GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
MINOR IRRIGATION DIVISION

REPORT OF THE WORKING GROUP ON MINOR IRRIGATION FOR FORMULATION OF THE TENTH PLAN(2002-2007) PROPOSALS

NEW DELHI, AUGUST, 2001

F O R E W O R D

India has 4% of the world's water availability and 15% of world's population to sustain. More than 90% of the annual runoff in peninsular rivers, and more than 80% runoff of the Himalayan rivers occur during months of June to September. Highly uneven distribution of water resources, call for need to store water in various types of storages, small, medium and large to fulfil country's requirement for sustaining population over 100 crores.

Agriculture is main occupation of rural population in India. It contributes about 30% of the National Gross Domestic Product. Irrigation potential from Irrigation Projects increased from 22.6 mha in the year 1950-51 to around 100 million hectares by the year 1999-2000. Food production correspondingly increased mainly due to irrigation from 50.8 million tons in the year 1950-51 to over 205 million tons by the year 1999-2000. Pace of agricultural food production increase during IX plan period has remained rather slow. Investment in agriculture, according to Planning Commission sources, generates three times more employment, as compared to equivalent investment in industry. Basic thrust therefore, should focus towards rapid and sustainable growth of irrigated agriculture, as 60% of nation's food production is contributed by irrigated area.

During Xth five- year plan, as the country strives to achieve a growth rate of 8%, importance of a strategy, oriented towards rapid and sustainable growth in agriculture can not be over looked. Investment in irrigation sector is the key to strengthen our rural infrastructure. Access to reliable irrigation, when equitable, is known to be amongst most powerful and versatile intervention, against rural poverty. This fact is also well recognised in National Agenda for Governance (1998) as well as in report of National Commission for Integrated Water Resources Development (1999).

The ultimate irrigation potential of the country is estimated at 140 million hectares, out of which the share of minor irrigation is 58.58% i.e. 81.54 million hectares. Minor irrigation schemes are expected to irrigate 51.9 mha by end of IX five- year plan

(2001-2002). Minor irrigation schemes are environment friendly and provide gainful employment opportunities to the rural population, resulting in optimum utilization of resources. This also contributes to rural economic growth and support numerous vegetable and food processing units.

Nation's population has crossed figure of 100 crores as per census 2001. Population growth at present estimated around 2% per annum, would necessitate corresponding increase in national food production. According to an estimate, food production needs to be increased by 20 Million Tons during X five-year plan period (2002-2007) so as to reach 220 Million Tons. Working Group has assessed, that proportionate share of minor irrigation sector, @ 60% would be to create additional irrigation potential of 8 Million Hectare to achieve additional food production of 12 Million Tons.

We have to meet the challenges of food security in Minor irrigation sector, which calls for revision of Govt. policies, procedures and institutional changes to enable economy to grow at the rate of 8% during Xth plan period, as is being stressed, by the Planning Commission recently. Working Group has felt that, inspite of large national investments, Minor Irrigation sector remained neglected due to lack of coordination, executive control and lack of accountability amongst various central and state Govt. departments. We have accordingly proposed creation of Minor Irrigation Development Organisation (MIDO), with clear vision, foresight and transparency to implement minor irrigation programme proposed in Xth five year plan. Minor Irrigation Development Organisation will be armed with policy formulation framework for action plan, to achieve the targets set for irrigation development and appropriate monitoring mechanism.

Principal thrust in the programme is provided for modernization and improvement of existing irrigation tanks, besides taking up large numbers of Minor Irrigation schemes. An additional area of about 0.7 mha is proposed to be brought under irrigation by modernization, improvement and extension of canal system of existing tanks. Special

attention is given for restoration of potential of existing minor irrigation tanks covering a large area of 1.1 mha. Minor irrigation development is proposed to be accelerated in Tribal Districts. It is this sustainable development vision, where ecology, meets economics.

Ground water resources development is proposed with foresight, vision and re-orientation, by priortising development in 'safe' and 'semi critical' areas. Special attention is proposed to be given for better water management and improvement in irrigation efficiencies. It is expected that Minor Irrigation schemes will provide better opportunities for participatory irrigation through relatively smaller and cohesive participartory irrigation associations. Recent scientific perceptions on economical use of water have been incorporated. Minor Irrigation schemes during construction and operation, will provide gainful employment totaling to about 3720 million man days and provide opportunities to rural women and people living below poverty line and utilize their productive potential.

Funds constraint situation in financing the irrigation sector/minor irrigation sector, may necessitate lowering of additional irrigation targets and consequently call for reduction of food production targets set for X Five Year Plan. Therefore, once reports of all the Working Groups of irrigation sector are received prioritisation exercise could be carried out during the next meeting of the Steering Committee on irrigation based on reduced irrigation and food production targets for the X Five Year Plan.

Drafting committee's meeting was held on 25th June, 2001 to finalise the draft report of the working group. Data available in Central Water Commission and statistics cell of Ministry of Water Resources was beneficially utilized.

The 5th meeting of the Working Group was held on 26.07.2001 wherein the draft report was placed before the working group. After discussions, the draft report was approved with minor modifications. Final meeting of the Drafting Committee was held on 23.8.2001, wherein the Draft Report of the Working Group was finalised for its submission to the Planning Commission.

Members of the Working Group both official and non official spared their valuable time and attended most of the meetings and substantially contributed towards preparation of

chapters of the report. I would therefore like to personally thank all the members of the Working Group for their excellent cooperation and support. I feel that particular mention needs to be made about non official members Sarva Shri A. Mohankrishnan, Adviser to Government of Tamil Nadu (WR), M. Krishnappa, Former Secretary to the Government of Karnataka, S.S. Sohani, Former Commissioner, Ministry of Water Resources, R.S. Saxena, Former Chief Engineer, Ministry of Water Resources and Shri Vasimalai, Executive Director, DHAN Foundation, Tamil Nadu who were helpful in preparation of various chapters assigned to them.

I would like to record my special appreciation towards Shri V.P. Shiv, Senior Joint Commissioner, Minor Irrigation and his Private Secretary, Shri L.Srinivasan for all the secretariat support in organizing the work of the report preparation and liaison with Planning Commission. I also thankfully acknowledge the efforts made by Shri. O.P. Mishra, Director Statistics, Ministry of Water Resources and Shri V.N. Kathpalia, Dy. Commissioner(MOWR) for procuring statistical data and preparation of various tables for the report.

I would finally like to thank Shri B.N. Navalawala Secretary, Shri Palat Mohandas, Addl. Secy., Shri A. Shekhar and Sh. M.K. Sharma, Commissioners, Ministry of Water Resources and Shri P.S.S. Thomas, Addl. Secy. & Adviser, Water Resources, Planning Commission, who attended meetings of the working group and contributed substantially in preparation of the report of the Working Group.

I record my personal appreciation for all help and cooperation, that we, in the Working Group, received from many individuals in Ministry of Water Resources and Planning Commission.

(M.S. Billore)

Former Secretary (WR),
Government of Madhya Pradesh,
Chairman, WorkingGroup.

CONTENTS

EXECUTIVE SUMMARY

1.0 The Working Group on Minor Irrigation Programme for formulation of the tenth five year plan (2002-2007) was constituted by the Planning Commission vide their letter No.25(1) D-2000-WR, Nov, 20th 2000, Dec. 19th , 2000 and March 2nd, 2001 (Appendices 1,2,3) Shri M.S. Billore, Former Secretary, Water Resources Deptt., Madhya Pradesh was appointed as Chairman of the Working Group.

Four meetings of the Working Group were held (17th January, 7th Feb., 15th March and 11-12 April, 2001). During the meetings most of the report chapters drafted by members were discussed (appendix 4). During the 4th Meeting, the working group constituted the Drafting Committee to be chaired by Shri Palat Mohandas, Addl. Secy., Ministry of Water Resources (appendix 5).

The First meeting of the steering committee of the Planning Commission on irrigation sector was held on 31.05.2001. The committee felt that Working Group should lay emphasis on renovation, improvements of existing minor irrigation tanks and canal systems. Steering Committee, also recommended that special priority be given and funds be provided accordingly for minor irrigation schemes in Tribal Districts.

The meeting of the drafting committee was held on 25.06.2001 and the draft report was finalised. The 5th and final meeting was held on 26th July, 2001 wherein the draft report was placed before the Working Group.

The Working Group for the Xth Five Year Plan has proposed Minor Irrigation development with emphasis on modernisation and improvement of existing irrigation tanks in the country. Special attention is also proposed in respect of Minor Irrigation development in Tribal districts of the states and union territories. Proposals are in conformity with the National Agenda for Governance adopted by the Central Govt. Financial outlays in the State sector, and Central sector have been proportionately increased including institutional funding.

2.0 India has a history of progressive irrigated agriculture. Irrigation potential of 22.6 mha in 1950-51 has now reached around 100 mha. Food production increased from 50.8m tonnes in 1950-51 to about 208 m. tonnes by 1999-2000. Considering the demand of the nation and to create a reasonable export surplus we need to plan 500 m. tonnes by 2050 AD. Out of 1953 BCM of country's water resources only 1086 BCM and utilizable surface water resource is 690 BCM and balance 396 BCM is estimated to be available from ground water resources. However, the expenditure on irrigation uring the first plan (1951-56) was about Rs.442/

crores which was 23% of the total expenditure. This percentage has constantly declined and came down to 6% which needs serious considerations. Minor Irrigation sector's utilisable irrigation potential is estimated as 81.54 mha. Out of the 13.02 mha surface water potential created upto 1999-2000, the actual utilisation was only 8.27 mha. The irrigation potential from ground water resources created upto 1999-2000 is about 53.01 mha and the actual utilisation has been 41.80 mha.

The targets of potential creation and achievement during the IX five-year Plan were 7.24 mha and 4.93 mha respectively. However, the potential created upto March 2000 is 3.6 mha while actual utilisation is 2.76 mha only. Considering the development of water resources sector as a whole, it is observed that ground water resources are continuously being exploited in most of the river basins except the Indo-Gangetic plains and the Brahmaputra basin. It is therefore necessary to have appropriate planning on integrated water resources development in the minor irrigation sector. The utilisation/performance of irrigation and the management of minor irrigation sector has not received due attention. Vital areas of improvement to be addressed are optimisation of irrigation capacity including renovation and modernisation of irrigation projects, change over from land irrigation to crop irrigation, renovation and restoration of tanks along with new tanks, promotion of water conservation devices, pricing of water for raising funds for regular maintenance and conservation of water and peoples participation in minor irrigation sector.

An additional irrigation of 12 mha was proposed in the report of the Working Group on Minor Irrigation for formulation of the IXth Five -Year Plan. This figure was reduced to 7.24 mha by the Planning Commission.

Nation's population has crossed figure of 100 crore as per census, 2001 population survey. Population growth at present estimated around 2% per annum would necessitate corresponding increase in National Food Production. According to an estimate, food production needs to be increased by 20 million tonnes during X Five Year Plan period (2002-2007) to reach 220 million tonnes.

Working Group has assessed that proportionate share of minor irrigation sector @ 60% of targeted irrigation would create additional irrigation potential of 8 mha to achieve additional food production of 12 million tonnes. It is further proposed to provide physical target of 3 mha from surface water resources and 5 mha from ground water resources.

"Breakup of 3 Mha from surface water resources is proposed as 2.4 Million Ha from New Minor Irrigation Schemes and 0.6 Mha from

Renovation of existing tanks. Sustainable Ground Water development in safe and semi-critical areas for creation or additional potential of 5 Mha".

We have to meet the challenges of food security in minor irrigation sector, which calls for revision of Govt. policies, procedures and institutional changes to enable economy to grow at the rate of 8% during tenth plan period as is being stressed by the Planning Commission recently.
It is of utmost national interest that programme of modernisation and improvement of tanks to be taken up in different districts of the country. This will comprise of two categories of existing tanks. Rs. 3600 crores are proposed to be provided for modernisation of existing tanks resulting in increase of additional irrigation potential to the extent of 0.6 mha. Rs. 3600 crore has been proposed to be provided for the second category of existing tanks. These will be so selected so as to restore the lost irrigation potential around 0.9 mha.

In accordance with National Water Policy 1987 and suggestions from first meeting of Steering Committee on Irrigation Sector, priority is also accorded to minor irrigation schemes in Tribal Districts. Rs. 800 crore is provided for renovation of existing minor irrigation tanks in tribal districts to restore lost potential of 0.2 mha and Rs. 500 crore has been provided to take up new minor irrigation schemes to increase the irrigation potential to the extent of 0.1 mha. Thus restoration of existing tanks would regain 1.1 mha of the irrigation potential.

3.0 Tank irrigation has been prevalent in the States of Maharashtra, Madhya Pradesh, Orissa, Karnataka, Andhra and Tamil Nadu. There are nearly 4.4 lakh tanks existing in the country. Being a very old irrigation system tanks were traditionally considered to be assets by the princely states and created by state funds. However, their maintenance has always been neglected by the rulers. Many of village irrigation tanks have lost their capacity due to silting, weed growth and structural erosion. Feeder channels are not functioning due to encroachment and distribution network has been disrupted. Tanks are basic resource for irrigation, drinking water, domestic use for people and animals, recharging ground water, fuel wood and timber, fish production, fodder, environment and silt and sand for construction.

Current scenario of tank irrigation is discouraging. Deterioration of tank irrigation, has been due to, break down of related local institutions, departments apathy, encroachments, lack of farmers initiative and involvement and meagre resource allocation. About 1.7 mha of net command area is reported to have been lost under tank irrigation. It needs determined efforts to revive the tank irrigation system. This would require large capital investment in restoration and renovation of old tanks. Therefore, an amount of about Rs. 7200.00 crore has been recommended

by the Working Group for modernisation and improvement of existing tanks. Institutional support will be provided by Minor Irrigation Development Organisation (MIDO), which is proposed to be created in the centre and the states by redeployment of existing staff from various Government organisations. MIDO will also oversee the renovation and restoration of old tank systems to regain and enhance their capacity as well as create more tanks to generate new potential.

4.0 Improvement in irrigation efficiency along with modern management methods can go a long way in achieving designed irrigation potential in Minor Irrigation Schemes. National Commission for Integrated Water Resources development (NCIWRD) September, 1999, has suggested to improve overall irrigation efficiency from the present level of 30% - 40% to 50% by year 2015 and upto 60% by year 2025. Similarly NCIWRD has suggested to improve ground water irrigation efficiency from the present level of 65% to 72% by the year 2025.

Operational irrigation efficiency can be improved by appropriate water allocation, mode of canal operation, minimisation of canal seepage losses and improving field irrigation methods. Levelling and land shaping, On-Farm Development, irrigation through 'network of field channels, participatory irrigation management, providing appropriate training facilities and knowledge about scientific irrigated agriculture are equally important.

5.0 Water is a state subject and minor irrigation sector as a whole is planned, investigated and implemented by the States, Government of India is assigned the task of policy planning, research and development, performance evaluation and means to increase additional area irrigated from Surface Water Minor Irrigation Schemes and Ground Water Minor Irrigation Schemes. Investment made in the Minor Irrigation Sector in the past, remained uncoordinated amongst Ministry of Water Resources and various ministries of Government of India, State Governments and financial institutions. Correct and realistic statistics of Minor Irrigation sector are difficult to obtain. There is no satisfactory monitoring of development or over exploitation of the water resources, which already suffer from topographic constraints in case of surface water and water availability constraints in the case of ground water.

Therefore, there is need to create a regulatory mechanism for Minor Irrigation Sector at Central and State level to look after all the aspects of development. It is recommended to create a Minor Irrigation Development Organisation envisaged as a professional organisation at the Central and State level. The responsibilities of this organisation would be, policy planning for development of the sector based on the data collected from various agencies, assessment of surface water and ground water

potential and utilisation, collection, storage, retrieval and communication of relevant data and information at the central and state level. The organisation would also be responsible for identification of thrust areas, formulation of guidelines for survey investigations, design, execution, operation and maintenance of Minor Irrigation schemes including conjunctive use of surface and ground water. The organisation will also plan for training of officers and beneficiaries in the field of water management, distribution, network, participatory irrigation management, formulation of guidelines for Govt. and institutional funding and linkages for resource mobilisation and co-operation amongst various agencies of central and state Govt. Such a mechanism will therefore need institutional arrangements at the central; state and district level with appropriate staff and office automation, computerisation and communication facilities. The staff will be suitably drawn from various Government organisations at Centre and States.

Working Group has therefore recommended, with utmost urgency, creation of Minor Irrigation Development Organisation at the central and state level. Correspondingly, a provision of Rs. 10.00 crore at Centre and Rs. 200.00 crore for States and Union Territories is recommended.

6.0 During the past five decades, there has been phenomenal increase in the growth of ground water abstraction structures. Their number has increased from 4 million in 1951 to 17 million in 1997. The ground water development has been intensive in alluvial areas of Indo-Gangetic plains of Punjab, Haryana, Uttaranchal and Uttar Pradesh and in parts of hard rock region in the Southern states. In many arid and hard rock areas, over draft and associate water quality problems are increasing. Ground water Resources could be augmented by recharging techniques. Stress would need to be laid on conjunctive use of surface and ground water in the irrigated command of minor irrigation schemes. Integrated approach for ground water management needs to address identification and protection of potential source of fresh ground water, alongwith sustainable ground water development, data base management, monitoring network, conjunctive use of water in irrigated command areas, recharge of ground water and evaluation studies of ground water development. A sustainable ground water development approach will require appropriate weightage to the classification of ground water potential as Safe, Semi-critical, Critical and Unsafe. Activities of ground water development will need appropriate prioritisation of exploration. Working Group has therefore recommended Rs. 600 crore in the central sector to Central Ground Water Board (CGWB) for these activities. An amount of Rs.12,500/- crore is proposed in state sector for development of 5 mha additional irrigation.

7.0 Participatory Irrigation Management (PIM) has a long history in irrigated agriculture. This has been present in one form or other in the old princely

states and thereafter during British rule also. After the independence, many states tried to encourage PIM through various programmes. However, it has been observed that PIM has worked very well only in those projects which are externally funded or receiving substantial Govt. support.

Participatory Irrigation Management would have been better implemented in Minor Irrigation Schemes, but for the reasons that these schemes, surface water or ground water, have remained neglected. Lack of maintenance of storage reservoirs and distribution network has contributed to the deterioration of this sector. Once partially disowned by Govt. and not transferred to the beneficiaries, a kind of confusion has been generated amongst the users. Some of the beneficiaries, therefore, switched over to private dependable water supply for irrigation.

If the PIM is to be encouraged in MI Sector, Govt. will have to come up with suitable legal and crop insurance packages with an assurance of timely and agreed irrigation waterings. Education and training of the beneficiaries is an essential part of the success. This would need clear delegation of responsibilities and the rights of the Govt. and the beneficiaries, institutional arrangements with financial and human resources, agricultural extension programme and crop insurance. On the beneficiaries side the arrangement could be at three levels i.e. Water Users Associations, Distributory Level Society and Minor Irrigation Project Level Council. For a proper interaction between the Govt. and the beneficiaries institutions, as above, Minor Irrigation Development Organisation could provide necessary guidelines. Working Group has recommended an amount of Rs. 75 crore in central sector and Rs.25 crore in State sectors for this purpose. Working Group has also recommended Rs. 115 crores for CADA activities and Rs. 100 crore for the Centre and Rs.25 crore in the State sector for irrigation in water deficient areas by sprinkler and drip irrigation system.

8.0 Water as an input in irrigated agriculture is no more a free commodity. At the same time an irrigation project need not be considered to be funded by users alone. However, the operation and maintenance of distribution network could be handed over to the users. Storage reservoir and main canal could be operated by the Government but the lower distribution network could be maintained by the users. In a Minor Irrigation scheme what could be handed over to the users will depend upon size of the scheme and the level of users awareness and participation.

Govt. has been considering to price the water for the last two decades. Vaidyanathan Committee, in 1992, recommended a two part tariff comprising a fixed charge of Rs. 50/- per ha applicable to entire command area as a membership charge and a variable charge per ha of irrigation that

would recover the annual operative and maintenance cost and 1% interest on capital cost. The recommendation was endorsed by Govt. of India except the fixed charge. States did not agree to it.

Pricing of irrigation water rate is another most important factor, which needs to be reviewed by States. State like Maharashtra has adopted realistic water pricing resulting in availability of more financial resources for better operation and maintenance. Pricing of water for various users is to be rationalized so as to at least fully recover the operation and maintenance cost of irrigation system.

9.0 Natural resource base of any country, its land water and forests must be productively used and conserved, not merely preserved. The growing scarcity and inter sectoral competition of water, however, is a matter of serious concern for further advance in poverty alleviation. Food production is likely to be adversely affected particularly in the semi arid regions of the country for want of irrigation water. The total water demand for the year 2050 is around 1180 BCM against the country's utilisable water resources of 1086 BCM. Thus almost the entire utilisable water resources of the country would be required to be put to use by the year 2050. Funds for irrigation sector has been declining with respect to total plan size gradually. It has reduced from 23.25% in the Ist Plan to 6% in IXth Plan.

However, considering the national investment on Minor Irrigation sector, serious and concerted efforts are to be made to improve the sector.

To summarise the overall strategy as proposed in the Tenth Plan will be to address the following issues in Minor Irrigation Sector :-

1. To bridge the gap between the potential created and its utilization through proper institutional arrangement at central and state level, like proposed Minor Irrigation Development Organisation (MIDO).

2. Restoration improvement and modernisation of existing tank irrigation system.

3. Development of additional irrigation through new Minor Irrigation Schemes with emphasis on exploration of surface water potential.

4. Integrated development of surface water and ground water.

5. Special schemes for development of Minor Irrigation in Tribal Districts.

6. Participatory irrigation management.

7. Command area development activities in large Minor Irrigation schemes with a CCA between 500 to 2000 ha.

8. To promote measures to improve irrigation efficiency and water conservation by Sprinkler and Drip Irrigation.

9. Pricing of water, at least to cover the cost of operation and maintenance of storages and distribution system.

10. Sustainable ground water development with proper classification of area as Safe, Semi-critical, Critical and Unsafe.

11. Priortisation of exploration work by Central Ground Water Board to achieve economical and sustainable development of ground water and augmentation of ground water resources by recharging technique.

Programme for providing 8 mha of additional irrigation in the Xth Five Year Plan is based on above stragegy.

10.0 Institutional credit is provided by rural financial institutions i.e. banks with refinance support from National Bank of Agriculture and Rural Development (NABARD). Institutional investment during second Five Year Plan (1956-61) was only Rs. 19.15 crore, which has steadily grown to Rs. 2659 crore during IX Five Year Plan where as the expenditure incurred so far during IX Five Year Plan in minor irrigation sector is about Rs. 1595.54 crore (upto 1999-2000) as per the data available in MOWR.

Physical targets planned during IX Five Year Plan are 11.40 lakh Dugwells, 17.63 lakh Shallow Tubewells, Borewells and installation of 35.15 lakh Pump Sets. Projected unit cost is Rs.15400 per centrifugal pump set, Rs. 21000 per shallow tubewell and Rs. 35000/- per Dugwell. Unit cost of deep Tubewells is around Rs. 6 to 8 lakhs depending on depth, location and discharge. For X Five Year Plan year 2002-2007. NABARD has prepared financial programme of Rs. 9963.93 crores for ground water excluding cost of pumpset which are mostly financed in private sector. As regards surface water minor irrigation schemes, NABARD has proposed investment of Rs. 2700 crore. NABARD has also proposed for investments in Drip Irrigation systems and Sprinkler systems for better water management. An institutional credit of Rs. 2361.21 crore is provided in tenth five year plan to fulfil physical target of 5 lakh drip irrigation systems and 8 lakh sprinkler systems. It is equally important

that irrigation pumpsets are energised early, for which NABARD has proposed to share cost of energisation with electrification corporation.

There is a large gap between requirement of credit as projected for the Xth Plan and refinance distributed by NABARD in three years of IXth Plan. An over all provision of Rs. 10000/ crore is recommended by the Working Group for institutional finance during X Five Year Plan. Working Group has also recommended that the provision of private investment of about Rs. 3000/ crore may be made to cover purchases of pumpsets and other miscellaneous facilities. Rs.2000/ crore is anticipated to be made available from various Central Ministries for development water sector in rural areas.

11.0 For optimum development and efficient utilisation of water resources, it is essential to have dependable database. There is a need to ensure that the Centrally Sponsored Plan Scheme "Rationalisation of Minor Irrigation Statistics (RMIS) is implemented in the most efficient manner. For this purpose, the Statistical Cells under the RMIS scheme in the remaining States/UTs should be created immediately. Further, all the Statistical Cells should be provided with comprehensive facilities. This would help in immediate retrieval of data as and when required for policy formulation, planning etc. The entire RMIS schemes and other monitoring arrangements will be under guidance and administration of Minor Irrigation Development Organisation.

The State coordination committee has been set up in each State to resolve any difficulty in obtaining relevant data from various agencies implementing minor irrigation development either as main or subsidiary programme. However, it has been observed in the past that these committees do not meet to take stock of the situation even once in a year. It is necessary that RMIS scheme would continue in the X Five Year Plan in all the States and UTs.

The 3rd Census of Minor Irrigation Projects with reference year 2000-2001 has been launched in all the States/UTS. Concerted efforts should be made to ensure that the Census work is completed in a time bound and comprehensive manner. The data on area irrigated should be recorded separately. Quite a large number of tube wells and dug wells are being constructed in the commands of major and medium irrigation projects. The area benefited by such minor irrigation schemes cannot be ignored. In addition to the above, the reconciliation of data compiled by the Government Department implementing irrigation development and the land use statistics should be taken up at District level. For this purpose, it is necessary to ensure that in the Land Use Statistics, the classification of irrigation sources such as Major, Medium and Minor is specifically mentioned. Further, under Minor Irrigation, the classification of source

should be mentioned as Dug well, Shallow Tube well, Deep tube well, Surface flow and Surface lift irrigation. Rs.40 crore is proposed in Central sector for the RMIS scheme.

12.0 Research and Development is an integral component of Water Resources Management. This objective of research and development in water resources sector include improvement in technologies to plan, investigate, construct and manage the water resources more efficiently in an optimum, integrated and harmonious manner. The science and technology input in minor irrigation sector mainly consists of scientific approach for survey, investigation, design and construction of minor irrigation projects. In the operation and maintenance stage the scientific input will be required in the form of measured water supply for optimal crop production and higher irrigation efficiency.

The Research and Development in the field of controlled irrigation is necessary for conservation of surface water, soil moisture and conjunctive use of ground water. During the rainy season scientific management is involved in prevention of water logging by provision of adequate drainage and to facilitate ground water recharge. During irrigation season in the non monsoon period the strategy would call for appropriate irrigation techniques and scheduling scientific irrigation practices are called for to achieve higher irrigation efficiency and water management. It is recommended that extensive research and development activities could be conducted on pilot projects considering agroclimatic zones, hydromet data, soil classification, moisture retention properties and drainage. These results could be incorporated in planning and design of minor irrigation projects locate in similar agro climatic zones. To obtain better results in irrigated agriculture, multidisciplinary approach consisting of soil sciences, agronomy, croping patterns and drainage capacity should be adopted. The Working Group has proposed Rs.100 crore for R&D.

13.0 The Working Group on Minor Irrigation for IX Five Year Plan recommended an outlay of Rs.1450 crore in Central Sector, Rs.10,000 crore in State sector and anticipated investment of Rs.18,000 crore by institutional and private funding. Thus total outlay for Minor irrigation Sector was anticipated as Rs.29,450/- crore. This was also anticipated that additional irrigation potential of about 12 mha will be created. In the Xth Plan proposals the Working Group has proposed additional irrigation of 3 mha from surface water irrigation. The Working Group has laid emphasis on modernisation and improvement of existing tanks, special schemes for tribal districts and creation of Minor Irrigation Development Organisation. The Working Group has proposed 5 mha additional irrigation from ground water resources.

Considering the cost of these works and appropriate infrastructure, large capital investments are to be made in initial stage, the Working Group has recommended an outlay of Rs.36200/- crore in central sector, state sector,

institutional finance and private funding. This would generate an employment potential of 3720 million man days.

Women's participation

There is considerable scope for gainful employment for women as they contribute to and benefit from rural minor irrigation schemes. Women's role is not limited to participate as field workers or farmers in small scale irrigation projects. They also participate in institutional arrangements such as Water Users' Association or Water Committees. It is envisaged that women will also be assigned important role in Minor Irrigation Development Organisation at the district level during the X Plan period. This is briefly narrated below:-

1.	Women as labourers	Village level
2.	Women as farmers and decision takers	Village level
3.	Women as water Users' Committee members	Village/ Project level
4.	Women as Advisory/Regulatory level in MINOR IRRIGATION DEVELOPMENT ORGANISATION	District level Block level

Training of beneficiaries and administrative units is necessary part of development. As the newer techniques and concepts are being experienced in irrigation sector appropriate training modules could be introduced at all levels. Areas of training which need immediate attention are policy planning for development of the sector, formulation of guide lines for design and execution, distribution of water and water management, extension programs for water application conservation and water management and marketing of food products. Minor Irrigation Development Organisation could be incharge of educating and imparting training to all concerned.

14.0 The break up of additional irrigation proposed in the X Five Year Plan and provision of outlay is described below. The development of surface irrigation will comprise of new minor irrigation tanks, lift irrigation schemes and pick up weirs etc. The cost of these schemes has increased due to R&R cost and cost of other environmental mitigation measures. Admittedly over all average cost/ha would swing around Rs.60,000/ha.

Modernisation and improvement would involve renovation of existing tanks, canals and in additional would enhance the commanded area and canal system. The provision of Rs.60,000/ha. has been made accordingly. In order to regain the designed irrigation capacity, renovation of existing minor irrigation tanks is proposed. This would include restoration of dams to its designed profile, redesign of waste weir where needed. Renovation/replacement of head sluice and renovation, resectioning of canal along with lining/land acquisition of canal alignment where called for. An overall provision @ Rs.40,000/ha is made to accommodate cost of entire construction works involved.

Renovation of existing minor irrigation schemes in Tribal Districts would create additional irrigation potential for which rate of Rs.40,000/ha is proposed as local labour are relatively cheaper.

The environmental costs including payment of land compensation, rehabilitation has considerably escalated during last 5 years and as such overall workable rates have been proposed.

Tenth Five year Plan Proposals (Year 2002-2007)

A.	**PHYSICAL**		
	Proposed Target for Development of Irrigation Potential		8 mha
	(i)	Surface Water Schemes	3 mha
	(ii)	Ground Water Schemes	5 mha

B	**FINANCIAL REQUIREMENT**	Amount in Rupees (Crore)	
		State Sector	Central Sector
1.	Provision for Development of Additional Irrigation	26300	
2.	Provision towards Research & Development	-	100
3.	Provision towards Development of CAD activities in minor irrigation schemes having CCA between 500 - 2000 mha.	-	115
4.	Provision towards modernisation and improvement of existing tanks	7200	-
5.	Special schemes for Tribal Districts for development of minor irrigation schemes	1300	-
6.	Provision for rationalisation of minor irrigation statistics schemes	-	40
7.	Provision for creation of Minor Irrigation Develop -ent Organisation at the Centre and in the States for m irrigation data base management and professional upgradation of minor irrigation schemes (Central/States/UTs/ MIDO)	200	10
8.	Provision towards sprinkler and drip irrigation and Measures to improve irrigation efficiency	25	100
9.	Provision towards Participatory Irrigation Management (PIM) of minor irrigation schemes	25	75
10.	Provision towards performance evaluation studies	-	10
11.	Provision towards equity for privitization	-	100
12.	Central Ground Water Board including artificial recharge	-	600
	Total (1 to 12)	35050	1150

C	**FINANCIAL RESOURCES FROM NABARD, PRIVATE FINANCE AND OTHER MINISTRIES**	Amount in Rupees (Crore)		
		Institutional and Private Sector	State Sector	Central Sector
13.	Assistance available from Institutional Finance (NABARD)	10000		
14.	Private Investment (20% of Institutional Finance)	3000		
15.	Government funding in Rural Development		2000	
	Total (13+14+15)	15000		
D.	**TOTAL OUTLAY REQUIRED TO MEET THE TARGET**	State Sector	Central Sector	
16.	State Sector Plan Outlay(35050-10000-3000-2000)=	20050		
17.	Central Sector Plan Outlay		Rs. 1150	
18.	**Net Outlay** Total Rupees crores	21200		
19.	**Gross Total Outlay** Rupees crores	36200		

BREAK UP OF ADDITIONAL IRRIGATION PROPOSED IN TENTH FIVE YEAR PLAN AND PROVISION OF OUTLAY

S. No.	Particulars	Qty. (mha)	Rate/ ha	Amount (Rs. in Crores)
1.	Development of Minor Irrigation from New Minor Irrigation Schemes	2.3	60000.00	13800.00
				13800.00
2.	Modernisation and improvement of existing tank for creation of additional potential	0.60	60000.00	3600.00
2.A	Renovation of existing Minor Irrigation Tanks to restore irrigation potential (This includes desilting of existing minor irrigation tanks) (0.9)		40000.00	3600.00
	Sub Total 2 & 2 A			**7200.00**
3.	New Minor Irrigation Schemes in Tribal Districts/ Blocks.	0.10	50000.00	500.00
3.A	Renovation of existing Minor Irrigation Schemes in tribal District ton restore irrigation potential (This includes desilting of existing minor irrigation tanks) (0.2)		40000.00	800.00
	Sub Total			**1300.00**
Total Restoration (1.1 M.ha) (Sub total 2A + 3A)				
4.	Minor Irrigation Ground Water Schemes	5.0	25000.00	**12500.00**
5 (a)	Addl. Irrigation from New Minor Irrigation Schemes.	**8.00 mha**		
(b)	Restoration of existing Minor Irrigation tanks to its designed irrigation capacity	**1.1 mha**		
			Total	**35000.00**

CHAPTERS

CHAPTER - I

IMPORTANCE OF MINOR IRRIGATION

1.0 Agriculture is of fundamental importance in India's economy. While investments in agriculture amount to only 11 percent of gross domestic investment, it contributes 28 percent of GDP and generates two third of the employment. It generates some 10 percent of total exports following the economic liberalisation programme which commenced in the early 1990s. The irrigated agriculture contributes nearly 56% of the agriculture out put.

