

**ENVIRONMENTAL AND SOCIAL ASSESSMENT
FOR
RIVER BASINS IN TAMIL NADU – IAMWARM PROJECT**

FINAL REPORT

Submitted to
The Chief Engineer (Plan Formulation),
WRO, PWD – Chennai

by



EPTRI

**ENVIRONMENT PROTECTION TRAINING AND RESEARCH
INSTITUTE (EPTRI)**

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FOREWORD

Farm sector has been an important contributor to the Gross State Domestic Product (GSDP) of different states. However, over the years there is a perceptible decline in the farm sector contribution to GSDP. The decline is in a way linked to the absence of modern irrigation practices and water resource management. Given this context, the Irrigated Agriculture Modernization and Water Resource Management (IAMWARM) of the Tamil Nadu Government is a pioneering effort and could indeed be a trendsetter for other States.

The success of a pioneering initiative such as IAMWARM Project is naturally dependant on a thorough understanding of aspects such as modern agriculture, crop diversification, agriculture marketing, Rural IT Kiosks, livestock management, organic farming etc.

This report takes a close look at the Water Resources Consolidation Project (WRCP) which is the precursor of IAMWARM Project and makes a detailed presentation on the IAMWARM Project institutional framework, ESA approach to the study area, SEMF, Institutional strengthening and the key environmental and social issues of the river basins.

We earnestly believe that this report would contribute in the furtherance of productive agricultural practices and effective water resource management in the State of Tamil Nadu and contribute to enhance level of individual productivity and prosperity of the farmers in the State.

Further, we trust the report will prove to be a rallying force in our quest for a better environment and sustainable development.

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Director General, EPTRI &
EO Special Chief Secretary to
Government of Andhra Pradesh

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- Sri Rajagopalan, IAMWARM Project Consultant, WRO, Chennai
- The Director, Senior Officers, Officers and Staff of IWS
- The Director, Senior Officers, Officers and Staff of State Ground and Surface Water Resources Data Centre
- The Director, Department of Environment, Government of Tamil Nadu
- Officers and Staff of Environment Cell Division of Chief Engineer (PF), WRO, PWD and Environment Cells of IWS.
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DIRECTOR GENERAL

Environment Protection Training & Research Institute (EPTRI)

CONTENTS

Chapter No.		Page No
	FOREWORD	
	ACKNOWLEDGEMENT	
	EXECUTIVE SUMMARY	1
1	INTRODUCTION	35
	1.1 Water Resources	35
	1.2 Irrigated Agriculture	35
	1.3 Tank Systems	36
	1.4 Overall Economy	37
	1.5 Tamil Nadu Water Resource Consolidation Project (WRCP)	39
	1.6 Context for ESA	40
	1.7 IAMWARM Project Description	42
2	POLICY AND INSTITUTIONAL FRAMEWORK	50
	2.1 Introduction	50
	2.2 Water Resource Organization	50
	2.3 Dam safety Directorate	50
	2.4 Water Resources – Institutions	51
	2.5 Water Resources – Policies and Acts	59
	2.6 National Environment Policy	65
	2.7 Air (Prevention and Control of Pollution) Act, 1981	66
	2.8 The Environment Protection, Act, 1986	66
	2.9 The Indian Forest Act, 1927	66
	2.10 Manufacture, Storage and Import of Hazardous Chemical Rules	68
	2.11 Notification on Coastal Regulation Zone, 1991	68
	2.12 Irrigated Agriculture- Institutions	69
	2.13 Participatory Irrigation Management	73
	2.14 Irrigation Acts	73
	2.15 Aquaculture Acts	75
	2.16 Tamil Nadu Agricultural Produce Marketing (Regulation) Act 1987	75
	2.17 Panchayat & Land Acts	75
	2.18 Implications of various Acts on IAMWARM Project	76

3	REVIEW OF PAST EXPERIENCES	77
3.1	Tamil Nadu Water Resource Consolidation Project (TNWRCP)	77
3.2	Participatory Irrigation Management (PIM)	79
3.3	LAER (Land Acquisition and Economic Rehabilitation) Cell	83
3.4	Environmental Cell Division (EC Division)	84
3.5	Pilot Project in Hanumanadhi Sub-Basin – Review	84
3.6	Tamil Nadu Women in Agriculture (TANWA) funded by DANIDA	90
3.7	Pudhu Vazhvu	92
3.8	Social Welfare Schemes and Programmes	93
3.9	Area Development	100
3.10	Drought Prone Area Development Programme (DPAP)	100
3.11	Integrated Wasteland Development Programme (IWDP)	101
3.12	Provision of Infrastructural Facilities in Tribal Blocks	101
3.13	Community Welfare Development Programme	101
3.14	Rural Poverty Profile	105
3.15	Hydrology Project - I	108
4	BASELINE ENVIRONMENTAL AND SOCIAL INFORMATION	111
4.1	Demography	111
4.2	Tamil Nadu Human Development Report	113
4.3	Climate	115
4.4	Water Resources	115
4.5	Forest Cover	115
4.6	Wetlands	115
4.7	Agriculture	116
4.8	Irrigation	121
4.9	Tank Systems	121
4.10	Dam Safety	124
4.11	Sand Mining	126
4.12	Fisheries	128
4.13	Fertilizer Consumption	131
4.14	Pesticide Consumption	131
4.15	Crop Diversification	133
4.16	Water Weeds	136
4.17	Prosopis juliflora	137
4.18	Live Stock	138
4.19	Poultry	141
4.20	Water Born Diseases	142
4.21	Municipal Solid waste	144
4.22	Disaster Management	145
4.23	Rain Water Harvesting	145
4.24	Comprehensive Waste Land Development Programme	146
4.25	Participatory Watershed Development	146
4.26	Information Technology in Tamil Nadu	147
4.27	Study Area	152
4.28	Environmental and Social Issues in the Sub Basins	156

4.29	Water Related Environmental Issues in River Basins	170
5	ANTICIPATED ENVIRONMENTAL & SOCIAL IMPACTS AND ANALYSIS OF ALTERNATIVES	172
5.1	Introduction	172
5.2	Legal and Administrative Frame Work	172
5.3	Environmental Impacts	173
5.4	Social Impacts	175
5.5	Environment Management Plan (EMP)	176
5.6	With and Without Environment Management Plan	180
5.7	Analysis of alternatives with and without project	183
5.8	Social and Economic Impact and Alternative Strategies	184
6.	STAKEHOLDERS' CONSULTATIONS	185
6.1	Target Participants	185
6.2	Consultation Workshops	185
6.3	Process of Consultations	186
7	SOCIAL AND ENVIRONMENTAL MANAGEMENT FRAMEWORK	211
7.1	Introduction	211
7.2	Overview of TNWRCP and IAMWARM projects	211
7.3	Social and Environmental Management Framework (SEMF)	214
7.4	SEMF for Sub-Basins	226
7.5	Irrigation Scheduling Model	258
7.6	Real Time Forecasting Model	259
7.7	Application of World Bank Safeguard Policies	260
7.8	Guidelines for Screening Social Safeguards	261
7.9	Checklist for Screening of Land Acquisition and Resettlement Impacts	262
7.10	List of Ineligible Activities	270
7.11	Indicative Outline Terms of Reference for Social Assessment	270
7.12	Land Acquisition and Monitoring Sheet	273
7.13	Overall Suggestions	274
7.14	Training due to Mechanization	282
7.15	Institutional Framework	282
7.16	Institutional Framework – State Level	282
7.17	Project Implementation Agencies	283
7.18	Training Institutions	284
7.19	External Monitoring and Evaluation Agency	284
7.20	Constitution of an Apex Body at State Level	284
7.21.	Suggestions for the Farmers for the sustainability of WUAs	285

