist neither is there any other society registered under any Act. The beneficiaries/group of farmers come together to get irrigation water from an outlet.
- The officials of the State Department of Irrigation decide the frequency and distribution of water to be supplied to farmers. The Department of Irrigation itself collects the revenue from the farmers on the basis of crops sown and the area covered by them.

West Bengal

Though PIM Act for CADWM has not been enacted in the state but it is guided by the Operation and Management Rules for Minor Irrigation Schemes 2011 as the outlet command area of the CAD projects in the State varies ordinarily between 40 hectares (1cusec) to 400 hectares (10 cusec).

- There are 10,000 Beneficiary Committees in the state. The procedure for framing the Beneficiary Committee was introduced in DV CADA during 1988-1989. The ultimate responsibility of the Beneficiary Committee is to look after the equitable distribution of water and to prevent misuse of water along with maintenance/operation of the Field Channel scheme.
- Formation of WUAs under the Cooperative Society Act is a recent process in the State.
- The contribution of the farmers is in the form labour to perform OFD and other work such as land levelling etc.
- The State has taken steps to motivate the farmers for effective implementation of PIM activities through series of farmers' training programmes held in different areas of the command from time to time.

Jharkhand

The PIM Act has not been enacted in the state. The state officials are aware of the usefulness and importance of the Act and efforts are being made to propose a draft PIM Act soon.

- Survey and planning work is being carried out expeditiously and WUAs are in the process of being formed and getting registered under Societies Registration Act, 1960.
- 19 WUAs have been formed out of which 5 have been registered under the Societies Registration Act, 1960.
- Since the WUAs are in the stage of formation and registration, none of them have been handed over the system.
- The farmers have not really contributed to the WUAs in the form of either labour or crop produce or construction material as it is still in the initial stages and are in the

process of strengthening. Hence, there is no expenditure pattern relating to operation and maintenance.

- The water charges are collected by the WRD. Normally, the water charges are revised every 10 years.
- The one-time functional grant has not yet been provided to the WUAs, though; the farmers have started collecting their share of ₹ 100 as contribution for OFD works.

Nagaland

The PIM Act has not been enacted in the state. The state officials are aware of usefulness and importance of the Act but the same could not be proposed due to pending enactment of State Water Policy The process for enacting PIM Act in the state can only take place once the State Water Policy is enacted. The WUAs already formed will be brought under the purview of the PIM Act after its enactment.

- Though 24 WUAs have been registered to cover the entire Command Area in the state but they still function more as individual beneficiaries of the programme rather than collective group.
- All the WUAs covered under the study were registered in 2005 under the Nagaland State Co-operative Societies Act 1960.
- The farmers have not contributed towards the cost of the project in any form. None of the WUA is collecting any monthly charge due to non capability of the farmers to make payments.
- The water distribution system has been handed over to all the 6 WUAs. The project had planned to hand over the water distribution system to WUAs after 3 years of their formation. The process, therefore, started in 2006. WUAs are able to maintain and operate the water distribution system.
- All the WUAs visited in the command area have their bank accounts with the balance amount ranging from ₹ 1200 in to ₹ 118,000.

Manipur

The PIM Act has not been enacted in the state of Manipur. The introduction of PIM System involving WUAs in the State for effective water management & collection of water charges is currently under the drafting stage and pending in the State Law Department and is likely to be moved as a Bill in the forth coming Assembly Session. The Government of Manipur with its publication in Manipur Gazette published on 07.01.2008, has issued an understanding that WUAs would be brought under the purview of PIM Act of Manipur state after its enactment.

- 69 WUAs have been formed and registered in the command of the state. These Associations were registered under Manipur State Act. There is a prospective Action plan in place to promote and sustain Farmers' participation and reorganize WUA/Cooperative societies to function better.
- The irrigation water charges fixed in 1977 have been revised in August 2003. The Manipur Irrigation Act & Canal Rules does not contain any penal clause to take action against defaulters; therefore, the State is facing difficulties in collection of taxes.

Mizoram

The PIM Act has not been enacted in the state. The Act is significant for the state but the same could not be finalised. It is expected to be enacted soon in the State.

- 390 WUAs have been formed in the state which are yet to be registered. None of the WUAs covered under the study have been registered. It is recently that the Department has decided that all new WUAs have to be registered for accessing the benefits.
- The water distribution system has been handed over to the WUAs only at the formal level limited to distribution of water in the field. All other work pertaining to maintenance and repair is being taken care of by the Department of Minor Irrigation.

Arunachal Pradesh

The PIM Act has not been enacted in the state. The State Government is making efforts to convince the people to move from Shifting (Jhum) cultivation to settled cultivation. Currently, the Arunachal Pradesh Water Resources Management Authority Bill (2006) provides for the establishment of the Arunachal Pradesh Water Resources Management Authority to regulate water resources within the state, facilitate and ensure judicious, equitable and sustainable management, allocation and utilisation of water resources, fix the rates for use of water for agriculture, industrial, drinking and other purposes and other related matters

- 43 WUAs have been formed and registered in the state
- The state has decided that the water charges will not be applicable for WUAs because government is making efforts to convince the people to move from Shifting (Jhum) cultivation to settled cultivation by providing various incentives. Recovery of water charges would discourage the farmers from settled cultivation and they may go back to their traditional shifting cultivation. Thus, all the farmers in all the societies are getting irrigation water free of cost.

- The only source of finance of WUAs is one time grant provided to them by government. The WUAs deposited the amount in bank and utilized its interest on small repair and maintenance. The balance amount in the bank ranges from ₹ 1500 to ₹ 3500.

Tripura

The State does not have any PIM Act. The Government of Tripura has published guidelines for handing over irrigation schemes to Panchayats for operation, maintenance and collection of water charges for irrigation schemes in the Cluster of 4 MI Projects studied intensively.

No WUAs have been formed in the state. The Panchayat Committee consists of the User Committee members and in consultation with these representatives, the Panchayats ensures the distribution of water. The Department of Agriculture & Department of Horticulture takes care of training and demonstration programme for the farmers in the project area. The extension workers from both the Department visits the farmers field from time to time and give expert opinion for the crops. The operation and maintenance works of existing system are normally done by the Department.

Meghalaya

PIM Act does not exist in the State. However, a Cabinet Memorandum has been approved by the Cabinet during November 2008 on implementation of PIM in the State by which maintenance, operation and distribution of irrigation water in completed irrigation projects can be handed over to the duly registered WUA.

The state officials are aware of usefulness and importance of the PIM Act but the same could not be finalised because the preparation of Water Policy and Water Act in the State is under progress. The Draft Water Act which is pending for approval has laid emphasis on PIM. The process for enacting PIM Act in the state will take place once the Water Act and State Water Policy is approved by the legislature.

- 159 WUAs have been formed in the state. WUAs are registered under Meghalaya Co-operative Society Act 1950.
- Though the WUAs have been registered but they have not been formally handed over the O&M of water distribution system. The system of community participation is imbibed in the tradition of the tribes of the state; therefore, they work as a group rather than an individual. They have a traditional system of land management and customary laws of addressing the grievances.
- Taking the economic status of farmers into consideration, the State Government has waived off the 10% contribution of the farmers in the OFD works.

- The state has decided that the water charges will not be applicable for WUAs because government is making efforts to convince the people to move from Shifting (Jhum) cultivation to settled cultivation by providing various incentives. Recovery of water charges would discourage the farmers from settled cultivation and they may go back to their traditional shifting cultivation.
- As the WUAs are not incurring any expenses on Operations and Maintenance (O&M), therefore, they are not maintaining any accounts or cash book which requires auditing.

7.5 Sustainability of Water Users Associations

To assess the impacts of PIM Act at the ground level in relation to the defined objectives, 6 WUAs in each of the intensive study projects were studied in detail which has been described in the following section.

Detailed analysis about the WUAs has been given in the Annexure Volume 3.

WUAs, earlier known as Farmers Organisations (FOs) with limited objectives were started in 1970s under the CAD programme. Owing to its top-down approach, a few FOs established could not function for long and gradually disappeared with change in field staff as staff was diverted to other activities. In the 1980s and 1990s, several NGOs and Water and Land Management Training Institutes had initiated pilot WUAs. They had successfully demonstrated in several states of India like Maharashtra (Ozar), Gujarat (Mohini), Andhra Pradesh (SRSP), Tamil Nadu (LBP), Bihar (Paliganj), Rajasthan (Chambal). The real push came in 1997, when the Andhra Pradesh government had passed a separate law (APFMIS Act, 1997) to promote WUAs. The leadership provided the elected leaders and enormous efforts by the staff at all levels of WRD, created a new wave of PIM in India. It made several other states to consider PIM as serious option for improved irrigation management.

The sustainability of Water Users Associations (WUAs) depends upon various factors including equity in water distribution to its members, effective operation and maintenance system, transparency in participatory management system, active participation of WUA members, adequate capacities of WUA office bearers and its members, ensured mechanisms for generating financial resources like water charges, collective approach to access to agricultural inputs and marketing of crops etc. The analysis of these aspects below is on the basis of a sample study of WUAs randomly selected at head, middle and tail end.

Identification of Water Users Associations

On an average 6 WUAs were identified and intensively studied in each state. These WUAs were mostly a representative sample of Head, Middle and Tail. The number of villages covered by WUAs varied from 3 in Goa to 22 in Chhattisgarh. Many were formed by clubbing the outlets at different minors and distributaries. The outlets, in many states, have been provided for the command area varying in the average range of 5-8 hectare each from minors/water courses. In Chhattisgarh, each Water Users Association has been divided into a minimum of 4 and maximum of 12 territorial constituencies on the hydraulic basis. In states like Karnataka, there is difficulty observed in getting water at the tail end as more water is used at head. In Uttarakhand and Tripura, there are no WUAs neither is there any society registered under any Act.

Legal Status of Water Users Associations

Registered/legal status of WUAs across the nation shows a mixed picture. All the studied WUAs were found registered in the states of Punjab, Kerala, Gujarat, Goa, Manipur, Nagaland, Chhattisgarh, West Bengal, Odisha, Rajasthan, Meghalaya and Jharkhand while in states like Bihar, J&K, Tamil Nadu, Arunachal Pradesh, Assam, Himachal Pradesh etc.; the WUAs are partly registered. States like Mizoram do not have any WUAs registered. Most of the registration has been under Societies Registration Act 1860 or under the respective State Cooperative Act 1960. In Chhattisgarh, WUAs were registered under the *Sinchai Prabandhan mei Krishakon ki Bhagidari-1999* (Participatory Irrigation Management Act-1999). In Odisha, initially Pani Panchayat was formed and registered under the Societies Registration Act, 1860. In J& K, the process of registration of WUAs will take place once the draft PIM act is passed in legislature.

Area Covered under Irrigation

The average area covered under irrigation in the areas where WUAs were surveyed are in the range of 90-100% in the states of Punjab, Haryana, Andhra Pradesh, Tamil Nadu , Gujarat, Goa, Mizoram and Chhattisgarh. The percentage area irrigated is very low in the range of 1.5% to 3.5% in J&K. Nagaland showed a decrease in the area under irrigation as one moved from Head to Tail. In states like Arunachal Pradesh, Goa, Gujarat; some of the small and marginal farmers in the command area do not cultivate as it is not economical for them. They have diversified to secondary or tertiary sector which they find is more lucrative compared to agriculture. In states like Karnataka and Madhya Pradesh, WUA members decide the timing of water distribution in the area on rotation basis.

Farmers' Category in Water Users Association

The total number of farmers associated with WUAs in the states studied vary in the range of 96 (Manipur) to 14,798 (Punjab). In states like Manipur, Odisha, Meghalaya; all farmers mentioned are members of WUAs while in Chhattisgarh, eligible farmers may or may not be the member of WUAs. The percentage of marginal farmers to the total farmers is highest in West Bengal (88%) and lowest in Haryana (18%). Small farmers vary in the range of 11% - 54% in the states. Against the total number of farmers associated with WUAs, Andhra Pradesh has the maximum percentage (24%) of large farmers. The average land holding varies in the WUAs from 0.5 – 2 Ha.

Farmers' Contribution to Water Users Association

In most of the states like Haryana, Punjab, Bihar, Odisha, Chhattisgarh, J&K, Gujarat, Kerala, Tamil Nadu, Madhya Pradesh, Maharashtra, Rajasthan, Manipur, Nagaland, Mizoram, Meghalaya, etc., monetary contributions to the project have not come from the farmers. Here, the contribution has been in terms of labour. From other states, there are reports of farmer's contribution in terms of crop produce (Bihar, Karnataka, Kerala, Manipur); OFD works (West Bengal); construction materials (Andhra Pradesh, Gujarat, J&K, Arunachal Pradesh). In Goa, initially, WUA members deposited an amount of ₹5/- per member as the membership fee. Goa members were also expected to deposit ₹50/- per month to WUAs. The process continued for 5-6 months in different societies which is no more in practice now. In Odisha, it was encouraging to note farmers making voluntary contribution of land donation for construction.

Members in Executive Committee of Water Users Associations

Majority of the states have an Executive Committee representing head, middle and tail end of the micro canal system. These include Andhra Pradesh, Tamil Nadu, Kerala, Rajasthan, West Bengal, Chhattisgarh, Goa Gujarat, Nagaland, Manipur, Mizoram, Meghalaya etc. The average range of Executive committee members in the states is 5 to 10.

18% of the executive committee members in Tamil Nadu are women. Women representation in Executive committee, however, is insignificant in many states like Bihar, Goa, Chhattisgarh, Kerala, West Bengal, Andhra Pradesh, Rajasthan, Gujarat, Odisha, Nagaland, Manipur, and Punjab. Their representation can however be seen in WUAs in Karnataka, Chhattisgarh, Madhya Pradesh, West Bengal, Nagaland, Manipur, Rajasthan, Gujarat. In Mizoram 10-20% of the WUA members are women.

In most of the states, the position and election of chairman is rotational. In Chhattisgarh, election of Chairman of the committee is done through a lottery system. In West Bengal, Andhra Pradesh, Rajasthan, Gujarat, Kerala and Goa, however, the position of the Chairman has

not been rotated from head, middle and tail of the canal system since the inception of some WUAs. In Jharkhand, as the WUAs are at infant stage, the rotation has not happened. In J& K, since all the WUAs are on ad-hoc basis and are dissolved after the construction work is complete, the executive committee has not been formed in any of the WUAs.

Meeting of Managing Committee of Water Users Associations

Management Committees in majority of the states, like Chhattisgarh, Goa, Kerala, Tamil Nadu, meet at an average frequency of 2-3 times in a year with their regular attendance varying from 10% to 100%. Some WUAs meet monthly. In Gujarat, the committees meet monthly. In West Bengal, Rajasthan, the management committee meets once in a year while in Bihar, Jharkhand, Nagaland, it meets once in more than one year. In J& K, the Management Committees have not been formed in any of the WUAs. However, the WUAs meet two to three times in a year during the time of construction of channels. Many of these states have General body meetings that are held once in a year. In Andhra Pradesh, the GBM meets twice a year. Majority of the states have presence of small and marginal farmers in the WUAs.

In many states like Goa, Kerala, Tamil Nadu, Andhra Pradesh, Jharkhand, Meghalaya and Manipur, no government employees are involved in the Management Committee across the WUAs visited. However, in Chhattisgarh, Manipur and Gujarat, the government employees were found involved in the Management Committee of some WUAs. The concept of Contract Managing Committee (the provision of having a section of committee members to deal with contract management) was found in Nagaland, Chhattisgarh, Andhra Pradesh, Manipur, Meghalaya ; it has partly started in Bihar, and due to be started in states like, Goa, Kerala, Tamil Nadu, Gujarat, Assam. It is believed that such initiative will not only strengthen continued relationship of WUAs with the CADA but also will facilitate income generation activities to help them sustain financially.

Functioning of Managing Committee of Water Users Associations

Functioning of Management Committee of WUAs and its effectiveness can be seen largely dependent on the stage in which the WUAs are in various states. In states like Goa, West Bengal, J&K, these are in infant or dormant stage, where the CADW programme is yet to take off in the PIM spirit, WUAs do not seem capable of taking over the complete charge including those of the water distribution system.

Farmer's attitude towards WUAs seems to be changing for better in Kerala. In Chhattisgarh, Andhra Pradesh, Manipur, Nagaland, Odisha, the WUAs are found effective in managing systems which are handed over to them. In Tamil Nadu, WUAs have build up their own offices and have shown responsible behaviour by promptly taking up minor repair activities and OFD

Works with PWD and Agriculture Engineering Department. However, in Rajasthan, though the WUAs are quite old, they are yet to become effective.

Data collected from the field indicates that the effectiveness of WUAs needs to be sincerely enhanced in the years ahead. One demonstrated way to enhance the effectiveness is, like in Rajasthan, to hire/depute non-professional employees on contractual basis to the WUAs to whom the system has been handed over. Several states, like Chhattisgarh, have taken up initiatives to enhance the motivational levels of the WUAs.

Expenditure Pattern on Operation and Maintenance

Expenditure patterns on operation and maintenance vary in states. WUAs visited in states like Chhattisgarh, Maharashtra, Tamil Nadu, show expenditure on maintenance, including repairs, replacement of infrastructure. Rajasthan shows expenses on maintenance costs including repairs, replacement of infrastructure, replacement of machinery and equipment, taxes and water rights which is not the case in Chhattisgarh. The WUAs in Gujarat and Karnataka have incurred expense on Maintenance costs including Repairs.

In Andhra Pradesh, Kerala, Goa, West Bengal, Arunachal Pradesh, Odisha, Punjab, Himachal Pradesh, Meghalaya, Manipur and Mizoram, the WUAs have not incurred any expense on operating costs for water delivery, maintenance costs including repairs, replacement of infrastructure, replacement of machinery and equipment, taxes and water rights. For WUAs in Goa and Kerala, however, all the societies have got their accounts audited.

In Bihar, only one WUA visited in the project area has incurred expense on operating costs for water delivery and maintenance costs, including repairs.

Number of Rotations in which Water is supplied

In Chhattisgarh, the farmers associated with WUAs apply irrigation water once in the kharif season. In Nagaland, West Bengal, Rajasthan, Uttarakhand; WUAs/farmers apply irrigation water varying on an average for 1-2 days for different crops in rabi season whereas the same is 2-3 days in kharif season. As most of the farmers in Nagaland produce paddy which needs submergence, it results in frequent rotation of water. In Manipur, water is supplied in rotation only once during the kharif season In Goa, West Bengal, Rajasthan, Mizoram; farmers having their orchards irrigate their fields on daily basis.

Warabandi is seen in states like, Jammu & Kashmir and Punjab. The amount of water to be distributed to the farmers is decided in advance. All the farmers have to be the members of WUA to avail the water for irrigation. There is no provision for special charge for private well usage in the command area.

In Goa, Nagaland, Chhattisgarh, Odisha, West Bengal, J&K, Mizoram; the farmers at times over-irrigate their fields because of regular water availability, no water charges applicable and high percolation rate, in some states. If Warabandi mechanism is developed in such states, the farmers will be bound to use the water share available to them. Water charges are collected mostly by the Water Resources Department of the concerned states.

Water Distribution System

Water distribution system is largely dependent on the operational condition of the canal system and the location of the area in terms of head, middle and tail.