1.1 SCOPE & OBJECTIVES OF THE WORKING GROUP

Planning Commission G.O.I. constituted working group on the Minor Irrigation Programme for the Formulation of X Five Year Plan (Year 2002-2007) vide their letter No,25(1)D-2000-WR Nov 20th, 2000 and Dec 19th,2000, 2nd March, 2001, Appendix 1, 2, 3.

Scope & Objective of the Working Group is to formulate proposals on Minor Irrigation for the X Five Year Plan. This objective is to be achieved by the review of performance of various components of Minor Irrigation sector during the period of the IX Five Year Plan, and frame appropriate policy for achieving the physical targets, based on identification of surface and ground water resources and financial resources.

Scope of the report is confined to performance of minor irrigation sector including water storage facilities and its distribution systems, irrigation efficiencies, water management, Govt funding, institutional finance, pricing of water, participatory irrigation management funding and development frame work for the sector.

It is proposed to review the sectoral performance in the IX Five Year Plan and recommend appropriate strategy for achievement of proposed physical target to bring additional (rainfed) areas under irrigation by surface and ground water resources. The

policy recommendations contained in the report also include scientific data base management, appropriate technology inputs in various agro climatic zones and consequent employment generation.

1.2 SUMMARY OF TERMS OF REFERENCE

Planning Commission while constituting the Working Group directed that the report be based on the terms of reference as per Appendix 1.

The terms of reference consist of two components: one being review of IX Five Year Plan performance in minor irrigation sector and the other comprises of appropriate strategy for minor irrigation programme and its formulation in the X Plan.

The terms of reference lay emphasis on a review of physical and financial performance of minor irrigation sector in the IX plan including performance evaluation of minor irrigation schemes. The review will also deal with project performance related agricultural activities, environmental impact, tank irrigation, rain water harvesting, status and performance of ground water development, institutional and private sector funding, existing data availability and employment generation.

Based on this review, the Working Group may suggest appropriate development strategy for surface and ground water resources and appropriate technology inputs based on scientific data. Suggestions will also be provided on structural rehabilitation and modernisation of existing storage facilities, distribution system and creation of new irrigation facilities.

As regards operation and maintenance of existing facilities, recommendations are to be made on increasing irrigation efficiencies and optimal use of existing assets. Recommendations would also include overall measures for increasing revenue in minor irrigation sector, raising institutional finance and private sector investments.

Institutional arrangements at State and Govt. of India level are to be recommended for scientific data base management, upgradation of minor irrigation technology, mechanism for central, state and institutional finances, people's participation and training of beneficiaries. An institutional arrangement like Minor Irrigation Development Organisation could be envisaged.

1.3 WATER RESOURCES SECTOR IN INDIA

India is among the foremost countries in the world practising large scale irrigation through development of its water resources for irrigation, generation of hydropower and providing domestic water supply. Irrigation potential which stood at 22.6 mha in 1950-1951, has now reached 100 mha, which is about 1/3 of total cropped area, and as a result thereof food production has increased from 50 m tonnes (1951) to about 208 m tonnes (2000).

The projections for future population and food requirement of the country indicate that the population of India may stabilise around 1.6 to 1.7 billion by 2050 AD and that would require about 450 m tons of food grain annually at the present level of food consumption. However, to meet the demand of our nation and create reasonable export surplus in the international market, we need to plan production of food grains, to be not less than 500 m tons by 2050 AD.

Area wise it is necessary to provide irrigation in at least 130 mha for food crops alone and in an area of 160 mha for all crops to be able to meet the demands of the country in 2050 AD and ensure food security.

The country's water resource available in a year is considered to be 1953 BCM out of which only 1086 BCM is available for utilisation. Estimated utilisation of surface water resources is considered to be 690 BCM. The balance 396 BCM is estimated to be available from ground water resources.

The expenditure on irrigation sector in India during the first Five Year Plan (1951-56) was about Rs.442 crore which was 23% of total plan expenditure of the country. The trend of reduction in irrigation outlays during the subsequent plans upto VII Five Year Plan was brought down to 9% of the total plan expenditure. This down slide further continued and the expenditure was gradually reduced to 6% during IX Five Year Plan.

1.4 MINOR IRRIGATION SECTOR IN INDIA

All surface and ground water schemes having cultivable command area upto 2000 ha are classified as minor irrigation schemes. Minor irrigation schemes comprise surface water schemes viz. Minor irrigation tanks and canal systems, diversion wiers (anicuts), lift irrigation schemes and sub-surface schemes viz. Dug wells and tube wells.

The minor irrigation sector is an important sector, as it is spread over the entire country and its rural environment. The development of minor irrigation practices has been followed since ancient times and find mention in `Rigveda and Yajurveda'. Subsequently, in course of time these were subjected to various technological upgradation.

The rational concept of surface water minor irrigation scheme comprises a storage structure along with surplussing arrangements and canal distribution system. The surface water potential of 12.08 mha has been created upto VIIIth Plan, while actual utilisation is 7.73 mha (1997-98).

Central Ground Water Board has also estimated utilisable irrigation potential from ground water sources as 64.17 mha. The potential of ground water created upto 1997 is 50.31 mha and utilised is 39.58 mha.

The expenditure incurred on minor irrigation sector during the first Five Year Plan was Rs.65.6 crore which was about 14.84% of the total plan outlay of Rs.441.8 crore on irrigation sector. In the subsequent plans, the ratio of expenditure on the minor irrigation sector has been almost the same.

During the VII Five Year Plan (1985-90) the allocation on minor irrigation was Rs.619 crore which was about 33.03% of the total plan outlay on irrigation sector. Subsequently the same ratio has been almost maintained.

1.5 DEVELOPMENT OF MINOR IRRIGATION IN INDIA

The ultimate minor irrigation potential of the country is estimated to be 81.54 million ha. The potential of minor irrigation schemes created by the end of March 1992 is 50.35 mha, out of which actual irrigation has been achieved to the extent of 46.54 mha. Total potential of minor irrigation schemes created upto March 1997 has been 62.39 mha out of which actual irrigation achieved is 47.31 mha.

The targets of potential creation and achievement during IX Five Year Plan were 7.24 mha and 4.93 mha respectively. However, data collected by MOWR indicate that upto the end of March, 2000, the potential created is 3.64 mha while the actual utilisation is 2.76 mha only. Thus potential of Minor Irrigation schemes created upto 1999-2000 is 66.03 mha, out of which actual irrigation achieved is 50.07 mha.

The Working Group Report is based on the data collected in the 2nd census of Minor Irrigation Projects with reference year 1993-94 and quarterly progress reports on minor irrigation development received in Ministry of Water Resources from the States/ UTs under the Rationalisation of Minor Irrigation Statistics scheme updated to 2000 - 2001. The data in respect of the States of Chhatisgarh, Jharkhand and Uttaranchal are included in the data of the states of M.P. Bihar and U.P. respectively.

1.6 IMPLEMENTATION OF MINOR IRRIGATION SCHEMES AND THEIR FINANCING MECHANISM

As water is a state subject, minor irrigation sector as a whole is formulated, planned, investigated and implemented by the State Governments and Union territories. However the Govt. of India is assigned the task of policy planning, design and development of this sector. Anomaly of this sector is that it is being implemented by various Ministries at the Centre and different departments of State Governments. There is lack of coordination amongst these organisations, resulting in overlapping in planning and execution of minor irrigation schemes and wastage of resources. Minor irrigation sector in the Govt of India is handled by the Ministry of Water Resources, Ministry of Agriculture, Ministry of Rural Development and Ministry of Tribal Affairs. Similarly at the state level respective Ministries and Departments of Water Resources, Agriculture, Rural Department and Tribal Welfare deal with the sector. As these schemes are planned, executed and funded by different Govt. Agencies and occasionally by a few non-government organisations, there is no uniformity in planning, specifications, standards of construction and quality

control. This results in wastage of funds and suboptimal use of precious water and human resources. The minor irrigation sector is developed and funded by public and private sectors as well as by the individual agriculturists, industries and non-government organisations.

The mechanism of funding of these schemes by various Central and State Departments is also different. Audit and accountability of these funds leave much to be desired in the case of minor irrigation schemes funded and operated through non-professionals, Govt. departments and private organisations.

Pricing of irrigation water is another important factor, which needs to be reviewed by the states. State like Maharashtra has adopted realistic water pricing resulting in availability of more financial resources for better operation and maintenance.

1.7 STRATEGY FORMULATION FOR SCHEMES IN THE MINOR IRRIGATION SECTOR

The utilisation/performance of irrigation and the minor irrigation sector's broader management has not received due attention. Certain vital areas have to be addressed with much focused attention, not only to bridge the gap between the created potential and its utilisation, but also to ensure more economical and efficient use of water. These are optimization of existing irrigation capacity which includes renovation and modernization of old irrigation projects, accelerated change-over from land irrigation to crop irrigation at least in arid and semi-arid areas, renovation and restoration of tanks along with construction of new tanks in villages and promotion of water conservation devices such as sprinkler and drip irrigation, particularly in water short areas. Expansion of irrigation facilities is proposed through time bound programme including exploitation of ground water potential.

Some of the additional issues which also need to be addressed are :

(i) Pricing of water for various uses is to be rationalised so as to at least fully recover the operation and maintenance cost of irrigation system. Requisite fund for regular and proper maintenance of existing irrigation system by setting apart certain percentage of plan and non-plan funds in the state budget every year is also to be ensured.

The recommendations of Water Pricing Committee and the Committee of Group of Officials set up by the Planning Commission are still to be accepted by the State Governments. All the State Governments have to be persuaded to implement the recommendations of the Group of Officials in the first phase of implementing Water Pricing Committee's Report.

(ii) The ground water quality is being monitored by the Central Ground Water Board (CGWB) through a network of 14995 monitoring stations set up in different parts of the country. Changes in water quality have been observed in major agricultural

and industrial belts and urban complexes as a result of over use of fertilizers, pesticides and insecticides in agriculture and disposal of untreated wastes from industries and urban cities.

A comprehensive Act is also required for regulation and development of ground water on sustainable basis both in public and private sector. Another important concern in the X Plan is the restoration and modernisation of old irrigation systems executed during the pre-independence period and twenty-five years ago.

It should be prominently considered to promote Participatory Irrigation Management (PIM) with full involvement of water user community, which will be at the centre stage of the implementation of above strategies of the X Plan.

1.8 PEOPLES' PARTICIPATION IN MINOR IRRIGATION SECTOR

Value of water as commercial commodity lies in its multiple uses. Storages proposed to be created for minor irrigation projects should be planned to provide the releases of water into the river, to enhance the water quality in the river system for riparian use in villages and towns located in the downstream reaches of the river. Piped filtered water supply in the command area of minor irrigation projects to a cluster of villages can also be a viable proposal as cultivators have reasonable prosperity to pay for quality drinking water.

A well managed irrigation and water supply utility may accentuate economic growth. Cooperative sector can also play its role and form sharesholder company for managing drinking water and irrigation.

Success, however, depends on cooperation from the state sector in acquisition of land required for the reservoir as well as for canal system. State Governments can procure, carry out component of R&R and environment mitigation measures. Cost of these measures, which may vary between 5% to 20% of project cost, can be repaid to the State Government in a period of 10-15 years.

Value of water as a commodity is getting acceptance not only in drinking water subsector but also for consumptive water use in industries and piped drinking water supply to a cluster of several villages and towns.

Value added agriculture production (cash crops) has strengthened farmer's socio-economy in the irrigated command areas. Farmers are prepared to pay higher water rates even on volumetric basis, for the water used for irrigated agriculture. This requires high irrigation efficiencies and better water management to increase production of crops per unit of water supplied.

Similarly, operation and maintenance of irrigation systems could be tendered out to qualified private firms. Such firms could also be asked to assist the management of water service agencies.

1.9 VISION OF FUTURE DEVELOPMENT OF THE MINOR IRRIGATION SECTOR

Irrigation has played a pivotal role in India's agricultural production and growth. Although gross irrigated area, which is currently about 100 mha is only about one third of total cropped area in India, the production from irrigated lands greatly exceeds the productivity of rain-fed farming. In the monsoon-dependent agriculture systems, with both spatial and temporal variation in the rains, and large areas with rainfall less than 1,000 mm per annum, irrigation is a crucial input for agricultural production. Both at the national and regional levels, agricultural growth and rural development closely follow the growth pattern of irrigation expansion. Water resources development, particularly irrigation, has made an enormous contribution to the achievement of higher levels of national food security, keeping pace with population growth and economic development more generally.

The funds for minor irrigation sector projects are generally being allocated as under:

(i) About 33% of the total outlay for irrigation sector is being allocated by Ministry of Water Resources.

(ii) About 20% of the plan allocation of rural development sector is earmarked for water resources, which are spent basically on all types of minor and micro-minor schemes and drinking water supply schemes.

The inadequate quality of design, construction and management of system operations and maintenance, and inefficient water delivery systems have contributed to water losses, inadequate, unreliable and inequitable distribution of water to farmers, reduced irrigation areas and agriculture productivity below potential. Hence there is a need for improving operation and management of the systems. It will be more prudent to deal minor irrigation schemes of rural development sector with the same technical and professional standards. This procedure will ensure appropriate additional irrigation and professional monitoring by the Water Resources Department.

12 mha additional irrigation in minor irrigation sector, was proposed in the report of Working Group on Minor Irrigation for formulation of the IX Five Year Plan. Subsequently, in the mid term appraisal of the ninth Five Year Plan, the above stated figure of additional irrigation proposed has been reduced to 7.24 mha. Even this substantially reduced target is not likely to be achieved.

As per the Finance Bill of 2001-2002 presented recently in the Parliament, Finance Minister has laid emphasis on agro based industries, food products, and fruits and vegetable products for increasing exports in the global market. Tax exemptions are also provided for this sector. Expansion of agro based industries, as a result is likely to be

made in rural areas, which have to be provided with water resources input by minor irrigation schemes. There is, therefore, urgent need to enhance the targets in minor irrigation sector in the X Five Year Plan to achieve enhanced growth of Gross Domestic Product (GDP).

Considering the above reasons, it will be a good strategy to be more aggressive, while designing and executing surface water storage structures. This would also call for adopting a better option of large sized minor irrigation storages with water efficient distribution systems. If the topography permits, cascades of minor irrigation storages could also be conceived, designed and implemented. This would require upgradation of appropriate technology inputs so as to achieve cost effective water efficient solutions.

The ultimate irrigation potential in the country using both the surface and ground water sources is of the order of 140 mha comprising of 75.83 mha from surface water sources and 64.17 mha from ground water sources. The same trend and proportion between surface water sources and ground water sources should be reflected in the X Plan proposal, of minor irrigation schemes. Working Group has therefore proposed the target of additional potential of minor irrigation sector to be created, as 8 mha. To keep the proposal, in accordance with the distribution of surface and ground water sources, it is proposed to provide physical targets of potential created as 3 mha by surface water resources and 5 mha from ground water sources.

1.10 INTEGRATED WATER RESOURCES DEVELOPMENT AND INSTITUTIONAL ARRANGEMENT PROPOSED FOR ACCELERATED DEVELOPMENT IN MINOR IRRIGATION SECTOR

The increase in area covered by minor irrigation schemes depends on its scientific planning. The ground water resources can be better tapped in the command area and near the periphery of command of minor irrigation schemes. Ground water recharge can be increased by complementary development of small surface water storage and its canal system. During the IX Plan period, excessive ground water extraction has created problem. The study sponsored by the Ministry of Environment and Forest reveals that ground water loss is highest in Haryana sub region followed by Rajasthan, Uttar Pradesh and NCT Delhi. The avoidance cost of ground water mining is estimated as Rs.12,800 crore. The ground water mining, has led to degradation of water quality.

Working Group has therefore emphasised on integrated and balanced ground water development. Monitoring of surface and ground water development needs to be tied up with institutional arrangements.

The reform agenda for improving the performance of irrigation is suggested as follows:

(i) Institutional reforms both to involve farmers and to restructure Irrigation Departments (IDs) as client driven and commercially operated entities.
(ii) Restoration of the sector's financial viability and cost effectiveness.

(iii) Improving technical performance through upgrading irrigation systems and agricultural extension.

Govt. of India, Union Territories and States are likely to be allocated substantial Budgetary Finance broadly around Rs.21200 crore through MOWR. At present, no mechanism operates effectively to oversee minor irrigation development and monitoring thereof in order to closely follow water resources development in the minor irrigation sector either at Govt. of India or at the level of States and Union Territories. In addition, an amount of Rs.15000 crore is expected to be made available by NABARD, Ministry of Rural Development, Ministry of Agriculture, Ministry of Tribal Welfare and other private financiers. Sincere efforts are therefore needed to structurally create, in built institutional mechanism, to oversee appropriate integrated water resources development in the minor irrigation sector. It is strongly recommended that Minor Irrigation Development Organisation be created at the Centre and in all the States, reporting to respective Secretary (WRD). Primafacie this Development Organisation will plan, implement and oversee specifications and quality control of minor irrigation schemes. The Minor Irrigation Development Organisation (MIDO) will also be responsible for policy formulation, assessment of surface and ground water resources, command area development, participatory irrigation management, training needs and creation of necessary infrastructure for effective data base management of the minor irrigation sector.

CHAPTER - II

BRIEF REVIEW OF OVERALL PERFORMANCE OF MINOR IRRIGATION SECTOR

2.0 Next to air, water is the most important commodity required for the sustenance of mankind. Though India has been bestowed with abundant water resources, yet the utilisable water is very limited. With the ever increasing population, coupled with urbanisation the requirement of water is growing steadily and the per capita availability is reducing day by day. The rain fall pattern in the country is also very erratic. It is limited to only 4 to 5 months in a year with only 30 to 40 rainy days leaving very little scope for rainfed agriculture.

The total ultimate irrigation potential has been assessed as 140.00 mha. of which contribution of major and medium irrigation projects has been assessed as 58.50 mha and of minor irrigation as 81.54 mha. Potential created from minor irrigation schemes upto the end of VIII Five Year Plan has been 62.39 m.ha.

Surface water potential has been reassessed as 17.37 mha instead of 15 mha and ground water potential has been revised from 40 mha to 64.17 mha. The potential created under minor irrigation sector (both surface water and ground water) upto March 2000 is of the order of 66.03 mha.

So far as surface water potential is concerned, majority of good minor irrigation sites have already been constructed. Therefore, for future development the additional sites need extensive investigations. The scope for development of surface water potential at the prevailing pace appears to be difficult, however, in order to meet our requirement, more thrust is to be given towards development of irrigation potential by consumptive use of surface water and ground water. By this approach, though national goal can be achieved, however, to minimise regional imbalance some extra efforts are needed to enhance the pace of development under surface water minor irrigation schemes. Regions like North-East where most of the potential available is through surface water, have to be encouraged for development of surface irrigation schemes. Moderately developed states in the field of surface minor irrigation like Madhya Pradesh, H.P., Maharashtra, Rajasthan, Orissa, Uttranchal, Jharkhand and Chatisgarh would require special attention. Modernisation and improvement of existing irrigation tanks in southern states and central India would also contribute towards development of irrigation potential in minor irrigation sector.

2.1 PERFORMANCE REVIEW

Performance review of the last 7 years (1992-93 to 1999-2000) which include VIII Five Year Plan and the first three years of the IX Plan period (1997-98 and 1998-99) indicates:

- Potential created per year from surface water schemes has come down during the VIII and IX plans as compared to the VII Plan. Same is the case for potential created from ground water schemes.

- Potential created during the VIII Plan (both surface and ground water) is of the order of 12.04 mha while the anticipated achievement during the IX Plan will be only around 6.06 mha against a target of 7.24 mha. The achievement for the IX Plan thus works out as roughly 83% from both surface and ground water schemes. However, potential created from surface water has been much less as compared to ground water resources. Prima facie, the main reasons for lesser development under surface water as compared to ground water are:

- Once a source is established and ascertained lesser time is needed for planning and implementation of ground water schemes.

- Ground water schemes are compact in nature and can be handled either individually or by a group of farmers.

- Most of the surface water minor irrigation schemes suffer from poor operation and maintenance resulting in reduction in design irrigation capacity. Surface water minor irrigation sector requires special attention towards modernisation restructuring and improvement so as to regain its lost irrigation capacity.

- The average figure for the last 7 years 1992-1999 for the potential created per year works out as 2.07 mha . While for the last three years (1997-2000) it works out as 1.21 mha indicating a fall in the trend during the IX Plan period.

2.3 CONSTRAINTS AND REASONS FOR LOWER ACHIEVEMENT IN SURFACE WATER POTENTIAL

The utilisation of surface water minor irrigation potential created has been 0.54 mha during first 3 years of the IX Plan thus leaving a gap of 0.40 mha. between the irrigation potential created and that utilised. Efforts are to be made to bridge this gap at a faster rate. The end benefit of the irrigation is its utilisation. The main reasons for less utilisation of tanks are as follows:-

a. Silting up of the supply channels and damage to head sluice or other masonry works

b. Silting up of the old tanks resulting in reduced capacity and larger water spreads thereby causing increased loss of water through evaporation.
c. Encroachment of the foreshore lands of the tanks by farmers for cultivation.
d. Lower sluices practically rendered non-functional and upper sluices functioning at reduced capacity due to silt accumulation.
e. Inlets and outlets of sluices having no shutters or plug / plug rods.
f. Surplus weirs damaged and protective works eroded.
g. Obstruction of supply channels at many places due to weed growth.
h. Substantial seepage losses in the distribution channels and no regulating structures for the off taking branches.
i. Obstruction of distribution channel beyond the sluice opening in a large number of tanks.
j. Improper selection of cropping pattern in the command of the tanks resulting in crop loss.

Inadequate operation and maintenance grants is one of the main reasons for poor performance of surface water schemes. A good part of maintenance grant is being utilised for wages and salaries.

There is a considerable gap between potential created and potential utilised. The broad year-wise details of the potential likely to be created and utilised in the IX Plan period for surface water schemes are given below:-

(Unit: Mha.)

S.No.	Year	Target	Potential Created	Potential Utilised
1.	1997-98	0.54	0.33	0.15
2.	1998-99	1.61	0.27	0.20
3.	1999-2000	0.58	0.34	0.19
4.	2000-2001	N.A	N.A	N.A
5.	2001-2002			

With a view to utilise the potential created so far to the maximum the Parliamentary Standing Committee on Agricultural Demands, felt that the old dilapidated tanks which have lost their useful capacity due to silting up and encroachment etc. be rehabilitated and emphasised that a Centrally Sponsored Scheme be formulated for the purpose. Ministry of Water Resources has thus formulated a Centrally Sponsored Scheme "Participatory Irrigation Management and Rehabilitation of Minor Irrigation Projects" costing Rs. 760 crore, and has submitted an EFC Memo, for approval. Necessary provision has to be made in the Xth Plan for the scheme as this scheme would create/rejuvenate additional irrigation potential with minimum effort and cost. Working group has however taken a wider vision of the status of the existing tanks in the country and suggested determined efforts for renovation of old tanks. An amount of Rs.7200 crore is recommended by the Working group for modernisation and improvement of existing tanks. Working Group further suggested that centrally sponsored schemes of

Ministry of Water Resources should be reviewed to give more importance to the renovation and rehabilitation of minor irrigation work and accordingly provision may be made for the X Five Year Plan. Provision shown in the State sector could accordingly be readjusted.

2.4 CONSTRAINTS AND REASONS FOR LOWER ACHIEVEMENTS IN GROUND WATER DEVELOPMENT

Even though ground water resources in some parts of the country have been over-exploited, there are certain areas where development of ground water has been very low. Ground water development in the eastern states and in the command areas of major and medium projects has been inadequate. The factors responsible for poor development of ground water development are indicated below :

a) Fragmented land holdings and lack of public funding

Fragmented land holdings and financial condition of farmers is a constraint to guarantee return from investments by banks/private institutions.

b) Lack of consultancy services

The technical and scientific support for the location of sites and construction and design of structures and pumping devices has not been available on site. Unscientific construction of wells and tubewells reduce their rate of success.

c) Non-availability of timely and assured power supply

Electric power for pumps and agriculture purposes is either not available on regular basis or when available is not of the right voltage.

d) Training & Extension service

Training facilities for scientific desilting, construction and energisation of ground water abstraction structures is nearly absent both in Academic and Professional Institutions.

e) Subsidised water rates in canal commands

In canal commands of major and medium irrigation projects, water rates are highly subsidised. On the other hand, no subsidy is provided for development of ground water. As a result farmers opt for utilising canal water instead of constructing tube wells from their own resources.

2.5 PHYSICAL TARGET FOR THE X PLAN

Having reviewed the performance under different Five Year Plans with special reference to IX Plan, a target of 8.0 mha (ground water =5 mha and surface water = 3.0 mha) is proposed for the X Five Year Plan. The proposed target also takes into account the following factors :

- Reorientation towards minor irrigation surface water scheme is proposed to utilise surface water resources in the regions located in hard rock areas which have lower irrigation development.

- Minimise regional imbalance and to take more surface water and ground water irrigation schemes in the North-East and other regions where there is scope for development of minor irrigation.

2.6 CONSTRAINTS IN CREDIT SUPPORT

The major constraints in the accelerated growth of credit support for the development of minor irrigation are:

(i) Inadequate technical guidance to farmers for site location and construction of works especially for bore well and tube well.
(ii) Delay in loan appraisal due to cumbersome procedure and documentation insisted by Bank resulting in delay in loan disbursement.
(iii) Insufficient technical expertise with financing banks to identify suitable investment and favourable areas for investments.
(iv) Inordinate delay in repair of faulty pump sets and shortage of electric power supply.
(v) Poor recovery position of loans extended by banks leading to reduced lending eligibility.
(vi) Lack of co-ordination among different departments and agencies connected with the programmes.
(vii) Delay in sanction and release of funds/subsidy.
(viii) Well failure particularly in hard rock areas.
(ix) Poor extension service
(x) Depleting water levels and over exploitation of groundwater resources.

2.7 MEASURES FOR IMPROVEMENT

(i) To facilitate financing banks to sanction loan without obtaining formal approval from NABARD, before sanction of loans.

NABARD has introduced a new Automatic Refinance Scheme under which banks are allowed to sanction and disburse loans for conventional activities up to Rs.10 lakhs for each scheme and claim refinance without formulating and submitting schemes to NABARD. Further to avoid under-financing of the assets the banks are advised to finance the actual cost of investments even in excess of unit cost recommended by

NABARD. These improvements have encouraged bankers to increase the credit flow for minor irrigation.

The State Ground Water Department do not have adequate staff to select sites for wells and bore wells in hard rock areas. It is necessary to encourage private consultants for technical assistance and their consultancy fees could be capitalised in the cost of investments.

(ii) Considering the high cost of investments and small and fragmented land holdings, the small and marginal farmers are not able to avail bank loans. It is necessary to encourage and promote joint and cooperative investments.

(iii) Conjunctive management of surface and ground water resources should be accepted as a necessary principle and strategy. Conjunctive management should integrate the management of all available supplies to meet the full range of uses in an unified manner.

(iv) Links need to be established between research, experimentation and implementation and the role of NGOs, Government and academic institutions involved. Some form of network research experimentation programme needs to be established and the results from this fed into the policy formation and implementation process. Government working groups containing NGOs and academic representatives should be established. In addition an institutional base is required to be identified for the formation and operation of ground water network. One of the central activities of this network should be to arrange workshops on key issues.

(v) Approach to groundwater data collection.

Investigations must be carried out by CGWB to classify the ground water availability areas as (i) safe, (ii) semicritical, (iii) critical, (iv) unsafe. This would avoid wasteful expenditure and sub optimal use of ground water. Data available with different organisations needs to be compiled and analysed. There needs to be greater emphasis on the relevance of data and the capabilities and needs of the end users. Keeping in view the end users decision of the methodology of data collection the format for data management and the extent of data publication should be characterised. Greater emphasis has to be given on scientific validity of data and transparency with which it is collected and analysed. Freedom of information and access to data are required for the development of any effective management institution. More effective use also needs to be made of sources such as remote sensing that can generate large amount of accurate data quickly.

CHAPTER - III

PERFROMANCE EVALUATION OF TANK IRRIGATION

3.0 HISTORY OF TANK IRRIGATION

Tanks are small scale surface storage devices created in natural valleys or depressions by constructing bunding structures across the flow courses to harness the rain water running down the land slopes and do not include the major and medium reservoirs formed in the riverbeds by constructing dams across the rivers and their tributaries

These tanks depend on the runoff generated by the rainfall in their own catchments for their water resource and have devices to let go the surpluses down stream when they hold their fill to their storage capacities. It is possible that there could be another tank in the lower contour to halt and hold the surplus to its capacity and let got the further surpluses to a series of such tanks down the valley in which case these tanks are said to be in cascade. We may have independent tanks or chain of tanks in a sloping terrain and in any case they well serve to harness the local rainfall and the overland run off generated in a mildly sloping country.

The surface storages in these tanks are utilised for irrigating the area commanded by them just downstram by drawing water through one or more sluices built across their bunds and conveying the same through a small network of canal system distributory channels and field channels. Depending on their capacities, their command areas may be in one or more number of villages served. In the cascade of tanks it is possible that the command area of the upper tank almost extends upto the waterspread of the lower tank, thus giving a picture of the spread of the blue storages and the green fields alternately down the contour of a natural valley.

In some cases, where there exists a running stream or river nearby, water is diverted from that source by constructing a weir or an anicut across and leading the flow through a feeder channel to augment the storage of the tank and to ensure better dependability of supply to its command. More often the entire group of tanks in the chain or cascade get the benefit and such a group is called system tanks quite different from the non-system tanks which totally depend on their own catchments.

Most of the existing tanks in the different States in India are the ones inherited from ancestors who have been wise enough to device these appropriate units to harness the rain waters and formed them over centuries as and when some benevolent king or chieftain took up the cause of the farmers to improve their food production. There is evidence of substantial contribution in cash and kind from the beneficiaries who in many cases organised themselves to create these structures all by themselves and also maintain them on a sustainable basis. Zamidars, Malguzars built several tanks in villages and collected revenue from the beneficiaries.

These tanks are largely seen in the States of Maharashtra, Madhya Pradesh, Orissa, Karnataka, Andhra Pradesh and Tamil Nadu and are best suited to hold the runoff flowing down the Deccan Plateau and the eastern plains gently sloping from northwest to southeast. Historically these are the handi work of several rulers and dynasties like the Sathavahanas, Parmers, Ikshvakus, Chalukyas, Rashtrakutas, Kakatyas, Bhaminis, Vijaynagar emperors, Pallavas, Cholas, Pandyas and so on.

The irrigation tanks can very well deserve to be categorised as 'heritages' and merit all the attention they need for restoration and preservation, but should not be so classified for the reason that they continue to be utilised and should rather be rejuvenated, preserved and maintained for continuous long usage and hence to be termed as live structures.

3.1 ROLE OF STATE IN TANK IRRIGATION

Historically Irrigation Development in India was thought as the role and function of the state. The country has been rich in Agriculture even in medieval times because of the systematic development of appropriate irrigation systems in all parts of the country. The West Central and Southern parts of the country which depend on monsoon rainfall could develop networks of tanks and create irrigated agriculture. Every kingdom in the Central and Southern peninsular India had set up separate departments or units for promotion of tanks. Various studies say that the pre British India had around 300,000 irrigation structures spanning all parts of the country. The growth of the tank irrigation has been sustained with the help of practices set up by the village communities. These communities had established numerous codes and rules based on the benefits and values prevailing during the period.

Scholars who had done studies on growth of traditional tank irrigation found that while the state had taken the role of creating the capital assets like tank systems, it had not involved in maintenance and operational functions. The state had also found numerous ways of creating sustainability within the tank resources itself. Records in the form of inscriptions and colonial officials notes depict that the state had set up endowment grants in the name of the tanks, transferring usufructory right such as trees, fishing, sand etc. to the tank organisations. These annual resources, through local management, could generate sufficient revenue to sustain the tank systems. Further the village assemblies have also recognised the tank associations as part of their user groups in governing the resource administration.

To summarize, the traditional Indian state and communities had a well oiled machinery equipped with a regulatory framework for Development of Tank systems and their conservation as performing livelihood systems.

The British, in the name of revenue generation to the central government, took over the common properties. In effect the tank systems had undergone great amount of changes in terms of administration and governance, over the years and transferred to the Panchayats systems in the assumption that they are closer to the ground. However, the

results of such transfers, confused with various community based management/institutional efforts, had not met with success.

As the Britishers took away the rights and revenue from the people they also realized that improvement can only be brought by getting 'closer' to the local community. The Madras Village Panchayat Act of 1920 had provision for 'transferring' the works as well as tanks as such (owned by government) to Village Panchayats. The concept of the British was that Village Panchayats might be the nearest and closest local institutions to take care of these systems as they wanted. Though the Panchayat Acts of 1920 and 1930 called for the 'transfer' of works and functions related to tank maintenance and management, very little was achieved in this regard. Though transfers happened in the 'statute' books, on the ground the technical improvement works over the Panchayats were given decision making powers for executing improvement works over the Panchayat Unions through other provisions and executive orders.

Until the British took over the administration of this country, and thrust in the centralised system of governance sometime in the middle of the nineteenth century India has been a land of villages, each village functioning as a self contained unit in the decentralised system of governance. The Royal Kings and the Emperors did not interfere in the village administration except to the extent of collecting the prescribed taxes and maintaining general law and order and defending the borders. There was mutual understanding among the several communities living in the village, with people following their own vocations and the decision of the head of the village was accepted in public administration.