7.22	Suggestions for speedy implementation of PIM	286
7.23	Suggestions for Disaster Management	286
7.24	Water Conservation Measures	287
7.25	Suggested Institutional Arrangements	288
7.26	Suggested Organizational Structure for Environmental and Social Development Cell	290
8	MONITORING FRAMEWORK	291
8.1	Need for Monitoring and Evaluation	291
8.2	Monitoring and Evaluation for IAMWARM	292
8.3	Key Monitoring Indicators	293
8.4	Monitoring and Evaluation Indicators	297

ANNEXURES

1.	Baseline Environmental and Social information for 16 river basins	A-1
2.	Photos of stakeholder meetings	A-242
3.	Dam Safety	A-245
4.	Integrated Pest Management Plan	A-259
5.	Cultural Property Management Plan	A-266
6.	Resettlement Framework	A-275
7.	Tribal Development Strategy	A-290
8.	Gender Issues	A-300
9.	Institutions working on water related issues in Tamil Nadu	A-307
10.	List of Officials consulted during the Study	A-344
11.	Schematic Presentations	A-349
12.	References	A-355

LIST OF TABLES

Table	Name	Page No
1.1	Growth in Gross Domestic Product (1993-94) Prices – A Trend Analysis	39
1.2	National Income (GDP) vis-à-vis State Income (GSDP) and Per capita Income at Constant (1993-94) Prices	39
2.1	Technical working group committees of WRCRC	55
2.2	Technical working group committees of Environmental Sector	57
2.3	Activities of the Line Departments	70
2.4	Farmers Councils	73
3.1	Farmers Councils (WUAs)	80
3.2	Benefits of Haat	92
3.3	Poverty Alleviation Programmes	99
3.4	No. of Panchayats as on 2003-04 by Population	103
3.5	Distribution of Panchayat Unions & Village Panchayats by District 2004-05	104
3.6	Trends in Incidence of Poverty in Tamil Nadu	105
3.7	Performance of Important Schemes during 2003-04	106
4.1	Total Population of Tamil Nadu	111
4.2	Total Child Population of Tamil Nadu	112
4.3	Total SC Population of Tamil Nadu	112
4.4	Total ST Population of Tamil Nadu	112
4.5	Literacy rate in Tamil Nadu	112
4.6	District-wise HDI and GDI values, 2001	114
4.7	Wetlands of Tamil Nadu	116
4.8	Area Production and Yield Rate of Principal Crops	117
4.9	Proposed productions for 2005-06	117
4.10	Agricultural performance of Tamil Nadu	117
4.11	Value of Agricultural Produce Sold by Marketing Cooperatives	120
4.12	Categorization of Tanks in Tamil Nadu	122
4.13	Area irrigated by different sizes of Tank in Tamil Nadu	122
4.14	Constraints in tank irrigation development and required modernization measures	123
4.15	PWD dams	125
4.16	Approved Sand quarries	126
4.17	Authorized Sand quarries in Madurai Region	126
4.18	Authorized Sand quarries in Chennai Region	126
4.19	Authorized Sand quarries in Pollachi Region	127
4.20	Authorized Sand quarries in Trichy Region	128
4.21	Marine Fish Catches by Boats	129
4.22	Inland Fish Production: By Source	130
4.23	Export of Fish and Fish Products	130
4.24	List of Common Pests	132
4.25	Area, Production and Yield rate of Horticulture Crops	136
4.26	Trends in Livestock Population (lakhs) – Tamil Nadu	138

4.27	Milk Products and Value	140
4.28	Average Yield Rate of Milk (Kgs., / Animal / day)	141
4.29	Malaria incidence in rural and urban Areas of Tamil Nadu	143
4.30	Details of ADD/Cholera in Tamil Nadu	144
4.31	Stakeholder consultation workshops in 16 river basins	156
4.32	Major environmental and social issues in the sub basins	157
4.33	Water related Environmental issues	170
5.1	Analysis of alternatives	180
6.1	Stakeholder consultation workshops in 16 river basins	186
7.1	IAMWARM Sub-Basin Project Cycle	213
7.2	SEMF	214
7.3	SEMF for the IAMWARM Project	226
7.4	Bank Safeguard Policies	260
7.5	Sub Project Activities and its Impacts	261
7.6	Category of Impacts	265
7.7	SWOT Analysis of Institutional Strengthening under IAMWARM Project	275
7.8	Principal aspects of training required for various stakeholders	279
8.1	Use of Various Indicators	292
8.2	Key Monitoring Indicators for Projects and Sub Projects	293
8.3	Monitoring Indictors for Planning, Designing, Implementation and Post Implementation	294

ABBREVIATIONS

ADD	Acute Diarrhea Disease
APWALTA	Andhra Pradesh Water, Land and Trees Act
BEES	Battelle Environment Evolution System
BMP	Basin Management Plan
BOD	Biological Oxygen Demand
BPL	Below Poverty Line
CAD	Computer Aided Drafting
CDM	Clean Development Mechanism
CE	Chief Engineer
CETP	Common Effluent Treatment Plant
CWC	Central Water Commission
DANIDA	Danish International Development Assistance
DFO	Divisional Forest Officer
DPR	Detailed Project Report
DSS	Decision Support System
DVMS	Data Base Management System
DWACRA	Development of Women and Child in Rural Areas
EAP	Environment Action Plan
EC	Electrical Conductivity
EIA	Environment Impact Assessment
EPTRI	Environment Protection Training and Research Institute
ESA	Environmental and Social Assessment
ESG	Environmental and Social Guidelines
ESR	Engineer Survey Report
ETI	Environment Training Institute
FOT	Farmers Organizations Turnover
FYM	Farm Yard Manure
GDI	Gender Development Index
GDP	Gross Domestic Product