In Chhattisgarh, the canal system is fully operational, therefore, most areas get adequate water. In Gujarat, micro level canal systems with appropriate structures are being designed and constructed to ensure timely and equitable distribution of water. This guards against the most commonly observed problem of over-use of water by initial command blocks, leaving less supplies to the tail enders. In Meghalaya, farmers get assured and timely irrigation from the canal system. This has encouraged them to shift from Jhum cultivation to settled farming. They have also started growing vegetables along with paddy.

In states like Goa, Kerala, Gujarat, Haryana, J & K; where the canal is not fully operational, there is no reliability or adequacy in water distribution. Water availability is unreliable and there are delivery problems in terms of broken canals and other reasons. All the farmers require water at the same time, thus, the tail end users are deprived of water. If the water is released at the tail end first followed by middle and head reach as practiced in Odisha, the distribution of water will be more equitable.

In states like, Odisha, Chhattisgarh, Andhra Pradesh; WUAs are involved in water distribution system. Unlike in Bihar, it is not mandatory for the farmers in Chhattisgarh to be member of the WUA to avail water. In states like Goa, Chhattisgarh, Kerala, Rajasthan, Haryana; water availability has improved during last 1 year and in many of the WUAs, farmers are confidently cultivating their fields.

Water Charges on Irrigation

There are states where the governments have levied water charges for irrigation on WUAs (Bihar, Gujarat) while there are states like West Bengal, Manipur, Punjab; where this is not a part of the system, neither is there a mechanism in place to collect the charges. In Bihar, water charges are applicable for the WUAs and these are collected and paid to the Irrigation Department.

In states like Arunachal Pradesh and Chhattisgarh, the state has taken conscious decision of not levying water charges in the tribal area. Therefore, all the farmers in such WUAs are getting irrigation water free of cost. It was also realized that farmers are reluctant to pay the charges. Therefore, in Chhattisgarh, another decision taken now is 25% of the water tax that would be collected by the Water Users Association at a later stage will be given back to them (WUA) for the maintenance of the irrigation system. Thus, the WUAs have been rendered self-dependent by granting them the financial right of revenue recovery.

In Rajasthan, water charges are being collected regularly from the WUAs. In Andhra Pradesh, the charges are selectively levied on WUAs and collected by the Revenue Department.

Water Charges Applicable

There are states where water charges are applicable to WUAs and there are states where it is not. In states like Odisha, Chhattisgarh, Bihar, Rajasthan, Maharashtra, Andhra Pradesh, Kerala and Karnataka; water charges are applicable and decided on the basis of crop and area in the WUAs. The charges are decided by Department of Water Resources. The charges are revised every year in Bihar while in Odisha, it was last revised in 1999. The frequency of revision of charges is once in 3-5 years in Chhattisgarh.

In Gujarat, water charges are determined by SSNNL and based on the volumetric supply of water instead of conventional area approach. In Rajasthan, water charges are being collected from all the WUAs. This year it amounted to more than ₹ 2.5 lakhs which is used by WUAs and government in 50:50 ratio. The water rates have not been revised since the last 40 years. In Himachal Pradesh, water charges are decided by the I&PHD, GoHP. The water charges which is called as *Abhiyana charge* is levied on the basis of per crop per acre. The water charges are applicable to all the farmers using water from tube wells. The responsibility of collection of water charges lies with Lamberdaar. Due to efficiencies in collection of water charges, I&PHD has decided to collect water charges themselves from the next financial year.

In Kerala, Goa, Haryana, Arunachal Pradesh, Punjab and Mizoram; the water charges have not been decided as yet as the mechanism is not in place and the project is likely to take decision on irrigation charges in the time ahead. In Meghalaya, the state has decided that the water charges will not be applicable for WUAs because government is making efforts to convince the people to move from Shifting (Jhum) cultivation to settled cultivation by providing various incentives. Recovery of water charges would discourage the farmers from settled cultivation and they may go back to their traditional shifting cultivation.

Type of Documents Maintained

The type of documents maintained by WUAs varies from state to state. Northern and Southern zone states are stronger in documentation than the Western and North Eastern zones. Most of the states like Andhra Pradesh, Tamil Nadu, Kerala, Rajasthan, Odisha, Bihar, Chhattisgarh, Goa and Gujarat etc. have register of members, map of micro canal system, and minutes of meeting book. Many amongst these also maintain cash book, audit reports and bank documents and some like Andhra Pradesh, Odisha and Chhattisgarh; have copy of resolution and election of directors. Assam only has the register of members while Manipur and Meghalaya have the register of members and copy of the resolution In Meghalaya, stage has not reached yet for WUAs to maintain the other records like map of micro canal system, minutes of meeting book. Since the WUAs are not incurring any expenses on O&M therefore there is no requirement to maintains the assets and liabilities book, sales and purchase book, water accounts, cash book, audit reports and bank documents etc.

Sales and purchase book and water accounts are not maintained in any states. Mizoram, Punjab, Jharkhand and West Bengal are yet to start keeping and maintaining documents. It may require adequate trainings for these states to see that they start maintaining necessary documents.

Accounts Audit

In states like Tamil Nadu and Chhattisgarh; the accounts have formally been audited in the visited WUAs and the reports are published and maintained with them. In Gujarat, Goa, Rajasthan, Andhra Pradesh, Karnataka etc.; the WUA accounts though are audited but are yet to be published. There are some states like Kerala, Odisha, Jharkhand, Nagaland, Manipur, Mizoram, Arunachal Pradesh, Meghalaya, Punjab and J&K, where the accounts have not been audited so far.

WUAs Involved in Providing Services other than Irrigation Water Delivery

In Andhra Pradesh and Chhattisgarh; the WUAs are playing an important role in managing different services such as distribution of water, maintenance of micro canal system, construction of facilities, collection of water charges and crop diversification. However, they do not provide other services like initiating farm co-operatives, providing technical advice to the farmers, initiating side business, establishing linkages with input supply and marketing agencies etc. In Bihar, no WUA at the moment is providing services other than irrigation water delivery. In Nagaland, the WUAs are involved in canal maintenance and water distribution.

In many states like J & K, Arunachal Pradesh, Mizoram, Rajasthan Gujarat, Himachal Pradesh and Kerala; the WUAs are yet to reach the level where they play a crucial role in managing

different services. At present, they are involved in distribution of water, maintenance of micro canal system, construction of facilities, and collection of water charges. They are not in a position to provide other services such as initiating farm co-operatives, providing technical advice to the farmers, initiating side business, establishing linkages with input supply and marketing agencies etc. However, the availability of irrigation water has encouraged the farmers to diversify into high value crops.

Grievance Redressal Mechanism

In states of Andhra Pradesh, Manipur, Chhattisgarh; the WUAs have functional grievance redressal institutions. Most of the time, individual conflicts are sorted out amicably amongst themselves. There have been warnings given to WUAs in cases of conflicts in Manipur. The WUAs are yet to reach a stage where they can suspend, punish or fine their members. In Andhra Pradesh, Odisha and Nagaland, however, there have been some instances when WUAs have taken action of suspension and monetary fine.

In Bihar and Gujarat; WUAs are yet to start functioning as grievance redressal institutions. If there are individual conflicts, they are sorted out amicably amongst themselves. The WUAs are yet to reach a stage where they can warn, suspend, punish or fine their members. One WUA in Bihar, however, has shown signs of it.

In states like Haryana, Jammu and Kashmir, Goa, Kerala, Tamil Nadu, Himachal Pradesh; where WUAs are not fully involved in operation and maintenance of the micro level water distribution system, they have not yet started acting as institutions. Therefore, they have not received any complain about water services. All the complaints are made to Patwari or Lumberdar in J&K. In Goa, if there are individual conflicts, they are sorted out amicably amongst themselves.

In Arunachal Pradesh and Meghalaya, there is a traditional system of land management followed by hilly tribes of the State and customary laws of addressing the grievances and general problems within the farming community.

Environmental Problems in the Command Area

The environmental effects of the project vary from state to state and amongst WUAs. Such effects were assessed in terms of high use of fertiliser, high use of pesticide, unsafe disposal of agro-chemicals, soil erosion, poor quality of groundwater, soil salinity, soil alkalinity etc.

In majority of the states like Jharkhand, Goa, Chhattisgarh, Nagaland, Odisha, Tamil Nadu, Gujarat, Haryana, J&K, and Arunachal Pradesh; such side effects of the project are yet to be experienced. However, the pattern of mono-culture cropping system has started marginalizing bio-diversity of the area. Poor quality of ground water in Chhattisgarh and problems of water

logging are seen in Haryana, Goa, Manipur, Bihar and Odisha due to seepage of canal water and subsequently leading to inadequate drainage system to dispose of this water. WUAs do not monitor the salinity and water table in their respective command area in Manipur.

In Bihar, while the use of fertiliser and pesticides and soil erosion are moderate, quality of ground water, soil salinity and alkalinity is serious in 2-3 WUAs. Water logging is also serious problem in some WUAs. In West Bengal, no significant environmental concern regarding environmental hazards have been reported by the farmers. In Haryana, moderate salinity is a problem faced by the farmers.

In Tamil Nadu, some measures have been initiated towards mitigation. Experts from Tamil Nadu Agriculture University and local KVKs regularly visit the project area and address the farmers on issues such as use of Integrated Nutrient Management and Integrated Pest Management which has helped the farmers in deciding the dose of chemicals in the field and low to moderate use of chemicals has been reported. Secondly, farmers have adopted leguminous crop in the cropping cycle which has also helped in maintaining the fertility of soil.

Salinity Problem in the Command Area

The issues related to soil salinity in the command area are not very significant in states like Gujarat, West Bengal, Chhattisgarh, Goa, Nagaland, Odisha, Kerala, Tamil Nadu, J&K, Arunachal Pradesh, Meghalaya, Himachal Pradesh. One reason for this is that the region has a natural drainage system that is quite efficient due to undulated topography and high soil porosity rate. In Haryana and Punjab, there are reports of salinity in some WUAs, which however, is not very serious.

In Rajasthan and Andhra Pradesh, side effects of the project are yet to be experienced in case of high use of fertiliser, high use of pesticide, unsafe disposal of agro-chemicals, soil erosion, poor quality of groundwater, soil salinity, and soil alkalinity. Salinity and Water Table in the WUAs is monitored regularly in Andhra Pradesh and Assam.

Irrigation Water Supply used for Drinking Purpose

While in all states the project is focusing on irrigation water supply to the farmers in the command area, in some states like Bihar, Goa, Nagaland, Odisha, Tamil Nadu, Gujarat, West Bengal, Rajasthan, Haryana, J & K, Mizoram, Arunachal Pradesh; water is also supplied for drinking purpose at different WUA locations. In Manipur and Punjab, irrigation water supplied is often used for drinking purpose in WUAs. In Kerala and Andhra Pradesh, water is not used for drinking purpose.

No cases have been reported on incidence of any water borne diseases in the command area of Chhattisgarh, Nagaland, Odisha, Gujarat, Rajasthan, Meghalaya and Arunachal Pradesh. In Tamil Nadu, however, instances of water borne diseases have been reported as the water here is more polluted due to hospital waste and drainage.

Aquaculture is not in practice in the command area of Chhattisgarh, Goa, Odisha, however, the WUA leaders shared a possibility of fish farming in their area. Aquaculture is practiced in all WUAs command areas in Manipur.

Presence of Drains in the command area

In most of the states like Kerala, Nagaland, Odisha, Tamil Nadu, Bihar, Haryana, Mizoram, Arunachal Pradesh, Punjab, Uttarakhand, Assam; drains have been constructed in the command areas of the WUAs (selective in some case) covered under the sample study. In Odisha, these are largely surface drains constructed instead of buries drains. In Punjab, almost all the area is served by the surface drains.

In Andhra Pradesh, Manipur and Chhattisgarh, no drains have been constructed in the command areas of the WUAs covered under the sample study and 100% area under irrigation has been covered under natural drainage. In Bihar, some areas are also covered under natural drainage. In J& K, due to the undulating topography, a large portion of the command area is under natural drainage.

No drains have been constructed in the command areas of the WUAs in Jharkhand, Goa and Gujarat.

Government Support to Water Users Association

In many states like Goa, Nagaland, Odisha, Kerala, Tamil Nadu, Gujarat, Rajasthan, Andhra Pradesh; government support has been provided to WUAs in the form of providing training and exposure visits, stationary and books of accounts.

In Goa, Kerala and Rajasthan, non-professional supervisors have been employed on contractual basis in the WUAs which have been handed over the water distribution system. In Chhattisgarh, government support has been provided to WUAs in the form of providing training and exposure visits, and technical assistance. In Bihar, government has also provided subsidized and free seeds and equipments for maintenance. In Manipur, few WUAs have also received support during disasters.

In Odisha, government has issued instructions to provide assistance for construction of office building for Pani Panchayats out of M.P. and M.L.A. (Local Area Development) LAD fund, once the WUAs fulfil the set criteria.

In Gujarat, basic infrastructure such as building, furniture, equipments for maintenance have not been provided to any of the WUAs. In West Bengal, no support to WUAs has been provided in terms of exposure visits, stationary and books of accounts. In Jharkhand, government support has been marginal and mostly related to technical assistance, equipments for maintenance and seed support. In J& K, as WUAs are not formed and they work more like SHGs, Government support has not been provided to WUAs in the any form. Only technical assistance has been provided in terms of cropping pattern. In Meghalaya, government support has not been provided to WUAs in any form.

Relationship between WUAs and Government Department

In majority of the states including Odisha, Kerala, Chhattisgarh, Goa, Nagaland, Tamil Nadu, Gujarat, West Bengal, Andhra Pradesh, Haryana, Manipur, Meghalaya and Assam; the WUAs have fairly good working relationship with the department officials. There are no signs of conflicts with regard to non-timely supply of water, inadequate supply of water, non-disbursement of sanctioned grants, non-provision of infrastructure, maintenance of system by WRD. They are satisfied with the assistance provided by them on various aspects.

In Bihar, there have been cases of disputes noticed between some WUAs and government officials. These are mostly with regard to non-timely supply of water, inadequate supply of water, maintenance of system by WRD. Such disputes are resolved informally and as per the provisions and rules of State Act. WUAs, in Jharkhand, have expressed the feeling that the local authorities do not resolve the problem of timely water supply immediately and effectively. This can be attributed to the fact that the system is yet to become fully operational. In J&K, WUAs are not satisfied with the department officials. The major reasons of dissatisfaction of farmers are non-equitable distribution of water. According to the farmers, the officials do not take immediate decisions against the disputes. The WUAs themselves do not have enabling laws to resolve the disputes or enforce penalty.

There are chances that WUAs might get into conflict on certain aspects once they start working as institutions and advocate for their rights and entitlements.

Financial Sources of Water Users Associations

In many of the states like Tamil Nadu, Haryana, Rajasthan, Chhattisgarh, Nagaland, Manipur, Goa and Gujarat, the WUAs have bank accounts. These are either in the State Cooperative banks or nationalized banks. The lowest amount in the WUA was seen in Chhattisgarh (₹1000)

while the highest amount is as much as ₹2.5 lakhs in Rajasthan. Some states like Odisha, Nagaland and Goa, are among those which are having membership fees as a source of income. Interest accrued from bank account is one additional source of income for these WUAs. Gujarat, Manipur and Andhra Pradesh, levy irrigation charges as one income stream.

While one time grant to WUAs have been provided in Arunachal Pradesh; states like Manipur, West Bengal, Jharkhand, Bihar have not received it. Grant-in-Aid is being given to the Pani Panchayat in Odisha as and when 75% of membership is achieved in WUAs.

Awareness and Benefits of Non-WUA Members

In several states, the non-WUA members were found informed about the existence, purpose and functions of the WUAs. They also knew about the project associated with the WUAs and that these associations work for better water distribution and irrigation. They acknowledged the benefits accrued in terms of water made available for irrigation. One important reason for not joining WUA is that some other members of their families are in the WUAs. As there is an enhanced access to free (without charge) water for irrigation, the non-WUA members are not too keen to become a WUA member. Non-WUA members have mixed thoughts on sustainability of the WUAs. Some are not sure while others are quite optimistic.

Handing Over of Water Distribution System to WUAs

In many states like Tamil Nadu, Chhattisgarh, Andhra Pradesh, Nagaland, Odisha, Rajasthan, Haryana, Gujarat, Arunachal Pradesh; the water distribution system has been handed over to all the surveyed WUAs. Andhra Pradesh was one of the first to transfer this in 1997. The handing over water distribution system has been done to selected WUAs in states including Goa, Kerala, West Bengal, Haryana and Punjab. In Chhattisgarh, Goa, Tamil Nadu, Odisha Rajasthan, Gujarat; the WUAs have got office records like cash book, registers, command area maps and other documents. Agriculture Extension Officer/Rural Agriculture Extension Officer has been appointed as Agriculture-advisor of the concerned WUA. In Odisha, the Pani Panchayats take keen interest in maintaining the quality of work.

In Himachal Pradesh, water distribution system has not been handed over to any of the WUAs. The project had planned to hand over the water distribution system to WUAs after their formation but the same has to take place yet.

In J&K, water distribution system has not been handed over to any of the WUAs. It is the Patwari or Nambardar that manages the water distribution system.

It is, however, found that in some states like Gujarat, Chhattisgarh, Goa, Nagaland, Rajasthan, Haryana, the WUAs do not have enough interest in taking full charge. Neither do they have a

clear vision with regard to operation and maintenance of the water distribution system in future. Also, the capacities are not adequate to help them function effectively and efficiently.

7.6 Capacities of Water User Associations

Creating sustainable and self-reliant WUA is one of the major goals to be achieved in CADWM programme. The WUAs will sustain only when they;

- have clear institutional vision and mission
- have clear understanding on their roles and responsibilities
- have adequate capacities to perform their roles effectively
- have transparent and participatory systems & procedures
- follow the concept equity and or equality
- have linkages with outside agencies including the government, non-government and private
- have access to negotiate with officials and other agencies
- develop regular source of income
- have capacity to deal with internal conflicts
- have visionary and dynamic leadership

WUAs require capacities to perform effectively and to achieve the above mentioned targets. The scenario in this respect in various states is as follows:

- The level of WUAs is yet to reach the required level in most of the projects across south zone. The WUA leaders and farmers were covered under capacity building programmes in Karnataka. Around 350 WUA members in Tamil Nadu were taken on an exposure visit to Agricultural Engineering Training Centre, Trichy and Tamil Nadu Agriculture University, Coimbatore. Though the WUAs have been registered, they have yet to start functioning as an institution. The farmer members are functioning as individual beneficiaries of the programme. They have not yet to initiate collective functioning.

- CADA has not initiated the formation of WUAs in J&K. Ad-hoc WUAs are formed at the time of construction of field channel. Many a times, these WUAs are dissolved after the completion of work. These ad hoc WUAs were covered under capacity building programmes with an exposure visit to other completed projects of the State. The trainings are organised by Subject Matter Specialists (Agronomy) on water saving techniques and various cropping schemes.

- The training programmes have been conducted for WUAs in Punjab, Haryana, Himachal Pradesh, Madhya Pradesh and Rajasthan on basic principles of command area

development. However, most of them have inadequate capacities to function effectively to achieve their goal.