In the regions where minor irrigation through tanks has been the ruling resource, almost every village has a tank and it is totally managed by the beneficiaries. The Government organisation like the irrigation department comes into the picture when there is a need for undertaking special repairs to the tank structure like the bund, the sluices and the surplus weirs. Otherwise the beneficiaries through a small Committee either formally or informally constituted, take care of normal maintenance, keep the feeder channel and the distributory channels in good condition by trimming and cleaning up and also operate the sluices to draw water for irrigation according to the requirement of the crops grown in the ayacut. In most cases there is an unwritten traditional rotational plan for supply to the individuals by time and days of the week and an employee carries out this plan uninterrupted, under the guidance of the head of the irrigation Committee. The beneficiary subscribes to this task either by cash or voluntary labour and this system which was long in vogue was termed as 'Kudimaramath' literally meaning "maintenance by beneficiary".

This system of self-governance of the small irrigation tanks had been functioning satisfactorily until that was meddled with by the ruling administration in recent times.

3.2 PRESENT STATUS OF TANK IRRIGATION

Deterioration of Tank Irrigation

Most of the small irrigation tanks give a picture of slow deterioration lacking in periodical maintenance for want of funds. Many of them have lost significant part of their capacity due to silting, weed growth with their bunds eroded and structures in disrepair. The feeder channels are not functioning properly due to encroachment and wild growth and the distribution network also disrupted here and there for want of care by the farmers.

More than all, the erstwhile responsible village based governance has failed in many areas and is becoming ineffective in the rest. The present generation is unable to assess the value of these inherited assets and got disenchanted looking at the enormity of the work in periodical maintenance which is supposed to be carried through cooperative group effort. Evolution of the deep tube wells and the pumping machinery and the uncontrolled free use of the ground water unmindful of the ill effects of excessive pumping, have made it easy for the young farmers to prefer self regulated well irrigation to the community organised tank irrigation. They forget that they are killing the very source of recharge of their wells, the tanks, and are happy with their present easy alternatives.

With the result that the extent of irrigation under tank has fast dwindled and there is a spurt in the extent served by well. This is the phenomenon in almost all the States where tank irrigation was predominant earlier.

The tank systems which were developed indigenously over a period of several centuries have provided an insulation to the people living in fragile rainfed areas in this part of the country. Even so, the farmers in rainfed tanks who are predominantly marginal and small farmers are highly vulnerable to the vagaries of monsoon. Continuous failure of monsoon rains over two consecutive years would force them to abandon their small land holdings and migrate to other districts for their livelihood. Their importance is being realized more and more, as the potential use of groundwater and other water resources is proving to be very costly and inadequate to meet the varying demands. So these eco-systems have to be conserved at any cost to provide a safety net to the livelihood of the millions who thrive on these systems.

Tanks are also the resource complexes for multifarious uses.

- Irrigation
- Drinking water for people & animals.
- Domestic use for people and animals.
- Recharging ground water
- Fuelwood and timber
- Rearing fish
- Fodder
- Sanctury for birds
- Silt and sand for construction

3.3 CAUSES OF DETERIORATION

It is reported that, the area irrigated over the last 40 years by tanks is coming down steadily at an increasing rate. According to government statistics published by the Planning Commission around 17 lakh ha of net area irrigated by tanks has been lost measuring a capital loss of Rs. 5100 crores(Planning Commission 1999). The general deteriorating condition of tanks is characterized by siltation in the tank beds and supply channels; encroachments in the tank bund, foreshore, waterspread and supply channels, deforestation and denudation in the catchment areas; damaged sluices, weirs, bunds extinction of tanks as a whole for housing and urbanisation and indiscriminate use of tank beds as dumping yards.

Apart from the structural decay the centralization of the tank administration in the last two centuries by the British colonial administration is believed to be one of the prime reason which led to severe consequences-alienating the local community from taking up collective efforts towards the betterment of tanks. The investments by the locals on the preservation of tanks have also steadily declined, resulting in the deterioration of the tank systems. In the last three decades the decline in tankfed agriculture has become more rapid and has severally affected agricultural production in several places. The country is facing a grave situation through the deteriorating tanks, forcing the marginal and small farmers into a cycle of deprivation and debt, as also leaving them increasingly at the mercy of the vagaries of monsoon.

The reasons for the deterioration are many and may vary from region to region but in general the following factors may be identified as having accelerated the deterioration.

1. Attitudinal change in the modern society towards individualism in preference to collectivism and the tendency to opt for easy alternatives unmindful of the ill effects that may be caused to the society.
2. Political interference and the permeation of the party culture even in remote villages.
3. Apathy in the official machinery and unwillingness to put in extra effort to guard the valuable assets from deterioration.
4. Lack of funding for the general upkeep and the consequent backlog in the maintenance leading to deterioration.
5. Encroachment and free for all entry into the tank premises cutting down the very source of water supply to the tanks and bringing down the storages ultimately telling upon the usefulness of the tank as an irrigation source.

3.4 MANAGEMENT OF TANK IRRIGATION

Presently, in most of the states, the smaller tank systems are entrusted to the local bodies such as panchayats unions for maintenance and management while the bigger ones are rested with the government irrigation departments where there is no role for the local bodies in planning and implementing the development works. However, the tanks are even smaller units which need to be maintained and managed at the hamlet level where panchayats are considered to be bigger administrative units. Also the panchayats with multifarious activities tend to neglect tank development due to lack of manpower and other resources.

In some states like MP, Minor Irrigation tanks irrigating below 100 ha. and all Nistar tanks are with Panchayats. It is proposed to transfer Minor Irrigation Tanks even up to 250 ha to Janpad & Zila Panchayats. Water Resources Department maintains Minor Irrigation Tanks above 250 ha. onwards upto 2000 ha. Further large medium and minor tanks are also maintained by Water Resources Departments.

3.5 REHABILITATION OF TANK IRRIGATION

Data Base for Minor Irrigation Tanks

For any successful development as a long time measure, the data base is the first requisite. Presently the data base in respect of minor irrigation source is pretty poor. A few attempts made earlier like the minor irrigation census has not brought out adequate results. In such a process, quick assessment sometimes may serve the purpose and offer results good enough to proceed and improve upon in stages. A process similar to the one done in decadal population census may be tried. There could be an assigned enumeration month when the States could be requested to divert staff as many as required to gather all essential salient data of each tank including ayacut served in a prescribed uniform format. The compilation could be river basin wise and taken down to the watershed delineation since watershed map for the entire country is already made available. Use of remote sensing techniques can help fast enumeration of existing tanks. The Centre may support the States in the enumeration process and the results would be very useful for future planning and keeping a tag on the expenditure incurred and the physical works carried out periodically on each of these tanks. This will lead to easy computerization of all data relating to the tanks for effective monitoring. The format design should take into account this feature and the codification done accordingly.

As had been earlier said, operation and management of the minor irrigation tanks is to be left to the beneficiaries. Presently the Irrigation Committees constituted formally or informally functioning in most of the tanks are dormant or in a stage of dysfunction. It would be useful if there is a systematic compilation of the historical data of all the traditional existing institutions, namely organisations of the beneficiaries now maintaining and operating these tank systems all by themselves. Their compilation should include the pattern of organisation, the present incumbents, the way they are elected or nominated, the byelaws and codes if any they maintain, their day to day activities, their action to augment the sources and utilise the sources, their distribution of water in the tank with equality and so on. Such an information will enhance the prestige

of such organisations, induce them to function with responsibility, finding that they are now being reorganised and could be encouraged with better infrastructure facilities and training to improve their management capabilities.

Modernisation of Minor Irrigation Tanks

The tank systems have gone into disrepairs mainly due to long neglect of maintenance. Heavy silting of the tank bed, choked up feeder channels, leaking and weak bund, leaky sluices and dilapidated surplus weirs and ill maintained distribution channels are the common deficiencies seen in the present conditions of these minor irrigation tanks. These problems are to be scientifically assessed, and a pattern of cyclic maintenance schedule be drawn after the first initial investments for modernising and bringing the tanks to their original status are made.

In this, standard specifications for bunds wherever necessary, improving on the design of regulating devices for the sluices for easy operation, improving the inlets and outlets for smooth flow in transition, improving the designs of the surplus weirs for higher efficiency in discharges are areas where there could be scientific input. A sort of initial financial support from the Centre in the Tenth Five Year Plan is required. This special wing may also look areas of CAD, PIM and WM and develop necessary guidelines and provide training.

Pollution and encroachments are two serious problems which may if left unchecked annihilate the tank structure themselves and cut down the irrigation under the tanks drastically. An awareness campaign against these two evils may help to some extent, but strict laws and their enforcement are necessary. This responsibility lies entirely with the State Governments and the Centre can at best coordinate with various ministries and States. Periodical check of water quality at least in some of the vulnerable tanks which also supply drinking water may be necessary.

3.6 PARTICIPATION OF BENEFICIARIES

Minor irrigation schemes have certain inherent advantages like (i) low capital investment (ii) short gestation period (iii) small size for easy handling in operation and management (iv) suitable for direct management by the beneficiary and so on. Small storages like the tanks have already been created and what have been made available to us practically at no cost are to be restored to their original condition and maintained well to get optimum benefits from them.

Minor Irrigation, particularly the tanks in a basin, serve local commands and are to be looked at as ideal unit functioning in conjunction with any major, medium or minor irrigation systems created in a river basin. In some cases the large commands of major schemes encompass the existing minor irrigation tanks within their commands. All the same, the tanks retain their own identity and getting the benefit of dependable flows from the major irrigation project source, will serve their own commands with higher dependability and also higher irrigation intensity.

There is need to create awareness among the beneficiaries of all these benefits that flow from minor irrigation tanks and persuade them to revive their interest in maintaining them, perhaps in a better model, taking advantage of the technological development and management now available.

The tanks are small in size, large in numbers spread across the country and offers ideal scope for decentralized management. Experience gained with various research and development programs demonstrate unequivocally that the only solution to most of the problems facing the tank systems shall be resolved through the revival of the local management. The world over, current thinking on better management of water resources are identified with decentralization of the management combined with effective stakeholders' participation in irrigation decision making. In that context, minor irrigation tanks in India are ideal to be managed locally by involving the farmers, panchayats and other local community based organizations. Also, world wide experiences show that decentralized management alone provides better performance of the resource apart from reducing the burden on the government. Better performance could be achieved through effective supply and demand management. This can be done only by the local people not by the distant bureaucracy. There exists a need to restore a balance between the role of the state and that of communities. Encouragingly, in the current years, the governmental efforts are aimed towards participatory management of water resources combined with decentralised maintenance and management plans.

Apart from this general situation, local Management in tanks shall be thought of to increase the water use efficiency, equity of the water use and appropriate water use in the conflicting situations. The tanks serve as storage reservoirs of water in the monsoon dependent areas of the country where there exist a shorter period of rainfall and a long dry spell with very high deviation of annual rainfall. The cropping systems and agronomy practices are different and ingrained with the farming community to make appropriate decisions at the tank level. In such cases the efficiency of water use is mainly dependent on the management criteria rather than any other technical criteria. Tanks as one of the oldest man-made village ecosystems are highly productive in dry and drought prone parts of the country by having multiple use benefiting large sections of the community other than the seasonal activities like scoring salt and sand benefiting the rural communities. The traditional management practices are tuned to all these multiple uses. On that count, tank management needs to be thought of involving the multiple stakeholders at the community level. The appropriate use of water in conflicting situations shall be tackled at the community level rather than through a centralized bureaucracy. The relevance of local management in tanks is, therefore, very appropriate and needs to be taken up at the earliest before the systems collapse in a bigger way.

3.7 INSTITUTIONAL ARRANGEMENTS

Based on the learning from various experiments across the country and considering the need for establishing local management in tanks systems, the following recommendations are being made:

i. Long term Tank Development Programs need to be taken at a basin level in the long term (10-15) and the medium term (3-5 years). The implementation of the programs shall be based on the institutional framework of the watershed programs wherein user groups will be promoted by the Project Implementing Agencies (PIAs) including NGOs. In the institutions such as Tank Water Users Association and Tank Cascade Associations, NGOs will play a crucial role in implementing the programs with the help of Project Implementing Agencies. The role of the government shall strictly be limited in facilitating and enabling rather than implementing the programme. The cost share of the Watershed Development programs like 10% for Community organizing, 5% for Training, 5% for Administrative overheads and 80% of the tank physical works could be followed. The Contribution of the Users could be fixed at 10-20% depending on the area and willingness of the states, however the contribution should be a must in every programme.

ii. The State Governments shall undertake the overall development of tank irrigation systems along with other surface water schemes and groundwater schemes with the river basin as a hydrologic unit. All tanks both rainfed and system, shall be the responsibility of Panchayats, rehabilitated and thereafter managed through the WUAs and as a part of watershed.

iii. A perspective plan for 10 to 15 years, based on the above principle should be prepared in the next 2 to 3 years. The plan should be disseminated and debated widely on the public. In order to make Water Users Association (WUAs) sustainable, WUAs will have to be empowered to set their own water rates, enforce them and manage their budget. WUAs as separate committees under Panchayats will manage the income generated from resources with tanks like fishing rights, grazing, forest and tree resources and may return an agreed percentage income to Panchayats.

iv. The concerned government agencies like Forest & Fisheries will have over the legal rights to Panchayats and WUAs and provide adequate financial resources to WUAs, the WUAs will ultimately have to become self reliant. As in the Watershed Development programme the User Contribution shall form the corpus for the WUA at the end of the project period.

v. All irrigation tanks servicing lands situated within one Panchayat village(hamlet) will vest with the local body of that Panchayat village. Irrigation tank servicing land situated in two or more Panchayat villages will vest with the Village Panchayat having jurisdiction over that area. Irrigation tanks servicing land situated in more than one Village Panchayat will vest with the Panchayat Union having jurisdiction over the area. There shall be a Water Users Association for each tank for managing the functions of the village body related to the operation, maintenance, management and income generation from the tank system. The village body concerned may request the income share of the tank with an undertaking that it would restore the system to its functional efficiency and adequate funds may be provided to the village body to carry out the improvements.

vi. The functions related to usufructs from the tank system will be transferred to the WUA, and the income derived therefrom will be shared between the village body and WUA on a mutually agreed pattern. The WUA will contribute to an endowment fund within a period of five years from the turnover of the tank system, and the Panchayat will provide a matching grant to the WUA on a 1:1 basis. The income by way of interest from the endowment fund and from the WUAs share of unufructs will be utilised by the WUA, only for the operation, maintenance and management of the tank system. If and when any dispute arises between the WUA & village body, the power to arbitrate will rest with the next higher Panchayat or Panchayat Union of District Organisation as the case may be.

vii. The Village Panchayat or Panchayat Union or District Organisation shall, through appropriate rules, provide legitimacy to the WUA to function as a working group within the village body, if necessary by amending the Panchayat or to any organization authorised by it, to promote and foster Water Users Associations. A "tank manual" containing the functions, procedures and legal provisions related to irrigation tanks shall be prepared to serve as a guide for all those concerned.

The suggested Institutional framework for tank development and management are:

- The unit for planning and organizing could be taken as a Tank Cascade where hydrologically linked tanks are taken together for development.
- All Tank Associations and Tank Cascade Associations shall be formed on the watershed basis.
- All the tank development measures should be based on a basin approach rather than based on the administrative boundaries.
- All the development works shall be done through the user groups and the role of line departments shall be facilitators rather than implementators.
- The Linkages with the Panchayats and Panchayat Unions shall be made within the purview of the Panchayat Act by considering the tank user groups as functional groups of the Panchayats

The activities as described in the above paragraphs would be functional under overall guidance of State and District level Minor Irrigation Development Organisation.

3.8 RENOVATION AND IMPROVEMENT OF EXISTING TANKS.

Large number of existing irrigation tanks suffer from sub optimal irrigation utilisation due to deterioration of the tank structure and canal distribution system. Modernisation and improvement of thousand of these tanks, will provide additional irrigation potential to the extent of 0.6 million ha. for which a provision of Rs. 3600 crores would be required. Similarly thousands of existing minor irrigation tanks are irrigating much less than their designed capacity. A provision of Rs. 3600 crore would be required for the restoration of irrigation. Working Group has therefore recommended an amount of Rs. 7200 crore for renovation, modernization and improvement of existing tank irrigation. According to second census of Minor Irrigation schemes (tanks/ponds), there are 3.6 lakh existing tanks in the country, which are being utilised for irrigation.

3.9 Central Government has given high priority to sustainable development of rainfed areas. Water harvesting schemes in non-irrigated rainfed areas, have been implemented in many states over last decade. However, their contribution to increased agriculture production was not as desired. During IX Five Year Plan about 16 million ha of degraded/ rainfed area will be developed under various Watershed Development Projects. The results show that a strategy involving people's participation along with appropriate maintaining mechanism is called for to evaluate increase in ground water recharge, reduction in soil and run off losses and reduction in sedimentation at Watershed level.

CHAPTER - IV

IMPROVEMENT OF EFFICIENCY IN IRRIGATION MANAGEMENT

4.0 The occurrences of water in the form of rainfall is highly uncertain and varying in magnitude, pattern, intensity, time, frequency and space, whereas the requirement of water by the crops is definite for each type in magnitude, pattern and time under the climatic factors, like temperature, relative humidity, wind speed and sun shine of the area where the crops are grown. The real aim of efficient irrigation management is to optimize crop productivity, irrigated area and farm income in a sustainable way with out the degradation of eco-system.

After the Independence there has been a large scale and accelerated creation of irrigation potential all over the country. But at the same time, the technology and skill of efficient management and scientific and economical use of water have not been developed to the required extent. This phenomenon has resulted into wrong use of costly and scarce irrigation water. This has given rise to the serious problems of reliability, adequacy, equity and timely supply of irrigation water which are the major factors causing low efficiency being around 30% and even below some times, although the overall designed project efficiently being around 49 to 50%. It is possible to improve the efficiency in delivery system to a level of 65%. The main causes of the present low efficiencies are, 1) Absence of definite project system specific operational policies, principles, procedures, rules for mode of operation. 2) Operating the irrigation system without seasonal operational planning based on crop water requirement and scientifically evolved irrigation scheduling. 3) Lack of technical knowledge skills experience, training in planning, implementation and monitoring of the system on the part of personnel concerned. 4) Time lag between creation of reservoir and the canal net work system leading to excessive use of irrigation water coupled with the misnomer in the minds of the farmers that, more the water applied to the fields more the yield. 5) Improper and inadequate maintenance of the system. 6) Lack of understanding and objectivity on the part of the irrigation service personnel agriculture staff, CADA personnel and farmers. 7) absence of participatory irrigation management and failure of equitable distribution of water below the outlets and maintenance of the micro system. 8) Non adoption of scientific irrigation methods and policies, absence of land shaping/grading have resulted in excess use of water leading to land degradation and environmental hazards.

Improvement of efficiency in irrigation management in its totality will apply, from the day the scheme is formulated, designed, constructed, commissioned, till the final results are obtained. Irrigation system includes comprehensively several systems like a) Physical system b) Cropping system c) Social system d) Financial and administrative system. However, irrigation management is multidisciplinary in nature and it is supremely a techno-social' activity involving participation of all the concerned agencies

- Farmers, Irrigation engineers, Agricultural officers, Financial institutions, Govt. and quasi-Govt. and Private agencies, Co-operative institutions. The efficiency of irrigation management is entirely dependent on 1. System management 2. Land management and 3. Water management. In an irrigation scheme, whether big or small, the above three types are required to be managed properly in order to realize high efficiency. Lack of or failure of any of the above results in decrease in the output. The outputs are generally expressed in terms of the percentages, in other words, it is the ratio between the designed output of the system vs. realized output.

4.1 SYSTEM MANAGEMENT

Large number of irrigation structures have been created all over the country investing huge sums. Unfortunately, a lot more is desired so far as the upkeep of the system is concerned. Irrigation structures are created based on the needs and proper analysis of the scientific data and finally, the economic feasibility. If the health of the structure is maintained at its best, it serves to its optimal level. The irrigation structure will have (a) Head works (b) Delivery System.

(a) **Head works** – It is a surface water storage arrangement under flow irrigation or lift device under lift irrigation scheme.

(b) **Delivery System** – it is a network of water conveyance device. (It is for both flow and lift irrigation systems) Storage water ensures confidence in the minds of farmers regarding, assured water supply to their land. It is important that every unit of water stored is used for irrigation and not wasted. There will be inevitable wastages like evaporation, seepage, which are taken into consideration at the time of design. It is desirable that even these wastages are minimised as every unit of water stored will be at certain cost. It is approximately assessed that the evaporation and seepage losses alone work out to the extent of 30 to 40% depending upon the area of water spread and variation in temperature and soil structure below the water spread.

4.2 LAND MANAGEMENT

Land management is an important item in the field of irrigation and requires detailed scientific analysis of the soils and suitability for the type of crop intended to be grown. The soil analysis is detailed study of structure, texture, Ph value, fertility value, chemical contents, moisture retentive capacity and so many other factors. These studies are know as 'Off Farm Development' (OFFD) and a prerequisite, before the types of crops are decided in conjunction with 'On Form development' (OFD). On Farm Development is a process under which the land is given a shape depending upon the original slope of the land and the soil mantle from the hard surface. The depth at which the vertical flow of the water below the surface of the soil starts flowing horizontally is the strata of hard impervious soil. The slope of the land decides the shape to be given to the land. If the land is steep say more than 3% then normally 'contour furrough' irrigation is resorted and if the slopes is less i.e., between 1 to 2%, the land is levelled and ditches are formed. The intention of these methods is that no topsoil is unnecessarily removed and the soil

fertility is retained. Otherwise the humus built up in the soil mass is lost and it will take several seasons to rebuild the same causing loss of production.

4.4 DRAINAGE ARRANGEMENTS

Drainage arrangements for any irrigated land is very essential. The system, therefore, needs to be planned, designed, constructed, operated, maintained and managed in such a manner that the right quantity of irrigation water is conveyed and supplied to the root zone of crops at the right time and any surplus water is drained out of the system.

4.5 WATER MANAGEMENT

The main objective of irrigation water management is to ensure timely supplies to meet the net irrigation requirement (NIR) of the crops This needs a systematic operation of irrigation system which includes planning, operation and monitoring followed by evaluation to know the performance at the end of each season to improve the working of the system.

4.6 EFFICIENCY IMPROVEMENT

Net irrigation requirement (NIR) : is the amount of water conveyed through the delivery system to the root zone, equal to the moisture deficiency. The quantity of water diverted, conveyed through the canal system and applied on the farm is known as Gross Irrigation Requirement (GIR). This will have to be more than NIR on account of the losses attributable to (i) Seepage, (ii) Leakage, (iii) Dead storage in the canal, (iv) Evaporation, (v) Wrong operation, (vi) Incorrect supply, (vii) Wastage etc. Judicious use of irrigation water should aim at reducing the gap between the GIR and NIR. This can be achieved by improving Of Farm Efficiency and On-Farm Efficiency.

(a) The off-farm efficiency of the overall canal system,

Ec = EP x Es x Et = V2/V1 x V3/V2 x V4/V3 = V4/V1 where
V1 = volume of water diverted at canal head
V2 = " " " dist/minor head
V3 = " " " out-let head
V4 = " " " field head

(b) The on-farm efficiency is as follows

Ea : Field application efficiency,
DPR : Deep percolation ratio
Er : Water requirement efficiency
Uo : Distribution uniformity Now,

Ea = Water stored in the root zone
Total water applied.

DPR = Water lost in deep percolation
Total. Water applied

Er = Water stored in the root zone
Water required in the root zone

Ud = Average depth applied – mean deficit
Average depth applied

Ea + DPR = 1, if no run off

Acceptable values are EA = 70 to 80%, DPR = 20 to 30%
Er = 90%, Ud = 80%

Before going over to the issue as to how to improve the efficiency of irrigation management, it is necessary to formulate certain strategies.

Strategy No. 1 : Systematic operational planning is absolutely necessary for ensuring reliable and adequate irrigation water supplies. The present irrigation system operation service has to be reformed to bring it on the basis of systematic planning. The operation of an irrigation schemes implies PIME : (1) Planning (2) Implementation (3) Monitoring (4) Evaluation.

(1) Planning : Evolving operation schedules for various parts to convey predetermined quantity of irrigation water from the reservoir releases, through the canal network for an area over a set period.

(2) Implementation : Actual distribution with specific mode and method and response to the changes occurring during implementation.

(3) Monitoring : Identifying the shortcomings, finding out the corrections to be applied and likely changes to be made so that the irrigation service and water management improves and attains maximum efficiency.

(4) Evaluation : Operation of irrigation system is a complex process involving consideration of so many varying factors like soil, crop, climate, rain water or stored water, farmers' response, scientific and existing agricultural practices etc.

The above implies that an 'OPERATION MANUAL' for each scheme is very essential covering the following points;

i. Detailed operational policies. Specifications and enforcement rules.
ii. Procedure for operation, planning and duties/deltas in other words crop water requirement for various types of crops to be adopted.
Iii Mode of operation of reservoir and canal net work.
Iv Regulation and control guidelines.
v. Collection of data and documentation formats.
Vi Procedure for monitoring evaluation of operation and water management skills.

Strategy No. 2 - System development i.e. Strategy for equitable distribution of water to all the holdings under an out-let through a method acceptable to all the beneficiaries. It

may be by Rational Water Distribution System (RWDS) or 'WARABANDI', 'BARABANDI', BEESBANDI' are the type of water schedules that are prepared based on realistic 'Bharai and 'Zharai' time. In the process night irrigation is a must.

Strategy No. 3 - On Farm Development (OFD). For different soil, climatic and plant factors, the realistic and scientific application of water to the fields is required to be properly scheduled to get maximum yield. As already discussed land leveling and land shaping is a pre-requisite in order to improve water use efficiency and help maximise harvesting the rain water for the crops alongwith irrigation water. Most importantly land leveling and shaping will help the application of water uniformly all over the area without wastage resulting into saving of water by about 50% and an increase in the yield by 50%. Use of plastic pipes save seepage loses in field chanels.

Water efficiency can further be improved by growing such crops, which consume less water, (ii) Recycling and reusing regenerated water from the irrigated tracts, (iii) Adopting the modern methods like 'sprinkler irrigation' and 'drip irrigation' which give use efficiency of the order of 30 to 40% of canal irrigation. Giving subsidies by the state and central govts. encourages these methods which can be adopted for all field crops. Besides high water use efficiency there are a number of other distinct advantages of adopting sprinkler and drip irrigation system. Use of plastic pipes save seepage losses in field channels.

Strategy No.4 : Participatory Irrigation Management (PIM) is a must for successful irrigation. Involvement of farmer and his participation is essentially required in the present context of Indian conditions. The main objective of irrigation management is to ensure supplies to meet the NIR of the crops timely, by applying the realistic efficiencies of the delivery system. To achieve this a systematic operation plan is to be evolved and operated strictly. This is possible only by the farmers themselves in the participatory management programme.

Farmer is the end user of the precious irrigation water and he is the central figure of irrigated agriculture for which the water is the main input. But historically he is left behind and not consulted in all stages of the irrigation projects. He is therefore not prepared to co-operate in these processes as he is always skeptical about the scheme prepared for his benefits.

It is a collective responsibility in PIM system to maintain and operate the delivery system to ensure unobstructed flow to all the holdings. Water Users Cooperative Societies (WUCS) are formed by the beneficiaries. Under the PIM principles these farmers' organizations are helpful in settling some of the disputes amicably and handling the irrigation offences and punishing the offenders and further help in the economical and judicious use of water. The most important is prompt recovery of water charges. This has been experienced in Mohini and Rema Cooperative Societies in Gujarat.

Strategy No.5 : The physical structure created for the purpose of irrigation i.e. storage along with delivery system should be 100% fit all the time during its life to store and

carry the schedule of discharges efficiently on to the holdings. This is possible only if the structures are maintained and repaired regularly. This would mean expenditure and the money required for O&M has to be collected as water charges.

Strict discipline on the part of water management personnel and the farmer is necessary for smooth and peaceful conduct of irrigation water management activities.
The main impediment being the irrigation offences, crop violation, unauthorized irrigation etc., which are to be dealt strongly.

Strategy No.6 : The personnel of the irrigation and agriculture dept. and the farmers who are involved in the irrigation water management require to be trained to perform their duties to the expected level of efficiency. The engineer in charge of O&M of schemes need to be trained and provided with necessary knowledge, technique and skills for operation, maintenance, organization and management of the systems so that they can conduct the water management activities with proper understanding cooperation, coordination and co-action with all in the dept. and with others and farmers. The field level functionaries are to be trained to impart to them knowledge about modern scientific irrigated agriculture practices and water, land and crop management technologies in order to get a thorough and accurate understanding about the actual irrigation water management problems by the professionals managing the systems, Action research has to be conducted on a portion of live irrigation system as representative of the whole area by an inter-disciplinary team consisting of engineers, agronomist, agriculture economist, rural sociologist and farmers.

Strategy No.7: The research and development in irrigation sector which is applicable to increase the canal irrigation efficiency should also be fully utilised.

CHAPTER - V

PROPOSED DEVELOPMENT FRAMEWORK FOR MINOR IRRIGATION SECTOR

5.0 EXISTING DEVELOPMENT FRAMEWORK FOR MINOR IRRIGATION SECTOR

Water is a state subject and as said elsewhere in this report, minor irrigation sector as a whole is formulated, planned, investigated and implemented by the States and Union Territories. Govt. of India is assigned the task of policy planning, assessment of irrigation potential, research and development, performance evaluation and means to increase the area irrigated from surface water and ground water minor irrigation schemes by different States and UTs.

At present the minor irrigation wing functioning in the Ministry of Water Resources, Govt. of India, is attached with one of the Joint Secretaries/ Commissioners of the Ministry. The functions of this Wing are supervised in addition to other functions of the designated Commissioner. Minor Irrigation Wing was rightly transferred from Ministry of Agriculture to Ministry of Water Resources along with Command Area Development (CAD) and Water Management (SWM) Wings in seventies. This was necessary for an overall vision of development of the irrigation sector.

Minor Irrigation Wing of Ministry of Water Resources collects and compiles minor irrigation statistics from all the States and UTs. In addition minor irrigation wing is responsible for publishing minor irrigation census, once in five years. The externally funded projects are also monitored by the Minor Irrigation Wing of the Ministry of Water Resources. As per the extant guidelines Minor Irrigation projects are not required to be submitted by the States to CWC/Ministry of Water Resources for clearance. Minor Irrigation wing is the only organisation responsible for the development of minor irrigation sector in the country at the central level.

Besides Ministry of Water Resources, subject of water and specifically minor irrigation in one form or the other is being concurrently dealt in the Ministry of Agriculture and Ministry of Rural Development also through various programmes. Though these programmes are executed to serve the multiple purpose of rural development, it is understood that 20-% of the allocation of these programmes is desired to be spent on development of small sources of water storage for irrigation and drinking water supply mostly in rural areas.

In the States and Union Territories, minor irrigation is a part of the Water Resources Department. However, in smaller states particularly in the North East, minor irrigation

sector is attached with the Public Works Department. Depending upon the size of the budget and administrative convenience of the State the structure of minor irrigation department and its functions are different from State to State. In most of the States where minor irrigation is part of the Water Resources organisation it is headed by a Chief Engineer for the entire. State. If the State is divided into different river basins and headed by a Chief Engineer separately for each basin, minor irrigation is over shadowed by major and medium projects in the basins and does not receive the proper attention it deserves.

5.1 DEFICIENCIES OF THE EXISTING DEVELOPMENT ARRANGEMENTS IN THE MINOR IRRIGATION SECTOR

Out of the 140 million hectares of ultimate irrigation potential of the country, share of minor irrigation potential is 81.54 Mha which is about 58.58%. Out of the total MI potential of 62.39 mha created upto (1997), utilisation has been 47.30 mha which is 75.8% of the potential created.

Though the expenditure on the irrigation sector has reduced from 23% during Ist Five Year Plan to 6% (IX Five Year Plan) of the total plan expenditure, allocation on minor irrigation has been reduced from 33% during VII Plan to 16% in the IX Plan of the total outlay for the irrigation sector. However, the investment of the nation in the minor irrigation sector is much larger than these figures which represent only Govt. expenditure. Even in the IX Five Year Plan about 57% of the investment on minor irrigation sector is expected to be incurred by institutional and private funding. Thus national investment on minor irrigation sector is nearly 60% of the total outlay, for major and medium irrigation sector. In comparison to the investment on minor irrigation sector, efforts for the development of the sector leave much to be desired. This, therefore, calls for urgent restructuring of institutional arrangements to sustain the level of irrigation development in the minor irrigation sector.

In spite of the fact that minor irrigation sector is vitally important for the irrigated agriculture in the country in terms of water resources potential, actual irrigation and the size of investment made, the sector has remained ignored and neglected at the Govt. level. One of the reasons of this negligence may perhaps be that stake of the Government in the minor irrigation sector is around 33% only and majority of the funding is received from the institutional and private sector. As the institutional funding is governed by commercial interest, little attention has been paid to prevent over exploitation of ground water resources.

Farmers remained willing partners, of course inadvertently, in over exploitation of ground water resources. Under such a scenario State Govts. were apathetic towards appropriate institutional arrangements and sustainable development of surface water development in the minor irrigation sector. It has largely been the irony of the minor irrigation sector, that it was not completely owned and monitored by the States and the Central Govt. The financial institutions, the major investors, also ignored the limited water availability and optimal economic return.

The investment made in the minor irrigation sector by the various ministries and departments of the Central and State Governments has remained uncoordinated. While large part of the Govt. investment comes from the Ministry of Water Resources and is reflected in the central and state plan outlays, investments from Ministry of Agriculture and Ministry of Rural Development Department are not directly allocated to the Ministry concerned with the Irrigation sector. Under the various programmes of Ministry of Rural Development and Ministry of Agriculture, large amount of funds are made directly available to District authorities. In principle, 20% of this outlay is required to be invested on water resources sector, which largely constitutes minor irrigation and rural water supply. However, there is no check and accountability of this investment. Diversion of funds from one sub head to the other, is a common feature and there is no clear-cut accountability of the expenditure incurred on specific minor irrigation schemes and potential created thereof.