GHG	Green House Gases
GIS	Geographic Information System
GoAP	Government of Andhra Pradesh
GoI	Government of India
GoTN	Government of Tamil Nadu
HADP	Hill Area Development Programme
HCWC	Horizontal Continuum Work Culture
HDI	Human Development Index
HDR	Human Development Report
HHL	House Hold Latrines
HYV	High Yielding Varieties
IAM	Impact Assessment Matrix
IAMWARM	Irrigated Agricultural Modernization and Water Resource Management
ICAR	Indian Council of Agriculture Research
ICR	Implementation Completion Report
ICID	International Commission for Irrigation and Drainage
IEC	Information Education and Communication
IES	Integrated Environment Strategies
IGA	Income Generating Activities
IIT	Indian Institute of Technology
IMTI	Irrigation Management and Training Institute
IMY	Indira Mahila Yojana
INM	Integrated Nutrient Management
IPDP	Indigenous Peoples' Development Plan
IPLS	Integrated Plant Nutrient Supply
IPM	Integrated Pest Management
IRDP	Integrated Rural Development Project
ISDI	Inter State Development Index
ITDA	Integrated Tribal Development Agency
IWRM	Integrated Water Resources Management
IWS	Institute of Water Studies
JFM	Joint Forest Management

KIWSS	Karnataka Integrated Water Supply and Sanitation
KLBC	Kodhaiar Left Bank Canal
LA	Land Acquisition
LPCD	Liters Percapita Per Day
M&E	Monitoring & Evolution
MCC	Municipal Corporation of Chennai
MDPP	Multi Disciplinary Project Preparation Panel
MDT	Multi Disciplinary Teams
MFP	Minor Forest Product
MIS	Management Information System
MNP	Minimum Needs Programme
MoEF	Ministry of Environment and Forests
MoU	Memorandum of Understanding
NA	Not Available
NDWM	National Drinking Water Mission
NGO	Non Governmental Organisation
NOC	No Objection Certificate
NRSA	National Remote Sensing Agency
O&M	Operation and Maintenance
OBC	Other Backward Caste
OHT	Over Head Tank
PACT	Project Appraisal Core Team
PAF	Project Affected Family
PAP	Project Affected Person
PC	Project Committee
PESA	Panchayats Extension to Scheduled Areas
PF	Plan Formulation
PFA	Prevention of Food Adulteration
PFC	Plan Formulation Circle
PHC	Private Household Connection
PHED	Public Health Engineering Department
PIM	Participatory Irrigation Management

PPC	Plant Protection Chemicals
PPTT	Project Planning Task Team
PRA	Participatory Research Appraisal
PSP	Public Stand Post
PWD	Public Works Department
QA	Quality Assurance
R&D	Research and Development
R&R	Rehabilitation and Resettlement
RAP	Resettlement Action Plan
RD	Rural Development
RP	Resettlement Plan
SAR	Sodium Absorption Ratio
SEMF	Social and Environmental Management Framework
SHG	Self Help Groups
SG&SWRDC	State Ground and Surface Water Resources Data Center
SPCB	State Pollution Control Board
SPOR	State Policy on Rehabilitation
TANWA	Tamil Nadu Women in Agriculture
TBO	Tree Borne Oil
TC	Territorial Committee
TDS	Total Dissolved Solids
TN	Tamil Nadu
TNIIN	Tamil Nadu Irrigation Information Network
TNPCB	Tamil Nadu Pollution Control Board
TNWRCP	Tamil Nadu Water Resources Consolidation Project
TOR	Terms of Reference
TWADB	Tamil Nadu Water and Drainage Board
UNEP	United Nations Environment Programme
UTM	Universal Transverse Mercator
VWSC	Village Water Supply Committee
WB	World Bank
WHC	Water Holding Capacity

WRCP	Water Resources Consolidation Project
WRCRC	Water Resources Control and Review Council
WRO	Water Resources Organization
WUA	Water User Association
WRRF	Water Resources Research Fund
WRM	Water Resources Management
ZPG	Zero Population Growth

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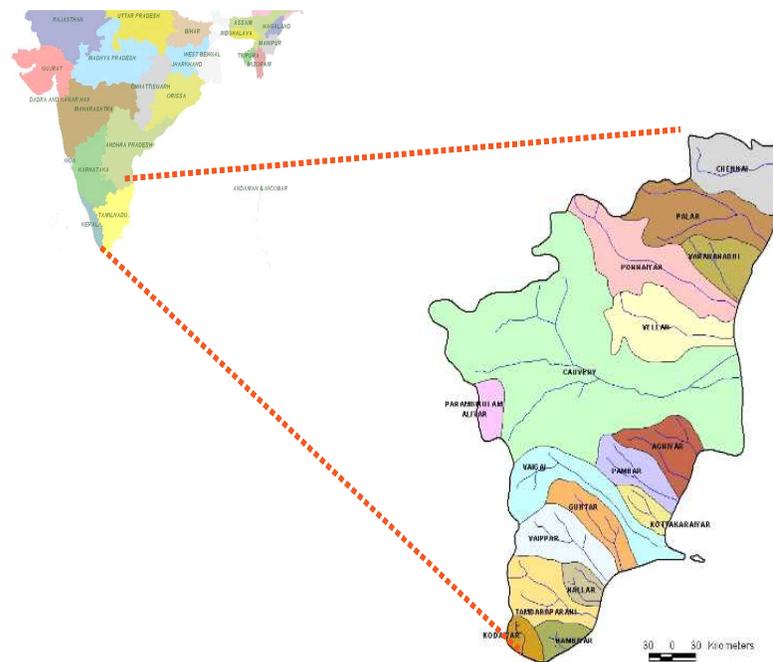
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EXECUTIVE SUMMARY

Introduction

Tamil Nadu, the southern most State of the Indian peninsula is, spread over 1,30,058 km² and lies between 08° 05"N and 13° 35" N and 76° 15" E and 80° 20" E. It is surrounded by the States of Andhra Pradesh in the north, Kerala in the west, Karnataka on the Northwest, Indian Ocean on the south and the Bay of Bengal on the east. The population of Tamil Nadu is 6,21,10,839 as per 2001 Census. The rural population is entirely depending on agriculture.



Water Resources of Tamil Nadu

There are 17 river basin groups in Tamil Nadu, a majority of which are water-stressed. There are 61 major reservoirs, about 40,000 tanks and about 3.0 million wells, that heavily utilize the available surface water (17.5 BCM) and groundwater (15.3 BCM). Agriculture is the single largest consumer of water in the state, using 75% of the states water. Irrigation through a combination of canals, wells and tanks increases the reliability and availability of water for farming and is essential for cultivating crops in much of the state. About 30% of the net irrigated area is watered by canals, 21% by tanks and 49% is fed by wells. The remaining area is irrigated by other sources such as streams and springs. Rain fed agriculture employing about 25% of farmers accounts for 46% of the net sown area of 5.5 million hectares. The percapita availability of water resources in Tamil Nadu is 900 cubic meters a year as against 2200 cubic meters for all India.