- In West Bengal, the main focus is training of WUAs in crop production and water management. The WUAs have been oriented on concept of Pani Panchayats along with other components of water management in Odisha by WALMI.

- Around 3300 WUA leaders and farmers were covered under capacity building programmes in Nagaland. Many of the groups are still immature for handling the management responsibilities and became self-reliance and sustainable. WUA leaders in Arunachal Pradesh were covered under capacity building programmes. The training was provided to farmers by NERIWALM but no exposure visits were organised for them. The project did not focus on training needs identification, designing & execution of capacity building inputs in holistic way so as to strengthen and lead them towards self-reliance and sustainability.

- Around 1700 WUA leaders and farmers in Goa were covered under capacity building programmes with an exposure visit to Maharashtra and Agricultural Research Centre at Goa. The project is yet to initiate the process of their training needs identification, designing and execution of capacity building inputs in holistic way so as to strengthen them and lead them towards self-reliance and sustainability. The training and capacity building of the WUAs and farmers is undertaken by WALMI in Gujarat. Looking at the vast command area of SSP, it is very difficult to cater to the requirement of training of all the WUAs in the entire command area.

7.7 Conclusion

The functioning of WUAs varies across the States. The structure of WUAs is more or less same in the States. But functions of WUAs and the efforts to promote them differ from State to State. Farmers' empowerment has increased through WUAs as they are more articulate now and the irrigated area has increased.

Fifteen State governments have enacted exclusive legislation for involvement of farmers in Irrigation management. The legal framework created out of these acts resulted in creation of farmers' organisations at three different levels of irrigation system i.e. Water Users Association (WUA), Distributary Committee (DC) and Project Committee (PC). There are two major issues with regard to PIM Act;

- The PIM act has been enacted only in 15 states whereas its importance is recognised at ground level across the country.
- The states where the PIM Act is in existence have not executed it in its true spirit.

Regular meetings like Annual General Meeting (AGM) and the Managing Committee (MC) Meetings have been observed in all the selected WUAs for water distribution, O&M works, conflict resolution etc. Conducting meeting either AGM or MC meetings are the major activities carried out by WUAs.

It is observed that WUAs maintained bank account, records, registers and the WUCs in Karnataka, Maharashtra and Gujarat are better equipped to handle O&M activities. The Water Users Cooperative Societies (WUCSs) have been empowered, to develop irrigation infrastructure, availing institutional finance, to procure water on volumetric basis and distribute the same to members and non-members as per principles laid down by the general body of the society; operate and maintain canals, levy and collect water charges and service charges at rates determined by the general body of the society; prepare water and financial budgets for each season; resolve disputes among water users. These WUCs/WUAs in the state do not have enough resources to carry out O&M activities as the shares allocated by State government for the water tax are not sufficient.

The GBMs of WUAs with all water users representing head, middle and tail end discuss and decide the quantity of water available and crop rotation. All important decisions on water regulation and allocation are discussed in the presence of all WUA members and WRD officials.

The WUAs have been able to prepare and implement Warabandi schedule, prepare a plan for the maintenance of irrigation system, promote efficient water use, assist the Revenue Department in collection of water charges, ensure equitable water distribution and resolve conflict amongst water users.

The access to information to WUAs about frequency, quantity, closing and opening of the canals has been improved. Functioning of WUAs helped in increasing farmers' capability in managing irrigation system which increased their self confidence (20% in the pre PIM situation to 50% in the post PIM situation). There is increase in agricultural production and productivity due to increase in irrigated areas and adoption of improved varieties and cropping pattern.

WUAs require an enabling environment, accountable partnerships and incentives. Merely creating a legal framework alone will not lead to successful WUAs. The empowerment of water users, long term capacity building, financial resources, and appropriate incentives with timely monitoring and remedial actions can go a long way in strengthening the WUAs. The sustainability of a WUA depends upon various factors such as social stratification and heterogeneity, institutional environment, legal framework, staffing, financial and technical assistance, agricultural policies, markets, hydraulics and demography.

Government of India has been laying special emphasis on involving women in the process of implementing PIM. In pursuance to the provisions in National Water Policy 1987 and 2002, MoWR, while issuing guidelines, specifically emphasised the States to consider representation of women in the WUAs at all levels. State governments have taken some steps and 10-15% women participation is there at WUA level as management committee members but no representation at Distributaries and Project level committee are there. Though there is no specific provision for women participation in the WUAs or at Distributaries or Project level committee in the PIM Act, necessary legal and institutional changes should be made at various levels for the purpose, duly ensuring appropriate role for women.

The WUA's role in operation and maintenance of irrigation system depends on its ability to generate resources. The major source of revenue is water tax. Irrigation water charges in most states are not adequate to meet the O&M costs. To fund the activities of farmers' organisations, the state governments have notified proportions of the water tax collection that would be shared among the various concerned organisations in the operation and maintenance (O&M) of irrigation projects. O&M cost is much higher than the recoverable irrigation charges as per present rate. Even though the low rates also not being recovered in full, often the cost of recovery of water charges by government is more than the amount recovered. This is creating severe budgetary constraints to government and consequently O&M could not be properly carried out resulting in system deficiency and unreliability of irrigation water to farmers.

The WUAs are not able to manage the O&M works with shared amount of water tax. Further, the WUAs were to take over the role of collection of water charges from Revenue Department. But, this has not happened in most states. At present, Revenue Departments are still collecting the charges and passing on a certain portion to WUAs for maintenance works. Thus, in most states, the WUAs remained powerless with neither management of irrigation systems nor the collection of water charges being entrusted to them.

It is observed that beneficiary contribution of 10% is received in very few WUAs/WUCSs due to large number of farmers being marginal and small and not being able to pay. In absence of beneficiary contribution, the one time functional grant is not released to the associations. Poor connectivity and in absence godown-cum office building, the WUAs are not able to function properly. The State of Karnataka has provided assistance for construction of godown-cum office for functioning of WUASs.

CHAPTER-8: MAJOR IMPACTS AND CASE STUDIES

The impacts seen after implementation of CADWM scheme were studied in the selected WUAs. An attempt has been made to compare the situation with respect to various interventions before and after the Implementation of CADWM scheme. The chapter presents the impacts in terms of case studies of the farmers interacted with during the field visit, showing the benefits derived by farmers from the implementation of CADWM programme. Some of the impacts and case studies, as observed in the WUAs are as follows:

Andhra Pradesh

The case discusses on initiative of Farmers' Organisation (FO) in appointing the community lashkars in absence of government appointing lashkars to help improve water use efficiency and maintain order in water distribution in RDS and Nizamsagar major irrigation projects. The community lashkars refer to people hired by the community to actually carry out water distribution at various levels of canal network namely distributary, sub-distributary and tertiary (outlet) level. This service is called by different names in different places like *Neellu Petta Kaavali vallu, Neergatti, Neerkatti, Neeradi, Patkari, Lushkars and Soudi.* This case study is also to highlight that the community lashkars are not confined only to outlet (*Thoomu)* level in canal irrigation. Compared to tanks and other small water bodies, the community lashkars become essential in major irrigation projects because of vast command area, number of farmers and other complexities. The purpose of community lashkars is to address to the issues such as water use efficiency through avoiding wastage and leakage, implement water scheduling to prevent water conflicts, facilitate water scarcity and tail end deprivation and to avoid tampering of irrigation infrastructure by aggrieved farmers. The community lashkars (*Neellu Petta Kavalivallu)* are the local people hired by the irrigators locally. The services of these community lashkars are assigned in the area based on the hydrology boundary like distributary, sub-distributary and outlet level. These community lashkars in some cases are from specific families engaged over the years and in some cases, persons are newly hired. Among them, small percentage is also of ayacutdars in the command area. Community lashkar arrangement is indeed very beneficial to irrigation management and to FOs. Hence, it would be good exercise if FOs adopt community lashkars in major irrigation projects to enhance water use efficiency, agriculture productivity, reduce tail end deprivation and avoid water conflicts among irrigators in the command area.

Karnataka

Changes in irrigation area have been experienced after formation of WUCSs in the State.

S. No.	Name and Location of WUCS	Area irrigated by canal before CADWM (ha.)	Area irrigated by canal after (ha.)	Reclamation of water logged area before (ha.)	Reclamation of water logged area after (ha.)	Cropping intensity enhanced
1.	Budinal (3 A of NLBC) Head	210	225	10%	20%	170%(paddy, wheat and other crops enhanced)
2.	Gullel (D-5, NLBC)	250	347.97	10%	20%	170%(paddy, maize, wheat crop enhanced)
3.	Kawadimatti-2(SBC shahapur Br. Canal)-Middle	100	125	10%	15%	150%(wheat, jowar and other enhanced)
4.	Kawadimatti-I(No6 shahapur Br. Canal)-Middle	300	360	10%	20%	150%(Paddy, groundnut, jowar and other crops enhanced)
5.	Dornalli-4(D-14 shahapur Br. Canal)-Tailend	275	325	10%	25%	130%(Paddy, crops enhanced)
6.	Dornalli-5(D-14 shahapur Br.Canal)	300	475	20%	25%	140%(Paddy, wheat and dal crops enhanced)

The Command Area Development Programme has direct impact on enhancing area under irrigation, cropping intensity, production and productivity and production of crops. The access to health care, education, income level has also been enhanced. The milk production has also enhanced. The employment opportunities have been enhanced and reduced migration.

Tamil Nadu

Prior to implementation of the programme, the farmers in the region used to follow mono cropping system with only rice being the core crop. Since the entire region is rain-fed, it is not possible to take up cultivation in another season. However, since the inception of CADWM

programmes in the region, farmers are adopting multiple cropping system with addition of horticultural as well plantation crops. In respect of CADWM programme implemented in the Chittar, Gundar and Karuppanadhi, the cropping intensity during the pre-project in the direct and indirect area was 175% and 167%.

The cropping intensity was increased to 181% and 176% in the post project in respect of direct and indirect ayacuts. The area cultivated increased from 224 ha to 231 ha (3.44%) in the project area. The total gross cropped in indirect area in Chittar, Gundar and karupanadhi project increased from 221 ha to 225 ha (1.65%) areas using tank during the post project shows a meagre improvement.

Jammu and Kashmir

The village Rangpur Maulana being at the tail end of the distributary No. D 10-A, was not getting the irrigation water; whatever water was available was lost due to seepage and leakage. The farmers used to sow only wheat in Rabi and paddy in Kharif. But after the field channels were constructed, the farmers changed their cropping pattern from traditional agriculture to diversified agriculture as the assured water was available for irrigation. They are now cultivating vegetables, fodder and other cash crops along with wheat and paddy. The area under cultivation of Village Rangpur Maulana WUA has increased from 70% to 100%; similarly the area covered under irrigation has also increased from 25ha to 33ha. Post implementation of CADWM scheme, number of milch animals and production of milk has also increased. Income levels of the people have increased which has led to access to better infrastructure facilities such as access to education and health care facilities.

The area under cultivation and irrigation of Kuliankallas WUA has increased after implementation of CADWM scheme. The paddy yield has risen significantly from 20 qtl/ha to 25 qtl/ha and wheat yield has increased from 12qtl/ha to 18qtl/ha. The production of basmati rice and wheat 502 is the main crop of this village. Post implementation of CADWM, farmers have also started cultivating vegetables and maize. The water is supplied once in 8 days to each farmer, this assured irrigation has improved the quality and quantity of crops. The farmers have expressed their desire that if water is available round the year, they can also opt for the third crop.

The area under cultivation and irrigation of Tundiankalai WUA has increased after implementation of CADWM scheme. The paddy yield has risen significantly from 20 qtl/ha to 25 qtl/ha and wheat yield has increased from 12qtl/ha to 18qtl/ha. The farmers are able to cultivate other crops such as vegetables and flowers. Though the situation has improved, post implementation of CADWM, farmers want that entire area should have lined channel to stop leakages.

In village Baspur, there is a fixed pattern for distribution of water by Warabandi. Initially, there was a loss of water due to leakage and seepage but after the construction of field channel in plum concrete, the loss of water due to spoilage and leakage has come down to negligible. Due to assured irrigation, farmers have changed the cropping pattern from traditional agriculture to diversified agricultures like vegetables and cash crops, fodder. The area covered under cultivation has increased from 70% to 100% and area under irrigation has increased from 17ha to 152ha. After the implementation of CADWM, the paddy, wheat and maize yield has increased significantly. The number of milch animals and average milk yield has also increased. Increase in quality and quantity of crops and dairy products has increased the level of household income which has resulted in improved quality of life of people. The introduction of suitable high yielding varieties, together with application of proper dose and method of fertilisers and optimum use of water has increased the productivity of crops per unit area. The paddy yield has risen significantly from 20 qtl/ha to 25 qtl/ha and wheat yield has increased from 12qtl/ha to 18qtl/ha.

The area under cultivation and irrigation of Kotali Arjun SIngh WUA has increased after implementation of CADWM scheme. Vegetables are grown as additional crops. Floriculture is also practiced. The quality of rice and cash crop has also improved due to assured water supply. The overall production of crops has increased manifold that resulted in higher farm income which ultimately helped in improvement of socio economic conditions of the farmers in the project area.

Rajasthan

In Talera Sandari WUA, before the programme, the whole cultivable area of 885 ha was rain-fed and crops grown were maize and jowar with poor yield of about 3-4 qtl/bigha. Now wheat, mustard and garlic have replaced jowar and maize, and farmers' income has improved several folds. The water table before the programme was 150'-200' which now has risen to 40'-50'. The woman used to fetch drinking water from wells at a considerable distance before the programme but now hand pumps are used for the purpose because of rise in water table. Due to fodder crops, the number of buffalo has increased resulting into the increasing the milk production. The number of cows though, has decreased due to loss of pasture. Employment opportunities have increased and due to higher income now, access to child education and health care have also considerably improved. The woman drudgery has reduced due to availability of hand pump and improvement in income

In Khalkar WUA, before the programme, out of 675 ha, only 375 ha was under cultivation. Large part of CCA was rain fed. Crops grown were jowar and maize with a yield of 3-3.5 qtl/bigha. After the programme, whole area of 675 ha is under cultivation. The coverage during Kharif is 472 ha and in Rabi 675 ha. High value crops like wheat, dhaniya, soya bean and garlic have

replaced jowar and maize crops. The productivity of jowar/maize was 3-3.5 qtl/bigha if there were timely rains. Now the productivity of high yielding crops/bigha are wheat 6-7 qtl, garlic 12-14 qtl, soya bean 3 qtl, and Dhania 3-3.5 qtl. The present market rates of these are Dhania ₹4200/Qt, soya bean ₹2000-2200/Qt, wheat ₹1120/Qt and the rate of garlic varies from ₹5000-7000/Qt. Woman drudgery reduced considerably as the drinking water is now available through hand pumps and through storage tank constructed by the government. Milk production is more or less the same. Milch cattle number also does not reflect much difference. Number of buffalo increased while cows have decreased. Income level of the farmers has increased resulting into better access to child education and to health care.

In Lakshmipura Vitran Samiti, Lakshmipura-VI-C, District-Kota; after the CADWM, jowar and maize were replaced by wheat, mustard, soya bean, vegetables and fodder crops. This has raised the income level of the farmers. Now of late, some farmers have switched over to garlic crop, the yield of wheat is 6 qtl/bigha and at ₹1180/qtl; it comes to ₹7080/bigha. The yield of garlic is about 12 qtl/bigha. Last year it was sold at ₹8000/qtl but this year the market rate is ₹4500/qtl after comparing the cost of production and net return, garlic crop is giving much higher return.

Rajasthan is one of the few states where PIM Act has been in practice since 2000. At the minor level, the water users (member of WUA) select their Chairman, Secretary, Treasurer and other members through election and thus, managing committee is formed. Several such committees on minor level elect the Vitran Samiti at the distributary level. Similarly, several Vitran Samities at distributary level elect the project samiti at the project level. The WUAs are provided one time grant by the state government for their operation. These associations also receive 42% of the total water charges collected. The WUAs are taking care of collection of water charges maintaining various records, repair and maintenance of the system besides their own Grievance Redressal Mechanism. Though there are some minor difficulties in their functioning due to shortage of fund but it is hoped that these difficulties would be reduced overtime and the act would serve as a model for the other states in the country.

For crop diversification, the farmers have already switched over from jowar and moong previously grown; to wheat, coriander and soya bean. The association has Grievance Redressal Mechanism and it takes necessary corrective action as and when needed properly. There are no environmental problems due to high use of fertiliser and pesticides, or unsafe disposal of agro-chemicals. There is no water logging; however, drainage problem exists for which a drainage channel of 3.5km is needed. The tube well water is brackish and if used regularly, can create salinity to some extent. The irrigation water is not used for drinking purpose. The aquaculture in not practiced and the irrigation system of the WUA does not certain ditches. There is no

provision of surface and sub-surface drainage in this WUA. The whole area of about 700 ha has natural drainage.

West Bengal

Overall impact of CAD Programme has not been assessed since the activity so far has not been extensive enough. However, the impact is perceptible in areas where CADA Programme has been completed or is under completion. Farmers are getting irrigation water smoothly and quickly and the misunderstanding and hitch among the farmers has been minimised. Loss due to over flooding the cultivated land, conveyance, seepage could be restricted to a great extent by constructing lined Field Channels resulting in saving of irrigation water and increasing the irrigated area.

Moreover, as the distribution system of the irrigating water has been improved due to this activity resulting in minimising the water logging problem at local depression zone, it improves the fertility of the land. Shallow/Deep Tube wells installed with subsidies by small and marginal farmers or any sponsored Organisation of the Government in the Command Area has improved the economy of the farmers. Soil Survey is generating useful data for planning the farmers to grow new varieties of crop with optimum moisture content. In this context, the command area of Damodar Valley (DV) System, predominated by small and marginal farmers, in course of last decade, has turned to be the cream of agricultural production of the State. It may be termed as the Rice Bowl as well as Potato Basket of the State. With the introduction of the High Yielding varieties, flanked by availability of irrigation water from D.V. System, a breakthrough in the production of Rice could be achieved. This is especially true in respect of the unconventional rice i.e. Boro which has struck deep in the area. The cultivation of potato, on the other hand, has reached to the tune of art. The productivity of potato of the region is highest in the country, thereby turning the state much surplus in the production of potato.

Thus, the agro-economy of this region pivots on rice and potato. Of late, the cultivation of mustard as oilseed crop has gained buoyancy. Due to the impact of industrial complex in the western part, proximity to Calcutta metropolis, number of towns in the area and good transport facilities, cultivation of vegetable is also sharing an increased space in the crop map of the region.

After sustained extension efforts, the farmers are now well aware of the importance of High Yielding Varieties not only for their high yields but also for their early maturity which has opened a new vista for multiple cropping. The laying out of Field Channel plays a vital role in adoption of these varieties as well as for raising and extension of subsequent crops. It is

estimated that there is increase of about 35% in the area under High Yielding Varieties till date over the Pre-CAD Programme.

The area under cultivation of Jamdara Matnala WUA has increased from 80 ha to 240 ha. Productivity of rice almost doubled from 26qtl to 44qtl per ha. Similarly, the productivity of crops such as mustard, potato has increased by almost 1.5 times. Income of the farmers has increased and also accessibility to education and health has increased.