There is a general lack of co-ordination in respect of planning, construction, implementation, physical achievement of irrigation potential created and channelisation of funds through various funding agencies. Correct and realistic statistics on minor irrigation sector are available with difficulty from the states and the centre. Thus, there is no monitoring of development or over exploitation of the precious water resource which already suffers from topographic constraints in the case of surface water and water availability constraints, in the case of ground water. Central Ground Water Board have reclassified the areas of the country in terms of Geohydrologic units of ground water availability for its development as (i) Safe, (ii) Semicritical (iii) Critical and (iv) Unsafe. However, there is general lack of vision about the development and recharge of ground water resources in rocky areas. There are no legal and financial checks that ground water will be developed only according to the areas categorised as safe or semi critical as mentioned above.

As India has entered World Trade Organisation regime and agricultural products are a significant part of this agreement, it is time to appreciate the challenges facing this sector in the years to come and provide additional water resources input for increasing the food production and meet the competing demands. Considering the facts as above there is need to create a regulatory mechanism for minor irrigation sector at the Central and State level to look after all the aspects of development of this sector.

5.2 PROPOSED MINOR IRRIGATION DEVELOPMENT ORGANISATION (MIDO)

Scope and objectives of Minor Irrigation Development Organisation

Proposed Minor Irrigation Development Organisation is envisaged as a technical organisation at the central and state level to look after following aspects of minor irrigation sector:-

1. Policy planning for development of the minor irrigation sector

2. Collection of data pertaining to all aspects of minor irrigation sector at the Centre and State level, its storage, retrieval and analysis.
3. Assessment of surface and ground water potential and actual utilisation, based on the data collected from various agencies.
4. Identification of thrust areas in respect of development of surface water and ground water.
5. Formulation of guidelines for survey, investigations, design, execution, operation and maintenance of schemes of surface water and ground water including appropriate conjunctive use.
6. Training of beneficiaries and officers in the field of on farm water application development, distribution, networking, new techniques of water application and water management and participatory irrigation management.
7. Formulation of guidelines for Govt. and institutional funding.
8. Institutional and Governmental linkages for resource mobilisation, new technological application and also to monitor creation of additional irrigation potential from minor irrigation schemes.
9. Coordination amongst beneficiaries, their associations, district authorities, State Govt. Central Govt. and Institutes.

5.3 ARRANGEMENTS AND FUNCTIONS AT THE CENTRE.

A strong central office for Minor Irrigation Development Organisation is envisaged in the Ministry of Water Resources, Govt. of India/ Central Water Commission which will be headed by an independent Commissioner/ Chief Engineer along with necessary supporting staff and computers. This establishment will comprise of at least three units headed by not less than Senior Joint Commissioner/ Director with Deputy Commissioners, Assistant Directors, secretariat service and supporting staff.

The Organisation will be fully equipped with modern office equipments and computer facilities along with necessary communication back up and internet access. The Organisation will establish National Data Base and collect all the information from various Ministries/Department/Agencies pertaining to the minor irrigation sector. The Organisation could draw experts on hydrology and water management and other staff from Central Water Commission, National Water Development Agency, National Institute of Hydrology Roorkee on transfer or on deputation basis.

The Minor Irrigation Development Organisation would perform the following functions at the central level.

1. Policy planning regarding development of surface water and ground water as a resource for minor irrigation sector.
2. Assessment of surface water and ground water potential, creation of potential and actual utilisation by minor irrigation schemes.

3. Institutional and Govt. funding for minor irrigation sector and interaction with various Govt. and funding agencies.
4. Monitoring over all development of minor irrigation sector and assessment of additional irrigated area.
5. Data Base Management.
6. Training facilities and co-ordination of training programmes at the central and state level.
7. Institutional linkages.

An advisory council of eminent experts in the minor irrigation sector and related disciplines could assist the Organisaton. Such advisory council could make its own rules and regulations for conducting its business.

5.4 ARRANGEMENTS AND FUNCTIONS AT STATE LEVEL OF PROPOSED MIDO

At the level of State Govt. Minor Irrigation Development Organisation will be located at the State Headquarters and chaired by Secretary of the Water Resources Department.

The constitution of Minor Irrigation Development Organisation at the State level would be as below:

1.	Secretary WRD	Chairman
2.	Engineer in Chief	Member
3.	Commissioner Agriculture	Member
4.	Commissioner Rural Development	Member
5&6.	Non official Technical Experts	Member
7.	Chief Engineer, Minor Irrigation	Member Secretary
	(To be nominated by Secretary WRD)	

Member Secretary of Minor Irrigation Development Organisation at the State level will be the executive head of the organisation responsible to fulfil objectives of the Organisation. This organisation will be supported by suitable staff as per norms equivalent to an office of the Chief Engineer. The staff could be transferred on deputation without any additional cost to the exchequer. Like central office, the Organisation will be well equipped with communication, computer and internet facilities for speedy collection of information and data.

The Organisation would perform following functions:-

1. Identification of potential surface water and ground water development sites with the help of available data from various organisations. In areas where surface and ground water sites are available, suitable prioritisation guidelines may be issued.

2. Data Base Management including collection, storage, retrieval and analysis of all the data pertaining to minor irrigation sector and its technical and statistical reporting to Central Office of the Organisation.

3. To oversee Govt. and institutional funding and to co-ordinate between States and District Authorities regarding allocation and release of funds and audit and accountability measures for such releases.

4. Formulation of guidelines for design specification, general layout of minor irrigation schemes and participatory irrigation management.

5. Screening and clearance of minor irrigation projects and quality control of projects under construction. Post project monitoring of irrigation performance and additional area irrigated.

6. Co-ordination with Central and District offices of Minor Irrigation Development Organisation.

7. Formulation and implementation of guidelines for functioning of District level offices of Minor Irrigation Development Organisation.

8. State level training arrangements and extension programmes.

5.5 ARRANGEMENTS AND FUNCTIONS OF MIDO AT DISTRICT LEVEL

Minor Irrigation Development Organisation at the district level will comprise of the following:-

1.	District Collector	Chairman
2.	Representative from Agriculture Dept. not below the rank of Deputy Director	Member
3.	Representative from Rural Development Dept. not below the rank of Dy. Director	Member
4.	Executive Engineer of Water Resources Dept. I/C Minor Irrigation in the District	Member Secretary

"Special Invitee"- (i) Officer from ground water discipline in case of ground water schemes (ii) EEPHE Dept. for drinking water supply schemes and (iii) NGO of repute in minor irrigation sector may be invited .

The Committee may meet once in a month. Member Secretary would perform appropriate scrutiny of minor irrigation schemes, through his Divisional technical staff and put up the schemes to the MIDO Committee for approval in respect of minor irrigation schemes funded by District Administration. Information on hydrology, storage, capacity, Cropping pattern and area proposed to be irrigated by the minor irrigation canal system will be clearly spelt out in the project report. The estimates to be approved will be based on appropriate technical information and quarry charts dependable inflow from the catchment and traditionally accepted technical standards. Design of minor irrigation schemes will conform to the technical circulars issued by the WRD.

Senior Officers and Head of Water Resources Department will also be authorised to inspect a minor irrigation scheme to ensure its utility in terms of quality of construction and area proposed to be irrigated. In the case of ground water schemes specific reference to availability and classification of ground water potential, i.e. regarding specific area of the source of the command as safe or subcritical will be made. Schemes in critical and unsafe areas will not be generally taken up unless supporting surface water storages are implemented. The special invitee officer will have to provide necessary certificate of availability of ground water potential of requisite quantity (volume and expected flow rate) and quality to irrigate the designated Minor Irrigation command area.

The District unit of Minor Irrigation Development Organisation will be fully equipped with modern office automation, communication and computerisation facility located in the nodal office. The unit will undertake collection, storage, retrieval and transmission of all the relevant information and statistics to the State Office of Minor Irrigation Development Organisation. The unit will also disseminate all minor irrigation related information and data to other govt. department on demand.

The guidelines for District level Minor Irrigation Development Organisation will be formulated by the State level Minor Irrigation Development Organisation to ensure appropriate development of irrigation, audit and accountability. Minor irrigation schemes will be implemented by Water Resources Dept. as far as possible also so as to be governed by AG's audit and to maintain appropriate quality standards during implementation of the schemes . Executive Engineer will be the nodal officer to maintain proper record and documents.

It is expected that institutional arrangement provided above will streamline the working of minor irrigation sector at the District level. Due to technological upgradation through procedures proposed to be adopted, there will be improvement in reliability of irrigation.

5.6 CONCLUSION

Estimated irrigation potential of the country is 140 Million Hectare. Minor irrigation sector with its ultimate estimated irrigation potential of 81.54 million hectare would contribute 58% of National Irrigated Area. The area irrigated by minor irrigation schemes is about 47.3 Mha(1997) which is about 75.8% of the actual area irrigated in the country. Multipurpose, Major and Medium irrigation projects in the country, since past

four decades have received special attention in respect of institutional arrangements like Central Water and Power Commission , succeeded by Central Water Commission , Central Water & Power Research Station, Pune, Central Soil & Material Research Station, New Delhi and National Institute of Hydrology, Roorkee, State Authorities for command area development i.e. (WALMI) in different states.

National Agenda for Governance (1998) lays emphasis on :-

> "60% of plan funds to be allocated for public investment in Agriculture, Rural Development Irrigation."
>
> "Quantum Jump in Agriculture Production" (Item 4)
>
> Adoption of National Water Policy (1987) (item 5)

A well structured scientific approach is required for successful implementation of minor irrigation schemes in the Country. The systematic framework to be designated as "Minor Irrigation Development Organisation" and its scope and objectives are well described in para 5.3 to 5.3.4 and is essential to promote sustainable cost effective and ecofriendly development of minor irrigation sector in the States and Union Territories in the tenth Five Year Plan of the nation.

An amount of Rs.200 crore at State level and Rs.10 crore at Central level have been recommended by the Working Group for creation and functioning of Minor Irrigation Development Organisation (MIDO) for the X Five Year Plan.

CHAPTER - VI

PERFORMANCE EVALUATION OF GROUND WATER DEVELOPMENT

6.0 Over the past few decades, ground water development has played an important role in stabilizing the growth of Indian Agriculture and mitigation of drought, in addition to the pivotal role of supplying drinking water to the rural and urban agglomerates. Poor sectoral planning and financial management on the one hand and inadequate water management and maintenance on the other may have lead to mediocre performance. The choices are continuation of the status quo and a modest, possibly diminishing agricultural growth rate or concerted reform and renewal in the interest matching reality to potential.

Number of wells has increased manifold in the post independence era and overdraft situation and water logging has become major issue in some locations. Minor irrigation schemes could have performed even more efficiently if the regulatory measures had been strictly adopted as per the requirement of each hydrogeological setting. The overall magnitude of over development problems, their potential and serial implications and existing management options are not very clear. However, still a lot of scope is there to suggest potential management alternatives.

6.1 GROUND WATER DEVELOPMENT SCENARIO

During the past five decades, there has been phenomenal increase in growth of ground water abstraction structure. Their number has increased from 4 million in 1951 to 17 million in 1997, while the irrigation potential created from ground water has increased from 6 to 51 million hectares by 2000. These achievements were made possible by major contribution from Central Ground Water Board in terms of its recommendations based on the different studies under normal exploration programme and bilateral and indigenous project which has been successfully completed by the Board.

The ground water development has been intensive in alluvial areas of Indo-Gangetic plain of Punjab, Haryana, U.P., and in parts of hard rock terrain in southern state. Though over-development of resources in some part of the country has created serious problems, a large portion of the available resources still remain un-tapped, particularly in north eastern states, where precipitation is high and demand for irrigation is low and in eastern states where fragmented land holdings have been a major factor in low development of ground water.

6.2 IMPACT OF DEVELOPMENT

The rapid pace of water resources development during the past five decades has led to many problems. In many arid and hard rock areas, over draft and associated water quality problems are increasingly emerging. In 231 blocks (out of total 4272) in various states in the country besides 6 mandals in Andhra Pradesh and 12 talukas in Gujarat, situation of over draft exists i.e. the stage of groundwater development has exceeded annual replenishable resource. In addition, in 107 blocks all over the country besides 24 mandals in Andhra Pradesh. 14 talukas in Gujarat and 34 watersheds in Maharashtra, the stage of groundwater development has exceeded 85% of the annual replenishable resource. The overdraft has resulted in failure of wells, shortage of water supplies necessitating deepening of existing structure thereby increasing pumping lift and pumping cost and even salinity ingress in coastal areas.

The unscientific development of ground water in some coastal area in the country has led to landward movement of sea water fresh water interface resulting in contamination of fresh water aquifers. Problem of salinity ingress has been noticed in Minjur areas of Tamil Nadu and Margulchked- Porbander belt along Saurashtra coast. Over pumpage of fresh water aquifers has caused flow of water from underlying saline water aquifers. Further shallow wells which were yielding fresh water for the last two decades in Pondicherry region east of Naively Lignite Mines have started yielding saline water due to salinity ingress. It has been established that interface has moved 6 km landwards.

Changes in ground water quality have been observed in major agricultural and industrial belts of urban complexes. This has been due to over-use of fertilizer pesticides/ insecticides in agriculture and haphazard disposal of untreated urban and industrial waste. Pollution due to human and animal wastes and fertilizer application have resulted in high level of nitrate, potassium and phosphate in ground water in parts State of Bihar, Haryana, Gujrat, Orissa, U.P. and NCT of Delhi. Fluoride concentration above permissible limit for drinking water has been reported in parts of A.P., Haryana, M.P. Orissa, Punjab, Rajasthan and U.P. Pollution of groundwater with toxic chemicals in the vicinity of industrial areas and urban settlements has been observed in many parts of the country. In the industrial zone of FARIDABAD, higher concentrations of Chromium and Copper have been reported in Ground Water. In Rajasthan, pollution of groundwater occurs in Udaipur, Pali, Khetri and Jodhpur. In Kanpur city in U.P. higher concentration of chromium and iron. have been reported. In Warangal city in A.P., effluents from textile and tannery industries have affected ground water quality in localized areas.
In addition to above problems caused due to man's interference natural factors have also affected ground water quality. It has been estimated that over 1.93 lakh sq.km. area in parts of Haryana, Punjab, Delhi, Rajasthan, Gujarat, U.P. , Karnataka and Tamil Nadu is affected by inland salinity in ground water (EC>4000 micros). Saline/ brackish groundwater resources up to a depth of 300 m below ground level in hard rock areas have been estimated to be about 1164 BCM. Further, occurrence of high iron content in North Eastern States and Arsenic in eight districts of West Bengal is a critical problem.

6.3 MEASURES TO INCREASE POTENTIAL

The ever- increasing population has forced the international community to look for certain viable strategy for meeting the increasing water demand. The first & fore most task at hand is to look for conservation, augmentation and regulation of the water resources in the country. Central Ground Water Board has taken up the feasibility studies for such an option in different hydrogeological set up and completed few projects successfully which has generated wealth of data and can be utilized elsewhere in the country.

Ground Water Resources could be augmented by harnessing surplus monsoon flows to recharge the aquifer system. According to a study conducted by CGWB about 214 BCM of surplus monsoon run off in 20 river basins in the country could be stored as ground ground water out of which 160BCM) is considered to be retrievable. In the minor irrigation sector as discussed in the proceeding paragraphs Irrigation Tanks, Nala Bunding, Gully plugging; Check Dam, Sub-surface Dyke are suitable structures which can be used depending up on the hydrogeological setting to augment ground water resources and also provide irrigation water to needy farmers.

Conjunctive Use of Surface and Ground Water

Stress would need to be laid on conjunctive use of surface and ground water in the irrigated command of any minor irrigation scheme. This will not only be a eco-friendly option but it will boost the irrigation facility in the tailed area. The tanks used for irrigation can be designed to act as percolation tank and the same can be augmented by tubewell water which will stabilize the water table in the upper reaches. The streams/rivulets can be provided by check dams and augmentation tubewell to stabilize the water table and enhance the irrigation command.

6.4 INTEGRATED WATER RESOURCES MANAGEMENT

Water resources development and management need to be planned in an integrated manner taking into consideration long term as well as short term planning needs. They need to incorporate environmental, economic and social considerations based on the principles of sustainability. Integrated groundwater development and management plan envisaging rational and efficient utilization of regional groundwater system requires a reliable data base, modelling tools to describe the regional flow pattern, proper definition of goals and related criteria and a monitoring network for ground water flow and ground water pumpage.

The concept of integrated approach for ground water management needs to address the following issues:

- Identification and protection of potential sources of fresh ground water.
- Sustainable ground water development and management including rational water utilization, protection and conservation
- Trans-boundary aquifer system analysis
- Database and analytical tools
- Strengthening of monitoring network

- Development of ground water forecasting model and ground water basin models
- Conjunctive use models and implementation of schemes of conjunctive use in canal command areas
- Drought proofing through accelerated programme of groundwater exploration and construction of production tubewells to serve as" Ground Water Sanctuary Wells" for drinking water supply
- Artificial recharge of ground water
- Documentation and information dissemination
- Training and capacity building
- Impact assessment studies of ground water development.

6.5 SEARCH FOR HITHERTO UNTAPPED RESOURCE

The present day ground water resource estimate of the country is based on our knowledge gathered from studies carried out so far. Preliminary studies have shown that there are still many areas in the country, which remained unexplored from groundwater resource point of view. Specialized studies have to be taken up within a targeted timeframe to find out groundwater potential of these hitherto unknown areas. CGWB has recently classified ground water potential with reference to its availability (i) safe (ii) subcritical (iii) critical (iv) unsafe areas. It is therefore proposed to assess the ground potential of various revenue blocks on the basis of above classification.

Application of High Resolution Satellite Data and GIS in Search of Ground Water of Hard Rock and Desert Areas

Satellite data provide information on rock types, landforms, geological structures, namely faults, folds, fractures, dykes, etc; weathering, soil types, erosion, land use/ land cover and surface water bodies (lakes, tanks, reservoirs), distribution of ground water irrigated areas and their acreage. Such information when integrated in a Geographic Information System (GIS) environment enable ground water recharge estimation, draft estimation, calculating the balance, categorization of areas into highly developed, under developed and undeveloped, identification and mapping of prospective groundwater zones, systematic planning and development of ground water, identification of over-exploited zones, prioritization of areas for resource augmentation, conservation and optimal use of water and continuous monitoring of ground water development and its utilization. Polarimetric SAR, Radar Interferometry, Ground Penetrating Radar(GPR) and nuclear magnetic resonance techniques along with the stereoscopic measurements in the optical region will help further refinement in the level of information generated on ground water using remote sensing data. The development of Ground Water Information System based on information derived from in situ, and air and space born observation help in judicious planning, effective management and sustainable development of ground water resource in the country.

Application of Newer Geophysical Techniques

Geophysical tools are quite useful in deciphering the ground water occurrence and its quality without undertaking the costly and strenuous task of well drilling. Geophysical studies in the coming years would aim at minimizing the ambiguities in the interpretation of data. This can be achieved through integration of disciplines and the geophysical techniques including the modern ones. The essential ones would be the area and problem specific standardization of the techniques, the approaches (e.g., type of profiling, increment in electrode spacing and surveying). There is a need of an overall assessment of the widely applicable gradient resitivity profiling techniques, its quantitative interpretation and preparation of master curves as well as optimization of the curve-break technique of resistivity sounding interpretations. Associated surface geophysical fieldwork has to be taken up in the typical area of granites, Deccan Traps, coastal sediments, cavernous limestones and desserts. Besides the existing interpretation techniques, there is a need of 2- and 3- dimensional numerical modelling to stimulate the realistic earth.

The geophysical applications in ground water is now divided into two main groups, viz. for the shallow and the deeper zone. Accordingly, the thrust area for geophysical studies in the coming century should be clearly aimed at the shallow zones or the environmental problems and the delineation of deeper potential targets. Such activities would require a combination of high resolution equipments. It will be quite useful to carry out hydrogeological interpretation of the huge aeromagnetic data from hard rocks and seismic data from various river basins available with other agencies. The study of the environmental problem would require a newer approach with modern techniques of imaging and ground probing radar. Procurement of modern equipment as HRS,GPR, Deep Resistivity/ Borehole loggers with advanced techniques will be carried out for research oriented studies.

Advanced geophysical studies will succeed remote sensing studies and one area will be taken up per year, totaling 15 such studies in a span of 15 years.

Accelerated Ground Water Exploration

Central Ground Water Board has so far drilled more than 15000 wells which have yielded information on the ground water regime at various depths for an estimated area of more than 11000 sq.kms. Around 13000 sq.km. area is yet to be explored which could be done by constructing about 125000 wells. So far the Board has got an experience of drilling down to the depth of 800 meters in alluvial plain, 350 meters in compact hard rock and 300 meters in boundary formation of the country. In future newer techniques like Open Hole Percussion Drilling, Odex Drilling and simultaneous Casing Drive, Hydro Fracturing etc. should be adopted for drilling beyond this depth and horizon.

Apart from the normal exploratory activities the Board in the coming years will take up some additional activities, keeping in view the present scenario of development as well as future requirements of the ground water resources. Two major areas identified are –(1) Environmental drilling and (ii) Deep drilling in Ganga Basin. Under Environmental drilling, exploration will be carried out to study quality problem by demarcating the area

of influence, identifying the source of contamination etc. These drillings for environmental impact assessment will be shallow in nature. Deep drilling beyond 1000 m will be taken up in Ganga Basin which have good prospects of encountering prolific fresh water aquifers under high pressures at remarkably deep levels. This auto flowing zones could be tapped for water supply with less energy input. Exploring and tapping of this static resources will be a challenging task for drilling, innovative well-designing as well as for the construction of deep wells. It is important to estimate the cost of effectiveness of ground water so made available even at exploratory stage.

The current pace of ground water exploration needs to be speeded up since without adequate data input, accurate assessment of the resource potential and the futuristic predictions are not possible. In the coming years accelerated ground water exploration is envisaged through construction of 15,000 deep tubewells over 15 years at the rate of 1000 per year. At present, Board has 88 working drilling rigs. From practical point of view, the target of 15,000 well construction in a period of 15 years cannot be achieved with the present strength of machine and manpower. It is therefore quite implicit that the fleet of drilling machines and strength of drilling crew and engineers needs to be increased. Simultaneously, in these days of Financial Reforms, private participation for Ground Water Exploration on short- term experimental basis can be taken up. In case proven successful, the participation of private drilling sector can be utilized on both short and long term basis. Some of the items of ground water exploration can be successfully handled by the private sector drilling agencies. R&D activities related to exploratory drilling operations which require interaction with manufacturing industries and drilling agencies at national and international levels should remain under the domain of Central Ground Water Board.

Working group has recommended a provision of Rs. 600 crores in central sector to be provided to CGWB for these activities.

6.6 DRINKING WATER SUPPLY FOR RURAL AND URBAN DEVELOPMENT

1981 to 1990 was the International Drilling Water Supply and Sanitation Decade which resulted from the Mar del Plata Action Plan adopted by the United Nations Water Conference in 1977. The target of the Decade was to provide safe drinking water and sanitation to underserved urban and rural areas by 1990, but even the unprecedented progress achieved during the Decade and in the subsequent decade were not enough. Still around 1 lakh habitations in the country do not have any source of water provided by the Govt. The nodal authority for providing water supply is State Govt. But considering the enormous tasks ahead in this field, a joint venture needs to be taken up on war footing. Central Ground Water Board in collaboration with Rajiv Gandhi Drinking Water Mission will provide technical guidance in the location of sites for safe and sustainable ground water. Advance techniques such as Remote Sensing & GIS systems, Geophysical techniques alongwith conventional field studies would be applied, to locate safe drinking

water sources for 3000 villages per year. By the year 2015,45,000 villages will be covered in this process.

Most of the villages where drinking water sources are not available are located in difficult terrain conditions like mountainous terrains, poor ground water quality regions or in arid regions where natural recharge to ground water is meager. Location of source for drinking water is therefore not enough in such areas. Water conservation measures should also be adopted simultaneously. This would provide sustainability to the existing source. Suitable Artificial Recharge measures should therefore be designed alongwith site selection for individual villages.

6.7 GROUND WATER FOR SUSTAINABLE FOOD PRODUCTION

Impact Studies of Developing Static Water Resource on Ground Water Regime

National Water Policy emphasized that only amount of water which is being recharged annually should be extracted for usage. However, recent ground water exploration studies show that enough ground water is stored in certain underground reservoirs like Indo-Gangetic Alluvium. Surface water in these areas are also available in plenty. In such areas, static ground water can be used to a limited extent on experimental basis, to study its impact on the ground water regime. Since in these areas, surface water is available, rainfall is adequate, and hydrogeological setup is favourable, artificial recharge schemes are expected to be successful. The ground water regime will therefore not likely to suffer on a long run due to the restricted mining of ground water in these areas. 15 such studies can be taken up in first 5 years i.e. 3 studies per years. However, the cost effectiveness of these studies should be ascertained and reported. The results of these studies will also be critically examined and their application will be restricted to specific location.

In order to expedite development of ground water resources in minor irrigation sector a provision of Rs. 10000 crores has been recommended by the working group to create additional irrigation potential of 5 mha in 10th Five Year Plan.

CHAPTER - VII

PARTICIPATORY IRRIGATION MANAGEMENT IN MINOR IRRIGATION SECTOR

7.0 HISTORY OF PARTICIPATORY IRRIGATION MANAGEMENT (PIM) IN INDIA

Kautilya, in his politico economic treatise "Arthashastra" urged the rulers to assist the farmers in the construction of irrigation works and encourage them with incentives in Fourth Century A.D. In Vijanagar empire (13^{th} – 16^{th} Century) small irrigation works were built by kings and farmers were participating voluntarily in water management including resolution of conflicts and routine maintenance. Distribution system of the Grand Anicut on river Cauvery initially built by Chola Kings and afterwards renovated by Britishers was maintained jointly. Upper part of the network was maintained by Govt. and the lower part by farmers. Kuhl irrigation in H.P. was managed by farmers community, so was the case with Uttar Pradesh.

In Maharashtra maintenance and distribution was taken up by farmers community, the system known as Phad irrigation. Govt. of Bombay appointed Visvesvaraya committee to examine under utilisation of irrigation facilities. The Committee recommended for entrusting irrigation to the farmers. In 1947 Govt. of Bombay set up Canal Advisory Committee and Water Panchayats to facilitate farmers participation.

7.1 POST INDEPENDECE PRACTICE OF PIM

In the decade of sixties various Southern states tried to introduce Kudi marmmat (Maintenance by donated labour) by enacting laws to make it mandatory. This however did not work because of lack of cooperation form farmers and Govt's indifferent attitude. In 1972 the Irrigation Commission expressed concern about less than optimal use of water in irrigation commands and the gap between the potential created and utilised. A Command Area Development Programme was started in 1974 in order to ensure that water below the outlet should reach all the fields in command area. A management subsidy to farmers association at the rate of Rs. 275/- ha was proposed to be paid in three years. Subsequently large number of farmers association at the outlets levels were formed. Devoid of authority and responsibility these Water Users Associations remained merely cosmetic without serving any purpose. WUA in Maharashtra were formed due to sugar mills. These factories helped groups of farmers in availing canal water and electricity at certain cost. Once these facilities were made available water distribution was left to WUA. International Funding Agencies insisted upon creating WUAs. In some cases of US AID and World Bank this became a precondition for funding. Subsequently same trend continued in Water Resources, Consolidation Projects funded by WB in Tamil Nadu, Orissa and Haryana. Water Users Association were successfully tried in Maharashtra, MP, Gujarat, Karnataka and Tamil Nadu. The initiative came some time from serving Irrigation Engineers and NGOs. A

large number of NGOs came up in Maharashtra, Gujarat and Karnataka. Most of such work started with Minor Irrigation Projects. MI Schemes are better suited to PIM. WALMIS played a significant role in creating awareness about PIM. Some of the WALMIS particularly Gujarat, MP, Maharashtra, Karnatak and Tamil Nadu took a lead in training of farmers. These training programmes were designed to train the beneficiaries as well as trainers.

7.2 OVERVIEW OF PIM IN VARIOUS STATES

In 1984 Andhra Pradesh Govt. came up with AP Irrigation and CADA Act with a provision for creating CADA and Pipe Committees. These Committees were continued to outlet command and were made responsible for distribution of water within the outlet command and maintenance of micro system network. Pipe Committees were not successful due to lack of powers. Govt. of AP held State level conference with farmers to discuss issues relating to PIM in 1995.

Govt. of Assam have set up a High Level Working Group for implementation of PIM. However no policy decisions have so far been taken. In Arunachal Pradesh and other states of North East hardly any work has been done in PIM.

Bihar in its State Water Policy announced in 1993 directed that farmers organisations will be set up to take over the management of irrigation systems. Such organisations will be given some incentives also. WAL MI Bihar organised training programmes. Govt. of Bihar also decided to hand over deep tube wells and lift irrigation schemes to farmers associations. Some of the farmers committees decided to collect water rates from members giving 30% to WRD and keeping 70% to cover O&M Cost. However the schemes did not come up to expectations.

In Orissa, farmers associations were set up under CADA programme and World Bank assisted WRC project. The component of farmers association is an integral part of this programme. The JE of the WRD will be responsible for initiating dialogue with the farmers about the need of WUAs. Each JE will be responsible for an area of 2000 to 3000 ha. The WUA will be formed at a Minor commanding an area of 300 to 600 ha. A sum of Rs. 250/- will be collected from and deposited in the bank.

West Bengal has successfully introduced PIM in tube well irrigation schemes. Three thousand high capacity tube wells run by State Govt. were facing various problems. Water rate charges were very low. Irrigation installations were stolen. Repair was delayed. Often the operator was not available. Govt. decided to hand over these installations to Panchayats. Panchayats thereafter organised beneficiaries committees. Panchayats were free to fix and realise water charges from beneficiaries. After this change in the management system, schemes became self sustaining. Incidence of theft had been reduced. Operation became easier and timely. Water was being used more efficiently because farmers paid the water rate. The success of this arrangement needs to be reviewed to know the ground realities under changing social conditions.

In Himachal Pradesh a high level Committee under the chairmanship of Chief, Secretary was constituted for effective implementation of PIM. Some farmers associations had been formed during US AID programme. They have all become defunct now. In the neighbouring state of Haryana PIM has been implemented under WRC project assisted by World Bank. A state level conference on PIM was organised by Govt. with participation of farmers. Punjab has a strong tradition of warabandi. There has been no effort to educate the farmers to participate in the management of irrigation.

Cooperative movement had taken roots in Gujarat quite early. Ukai Kakrapar project was one of the pioneering efforts in PIM. Formation of WUA in Mahi Kadana project was another early experiment. Formation of WUAs got impetus under the Action Research Programme in 1984-85 as a part of US AID programme. Mahi project was selected as Action Project. Govt. of Gujarat had adopted the Principal of PIM and issued an order on 1.6.1995. After the deliberations of High Level Working Group it was decided to take up 13 pilot projects. These have been selected in different parts of state and in different agro climatic conditions. A draft MOU between the WRD were continued to distribution of water, collection of water charges, normal system maintenance, and conflict resolution. If the WRD fails to deliver water at the head and crops fail, crop compensation will be given to farmers. There has been a favourable atmosphere in Gujarat for participation of NGOs in development activities. Govt. of Gujarat has decided to reimburse 90% of expenditure incurred by NGOs on community organisers engaged for promoting PIM. Another alternative model in Gujarat is of tube well companies. All promoters of company enter into an agreement as shareholders Bank Account is maintained by company in the name of manager. These companies are more robust and vigorous.

The Madhya Pradesh Irrigation Act was the first of its kind to provide for Water Panchayats. These have been proved powerless and lack direction. The WRD Dept of Madhya Pradesh has decided to start some pilot projects for formation of WUAs at the Minor Canal level with a maximum discharge of 15 cusecs and a maximum command of 2000 ha. In these schemes operation maintenance and recovery of irrigation dues is to be entrusted to the farmers. A decision was taken to constitute 73 societies in all the districts of State. There after further progress has been reported by MP State WRD, that 497 WUA with an area of 585774 ha were formed in on going CAD projects. An Act has been passed by the state to promote Participatory Irrigation Management. The progress included erstwhile Madhya Pradesh including Chattisgarh State.

PIM in Maharashtra dates back to seventeenth century when Phad System was in vogue. Visveswarya Committee in 1938 recommended that water distribution should be entrusted to farmers themselves. In 1947 Govt. of Bombay resolved to have Canal Advisory Committee, Pani Panchayat Committee and Bagayatdar Committee at different levels. Maharashtra Irrigation Commission in 1960 recommended supply of water on volumetric basis and handing over of water management to farmers group 1987 onwards, large number of NGOs came up and water distribution societies were formed. Govt. of Maharashtra circulated draft guidelines for formation of WUAs in

Minor Irrigation Schemes in March 1991. The MOU between WRD and WUA provided guidelines for delivery of water, choice of cropping pattern, collection of revenues, distribution of water and maintenance of the system. Up to July 1996 Maharashtra had 106 Water Users Associations covering an area of about 45432 ha. There has been, however, lack of institutional arrangement and some WUAs have become defunct. In 1998 Govt. of Maharashtra constituted second State Irrigation Commission in which PIM is also one of the important terms of reference. The report has been submitted by the commission.

Rajasthan has been implementing CADP very successfully and had followed the practice of setting up Chak samities(Outlet Committees). In IGNP 3843 Outlet Committees have been formed during the implementation of OFD. The lack of focus, powers and functions are the reasons for deterioration of such committees. This has particularly been observed after the end of USAID programme. A working group on PIM was constituted by Govt. to make recommendations about policies and strategies to be followed.