Project Description

Tamil Nadu has implemented a World Bank financed Water Resources Consolidation Project (WRCP) from 1995-2004. The WRCP project has contributed to improving the environment by developing a State Environmental Planning Framework, by creating an Environmental Cell (EC) in the office of Chief Engineer (Plan Formulation), formation of three WRO EC divisions as focal points for environmental activities in the WRO, creating and strengthening an environmental wing at the Institute of Water Studies (IWS). A special unit in the PWD Secretariat has been created for Land Acquisition and Economic Rehabilitation (LAER). Water Resources Research Fund (WRRF) capitalizing on the success of the WRRF established in the TN WRCP, this investment would expand the activities undertaken using the fund for targeted studies, awareness raising and applied research on key water and irrigated agriculture issues (including related environmental and social development issues) facing the state.

The IAMWARM project is a successor to the recently-completed TN WRCP. The WRCP supported the state in a wide range of physical investments and institutional development that the IAMWARM project seeks to deepen. The key focus areas for IAMWARM are on irrigated agriculture modernization and on integrated water resources management to improve the productivity of water.

Proposed Project Development Objective: The proposed project development objective is to improve and sustain irrigation service delivery and productivity of irrigated agriculture with effective integrated water resources management in a river basin/sub-basin framework in Tamil Nadu.

The capacity-building activities would be state-wide in scope but the physical investments (rehabilitation of existing irrigation/water assets and support for agricultural diversification and improved livestock and fisheries management) under the project would be located in selected river basins/sub-basins throughout the State of Tamil Nadu, India.

The above objectives are to be achieved through investments for modernizing irrigation infrastructure (including systems rehabilitation, on-farm works, technical and managerial upgrading of institutions involved in irrigation development, operation and management, diversification of agriculture with appropriate extension measures and market linkages, promoting public-private partnerships, piloting innovative irrigation infrastructure development and management options) and re-orienting and strengthening institutions and instruments required for integrated effective water resources management in the State (including unbundling resource management from service delivery institutions).

The proposed project would consist of the following two key components:

- Irrigated Agriculture Modernization
- Water Resource Management

Irrigated Agriculture Modernization: Irrigation systems modernization in a sub-basin framework (including participatory and sustainable modernization of any water storages and related irrigation infrastructure including system/non-system/rainfed tanks, pump set efficiency; measurement and monitoring covering about one million hectares expanding on

the experience of the Hanuman Nadhi pilot. It is expected that this would be initiated in the Palar, Parambikulam Aliyar, Thambiraparani, Vaigai and Kodayar Basins and extended to other basins.

Institutional Modernization for Irrigated Agriculture (targeted modernization and improved asset inventory and management plans (for instance, dams, tanks, irrigation infrastructure, agricultural, horticultural, fisheries data) technical and managerial upgrading of irrigation development and service delivery institutions, modernization of manuals/procedures, computerization, LAN and WAN, knowledge management software, information management and sharing, public interaction, closer integration of WRO/PWD and Agriculture, Horticulture, Agricultural Engineering, Livestock/Fisheries Departments. Sustainable Agriculture modernization (cropping systems diversification and management to improve water conservation and farmer returns, integrated pest and nutrient management, public private Partnerships for extension, post-processing, certification, marketing)

An integrated Sub-basin Development and Management Plan would be developed for each sub-basin to provide a shared vision planning of proposed investments and capacity-building under the project.

Water Resources Management: This component is intended to strengthen the policy and institutional framework for improved sustainable management of water resources in the State. These activities would include:

State-level (converting the WRCRC to a State Water Council, amalgamating the associated sub-committees and upgrading the Institute of Water Studies (IWS) and the Surface and Groundwater Data Center (SGDC) to a State Water Resources Agency, establishment of a Water Regulator, development of appropriate policy and institutional arrangements, instruments, and information tools to promote flexible water resources management)

Basin-level (Strengthening, empowering and expanding Basin Development and Management Boards, development of basin analytical decision support systems targeted to support key policy and investment decisions, drought/flood preparedness, participatory structured consultations including strategic social and environmental assessments to systematically develop sub-basin development and management plans, demonstration pilots)

Environmental & Social Assessment (ESA)

The ESA has been carried out to provide input into the IAMWARM Project in accordance with the World Bank operational guidelines. The primary objective of the ESA is to identify the key environmental and social issues in 41 sub-basins relating to agriculture (irrigation systems improvement, agriculture, horticulture, fisheries, etc.). A wide range of data has been collected pertaining to environmental and social issues and prepared SEMF.

Study Area

The IAMWARM project is for the entire State of Tamil Nadu covering 117 sub-basins in 17 river basins of Chennai, Palar, Varahanadi, Ponnaiyar, Paravanar, Vellar, Agniyar, Pambar & Kottakaraiyar, Vaigai, Gundar, Vaippar, Kallar, Tamirabarani, Nambiyar, Kothaiar, Parambikulam & Aliyar Project. In the first year 41 sub basins are proposed under this project. The methodology adopted for this study includes stakeholders consultations, field visits, secondary data collection, compilation and interpretation.

Stakeholders Consultations

Stakeholder consultation is an important aspect in this project to obtain the perception and views of the stakeholders on social and environmental concerns pertaining to the local areas. The objective of stakeholders consultation is to minimize the negative impacts in the area and make them feel that they are the ultimate beneficiaries of the project in this process the views ascertained from the stakeholders is analyzed and incorporated in the project document. The ESA study initially obtain the opinions of the stakeholders and the same has been analyzed and incorporated at the sub basin level.

The stakeholder views from various stakeholders consultative workshops are as follows:



River Basin	Stakeholder views
Pollachi (PAP)	<ul style="list-style-type: none"> • Sprinkler and drip irrigation should be introduced in the entire canal instead of selected area. • Live stock development should be encouraged. • Dairy activities should be encouraged.
Thiruvannamalai (Ponnaiyar River Basin)	<ul style="list-style-type: none"> • Drip irrigation • Introducing of modern agriculture practices • Alternative cropping pattern in draught prone areas • Market linkage
Krishnagiri (Ponniyar River Basin)	<ul style="list-style-type: none"> • Construction of check dams • Cold storage facilities • Training of Vermicomposting and organic farming
Atthur (Vellar River Basin)	<ul style="list-style-type: none"> • Information should reach to tailend farmers • Setting up of water and sewage treatment plants • Embryo transplantation techniques should require