The area under cultivation of Gopi nathpur -1 WUA has increased from 150 ha to 215 ha. Productivity of rice almost doubled from 28qtl to 46qtl per ha. Similarly, the productivity of crops such as mustard, potato has increased by almost 1.5 times. Income of the farmers has increased and so accessibility to education and health has increased.

The area under cultivation of Takipur mathnala society WUA has increased from 135 ha to 265 ha. Productivity of rice also increased from 28qtl to 42qtl per ha. Similarly, the productivity of crops such as mustard, potato has increased by almost 1.5 times. Income of the farmers has increased and so accessibility to education and health has increased.

The area under cultivation of Balari mathuala society WUA has increased from 120 ha to 195 ha. Productivity of rice almost doubled from 24qtl to 44qtl per ha. Farmers started cultivation of wheat which was not done earlier. Similarly, the productivity of crops such as mustard, potato has increased by almost 1.5 times. Income of the farmers has increased and so accessibility to education and health has increased.

Odisha

The impact of the programme since it has started has been very much appreciated by the cultivators. The Field Channel networks constructed in the farmers' field below the canal outlet have immensely benefited the farmers to provide available irrigation water uniformly throughout the command area of the outlet. During drought situation, the presence of Field Channels has helped the farmers to a great extent to avoid crop loss at the tail end. The social disputes arising out of non-uniform distribution of available water during peak period and also during the period of scarcity have been reduced to a great extent.

The impact of the Field Drain on the farmers is also very much encouraging. It has been observed that due to construction of Field Drains, the prevalent water logging condition has been substantially removed and the average yield of the affected area has been increased. Due to farmers' training and Crop Demonstration Programme, the cultivators in the command area are now ready to go for diversification of crops and adoption of modern methods of cultivation

and water management practices for higher productivity. The need of Field Channels is so felt by the farmers that they are now coming forward to donate the required land for construction of Field Channel and Field Drains.

The area under cultivation of Maa Chaurasi Pani Panchayat has increased after the intervention. Sunflower and Groundnuts are grown as an additional crop after implementation of CADWM scheme. The paddy yield has risen from 18 qtl/ha to 30 qtl/ha. The area under paddy cultivation has also increased from 375 ha to 467 ha. Post implementation of CADWM scheme, ground water in the command area is available throughout the year as compared to the previous situation. The milch animals and dairy productivity has also increased. The increase in quality and quantity of products has resulted in higher income level. The project has also given intangible benefits such as access to education and health care facilities.

The area under cultivation of Pithapotalien Pani Panchayat has increased from 156 ha to 257 ha. Post intervention, farmers are able to cultivate Rabi crop on 154 ha of land. The paddy yield has increased from 19 qtl/ha to 46 qtl/ha. Agriculture was earlier dependent on rainfall for irrigation, now it gets timely and sufficient water for irrigation. Post implementation of CADWM scheme, ground water in the command area is available throughout the year as compared to the previous situation when ground water was available only up to the month of March. Access to other facilities such as school and health centers has also improved.

The area under irrigation of Maa Kandheubai Pani Panchayat has increased from 256 ha to 476 ha. The area under Kharif crop has increased from 256.016 ha to 458.271 ha. Post implementation of CADWM, mustard and groundnuts are grown for the first time. The paddy yield has increased from 18 qtl/ha to 42 qtl/ha. Increase in number of milch animal and milk products has created the employment opportunities in dairy sectors. People now have access to safe drinking water

The area under cultivation of Baba Vishwanath Pani Panchayat has increased from 279 ha to 553 ha after the intervention. Mustard and Groundnuts are grown as an additional crop after implementation of CADWM scheme. The yield of potatoes and tomatoes has also increased. The paddy yield has risen from 23 qtl/ha to 44 qtl/ha. The area under cultivation has also increased twice. Agriculture which was highly dependent on rainfall, now has irrigation facilities throughout the year Post implementation of CADWM scheme, ground water in the command area is available throughout the year. People now have access to safe drinking water from hand pumps and piped water. The milch animals and dairy productivity has also increased. The increase in quality and quantity of products has resulted in higher income level. The project has also given intangible benefits such as access to education and health care facilities.

The area under cultivation of Maa Sawaleswari Pani Panchayat has increased three folds. The area under kharif crops has increased from 263 ha to 648 ha. After the intervention, farmers are able to grow moong, mustard and groundnuts. The paddy yield has also increased from 17 qtl/ha to 47 qtl/ha and the average milk yield has increased substantially. Income generation has started after implementation of CADWM.

The area under irrigation of Maa Kaunari Path Pani Panchayat has increased from 118 ha to 592 ha. The paddy yield has risen from 20 qtl/ha to 40 qtl/ha. Post implementation of CADWM scheme, increased in number of milch animal and milk products has created the employment opportunities in dairy sectors. People now have access to safe drinking water.

Chhattisgarh

The area under cultivation of Fulbandiya WUA has increased; the paddy yield has risen from 20 bags per acre to 35 bags per acre. Post implementation of CADWM scheme, the water table has also increased to 150 ft below the ground surface. Employment level in the area has risen which has lead to income enhancement. Post implementation of the project the level of social infrastructure has also increased.

Though the area under cultivation of Faguram WUA has remained same, area covered under irrigation has increased from 1190 ha to 1415 ha. After implementation of CADWM scheme in the area, the paddy yield has risen from 25 bags/acre to 35 bags/acre. The water table has also increased to 150 ft below the ground surface. According to the members, the increase in quality and quantity of crop has led to income enhancement. The paddy yield of Karhi WUA has increased from 9-10 qtl/acre to 20-25 qtl/acre. Post implementation of CADWM scheme, the farmers are now able to grow other vegetables as well. Agriculture which was highly dependent on monsoon now gets water for irrigation throughout the year

Nariyera WUA has benefitted extremely after the implementation of CADWM in the command area. From just 2-4 ha of area under cultivation before the implementation of CADWM, the area under cultivation and irrigation has increased to 1200ha. The paddy yield of the area has increased from 200 quintals to 48000 quintals. The water table has also increased making water more accessible. The increase in quantum of crop has also increased the level of income.

In Ghogri WUA, the total area under cultivation before the implementation of the programme was just 30% which has now increased to 80% of the total area. The kharif crop is now cultivated on 1000 ha of land. The paddy yield has also doubled. The water table has enhanced by 20%. The level of other infrastructure has improved but a lot needs to be still done.

Nagaland

Nagaland has an agrarian economy. It has been observed that both the quality and quantity of crops has improved after the implementation of CADWM scheme. Farmers are no longer growing the subsistence crop but are able to cultivate additional crops and vegetables such as carrots, chillies, onion, melon, spinach leaf, cucumber, brinjal, tomatoes and mustard. In many WUAs, number of milch animals has also increased which gave income earning opportunities in dairy sector. The interventions have resulted in increased income of farmers which eventually has led to better quality of life of Nagas.

Sochonuma WUA is able to cultivate the vegetables in winter as well, which was not possible earlier as there was scarcity of water for the month of November to June. The number of irrigations has increased to 2. Khaibung WUA has also been able to dedicate 21 ha of area for vegetables and pulses in winter. This eventually resulted in increase in their income. In Upper Bungsang WUA, the production of paddy increased from 70 *tinnas* (local land unit) per acre to 100 *tinnas* per acre. Upper Molvum WUA has been able to produce 130 *tinnas* of paddy per acre after the programme intervention. This was only 70 *tinnas* per acre earlier. The number of milch animals has also increased, which has resulted in increase of dairy productivity.

The area under cultivation of Lower Molvum-1 WUA has increased from 55 ha to 102 ha. The area under kharif crop has increased from 55 ha to 102 ha and area under paddy has also doubled. Vegetables are grown as additional crop after implementation of CADWM scheme in 2 ha of area. The paddy yield has risen from 24 qtl/ha to 35 qtl/ha. Post implementation of CADWM scheme, drinking water in the command area is available through ring well instead of dug well. In Lower Molvum-2 WUA, the production of paddy increased from 1700 *tinnas* to 2000 *tinnas* and other vegetables production has increased from 30 kg to 70 kg.

Madhya Pradesh

The Command Area Development Programme has direct impact on enhancing area under irrigation, cropping intensity, production and productivity and production of crops. On an average, 50% production has been enhanced in the project areas particularly for wheat crops. The access to health care, education, income level has been enhanced. The milk production has also enhanced. The employment opportunities have been enhanced and reduced migration. The availability of water needs to be supplemented with new technologies of irrigation practices, quality seeds, fertilisers, training and visits. Awareness campaign by Water Resources and Agriculture Department about the latest available agriculture and irrigation techniques and practices at village level will provide the farmers better idea and understanding. Efforts are needed to provide timely inputs for agriculture to the farmers like seeds, fertilisers, pesticides, insecticides, diesel etc.

Goa

The area under cultivation of Sateri Ghodedev Pani Vatap Vyavastha Sahkari Samiti WUA has increased from 55 ha to 79 ha; similarly the area covered under irrigation has also increased from 16 ha to 79 ha. Sugarcane is grown as an additional crop after implementation of CADWM scheme in the area together with the production of banana, chilly, onion, groundnut and paddy. The paddy yield has risen from 18 qtl/ha to 20 qtl/ha and the average milk yield has increased from 8-10 litre/day to 12 litre/day (for 5 months). Post implementation of CADWM scheme, ground water in the command area is available throughout the year as compared to the previous situation when ground water was available only up to the month of February. The cow population has seen a 20% increase (from no cow population before the implementation of CADWM) and the employment level in the area has risen from 40% to 75%. Income generation is yet to start after implementation of CADWM.

The area under cultivation of Shri Baradi Devi Pani Vatap Vyavastha Sahkari Samiti WUA has increased from 75 ha to 95 ha; similarly the area covered under irrigation has also increased from 25 ha to 75 ha. Sugarcane is grown as an additional crop after implementation of CADWM scheme in the area together with the production of banana, chilly, onion, groundnut and paddy. The paddy yield has risen from 18 qtl/ha to 20 qtl/ha and the average milk yield has increased from 8-10 litre/day to 12 litre/day (for 5 months). Post implementation of CADWM scheme, ground water in the command area is available throughout the year as compared to the previous situation when ground water was available only up to the month of February. The cow population has seen a 20% increase (from no cow population before the implementation of CADWM) and the employment level in the area has risen from 30% to 70%. Income generation is yet to start after implementation of CADWM. The labour rate has seen a 4 times increase from ₹25 to ₹100 per day.

The area under irrigation of Bhumika Devi Pani Vatap Vyavastha Sahkari Samiti WUA has increased from 25 ha to 75 ha. No crops were grown before the implementation of CADWM but post implementation of CADWM, chilly, banana and sunflower are grown and sugarcane has been sown for the first time. Post implementation of CADWM scheme, ground water in the command area is available throughout the year as compared to the previous situation when ground water was available only up to the month of March.

Sateri Siddheshwar Pani Vatap Vyavastha Sahkari Samiti WUA has benefitted after the implementation of CADWM in the command area. From no area being cultivated and irrigated pre-CADWM implementation, the area under cultivation and irrigation has increased to 6 ha and 6 ha at present. The paddy yield in monsoon season has increased from 0 qtl/ha to 30 qtl/ha whereas in winter season, it has been 20 qtl/ha (as compared to nil in pre-CADWM phase). Post implementation of CADWM scheme, ground water in the command area is

available throughout the year as compared to the previous situation when ground water was available only up to the month of March.

The area covered under irrigation of Kaleshwar Tamar Naik Pani Vatap Sahkari Samiti Maryadit WUA has Increased from 0 ha to 152 ha. Paddy is grown in 90% of the area under cultivation as compared to 10% area before the implementation of CADWM. The paddy yield has also doubled from 6 qtl/ha to 12 qtl/ha and the average milk yield has increased from 10 litre/day to 15 litre/day (for 5 months). Post implementation of CADWM scheme, ground water in the command area is available throughout the year as compared to the previous situation when ground water was available only up to the month of April. The cow population has seen a 20% increase (from no cow population before the implementation of CADWM). Income generation is yet to start after implementation of CADWM.

The area under irrigation of Mae De Deus Pani Vatap Vyavastha Sahkari Samiti WUA has increased from 90 ha to 140 ha. The paddy yield in the monsoon season has risen from 12 qtl/ha to 20 qtl/ha. Post implementation of CADWM scheme, ground water in the command area is available throughout the year as compared to the previous situation when ground water was available only up to the month of March.

Gujarat

The area under cultivation of Pala Vishwanthan Maharaj Kripa Piya Sahakari Mandli WUA has remained same but area under irrigation has increased from 26ha to 144ha. Maize and wheat is grown as an additional crop after implementation of CADWM scheme in the area together with the paddy. The paddy yield has risen from 2-3 qtl/ha to 3-4 qtl/ha, and wheat and maize production is 5qtl/ha. The number of milch animal has increased which has resulted in increase in milk production. The average milk yield has doubled increased from 100 litres to 200 litres. The average household income has increased substantially. The access to social infrastructure facilities has also improved, which has made positive impact on quality of life of people.

Cotton and tuar pulse were the only crops grown in the command area falls under Nimeta Minor Narbada Piya Sahakari Mandli WUA. Post implementation of the programme, paddy and wheat are also cultivated. The maize has increased from 5 qtl/ha to 12 qtl/ha. The milk production has increased largely, which has lead to increase in dairy activities. The network of dairy cooperatives provides the ready market to the farmers for milk. These interventions have increased the household income by 3 to 5 times. The health care facilities and other facilities have also improved.

Alindra Minor Narmada Sahakari Mandli Limited WUA has benefitted after the implementation of CADWM in the command area. From no area being irrigated before the implementation of CADWM, the area under irrigation has been 176ha at present. The maize yield has increased

from 1 qtl/ha to 5q/ha and wheat from 2q/ha to 5q/ha. Though the crop cultivation has increased but the milk production and number of cattle has decreased due to setting up of industrial establishment in the vicinity. The people are moving from primary sector to secondary or tertiary sector for employment.

In Shri Durga Mata Piya Sahakari Mandli WUA, the crops cultivated are paddy, castor, wheat, corn. The paddy yield has risen from 30 qtl/ha to 70qtl/ha and wheat from 40qtl/ha to 50 qtl/ha. The number of milch animal and average milk yield has also increased. The average household income has increased substantially. The access to social infrastructure facilities has also improved, which has made positive impact on quality of life of people

It has been observed that there is an increase in the quality and quantity of the crops cultivated in all the WUAs, but it is not substantial. Much of the improvement is in dairy activity, which is not only because of CADWM programme but also because of the white revolution of Gujarat Looking at the huge investments made, much of the tangible and intangible benefits have yet to take place.

Maharashtra

In the command area of Kanifnath WUA, irrigation coverage increased from 125 ha to 255 ha after CADWM programme. The cropping pattern focused more from onion and grapes to sugarcane, maize and wheat cultivation. The productivity of sugarcane increased by 20% whereas the productivity of maize reached to a level of 15 qtl/ha. The yield of wheat increased from 9 to 15 tonnes/ha. The animal rearing increased on mass scale in the command area leading to increased production up to 2,000 litter/day and employment opportunities.

The major impacts under Shiv Shakti Panivyapan Sansthan WUA included 50% increase in irrigation coverage. The sugarcane, maize and wheat crops were prioritized due to increased irrigation with increased crop yield by 20%. Similarly in the command area of Kharrifnath, irrigation coverage increased by 30% with a shift to cropping pattern as in other cases and increase in milk yield and employment generation.

Meghalaya

It has been observed that after the implementation of CADWM scheme, farmers are no longer growing the subsistence crop but are able to cultivate additional pulses and vegetables such as potatoes, tomatoes, cabbage, cauliflower and mustard. The vegetables grown in Meghalaya are of very high quality as climate is very favourable for cultivation throughout the year. The off-season vegetables have a great demand outside the state. In many WUAs, number of milch animals has also increased marginally which gave income earning opportunities. Largely Meghalaya is low milk producing State due to low preference given to dairy activities and less

affinity of milk by the people of the state. The interventions have resulted in increased income of farmers but there is still a long way to go. The impact has also been very evident in terms of development of social infrastructure.

The area under cultivation of Nongtraw WUA has increased from 120ha to 200ha. Mono cropping was practiced earlier. Farmers now cultivate vegetables such as tomato, cucumber, pumpkin etc along with paddy. The area under rabi cultivation has also increased from 20ha to 100ha. Increase in quality and quantity of crops has resulted in increase in household income.

In Kynrut WUA, the area under cultivation has increased from 35ha to 87ha Post implementation, rabi crop is cultivated on 18ha of land. Agriculture which was rain-fed earlier, now has assured irrigation. Potatoes are grown as an additional crop after implementation of CADWM scheme in the area together with the production of paddy The paddy yield has risen from 18 qtl/ha to 24 qtl/ha. Post implementation of CADWM scheme, the average milk yield has also increased.

The area under cultivation of Nekora WUA has increased from 40ha to 61ha. The area under kharif and rabi crops has also increased. Post implementations of CADWM, pulses are grown for the first time. The paddy yield has increased from 13 qtl/ha to 20 qtl/ha, mustard production increased by 2 qtl/ha. The intervention has led to increase in income earning opportunities. The access to health and education facilities has also improved.

Madan Umthied WUA has benefitted after the implementation of CADWM in the command area. From 20ha area cultivated before the implementation of CADWM, the area under cultivation and irrigation has been 32.5ha. The paddy yield has increased from 15 qtl/ha to 24 qtl/ha. The number of milch animals has increased which resulted in increase in average milk production The farmers have access to drinking water through taps. The level of social infrastructure has also improved which resulted in better quality of life.

In Phudumjer WUA, the area covered under cultivation has increased three times from 8ha to 31ha. The paddy yield has also increased from 15 qtl/ha to 22 qtl/ha. The agriculture which was rain-fed before the implementation of CADWM, now has assured irrigation.

The area under irrigation of Kharrukal WUA has increased from 75 ha to 126 ha. The area under rabi crop has also increased from 20ha to 90ha. Before the implementation of the CADWM scheme, the agriculture was rain-fed; post implementation, the crops have assured 5 irrigations. The paddy yield has risen from 15 qtl/ha to 24 qtl/ha and pulses yield increased from 10q/ha to 14q/ha.

Mizoram

In Biakinlui WUA, the area under cultivation has increased from 12ha to 41ha after creation of irrigation facilities in the command area. The area under irrigation during kharif was 12ha which got increased to 35ha There was no area under irrigation during rabi season whereas the same is around 30ha presently. In case of summer season (zaid), the area has been brought under irrigation by 10ha due to increased potential created under the command area. The number of irrigations provided before the CADWM implementation varied from 1-2 whereas the same increased to 3 times in rabi and kharif. With regard to the cropping pattern, the local variety of paddy was commonly grown which has shifted towards high yielding and improved varieties. The major crop before irrigation was paddy whereas the same has diversified to other crops including maize and vegetables. The average yield of paddy increased from 10qtl/ha to 17qtl/ha whereas the average yield of maize is around 30qtl/ha. One of the major impacts includes increased access of the villages for drinking water and domestic consumption purposes. The employment opportunities have been created in the area in farming system as the farmers work across the seasons whereas they used to work only in rainy season earlier. The impacts have also led to indirect change in life of the people in terms of improved food habits, child education and health care due to increased income level.