The activities of formation of WUA in Karnataka were taken up in the decade of Eighties. These areas were Malaprabha command, upper Krishna project and Hemavati project. The task of organising the WUAs was assigned to the officials of the Cooperative Department. Function of distribution of water has not been handed over to Societies. CADA, however, formed some WUAs but these were almost non functional due to lack of powers. Govt. did not finalise the MoU, volumetric rates etc. The effort seems, to be half hearted.

In Kerala PIM has been implemented under CAD. Three tier associations at the outlet, canal and project level have been contemplated. Govt. is formulating policy guidelines for PIM. Kerala CAD Act of 1986 provided for formation of Beneficiary Farmers. Association, for one or more pipe outlets. All the BFAs in a distributary are grouped together to form canal committees. These committees are constituted by CADA. The committee is responsible for equitable distribution of water, adoption of uniform agricultural practices in the command of the canal and coordination of the function of BFAs. Same CAD Act provided for constitution of project committees in which canal committees are represented along with Deptt. of Agriculture and Cooperation, MLAs and MPs.

Tamil Nadu has a long tradition of irrigation by tanks, nearly 39000, second largest after Andhra Pradesh. About 20400 tanks with a command of 40 ha. and below are looked after by Panchayats and the rest are with Govt. In the minor irrigation system construction operation and maintenance of distribution channel below the sluice is the sole responsibility of the farmers. There are five types of Farmers Organisation (FOs) functioning in the state.

- Traditional FOs active in tanks and weirs, mostly under the system of Kudimarammath.
- Modified Fos to suit new socio- economic environment.

- FOs recently initiated and developed by AFD with the help of community organisers.
- FOs initiated with the help of Irrigation Training and Management institutes.
- FOs initiated by NGOs .

In some tank commands good results have been observed under the European Economic Community Programme. World Bank model under Water Resources Consolidation Project has also been recently attempted.

Under Centrally Sponsored Command Area Development Programme, 463 associations with an area of 4,74,281 ha. have been formed. As described above, most of the PIM activities have been concentrated in various states largely in major and medium projects commanded area. Only few states like Tamil Nadu have encouraged PIM in MI sector. This useful experience should also accelerate similar activity in MI sector.

7.3 CONSTRAINTS AND STRATEGY FOR PIM IN MI SECTOR

PIM in MI Sector could have been relatively more successful than the major and medium projects. However whole MI sector has been grossly neglected by Govt. and beneficieries both. Once a minor irrigation scheme, surface or ground water, has been constructed, Govt. has very little financial and human resources to take care of such assets. Over the years storage have been silted up. Faulty designs due to lack of hydromet data have led to the construction of such schemes which were either over sized or undersized. WRD made no efforts to issue proper guidelines for design and construction of such schemes at District and Gram Panchayat level.

Lack of maintenance of storage reservoirs and canal distribution network has contributed to the failure of this sector. Once partially disowned by Govt. and not transferred to beneficiaries, a kind of confusion has been generated about surface water schemes. Water supplies have been irregular in volume and time, Tail enders are the most sufferers. Beneficiaries therefore switch over to ground water irrigation to save their crops. On the part of Govt., lack of funds and the manpower, have been the reasons for deterioration of minor irrigation schemes. Wherever the experiment of PIM was conducted in MI command area, it was observed that lack of organisation, discipline and maintenance led to similar results. In some states Govt. came up with some kind of MoU between Govt. and the beneficiaries for sharing the responsibilities of running such schemes. Here again, Govt. as well as beneficiaries, backed out of their respective duties. Without legal backing, and in absence of incentives and disincentives, PIM did not work. Ground water irrigation by tube well has been a classic example in failure of PIM. Govt. failed to supply water in quantity and time. Electric supply had been irregular, maintenance was poor and the operators were not found at the station.

On the side of beneficiaries there has been reluctance in undergoing such an education and training, Reasons could be lack of trust in the system, lack of desire to spend money and chaotic conditions created by powerful farmers lobby, sitting on the head of

channel and using bulk of water supply. Violence has been witnessed in some cases. Little success has been reported in private tube wells where tube well owners agreed to share the water at specific cost. Same has been observed in small private lift irrigation where a group of farmers pooled their resources and shared the profits and losses.

If the PIM is to be encouraged in MI Sector, Govt. will have to come up with suitable legal and crop insurance packages. Success stories are the best publicity of PIM. State Govt. will have to identify such schemes in different command areas where PIM could be successfully experimented and treat them as pilot projects. These could require certain obligations on the part of Govt. and WUA.

1. Govt. will have to come up with draft MOU clearly indicating responsibilities and the rights of the Govt. and the beneficiaries.
2. Institutional arrangements on Govt. side and beneficiaries side, suitably equipped with financial and human resources and backed up by legal provisions.
3. Agricultural extension programme, for suitable irrigated crop production.
4. Crop insurance.
5. Encouragement to agro- industries in the command area, particularly in case of fruits and vegetables, or other value added crops.
6. Financial Institutions to help in operation of such activities.

Though it sounds too much to associate all these provision with PIM but it needs to be comprehended that PIM can not be considered in isolation.

7.4 INSTITUTIONAL ARRANGEMENTS

Participatory Irrigation Management is a process quite different from the present system of top-downward management followed by the bureaucracy. PIM approach is from, part to whole i.e., from down to top management where, the bureaucracy shares the responsibility of management along with the users. The basic element of operation is through an institutional structure that develops the participatory process by the bureaucracy and the user and evolves upwards. Ministry Of Water Resources, GOI, pressurized the State Government's for the constitution of CADA Boards, CADA Councils and Farmers Association and, GOI was serious about its stand on farmers participation in the irrigation management.

To achieve desired results, institutional arrangements are to be made both in the Govt. and the beneficiaries. In Govt. as envisaged earlier a Minor Irrigation Development Organisation could be created in each State. Such an Organisation should be responsible for

1. Entering MoU on behalf of Govt. with the beneficiaries.
2. All financial assistance provided by centre or international funding agencies should be routed through such an Organisatin so as to improve management.

3. The Organisation will monitor and draw up plans, formulate design specifications, quality control during construction and participate in post project activities such as Education and Training, On Farm Development, Water Management, pilot project studies and participatory irrigation management.
4. The Organisation will tie up with financial institutions of repute for lending facilities, crop insurance, banking facilities and any other financial help to WUA.
5. Any other commercial guidance required by WUAs.

On the beneficiaries side the arrangement could be at three levels.

1. Water Users Association.
2. Distributory Water Users Level Society.
3. Project Water Users Level Council

Their function could be as follows:-

a) Water Users Associations (WUA)

1. To develop irrigation infrastructure by availing institutional finances.
2. To procure water in bulk on volumetric basis from the source i.e., irrigation department and distribute to the land holders in accordance with the principle laid down by the general body for equitable distribution of water.
3. To operate and maintain canals situated within its jurisdiction.
4. To levy/collect water charges and service charges from the beneficiaries at the rate approved by the general body of the WUA.
5. To educate and train the beneficiaries in the field of efficient economical use of water and adoption of new technologies as well to implement necessary programs.
6. To prepare water and financial budget for each irrigation season.
7. To resolve disputes that may arise amongst the land holders.

b) Water Users Distributory Level Socisety (WUDLS)

1. To prepare an operational plan based on entitlement of water, command area, soil properties and the cropping pattern at the beginning of each irrigation season consistent with the operational plan prepared by the Project Water Users Level Council.
2. To identify the critical maintenance works that are to be carried out and prioritize these works.

3. To monitor the works that are executed and to ensure that they conform to prescribed standards.
4. To monitor and regulate the use of water among various societies in its area of operation.
5. To abide by the decisions of the Water Users Project Level Counsil.
6. To Prepare water budget and crop plans.
7. To promote economy in the use of water and encourage avenue plantation in its area of operation.
8. To undertake periodical social audit.

The Working Group has recommended a provision of Rs.75 crore for participatory irrigation management in Central Sector and Rs.25 crore in State sector.

c) W**ater Users Project Level Council (WUPLC)**

1. To prepare operational plan based on the availability of water, command area, soil properties, cropping pattern at the beginning of each irrigation season.
2. To identify the critical maintenance works that are to be carried out and prioritize these works.
3. To monitor and to ensure that, the maintenance work executed conform to the prescribed standard.
4. To prepare financial and water budgets and promote economy in the use of water.
5. To under take periodical social audit.

For a proper interaction between the Govt. and the institutions as above Minor Irrigation Development Organisation could play an important role. The Working Group has recommended a provision of Rs. 75 crore for Participatory Irrigation Management in Central Sector and Rs.25 crore in State Sector.

CHAPTER - VIII

WATER PRICING

8.0 RATIONALE FOR WATER PRICING IN MI SECTOR

Having signed the WTO treaty, farm sector in India has now entered an era of import decontrol . Large number of farm products have been listed which will be decontrolled in a phased manner. The full impact of this WTO regime is yet to be played out, but it is apprehended that the consequences of international price volatility on farm products have the capacity to ruin the Indian cultivators who are likely to face the international competition without adequate safety nets. World Trade Organisation treaty's impact on water pricing for irrigation is yet to be evaluated. Another possibility in water pricing could be passing the burden of state's establishment, usually the technical bureaucracy, to the farmers. The cost of the state's establishment has no relation what so ever with the price which the farmer ultimately gets for his produce. In our anxiety to ensure adequate financial returns from the existing minor irrigation projects financed by the Govt. we should not advertently or inadvertently pass on these burdens to the beneficiaries. Water Pricing Policy for MI sector will have to be formulated carefully considering the net income of the farmer under various factors affecting the crop production with caution and with consideration of situation beyond the control of farmer.

There are three major reasons for pricing the water as an input in irrigated agriculture.

To recover investment cost. This reason, as explained, may not hold good for the investments made by Govt. However in case of a community project which is privately funded with full consensus of beneficiaries, the aspect of recovering the cost may be considered.

To fund operation and maintenance. In India, water charges are low and Govt. funds are thinly spread on various works without giving any time bound tangible results. If farmers are benefited by this service i.e., proper timely supplies, then there is no need of subsidising the service and the funding by Government agencies could be restricted. On the other hand poor maintenance leads to low productivity, and thereby unwillingness of the users to pay, further reducing the funds and so the vicious circle is closed.

To encourage productive and conservative use of water entitlement. Due to competing demands water is becoming scarcer day by day and providing subsidized or free water to alleviate poverty or increase food production would not be feasible in order to ensure that a limited resource is used as productively as possible which is now being wasted. Each demand has to be suitably priced. The last objective needs special focus on the

issue of incentives and how to price water in order to encourage productive use and conservation of water.

Approach adopted so far.

In some irrigation projects water is provided as a free service. In some projects even the low charges which are supposed to be collected are not realised. Where ever the water is charged marginal price tends to become zero. When the charge is fixed by crop or farm area and does not vary with the quantity of water actually used, marginal price tends to be zero. It is important to distinguish between average price and marginal price. Increasing a flat rate charge will lead to farmer abandoning irrigation or atleast the crop with the high water rate but will not encourage water conservation. Even if the full cost of the service is recovered but there is no incentive for the farmer to save water, he will either take water as much as he can get, while the fixed price allows a profit to be made or some times will not irrigate at all if the price is so high that he cannot make a profit. On the other hand it is possible to have a low average price and a high marginal price by a tiered rate structure by offering desired volume of water at a certain charge and then charging high cost for additional water. This will encourage farmers to irrigate within the lower tire and use water more efficiently and economically. Indian practice of water pricing has all along been, on the basis of area irrigated and crops grown. This information is obtained from revenue/irrigation authorities.

Vaidyanathan committee in 1992 recommended a two part tariff in the first phase, comprising a fixed charge of Rs.50/- per ha applicable to the entire command area as a membership charge and a variable charge per ha. of irrigation that would recover the annual O & M cost and 1% interest on capital cost, the goal finally being recovery of full cost. GOI endorsed the recommendations except the fixed charge as the majority of the State Governments did not favour it. However State Govts. did not enhance the tariffs as per recommendations of the Vaidyanathan committee relating to the variable charges as it appears that 1% interest on capital was not accepted.

The National Commission for Integrated Water Resources Development submitted a plan for action in September, 1999. The recommendations of the report are as below.

1. Water rates should be revised upward so as to cover the annual O&M cost plus 1% of the gross value of the produce per ha. for cereals and a higher percentage for cash crops.

2. The rates may consist of one part covering the variable charges only.

3. The revised rate structure should allow suitably lower rates as incentive to groups that receive supply on volumetric basis.

4. The states, while refixing the rates should rationalization in the present irrigated area, crop wise and season based rates.

5. Realistic O&M costs need to be worked out but there should be a ceiling on establishment charges.

6. The O&M component of the refixed rates should be spent on O&M only, while the part realized form the gross value of the produce, after being suitably supplemented by budgetary allocations should be spent for modernization of the irrigation system.

7. The ultimate objective should be to achieve supply of irrigation by volumetric measurement only.

8. Farmer's association should be encouraged.

9. There should be state wise Water Pricing Authorities, on the analogy of Energy Pricing Authority to lay down state wise prices of water.

Some of these recommendations are vitally important. However the entire recovery of O & M costs which is the barest minimum return from irrigation projects needs to be reviewed afresh. Even though State Govts. have not succeeded to enhance the rates adequately over the last few years, enhancing the rates might not have helped to recover the full O&M costs, because of the sharp escalation in the O&M costs particularly the establishment charges of the Govt. for operating and maintaining these irrigation systems.

Introduction of Participatory Irrigation Management and resultant reduction in Govt. expenditure has to be achieved and irrigation systems maintained accordingly. This has not been seriously considered.

8.1 CONSTRAINTS IN ADOPTION OF A COMPREHENSIVE WATER PRICING POLICY

Pricing of water in Indian irrigated agriculture has to be seen in the larger context of irrigation systems followed in the country. These hold good for Major and Medium irrigation projects and also for minor irrigation projects (surface water).

Essentially there are five regional systems of irrigation. These are Warabandi systems of North West India, Shejpali system of Western India, Localisation system of Southern India, Field to Field irrigation of rice used in Eastern India and delta areas of Southern India and Tank irrigation in Western, Central and Southern India. These five systems are to be seen in relation to legal, regulatory and operational requirements for the introduction of water pricing.

In warabandi system water right assures equitable share of total water and not the quantity required. Crop selection is at the liberty of farmers. Rules are generally followed and the distribution is equitable and uniform. The system is not suitable for differentiated water supply at farm level.

In shejpali system, water right assures adequate water for crop and not specific volume. Water distribution is skewed. The system is difficult to operate but suitable for differentiated supply.

In localisation system, water right is for 'enough'water for specified crop only. Rules are difficult to be enforced, and not possible for differentiated supply of water.
In field to field rice irrigation there are no water rights at farm level, water distribution between farms is not controlled and it is impossible to provide differentiated supply of water.

In tank irrigation system, water rights are hierarchial among tanks and farmers within tank commands. Rules are locally enforced and it is difficult to provide differentiated service.

It is generally the agreed past experience that the irrigation supplied by the Govt. canal system is financially and economically unsustainable. The cost of irrigation by Govt. sector has become very high due to several reasons such as.

1. There are large number of state sponsored projects
2. Funds are not fully available.
3. Cost and time overrun are making the projects unviable.
4. Poor maintenance.
5. Financial returns are unsatisfactory while the water rates are not increased adequately.
6. Irregular and untimely water supply compelling farmers to search for alternative water sources.

In case of state tubewells, there are similar problems. Dedicated energy lines are not available. Operation and maintenance is poor. Operator is generally not available for timely supply of water. Once water is released, distribution in the command is irregular.

In short, farmers have no faith in the system and they prefer to invest in more dependable water supply systems. Private tubewells, dugwells and small lift irrigation schemes appear more dependable to them where the controls lie with them.

8.2 MODEL WATER PRICING POLICY FOR MI SECTOR

For a good, sound water pricing policy, specially suited to MI Sector, following suggestions may be considered.

1. Surface water minor irrigation projects ready with distribution network are state funded schemes. Hence proper maintenance of the structure and distribution network upto a level of sub-minor/outlet could be the responsibility of the Govt. Down below, the network could be handed over to farmers. Farmers will pay the cost of maintenance of lower canal network only. They will also be responsible for distribution of water. The

cost of storage of water and delivering water upto the mouth of lower canal network should not be recovered from farmers.

2. In case of complete project being operated and maintained by Govt., the cost of water will be recovered from farmers or WUAs on volumetric basis.

3. In case of fully owned private sector project cost of water will have two components.

i) Cost of storage of water and delivering upto lower network. This will be a fixed cost chargeable to all the farmers on the basis of area irrigated.
ii) Cost of maintenance and distribution. This will be a variable cost to be shared on volumetric basis.

Delivery cost of water may also have two components.

i) Low cost water, minimum quantity of water which could be made available to all the farmers.
ii) High cost water which could be made available to needy farmers for their cash crop water requirements.

Differentiated water supply and pricing will have two desired responses. First to make user aware of an incremental charge related to incremental use and to encourage avoidance of wastage. Second, to achieve a balance between supply and demand through the pricing mechanism. In other words to find the price which will optimise demand for and allocation of any given availability of water. The price charged must be significant in relation to the benefits derived from using water.

8.3 CONCLUSIONS

It need not be emphasized that water is finite resource and that the balance between supply and demand is precarious. In minor irrigation sector, infrastructure has deteriorated due to lack of proper funding for operation and maintenance. These two phenomenon have generated interest in the potential role of water pricing. Water Pricing is being treated either as an economic good or as a direct means of affecting the demand.

Charging for water will clearly raise funds for required operation and maintenance works and will simultaneously induce a reduction in demand. The first of these desirable results, that charges raise funds is self evident. The second, that charges reduce demand is persuasive and consistent with experience in other sectors such as electricity but requires a number of preconditions to be met. These are :

1. The law includes specification of a price related water right for the farmer.
2. Management has to be precise so as to vary the supply as per individual's requirement.
3. Adequate accounting procedures are in place.

4. Price to be charged should be reasonably adequate to induce reduction in demand.

Agreed, measured, differentiated deliveries at farm level have been proved feasible where farm sizes are very large. For smaller farm sizes there are hydraulic complexities of delivering or not delivering incremental water supplies to individual farmers, associated with complexities of billing.

For MI Schemes, pricing of water could be at the mouth of lower distribution network as payment to the owner for bulk supply. The rest has to be managed by beneficiaries by evolving suitable price frame work.

Recommendations

Progressive states have revised water rates in last decade of 20th century. The discussion above reflects the philosophy of 21st century. Consistent efforts would be necessary to achieve volumetric distribution of water. The importance of upward revision of irrigation water rates is emphasized in the larger interest of appropriate operation and maintenance of Minor Irrigation Schemes.

CHAAPTER - IX

FORMULATION OF APPROPRIATE STRATEGY TO ACHIEVE PHYSICAL AND FINANCIAL TARGETS

9.0 The natural resource base of any country, its' land, water and forests must be productively used and conserved, not merely preserved. This provides the foundation for agriculture, industry and urbanization. The emerging water crisis, courses of action to be taken to supplement the availability of water, equity and a better quality of life for the people including India's large and growing tribal population are to be included in the national agenda.

We therefore have to harness available water resources to the extent possible. Irrigation has played a major role in poverty alleviation by providing food security, protection against famine and expanded opportunities for employment both on and off the farm. Development of irrigated agriculture has been a major engine for economic growth and poverty reduction. The growing scarcity and inter-sectoral competition for water, however, is a matter of serious concern for future advances in poverty alleviation. Food production is likely to be adversely affected particularly in the semi-arid regions of the country for want of irrigation water. An increasing number of rural poor are seeking entitlement and access to water for food production and for domestic purposes, since lack of it poses a major threat to environment, health and food security. The progress in irrigation development in the country through successive plan periods indicates that while the potential created through major and medium irrigation projects has recorded about a 4-fold increase, the irrigation potential created through ground water schemes which is mostly executed and managed by the farmers themselves has recorded about 7-fold increase.

The irrigated agriculture contributes nearly 56% of agricultural output. Current performance problems have to be borne in mind while deciding future strategy for agricultural development. The strategy envisaged in pursuance of the Prime Minister's address on 22nd March 1998 "to ensure that no water goes waste and quality of our water resources are improved and maintained" is as under :

- Optimization of existing irrigation capacity which includes renovation/restoration of old tanks along with creation of new tanks in villages and towns, promotion of micro irrigation system i.e. sprinkler and drip irrigation, particularly in water short areas;
- Expansion of irrigation facilities through time bound programme including exploitation of ground water potential of 1.5 lakh hectares (out of the ground water potential of about 20 mha) as available in the eastern region.
- Pricing of water for various uses is to be rationalized so as to at least fully recover the O&M cost of irrigation system.

- Requisite fund for regular and proper maintenance of existing irrigation system by setting apart certain percentage of plan and non-plan funds in the State budget every year is also to be ensured.
- A Comprehensive Act is also required for regulation and development of ground water on sustainable basis both in public and private sector.
- National campaign needs to be launched through mass education and public awareness using the electronic and print media to convince people that water is a precious resource and it has to be used judiciously through water conservation including rain water harvesting.

Water use efficiency is presently estimated to be about 35-40% for canal irrigation and about 65-70% for the ground water irrigation schemes. In the total water used, in 1997-98 the share of irrigation was 83% followed by domestic use (4.8%), industrial use (4.7%) and energy (1.5%). The projected total water demand for the year 2050 is around 1180 BCM against the country's utilizable water resources of 1086 BCM. Thus almost the entire utilizable water resources of the country would be required to be put to use by the year 2050. Irrigation being the major water user, its share in the total demand is bound to decrease due to more pressing and competing demand from other sectors by that year. Hence the question of improving the present level of water use efficiency in general and for irrigation in particular assumes great significance in the matter of perspective water resource planning. This will require modernization, renovation and upgradation of the system to optimize the benefits.

Funds for irrigation sector has been declining with respect to total State Plan size particularly from the 5th Plan onwards. It has reduced from 23.25% in the first Plan, to 6% in the IX Plan. To improve the funds availability , a modest approach has been made during 1999-2000 by launching the Accelerated Irrigation Benefit Programme (AIBP) for minor irrigation projects. This programme has been launched specifically for the upliftment of the tribal population in the North Eastern States and the KBK districts of Orissa.

9.1 DEVELOPMENT OF MINOR IRRIGATION IN TRIBAL DISTRICTS

For the socio-economic development of the Scheduled Tribes and their protection against the exploitation, Government of India is operating a strategy known as Tribal Sub Plan (TSP) strategy since Fifth Five Year Plan with the objectives of (i) bringing them on par with other sections of the society and (ii) protecting them from exploitation by various vested interest groups. TSP strategy is in operation in 18 States, namely, Andhra Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur Orissa, Rajasthan, Sikkim, Tamilnadu, Tripura, Uttar Pradesh and West Bengal and two Union Territories, namely Andaman and Nicobar Islands and Daman & Diu. In order to fulfil the above objective, 194 integrated Tribal Development Projects (ITDPs) have been set up in blocks/groups of blocks where the ST population is more than 50% of the total population. The Special Central Assistance (SCA) is given by the Ministry of Tribal Affairs to the 20 Tribal Sub-Plan

states/UT Administrations including North Eastern States of Assam, Manipur and Tripura as an additive to their own outlay to fill in the gaps. These grants are basically meant for family oriented income generating schemes in the sectors of agriculture, horticulture, minor irrigation, soil conservation, animal husbandry, forests, education, cooperatives, fisheries, village and small scale industries and minimum needs programme. SCA is to be utilised in conjunction with TSP flow to meet the gaps which have not otherwise been taken care of by the State Plan. Ministry of Water Resources is seriously considering rehabilitation of old and depleted tanks in the country. It is well known that tanks are located in the backward areas and hilly areas whether mostly the backward population and the tribal population is inhabited. In line with the GOI programme for the upliftment of Tribal population special provision has been made in the scheme for the Special Component Plan(SCP) and Tribal Sub-Plan(TSP) to the extent of 10 to 15%. New minor irrigation projects are being taken up under this programme. Greater thrust has to be given in the X Plan by providing sufficient funds. The Rural Infrastructure Development Fund (RIDF) under NABARD also provides loans to the State Governments for financing rural infrastructure projects including irrigation, soil conservation and watershed management, etc. The Working Group has recommended a special provision of Rs.2000 for development of minor irrigation in Tribal Districts.

Against the background of constraints in domestic funding, rigorous efforts to attract more external investment in irrigation sector as well as to improve the level of utilization have been recognized as the need of the hour particularly with regard to the externally aided irrigation projects.

Another important concern is the restoration and modernization of old irrigation systems executed during the pre-independence period and 25 years ago. Water Resources Consolidation Project has been going on in the States of Haryana, Tamil Nadu and Orissa during the Eighth Plan which also envisages, strengthening of institutions on the lines of participatory irrigation management/irrigation management transfer. More States are expected to be covered under this programme during Ninth Plan.

One of the major reasons for the deterioration in the performance of the irrigation systems in terms of adequacy, is the lack of funds provided for the operation and maintenance of the system. Against the total estimated cost of about Rs. 2500-3000 crores for O&M , the amount being provided is actually less than $1/4^{th}$ with wide variations from State to State. A major part (in most cases as high as 70-80%) of the funds provided for O&M caters to meet the cost of establishment, thus leaving a trifling amount for carrying out the actual physical works required for proper upkeep of the system. In this context, the issue of rational pricing of irrigation water has been agitating the planners and decision makers for quite some time. The recommendations of Water Pricing Committee and the Committee of Group of Officials set up by the Planning Commission are still to be accepted by the State Governments. All the State Governments have to be persuaded to implement the recommendations of the Group of Officials in the first phase of implementing Water Pricing Committee's Report.

Ground water has a crucial role in agriculture development of our country. During the last four decades there has been a phenomenal increase in the growth of ground water extraction structures in the country. In view of this, the regulation of ground water extraction has become imperative as over-exploitation of ground water in many areas has turned such areas grey and even red. To avoid this situation, it is necessary to regulate the ground water exploitation on scientific basis. However, the optimum development and utilization of water resources can be achieved by conjunctive use of ground water and surface water resources which will help considerably in preventing water-logging and soil salinity and alkalinity and also in providing adequate and assured irrigation water for crops.

The ultimate irrigation potential in the country through minor irrigation is tentatively estimated at 81.54 mha comprising 17.37 mha from surface water scheme and 64.17 mha from groundwater schemes. The potential created up to the end of 8th Plan is 62.39 mha. Upto the Ninth Plan it is anticipated to create a total potential of 68.45 mha. Thus the additional creation of potential is 6.06 mha during the Ninth Plan. Institutional finance plays an important role in implementation of the minor irrigation programmes. The Land Development Banks, State Cooperative Banks, NABARD and Commercial Banks provide credit facilities to the farmers and institutions for development of minor irrigation facilities. The minor irrigation schemes are much in number, scattered in location and implemented by various agencies of the Government, private and individuals. Due to lack of coordination among them, reliable data for irrigation potential and utilization is not available. After the first census with reference to 1986-87, the second Census with reference to 1993-94 has already been completed and the data is likely to be available soon. The thrust in this regard is required to be continued. The basic strategy for development and optimum utilization of minor irrigation works during the Ninth Plan includes the need for restoration and improvement of existing tanks as well as development of new works as part of the integrated minor irrigation development and this has to be continued with vigor during X Plan also.

To summarise, the overall strategy as proposed in the Tenth Plan, will be to address the following issues in the irrigation sector :

- To bridge the gap between the potential created and its utilization through institutional reforms and promoting farmers' involvement in irrigation management.
    - To restore and modernize the old irrigation systems.
    - To introduce rational pricing of irrigation water, based initially on O&M cost.
    - To Promote Participatory Irrigation Management (PIM) with full involvement of water user community.
    - To encourage and implement the conjunctive use of ground and surface waters towards optimal utilization of water resource and to have its development environmentally sustainable as well.
    - To accelerate the development and utilization of ground water, particularly in the eastern region on sound technical, environmental and economic considerations along with proper regulatory mechanisms.

- To promote adaptive research and development to ensure more cost-effective and efficient execution and management of irrigation systems

The largest opportunity for accelerating and sustaining agricultural development in the country is to improve the performance of the irrigation potential already created. The physical, institutional and financial problems which affect the irrigation sector, are operationally inter-related. For the farmer, since they are not involved in the management of the system and are seldom consulted by the Government, they feel that they have little influence in improving the services. Their only leverage is through political pressures and by resisting to pay for surface water, and electricity charges for ground water pumping. Hence this incentive gap for both services provider and user must be tackled at the first instance for improving the performance in the sector. Marginal changes in the institutional and financial aspects will not be able to surmount this problem. Significant restructuring is required to create the incentives to initiate a continuous and vigorous process of change. There is need to bring farmers into the management of irrigation system and to create client driven pressures on the service provider to improve performance. A parallel need is to change the role of the Irrigation Department (ID) making it a client responsive agency funded by the client and generating revenues to cover full O&M costs and fully accountable to the client.

In due course, the Government's role in management can be reduced, limiting its activities to the management of head works. At the State level, a service provider would become a fully autonomous corporate body, entirely funded by user contributions and fully accountable to users who would be represented on the Board of Directors. The agency could take various corporate forms from a public corporation, a joint farmer/ Government ownership, or to full farmer ownership and also involving the private sector through service contract for particular activities or management contracts. These changes are to be accompanied by actions to create accurate monitoring of technical and financial performance and fully transparent information for users, civil society and the private sector.

9.2 APPROPRIATE STRATEGY PROPOSED FOR DEVELOPMENT OF MINOR IRRIGATION SECTOR

Technical Improvements

The inadequate quality of design, construction and management of system, operations and maintenance, and inefficient water delivery systems have contributed to water losses. Inadequate, unreliable and inequitable distribution of water to farmers, reduced irrigated areas and agricultural productivity below potential. Hence there is a need for improving operation management of the systems. In particular, measures are needed to improve operational efficiency. Upgrading maintenance of the system, making use of the latest management techniques available, utilizing the full funding levels for maintenance and rehabilitating schemes which have been heavily silted up, weed infested and left with broken structures and outlets, would improve deliveries and reduce losses in the supply.

9.3 STRATEGY AND ACTION PLAN

On the basis of the issues discussed in the previous paragraphs, the key messages reflected can be summarised as under:

i) As water becomes increasingly scarcer and demands of water are coming from all sectors, the key issue will be more of water transfer between current users and sectors than one of allocating new water resources to new claimants. In particular, the productivity of water and irrigated agriculture, must be emphasized. Such scarcity must also be reflected in what is charged for water. Rationalized water charges should reflect water scarcity value and the need for irrigation agencies to be financially self-sufficient at least for operation and maintenance;

ii) Farmers must play an active role in operating, managing and maintaining the irrigation distribution system. Formation of Water Users' Associations has to be at the minor and distributory level and the process must be established in partnership with the agricultural departments.

iii) State Irrigation Departments need to be made financially self-sufficient, water charges rationalized, collection rates improved and Irrigation Departments allowed to retain these charges. Their investment of expenditure programmes also need to be reprioritised to emphasise full funding of maintenance works, rehabilitation and modernisation of irrigation systems, training personnel etc. Financial Management needs to be upgraded and financial viability achieved to attract private sector involvement. Transforming Irrigation Departments into autonomous utility like irrigation service agencies needs immediate consideration.

iv) States should launch carefully planned programmes linked with irrigation management transfer to Water Users' Associations (WUAs) and participation in decisions and investment costs by WUAs, to rehabilitate and then progressively modernize the irrigation systems..

vi) Research and Development efforts should be given high priority.

9.4 FINANCIAL REFORMS

The institutional reforms discussed in the previous paragraph must be integrally accompanied by reforms in irrigation sector financing. The sector is presently in financial crisis due to various factors such as inadequate revenue generation, chronically under-funded O&M, revenues not channeled directly to expenditure, inappropriate prioritization of government expenditures etc. Similarly, contributions from water users are in many States, as low as 5% of O&M expenses. The almost invariable result is the short changing of funds for O&M. It barely covers staff costs leaving negligible amounts for actual maintenance works. The entire priority ranking for expenditures in the sector needs overhaul. Inadequate cost recovery and lack of direct linkages between both

revenue and expenditure and between client and service agency are at the root of all these problems. As a result, many projects do not address the real needs of the intended "beneficiaries". Hence the major financial issues demanding priority actions are :

- Achieving financial self-sufficiency of the sector at large and its main entities such as IDs, WSAs and WUAs.
- Reprioritising Government expenditure in the sector and
- Establishing the conditions for access to credit, private sector and capital markets.

For cost recovery and financial self-sufficiency, there is need to drastically increase and rationalize the current water rates. Reduce in-efficiencies in the costs at which O&M are performed; and develop additional sources of revenue to finance irrigation expenditure. In case a one-time jump is not feasible, increase in water charges should be implemented through annual increases in a time-bound programme. Further, as soon as possible, direct linkage between revenue collection and expenditure should be established for which purpose direct collection of water charges by WUAs, WSAs and ID and making use of the revenue to finance their operations will be the appropriate step to be taken.

Improvements in billing and collection of revenue, introduction of volumetric pricing, improvements in the cost effectiveness of O&M through reduction in staff strength, eliminating duplications etc. are the need of the day. Client-driven service improvements, cost sharing, establishing an independent price regulating agency etc. have also to be achieved for financial viability.

9.5 PRIVATE SECTOR INVOLVEMENT

Involving the Private sector also offers significant opportunities. As on date, this is primarily restricted to contracting of construction activities by IDs and to a lesser extent of contracting for identified maintenance works. Some of the items in irrigation sector where the private sector can be involved on contract basis are establishment and operation of communication systems, computerization and computer networks, monitoring and evaluation, computerized billing and collection systems for water charges. Private firms and private sector associations (like Indian Water Works Association) could be involved in supporting innovations in irrigation. Similarly, scheme operation and maintenance could be rendered out to qualified private firms. Such firms could also be asked to assist the management of WSA(s).