Pudukkottai (Agniar River Basin)	<ul style="list-style-type: none"> • Awareness cultivation of herbal plantations • Mobile veterinary van should provide • Construction of percolation ponds
Vaigai Basin, Madurai	<ul style="list-style-type: none"> • Separate news letter should published to disseminate modern agriculture techniques • Environmental awareness programmes should conduct
Vaipar River Basin, Srivalluputhur	<ul style="list-style-type: none"> • Protection of wild life sanctuary • Improve and implementation of rainwater harvesting pits • Sustainable drinking water facilities • Old pump set motors should replace
Tamirabarani, Thirunelveli	<ul style="list-style-type: none"> • Cooperative milk society should establish • Marketing arrangement for bio-fuel • Restoration of ecological balance through resource conservation
Kothaiyar, Nagerkovil	<ul style="list-style-type: none"> • Better irrigation facilities should provide • Awareness should be created on eco tourism concept • Better market price for agriculture products
Valliyoor (Nambiyur River basin)	<ul style="list-style-type: none"> • Disiltation of tanks should taken up • Horticulture crops should promote • Better marketing accessibility with information technology
Palar River Bain, Cheyyar Sub Bain, Kancheepuram	<ul style="list-style-type: none"> • Disilting of tank and supply channels • Promotion of drip and

	<p>sprinkler irrigation methods</p> <ul style="list-style-type: none"> • Land reclamation
Tindivanam (Varahanadhi River Basin):	<ul style="list-style-type: none"> • Training in crop diversification, cropping practices and waste water use in agriculture • Application of gypsum as soil conditioner to improve soil fertility • Training on integrated pest management techniques
Vaigai Basin, Paramakudi	<ul style="list-style-type: none"> • Promotion of SHGs • Facilities for seed marketing technology • Training programmes on vermicompost, honeybee cultivation and fish culture
Gundar Basin, Aruppukottai	<ul style="list-style-type: none"> • Revenue from sand mining should distribute equally • Solid waste must be disposed hygienically • Fish stocking in irrigation tanks • Fish seed should promote • Marketing facilities for agriculture products
Velar Basin, Perambalur	<ul style="list-style-type: none"> • Separate website should be created to know the market price and to know the new technologies available in field of agriculture and horticulture • Prevent dumping of plastic and solid waste into the tanks • Water borne diseases must prevent • Milk chilling facility should require
Kosasthalaiyar Sub Basin, Thiruvallur	<ul style="list-style-type: none"> • Integrated pest management and organic

	<p>farming should be practiced</p> <ul style="list-style-type: none"> • Awareness programmes to the farmers to use modern agriculture implements • Disiltation of tanks • Catchment degradation should address • Crop diversification information should provide
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Application of World Bank Safeguard Policies

Policy	Applicability	Comments
Environmental Assessment (OP/BP 4.01)	Yes	Significant adverse social or environmental impacts are not expected as all significant physical investments are expected to be in the nature of rehabilitation of existing assets. However, an integrated Environmental and Social Assessment (ESA) with an Environmental and Social Management Plan (ESMP) to both manage risks and maximize environmental and social opportunities will be finalized based on earlier work and experiences of the TN WRCP project and consideration of new activities proposed in the TN IAMWARM project.
Natural Habitats (OP/BP 4.04)	No	No adverse impacts on natural habitats expected, but this issue will be further tracked during the ESA implementation
Forests (OP/BP 4.36)	No	No proposed activities would trigger this policy.
Pest Management (OP 4.09)	Yes	No pesticides and fertilizers are expected to be financed directly by the project; however, there may be induced impacts of increased fertilizer and pesticide use due to improved agricultural intensification and diversification. The project will support scaling-up state-wide Integrated Pest Management and Integrated Nutrient Management efforts and support for safer and organic food production and marketing. A pest management plan will be proposed as part of the ESA and ESMP.

Cultural Property (OPN 11.03)	Yes	No significant adverse impacts on cultural property expected, but this issue will be examined during the ESA (particularly in relation to proper management of any religious and other physical cultural property associated with tanks during rehabilitation).
Indigenous Peoples (OD 4.20)	No	No adverse impacts on tribals are expected, but the project will examine ways to improve benefits to tribals, women, and other vulnerable groups as part of the ESA.
Involuntary Resettlement (OP/BP 4.12)	Yes	No significant resettlement expected – but these will be examined further as preparation proceeds. The successful arrangements adopted under the previous TN WRCP project will also be adopted as required.
Safety of Dams (OP/BP 4.37)	Yes	The project will support safety of dams associated with the project areas (unless already addressed under other parallel projects). The project will also support safety improvement of tank systems as part of tank rehabilitation.
Projects on International Waterways (OP/BP 7.50)	No	No project activities in international waterways.
Projects in Disputed Areas (OP/BP 7.60)	No	No project activities in disputed areas.

Key Environmental issues in the river basins

The distinct environmental issues confronting the river basins essentially relate to groundwater depletion, excess fluoride and nitrate concentration in groundwater. Further, it has been noticed that the surface water is polluted due to untreated industrial effluents. There is also the problem of sea water intrusion and soil erosion. Consequent to the rapid urbanization, there is increase in sand mining resulting in catchment area degradation. It has been noticed that there is growth of Juliflora and aquatic weeds. The key issue that emerges from the study is the need for extensive promotion of organic farming, vermicomposting and bio-fertilizers.

Key social issues in the river basins

There are distinct social fallouts, significant among them being the aspect relating to migration. There is a discernable decline in livestock population. It has emerged from the study that there is a need for adoption of modern agricultural practices, as also the need for training women in post harvesting technologies. More significantly the emphasis ought to be on local specific rural enterprise development and vocational training programmes for the adolescent boys and girls. There is a need to strengthen the existing agriculture markets and introduce the IT based agri-marketing initiatives. There is also need for strengthening of rural health, sanitation and infrastructure.

While the above are key environmental and social issues at random, an effort has been made to establish the environmental and social issues specific to the sub-basin which is tabulated below. However, it is pertinent to point out that there is not much of a variation in

the environmental and social concerns of the different sub-basins. It is just that there may be a variation in the intensity and magnitude of the problem.

Sub basin wise Environmental and social issues:

S.No	Main River Basin	Sub Basin	Environmental Issues	Social Issues
1	Chennai	1. Kosasthalaiyar	<ul style="list-style-type: none"> • Industrial Pollution • Sea water intrusion reduced the quality of groundwater • Sand Mining is prevalent in the river bed areas • Siltation • Coastal erosion • Weed growth • Industrial effluents released into river • Domestic Sewage released into river • Over exploitation of ground water • Dumping of debris into tanks 	<ul style="list-style-type: none"> • Encroachment in the river and tank beds • Poor sanitary conditions • Skin allergies • Mosquito breeding due to water stagnation and • Elephantiasis
2	Palar	2. Cheyyar	<ul style="list-style-type: none"> • Ground water contamination • Dying Effluents In Arni Taluk • Water contamination due to Kattamanku • Sand mining seen in the river bed areas • Domestic Sewage of Arni town and Thiruvathipuram • Water weeds 	<ul style="list-style-type: none"> • Poor literacy levels • Anthrax disease in cattle • Provide good linkage for marketing