In case of Kawrthindeng WUA, the area under cultivation has increased nearly by 3times as compared to the past. The area under irrigation during kharif season has also increased by above 3 times. In rabi and zayad, the area under irrigation is 30ha and 18ha respectively. Paddy was the major crop and the crop yield has increased from 9qtl/ha to 15qtl/ha. Other major changes are similar to the case mentioned above.

Assam

In Mankar Charaimilijuli Krisak Samiti, area under cultivation and irrigation has increased hugely to almost twice in the case of irrigation. In the case of rabi and kharif, there is a marked increase from before to now to almost 50%. In the case of paddy, oilseeds and masoor; the levels have again gone up to almost twice while in the case of wheat and maize, it has gone up from 50% to 75%. Looking at productivity, there has been a positive change to all the crops. The water table has remained the same in summer as before and so has accessibility to drinking water. In the case of milk production and milch animals, there has been a marked increase. Better employment opportunities have resulted in better income for the farmers There is now a private school that provides education to the children as opposed to the government schools earlier. Also, the health facilities have improved from before.

In case of Charaimari Krishak Samiti, access to health care, income level as a result of employment opportunities and child education has improved considerably. Also, the number of

milch animals has increased and milk production has gone up from 200 to 300 litres/day. The water table has remained the same as before and so has accessibility to drinking water. Looking at cultivation, the area under cultivation has increased from 250ha to 400ha. Also, in the case of area under irrigation, kharif and rabi and paddy have increased yet again up to 50%. In the case of oilseeds, pulses and maize; there has been a marked decrease. In the case of the productivity of maize, wheat and paddy, there has been a 30 50% increase.

Area under irrigation in the case of Naharbari Patharparichalna Samiti has increased marginally. The area of irrigation in the case of kharif and rabi has increased by 50% and same in the case in the number of irrigations. Irrigation in the case of paddy and wheat irrigation has gone up to almost twice while in the case of mustard oil, it has increased a little. Also, in the case of maize it has gone down marginally. Productivity in the case of all the 4 crops has gone up marginally and so has milk production. Employment opportunities have improved resulting in increase in income levels, better access to child education, health care and reduction in the case of woman drudgery is a positive change from before.

In case of Sonali pathar parichalna Samiti, the number of irrigations has remained the same as before while in the case of rabi and kharif irrigation, there has been almost a 50% percent increase. In the case of irrigation, wheat and maize has increased marginally while in the case of paddy, it has increased about 3 times. Access to drinking water has remained the same but in the case of employment opportunities leading to better income, health care and education, there has been a positive developmental change.

Looking at the area under cultivation, there has been an increase in the case of cultivation and irrigation in Sarat Basumatary Samiti. In the case of kharif and rabi, the level from before is almost twice as much. In the case of irrigations, the number has become twice. In the case of production of wheat, maize, oilseeds and paddy the crops grown have only increased. In the case of the productivity of the same, there has been a marked increase. The milch animals and milk productivity has also increased. Increase in the case of income level, access to child education, healthcare and decrease in woman drudgery have shown a marked improvement from before.

In Dawagafufat Krishak Samiti, while the number of irrigations has remained the same as before, there has been increase in irrigation in both rabi and kharif. In the case of oilseeds, wheat and paddy, irrigation has increased while in the case of maize, it has marginally decreased. In the case of income levels, access to health care and woman drudgery there has been a positive change towards betterment.

Himachal Pradesh

The area under cultivation of KVK-Tube Well No-76 WUA has increased. Potato is grown as an additional crop after implementation of CADWM scheme together with the production of wheat and maize. The maize yield has risen from 20 kg/kanal to 2 qtl/kanal and wheat yield has increased from 40 kg/kanal to 2 qtl/kanal. The number of milch animal has not increased but the production of milk has increased due to availability of fodder for animals. Employment opportunities have increased due to dairy activities. The increase in quantity and quality of products has lead to increase in household income. (Note: 25 kanal = 1 ha)

In KVK Tube Well No- 62 Saloh WUA, the area was fallow and covered with bushes due to non availability of water. After the implementation of CADWM scheme, farmers have started cultivating paddy, wheat and vegetables. Presentably, the crops are mostly grown for local consumption. The availability of grazing fields has led to increase in milk production. Income generation is yet to start after implementation of CADWM.

KVK Tube Well No- 17 Nagnoli WUA has benefitted from CADWM scheme both in terms of agriculture and availability of drinking water. Earlier people had to travel 1 km to fetch water, now they have individual water connection. The dairy activities have led to increase in milk production. After implementation of CADA, fallow land has been put under cultivation. With assured irrigation, the wheat yield has increased from 40kg/kanal to 2qtl/kanal and maize yield has increased four times. Potatoes are being grown as additional crop.

K.V.K Tube Well No-38 WUA has also benefitted after the implementation of CADWM in the command area. The production of wheat and maize has increased but is utilised for consumption. According to the members of the WUA, the major hindrance in optimising the opportunities of CADWM is system deficiencies. Most of the field channels are underground and it becomes difficult to repair the underground pipes in case of leakages. Therefore, they are of the opinion that the field channels should be of cement concrete and open instead of underground

The area covered under irrigation has increased in Krishak Vikas Sangh Tube Well NO-41 WUA. Earlier only one half of the area was under cultivation, post implementation entire area is under cultivation. The wheat yield has increased from 5kg/kanal to 2 qtl/kanal. The per kanal yield of paddy and maize has also increased significantly. Mustard and vegetables are grown as additional crops. The average milk yield has also increased. Before implementation of the CADWM scheme, the source of drinking water was 2 km away and after implementation, people now have individual household tap connection.

Maharashtra

Major impacts on irrigation area, agricultural production, milch animals and milk production have been experienced post implementation of CADWM in the State.

S. No.	Name and Location of WUAs	Area Under Irrigation	Major crops grown	Productivity Enhanced	Milk production and Milk animals	Employment opportunities
1.	Kanifnath WUA no.55th kukrari left bank canal	Before-125 ha, After-255 ha	Before-Onion, grapes After-sugarcane, Maize, wheat	Sugarcane-20% increase, Maize-15 q/ha Wheat-9qtl(before) and 15 qtl(after),	Milk production-20,000/day (after) Milch animals-100-200(before) and 3000(after)	More employment (after)
2.	Shiv shakti panivyapan sansthan no.60	50% increase	Sugarcane, maize, wheat are grown after the project implementation	Productivity enhanced; sugarcane-10%, Maize-10%, Wheat-10%, others-70%	Milk production from 1000lts to 20,0000lts	More employment opportunities
3.	Kharrifnath at Minor 37 of KLBC	20% more	Sugarcane-5% more, maize-20% more , wheat-10% more areas grown	-	Milk production enhanced from 1000lts to 5000lts	--
4.	WUA(110) Vignahar WUA belwandi	30% increase	Sugarcane 40% more, maize-20% more, wheat-30% more	--	Milk production enhanced-110%	--
5.	Krishna Kanaryliya of No.9 of KLBC(paragon)	30% more	Sugarcane-50% more, maize-40% more,	Paddy-50% more, sugarcane-50% more, maize-50% more, wheat-50% more	Milk production enhanced from 1000lts to 5000lts	More employment opportunities
6.	Shiddheshwar sarkari panivyapan sansthan of visapur br. Canal of KLBC(kukadi)	50% more	Sugarcane-15-20% more, maize-15-20% more, wheat 15-20% more	Sugarcane, maize and wheat 15-20% more	Milk production enhanced from 100-200 lts to 3000lts /day	More employment opportunities

CHAPTER-9: BALANCE WORK AND QUANTUM OF FUND REQUIRED

The chapter covers the physical achievement of the command area (till December 2011) as against the planned CCA during the XI Five Year Plan. The information was collected from the project offices of the respective states and was also triangulated with the information available at the CADWM office, Delhi. The percent of balance work which is yet to be completed in each project has been provided zone-wise in the following tables (Table 9.1 – Table 9.5), the state wise balance work with the fund requirement has been given in Table 9.6 whereas the details on component wise balance work with the quantum of fund required have been provided in Annexure-3 of the Annexure Volume 1.

South Zone

As indicated in Table 9.1 below, the balance work to be completed is below 10% in case of Sriramsagar Project in Andhra Pradesh; Tungabhadra Project, Upper Krishna Project and Bennithora Project in Karnataka; and Gundar Chittar Karruppandi Project and Thirukoilur Anicut in Tamil Nadu.

10% to 30% balance work has to be completed in Bhadra Reservoir, Malaprabha, Ghataprabha and Gandorinala Projects in Karnataka; Wellington Reservoir and Kodiveri Anicut in Tamil Nadu; and Kallada Irrigation and Kanhirapuzha Projects in Kerala.

Srisailam RBC Project in Andhra Pradesh; Karanja Irrigation Project in Karnataka; Vaigai Project and Kodangar Reservoir in Tamil Nadu have about 30% to 55% of their work as balance to be completed in XII Five Year Plan.

Other projects have more than 75% of the work as balance with some projects like Upper Mullamari and Chulkinala Project in Karnataka; Kalingarayan Anicut in Tamil Nadu and Muvattupuzha Valley Irrigation Project in Kerala having reported 100% balance work as these projects have not been started.

Table 9.1: Project wise Balance Work and Fund Required (South Zone)

S.No.	Project Name	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
1	Andhra Pradesh							
	Sriramsagar Project	411000	393941	17059	3693	7544	4.15	
	Srisailam R.B.C	76890	52429	24461	5296	10818	31.81	

S.No.	Project Name	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
2	**Karnataka**							
	Tungbhadra	529000	520820	8180	1771	3618	1.55	
	Upper Krishna	622000	566209	55791	12078	24673	8.97	
	Bhadra Reservoir	105570	86223	19347	4188	8556	18.33	
	Malaprabha	214980	188540	26440	5724	11693	12.3	
	Ghataprabha	317430	266742	50688	10973	22416	15.97	
	Karanja irrigation project	35614	20942	14672	3176	6489	41.2	
	Amarja	8903	35	8868	1920	3922	99.61	
	Bennithora	20234	18857	1377	298	609	6.81	
	Upper Mullamari	3279	0	3279	710	1450	100	
	Gandorinala	8094	5891	2203	477	974	27.22	
	Lower Mullamari	9713	2283	7430	1609	3286	76.5	
	Chulkinala	4047	0	4047	876	1790	100	
3	**Tamil Nadu**							
	Vaigai Project	50188	22673	27515	5957	12168	54.82	
	Kodangar Reservoir	4117	2748	1369	296	605	33.25	
	Varadhamanathi Reservoir	2323	91	2232	483	987	96.08	
	Kalingarayan Anicut	4800	0	4800	1039	2123	100	Project not started
	Wellington Reservoir	11153	9247	1906	413	843	17.09	
	Gunder-Chittar-Karuppanadi	15000	14410	590	128	261	3.93	
	Kodiveri Anicut	9916	8320	1596	346	706	16.1	
	Thirukoilur Anicut	9783	8831	952	206	421	9.73	
4	**Kerala**							
	Kallada Irrigation Project	53514	37506	16008	3466	7079	29.91	
	Kanhirapuzha	9720	7272	2448	530	1083	25.19	

S.No.	Project Name	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
4	Pazhassi Irrigation Project	11530	1882	9648	2089	4267	83.68	
	Muvattupuzha Valley Irrigation Project	19237	0	19237	4165	8507	100	Project not started

(Source: Project Offices in the Respective States)

North Zone

As shown in Table 9.2 below, balance work is less than 10% in Western Yamuna Canal Phase-6 Project in Haryana, Cluster of 40 MI Schemes in Himachal Pradesh and Sharda Canal System in Uttar Pradesh.

About 12 projects in the zone have reported balance work in the range of 10% to 30%; and 23 projects have more than 50% of their work as balance work to be completed.

Uri-Narvaw, Vaishow and Kargil Projects in Jammu and Kashmir; Shah Nahar Project-Kangra and Cluster of various MI schemes in district Sirmour in Himachal Pradesh and Sirsee Dam Canal in UP have not started; hence, their 100% work is balance work. For the 3 projects in Uttarakhand, MoU has not been signed; hence, balance work is 100%. Some other projects in Madhya Pradesh like Rajghat Canal Project, Bariyarpur LBC and Bansagar Project also have 100% work as the balance to be completed as the projects have not been started.

Table 9.2: Project wise Balance Work and Fund Required (North Zone)

S.No.	Project Name	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
1	Jammu & Kashmir							
	Zainageer Canal	5100	4544	556	120	246	10.9	
	Duchnipora Rajpora-Tral	12526	7806	4720	1022	2087	37.68	
	Kahmil Kupwara	7300	4526	2774	601	1227	38	
	Tongri	4064	752	3312	717	1465	81.5	
	Ganderbal	6892	97	6795	1471	3005	98.59	
	Dehgam-Veerinag	2934	2256	678	147	300	23.11	

S.No.	Project Name	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
1	Arin Bandipora	2860	2096	764	165	338	26.71	
	Ferozpora-Tangmarg	9644	2267	7377	1597	3262	76.49	
	Uri-Narvaw	6770	0	6770	1466	2994	100	Project not started
	Ahaji-Beerwah	8813	2450	6363	1378	2814	72.2	
	Vaishow	13738	0	13738	2974	6075	100	Project not started
	Kargil	12000	0	12000	2598	5307	100	Project not started
	Ranbir Canal	38600	30436	8164	1767	3610	21.15	
	Sonawari	20370	5122	15248	3301	6743	74.86	
	Ego-Phey Canal	3000	873	2127	460	941	70.9	
2	**Punjab**							
	Upper Bari Doab canal command	184861	33182	151679	32837	67079	82.05	
	Srihind feeder part-II command	314496	157799	156697	33923	69298	49.82	
	Bhatinda Br Part-II	181707	78384	103323	22368	45694	56.86	
3	**Haryana**							
	Bhakra canal project phase-II	351853	65325	286528	62030	126714	81.43	
	Western Yamuna canal phase VI	205600	191712	13888	3007	6142	6.75	
	JLN canal phase-II	99383	5667	93716	20289	41445	94.3	
4	**Himachal Pradesh**							
	Cluster of 12 Nos MIS Rampur District Shimla	766	514	252	55	111	32.9	
	Cluster of 27 MI Scheme	2209	260	1949	422	862	88.23	
	Cluster of 42 MI Scheme Teshil Sarkaghat	1087	870	217	47	96	19.96	
	Shah Nahar Project, Kangra	15287	0	15287	3309	6761	100	Project not started

S.No.	Project Name	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
4	Cluster of 40 MI schemes	1377	1300	77	17	34	5.59	
	Cluster of various MI schemes in Paonta & Shillai tehsil in distt. Sirmour	2342	0	2342	507	1036	100	--
5	**Uttarakhand**							
	Laster canal's Offshoots	1120	0	1120	242	495	100	MoU not Singed
	Jatowala & Prateetpur Canal	278	0	278	60	123	100	MoU not Singed
	Tumaria Dam Canal System	30436	0	30436	6589	13460	100	MoU not Singed
6	**Uttar Pradesh**							
	Sirsee dam Canal	44880	0	44880	9716	19848	100	Project not started
	Sharda Canal system	1613000	1473053	139947	30297	61890	8.68	
	Sharda Sahayak Phase-2	330000	87374	242626	52526	107299	73.52	
	Saryu Phase 2	280000	22411	257589	55765	113916	92	
	Tumaria Dam Canal System	64010	23010	41000	8876	18132	64.05	
	East Gang Canal	233000	73970	159030	34428	70329	68.25	
	Lower Rajghat	43210	11000	32210	6973	14245	74.54	
	Betwa & Gursarai Canal	422000	262640	159360	34500	70475	37.76	
	Ken Canal System	222000	108240	113760	24628	50309	51.24	
	Belan Pump Canal System	71050	42540	28510	6172	12608	40.13	
	Tons Pump Canal System	34000	26940	7060	1528	3122	20.76	
	Jakhloun Pump Canal System	29870	10000	19870	4302	8787	66.52	
	Son Pump Canal System	93650	48600	45050	9753	19923	48.1	
	Upper Ganga Canal	457000	363510	93490	20240	41345	20.46	
	Madhya Ganga	229000	73550	155450	33653	68746	67.88	

S.No.	Project Name	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
7	**Rajasthan**							
	Amar Singh Sub Branch and Jassana district of Bhakra Canal System(ASSBP)	67210	57783	9427	2041	4169	14.03	
	Sidhmukh Nohar Irrigation Project (SNIP)	111460	96850	14610	3163	6461	13.11	
	Gang Canal Project (G.C.P)	183201	1560	181641	39323	80329	99.15	
	Bisalpur Project	81800	31605	50195	10867	22198	61.36	
8	**Madhya Pradesh**							
	Kolar	45000	10721	34279	7421	15160	76.18	
	Rani Avanti Bai (Bargi)	157000	31004	125996	27277	55720	80.25	
	Upper Wainganga	112900	93087	19813	4289	8762	17.55	
	Bagh	16600	14782	1818	394	804	10.95	
	Harsi	44354	36193	8161	1767	3609	18.4	
	Kunwar Chain Sagar	3700	2026	1674	362	740	45.24	
	Rajghat Canal Project	164789	0	164789	35675	72876	100	--
	Bariyarpur Left Bank Canal	46682	0	46682	10106	20645	100	--
	Bansagar Project	154687	0	154687	33488	68409	100	Project not started

(Source: Project Offices in the Respective States)

East Zone

Hirakud Project in Orissa and Kosi Project in Bihar have less than 10% balance work, as has been shown in Table 9.3 below. 7 projects in the zone have about 25% to 50% of their work as balance.

20 projects have more than 50% of their work as balance including 4 projects (Rengali Irrigation Project, LBC-I & LBC-II Phase –I in Odisha, Kanchi Weir Irrigation Scheme and Mayurakshi LBC in

Jharkhand and Khapri Irrigation Project in Chhattisgarh) which have either not started or MoU has not been signed for them, hence, 100% balance work.