9.6 PHYSICAL TARGETS AND FINANCIAL OUTLAY

To achieve the targeted irrigation during X Five Year Plan, following financial outlays are proposed for development of additional irrigation. Emphasis has been laid on modernisation and improvement of existing tanks. Greater thrust has been laid to increase irrigation percentage of the tribal districts. Effective coordination and

streamlining of the activities of the minor irrigation sector has been envisaged by creation of Minor Irrigation Development Organisation.

The Working Group on Minor Irrigation for IX Five Year Plan recommended an outlay of Rs.1450 crore in Central sector, Rs.10,000 crore in State sector and anticipated investment of Rs.18,000 crore by institutional and private fundings. Thus total outlay for Minor Irrigation Sector was anticipated as Rs.29,450/- crore. This was also anticipated that additional irrigation potential of about 12 mha will be created. In the Xth Plan proposals the Working Group has proposed additional irrigation of 3 mha of surface water irrigation. The working Group has laid emphasis on modernisation and improvement of existing tanks, special schemes for tribal districts and creation of Minor Irrigation Development Organisation. The Working Group has proposed 5 mha additional irrigation from ground water resources.

As cost of these works need appropriate, infrastructure, large capital investments are to be made in initial stage. The working Group has recommended an outlay of Rs.36200/- crore in central sector, state sector, institutional finance and private funding. This would generate an employment potential of 3720 million man days.

Women's participation

There is considerable scope for gainful employment for women as they contribute to and benefit from rural minor irrigation schemes. Women's role is not limited to participate as field workers or farmers in small scale irrigation projects. They also participate in institutional arrangements such as Water Users' Association or in Water Committees. It is envisaged that women will also be assigned important role in Minor Irrigation Development Organisation at the district level during the X Plan period in gender composition of various activities. This is briefly narated below:-

1.	Women as labourers	Village level
2.	Women as farmers and decision takers	Village level
3.	Women as Water Users' Committee members	Village/ Project level
4.	Women as Advisory/Regulatory level in MINOR IRRIGATION DEVELOPMENT ORGANISATION	District level/ Block level

Training of beneficiaries and administrative units is necessary part of development. As the newer techniques and concepts are being experienced in irrigation sector appropriate training modules could be introduced at all levels. Area of training which need immediate attention are policy planning for development of the sector, formulation of guide lines for design and execution, distribution of water and water management, extension programs for water application conservation and marketing of food products. Minor Irrigation Development Organisation could be incharge of educating and imparting training to all concerned.

The break up of additional irrigation proposed in the X Five Year Plan and provision of outlay is described herewith. The development of surface irrigation from new schemes will comprise of new minor irrigation tanks, lift irrigation schemes and pickup wier etc. The costs of these schemes has increased due to R&R costs and cost of other environmental mitigation measures. Admittedly over all average cost/ha would swing around Rs.60,000/ha. Modernisation and improvement would involve renovation of existing tanks, canals and in addition would enhance the commanded area and canal system. The provision of Rs.60,000/ha has been made accordingly. In order to regain the designed irrigation capacity, renovation of existing minor irrigation tanks is proposed. This would include restoration of dams to its designed profile, redesign of waste weir where needed. Renovation/ replacement of head sluice and renovation, resectioning of canal along with lining/land acquisition of canal alignment where called for. An overall provision @ Rs.40,000/ha is made to accommodate cost of entire construction works involved.

Renovation of existing minor irrigation schemes in Tribal Districts would create additional irrigation potential for which rate of Rs.40,000/ha is proposed as land compensation costs as costs of local labour are relatively cheaper.

The environmental costs including payment of land compensation, rehabili-tation has considerably escalated during last 5 years and as such overall workable rates have been proposed.

9.7 A well structured approach is proposed to achieve additional irrigation in 8 mha and restoration of irrigation potential in 1.1 mha from improvement in existing tanks and tank system in X Five Year Plan. Additional irrigation potential of 3 mha from surface minor schemes is proposed. This consists of 2.4 mha from New Minor Irrigation Schemes including tribal areas and 0.6 mha to be achieved by modernisation of existing irrigation tanks and tank systems. Additional irrigation potential of 5 mha is proposed to be created on the basis of recent classification of CGWB with reference to water availability in (i) Safe and (ii) Sub critical areas. Thereafter critical areas will be explored.

Tenth Five year Plan Proposals (Year 2002-2007)

A.	**PHYSICAL**		
	Proposed Target for Development of Irrigation Potential		8 mha
	(i)	Surface Water Schemes	3 mha
	(ii)	Ground Water Schemes	5 mha

B	**FINANCIAL REQUIREMENT**	Amount in Rupees (Crore)	
		State Sector	Central Sector
1.	Provision for Development of Additional Irrigation	26300	
2.	Provision towards Research & Development	-	100
3.	Provision towards Development of CAD activities in minor irrigation schemes having CCA between 500 - 2000 mha.	-	115
4.	Provision towards modernisation and improvement of existing tanks	7200	-
5.	Special schemes for Tribal Districts for development of minor irrigation schemes	1300	-
6.	Provision for rationalisation of minor irrigation statistics schemes	-	40
7.	Provision for creation of Minor Irrigation Develop -ent Organisation at the Centre and in the States for m irrigation data base management and professional upgradation of minor irrigation schemes (Central/States/UTs/ MIDO)	200	10
8.	Provision towards sprinkler and drip irrigation and Measures to improve irrigation efficiency	25	100
9.	Provision towards Participatory Irrigation Management (PIM) of minor irrigation schemes	25	75
10.	Provision towards performance evaluation studies	-	10
11.	Provision towards equity for privitization	-	100
12.	Central Ground Water Board including artificial recharge	-	600
	Total (1 to 12)	35050	1150

C	FINANCIAL RESOURCES FROM NABARD, PRIVATE FINANCE AND OTHER MINISTRIES	Amount in Rupees (Crore)		
		Institutional and Private Sector	State Sector	Central Sector
13.	Assistance available from Institutional Finance (NABARD)	10000		
14.	Private Investment (20% of Institutional Finance)	3000		
15.	Government funding in Rural Development		2000	
	Total (13+14+15)	15000		
D.	**TOTAL OUTLAY REQUIRED TO MEET THE TARGET**	State Sector	Central Sector	
16.	State Sector Plan Outlay(35050-10000-3000-2000)=	20050		
17.	Central Sector Plan Outlay		Rs. 1150	
18.	**Net Outlay** Total Rupees crores	21200		
19.	**Gross Total Outlay** Rupees crores	36200		

BREAK UP OF ADDITIONAL IRRIGATION PROPOSED IN TENTH FIVE YEAR PLAN AND PROVISION OF OUTLAY

S. No.	Particulars	Qty. (mha)	Rate/ ha	Amount (Rs. in Crores)
1.	Development of Minor Irrigation from New Minor Irrigation Schemes	2.3	60000.00	13800.00
				13800.00
2.	Modernisation and improvement of existing tank for creation of additional potential	0.60	60000.00	3600.00
2.A	Renovation of existing Minor Irrigation Tanks to restore irrigation potential (This includes desilting of existing minor irrigation tanks) (0.9)		40000.00	3600.00
	Sub Total 2 & 2 A			**7200.00**
3.	New Minor Irrigation Schemes in Tribal Districts/ Blocks.	0.10	50000.00	500.00
3.A	Renovation of existing Minor Irrigation Schemes in tribal District ton restore irrigation potential (This includes desilting of existing minor irrigation tanks) (0.2)		40000.00	800.00
	Sub Total			**1300.00**
Total Restoration (1.1 M.ha) (Sub total 2A + 3A)				
4.	Minor Irrigation Ground Water Schemes	5.0	25000.00	**12500.00**
5 (a)	Addl. Irrigation from New Minor Irrigation Schemes.	**8.00 mha**		
(b)	Restoration of existing Minor Irrigation tanks to its designed irrigation capacity	**1.1 mha**		
			Total	**35000.00**

9.8 CONCLUSIONS

The strategy proposed and the action areas identified are:

a) improving water use efficiency by progressive reduction in conveyance and application losses;
b) there is need to bridge the gap between potential created and utilized through various means;
c) there is need to introduce rational pricing and promote participatory irrigation management;
d) the conjunctive use of ground water and surface water with environmentally sustainable development is to be encouraged;
e) the ground water development should be accelerated with necessary regulation,
f) there is need for rehabilitating old irrigation system and modernizing such systems;
g) reprioritizing expenditure for O&M works so as to improve financial management.
h) involving people in development of local water resources right through during planning, implementation and subsequent maintenance.
i) tribal and backward areas to be given special attention by providing grants/funds along with imparting training.

CHAPTER - X

INSTITUTIONAL AND PRIVATE SECTOR ROLE IN FINANCING OF MINOR IRRIGATION SCHEMES

10.0 PREAMBLE

Minor Irrigation schemes particularly ground water schemes are largely dependent upon mobilization of institutional investments and to a lesser extent by private sector investments duly supported by the element of subsidy provided by central and state governments to promote and popularize minor irrigation investments amongst farmer-beneficiaries through the principles of growth and equity both from resource development and credit dispensation point of view.

10.1 INSTITUTIONAL INVESTMENT

Institutional credit is provided by rural financing institutions i.e., banks with refinance support from National Bank for Agriculture and Rural Development (NABARD), who as an apex institution guides the over all credit policy in agriculture and rural development of the country besides ensuring credit delivery at the ground level. Institutional credit is thus provided both for private and community owned dugwells, tubewells, agriculture pumpsets, energisation, river lift irrigation schemes as well as for water management schemes, such as drip and sprinkler irrigation systems. Thus, medium and long term (MT/LT) loans for minor irrigation structures are therefore provided to the farmers, as individual, group or cooperative society by the state Cooperative Agriculture and Rural Development Banks (SCARDBs), the State Cooperative Banks (SCBs), the Regional Rural Banks (RRBs) and the Commercial Banks (CBs) who in turn avail refinance from NABARD at a concessional rate of interest.

10.2 FINANCIAL ACHIEVEMENTS

Institutional investment during the First Five Year Plan (1951-56) was negligible but thereafter, it has steadily grown from Rs. 19.15 Cr. during Second Five Year Plan (1956-61) to Rs. 2659 Cr. (likely) during Ninth Plan (1997-2002) as could be seen from the Table 1.

Table 1 : Minor Irrigation Institutional Investment during various Five Year Plan Periods

(Rs. in Cr.)

S.No.	Plan	Period	Institutional Investment
1.	First Plan	(1951-56)	Negligible
2.	Second Plan	(1956-61)	19.15
3.	Third Plan	(1961-66)	115.29
4.	Annual Plans	(1966-69)	234.74
5.	Fourth Plan	(1969-74)	661.06
6.	Fifth Plan	(1974-78)	780.24
7.	Annual Plan	(1978-80)	490.40
8.	Sixth Plan	(1980-85)	1437.55
9.	Seventh Plan	(1985-90)	3060.95
10.	Annual Plans	(1990-92)	1349.59
11.	Eighth Plan	(1992-97)	4241.69
12.	Ninth Plan (1997-2000) (2000-2002)	(1997-2002) Achieved : Rs.5550 Target : Rs. 5030	2659.00 (Anticipated)

10.3 PERFORMANCE UNDER NINTH PLAN PERIOD (1997-2002)

During the Ninth Plan period the institutional investment target for minor irrigation works based on the projection of macro level credit flow was estimated at Rs.9923* Cr. These targets mostly covered development of ground water resource potential through dugwells, shallow tubewells / borewells and agriculture pumpsets. The year-wise targets and achievements are given in Table 2.

Table 2 : Minor Irrigation Institutional Investment during Ninth Plan Period (1997-2002)

(Rs. in Cr.)

S.No.	Year	Target	*Achievement
1.	1997-98	1598.00	505.99
2.	1998-99	1755.00	531.90
3.	1999-2000	1984.00	557.53
4.	2000-2001	2188.00	531.73
5.	2001-2002	2398.00	(Likely)531.73
	Total :	9923.00*	2658.88

* Data as available in the Ministry of Water Resources

The overall achievement during Ninth Plan is anticipated at Rs.2658.88 crore.

10.4 NABARD REFINANCE

The performance of NABARD as an apex refinancing agency is reviewed hereunder

FINANCIAL ACHIEVEMENT :

Minor Irrigation is the main activity supported by NABARD since inception (erstwhile ARDC) and it constitutes about 23 per cent of the total refinance under investment (MT/LT) credit extended so far. Refinance for minor irrigation purpose includes all ground water development structures like, dugwells, tubewells/ borewells, agriculture pumpsets, surface water lift irrigation schemes and water management schemes, such as, drip and sprinkler irrigation systems. Thus the status of refinance disbursed by NABARD under investment (MT/LT)
credit for minor irrigation as compared to total refinance is given in table 3.

Table 3 : Refinance Disbursed by NABARD under Investment (MT/LT) Credit during various Plan Periods (Total to Minor Irrigation Sector).

(Rs. in Cr.)

S.No.	Plan Period	Total	Of which Minor Irrigation	Percentage to Total
1.	Up to 1985 (Since Inception)	5427.23	2538.81	46.78
2.	During VII FYP (1985-90)	6980.04	2203.00	31.56
3.	During Annual Plans (1992-97)	3956.53	998.00	25.22
4.	During VIII FYP (1992-97)	14702.10	2946.00	20.04
5.	During IX FYP			
	1997-98	3921.91	506.00	12.90
	1998-99	4520.67	532.00	11.77
	1999-2000	5214.67	558.00	10.70
	Total :	44723.35	10281.81	22.99

The share of agency wise availment of NABARD refinance under minor irrigation to total under investment (MT/LT) credit amongst Cooperatives, RRBs, and CBs has shown a visible and desirable shift from the earlier long term trend in terms of percentage ratio standing at around 60:03:37 to now (1998-99) established at 42:03:55 respectively. This has resulted in improving the ground level credit disbursement during the first 3 years of Ninth Plan aggregating to Rs.1596 Cr. As against Rs.4242 Cr. registered during the entire Eighth Plan period, which is the cumulative result of the NABARD initiatives in boosting minor irrigation credit flow at ground level with effect from 1998-99 onwards in terms of lowering the refinance rates, increasing the quantum of refinance and holding regular district level MI colloquiums with a view to giving direction to credit in potential

areas. It is hoped that with such continued interventions ground level credit disbursement would further improve during the terminal years of Ninth Plan also.

10.5 PHYSICAL ACHIEVEMENTS

NABARD since inception in 1982 to 1994-95 has constructed through refinance facility 35 lakh wells, 38 lakh agriculture pumpsets and 10 lakh conventional lift irrigation schemes. The physical targets for dugwells, shallow tubewells / borewells and agriculture pumpsets as contemplated under Ninth Plan and achieved under institutional credit with refinance support from NABARD (excluding IRDP / SGSY) are given in Table 4.

Table 4 : Physical Targets and Achievements of various Minor Irrigation Works under NABARD Refinance during Ninth Plan (2002-07)

(000 No)

S.No.	Year	Target			Achievement		
		DW	STW/BW	PS	DW	STW/BW	PS
1.	1997-98	200	304	578	82	46	182
2.	1998-99	212	324	642	56	27	311
3.	1999-00	226	359	702	45	47	134
4.	2000-01	242	378	761	N.A.	N.A.	N.A.
5.	2001-02	260	398	832	N.A.	N.A.	N.A.
	Total :	1140	1763	3515	N.A.	N.A.	N.A.

Source : Annual Reports, NABARD

FINANCING BY STATE CO-OPERATIVE AGRICULTURE AND RURAL DEVELOPMENT BANKS :

The State Cooperative Agriculture and Rural development Banks (erstwhile State Land development Banks) have been playing an important role in ground level credit disbursement for minor irrigation development in the country because of their wide bank / branch network and long experience in MT/LT lending operations. Historically they have been providing continued support for minor irrigation as could be seen from Table 5.

Table 5 : Ground Level Credit disbursement by SCARDBs under Investment (MT/LT) Credit during various Plan Periods : Total Credit to Minor Irrigation

(Rs. In Cr)

S.No.	Plan Period	Total Credit	Of which Minor Irrigation	Percent to Total
1.	During VII FYP(1985-90)	3253.39	1587.34	48.79
2.	During Annual Plans(1990-92)	1087.13	684.62	62.97
3.	During VIII FYP (1992-97)	7592.09	2141.06	28.20

4.	During IX FYP 1997-98 1998-99 1999-2000	 2099.70 2167.80 2345.80	 422.34 400.56 441.15	 20.10 18.50 18.80

10.6 CONSTRAINTS IN FINANCING

It may be seen from Table 5 above that the performance of SCARDBs in terms of percentage share of minor irrigation credit to total credit slowly going down from 48.79 during Seventh Plan to 28.20 during Eighth Plan, whereas it recorded further decline during annual performance review in Ninth Plan showing 20.10 percent in 1997-98 and 18.80 percent in 1999-2000. The following constraints were responsible for the deceleration in the credit flow though SCARDBs under minor irrigation sector:

a) Unsatisfactory recovery position resulting into reduced lending eligibility, besides in some major states, SCARDBs have become weak due to mounting NPAs necessitating rehabilitation / adoption of reform packages;

b) Diversification to other activities like Farm Mechanization, Non Farm Sector and Other Priority Sector lending;

c) Incomplete land records; and

d) Inadequate monitoring of sanctions and disbursements.

10.7 TENTH PLAN PROPOSAL

In the back drop of the above performance review of the institutional credit vis-à-vis targets fixed under previous plan periods, the following physical and financial proposals are made based on the assessment of availability position of ground water and surface water resources both in space and time and the noncredit inputs and infrastructure availability position including bank / branch network as brought out in the annual district level Potential Linked Credit Plans (PLCPs) prepared for various states by NABARD

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10.8 GROUND WATER SCHEMES

The ground water schemes under institutional lending essentially cover dugwells. Tubewells / borewells, deep tubewells and agriculture pumpsets. In most of the states ground water conditions have changed over the years both in hard rock and alluvial areas of the country, resulting into striking change in the design and type of ground water structures. In many areas water tables have gone down, necessitating increase in depth of wells, particularly dugwells. Further, with the prevailing deep water table conditions in the hard rocks, particularly in the southern and central peninsular India, borewells and dug-cum-borewells have become more popular than dugwells, although, the latter would continue, whereas conditions are favourable, owing to its certain advantages, such as, less risks and larger storage. In alluvial areas, only shallow tubewells and deep tubewells are

constructed for development of ground water. Therefore, all the future programs for ground water development during Tenth Plan has to be covered by shallow tubewells under institutional investment and deep tubewells to be undertaken by the State Irrigation Development Corporations (SIDC) who are eligible to avail bank finance.

10.9 REPLACEMENT OF OLD STRUCTURES

Many of the existing tubewells and borewells and to a certain extent dugwells have outlived their serviceable life to have become non-operative due to changes in hydrogeological conditions. While plan priority would continue to be for creation of additional irrigation potential through new works, there is also a need for restoring the lost potential by replacing such defunct structures by new ones. The financial requirement for replacement of such wells would however, be sustained internally i.e., from the income derived over a period of time from these existing wells. Yet, many of the farmers particularly with small holdings would largely depend on bank loans. Therefore, based on the minimum need
and demand, the program for replacement of old ground water structures during Tenth Plan period is suggested on a limited scale. Neither it is excepted nor possible to replace all old structures during the next 5 years, hence the program for replacement of old structures during the Tenth Plan is moderately suggested at 1.5 lakh dugwells, 2.0 lakh borewells, 500 deep tubewells and 10 lakh agriculture pumpsets.

10.10 UNIT COSTS

The unit costs of different ground water structures in various states are reviewed and revised by NABARD on a continual basis. It is generally observed that units costs show an upward revision in relation to rate inflation prevalent in the country. The average rate of inflation prevailing in the country for the past few years is around 8 percent. The following projected average unit costs have therefore been considered for the first year (2002-03) of the Tenth Plan (see. Table 6) and the same are subsequently projected with similar 8 percent simple projection for working out the year wise financial projections of the proposed targets under the Tenth Plan Period.

Table 6 : Projected Unit Costs of Ground Water Structures for 2002 – 03
Being First Year of Tenth Plan

S. No.	Ground Water Structures	Unit Cost (Rs.)
1	Dugwell	35,000
2.	Shallow Tubewell / Borewell	21,000
3.	Deep Tubewell	6,30,000 to 8,54,000
4.	Centrifugal Pumpset	15,400

10.11 FINANCIAL TARGETS

Thus the total financial targets for creation of 2.10 mha. of surface water minor irrigation potential would be Rs. 20,750.00 Cr, out of which Rs. 2950.00 Cr would be supported by institutional credit, Rs. 900.00 Cr from private investment and bulk of it i.e., Rs.16,900.00 Cr would have to be provided through state plans, the scheme wise/ program wise financial break up is given in Table 7.

Table 7 : Financial Targets for surface Water Minor Irrigation Schemes/ Programs under Tenth Plan (2002-07)

(Rs. in Cr)

S.No.	Scheme/ Program	Private Investment	Institutional Investment	State Plan	Total
1	LI Schemes	900.00	2700.00	-	3600.00
2	State MI Schemes	-	-	15000.00	-
3.	Restoration of Lost Potential Program	-	-	1400.00	1400.00
4	PIM	-	250.00	500.00	750.00
	Total :	900.00	2950.00	16,900.00	20,750.00

These targets, after scrutiny, appear to be on higher side in comparison to IX Plan performance.

10.12 ADOPTION OF MICRO IRRIGATION SYSTEM

There is increasing awareness amongst farmers for adoption of better water management practices under irrigation through use of micro irrigation system such as drip and sprinkler irrigation systems. Although, these systems are more suitable for horticulture, plantation and oilseeds crops, these are being used for other crops also, like cotton, sugarcane, wheat, etc. There is therefore a need for encouraging use of drip and sprinkler irrigation systems for efficient use of water. It is necessary to give more thrust to these techniques during Tenth Plan. Although, Central and State subsidies are available for drip and sprinkler irrigation system, a sizable program is supported through institutional credit even in non-traditional areas like U.P., Orissa, West Bengal etc. Considering the past achievements and likely demand as estimated separately by NABARD and the Micro-irrigation Industry, the following targets for drip and sprinkler irrigation systems are suggested in Table 8 below.

Table 8 : Physical Target for Micro-Irrigation system under Tenth Plan (2002-07)

S. No.	Micro-Irrigation System	Physical Target (Ha)
1	Drip Irrigation System	5,00,000.00
2	Sprinkler Irrigation System	8,00,000.00

The performance of the drip irrigation program during the previous plan was much below satisfaction. Main constraint was delay in allocation and release of subsidy, which resulted in blocking of the manufacturers' capital against the systems supplied. This has

dis-enthused suppliers to take up larger programs. Therefore, during the Tenth Plan, it would be imperative to ensure that the allocations of subsidy are made much ahead of the season and the procedures for release of subsidy are made friendly.

10.13 FINANCIAL PROGRAM

Based on the current NABARD cost norms and after allowing for the cost escalations, the total cost of the micro-irrigation program works out to Rs.3890.68 Cr of which Rs.1432.47 Cr would be through subsidy, Rs. 98.00 Cr by private investment and Rs.2361.21 Cr through institutional credit. Table 9 gives the details of financial program for drip and sprinkler irrigation system during Tenth Plan Period.

Table 9 : Financial Program of Micro-Irrigation system under Tenth Plan (2002-07)

S.No.	Micro-Irrigation System	Total Cost	Subsidy	Pvt. Invest.	Institutional Credit
1	Drip	1986.20	968.10	50.00	968.10
2	Sprinkler	1905.48	464.37	48.00	1393.11
	Total :	3890.68	1432.47	98.00	2361.21

10.14 FINANCIAL REQUIREMENTS DURING TENTH PLAN (2002-07)

Year wise Requirement of Institutional Investment

During Tenth Plan the institutional investment for new works both ground water and surface water structures including micro-irrigation system proposed is Rs.12359.141 Cr against likely ground level credit disbursement of Rs.10580 Cr during Ninth Plan, showing an increase of 16.82 percent. Many other items like cooperative lift irrigation schemes, which were eligible for bank credit were not considered for institutional investments during Ninth Plan. The year wise requirement of institutional investments both under ground water and surface water potential, as estimated, is given in Table 10.

Table 10 : Year wise Institutional Credit Requirement during Tenth Plan(2002-07)

(Rs. in Cr)

S.No.	Plan Year	Institutional Credit
1	2002-03	2705.735
2	2003-04	3142.887
3	2004-05	3620.821
4	2005-06	4117.156
5	2006-07	4641.982
	Total :	18228.581

There is a large gap between requirement of credit as projected for the Xth Plan and refinance distributed by NABARD in three years of IXth Plan (refer Table 3). NABARD has disbursed only Rs.1686 crore in three years (1997-2000). Therefore, Working Group has suggested an

overall provision of Rs.10000 Cr institutional finance from NABARD during Tenth Plan. This assessment is based on anticipated disbursement of Rs.2659 Cr during Ninth Plan period. In addition, it is expected that finances to the extent of Rs.3000 Crore will be likely to be available from the private funding.

CHAPTER - XI

DATABASE MANAGEMENT FOR THE DEVELOPMENT OF MINOR IRRIGATION SECTOR

11.0 Minor Irrigation is a thrust area of national development. The input of water is vital for realising the full potential of this sector. The optimum development and efficient utilisation of Water Resources, therefore, assumes great significance. Further to make a meaningful move forward, dependable database is of paramount importance. At present there are four main sources of irrigation statistics. These are:

11.1 CENSUS OF MINOR IRRIGATION PROJECTS

The Ministry of Water Resources conducts Census of Minor Irrigation Projects on quinquennial basis under the Centrally sponsored Plan Scheme "Rationalisation of Minor Irrigation Statistics (RMIS)". The first Census with reference year 1986-87 was conducted in all the States/UTs except Rajasthan and the Census report was published in November 1993. The second Census with reference year 1993-94 has since been completed and the Census report has been sent for printing. The Census report provides valuable information in respect of Minor Irrigation works in each District and gives a realistic database for future planning. The number of Minor Irrigation works in use and which have gone out of use in each District along with various related information has since been updated in the report of second census of Minor Irrigation Projects. The information in respect of adoption of newly developed and technologically advanced water and energy conserving devices such as sprinkler and drip irrigation system and use of non-conventional energy sources such as solar pumps and wind mills are also included in the Census report. In addition to the above, the Census report also provides information regarding State wise Potential created/utilised through Ground Water/Surface water schemes of each type i.e. Dug wells, Shallow Tube wells, Deep tube wells, Surface Flow and Lift schemes. Crop wise area irrigated, number of Electrical/Diesel Pumps being used for Minor Irrigation schemes, number of Minor Irrigation schemes under utilised due to various reasons, ownership wise number of Minor Irrigation schemes, etc. through each type of Minor Irrigation schemes. However, there is a need to reduce the time lag in availability of census result which is about 7 years at present. The 3rd Census of Minor Irrigation Projects with reference year 2000-2001 has since been launched in all the States/UTs. This Census will further update the information in respect of number of Minor Irrigation Schemes in use, their potential created/utilised, number of schemes that have gone out of use due to various reasons, etc.

11.2 QUARTERLY PROGRESS REPORTS

The Ministry of Water Resources collects data on development of Minor Irrigation (MI) in each State in the form of Quarterly Progress Reports. The Statistical Cells created in the nodal Department of each State/UT under the RMIS Scheme are instrumental in

collecting the required information from all the Departments contributing towards the development of Minor Irrigation within the State/UT, getting it scrutinised/consolidated and forwarding the same to the Ministry of Water Resources. However, as some of the States/UTs (where the statistical cells have not been created) do not furnish the above reports, the total picture of Minor Irrigation development is not reflected exactly as the data in respect of such States/UTs are estimated. Efforts are being made to create Statistical Cells in the remaining States/UTs.

11.3 LAND UTILISATION AND AREA STATISTICS (LUS)

The Statistics of land utilization and crop area statistics flow chiefly as a by-product of the land records prepared annually by the revenue agencies on field to field enumeration basis in all States except Kerala, Orissa and West Bengal where these statistics are based on the method of random sample surveys. The primary reporter of the Revenue Department generally known as Patwari maintains for each village a basic register called the Khasra (Record) register, which gives information for each survey number (field) regarding total area, name of the owner and operator, tenure and tenancy rights, area under different land-uses, and in case the land is cultivated, area under different crops, fruit orchards, irrigated areas under crops, sources of irrigation, etc. After the entries in the basic village register are completed for a season, a village-wise crop abstract giving areas under different crops for every season is prepared by the primary reporter. Annual abstracts of different land uses and of areas irrigated from different sources are also prepared. The village totals are aggregated to obtain the figures for successive administrative units like tehsils, districts, States and for the country as a whole.

The Land Utilization Statistics are broadly classified under the three heads namely total area and classification of area; area under crops; and area irrigated crop-wise/source-wise. The Gross cropped area represents the sum total of area under all the crops. The difference between the total cropped area and net area sown is accounted for by area sown more than once on the same land during the same year with the same or different crops. Different sources of irrigation are canals (Government and Private), tanks, Wells (tube-wells and other wells) and other sources. Total area irrigated from different sources represents the net irrigated area. If two or more crops are irrigated in the same year from the same sources, the area is counted once only. The total irrigated area under all crops represents the gross irrigated area and includes area irrigated more than one crop during the same year.

The reporting area stands for the area for which data on land use classification of area are available. In areas where land utilization figures are based on land record reporting area the area according to village papers, i.e., the papers prepared by the village accountants. In some cases the village papers are not prepared for forest areas but the magnitude of such areas is known, also there are tracts in many States for which no village papers exists but for which ad hoc estimates of classification of area, etc. are framed to complete the coverage. In such cases, reporting area should give the summation of the area for which village papers actually exist and the area for which ad-hoc estimate are available. The main limitations of LUS is the rigid framework of land record instructions due to

which a real scenario of crop and non-crop utilization is not reflected. There is persistent delay in submission of LUS by the States. Some of the States are not furnishing complete information particularly irrigated area. As a result of this, there is a time lag of 4-5 years in the availability of land-use statistics.

11.4 ANNUAL ADMINISTRATIONS REPORT

The development of Minor Irrigation in a State is being taken up by many departments namely: Agriculture, Minor Irrigation, Rural Development, Cooperative, Welfare, etc. The plan funds are made available to these departments and accordingly the development is also reflected in their respective reports. The Minor irrigation Department publishes in its own share and in terms of irrigation potential created. The other departments publish data in terms of other parameters relating to the objectives of implementing the programme. However, these data pertain to Govt. owned schemes only. The irrigation parameters are generally not been recorded as the purpose is different. Minor Irrigation works are also taken up by the farmers with the help of their savings and bank loans and its contribution is significantly high. Many State Governments publish some information on the number of irrigation sources such as Wells, Tube wells, Pump sets and tanks, etc. installed during the year or target for the year. Thus complete information is not available for the State as a whole. The area benefited due to Minor Irrigation works are generally based on ad hoc norms. The schemes which have gone out of use are not taken into account for compiling the cumulative figures of irrigation potential created and utilised.

11.5 CONCEPTS AND DEFINITIONS

Irrigation Statistics comprises of data on number of Minor irrigation schemes, irrigation potential created, utilised, culturable command area, irrigation through supplementary sources, etc. Uniform adoption of the definition of these variables is a must for having a sound database for the MI sector. The irrigation potential of a project is the gross area irrigable with the amount of water available under the envisaged cropping pattern. The utilisation is the gross area actually irrigated each year and the same is assessed on the basis of construction of field channels in the Command of the project. Even if single watering is provided for Kharif crop and another single watering for Rabi crop in the command of the project, the irrigation potential created is twice the culturable command area of the project. The single watering may not be sufficient for the crop. Thus the concept of irrigation potential created does not appear to be satisfactory. Actually the project should be ready to provide as many waterings to the crop as is required for its maturity. If the water made available for the crop is not sufficient, the potential should not be considered as created for providing irrigation for that crop and needs to be supplemented by some other source of irrigation. These supplementary irrigation sources are crucial to the survival of the crop. The recording of irrigation potential created and utilised by such irrigation sources may result in duplication. With a view to avoid such duplication a concept of conjunctive use of water has been introduced. This conjunctive use may be from more than one source either entirely from surface water or surface water and ground water. This information is not being compiled. Generally, the cropping

pattern changes over the years and these changes are not taken into account. Therefore, the irrigation potential of a project may change in due course of time. The irrigation potential may also get affected due to depreciation of projects like siltation, etc. Therefore, the irrigation potential created by a project may change over the years. The utilisation of irrigation potential is complete if the project is commissioned and field channels are also constructed beyond the outlet level. In case of good rainfall the irrigation may not be required for a particular crop during a year. So the utilisation has not been there. There is a need to record such circumstances. Similarly if the project is designed and commissioned for double cropping in the command and the farmers are practising mono cropping, the utilisation remains less than the irrigation potential created. In other cases it may be more than the irrigation potential created when the project was constructed for single cropping but the farmers take double crops. Utilisation of irrigation potential created may also be less due to the non-availability of power supply or diesel for running the lift irrigation schemes. Similarly the discharge of water may get reduced due to bad maintenance of scheme or mechanical defects. The scheme out of use even makes the potential into non-existence. Therefore, the utilisation of irrigation potential may keep on changing due to various reasons. If the same field is irrigated by more than one scheme in a crop season, the multiple recording is also possible. The owner department/agency may record utilisation against the respective scheme. Such problems are more common in respect of minor irrigation works. Generally the canal water is available only once in a fortnight or so and therefore, farmers generally install minor irrigation schemes in their field. In land use statistics such area is likely to be recorded against the major or medium project only, while the Minor Irrigation implementing Department and the Irrigation Deptt., would be recording separately.