		3. Kliyar	<ul style="list-style-type: none"> • Sand mining seen in the river bed areas • Ground water depletion due to industries • Solid waste problem in Vandavasi Municipality • Sea water intrusion near Vayalur • Sugar mill effluents in Padalam • Water weeds • Lack of sewage treatment plant Vandavasi and Madurantagam Municipalities 	<ul style="list-style-type: none"> • Seasonal migration due to unemployment • Poor marketing facilities and poor value addition • Poor literacy levels leading to migration • Poor sanitary conditions and unhygienic conditions • Diseases surveillance due to mosquitoes and pigs
3	Pennaiyar	4. Chinnar 1 a	<ul style="list-style-type: none"> • Domestic sewage • Poor solid waste management • Drinking water pollution due to drainage water. • Sand mining seen in the river bed areas • Soil erosion seen in the river and tank beds • Water weeds 	<ul style="list-style-type: none"> • Livestock reduction with unidentified diseases • Poor sanitary conditions • Poor literacy levels • Water borne diseases in this river basin

		5. Chinnar 1 b	<ul style="list-style-type: none"> • Sand mining seen in the river bed areas • Water contamination • Domestic sewage led into rivers • Water weeds • Textile effluents 	<ul style="list-style-type: none"> • Seasonal migration due to poor literacy levels • Livestock reduction with unidentified diseases • Poor sanitary conditions and sanitation programmes are not properly implemented. • Health problems due to mosquitoes and stagnation of water
		6. Pennaiyar to Krishnagiri	<ul style="list-style-type: none"> • Water pollution due to industries • Mango processing effluents released into tank leading to water contamination and algal blooms • Sand mining is very high in the river bed area • Poor solid waste management • Soil erosion seen in the river and tank beds 	<ul style="list-style-type: none"> • Health problems due to industrial water pollution • Livestock diseases and decrease in the trend of livestock. • Encroachment of river and tank beds
		7. Pambar	<ul style="list-style-type: none"> • Lack of solid waste disposal method • Sago industrial effluents a major problem • Water weeds 	<ul style="list-style-type: none"> • Seasonal migration due to poor literacy levels • Livestock reduction due to diseases • Poor sanitary conditions leading to diseases • Encroachment of irrigation canals

		8. Vaniyar	<ul style="list-style-type: none"> • Lack of solid waste disposal method • Sago industrial effluents led into the river • Sand mining is seen in the riverbed areas. 	<ul style="list-style-type: none"> • Seasonal migration due to poor literacy levels • Livestock reduction due to diseases • Poor sanitary conditions in the residential areas •
		9. Musukundanadhi	<ul style="list-style-type: none"> • Municipal sewage letting out into rivers • Sand mining in the river bed areas • Lack of sewage treatment plant 	<ul style="list-style-type: none"> • Seasonal migration due to poor literacy levels • Livestock reduction due to unidentified diseases • Poor sanitary conditions in the residential areas
4	Varahanadhi	10. Varahanadhi	<ul style="list-style-type: none"> • Mining of rocks • Municipal sewage letting out into rivers • Sand mining in the river bed areas • Water weeds 	<ul style="list-style-type: none"> • Seasonal migration due to poor literacy levels • Livestock reduction due to unidentified diseases • Lack of awareness in solid waste minimization and management
5	Vellar	11. Manimuthanadhi	<ul style="list-style-type: none"> • Coconut trees are affected due to water pollution • Sand mining is prevalent in the river beds • Over exploitation of ground water 	<ul style="list-style-type: none"> • Social conflicts in water utilization • Inadequate school teachers leading low literacy levels • Anthrax diseases in cattle
		12. Kil Vellar	<ul style="list-style-type: none"> • Municipal sewage letting out into rivers • Effluents from sugar industries released into river • Lack of sewage treatment plants 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Livestock reduction due to diseases • Poor drinking water supply and sanitation

		13. Upper Vellar	<ul style="list-style-type: none"> • Sago industrial effluents released into river • Sand mining leading to depletion in ground water level 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Livestock reduction due to diseases • Poor drinking water supply and sanitation • No marketing facilities
		14. Swethanadhi	<ul style="list-style-type: none"> • Ground water pollution • Sand mining in the river beds • Air pollution due to cement factory 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Livestock reduction due to diseases in cattle • Poor drinking water supply and sanitation • No marketing facilities • Problem of mosquitoes leading to malaria
		15. Chinnar	<ul style="list-style-type: none"> • Ground water pollution • Sand mining in the river bed areas 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Livestock reduction due to unidentified diseases. • Poor drinking water supply and sanitation • Females affected by cancer
		16. Anivari	<ul style="list-style-type: none"> • Ground water pollution • Sand mining prevalent the river beds • No proper solid waste management 	<ul style="list-style-type: none"> • Seasonal migration due to unemployment • Livestock reduction due to lack of veterinary hospitals • Poor drinking water supply and sanitation

6	Agniar	17. Agniar	<ul style="list-style-type: none"> • Excessive nitrate concentration in ground water • Poor solid waste management • Soil erosion seen in river and tank beds • Excessive use of chemical fertilizers polluting the surface as well as ground water. 	<ul style="list-style-type: none"> • Seasonal migration due to poverty • Reduction in grassing land and livestock • Low literacy rate due to poverty • Poor marketing facilities • Poor sanitary conditions leading to several diseases.
		18. Ambuliar	<ul style="list-style-type: none"> • Juliflora growth is predominant • Sand mining seen in the river beds • Excessive use of chemical fertilizers polluting the ground waters 	<ul style="list-style-type: none"> • Seasonal migration due to unemployment • Women empowerment through SHGs • School drop outs due to lack of teachers • Poor sanitary conditions leading to several diseases.
		19. South Vellar	<ul style="list-style-type: none"> • Juliflora growth is predominant • Sand mining seen in the river beds • Over exploitation of ground water 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Women empowerment through SHGs • No health care centers
7	Parambikulam Aliyar Project	20. Parambikulam Aliyar	<ul style="list-style-type: none"> • Soil erosion seen in the river and tank beds • Siltation and deforestation • Sand mining leading to depletion of water level. • Pollution due to coir industries • Excess fluoride and nitrate concentration 	<ul style="list-style-type: none"> • Improved livelihood due to coir industries • Decrease in livestock due to diseases • Women empowerment through SHGs • Water borne diseases due to unhygienic conditions

		21. Palar	<ul style="list-style-type: none"> • Soil infertility due to salinity • Ground water pollution • Catchment area degradation 	<ul style="list-style-type: none"> • Improved livelihood due to coir industries • Decrease in livestock due to unidentified diseases • Women empowerment through SHGs
8	Kottakaraiyar	22. Kottakaraiyar	<ul style="list-style-type: none"> • Juliflora and Ipomea growth • Soil alkalinity and erosion • Sand mining seen in the river beds • Chlorides in ground water • Sewage discharge into water bodies • Solid waste disposal • Water logging in coastal areas • Respiratory disorder in RS Mangalam area 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Skin diseases and health problems due to poor sanitary conditions • Lack of small scale industries in the areas
		23. Saruganiar	<ul style="list-style-type: none"> • Juliflora and Ipomea growth • Soil alkalinity • Sewage discharge into water bodies • Lack of solid waste disposal method • Respiratory disorder in Vellalore areas 	<ul style="list-style-type: none"> • Migration due to lack of employment • Skin diseases and health problems due to poor sanitary conditions • Lack of teachers in primary schools