Table 9.3: Project wise Balance Work and Fund Required (East Zone)

S.No.	Project Name	Total CCA(Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
1	**West Bangal**							
	D.V.C System	391970	47711	344259	74529	152245	87.83	
	Kangsabati	340750	71979	268771	58186	118861	78.88	
	Mayurakshi	226630	30616	196014	42435	86685	86.49	
	Teesta Barrage	165000	4361	160639	34777	71041	97.36	
2	**Odisha**							
	Sunie Irrigation Project	10000	1850	8150	1764	3604	81.5	
	Jaimangla	7350	1852	5498	1190	2431	74.8	
	Hirakud	153240	141355	11885	2573	5256	7.76	
	Mahanadi delta	336300	24179	312121	67571	138032	92.81	
	Rushikulya	61230	15695	45535	9858	20137	74.37	
	Rengali Irrigation Project, LBC-I & LBC-II Phase –I	41333	0	41333	8948	18279	100	
	Salandi Right	40180	11137	29043	6288	12844	72.28	
	Baitarani	32770	8395	24375	5277	10780	74.38	
	Potteru	70100	15663	54437	11785	24074	77.66	
	Upper Kolab	47200	16808	30392	6580	13441	64.39	
	Gohira irrigation project	9172	1600	7572	1639	3349	82.56	
	Upper Indrawati major irrigation project	128000	2004	125996	27277	55720	98.43	
	Remal irrigation project	4313	1650	2663	577	1178	61.74	
3	**Jharkhand**							
	Kanchi Weir Irrigation Scheme	17800	0	17800	3854	7872	100	MoU not signed

S.No.	Project Name	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
3	Mayurakshi left bank canal system	9500	0	9500	2057	4201	100	MoU not signed
4	**Bihar**							
	Gandak Cada	960000	621464	338536	73290	149714	35.26	
	Badua and Chandan	106380	79232	27148	5877	12006	25.52	
	Lower Kuil	22260	13874	8386	1815	3709	37.67	
	Kosi	440000	417350	22650	4903	10017	5.15	
	Sone	865000	468000	397000	85947	175569	45.9	
	North Koel Project	123000	11500	111500	24139	49310	90.65	
5	**Chhattisgarh**							
	Ballar	6550	4362	2188	474	968	33.4	
	Khapri irrigation project	4588	0	4588	993	2029	100	
	Hasdeo Phase –II	168000	105290	62710	13576	27733	37.33	
	Mahanadi, Tandula, Kodar and Jonk	497659	319336	178323	38605	78862	35.83	

(Source: Project Offices in the Respective States)

North East Zone

As shown in Table 9.4 below, there is no balance work as work has been completed in Cluster of 13 Minor Irrigation Projects at Changki Valley in Nagaland, Cluster of 28 M.I. Schemes in Imphal East and Imphal West Districts in Manipur and Cluster of 40 MI Projects in Mizoram.

5 projects in the north east zone, namely, Bardikarai Irrigation Project in Assam; Khuga Multipurpose Project in Manipur; Cluster of 21 Minor Irrigation Schemes of South & West district of Sikkim; Cluster of 4 Minor Irrigation Projects in Tripura and Cluster of 6 MI schemes – Kynrut, Phudumjer, Nongtraw, Kharukol, Nekora, Madan Umthied in Meghalaya; have more than 50% of their work as balance.

Table 9.4: Project wise Balance Work and Fund Required (North East Zone)

S.No.	Project Name	Total CCA(Ha)	CCA Covered (Ha)till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
	Assam							
1	Dakadong	4940	3250	1690	366	747	34.21	
	Bardikarai Irrigation	16990	296	16694	3614	7383	98.26	
	Kaldiya	9830	7310	2520	546	1114	25.64	
	Pahumara Irrigation	9259	0	9259	2004	4095	100	
2	**Nagaland**							
	Cluster of 13 Minor Irrigation Projects at Changki Valley	1080	0	1080	234	478	100	
3	**Manipur**							
	Cluster of 21 M.I. Schemes under Bishnupur District, Manipur	9600	4746	4854	1051	2147	50.56	
	Cluster of 28 M.I. Schemes in Imphal East and Imphal West Districts	6665	5743	922	200	408	13.83	
	Khuga Multipurpose Project	9575	0	9575	2073	4234	100	
	Cluster of 37 M.I. Schemes under Thoubal, Ukhrul Chandel and Churachandpur Districts, Manipur.	6420	4624	1796	389	794	27.98	

S.No.	Project Name	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
3	Thoubal Irrigation Project, Ph-II	2485	1621	864	187	382	35	
	Mizoram							
	Cluster of 40 MI Projects	0	0	Nil	0	0	0	
4	Cluster of 60 Minor Irrigation Schemes Phase-II Aizawl, Lunget and Chhimtuipui district	3040	0	3040	658	1344	100	--
	Arunachal Pradesh							
5	Cluster of 102 MI schemes under Daporijo and Itanagar circle	2760	2265	495	107	219	17.93	
	Cluster of 39 MI schemes under Namsai circle	3340	3011	329	71	145	9.85	
	Sikkim							
6	A cluster of 17 MI of North and East district of Sikkim	1030	0	1030	223	456	100	MoU not singed
	A cluster of 21 MI schemes of South & West district of Sikkim	1220	107	1113	241	492	91.23	MoU not singed
	Tripura							
7	Cluster of 4 Minor irrigation projects	440	168	272	59	120	61.82	

S.No.	Project Name	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
8	**Meghalaya**							
	Cluster of 10 MI schemes viz. Tienglam and Pdern etc.	2440	1354	1086	235	480	44.51	
	Cluster of 6 MI schemes Kynrut, Phudumjer, Nongtraw, Kharukol, Nekora, Madan Umthied	380	120	260	56	115	68.42	

(Source: Project Offices in the Respective States)

West Zone

As shown in Table 9.5 below, Tillari Irrigation Project in Goa; Surya, Nandur Madumeshwar Canal and Dhombalkawadi Irrigation Projects in Maharashtra have more than 75% of their work as balance to be completed.

Table 9.5: Project wise Balance Work and Fund Required (West Zone)

S.No.	Project Name	Total CCA(Ha)	CCA Covered (Ha)till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
1	**Goa**							
	Tillari Irrigation	14521	3501	11020	2386	4873	75.89	
2	**Gujarat**							
	Sardar Sarovar Phase-I	446610	264836	181774	39352	80388	40.7	
3	**Maharashtra**							
	Chaskaman	43420	34660	8760	1896	3874	20.18	
	Khadakwasla	77680	46457	31223	6759	13808	40.19	
	Surya	14700	1100	13600	2944	6014	92.52	
	Krishna	74000	72849	1151	249	509	1.56	
	Upper Penganga	104000	81254	22746	4924	10059	21.87	
	Lower Wunna	21594	17361	4233	916	1872	19.6	

S.No.	Project Name	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)	% of Balance CCA	Remark
3	Nandur Madumeshwar canal	52864	6900	45964	9951	20327	86.95	
	Bhima	126000	111063	14937	3234	6606	11.85	
	Dhombalkawadi irrigation project	28100	50	28050	6073	12405	99.82	

(Source: Project Offices in the Respective States)

State wise Balance Work with the Fund Requirement

As has been shown in Table 9.6 below, taking the CCA covered till 31st December 2011 for the projects in all the States, the total area of balance CCA on which work has to be completed is 8181530 ha. The total estimated cost of the balance work as per the existing norms (Chapter 5, Table 5.8) comes to around ₹ 1771212 lakhs whereas the total estimated cost as per the proposed rates (Chapter 5, Table 5.8) comes to around ₹ 3621005 lakhs.

Table 9.6: State Wise Balance Work and Fund Required

S.No.	Name of State	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)
1	Andhra Pradesh	487890	426009	61831	13396	27366
2	Karnataka	1878860	1667528	211335	45751	93461
3	Tamil Nadu	97730	41822	65458	14167	28945
4	Kerala	94000	9336	84665	18329	37441
5	Jammu & Kashmir	176280	36712	231104	28383	57980
6	Punjab	681060	186475	494589	107073	218727
7	Haryana	656840	127249	529587	114650	234204
8	Himachal Pradesh	24530	3770	20766	4496	9184
9	Uttarakhand	35310	3961	31349	6786	13864
10	Uttar Pradesh	4166670	1996000	2170670	469927	959956
11	Rajasthan	672670	267785	404886	87654	179057
12	Madhya Pradesh	745710	187813	557899	120779	246725
13	West Bangal	1124350	154667	969683	209927	428832
14	Odisha	941190	242188	699000	151327	309125

S.No.	Name of State	Total CCA (Ha)	CCA Covered (Ha) till 31.12.2011	Balance CCA (Ha)	Estimated cost as per Existing Norms (₹ in Lakh)	Estimated cost as per Proposed Rates (₹ in Lakh)
15	Jharkhand	27300	0	27300	5911	12073
16	Bihar	2516640	1578798	937842	203033	414751
17	Chhattisgarh	676800	313219	363578	78711	160789
18	Assam	41020	10856	30163	6530	13339
19	Nagaland	1080	0	1080	234	478
20	Manipur	34750	15113	19632	4251	8682
21	Mizoram	3260	0	3262	706	1442
22	Arunachal Pradesh	13570	8627	4943	1070	2186
23	Sikkim	2250	107	2143	464	948
24	Tripura	440	168	272	59	120
25	Meghalaya	2820	1474	1346	291	595
26	Goa	14520	3501	11020	2386	4873
27	Gujarat	446610	264836	181774	39352	80388
28	Maharashtra	674360	510055	164303	35569	75474
	Total	16239599	8058069	8181530	1771212	3621005

(Source: Project Offices in the Respective States)

CHAPTER-10: EXTENSION, RENOVATION AND MODERNISATION OF COMPLETED PROJECTS

Fifteen (15) projects completed before 2001 were decided to be covered under the study in Andhra Pradesh (7), Maharatra (4), Uttar Pradesh (3) and Rajasthan (1) to assess their needs with regard to Extension, Renovation and Modernization (ERM) works if required. The process followed in assessing ERM needs of the completed projects included study & analysis of the base documents as available in the project offices, interaction with project officials, interaction with farmers, direct observation of the existing structures in the command areas, type of intervention required with regard to ERM and rough estimation of the quantum of work to be carried out.

Some of the selected projects in these states have already been taken up for completing the incomplete works and modernization of certain components under externally aided schemes supported by Japan International Cooperation Agency (JICA), World Bank, Asian Development Bank (ADB), etc. The construction activities are at different stages in the externally aided projects across these states. Therefore, it was found unrealistic to assess and capture ERM needs of these projects and to make realistic recommendations for carrying out ERM activities. However, the detailed assessment was carried out for remaining projects where ERM activities need to be carried out in the completed projects.

Out of 7 completed projects in Andhra Pradesh, Rajoli Banda, Peddavagu and Gandipalem Projects have been included under JICA whereas the detailed assessment was carried out for Tungbhadra complex, KC Canal, Gajuladinne and Vamsadhara Stage-I projects. Itiadoh, Ghod and Bagh Projects in Maharastra have been taken over by Maharashtra Water Sector Improvement Programme (MWSIP) supported by ADB and World Bank. In case of Uttar Pradesh, ERM assessment was carried out for Gandak, Jamrani and Sharda Sahayak projects.

10.1. Extension Activities

Extension activity in command areas of the completed projects relates to completion of CADWM works remained incomplete during the first phase The project officials across the studied states correlate the incomplete works under CADWM to number of reasons including inadequate budget, inadequate understanding of CADWM concept, spending the budget on specific components, etc. The major activity in the command areas emphasized on construction of unlined channels along with distribution boxes, foot cross, road cross/drain cross/siphon, tail cross, etc.

The crop intensity was very low at the time of completion of project, now the cropping intensity has increased to about 80%. In addition, the crop water requirement has also increased due to intensification of hybrid crops. Therefore, field conditions along with the perceptions of farmers and Government officials prefer lined channels over unlined channels with a view to increase velocity, reduce seepage losses and to ensure required number of irrigations to the prevailing cropping pattern. The lined channels will also be clubbed with field outlets and distribution boxes for uniformly water distribution, foot crosses for crossing of animals & farm equipments, road cross/drain cross/siphon for crossing of heavy Vehicles. Tail boxes will be constructed for protection of field channels, safely controlling of water at the end point, reducing water logging and reducing soil erosion.

The detailed quantum of work required to be carried out in the completed projects in Uttar Pradesh along with the funds requirement is given below in the Table-10.1 whereas the same was not required in other states.

Table 10.1: Proposed Extension Work and Finance Required

S.No	Item	Unit	Quantum of Work	Unit Rate (₹)	Amount Required in Lakhs)
	Uttar Pradesh				
	Gandak Project				
1.	Unlined FIC	Km	39000	35/Rmt	13650
2.	Lined FIC	Km	7800	1800/Rmt	140400
3.	Field Outlet	Nos	312000	1500/Structure	4680
4.	Distribution Box	Nos	31000	8000/Structure	2480
5.	Foot Cross	Nos	47000	1500/Structure	705
6.	Road Crossing/Drain Crossing/siphon	Nos	40000	40000/Structure	16000
7.	Tail Box	Nos	10000	8000/Structure	800
	Total				178715
	Jamrani Dam Canal Project				
1.	Unlined FIC	Km	10500	35/Rmt	3675
2.	Lined FIC	Km	2100	1800/Rmt	37800
3.	Field Outlet	Nos	50000	1500/Structure	750
4.	Distribution Box	Nos	8000	8000/Structure	640
5.	Foot Cross	Nos	8000	1500/Structure	120
6.	Road Crossing/Drain Crossing/siphon	Nos	8000	40000/Structure	3200
7.	Tail Box	Nos	2000	8000/Structure	160
	Total				46345

	Sharda Sahayak Phase 1				
1.	Lined FIC	Km	32000	1800/Rmt	576000
S.No	**Item**	**Unit**	**Quantum of Work**	**Unit Rate (Rs)**	**Amount Required (₹ in Lakhs)**
2.	Field Outlet	Nos	1280000	1500/Structure	19200
3.	Distribution Box	Nos	120000	8000/Structure	9600
4.	Foot Cross	Nos	240000	1500/Structure	3600
5.	Road Crossing/Drain Crossing/siphon	Nos	160000	40000/Structure	64000
6.	Tail Box	Nos	40000	8000/Structure	3200
	Total				675600

(Source: State and Project Offices)

As per the details given in table 10.1, the total amount required for carrying out all extension activities in Gandak, Jamrani Dam Canal and Sharda Sahayak-1 projects is ₹ 178715 Lakh, ₹ 46345 Lakh and ₹ 675600 Lakh respectively.

10.2. Renovation Activities

The major activities proposed for renovation in the projects across Uttar Pradesh, Andhra Pradesh and Maharastra include renovation of unlined channels constructed in the projects. Most of the unlined channels were destroyed over the years due to realignment of chak boundaries, land consolidation taken place by the revenue department and Public Works Department (PWD). Nearly half of the unlined field channels have got disappeared or are not in use. The lined channels constructed in the completed projects got damaged due to wrong agriculture practices and rough movement of farm equipments. Also, the salinity and alkalinity has lead to reduction in life of the lined field channels. The cisterns provided in the water conveyance system reduce velocity of water from the main source. Most of the siphons were found chocked and filled with silt.

Table 10.2 indicates the details with regard to renovation activities proposed to be carried out in different projects studied under ERM. The major components covered in Uttar Pradesh include renovation of lined and unlined field channels, cistern, field outlets, distribution boxes, foot crossings, tail boxes, road/drain crossings whereas the same relates to survey, planning & design, renovation of field channels and crossings. Girna project in Maharastra focuses on renovation of field channels.

Table 10.2: Proposed Renovation Work and Finance Required

S.No	Item	Unit	Quantum of Work	Unit Rate (₹)	Amount Required (₹) in Lakhs)
	Uttar Pradesh				
	Gandak Project				
1.	Unlined FIC*	Km	39000	35/Rmt	13650
2.	Cistern	Nos	10000	8000/Structure	800
3.	Field Outlet	Nos	312000	1500/Structure	4680
4.	Distribution Box	Nos	31000	8000/Structure	2480
5.	Foot Cross	Nos	47000	1500/Structure	705
6.	Tail Box	Nos	10000	8000/Structure	800
7.	Road/Drain crossing/Siphon	Nos	40000	40000/Structure	16000
	Total				39115
	Jamrani Dam Canal Project				
1.	Unlined FIC*	Km	10500	35/Rmt	3675
2.	Cistern	Nos	2000	8000/Structure	160
3.	Field Outlet	Nos	50000	1500/Structure	750
4.	Distribution Box	Nos	8000	8000/Structure	640
5.	Foot Cross	Nos	8000	1500/Structure	120
6.	Tail Box	Nos	2000	8000/Structure	160
7.	Road Crossing/Drain crossing/Siphon	Nos	8000	40000/Structure	3200
	Total				8705
	Sharda Sahayak Phase 1 project				
1.	Unlined FIC*	Km	80000	35/Rmt	28
2.	Cistern	Nos	40000	8000/Structure	3200
3.	Field Outlet	Nos	1280000	1500/Structure	19200
4.	Distribution Box	Nos	160000	8000/Structure	12800
5	Foot Cross	Nos	240000	1500/Structure	3600
	Total				
	Maharastra				
	Girna project				
1.	Unlined Channel	Km	2634	40	1053.6
	Total				1053.6
	Andhra Pradesh				
	BRR Vamsadhara				
1	Survey, plan &design	Ha	500	59994	299.97
2	Field channels for conveyance of water	Km	55755/km	725	404.22

S.No	Item	Unit	Quantum of Work	Unit Rate (₹)	Amount Required (₹) in Lakhs)
3	Crossings	Nos	165936/each	150	248.90
	Total				953.09
	Gajuladinne Project				
1	Field channels for Conveyance of water	Km	55755/km	20.00	11.15
2	Crossing	Nos	165936/Each	10.00	16.59
	Total				27.74
	K.C. Canal				
1	Field channel for conveyance of water	Km	55755/km	80.0	44.60
2	Crossing	Nos	165936/each	60.0	99.56
	Total				144.16
	Tungabhadra complex Project				
1	Field channel for conveyance of water	Km	55755/km	80.0	44.60
2	Crossing	Nos	165936/each	40.0	66.37
	Total				110.97

(Source: State and Project Offices)

10.3. Modernization Activities

The concept of modernisation relates to technological advancement with regard to various components of CADWM programme so as to enhance effectiveness and efficiency of the system. The farmers and project officials in the studied projects in Uttar Pradesh want to construct only lined channels across the command areas whereas the projects in Andhra Pradesh include control structure, farm roads, protection structures for field channels and core wall drops. Girna project in Maharastra also focuses on underground pipe lines for effective water conveyance.

Table 10.3: Proposed Modernization Work and Finance Required

S.No	Item	Unit	Quantum of Work	Unit Rate (Rs)	Amount Required (Rs in Lakhs)
	Uttar Pradesh				
	Gandak Project				
1	Lined FIC	Km	7800	1800/Rmt	140400
	Jamrani Dam Canal Project				
1	Lined FIC	Km	2100	1800/Rmt	37800
	Sharda Sahayak Phase 1 Project				
1	Lined FIC	Km	32000	1800/Rmt	576000
	Andhra Pradesh				
	BRR Vamsadhara				
1	Control Structure	No	373370/each	350	1306.816
2	Field channel protection works	Km	84321	210	177.0741
3	Others (Core wall drops)	Nos	42541/each	200	85.082
	Gajuladinne Project (Sanjeevaiah Sagar				
1	Control structure	No	379636/each	15.0	56.9454
2	Farm Roads	Km	1185188/each	15.0	177.7782
3	Field channel protection works	Km	86194	20.0	17.2388
4	Others (Core wall drops)	Nos	42541/each	20.0	8.5082
	K.C. Canal				
1	Control structure	No	379636/each	200.0	759.272
2	Field channel protection works	Km	86194.00	120.0	103.4328
3	Others (Core wall drops)	Nos	379636/each	40.0	17.0164
	Tungabhadra complex Project				
1	Control structure	No	379636/each	57.0	216.39252
2	Field channel protection works	Km	86194	95.0	81.8843
	Maharashtra				
	Girna Project				
1	Under Ground Pipe Line	Km	1580.4	800	12643.20
2	Distribution Box	Nos.	790500	10000	79050.00
3	Tail Box	Nos.	1054	10000	105.50
	Total				**91798.70**

(Source: State and Project Offices)

Conclusion

As per the findings of the field study of the completed projects, around 40% of the channels constructed in the command area have lost their relevance due to change in field boundaries after land consolidation. In addition, the increased number of holdings due to fragmentation needs additional channel length to be irrigated. Nearly 60% structures such a culverts, foot crossing, diversion boxes, tail end boxes have choked due to siltation or damaged by animals and agricultural operations. The field channels were constructed in the completed projects in Uttar Pradesh used 4.5" brick/slabs leading to damage of the same by around 80%.