11.6 DEFECTS, GAPS AND DELAYS IN PUBLICATION

There is an imperative need to sort out wide discrepancy between the irrigation statistics compiled under Land Use Statistics published by the Ministry of Agriculture and those maintained by the Minor Irrigation Division of the Ministry of Water Resources on the basis of data collected in the Census of Minor Irrigation Projects and through the Quarterly Progress Reports on development of Minor Irrigation in various States/UTs. Due to different methods of estimation and conceptual difference, the comparison between these two sets of figures is not possible on account of following reasons:

1. The land use statistics provide source wise net area irrigated by all the States/Union Territories, but gross area irrigated figures are available in respect of few States/Union Territories. For example, the latest land use statistics giving state wise gross irrigated area pertains to the year 1996-97 and the same is available for only 12 States and 1 UT. Against this, the data regarding potential created/potential utilised provided by the Ministry of Water Resources pertains to 1999-2000 and the same is available for 25 States and all Union Territories.

2. While as per the land use statistics the sources of irrigation are classified as Government canals, private canals, tanks, tube wells, other wells and others, the

Ministry of Water Resources Statistics identifies the sources as dug wells, shallow tube wells, deep tube wells, surface flow and surface lift schemes.

3. The land use statistics are collected through primary enumerator on the basis of plot to plot enumeration whereas, under the RMIS scheme the Minor Irrigation Census is conducted through the village level worker/patwaries in respect of each Minor Irrigation Scheme.

4. The land use statistics takes into account the main or the major source of irrigation where the area receives irrigation from more than one source of irrigation. Against this the Minor Irrigation Census data pertains to scheme wise potential created/utilised.

In land use statistics the Statistics collected by some States are under reported to the extent of area under summer crops. There may be bias in such reporting. In order to reduce the discrepancy between the two sets of figures following suggestions are made:

i. The figures of area benefited by various other irrigation works in the command of major schemes should be recorded separately as supplementary source of irrigation.
ii. The yardsticks adopted for assessing the area benefited by Minor Irrigation work appeared to be higher and should be fixed on the basis of sample surveys.
iii. There is a need to estimate Minor Irrigation works which have already gone out of use and to reduce the area benefit due to such works.
iv. To the extent possible the number of irrigation given crop wise should be recorded.
v. Irrigation potential created and utilised by various types of Minor Irrigation works need to be assessed on the basis of sample surveys in each District.

If the above suggestions are implemented the wide gap between the two sets of figures can be narrowed.

Further, there is considerable delay of about 5 years in publishing land use statistics. This delay in respect of M. I. Census is about 7 years. At the time of annual plan preparation and finalisation these data have to play an important role. Unless the data are published at the end of each year this requirement can not be fulfilled. The provisional figures may be used for the next year plan formulation but not for more than half of the plan period. Similarly the M. I. Census data should be available at the time of preparation of the next five year plan. Such a delay is likely to affect the evaluation studies and mid term corrections in the plan proposals. The time lag in publishing the M. I. Census data and the land use data has been a matter of concern. There is a need to take effective steps to reduce the time lag.

11.7 EFFORTS MADE TO CREATE A REALISTIC DATABASE

The need for realistic database for future planning of Minor Irrigation sector was felt at various fora of planning. The National Commission on Agriculture, 1976 had considered this aspect and recommended uniform adoption of standard concepts and definitions and reconciliation of figures published in land use statistics and reports of the irrigation department. It had also recommended for classifications as major, medium and minor irrigation (surface and ground water) sources, the census of Minor irrigation Projects on quinquennial basis, special surveys for assessing utilisation by Minor Irrigation works and statistical cells to be established in State Irrigation Departments. Relevant recommendations are given at Annexure-A to this chapter. A committee on Rationalisation of Statistics, methods and assessment of irrigation potential and utilisation headed by Member (WR), Central Water Commission (1981) and another Committee headed by Chairman, CGWB 1983 had also gone through these aspects and recommended various steps to be taken up for Rationalisation of Minor Irrigation Statistics. The recommendations are at Annexure-B and C respectively. The Working Group on guidelines and methodology for collection and reporting of data on potential created and area irrigated from major, medium and minor irrigation schemes headed by the Secretary, Ministry of Irrigation, Govt. of India and constituted by Planning Commission had also looked into the problems of irrigation statistics. It again recommended in 1986 certain measures to be taken for Rationalisation of Minor Irrigation Statistics. The recommendations are given at Annexure- D.

The matter regarding reporting of Minor Irrigation potential and its utilisation remained under consideration by the Planning Commission and Ministry of Water Resources. In July 1992, it was decided that in respect of Minor Irrigation schemes owned by Government the figures against these parameters should be reported as maintained by Government Departments but for private owned schemes the figures reported under land use statistics only be reported from 8th plan onwards. The difficulty is that the land use statistics do not recognise the private and Government owned Minor Irrigation Schemes. Even the Minor Irrigation schemes are not being identified so far as the surface water sources are concerned. The tube wells and other wells may be considered as ground water schemes. The tube wells are owned by Government as well as by Private owners. The depreciation rates and utilisation of irrigation potential for Government schemes are not assessed on scientific basis. The State Government remains reluctant to initiate any step in this direction due to financial constraints or other wise. Ministry of Water Resources, Government of India launched a Centrally Sponsored Plan Scheme "Rationalisation of Minor Irrigation Statistics (RMIS)" during 7th Five Year Plan with following objectives:

1. To organise Census of Minor Irrigation works on quinquennial basis.
2. To collect and compile the data contained in the Quarterly Progress Reports received from the nodal department regarding development of Minor Irrigation in the entire State/UT and furnishing the same to the Ministry of Water Resources regularly.
3. Reconciliation of discrepancies in figures of irrigated area published in season and crop report and report to Ministry of Agriculture vis-à-vis Statistics compiled by Minor Irrigation Deptt. in the States/UTs.

4. Conduct of special surveys to fix up yardstick for area benefits accruing through each type of Minor Irrigation schemes in a region.
5. Conduct sample surveys to ascertain the reasons for disuse Minor Irrigation scheme.
6. Compile data on crop wise area irrigated by minor irrigation works in different seasons.
7. Conduct studies to ascertain the impact of Minor Irrigation in agricultural productivity.
8. Compile data on Minor Irrigation Schemes installed through private and institutional investment.

With a view to firm up the database regarding Minor Irrigation Statistics a Census of Minor Irrigation works with reference year 1986-87 was conducted in all the States/UTs except Rajasthan. For conduct of Census, a nodal Department was identified by each State Government/Union Territory Administration. The Head of the Nodal Department was nominated as the Census Commissioner for conducting the Census in the State/UT. The main objectives of the Census was as follows:

(a) To enumerate completely the sources of Minor Irrigation in the State/UT.
(b) Assess the source wise area irrigated through Kharif, Rabi and summer season.
(c) To assess the contribution of the Minor Irrigation work as a new source of irrigation or as supplementary work.

In order to update the data collected in the 1st Census of Minor Irrigation Projects, the 2nd Census of Minor Irrigation Projects with reference year 1993-94 was conducted in 29 States/UTs. The Census revealed that a large number of Minor Irrigation works have already gone out of use. The details are as follows:

Table. Minor Irrigation Schemes in use and not in use 1993-94

(Figures in lakh)

Sl. No.	Type of Scheme	Total No. of Schemes	Schemes not in use
1.	2	3	4
(A)	Ground Water Scheme		
i)	Dug Well	44.67	5.92
ii)	Shallow Tube wells	50.81	0.78
iii)	Deep tube wells	1.04	0.08
(B)	Surface Water Scheme		
i)	Surface flow irrigation scheme	4.19	0.58
ii)	Surface lift irrigation scheme	3.53	0.17

As a result of this 11.55 lakh hectares of irrigation potential created by ground water scheme in the country had gone out of use. On the same basis about 9.65 lakh hectares of irrigation potential through Minor Irrigation surface water scheme had also become out of use. Therefore, a total of 21.20 lakh hectares of irrigation potential created by Minor Irrigation works went out of use by 1993-94.

11.8 COMPUTERISATION OF MINOR IRRIGATION STATISTICS

The data collected in the 2nd census of minor irrigation projects was computerised with the software provided by National Informatics Centre. Lot of valuable information regarding minor irrigation development is collected in the census. However, as the statistical cells created under the RMIS scheme do not have computer facility of their own, they depend on outside agencies for computerisation of data. In order to streamline the work relating to census of M.I. works, Quarterly Progress Reports, Sample Surveys, etc., it is necessary that each statistical cell is provided with appropriate computer and internet facilities. This would help in immediate retrieval of data as and when required for policy formulation, planning, etc.

11.9 IMPROVEMENT IN THE QUALITY OF MINOR IRRIGATION STATISTICS

The State coordination committee has been set up in each State to resolve any difficulty in obtaining relevant data from various agencies implementing minor irrigation development either as main or subsidiary programme. However, it has been observed in the past that these committees do not meet to take stock of the situation even once in a year. There is a need to ensure that such committees meet at least once in a year and a senior officer from RMIS wing of the Ministry of Water Resources is member of the committee. The cumulative figures of irrigation potential created and utilised upto the end of a year are obtained by adding the current year figures to the cummulative figures upto the previous year after applying appropriate depreciation rate for each type of scheme is to be compiled at the district level and then for the state. The reconciliation of this data with the land use statistics may be taken at the district level. The base year data for 1993-94 has already been firmed up on the basis of the second census of minor irrigation projects. The scheme-wise details collected during the census is being stored in the computer for its retrieval. On account of apprehension as whether the RMIS scheme would continue in the next five year plan or not, some of the States/UTs have not created statistical cell. As a result of this, firm data in respect of such States/UTs is not available. In order to remove such apprehension and build up a firm data base for minor irrigation sector, it is necessary to assure all such States/UTs that the RMIS scheme would continue in the 10th Five Year Plan.

Certain suggestions for improving minor irrigation statistics are as follows:

(i) Crop-wise gross area irrigated may be compiled for all the States/UT under land use statistics.

(ii) The classification of the sources of irrigation should be major, medium and minor for land use statistics also.

(iii) The data on area irrigated by more than one source of irrigation should also be recorded separately. Quite a large number of tube-wells and dug-wells are being constructed in the commands of major and medium irrigation projects. The area benefit due to such minor irrigation schemes cannot be ignored. But there should be no duplication too.

(iv) Reconciliation of data compiled by the Government department implementing irrigation development and the land use statistics should be taken up at the district level.

(v) Provision is made in IX Five Year Plan for assisting the States in strengthening their data base and also publishing the statistics periodically as that will form a good and useful information.

(vi) Periodic review of progress made in conduct of Census of M. I. Schemes, Sample survey, etc.

(vii) Creation of statistical cells in the remaining States/UTs and regular evaluation of their performance.

11.10 DATA BASE MANAGEMENT BY MINOR IRRIGATION DEVELOPMENT ORGANISATION (MIDO)

It is envisaged that proposed Minor Irrigation Development Organisation (MIDO) would be responsible for collection, storage, retrieval and communication of all the data and relevant information on surface water and ground water development. The MIDO would be created at the Centre, all the States and Union Territories and also at all the District Headquarters. The Organisation would also be responsible for analysis of data and information collected from various agencies and assessment of surface water and ground water potential and actual utilisation.

The Working Group has recommended a provision of Rs.40 crore for Rationalisation of Minor Irrigation Statistics (RIMS) under centrally sponsored scheme of Ministry of Water Resources and Rs.10 crore in Central Sector for Minor Irrigation Development Organisation.

ANNEXURE- A

REPORT OF THE NATIONAL COMMISSION ON AGRICULTURE (1970) PART XIV RECOMMENDATION RELATING TO IRRIGATION STATISTICS

22. Standard concepts and definitions of terms used in irrigation statistics should be adopted uniformly. Reconciliation of the figured reported in LUS and irrigation progress reports should be done by the planning unit at the district level. (Paragraphs 61.7.6 and 61.7.9)
23. Source-wise classification of irrigated area should be ample feed to give separate figures for major, medium and minor sources and from surface and ground water sources (Paragraphs 61.7.10)
24. A census of irrigation sources should be undertaken alongwith the Agricultural census area in five years Specials irrigation surveys on the number of wells and their utilisation may be undertaken by other States. (Paragraphs 61.7.13 and 61.7.14)
25. Annual administration reports of State irrigation departments should be published every year together with comprehensive statistical data in standard proformas. These data should be consolidated at all India level and published annually (Paragraphs 61.7.17)
26. Statistical units should be provided in the State Irrigation Departments for collection and analysis of irrigation statistics (Paragraphs 61.7.19)

ANNEXURE-B

CONCLUSIONS AND RECOMMENDATIONS OF THE COMMITTEE ON RATIONALISATION OF STATISTICS AND METHODS OF ASSESSMENT OF IRRIGATION POTENTIAL AND UTILISATION 1981

1. There is considerable scope for improvement in the compilation, scrutiny and publication of irrigation statistics in the country.
2. A unified procedure should be adopted by all the States for collection of irrigation statistics in respect of major, medium and minor schemes.
3. Standard proforma for collection of statistics in respect of major, medium and minor schemes should be adopted for use by all the States.
4. To avoid discrepancies in the irrigated area, the work of Irrigation Department and that of Revenue Department should be coordinated by the State Planning Unit.
5. Source wise classification of irrigated area should be amplified to give separate figures for major, medium and minor sources and from surface and ground water sources.
6. Annual Administration reports of State Irrigation Department should be published every year together with comprehensive statistical data in standard proformas. These data should be consolidated at all-India level and published annually.
7. Statistical units should be provided in the State Irrigation Departments for collection and analysis of Irrigation statistics.
8. One Statistical Supervisor should be provided in each Tehsil to supervise the fieldwork of different census and surveys etc.
9. A Statistical Unit consisting of a District Agricultural Statistics Officers assisted by Statistical Supervisors, Assistants and Junior Clerks/Computers should be provided at District level.
10. Adequate strengthening of the Statistical Directorate in the Central Water Commission should be carried out to enable scrutiny, compilation and publication of the data within a reasonable time.
11. Suitable training courses should be developed for periodic training of statistical staff employed in the State and Central Offices.
12. Refresher training should be imparted at frequent intervals to the field collection staff in the methods of collection of irrigation statistics.
13. The scope for the use of computers in the collection, compilation and analysis of irrigation statistics is considerable. A beginning in this regard should be made by transferring the basic data for past years to magnetic tapes for in-depth studies, easy and timely retrieval, and accuracy of tabulation.

ANNEXURE-C

RECOMMENDATIONS OF THE REPORT OF THE COMMITTEE ON RATIONALISATION OF STATISTICS AND METHODS OF ASSESSMENT RECORDING OF MINOR IRRIGATION POTENTIAL AND UTILISATION

CONCLUSIONS AND RECOMMENDATIONS

1. There is considerable scope for improvement in the collection, compilation, scrutiny and publication of minor irrigation statistics at the State/UT and National levels.
2. There is urgent need to adopt an uniform procedure for collection of minor irrigation statistics by all States/UTs.
3. There is need to adopt a standard proforma for collecting statistics in respect of minor irrigation schemes for use by all States/UTs.
4. The need for collection and compilation of Minor Irrigation Statistics on annual basis has been recognised. However, considering the magnitude of work involved, adequate strengthening of the existing organisation, if necessary, or providing extra staff may have to be done.
5. There is urgent need for close coordination between State/Deptt./Deptts responsible for implementing Minor Irrigation Programme and Revenue Deptt. of the State to work in a fashion complementary to each other and carrying out joint inspection for resolving discrepancies in the irrigated areas.
6. Land utilisation statistics published at present by the Directorate of Economics and Statistics of Department of Agriculture & Cooperation gives source wise up to date figures of gross area irrigated in respect of ten States and three UTs only. Source wise up to date figures of gross area irrigated for all States/UTs should be indicated by the Dte. of E&S in their future publications. Figures for the source wise gross area and net area irrigated from minor surface water sources should also be indicated separately in the LUS.
7. In respect of irrigation potential as far as ground water is concerned, there is no proper co-relation between the figures reported in terms of volume and those reported in terms of area on the State basis. The Committee feels that there is an urgent need for reconciling these figures for each state on a top priority basis. In respect of surface water, the assessment on volumetric basis is not available. There is an urgent need for carrying out necessary surveys for its assessment. Thereafter the revised figures in terms of area are to be worked out.
8. The CGWB should be made responsible to scrutinise, compile and publish the data in respect of Ground Water. Adequate strengthening of the CGWB may have to be done to carry out the works of scrutiny, compilation and publication of the data in respect of ground water within a reasonable time. In respect of minor surface water this work should be handled by the Minor Irrigation Division of the Ministry which should be suitably strengthened. A centrally sponsored scheme for giving 100% central assistance for staff etc. in the Departments dealing with Minor Irrigation

Ground Water Departments in the States, initially for a period of five years, may be considered for the purpose.

9. Annual administration reports of State MI Departments should be published every year together with comprehensive statistical data in standard proforma. This should be consolidated at All India level and published annually.
10. Suitable training courses should be developed and organised for periodic training of Statistical staff employed in State and Central offices of Irrigation Departments and Statistical Departments.
11. Regular courses should be organised/imparted at frequent intervals to the field data collection staff in the methods and techniques of carrying out random sample surveys and collection of irrigation statistics.
12. The basis statistical data collected, compiled over the past crop years should be transferred and recorded in magnetic tapes for analysis, in depth studies, easy and timely retrieval and accuracy of tabulation and thereby the use of computer for the purpose of collection, compilation and analysis of irrigation statistics should be gradually undertaken.
13. The following surveys should be undertaken:

    1. Census type survey - once in 5 years.
    2. Survey by NSSO for Minor Irrigation - up to date figures of
       Minor Irrigation
       Potential creation/utilisation
    3. Surveys by Cells created under the Centrally sponsored schemes of Statistics for the following:
       i) Studies regarding reconciliation of discrepancies in figures of area irrigated in different reports.
       ii) Co-ordination of Minor Irrigation Statistics on quarterly and annual basis.
       iii) Special surveys for estimating yardsticks of additional area irrigated by different categories of Minor Irrigation Schemes, and for ascertaining reasons for disuse of projects and for finding out the rate of depreciation in surface storage projects due to siltation, etc.
       iv) Census of minor irrigation schemes on quinquennial basis.
       v) Compilation of statistics of area irrigated under crops season wise.
       vi) Pilot studies to ascertain the increase in productivity in minor irrigation projects.
       vii) Collection of information regarding extent of construction of minor irrigation works through farmers own private sources (as a part of quinquennial census).
14. The CGWB and State Ground Water Organisations should be directed to undertake sample surveys on wells/tube wells district wise to evolve standard norms applicable to a Distt./Division and actual area irrigated depending upon yield of wells, area available for irrigation, cropping pattern, availability of electric power/diesel, etc.

ANNEXURE-D

SUMMARY AND RECOMMENDATIONS OF THE WORKING GROUP ON GUIDELINES AND METHODOLOGY FOR COLLECTION AND REPORTING OF DATA ON POTENTIAL CREATED AND AREA IRRIGATED FROM MAJOR, MEDIUM AND MINOR IRRIGATION SCHEMES

1. CONCEPTS AND DEFINITIONS

1.1 A scrutiny of information received from the various Departments of the States which responded to the questionaire indicates that by and large the concepts and definitions in annexure II are being followed. The Working Group recommends that these concepts and definitions may continue to be followed uniformally. In addition, it is recommended that a new concept on "design potential" of the project should also be introduced. The design potential is the gross area that can be irrigated from the project in the design year for projected cropping pattern and projected crop water requirements. This design potential maybe reviewed every five years and changes where necessary may be incorporated. The potential utilised in a year may be compared with the design potential so defined.

1.2 The concept and definitions indicated in Annexure II – 1 also apply equally to the Minor surface irrigation projects. In respect of ground water development, it is felt that the potential created in respect of tube wells, public and private, would be as per the norms for surface irrigation projects depending upon the capacity of the tube wells to command area, the potential created would be as per the design potential of the tube wells. The actual utilisation may vary from year to year depending upon the availability of power and under ground water, and may therefore be reviewed against the design potential. In respect of augmentation tube wells, it is considered that since the water pump through these tube wells is utilised through the existing canals these tube wells do not add to the potential of the projects in whose commands these are located. In so far as dug wells are concerned there yield is very small and therefore, the potential created or utilised maybe ignored for all the practical purposes for the final compilation of statistics of potential created and utilised.

1.3 The norms for potential created and utilised for private tube wells will be identical to the norms applied in respect of State tube wells.

2. TYPES OF DATA COLLECTED

2.1. The classification of sources of irrigation as prescribed by National Commission on Agriculture as in Annexure-III are being followed in all the States for collection of irrigation statistics. However, there is no uniformity in the type of data being collected for the potential created and utilised and for management of the projects. It is not clear whether the States are monitoring the project performances for the potential created vis-à-vis storage/diversion of water available and the area irrigated. It is recommended that systematic evaluation and monitoring of the project performance may be introduced in

respect of all projects executed so far. The results of the evaluation studies would be useful in the planning of new projects of future.

3. METHODS OF COLLECTION AND REPORTING OF DATA

3.1. MAJOR AND MEDIUM IRRIGATION PROJECTS

3.1.1 The information received from the various States indicates that the same methods for collection and reporting of data are not being employed. Various agencies are involved for the collection of different type of data. Even the same type of data is being collected by different agencies in different States. There is no uniformity of approach either amongst the various States or even between different departments of the same State. It is recommended that the agency/department executing the project should be made responsible for assessment, collection and reporting of the data on potential created. Similarly, the agency incharge of collection of land revenue should be made responsible for assessment, collection and reporting of the data on potential utilised.

3.1.2 The data collected on irrigation potential created and utilised in some of the States has built in checks to ensure accuracy of the data collected. The criteria generally applied is to compare mean duties actually achieved vis-à-vis the design duties as is done in the State of Gujarat and Punjab. It will be helpful if similar checks are exercised in other States.

It is further recommended that multi disciplinary teams consisting of the officers of the department of Irrigation, Agriculture and Revenue may be set up to conduct sample surveys in every crop season to ensure the reliability of the data.

3.1.3 The States have not given any affirmative information with regard to any performance evaluation being carried out by them for the projects under operation. However, it is understood that the Annual Administrative Reports of the Irrigation Department incorporate evaluation of the performance of the Projects in the States. For such evaluation studies data should be collected on availability of water i.e. inflow into the reservoir/water diverted, evaporation losses, withdrawal into the canal, escapades through canals, total area irrigated, cropping pattern, crop-wise delta achieved, vis-à-vis corresponding design values.

3.1.4 There are various agencies engaged in the collection and reporting of data on irrigation statistics. There is however, no coordination and reconciliation of the data being collected by these agencies. As it may be difficult to reconcile the real time data collected by different agencies it would be preferable that the Planning Department of the State nominates separate agencies for collection of data of specific items as indicated in para 3.1.1. No other Department/agency would be required to collect similar data on its own. If required, it must get the information from the agency so nominated by the Planning Department.

As recommended in para 3.1.1 above the Department responsible for creation of potential should report the data on potential created and the department assessing and collecting revenue should report data on potential utilised. The Directorate of Economics and Statistics in the Planning Department of the State should coordinate and reconcile the data in consultation with these collecting agencies where necessary, for publication and supplying the same to the State and Central agencies concerned.

3.2 MINOR IRRIGATION SCHEMES

3.2.1 Surface Water Schemes

3.2.1.1 The procedure followed in the various states for collection of data on potential created and utilised in respect of surface water minor irrigation scheme is similar to that in respect of major and medium irrigation projects.

3.2.1.2 There is no difference in the norms for assessment of potential created and utilised for normal and drought years. It is recommended that this practice may continue.

3.2.1.3 The information received from the State indicates that the period for full utilisation of the irrigation potential varies from three to seven years even though on an average about five years period is considered adequate by most of the State for full development of the irrigation potential. It is recommended that the period for full development of the potential may be taken as five years with the annual variations indicated below:

First year	50%
Second year	60%
Third year	80%
Fourth year	90%
Fifth year	100%

3.2.1.4 The practice of collection of basic data obtaining in the States appears to be that the data is collected at the field level by the Revenue Patwari, etc. and it is checked by the superior officers like Deputy Collector, Executive Engineer. While this practice may continue, it is also recommended that data actually observed at site may be compared with the design duty to cross check the accuracy of the data. It is further suggested that a multi disciplinary team comprising representatives drawn from the Department of Irrigation, Department of Agriculture and Department of Revenue may conduct sample survey during every crop season to ensure reliability of the data.

3.2.2 Ground Water Schemes

3.2.2.1 The procedure adopted for collection and reporting of the data on the potential created and utilised in respect of the ground water schemes has not been indicated by the States. It appears that such an assessment is being made on the basis of the norms for creation of potential which is also normally taken as the potential utilised. The norms adopted for various structures for creation of potential also differ from State to State. It is recommended that the agencies concerned with the development of ground water utilisation like Central Ground Water Board and State Ground water Organizations may undertake sample surveys on wells/tube wells district wise to evolve standard norms applicable to a district/division depending upon the yield of the wells cropping pattern, soil characteristics, availability of land for irrigation and availability of electric power/diesel, etc.

3.2.2.2. There is at present no uniformity in the rates of depreciation as applied to the various components of the ground water structures in various States. Some

norms have been evolved by Nationalised Bank for Agriculture and Rural Development. These norms (mentioned below) are recommended to be adopted uniformly by all the States.

1. Civil works 40 years
2. Mechanical works 20 years
3. Deep tube wells 20 years
4. Shallow tube wells 10 years

3.2.2.3. The State Governments are collecting basic data with regard to the performance of the ground water structures. However, these are not on a uniform basis and also in some cases the data collected do not enable a systematic analysis of the performance of the structures. It is essential to collect the data for this purpose on the following parameters:

1. Units of electricity consumed/fuel oil used.
2. No. of hours of pumping.
3. Discharge delivered.
4. Area irrigated net and gross, season-wise, crop-wise.

3.2.2.4 In the areas where no other source of surface water for irrigation is available, only ground water is used for irrigation. The norms for collection of data on potential created and utilised shall be in accordance with those indicated in paras 3.2.2.1 and 3.2.2.2 where the ground water is used conjunctively with flow irrigation as in the case of augmentation tube wells, no additional potential is created. The number of wells in the command of the irrigation project which pump water for conjunctive use may only be recorded along with the data on units of electricity consumed/fuel oil used, number of hours of pumping and discharge delivered in each case. Their potential and utilistion as such will not be recorded separately.

3.2.2.5 Presently the water pumped from the tube wells is supplied to the cultivators through independent carrier system as well as through the existing canals of the irrigation system.

3.2.2.6 The private tube wells in the command of the irrigation projects also pump water for conjunctive use with flow irrigation. As in the case of augmentation tubewells such private tube wells do not add the potential of the project in whose command they are located, in such cases only the number of private tube wells and electricity consumed/fuel oil used, hours of run and discharge delivered in each case may be recorded to enable compilation of data on the ground water use.

3.2.2.7 Almost all the States responding to the Questionaire have reported that there is no duplication in reporting of the area irrigated from ground water structures in the commands of major and medium irrigation projects. However, to avoid duplication it is recommended that where water is used conjunctively with flow irrigation it should be reported as conjunctive use. The potential created and utilised may, therefore, be reported for the following:

1. Major and Medium Projects ;
2. Minor projects; and
3. Conjunctive use project (total potential within major, medium, minor schemes less potential exclusively served by such surface schemes).

3.3 Irrigation development through Centrally sponsored scheme like drought prone area programme, desert development programme, etc.

The potential created under the Centrally Sponsored Schemes drought prone area programme, desert development programme etc. is actually potential created under major, medium and minor irrigation schemes of the States. It is recommended that potential created under such programme need not be reported separately except for non-command areas.

5. LAND UTILISATION STATISTICS OF IRRIGATED AREA

4.1. Presently various data on land use are being collected by States. It is recommended that all the States uniformally collect and furnish the data on following:

1. Net irrigated area source wise
2. Net irrigated area crop wise
3. Gross irrigated area source wise
4. Gross irrigated area crop wise

It is recommended that the data on yield from irrigated and un-irrigated fields may be collected and recorded separately by the concerned Department and transmitted to the Planning Department (Directorate of Economics and Statistics) of the State and through it to the concerned State and Central Agencies.

5. AGENCIES FOR COLLECTION, REPORTING, SCRUTINY AND RECONCILIATION AND MAINTENANCE OF DATA ON POTENTIAL CREATED AND UTILISED

5.1 At present various agencies are collecting and reporting the data on potential created and utilised. There is no single agency charged with the over all responsibility for coordination, collection, reporting, scrutiny and reconciliation and maintenance of data at the state level. Haryana, Maharashtra, Punjab, Tamilnadu and Uttar Pradesh have reported that the present system of collection of data is adequate. The States of Himachal Pradesh, Kerala, Madhya Pradesh, Orissa, Rajasthan and Tripura have reported that the present system is not adequate and needs improvement. It is recommended that the agency/department executing the projects should be made responsible for assessment, collection and reporting of the data on potential created. While the agency in charge of assessment and collection of land revenue should be responsible for assessment, collection and reporting of the data on potential utilised. The Directorate of Economics and Statistics in the Planning Department at the State Head Quarter should be the coordinating Agency for scrutiny, reconciliation and maintenance of the data on potential created and utilised. This Department will alone supply information to other uses organisations. No other Department except the executive department and the department in charge of assessment and collection of land revenue will collect information with respect to potential created and potential utilised respectively.

5.2 State of Andhra Pradesh, Haryana, Himachal Pradesh, Kerala, Punjab, Tamilnadu and Tripura considered that the existing facilities for scrutiny, reconciliation and maintenance of data on potential created and utilised are not adequate. Haryana has suggested that special coordinating agency may be set up at the State level to reconcile and maintain the data. Other State Departments have suggested the

strengthening of their department by increasing the staff in the existing Statistical Cell or setting up of a Statistical cell where it does not exist. It is recommended that in addition to statistical cell in the Planning Department exclusively for statistics on potential created and utilised, statistical staff may be appointed in the department executing the project for assessment of the potential created and also in the agency assessing and collecting the land revenue for collection of data with respect to potential utilised.

5.3 In depth studies have not been carried out in any of the States in order to determine the adequacy or otherwise of the present method of collection and reporting of data on minor irrigation statistics by different departments of the state. It is recommended that only the data collected by agency which is incharge of the assessment and collection of land revenue should be taken an authentic for purpose of reporting the statistics on potential utilised. It is also recommended that joint surveys may be conducted by the representatives of the agency executing the project and creating the potential and agency in charge of assessment and collection of the land revenue, along with a representative of the agriculture department to assess the accuracy of the data on the potential utilised which is being reported by the agency assessing and collecting the land revenue.

5.4 No studies have been carried out in any of the States on the utilisation of created storage/diversion for irrigation vis-à-vis area actually irrigated in order to determine the reasons for the short fall in utilisation of created potential. However, it is observed that the data on the operation of major/medium projects with regard to utilisation are maintained by most of the States in their irrigation department. It is recommended that the studies should be carried out annually to evaluate the performance of the irrigation projects and these reports may be included in the annual report of the concerned irrigation department of the States. The copies of the studies may be forwarded through the Planning Department to the Union Ministry of Water Resources, Ministry of Agriculture and Rural Development, Planning Commission and Central Water Commission.

6 ESTABLISHMENT OF STATISTICAL CELLS

6.1 As recommended by National Commission on Agriculture, Statistical Cells have been set up in concerned Departments of the States of Gujarat, Himachal Pradesh, Kerala, Madhya Pradesh, Maharastra, Orissa, Rajasthan and Uttar Pradesh for compilation. Statistical assistants may be appointed in the department of irrigation and land revenue department to assist on the collection of data on potential created and utilised respectively. It is recommended that similar units may be set up in the planning department of the other states for reporting the data of major and medium irrigation projects, for which the staffing pattern may be as follows:

Joint Director	1
Research Officer	1
Research Assistant	1
Statistical Assistants	3
Assistants	2
Clerk	1

Peon/Messenger	2

Staff strength at the Tehsil level may also be reviewed and strengthening where necessary to correspond with the following pattern may be done:

Research Assistant	1
Statistical Assistant	1
Clerk	1
Peon	1

It is also recommended that an additional hand may be provided depending on the work load at each Patwari Circle to relieve the Patwari of additional burden.

7 TIME LAG IN REPORTING OF THE DATA

7.1 In reporting the data on land utilisation statistics to the Directorate of Economics and Statistics in the Ministry of Agriculture and Cooperation, there is normally about one year's time lag after the end of crop season.

7.2 The data is collecting agency at the village level and district level are also burdened with other multifarious activities. The data has to be handled manually in almost all the States. Besides, the communication facilities available in some of the States like Himachal Pradesh are not adequate. In some States, Statistical Cells are yet to be set up. All these factors contribute to lag in the compilation and transmission of the data to the concerned agencies at the State Headquarters and also at the Centre.

7.3 In order to minimise the delay in collection and transmission of the data. It is suggested that the following measures may be adopted:

1. Where the Patwari is over burdened with work, he should be given some assistance to relieve him of some less important work. He should be given training for collection and compilation of data in the prescribed format.
2. Statistical Cells with suitable staff should be set up in the State Planning Department where they have not been established so far. In other States, where such Cells have been set up in the departments other than the planning department these cells may be transferred to the planning department.

Processing of the irrigation and agriculture statistics with the help of computers should be introduced at the State Headquarters.

CHAPTER - XII

SCIENTIFIC MANAGEMENT OF MINOR IRRIGATION SCHEMES

12.0 The size of an endeavour and its working efficiency seem to bear an inverse relationship. In the context of irrigation, a major project faces problems right from the start. There is uncertainty in smooth inflow of working funds to complete the targeted activities within the stipulated time. Environmental issues, which are becoming more stringent by the day, are not seriously and systematically addressed at the project planning stage, causing further delay in clearing the project proposal. After the major project becomes operational, there is a huge loss of water in long conveyance system leading to the distant beneficiaries. Creation of the water resource potential itself being a huge task, most of the attention is focussed on this activity with little money and manpower left for its subsequent management. Most of the above constraints are not present in minor irrigation projects limited to a size of 2000 hectares where it is possible to address the soil and water management issues as parts of an indivisible entity in a more holistic manner than is possible in a large irrigation project.