9	Pambar	24. Pambar	<ul style="list-style-type: none"> • Juliflora growth • Ground water depletion due to exploitation • Lack of Sewage & Solid waste disposal method • Water weeds • Water logging in coastal areas • Industrial effluents into water bodies • Siltation in tanks • Dumping granite quarry waste along the road 	<ul style="list-style-type: none"> • Migration due to lack of employment • Livestock reduction due to lack of veterinary hospitals • Encroachment in irrigation canals, river beds
10	Vaigai	25. Varaganadhi	<ul style="list-style-type: none"> • Sand mining in the river beds • Siltation seen in tanks • Reduction in fish population due to sewage 	<ul style="list-style-type: none"> • Out seasonal migration due to lack of employment • Reduction in livestock due to lack of veterinary hospitals • Social conflicts in distribution of water for the tail end farmers • Lack of water storage facilities • No storage facilities for food grains • Prone to drought and floods
		26. Sathaiyar	<ul style="list-style-type: none"> • Juliflora and Ipomea growth • Sand mining in the river beds • Soil erosion in river and tank beds • Air pollution due to flour mills • Mixing of sewage into tanks 	<ul style="list-style-type: none"> • Out seasonal migration due to lack of employment • Reduction in livestock due to diseases • Social conflicts in distribution of water for the tail end farmers • Encroachments in river beds and tanks • Poor marketing facilities • Health problems due to sewage

		27. Varattar – Nagalar	<ul style="list-style-type: none"> • Juliflora growth • Soil erosion seen in river and tank beds • Poor solid waste management 	<ul style="list-style-type: none"> • Out seasonal migration due to lack of employment • Reduction in livestock due to unidentified diseases • Social conflicts in water distribution • Health problems due to indiscriminate dumping of solid waste
		28. Manjalar	<ul style="list-style-type: none"> • Juliflora and Ipomea growth • Sand mining and soil erosion in the river beds • Siltation leading to depletion in water level • Mixing of sewage into tanks 	<ul style="list-style-type: none"> • Out seasonal migration due to lack of employment • Reduction in livestock due to unidentified diseases • Social conflicts in water distribution
		29. Lower Vaigai	<ul style="list-style-type: none"> • Juliflora growth • Sand mining and soil erosion in the river beds • Salt water intrusion in the surrounding areas thereby making the water unfit for drinking • Ground water salinity 	<ul style="list-style-type: none"> • Out seasonal migration due to lack of employment • Reduction in livestock due to unidentified diseases • Social conflicts in distribution of water • No electricity connections • Problem of pigs and mosquitoes leading to diseases
11	Gundar	30. Upper Gundar	<ul style="list-style-type: none"> • Juliflora growth • Sand mining and soil erosion in the river beds • Lack of water supply in the entire basin • Lack of Sewage disposal and Garbage disposal method 	<ul style="list-style-type: none"> • Encroachment in river beds • Dry land agriculture reduction in livestock • Poor marketing and transportation facilities

		31. Terkkar	<ul style="list-style-type: none"> • Juliflora growth predominant • Sand mining seen in the river bed • Lack of Sewage & solid waste disposal method 	<ul style="list-style-type: none"> • Encroachment of catchment area • Dry land agriculture • Reduction in livestock due to diseases
		32.Paralaiar	<ul style="list-style-type: none"> • Juliflora growth • Sand mining seen in the river bed • Water borne diseases due to unhygienic conditions • Sewage & solid waste disposal method • Air pollution due to brick kilns 	<ul style="list-style-type: none"> • Drought prone area • Seasonal Migration due to unemployment • No marketing facility • No organized cattle farm • Reduction in livestock due to diseases
12	Vaippar	33. Nichabanadhi	<ul style="list-style-type: none"> • Soil erosion seen in the river bed • Siltation depleting the water level • Poor solid waste management • Dye industry effluents letting out directly into the river. • Lack of Sewage disposal method 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs • Inadequacy of teachers in schools • Prevalence of child labour due to poverty
		34. Kalingalar	<ul style="list-style-type: none"> • Sugar industrial effluent letting out directly into the river. • Ground water contamination • Lack of Solid waste disposal method • Untreated sewage let into river 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs

		35. Arjuna Nadhi	<ul style="list-style-type: none"> • Soil erosion and Sand mining in the river bed • Effluent disposal from match, fireworks, printing & willow industries • High TDS, magnesium, bicarbonates & chlorides • Lack of Solid waste disposal method • Untreated sewage let into water bodies 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs • No cold storage facilities
		36. Sindapalli Odai	<ul style="list-style-type: none"> • Sedimentation found in tanks • Soil erosion and Sand mining in the river bed • Dumping of solid waste in water bodies • Sewage pollution • Effluent disposal from match, fireworks, printing & willow industries 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs
		37. Senkottaiyar	<ul style="list-style-type: none"> • Drought prone sub basin • Sewage disposal into water bodies • Lack of Solid waste disposal method 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs

13	Tamiraparani	38. Manimuthar	<ul style="list-style-type: none"> • Sewage pollution • Encroachment of canal • Soil erosion in the river and tank beds 	<ul style="list-style-type: none"> • Seasonal migration due to unemployment • Reduction in livestock due to diseases • Lack of marketing facilities • Encroachment of irrigation canals, tanks • Lack of cooperative milk society
		39. Chittar	<ul style="list-style-type: none"> • Sewage pollution • Solid waste dumping into water bodies • Sand mining and weed growth. • Siltation leading to decrease in water level • Industrial effluents directly led into river 	<ul style="list-style-type: none"> • Seasonal migration due to unemployment • Poor sanitary and sewage conditions leading several health disorders • Malaria and other diseases due to indiscriminate dumping of solid wastes and mosquitoes
		40. Lower Tamiraparani	<ul style="list-style-type: none"> • Sewage pollution • Solid waste dumping into water bodies • Sand mining and weed growth • Sea water intrusion into the coastal areas • Industrial effluents directly led into river 	<ul style="list-style-type: none"> • Seasonal migration due to unemployment • Poor drinking water facilities • Health problems due to unhygienic conditions • Lack of veterinary hospital