The initiatives to be taken with regard to FRM include;

- The field channels need to be extended, renovated and modernized (lined with required cross section) to irrigate each of the plots in the command area.

- All the damaged structures such as culverts, foot crossing, diversion boxes, tail-end boxes need to be renovated.

- The design of field channels should be followed as in case of on-going projects to renovate the field channels damaged due to inadequate design.

CHAPTER-11: UNCOVERED PROJECTS

The chapter provides the list of completed major and medium irrigation projects which could be included in CADWM in future. The corresponding fund requirement has also been given in Table 11.1 below. The detailed list of the projects has been provided in Annexure-4 of the Annexure Volume 1

Table 11.1: Number of Uncovered Projects in the States and Corresponding Fund Required

S. No.	State	Total No. of Projects	CCA (ha)	Estimated Cost as per Existing Norms (₹ in Lakhs)	Estimated Cost as per Proposed Rates (₹ in Lakhs)
1	Andhra Pradesh	82	1580700	342206	699049
2	Karnataka	34	263958	57144	116733
3	Tamil Nadu	18	104906	22711	46394
4	Kerala	3	22135	4792	9789
5	Punjab	5	681154	147463	301234
6	Haryana	2	114996	24895	50856
7	Uttar Pradesh	10	885635	191731	391663
8	Madhya Pradesh	79	616025	133363	272431
9	Rajasthan	107	1123973	243329	497066
10	Jammu & Kashmir	1	2996	649	1325
11	Uttarakhand	5	3038031	657703	1343539
12	Himachal Pradesh	2	5500	1191	2432
13	West Bengal	11	187329	40555	82844
14	Orissa	10	347955	75329	153880
15	Jharkhand	102	203800	44121	90129
16	Bihar	4	54792	11862	24231
17	Chhattisgarh	23	191781	41519	84813
18	Assam	5	14312	3098	6329
19	Manipur	2	16515	3575	7304
20	Arunachal Pradesh	4	11340	2455	5015
21	Gujarat	3	55763	12072	24661
22	Maharashtra	2	80729	17477	35702
	Total	**514**	**9604325**	**2079240**	**4247417**

(Source: Respective State Offices

As per the details given in the table below, the number of uncovered projects ranges from 1 project in Jammu & Kashmir to 107 projects in Rajasthan.

The number of uncovered projects varies from 2 to 10 in states like Kerala, Punjab, Haryana, Uttar Pradesh, Uttarakhand, Himachal Pradesh, Odisha, Bihar, Assam, Manipur, Arunachal Pradesh, Gujarat and Maharashtra.

The number ranges from 11 to 34 in states like Karnataka, Tamil Nadu, West Bengal and Chhattisgarh

Andhra Pradesh, Madhya Pradesh, Rajasthan and Jharkhand have a large number (79-107) of completed projects which can be included in CADWM in future.

Based on the data collected from the respective state offices, the total number of completed projects which can be included in CADWM in future is 514 projects covering an area of 9604325 ha. The total estimated cost as per the existing norms is ₹ 2079240 lakhs while the same cost as per the proposed rates is ₹ 4247417 lakhs.

CHAPTER-12: POLICY ISSUES

The chapter provides key observations with regard to policy aspects, which have been discussed below in detail:

PIM Act

The National Water Policy emphasises on water users' participation in maintenance of irrigation system in their area of operation, distribution of irrigation water to the beneficiary farmers as per the Warabandi schedule, assisting the irrigation department in preparation of water demand and collection of water charges, resolve disputes among the members and WUA, monitoring flow of water in the irrigation system, etc There are two major issues with regard to PIM Act;

- The PIM act has been enacted only in 15 states whereas its importance is recognised at ground level across the country.
- The states where the PIM Act is in existence, it has not been executed in its true spirit.

Existence of CADA

In pursuance of the policy of the Government of India for integrated and comprehensive development of the Command Area of Major and Medium Irrigation projects, the State governments have established Command Area Development Authority by drawing technical and other staff from different departments. Most of the states have exclusively established CADA to implement the CADWM Scheme. The State of Gujarat and Goa have given its responsibility for implementation of the CADWM Scheme exclusively to independent agencies to Sardar Sarovar Narmada Nigam Ltd (SSNNL) and Goa Tillari Irrigation Development Corporation (GTIDC), respectively. In Jharkhand State, the Water Resources Department implements the programme through Executive Engineers at project level. The State of Karnataka has proposed Directorate of CADA for implementation of the CADWM Scheme. The major findings with regard to policy aspects of institutional structure include;

- The states which have CADA or CADA type independent agencies have more focused approach towards execution of CADWM works as per the guidelines as compared to the states where the programme is implemented through independent departments. Also, the quality aspects with regard to WUA formation, farmers' participation, integrated and holistic approach, convergence, etc. are also more focused in CADA based states.

- The implementing agency(s) in most of the States have inadequate technical personal, institution building specialists and other administrative staff to handle enormous work. The Agriculture Department is involved in providing inputs such as seed, fertiliser, pesticide etc. but there is no direct linkage with CADA for providing technical inputs to the farmers. It is paramount important that agricultural personal should be involved in implementation of CADWM scheme by providing technical inputs.

Water Distribution Pattern

There is uneven distribution of water in the command areas. The farmers at head reach get more water because of which they switched to more water requiring crops such as paddy and there is continuous flow of water due to which there is wastage of water at many places. While the farmers at tail end do not get sufficient water to get irrigation at critical stages of the crops. Thus, crop based irrigation scheduling needs to be done for the entire command areas in the states to meet the adequate irrigation needs of any crop during critical stages of the growth for enhancing crop production & productivity.

The water charges need to be fixed on volumetric basis to discourage the wastage of water at head reaches. Water Users Association and local bodies such as Panchayats should particularly be involved in the operation, maintenance and management of water infrastructure/facilities at appropriate levels progressively, with a view to eventually transfer the management of such facilities to the user groups/local bodies.

Operation and Maintenance

Irrigation water charges in most states are not adequate to meet the O&M costs. To fund the activities of farmers' organisations, the state governments have notified proportions of the water tax collection that would be shared among the various concerned organisations in the operation and maintenance (O&M) of irrigation projects. O&M cost is much higher than the recoverable irrigation charges as per present rate. Even though, the low rate is also not being recovered in full, often the cost of recovery of water charges by government is more than the amount recovered. This is creating severe budgetary constraints to government and consequently O&M could not be properly carried out resulting in system deficiency and unreliability of irrigation water to farmers. The WUAs are not able to manage the O&M works with shared amount of water tax.

Fund Flow Mechanism

State Government has to spend own funds for implementation of CADWM and they get reimbursement from GoI. Due to constraint in resources, the release of funds to implementing agency is delayed and the execution of works is hampered seriously. If funds are released in advance on instalment basis as is being done in other Centrally Sponsored Scheme, the CADWM work will be carried out in time bound manner. Also, if the proposals are received in time from the projects, the State Governments will be able to release timely funds.

The State Level Monitoring Committee which has the members from CWC and MoWR may be authorised to approve proposals relating to Land Reclamation, Adaptive Trials, and Correction of System Deficiencies activities instead of referring the same to Core Group, which will save time and help the State Governments to implement the activities within the stipulated time frame.

Beneficiary Contribution

Strengthening financial resources of WUCSs is essential to make them viable. It is required to emphasise on building awareness among the beneficiary communities and motivate them to contribute at a rate of 10% in form of cash or kind. The concept of contribution is not merely a mechanical term but it is related to creating a sense of ownership of the beneficiaries on the assets created in the command area. The WUAs need to be strengthened adequately to motivate the farmers to contribute accordingly.

CHAPTER-13: TERMS OF REFERENCE WISE DESCRIPTION

The terms of reference for the study are as follows:

1. Identification of Inadequacies of the Programme and Subsequent Recommendations on the following:

1.1 General Programme Inadequacies

This includes the various inadequacies related to institutional structure adopted in different states for execution of CADWM programme; physical and financial achievement of the projects covered under intensive study; expenditure pattern covering the cost sharing mechanism amongst Central Government, State Government and the beneficiaries; fund flow mechanism; holistic, coordinated and integrated approach; water use efficiency including water distribution and management; adaptive trials and frontline demonstrations; technical up-gradation; project planning and monitoring; capacity building of staff and WUAs; and private sector participation in CADWM programme.

The findings related to these areas are as follows:

- 14 states namely Kerala, Karnataka, Jammu and Kashmir, Rajasthan, Haryana, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, West Bengal, Bihar, Orissa, Assam, Manipur and Maharashtra have CADA.

- In the remaining States; Irrigation and other Departments/Corporations like Agriculture, PWD, Soil Conservation, Agricultural Engineering, Tube well, Irrigation and Public Health, Irrigation and Flood Control are responsible for execution of CADWM work.

- Most of the projects covered under intensive study carried out more than 75% work on survey, planning and design component of the scheme. In some states like Andhra Pradesh, Goa, Himachal Pradesh, Gujarat and Uttarakhand; the activity was carried out by the Irrigation Department.

- The States namely Punjab, West Bengal, Goa, Gujarat and Maharashtra could not achieve their target in lined channel work during XI Plan. No work of construction of field channel was carried out in the States of Meghalaya, Sikkim, Uttarakhand, Mizoram, Jharkhand and Tripura, and limited work of construction of field channel was carried out in the States of Himachal Pradesh, Assam and Arunachal Pradesh. The unlined channels

were constructed with GoI funds in states like Tamil Nadu, Rajasthan, Madhya Pradesh, Chhattisgarh, Odisha, Punjab, J&K, Gujarat and Manipur. The States namely Andhra Pradesh, West Bengal and Assam are lagging behind to complete the targeted work.

- The Warabandi activity has been promoted in most of the States. Most of the states followed designing of the field channels varying from 1.25 to 4 cusec instead of the CADWM norm of 1 cusec discharge for 40 hectares. This results into reduction of length of channel causing reduction in coverage of area under irrigation.

- Cost sharing is an important part of CADWM programme. In addition to the central and state governments, the beneficiary farmers are also expected to share towards the project cost in form of cash or kind. The concept of beneficiary contribution is linked to create a sense of ownership of the project and subsequently maintain the structures and the systems created in the command area with a view to ensure sustainability.

- In most of the states, it is observed that the flow of funds is smooth and timely from state to CADA to projects. It was observed that the projects claim that delay in funds or non-timely receipt of funds is from Centre to the State and the delay from State to the projects is comparatively less. However, delays, if any, are procedural.

- As regards holistic, coordinated and integrated approach, projects emphasised on construction of engineering structures; and crop demonstrations and training of farmer associations are done by hiring expertise from different departments on deputation or taking the services of line departments especially in the field of crop demonstration, WUA formation and training. There is limited focus on integration of various interventions and agencies required to maximise production, productivity and economic returns per unit of water consumption in the command area.

- The adaptive trials and demonstrations are being planned and executed in the projects by the existing staff within the project establishment or by converging the activity with Department of Agriculture or other agencies including SAUs, KVKs and WALMI.

- Projects are coordinated by engineering professionals. They need to be oriented more on importance of the concept of action research/adaptive trials and replication of the learning on larger scale in the command areas.

- The routine monitoring system does exist in all the states but the same is inadequate in terms of participatory monitoring and evaluation framework that encourages involvement of WUA members and other stakeholders. The technological aids are yet to be initiated in the projects for effective and efficient monitoring and decision making.

The concept of setting the baseline and concurrent monitoring have not taken a shape in CADWM in most of the states.

- Capacity building of the staff is done by organising training programme/exposure visits through WALMI/Agriculture Universities/Other Institutions. But an integrated approach to capacity building (TNA, organising training programmes/exposure visits, follow-up mechanisms and impact assessment) has not been initiated in the projects covered under intensive study. Staff capacities in most of the projects lack in the areas of PIM, Institution building ensuring sustainability of WUAs and promoting the concept of agri business.

- The concept of private sector participation has not been initiated formally in any of the studied projects across the country. According to the State officials, poor road connectivity and lack of marketing facilities are the major hindrances for private sector participation.

The recommendations with regard to the same are as below:

- The state level institutions need to assess their human resource needs and equip themselves with required personnel in the field of institution building; agricultural extension and agri-business to take the concept of WUA managed sustainable approach in the command areas across the projects.

- Linkages may be established with Developmental/Financial Institutions such as NABARD, Banks.

- State Government has to spend own funds for implementation of CADWM and get reimbursement from GOI. Due to constraint in resources, the release of funds to implementing agency is delayed and the execution of works is hampered seriously. If mobilisation funds are released in advance as being done in other Centrally Sponsored Scheme, the CADWM work will be carried out in time.

- The State level Monitoring Committee which has the members from CWC and MoWR may be authorised to approve proposals relating to Land Reclamation, Adaptive Trials, Correction of System Deficiencies activities instead of referring the same to Core Group, which will save the time and help the State Governments to implement the activities within the stipulated time frame.

- CADWM requires a holistic, integrated and coordinated approach at all levels across the states for planning, execution and monitoring of the programme interventions. The strategies and approach to be adopted by the states need to be developed for

identification and active participation of various stakeholders including the line-departments, independent agencies in private sector and the NGOs. The concept of convergence needs to be adequately addressed at state and project levels both.

- The concept of convergence starts from the planning stage in which all the concerned departments and agencies participate and the roles and responsibilities are decided accordingly. Also, the issue has to be discussed at the State level amongst the concerned Ministries so as to issue the common guidelines to ensure convergence at the grassroots level.

- The states need to involve external agencies for capacity building of the WUAs in the framework of participatory irrigation management.

- The major themes may be related to institutional vision building, institutional development, operation and maintenance of micro-command systems, participatory approaches in planning & monitoring, water distribution and measurement, collective approach and agri- business models, convergence with schemes and programmes, establishing linkages with external agencies with regard to inputs and outputs management, etc.

- The devices related to water distribution and water management need to be installed.

- There is a need to promote the concept of water audit so as to ensure equitable distribution of water for irrigation. The water charges need to be fixed on volumetric basis to discourage the wastage of water at head reaches.

- The states may explore possibilities for use of Smart Card for water use system. An exposure visit may be organised for chief functionaries to the areas where such techniques have established their relevance for water distribution system.

1.2 Length of Channel Required per hectare of field (Channel Density) to cover each and every field

The data collected from different projects with regard to existing lined and unlined channel density has been analysed using outliers to reach the national average figure for channel density.

The approach was repeated for selected outlets with discharge capacity ranging from 0.75 to 1.25 cusec to estimate the national average figure for channel density for both lined and unlined field channels.

The approach was also followed for verified outlets covered under intensive study of the projects for estimation of existing lined and unlined channel density, and to estimate the required channel density and percentage of lining of the same. The approach involved consultation with Government officials and farmers, study of chak maps from the field and other relevant study material.

The recommendations with respect to channel density are:

- It is recommended that an average channel density is ensured at a rate of 80m/ha in the command areas with plain to moderate slope
- In case of high slope areas, the channel density is recommended at a rate of 65m/ha.
- It is recommended that 40% (nearly) of the total channel length is lined starting from the outlet to cover each field in the command area.

1.3 Suggest Change of Cost Norms of the OFD works and other Components of CADWM Programme in keeping with the rise in cost of material/labour

Similarly, the data collected for cost norms for different projects under CADWM has been analysed using the outliers to reach the state and national level averages.

The cost estimates have been provided for model designs for lined and unlined field channels; surface and sub-surface drains; survey, planning and design activity; reclamation of waterlogged areas; correction of system deficiencies; OFD etc.

Taking 2012 as a base year, the cost norms for CADWM components may be increased to

- Survey, Planning and Design
  - ✓ ₹ 2000/ha for survey/planning & design,
- OFD Works
  - Lined Field Irrigation Channel
    - ✓ ₹ 948/Rmt for stone masonry,
    - ✓ ₹ 932/Rmt for brick masonry,
    - ✓ ₹ 783/Rmt for cement concrete,
  - Unlined Field Channel
    - ✓ ₹ 102/Rmt for unlined channel

- Construction of field, intermediate and link drains
  - ✓ ₹ 200/Rmt for construction of field, intermediate and link drains,

- Reclamation of Waterlogged Areas
  - ✓ ₹ 29128/ha for surface drainage and
  - ✓ ₹ 70926/ha for sub-surface drainage,
- Correction of System Deficiencies
  - ✓ ₹ 8366/ha for correction for system deficiencies.
- 3% of the project cost may be allocated for software activities including institution and capacity building of WUAs and front line staff, Monitoring and Evaluation and adaptive trials and front line demonstration.
- ₹ 2500/ha as a one-time functional grant be provided to WUAs to ensure repair and maintenance and financial sustainability of WUAs.
- A yearly increase may be considered according to the changing price index during the XII Five Year Plan.
- Cost norms for the difficult areas and the areas under special category may be increased in proportion to the existing cost norms laid down in the guidelines.

2. Make a critical appraisal of the Participatory Irrigation Management Programme as implemented in the states and the functioning of WUAs. Evaluate the strength and weakness of the WUAs including their financial sustainability and ascertain whether the WUAs have been able to achieve their objectives of ensuring equitable distribution of water and proper maintenance of assets.

Review and analysis of PIM Act was done along with the functioning of WUAs, strengths and weaknesses of WUAs including their financial sustainability and the fulfilment of their objectives. Findings are as below:

- 15 State governments, namely Andhra Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Sikkim, Tamil Nadu and Uttar Pradesh have **enacted exclusive legislation** for involvement of farmers in irrigation management. The legal framework created out of these acts resulted in creation of farmers' organisations **at three different levels** of irrigation system i.e. Water Users Association (WUA), Distributory Committee (DC) and Project Committee (PC).

- The major issues with regard to PIM include;
- ✓ The PIM act has been enacted only in 15 states whereas its importance is recognised at ground level across the country.
- ✓ The states where the PIM Act is in existence have yet to execute it in its true spirit with effective participation of WUAs at all three levels.

- Sustainability of WUAs depends upon various factors including equity in water distribution to its members, effective operation & maintenance system, transparency in participatory management system, active participation of WUA members, adequate capacities of WUA office bearers and its members, ensured mechanisms for generating financial resources like water charges, collective approach to access the agricultural inputs and marketing of crops etc.

- The projects across the states mainly focus on construction and management of CADWM work and marginalise focus on strengthening of WUAs.

The recommendations with regard to PIM are:

- The states where the PIM Act is non-existent need to be influenced by the CADWM for taking initiatives to enact the same in their respective states, through:
  - ✓ Organising state level orientation workshops for the stakeholders to be involved in the project on importance of PIM Act;
  - ✓ Identifying and documenting the success stories/case studies which should be shared with the stakeholders in the orientation workshops.