12.1 SCIENTIFIC MANAGEMENT OF MINOR IRRIGATION SCHEMES

Scientific management of irrigation has the objective of ensuring the sustainability of the benefits of irrigation without degrading the natural resource base of agriculture. The degradation of resource base i.e., the land and the water, takes place due to a mismatch between the demand and supply of water for irrigation. The mismatch occurs due to various reasons, attributable to the planners, developers, managers and the users of the land and the water resources, besides the all-important natural causes. Under a tropical monsoon climate for example, rain water is excess of the demand during the monsoon and is less than the demand during most of the remaining period in a year. A scientific management would mean narrowing the gap between the demand and supply using such methods as water conservation, storage, ground water utilization, and crop selection; supplemented by suitable land management practices to increase the efficiency of water conservation and reduce erosion hazard. The causes of mismatch are relatively easy to identify and diagnose if the problem area is small, as in the case of a minor irrigation project. Hence, it is also relatively easy to plan and implement suitable preventive or curative measures to tackle the problem. Practices such as diversification of farming, avoiding excess use of irrigation and other inputs, runoff control and its channelization to small farm reservoirs for storage and subsequent use, land development for achieving increased irrigation application efficiency, selective introduction of advanced irrigation methods, are all better comprehended, planned and implemented on a small scale rather than on a large scale. The efficacy of a minor irrigation project finally depends on

efficient utilisation of water at Field. This can be substantially achieved through:

- Deployment of PVC water distribution network
- Drip irrigation network
- Micro sprinkler
- Use of mulching in conjunction with modern irrigation practices as above.

Such activities comprise scientific management of irrigation.

12.2 DATA COLLECTION, STORAGE AND RETRIEVAL

Scientific planning, efficient designing and effective implementation of minor irrigation projects need adequate information in the form of data on climate, soil, crop and social practices. Special efforts are to be made to survey a project area at a scale suitable for planning irrigation and drainage systems and land management alternatives which must include the suitability of soil for irrigation. Stream gauging data for the smaller streams are seldom recorded except in very few river valley projects and a lack of this particular data is a major constraint in assessing the watershed yield. Data pertaining to the chemical properties of soil and water are generally not routinely collected and recorded, though it is a common knowledge that chemical degradation of land and water is a gradual process. For proper planning, long-term data of weather parameters, hydrological data, ground water data, both quality and quantity-wise, land productivity data, soil survey data and the socio-economic parameters of the targeted beneficiaries of an irrigation project are necessary. It is admitted that data collection needs manpower and reliability of the data depends on the motivation of the people engaged in data collection. To circumvent the manpower problem or the problem of unreliable data, one may use remotely sensed data and calibrate these with limited but strategically collected ground truth data through a limited but motivated manpower. Use of remotely sensed data, without ground truth establishment may be highly hazardous.

Data at project area level needs to be generated while considering the entire activity in "extension development research mode". This will facilitate data based development and management of agriculture aimed at sustainability. Data on project area related to climatic parameters ground water levels, water quality, stream flows (if any), farming systems, production, marketing, social behaviour etc can be generated and documented and used at Panchayat level. Research Institutions located in the vicinity should assist such local management system to emerge. With expanding IT systems, it should not be difficult. Such management units ultimately should be linked with national network for wider interaction and mutual benefits.

For monitoring and management of minor irrigation scheme, it is essential to identify an institution or organisation which can be a repository of information on various aspects of ground water. Such an information base will be most essential for planning regional and national programmes, allocation of resources among the various user sectors and for making investment decisions.

12.3 TRADITIONAL METHODS VERSUS NEW DEVELOPMENTS

While considering science and technology plan for minor irrigation sector one has to recognize the basic fact that people's (farmers) involvement in this area dominates the working and activity .Traditionally in the process of evolution, small irrigation works at villages or farmers level were holistic in nature, where supply and demand management had been of integral nature. Tank based irrigation system throughout the country; water management systems at Apatani plateau in Arunachal Pradesh; 'Zobo' land management systems in Nagaland; terraced land cultivation in Himalyas does testify the skill, ingenuity and wisdom of the Indian farmers. Border strip irrigation method used by farmers of Gujarat, Rajasthan, Madhya Pradesh and Maharashtra along with agroclimatic data obtained from local sources have proved the capability of local farmer in efficient water management. However, the traditional approaches are not being fully practised. It is a matter of satisfaction that the present day researchers have started recognizing the wisdom of traditional approaches in minor irrigation sector and there is a change and inclination to explore and revive the old culture in the framework of "Science-People's Science and Good Society". Recent developments with high tech blend at micro-watershed level, involving people in this sector have started showing the way for change in our so called modern ways of natural resource management. The successes of Sukhomajari at Chandigarh and Ralegaon Siddhi in Ahmednagar in Maharashtra are well recognized.

Irrigation was one necessary input without which the green revolution would not have taken place. Irrigation will remain the one most important input to sustain the green revolution. The present situation warrants focussing attention to our forgotten traditional wisdom of developing small scale irrigation facilities which are user friendly, less expensive, eco-friendly, and have a low gestation period. While doing so, it will be imperative to increase the water use efficiency for

irrigation. This will involve use of efficient machinery for land preparation, a scientific selection of a diversified cropping system that can be sustained through irrigation by using the available water, scientific exploration and exploitation of groundwater leading to a conjunctive water use plan that will not result in irreversible decline in groundwater table and introducing advanced irrigation methods such as sprinkler and drip system that are known to economize on water use without posing any disadvantage to the crop. An important factor to keep in mind is that the success of a scientific land and water management package will depend on the people’s positive perception towards such a package. This can be ensured only when the people or the water users are made a party to the planning and development of the land and the water management package.

12.4 SCIENCE AND TECHNOLOGY PLAN FOR THE MINOR IRRIGATION SECTOR

Irrigation development has traditionally been considered mainly as a construction activity. The importance of the related sciences such as crop science, soil science, water science and the social science have not been completely ignored but have been considered as supplementary and not complimentary disciplines. Thus, an area is considered to be

irrigated even if the crops of the area just receives one watering out of a total requirement of say, four watering. In this way, the science of soil-water-plant relationship becomes irrelevant, though the outcome of irrigation do not result in achieving the potential yield. Though huge expenditure is incurred in constructing irrigation facilities, little effort is made towards proper land development to ensure that the water reaches every part of the irrigated field uniformly. The machinery used for such purposes are either primitive, or if mechanized, these are of a very large size and rated power that preclude the possibility of their adoption by the small farmers or on small areas. In the area of groundwater exploitation, the science of ground water movement is hardly taken into consideration by the vast decentralized individual groundwater users, leading to unscientific stiff competition among the users, who ultimately are the losers when an overall decline in groundwater table takes place. And in so far as the crop selection is concerned, the science is almost absence and is a free choice of the users, oblivious of the fact that whether the land and the water resources would sustain the selected crops.

12.5 SUSTAINABLE EXPLOITATION OF GROUND WATER RESOURCES

Although ground water is an annually replenishable resource, it is a finite resource. The current trend of indiscriminate exploitation of ground water, through increase in the number of wells, deepening of the existing wells and increasing the horse-power of pumping devices, has led to depletion of ground water reserves and in some hard rock areas the exploitation (output) has exceeded the input (Natural Recharge). The Government is involuntarily aiding and abetting this process by offering subsidies in purchasing of pumpsets and in power tariff.

For sustainable utilisation of ground water resources, it is necessary that the output needs to be same as the input to the system. The input to the system i.e. natural recharge arising out percolation of a fraction of the seasonal rainfall, needs to be quantified. Similarly the secondary recharge arising from irrigation or from the beds of ponds, lakes, streams needs to be measured.

Irrigation Return Flow

A large area of the country has come under irrigation as a result of several major and minor irrigation projects completed during the preceding eight five year plan.

Out of the water used in irrigating crops in the command area, a certain fraction percolates and joins the ground water reserves. Thus the ground water reserve of a command area is much higher than that of a unirrigated area having the same natural geoclimatic situation. However, quantification of this increment of ground water has not been carried out scientifically. At present only adhoc numbers are used to estimate the benefits accruing through irrigation return flow.

Controlled experiments are required to be carried out in different agroclimatic zones, for the main irrigated crops e.g. wheat, rice and sugarcane, to determine the irrigation return flow.

Artificial Recharge of Groundwater

Artificial Recharge of Groundwater comprises transferring of surface water to underground aquifers for replenishment and in some cases for improving its quality. The artificial recharge technique is of great relevance to our country as we have surplus of water resources during monsoon and scarcity of them during summer season. There is a strong need to evaluate the techniques available for recharge of ground water both in terms of site specificity and economic consideration.

Scientific research in Artificial Recharge techniques is of crucial importance to our country as 66% of the country's area is covered with hard rocks and not much work has been done in India or elsewhere in developing and evaluating Artificial Recharge in hard rocks.

Ground Water Quality in Coastal Aquifers

India has a long coast line. In the coastal areas, the fresh ground water and the sea water are in dynamic equilibrium. This equilibrium is disturbed and the sea water encroaches into coastal aquifer as a result of over exploitation of ground water. A similar situation is encountered in islands such as the Lakshdweep. The sea water encroachment takes place without the knowledge of the coastal community and once a well or a track of coastal aquifer suffers from salinity ingress, then the reclamation of the same becomes a rather difficult and expensive process. It is, therefore, necessary that the ingress of sea water is monitored at many points, in different hydrogeological situations, through a chain of monitoring stations.

Deterioration in the quality of ground water has been observed in some parts of the country presumably due to the intensive use of fertilizers and pesticides in agriculture, dumping of urban wastes, industrial activities, etc. Instances of heavy metal and cyanide contamination have come to light in and around industrial areas.

12.6 CONJUNCTIVE USE OF GROUND WATER AND SURFACE WATER IN CANAL COMMANDS

The problem faced in executing the programme of conjunctive utilization of ground water and surface water is that the development of ground water in a command has not formed a part of the surface water irrigation project right from the planning stage. It is only now that the conjunctive use is being advocated to arrest water logging and to provide water in the deficit areas of the command. A policy, however, needs to be evolved for funding of the schemes for development of ground water in canal commands.

In order to promote the conjunctive use of surface and ground water in the command of the surface irrigation projects, it is essential to plan and implement the development of ground water in the command areas as a part of the comprehensive plan for the development of water resources.

A Centrally sponsored programme should be launched for the development of ground water in the canal command areas to achieve optimal and integrated development of the total water resources in the basin. Central Ground Water Board should also expand its activities for preparing action plans for the development of ground water in command areas of existing irrigation systems with due consideration to the classification of the area as safe and sub-critical.

Scientific reasoning should be the main criteria to decide the location and depth of tube wells and legislations enacted to ensure that they are rightfully implemented.

It is strongly felt that a scientific assessment of the quantitative and qualitative aspects of the input resources of land and water, planning for their exploration, development and use, and simultaneous working out of a sustainable and socially acceptable crop plan, would be the key factors in developing and conducting minor irrigation projects.

Beneficial Use of Plastic Technology

Plastics products including plastics sheets, films, pipes, tubings and moulded products-made out of Polypropylene (PP), Polyvinylchloride (PVC), Polyethyhlene (PE) etc are playing major role in many irrigation schemes all over the world. The important and significant application of plastics in minor irrigation projects which have been proven in the country and many countries abroad are:-

- Lining of water harvesting and storage tanks with plastic film.
- Plastic pipes and fittings in the inlet and outlet of pumping, lifting and conveyance devices.
- Hilly area/undulated land with uneven topography, water conveyance and distributions through plastic pipes and fittings.
- Plastic pipes and prefabricated structures for minor irrigation water conveyance and handling system.

The efficacy of a minor irrigation project - finally depends on efficient utilisation of water at field level.

CHAPTER - XIII

ASSESSMENT OF EMPLOYMENT POTENTIAL AND TRAINING NEEDS

13.0 MINOR IRRIGATION SCENERIO IN X FIVE YEAR PLAN

The Minor Irrigation programme include all schemes of Ground Water Development and those Surface Water Schemes both flow and lift which individually have a Culturable Command Area (C.C.A.) not exceeding 2000 hectares. Minor Irrigation schemes by their very nature are quick maturing and labour intensive.

The private ground water schemes which are constructed, owned and operated by the farmers themselves mostly comprise of Dug wells, Dug-cum-bore wells, Bore wells, Filter Points, shallow Tube wells and individual boring with commands varying from 1 to 4 hectares on an average. Government assistance is confined to technical guidance, custom service for boring, subsidies and bank loans at reasonable interest rates through NABARD and nationalised banks. In addition there are large size deep public tubewells with command area upto 100 ha. by Govt. or State tubewells and lift irrigation corporation. However, these Govt. schemes hardly account for 5 to 10% of total ground water potential.

The surface water minor irrigation schemes includes the following type of structures;

Pumpsets installed by individual or group of farmers on surface water sources like small rivers, streams, tanks etc. These are usually placed under the category of small lift irrigation schemes with commands of 2 to 20 ha. on average.

Large size lift irrigation schemes with commands above 20 ha. but limited to 2000 ha. owned and operated by Govt. Departments or govt. owned lift irrigation corporation or a group of farmers forming a cooperative,

Small storage tanks generally called bundhies or by other local name owned by individual or a group of farmers and having command area upto 40 ha. only.

Large size storage tank with commands varying from 40ha. to 2000ha. owned and operated by Govt. Departments. In the Southern states they are the main works under minor irrigation.

Percolation tanks for the purpose of recharging ground water wells.

Diversion canals mostly small channels in hilly areas to divert the running water from streams. Check Dams and Ani cuts are also included under these schemes.

13.1 ULTIMATE IRRIGATION POTENTIAL AND STATUS OF MINAOR IRRIGATION DEVELOPOMENT

Ultimate irrigation potential of the country has been reassessed as 140 mha out of which 75.87 mha is considered to be from surface water while 64.17 mha is supposed to be from groundwater.

Ultimate minor irrigation potential of the country is estimated as 81.54 mha. MI potential created upto VIII Plan (1992-97) has been 62.39 mha while actual utilisation has been 47.31 mha. MI potential created during IX plan (1997-2002), upto March, 2000 has revealed following statistics.

MINOR IRRIGATION

(i)	Potential creation target	7.24 mha
(ii)	Potential utilisation target	4.93 mha
(iii)	Potential created (3 yrs) upto March, 2000	3.64 mha
(iv)	Actual utilisation (3 yrs) upto March, 2000	2.76 mha

On the basis of performance as above it could be assumed that expected potential created upto the end of IX Five Year Plan would be around 6.06 mha while actual irrigation achieved would be around 4.60 mha. Considering modest pace of development during X Five Year Plan it could be assumed that potential creation target would be more realistic at a figure of 8 mha out of which 3 mha would be earmarked to surface water minor irrigation and 5 mha would be for ground water minor irrigation.

The Working Group for IX Five Year Plan recommended an outlay of 10,000 crore in State sector and Rs.1450 crore in Central sector. The actual provision made by the Planning Commission was as below:

Financial outlay central sector		385 .00 crore
Financial outlay state sector		8977. 30 crore

	Total	9362.30 crore

This represents only government allocation. The total provision recommended by the Working Group for minor irrigation during IX Five Year Plan by the Government, financial institutions and private funding was Rs.29450 crore. This amount is likely to be increased to Rs.36200 crore in X Five Year Plan due to a more ambitious programme for integrated development of surface water and ground water.

The Working Group for X Five Year Plan has laid emphasis on modernisation and improvement of existing tanks, special schemes for tribal districts and creation of Minor

Irrigation Development Organisation. As most of these works would need appropriate infrastructure, large capital investments are to be made in initial stage.

13.2 EMPLOYMENT POTENTIAL IN X FIVE YEAR PLAN

There could hardly be any distinction between employment generation due to major and medium projects and minor irrigation schemes. However, minor irrigation has more impact on post project employment generation. During construction of the project, minor irrigation provides more employment in rural areas because of the proximity of the project. As the emphasis of the government policies is on food products and cash crops due to liberal tax exemptions, chances of employment generation in post project condition are brighter. Small scale agriculture based industries and marketing facilities would further boost employment generation. This sector will need large scale farm hands and marketing and transport infrastructure to facilitate fruit and vegetable industries, canning industries and cooperative societies. Exact assessment of such an employment generation could be based on plan outlays for minor irrigation sector during X Plan. The ground water irrigation forms important segment of minor irrigation there may be lesser employment generation during construction but post project employment potential would be same as in case of surface water minor irrigation. In surface water schemes the employment generation is in the direct form of using rural labour for construction purpose. While in ground water schemes it may be in the indirect form of manufacture of tubewells components sprinkler and drip irrigation components cement sluice and PVC pipe industry.

Assuming 3 mha of additional surface irrigation and 5 mha of additional ground water irrigation, restoration of tanks for 1.1 mha irrigation along with necessary labour intensive support services, an amount of Rs.36200 crore is likely to be made available for Xth Plan. Considering an investment of Rs.36200 crore assessment of employment potential is as below:

1.	Investment	Rs.36200 crore
2.	Labour cost @ 60% of investment	Rs.21720 crore
3.	Unskilled labour cost @ 80% of Rs.21720 crore	Rs.17380 crore
4.	No. of mandays at the average wage rate of unskilled labour @ Rs.60/ day	2900 million man days
5.	Skilled labour cost @ 20% of Rs.21720 crore	Rs.4344 crore
6.	No. of mandays at the average wage	

rate of skilled labour @ Rs.100/day	434 million man days
Total skilled and unskilled labour in mandays	3334 million man days

This is assumed to be the employment generated in construction of MI facilities. In addition, there would be additional labour required for irrigated agriculture. This could be assumed as 60 mandays per hectare of utilised irrigation potential.

Potential to be created during X Five Year Plan	8 mha
Assuming utilisation @ 80% will be	6.4 mha
Additional labour required in mandays is	6.4 mha X 60/ha
	= 384 million mandays
Total employment potential to be generated during X Plan in MI sector	= 3718 million mandays
	(say 3720 million mandays)

In addition there would be additional employment generated in agro based industries and transportation and marketing sector.

13.3 TRAINING NEEDS

In identifying training needs of the minor irrigation sector it will be important to consider the infrastructure of minor irrigation network. Basically five areas of training could be proposed. These are:

1. Policy planning
2. Design and execution
3. Distribution and water Management
4. Agriculture extension
5. Marketing of food products

Policy Planning

This area would need the attention of senior officers. In case of surface water storages comprehensive planning considering the topography, command area and hydrology would be required. The intention should be to store the water at such sites which will provide maximum yield and command with minimum engineering construction. Adequate knowledge of hydrology is essential to arrive at a realistic reservoir sizing and spill way sizing. An oversized reservoir is a costly affair and the capacity remains unutilised. Similarly, undersized reservoirs would need large surplusing arrangement because of lower capacity of the reservoir thus increasing in cost. Planning on toposheets with the help of hydromet data and the study of adjoining catchment will help in arriving at the optimum size of storage, spillway and distribution network. The tendency of very small storage has to be discouraged. Such structures are silted up within a few years and the structure becomes redundant.

Design and Execution

Concept of designing small structures is different from large structures. A bold design which is not too conservative will prove cheaper and yield better results. In design of such structures one need not opt for costly construction material. Appropriate technology using local material and labour with small leads will prove cheaper. It will be more useful to conceive cascade of small storages in a valley where surface run off is flashy and monsoon period remains for short duration. In such a system of cascade storage in the upper reaches will be adequate with a large spillway. Gradually along the valley storage will increase with small surplussing arrangements. Such a cascade will help in integrated development of surface and ground water resources. Right mix of reservoir sizing and spillway sizing according to the topography, hydrology and command area will yield better results.

Execution of such schemes is to be done by professionals rather than leaving it in the hands of nonprofessionals. Due to various sources of funding minor irrigation schemes it is all the more necessary that proper quality control may be maintained and overseen by one agency. Training programme will have to be designed as to achieve these objectives.

Distribution and Water Management

Training needs in this area are being addressed adequately in major and medium irrigation sector. This includes design of distribution network for equitable distribution of water, prevention of seepage losses and on farm development. Special design aspects will include water conservation by sprinkler and drip irrigation.

Agricultural Extension Programme

Training needs in this area will require crop rotation, application of fertilisers and pesticides and proper drainage. This has to be taken up extensively to educate farmers and administration both. Cultivation under moisture stress conditions for certain crops will need special attention. Selection of special farms for demonstration under controlled conditions and suitability of soil with proper soil testing facilities are required to be assessed. Support information for such a programme will be a must such as hydromet data and soil type and gradient of the field. Modern sowing and harvesting techniques are required to be adopted.

Marketing of Food Products

When the emphasis is on fruits and vegetable crops, marketing facilities are essential. If a farmer does not get right price for his produce he will be discouraged. This package should include crop insurance, marketing by cooperative societies and quick transport of perishable goods. A marketing infrastructure with inbuilt system of absorbing price fluctuations is necessary.

These goals cannot be achieved without training at farmers level, Gram Panchayat level and District Mandi level. All those who are involved in these operations need to be trained to deliver the goods.

Institutional Arrangements

For Indian farmers agriculture has not been strictly a commercial activity. Thus they never get the right price of their produce. To develop appropriate marketing infrastructure, a strong institutional arrangement is required. This can only be done with the cooperation of farmers, gramsevaks, block officers and revenue officers of districts. As the administration is only aware of land settlement and revenue collection, they have to be exposed to varied training programme, education and publicity. In one of the chapters of this report a Minor Irrigation Development Organisation has been proposed. Same Organisation could be incharge for educating and imparting training to all those who are involved in minor irrigation schemes. Such an institutional arrangement could be carved out of the existing technical expertise available in the state. Without any extra burden on govt. exchequer such an institution could draw professionals on deputation basis with a condition that their salaries are charged to respective departments.

Women's participation

There is considerable scope for gainful employment for women as they contribute to and benefit from rural minor irrigation schemes. Women's role is not limited to participate as field workers or farmers in small scale irrigation projects. They also participate in institutional arrangements such as Water Users' Association or in Water Committees. It is envisaged that women will also be assigned important role in Minor Irrigation Development Organisation at the district level during the X Plan period in gender composition of various activities. This is briefly narated below:-

1.	Women as labourers	Village level
2.	Women as farmers and decision takers	Village level
3.	Women as Water Users' Committee members	Village/ Project level
4.	Women as Advisory/Regulatory level in MINOR IRRIGATION DEVELOPMENT ORGANISATION	District level/ Block level

Training of beneficiaries and administrative units is necessary part of development. As the newer techniques and concepts are being experienced in irrigation sector appropriate training modules could be introduced at all levels. Area of training which need immediate attention are policy planning for development of the sector, formulation of guide lines for design and execution, distribution of water and water management, extension programs for water application conservation and marketing of food products. Minor Irrigation Development Organisation could be incharge of educating and imparting training to all concerned.

APPENDICES

APPENDIX - 1

No.25(1)/D/2000-WR

Government of India
Planning Commission

Yojana Bhawan, Sansad Marg,
New Delhi – 110001.
Dated, November 20, 2000.

O r d e r

Subject: Constitution of Working Group on Minor Irrigation Programme for the formulation of Tenth Five Year Plan (2002-2007).

With a view to formulate the Tenth Five Year Plan, it has been decided to set up a Working Group on Minor Irrigation Programme with the following composition and Terms of reference.

1)	Prof. B.D. Dhawan, Prof. & Head Institute of Economic Growth, University of Delhi, Delhi.	Chairman
2)	Adviser(WR), Planning Commission	Member
3)	Addl. Secretary, Ministry of Water Resources. Member	
4)	Chairman, Central Ground Water Board	Member
5)	Project Director, Water Technology Centre Indian Agricultural Research Institute, Pusa Campus, New Delhi.	Member
6)	Shri A. Mohankrishnan, Adviser to the Govt. of Tamil Nadu (Water Resources), "Cauvery Illam" Government Museum Compound, 406, Pantheon Road, Chennai- 600008.	Member
7)	Economic & Statistical Adviser, Directorate of Economics & Statistics, Ministry of Agriculture.	Member

8)	A representative of National Bank for Agriculture and Rural Development	Member
9)	Jt. Secretary (FB), Deptt. of Economic Affairs, Ministry of Finance.	Member
10)	Shri A.K. Sood, Joint secretary, National Committee for the use of Plastics In Agriculture, Himalaya Houses (2nd Floor), 23, Kasturba Gandhi Marg, New Delhi – 110001.	Member
11)	Commissioner (PR&MI),Min. of Water Resources.	Member
12)	A representative of Deptt. of Rural Development, Min. of Rural Areas & Employment	Member
13)	A representative of Rural Electrification Corporation.	Member
14)	A representative of Ministry of Social Justice and Empowerment.	Member
15)	A representative of Department of Banking, Ministry of Finance.	Member

State Irrigation/ Water Resources Secretary of

16)	Arunachal Pradesh	Member
17)	Assam	Member
18)	Himachal Pradesh	Member
19)	Madhya Pradesh	Member
20)	Tamil Nadu	Member
21)	Uttar Pradesh	Member
22)	`West Bengal	Member
23)	Sr. Joint Commissioner (MI) Ministry of Water Resources.	Member- Secretary

Non-official

1)	Shri M. Krishnappa, Former Secretary to Govt. of Karnataka No.1921, 30th Cross, 13th Main , Banshankari 2nd Stage, Bangalore – 560070	Member

2) Shri R.S. Saxena, Member
Chief Engineer(Retd.),
319-B, SFS Flats.
C-3, Janakpuri,
Pankha Road, New Delhi 110058.

3. Executive Director, Member
Dhan Foundation,
18, Pillaiyar Koil Street, SS Colony,
Madurai, Tamil Nadu-625010

4. Shri Narhari Venugopal Reddy, Member
23-6-202, New Nature Cure Hospital
Hunter road, Hanamkonda,
Warangal-506 001, Andhra Pradesh

Terms of Reference

1. To review the Ninth five Year Plan physical and financial performance of the Sector, Central and State-wise.

2. To review the performance of projects completed so far with regard to improvements in productivity, extension in agricultural activities, rise in ground water level etc., as well as environmental impacts.

3. To suggest appropriate strategy and formulate year wise proposals for the Tenth Five Year Plan (2002-2007), target wise and investment-wise, indicating the priorities.

4. To review the present mode of funding and suggest ways for expeditious completion of projects.

5. To review the present status (State-wise) of tank Irrigation and suggest measures and investments required for rehabilitation/modernization/renovation of these tanks.

6. To review the performance of local rain water harvesting schemes and the measures needed to popularize such schemes.

7. To evolve realistic strategy and suggest measures to improve irrigation efficiency of minor irrigation projects so as to ensure equitable, timely and optimal delivery of water to farmers.

8. To review the State-wise status and performance of ground water development and management and suggest measures to ensure sustainable development.

9. To suggest appropriate measures and suitable strategies for raising revenues from minor irrigation works including State Minor Irrigation/ Ground Water (Tubewell) Corporations and for optimum utilization of the existing assets i.e., irrigation systems and manpower.

10. To review the availability of institutional finance to this Sector and suggest ways for enhancing fund flow for this Sector as well as to cut down on procedural delays.

11. To suggest measures for enhancing private sector investments in the minor irrigation projects including their O & M.

12. To review the existing data availability and suggest measures to improve the data collection storing and retrieval methods.

13. To assess the employment potential in the Tenth Five Year Plan and requirements and training needs of various categories of personnel needed for the sector in the Plan period.

14. To prepare a S & T Plan for minor irrigation including ground water.

The Working Group may co-opt a Member(s) as may be required.

Expenditure of the Members on TA/DA in connection with the meetings of the Working Group will be borne by the respective Departments/Ministries/ Organisations. Expenditure in respect of non-official Members will be borne by the Planning Commission as per rules and regulations of TA/DA as applicable to Group 'A' Officers of the Government of India.

The Working Group shall submit its final report to the Planning Commission by 31st March, 2001.

SD/-
(T.R. Meena)
Deputy Secretary(Administration)

To

Chairman and all Members of the Working Group.

Copy to:

PS to Deputy Chairman. PS to Members/Minister of State. Sr.PPS to Secretary.
All Advisers/Heads of Divisions, Deputy Adviser(PC), US(Admn.I) (for Admn.I Section) PA to Dy. Secy.(Admn.)

SD/-
(T.R. Meena)
Deputy Secretary(Administration).

APPENDIX - 2

No.25(1)/D/2000-WR

Government of India
Planning Commission

Yojana Bhawan, Sansad Marg,
New Delhi – 110001.
Dated, December 19, 2000.

O r d e r

Subject: Constitution of Working Group on Minor Irrigation Programme for the formulation of Tenth Five Year Plan (2002-2007).

In continuation of Planning Commission's Order of even number dated November 20, 2000 on the subject cited above, it has been decided to appoint Shri M.S. Billore, former Secretary, Water Resources Department, Government of Madhya Pradesh as Chairman of the Working Group on Minor Irrigation Programme in place of Prof. B.D. Dhawan, Institute of Economic Growth, University of Delhi, Delhi.

SD/-
(T.R. Meena)
Deputy Secretary(Administration)

To

Chairman & All Members of the Working Group

Copy to :

PS to Deputy Chairman.
PS to Members/Minister of State.
Sr.PPS to Secretary.
All Advisers/Heads of Divisions
Deputy Adviser(PC)
US(Admn.I) (for Admn.I Section)
PA to Dy. Secy.(Admn.)

SD/-
(T.R. Meena)
Deputy Secretary(Administration).

APPENDIX - 3

No.25(1)/D/2000-WR

Government of India
Planning Commission
(WR Division)

Yojana Bhawan, Parliament Street,
New Delhi, the 2nd March, 2001.

O r d e r

Subject: Constitution of Working Group on Minor Irrigation Programme

for the formulation of Tenth Five Year Plan (2002-2007).

In continuation of this Commission Order of even number dated 20th November, 2000 on the subject mentioned above. Shri S.S. Sohani, former Commissioner, Minor Irrigation, Ministry of Water Resources has been co-opted as a non-official member of the Working Group on Minor Irrigation Programme for the formulation of Tenth Five Year Plan (2002-2007).

The Terms of Reference will be the same as per this Office Order of even number dated 20th November, 2000(copy enclosed).

(T.R. Meena)
Deputy Secretary(Administration)

Shri S.S. Sohani,
Former Commissioner,
Minor Irrigation, M/o Water Resources,
96, Shrinagar Extension,
Indore, MP-452001.

Copy to:

PS to Deputy Chairman.
PS to Members/Minister of State.
Sr.PPS to Secretary.
All Advisers/Heads of Divisions
Deputy Adviser(PC)
US(Admn.I) (for Admn.I Section)
Accounts I Branch
PA to Dy. Secy.(Admn.)
Chairman & all Members of the Working Group

Appendix - 4

CONTENTS

Chapter VII	Participatory Irrigation Management in Minor Irrigation Sector	Sh. S.S. Sohani, Former Commissioner, MOWR & Sh.M. Krishnappa, Former Secy, Govt. of Karnataka
Chapter VIII	Water Pricing	Sh. S.S. Sohani Former Commissioner, MOWR
Chapter IX	Formulation of Appropriate Strategy to Achieve Physical and Financial Targets	Sh.Palat Mohandas Addl. Secy., MOWR
Chapter X	Institutional and Private Sector Role in Financing of Minor Irrigation Schemes.	Sh.S.M.Mendhekar G.M. NABARD
Chapter XI	Data Base Management for the Development of Minor Irrigation Sector	Sh.O.P. Mishra, Director(STAT), MOWR
Chapter XII	Scientific Management of Minor Irrigation Schemes	Sh. A.K. Singh, Project Director, Water Technology Centre
Chapter XIII	Assessment of Employment Potential and Training Needs	Sh. R.S. Saxena, Former Chief Engineer, MOWR

Appendix - 5

No.1-8/2000-MI
Government of India
Ministry of Water Resources
(Minor Irrigation Divn.)

108-B, Shastri Bhawan,
New Delhi, the 16th April, 2001.

Subject:- Report of the working Group on Minor Irrigation for formulating proposals for Xth Plan.

During the Fourth Meeting of the Working Group on Minor Irrigation for Xth Five Year Plan, the Chairman and Members of the Group constituted a Drafting Committee consisting of the following members to finalise the various chapters for the Report of the Working Group:-

Sl.No.	Name & Designation	
1.	Shri Palat Mohandas, IAS Additional Secretary, MOWR	Chairman
2.	Shri Sinha Ray Member, CGWB	Member
3.	Shri A. Sekhar, Commissioner(PR&MI), MOWR	Member
	Succeded by Shri M.K. Sharma, Commissioner (WM&MI)	Member
4.	Shri M. Krishnappa Former secretary, Irrigation Govt. of Karnataka.	Member
5.	Shri S.S. Sohani Former commissioner, MOWR 96, Sri Nagar Extn. Indore 452 001 Tel: 560735® (Fax: 552111)	Member
6.	Shri O.P. Mishra, Director(Statistics), MOWR Shastri Bhawan, New Delhi.	Member
7.	Shri V.P. Shiv Sr. Jt. Commissioner(MI) MOWR	Member-Secretary

For attending the meetings of the Drafting committee TA/DA of two non-official members S/Shri M. Krishnappa and S.S. Sohani will be borne by the Planning Commission. It is requested that necessary instructions may please be passed on to the Accounts Deptt. for the same.

-Sd-
(V.P. SHIV)
Sr. Jt. Commissioner(MI)

Shri T.R. Meena,
Dy. Secretary(Admn.)
Planning Commission,
New Delhi.

Copy for information to the Chairman of the Working Group and all the members of the Drafting Committee.

-Sd-
(V.P. SHIV)
Sr. Jt. Commissioner(MI) &
Member-Secretary of Working Group on MI

ANNEXURES