- The states where the PIM Act has been enacted need to be facilitated for holistic implementation of CADWM programme as per PIM guidelines through:
  - ✓ Organising state level consultative meets;
  - ✓ Developing a comprehensive framework for training and capacity building of different stakeholders and execute the same;
  - ✓ Increasing staff motivation through incentives, awards, etc.;
  - ✓ Involvement of external resource agencies experienced in PIM.

3. Make a thorough assessment of the CADWM work that remains to be done in all states with reference to the data available in respect of the medium and major projects of each state and quantify the funds required for completion of the work under the present cost norms.

The data collected from different states has been analysed with regard to the balance work that remains to be completed in the XII Five Year Plan and the corresponding quantum of fund required to complete the work has also been calculated.

Taking the CCA covered till 31st December 2011 for the projects in all the States, it has been found that the total area of balance CCA on which work has to be completed is 8181530 ha. The total estimated cost of the balance work as per the existing norms comes to around ₹ 1771212 lakhs whereas the total estimated cost as per the proposed rates comes to around ₹ 3621005 lakhs.

In addition, information regarding the major and medium uncovered projects has also been been analysed.

Based on the data collected from the respective state offices, the total number of completed projects which can be included in CADWM in future is 514 projects covering an area of 9604325 ha. The total estimated cost as per the existing norms is ₹ 2079240 lakhs while the same cost as per the proposed rates is ₹ 4247417 lakhs.

4. Study the need for extension, renovation and modernisation of the old CAD projects undertaken in the states and assess the investment required for the same.

The information related to extension, renovation and modernisation of the completed CAD projects has been collected and analysed.

Based on the field visits done, following are the recommendations with regard to the need for ERM in the completed projects:

- The field channels need to be constructed additionally to irrigate each of the plots in the command area.
- All the damaged structures such as culverts, foot crossing, diversion boxes, tail end boxes etc. need to be renovated.
- The design of field channels should be followed as in case of on-going projects to renovate the field channels damaged due to improper design.

CHAPTER-14: MAJOR CONCLUSIONS AND RECOMMENDATIONS

The chapter covers the key conclusions and recommendations framed on the basis of the existing context across the states. The farmers in the command areas visited by the study team experience a great impact of CADWM programme across the states. The major impacts of the programme included increased area under irrigation, increased crop production and productivity, shift in cropping pattern, increase in rearing of milch animals and milk production leading to increased employment generation through various agricultural and animal rearing activities. However, there are certain aspects with regard to programme design, policy issues, programme management, sustainability of programme initiatives management and others which need to be addressed at an appropriate level to achieve the overall goal of CADWM.

PIM Act

PIM Act has been perceived as a need of the hour by most of the states. However, the same is non-existent in 12 states. The inaction and execution of PIM Act are the two major tasks to be dealt with by the states in the years to come. In the states where the PIM Act has been enacted, the same is yet to be implemented in its true spirit.

- *The states where the PIM Act is non-existent need to be influenced by the CADWM Programme for taking initiatives to enact the same in their respective states, through:*
    - ✓ *Organising state level orientation/sensitisation workshops for the stakeholders to be involved in the programme on importance of PIM Act;*
    - ✓ *Identifying and documenting the success stories/case studies and disseminating the same on periodic basis to all the stakeholders.*

- *The states where the PIM Act has been enacted need to be facilitated for holistic implementation of CADWM Programme as per the PIM guidelines through:*
    - ✓ *Organising national and state level consultative meets to encourage sharing experiences and learning from each others;*
    - ✓ *Developing a comprehensive framework for training and capacity building of different stakeholders and execute the same;*
    - ✓ *Annual internal review of the programme with focus on PIM indicators and thrird party review for mid-term and final evaluations;*
    - ✓ *Increasing staff motivation through incentives, awards, etc.;*

- ✓ *Involvement of external resource agencies experienced in PIM.*

Institutional Structure

Each of the states has its own structure to execute CADWM works. CADA has been formed in 14 states; some states have independent institutions promoted by Irrigation Department whereas in others, Irrigation Department is directly executing the programme. The State Level Monitoring Committees exist in some of the states whereas the same is non-existent in the others. The institutions seem to be adequately equipped in most of the states as far engineering staff is concerned. However, the same is inadequate with regard to staff for carrying out agricultural extension and institution building.

- *The purpose of setting up Command Area Development Authority (CADA) was to ensure that development of irrigation projects was not just restricted to being an engineering concept; rather it should be promoted based on the multi-disciplinary approach. The existence of CADA assures that there is a single window approach to deal with issues related to CADWM. The states where CADA does not exist have to depend upon convergence with the line departments and research and extension agencies for development of a joint action plan and execution of the same accordingly, which is many times impractical to achieve the integrated and coordinated results.*
    - *It is, therefore, recommended to create a single window approach, that is, establishment of CADA in the remaining 14 states. The state departments need to be sensitised about importance of CADA or CADA type institutional structure to provide a single window approach to the programme. A national level sensitisation workshop needs to be organised for the decision makers to analyse pros and cons of various structures to provide a single window approach.*
- *The state and project level leadership is the key to achieve expected resulst with regard to holistic approach in CADWM especially related to PIM. The leadership must have a positive approach in thoughts and action to ptomote and strengthen community based process in the projects.*
    - *The leadership needs to be deployed and trained on attitudinal and behavioural change (ABC) to work with farming community on social and gender equity and environmental aspects*
    - *Leadership is required to have an extensive exposure to the externally aided projects where such experiments have already been initated. In addition, small scale initiative*

taken up by NGOs will provide them key processes to promote and strengthen PIM related aspects.

- *The state level institutions executing CADWM programme need to assess their human resource needs and to equip themselves with required personnel in the field of institution building, agricultural extension and agri-business management to follow the concept of WUA managed sustainable approach in the command areas across the projects.*

- *State/project level CADWM implementing agencies need to establish linkages with external agencies/institutions dealing with agricultural inputs, agriculture research and extension, marketing, finance etc.*

Effective Financial Management

Timeliness in receipt of funds is a critical input for execution of CADWM works at project level. However, the efficiency of fund flow mechanism is guided by various factors including timing of submission of the proposals from project to state to centre, quality & quantiy of information required for sanctioning the project, time taken at state level for consolidation and submission to centre, time taken at CADWM Delhi for submission to IFD, time taken at IFD level for approval and release of the funds to state treasury, time taken in receipt of funds from state treasury to the department and subsequently to the project, submission of utilisation certificate, etc. The complete cycle of fund flow mechanism is corelated to achievement of physical and financial targets of the project. One of the findings from field visists to various projects across the country refelects delayed receipt of funds for execution which is some time 3 to 6 months due to various reasons. Key recommendations to enhance effectiveness and efficiency of the fund flow mechanism include;

- *Deployment of state level nodal person to deal with CADWM Delhi.*

- *Training and orientation of state level nodal persons on requirements of CADWM Delhi office for approval of the projects and release of the fund.*

- *Establishing internet portal to speed up information flow from both ends*

- *Reducing time taken between CADWM technical wing and IFD through an agreed internal mechanism for speedy release of the funds to the states*

Holistic, Integrated and Coordinated approach

CADWM is a multi-faceted programme dealing with water distribution & management, increasing crop production and establishing linkages between a drop of water and socio-economic returns by synergizing various programmes and schemes prevailing in the states. The concept in many states is yet to be strengthened to achieve the goal of convergence with various actors and agencies.

Integration of various technological interventions including construction of field channels has been done in all states except Sikkim; correction of system deficiencies has been done in 6 states (Karnataka, Tamil Nadu, Rajasthan, Madhya Pradesh, Manipur, Maharashtra); field, intermediate and link drains have been constructed in 15 states (Arunachal Pradesh, Assam, Bihar, Gujarat, Haryana, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh) and reclamation of waterlogged areas has been undertaken in 4 states (Karnataka, Orissa, Bihar, Maharashtra). However, on-farm development works like land levelling, shaping etc. have not been taken up in any of the states under CADWM. Adaptive trials and frontline demonstrations have been carried out in all the states either under CADWM programme or through concerned state departments.

- *The concept of holistic, integrated and coordinated approach needs to be strengthened through:*
    - *Involvement of various stakeholders including Irrigation Department, Agriculture/Horticulture Departments, WUAs, cooperatives etc.*
    - *Developing a participatory action plan for CADWM works involving all the stakeholders with clearly defining their roles and responsibilities.*

- *The issue has to be discussed at the State level amongst the concerned Ministries so as to issue common directives to ensure convergence at the grassroots level.*

Strengthening of Water User Associations

The projects across the states seem to be primarily responsible for construction and management of CADWM work marginalising focus on strengthening of WUAs. WUAs have been formed in many states but the same have yet to reach the required level to become self-reliant and sustainable. Creating sustainable and self-reliant WUA is one of the major goals to be achieved in CADWM programme. WUAs need to have clear institutional vision and mission, clear understanding on their roles and responsibilities, adequate capacities to perform their

roles effectively, transparent and participatory systems and procedures, follow the concept of equity and/or equality, establish linkages with outside agencies including the government, non-government and private, have access to negotiate with departments and other agencies, develop regular source of income, have capacity to deal with internal conflicts, have visionary and dynamic leadership, etc.

- *The states need to develop approach and strategies to deal with issues related to empowerment and sustainability of WUAs. An urgent focus needs to be laid on issues related to effective functioning of WUAs, efficient water use, crop production, processing and marketing through:*

    - *Equipping the projects with required human resources especially in the field of agriculture/horticulture/agri-business, institution building, social & gender equity, etc.*
    - *Enhancing capacities of WUAs at in-situ level. The states need to involve external agencies with regard to capacity building of the farmers' institutions in the framework of participatory irrigation management. The major themes may be related to institutional vision building, institutional development, operation and maintenance of micro-command systems, participatory approaches in planning & monitoring, water distribution and measurement, collective approach and agri-business models, convergence with schemes and programmes, establishing linkages with external agencies with regard to inputs and outputs management, etc.*

Multi-faced Land and Water Management Interventions

The project primarily focuses on construction of lined field channels under OFD works marginalising other land and water management activities such as land smoothening/shaping, field bunding, realignment of field channels, promotion of efficient irrigation systems, promotion of micro-irrigation system, drainage system where problem of seepage has started in the canal system, etc.

- *The states need to develop strategies to address to the issues related to land and water management to enhance efficient water use through water conveyance and application leading to increased crop production in the command area especially to the tail enders. The suggested interventions include;*

    - *Focus on construction of lined channels to increase water conveyance efficiency*
    - *Use of underground pipes to increase water conveyance efficiency*

- *Lnad levelling/shapping to increase water application efficiency*

- *Micro Irrigation activity needs to be given more thrust by offering subsidy to Sprinkler and Drip Irrigation at par with Centrally Sponsored Scheme of Micro Irrigation by including Micro Irrigation component and MI tank in the CADWM.*

Water Distribution and Measurement Systems

The concept of Warabandi is yet to be initiated in many states. The water distribution measuring/control devices such as parshall flumes, notches and weirs are yet to be installed in the command areas of many projects. The concept of auto-transmitters coupled with gauge recorders for speedy and reliable transmission of gauges to the control stations has also got low attention. The benchmarking and water auditing are the crucial aspects to be taken up by most of the states.

- *The devices related to water distribution and measurement need to be installed under selected CADWM projects on pilot basis participary learning with farmers. The learning needs to be documented and shared with with wider audience in farming community so as to motivate and encourage them for adoption and use of water distribution and measurement devices.*

- *There is a need to promote the concept of water audit so as to ensure equitable distribution of water for irrigation. The water charges need to be fixed on volumetric basis to discourage the wastage of water at head reaches. The project officials need to be trained in carrying out the study. Initially an experienced agency may be hired to promote the concept in the projects.*

- *The states may explore possibilities for use of Smart Card for water use system. An exposure visit may be organised for chief functionaries to the areas where such techniques have established their relevance for water distribution system.*

Maintenance of Micro Canal System

It is expected that the WUAs will own and play a crucial role in repair and maintenance of micro canal system after the system is handed over to them. However, the same is almost non-existent in the most of the states. WUAs which have been handed over the charge of water distribution and management system do not understand what role they are likely to play. They hardly own the sytem as the projects are not clear on how to increase WUAs ownership on the

system. WUAs are not even financially equipped to carry out repair and maintenance of the system. In fact, the show is managed by the respective project authorities and it will take long time to WUAs to play a crucial riole in repair and maintenance of the system. At first instance, the project officials are not adequately equipped with clear understanding of the concept on WUA based repair and maintence of the system and approach on how to operationalise the same. There are no clear instructions and guidelines from the state offices with regard to strengthening the role of WUAs in repaqir and maintenance of the system

- The state offices need to issue clear guidelines on involvement of WUAs in repair and maintenance of the system in the line of PIA Act.
- The project officials need to be trained and oriented in operationalising the concept in field. They need to be sent on exposure visists where such initiatives have already been experienced especially in externally aided projects or small scale initiatives under NGOs.
- *WUAs need to be trained and oriented on their role in repair and maintenance. The role of WUAs in collection of water charges also needs to be laid down so as to help them perform their duties accordingly.*

Handing Over Charge to WUAs

The process of handing over the charge of micro canal system to WUAs is going on in many states. However, most of the WUAs do not seem to be adequately equipped with required clarity on their roles and responsibilities and the capacities to manage the system.

- *It is recommended that the states need to rehabilitate the WUAs adequately before handing over the charge of micro canal system through:*
    - *Clarity of roles and responsibilities,*
    - *Clarity on systems for repair and maintenance,*
    - *Clarity on systems for water distribution and measurement,*
    - *Clarity on collection water charges,*
    - *Clarity on maintaining records and books of account,*
    - *Providing the required capacities to perform their roles and responsibilities.*

Farmers Contribution

The concept of contribution is not merely a mechanical term but it is related to creating a sense of ownership of the beneficiaries on the assets created in the command area. Therefore;

- *Strengthening financial resources of WUCSs is essential to make them viable. It is required to emphasise on building awareness among the beneficiary communities and motivate them to contribute at a rate of 10% in form of cash or kind.*

Collective Action for Crop Production, Processing and Marketing

The project interventions are limited to basic training and extension activities. The major intervention with regard to enhancement of crop production, productivity and income from the farming system are yet to be strategized in most of the states. Increased economic benefits to the farmers will strengthen WUAs which in turn strengthen their ownership on system with regard to repair & maintenance, equitable distribution, envrironment sustainability, etc.

- *The states need to promote and establish collective action in the command area for increased crop production, productivity and income. The approach may focus on strengthening the WUAs for collective action with a view to reduce the cost of cultivation by establishing linkages with agricultural input suppliers; increase production through training and extension of improved/advanced technologies; reduce losses during harvesting/threshing, storage and transportation; increase income through improved infrastructure and developing linkages with commission agents and other market players within or outside the project area.*

Planning and Project Monitoring

The holistic approach for monitoring and impact assessment is based on setting the baseline, setting the criteria and indicators, developing tools for information collection, building capacities of the project staff and WUA members involved monitoring, information communication, frequency of information communication, information compilation and analysis, use of results from information analysis by different stakeholders. *It is recommended to develop and execute a comprehensive monitoring and evaluation framework through:*

- *Setting the baseline for measuring the changes periodically and at the end of the project;*

- *An online Management Information System (MIS) needs to be established at the project level which will be connected to state and central offices;*

- *WUAs need to be equipped with the required capacities and guidelines to monitor the programme at the grassroots level.*

Staff Capacities and Motivation Level

The project staff is well equipped with required capacities with regard to construction works in the command areas across the states but most of them lack capacities to strengthen WUAs and innovations required under CADWM. In some cases, the project staff does not feel comfortable and convenient to work with WUAs. The initiative with regard to boost motivation level and to enhance capacities of the staff is an urgent need across the states. *The staff capacities need to be enhanced under CADWM programme through.*

- *Conducting Training Need Assessment (TNA) Study*
- *Identification of training institutions as per the needs emerging from the TNA study*
- *Conducting training programmes*
- *Organising exposure visits to places with demonstrable success stories.*

Channel Density

The changing scenario in the coming XII Five Year Plan is going to face challenges to meet the growing water needs of the farming community especially the tail enders in the command area. The fragmentation of cultivable land is unavoidable. In addition, the socio-economic and socio-cultural environment is changing rapidly, encouraging the distribution of land by the family head amongst his children during his lifetime only to avoid family conflicts. The increased rate fragmentation of land will lead to additional number of plots to be covered under irrigation by providing additional channel length.

- It is recommended that an average channel density is ensured at a rate of 80m/ha in the command areas with plain to moderate slope (upto 5%).
- In case of medium slope (5-10%) areas, the channel density is recommended at a rate of 65m/ha.
- The channel density in the areas with high slope (above 10%) is recommended at a rate of 110 m/ha.
- The field channels up to the first 40% length along with turning points and vulnerable reaches (expecting more seepage losses) should be lined to reduce losses through conveyance.

Cost Norms

The existing cost norms are not much relevant in the present scenario taking into account the increase in the cost of labour and material. It is, therefore, recommended to increase the cost norms.

Taking 2012 as a base year, the cost norms for CADWM components needs to be increased to

- *Survey, Planning and Design at a arte ₹ 2000/ha*
- *Lined Field Irrigation Channel at a rate of:*
  - *₹ 948/Rmt for stone masonry*
  - *₹ 932/Rmt for brick masonry,*
  - *₹ 783/Rmt for cement concrete*
- *Unlined Field Channel at arte of ₹ 102/Rmt*
- *Construction of field, intermediate and link drains at arate of ₹ 200/Rmt*
- *Reclamation of Waterlogged Areas at a rate of;*
  - *₹ 29128/ha for surface drainage*
  - *₹ 70926/ha for sub-surface drainage,*
- *Correction of System Deficiencies at a rate of ₹ 8366/ha*
- *3% of the project cost needs to be allocated for software activities including institution and capacity building of WUAs and front line staff, Monitoring and Evaluation and adaptive trials and front line demonstration.*
- *₹ 2500/ha as a one-time functional grant needs to be be provided to WUAs to ensure repair and maintenance and financial sustainability of WUAs.*
- *A yearly increase may be considered according to the changing price index during the XII Five Year Plan.*
- *Cost norms for the difficult areas and the areas under special category may be increased in proportion to the existing cost norms laid down in the guidelines.*

Extension, Renovation and Modernisation

As per the findings of the field study of the completed projects, around 40% of the channels constructed in the command area have lost their relevance due to change in field boundaries after land consolidation. In addition, the increased number of holdings due to fragmentation needs additional channel length to be irrigated. Nearly 60% structures such a culverts, foot crossing, diversion boxes, tail end boxes have choked due to siltation or damaged by animals and agricultural operations. The field channels were constructed in the completed projects in Uttar Pradesh used 4.5" brick/slabs leading to damage of the same by around 80%. The initiatives to be taken with regard to ERM include;

- *The field channels need to be extended, renovated and modernized (lined with required cross section) to irrigate each of the plots in the command area.*

- *All the damaged structures such as culverts, foot crossing, diversion boxes, tail-end boxes need to be renovated.*

- *The design of field channels should be followed as in case of on going projects to renovate the field channels damaged due to inadequate design.*