14	Kothaiyar	41. Pazhayar	<ul style="list-style-type: none"> • Salinity and alkalinity • Soil erosion in the river and tank beds • Poor solid waste management at tourist spots • Water weeds • Entry of untreated effluents into water bodies • Agro industry effluents • Sea water intrusion in coastal areas • Increased use of chemical fertilizers in the fields pollution ground as well as surface waters • Ground water depletion due to excessive with drawl by Pepsi and Coke companies • Fluoride in ground water in Anjugramam, Azhuppapuram and Kattuvilai 	<ul style="list-style-type: none"> • Migration due to lack of employment • Reduction in livestock due to diseases • Women empowerment through SHGs • Poor sanitation and drinking water facilities, • Encroachment of river banks, tanks etc • Poor marketing facilities • High transportation costs
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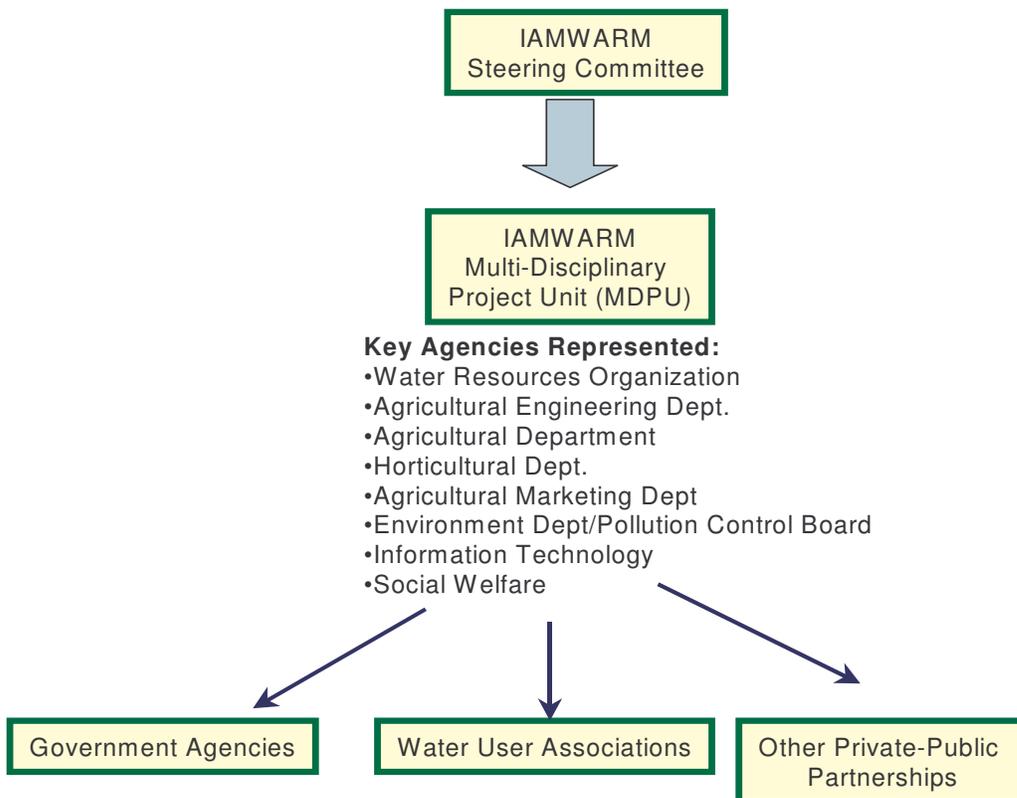
15	Nambiyar	42. Nambiyar	<ul style="list-style-type: none"> • Sand mining leading to decrease in water level • Dumping of solid and agricultural wastes • Sea water intrusion in coastal areas • Soil erosion in the river and tank beds • River bed degradation and instability of stream course 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Reduction in livestock due to diseases • Women empowerment through SHGs • Poor sanitation and drinking water facilities • Agricultural labour scarcity • Water borne diseases like malaria & diarrhea
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Institutional Framework

Institutional strengthening and reform is a continuous process and will be continued. Special efforts is made to bring about the changes among the departments who are involved in the project for proper infrastructure development, strengthening, reorganization, training and orientation of human resources. The key entity in the institutional framework is to set up a management cell in the WRO and to expand environmental and social development cells.

- Orientation and motivation towards participatory approach in development and management.
- Induce professionalism and accountability.
- Develop work norms and culture.
- Develop a system for addressing public grievances effectively and timely.
- Ensuring quality assurance and safety structures.

IAMWARM Institutional Arrangements



Participatory Irrigation Management (PIM)

The government of Tamil Nadu introduced the concept of farmers participation in irrigation management in the State through implementation of the Tamil Nadu Farmers Management of Irrigation Systems Act. 1566 WUAs were formed in 6.00 lakhs ha covering 20 out of 30 districts in the State under WRCP. All the above associations have elected Presidents and Members constituting the managing committees of the WUAs, taken over the O&M responsibilities and functioning. The same concept is proposed to be extended to cover the remaining area of about 15.00 lakhs ha under this project.

Social and Environmental Management Framework (SEMF)

SEMF will be prepared for use in this project and this can be applied to all the remaining river sub basins. There are several stakeholder groups will have direct and indirect stakes in the project. Each of these groups will have different levels of influence as well as interest in it. The important stakeholders include the relative government departments, regulatory bodies, agricultural universities, research institutions, NGOs, farmer's and individual (agriculture and allied activities), Panchayats and other representative bodies, private sector and donor agencies. A detailed stakeholder analysis has been provided in the SEMF.

The SEMF is the outcome of the ESA study, prepared in line with the standard Environmental and Social Management plan. This has to be applied by the Project Implementing Agency and their staff to all proposed sub-project activities through all stages of the project cycle for incorporation of environmental and social management measures. It also contains Framework and Action Plans for various key issues like Dam Safety, Pest Management, Cultural Property Management, Resettlement & Rehabilitation, Tribal Issues, Gender Issues and Community Sensitization that need to be addressed through the project. The SEMF will be further modified based on the lessons learnt from the first year projects.

IAMWARM Sub-Basin Project Cycle

Stage	Key Activities
Pre-Planning	<ul style="list-style-type: none"> • Collation of knowledge base for sub-basin (sub-basin data, previous, ongoing and proposed projects of relevance) • Preparation of thematic Atlas for sub-basin • Consultations (initial) and identification of key stakeholders
Planning	<ul style="list-style-type: none"> • Consultations to identify key relevant issues and options in sub-basin • Development of Sub-basin Development and Management Plans and procurement documents • Draft MOU between MDPU, sector agencies and WUAs
<i>Appraisal</i>	<ul style="list-style-type: none"> –<i>Environmental and Social</i> –<i>Economic/Financial</i> –<i>Technical</i> –<i>Procurement</i>
Implementation	<ul style="list-style-type: none"> • Contracting • Monitoring/Supervision/Quality Control/Community Book-keeping
Post-Implementation	<ul style="list-style-type: none"> • Establish linkages and identify further work to improve effectiveness and sustainability • Implementation Completion Report for each sub-basin

**IAMWARM Sub-Basin Project Cycle:
Environmental and Social Aspects**

Stage	Environmental and Social Implications
Pre-Planning	<ul style="list-style-type: none"> • Collation of available social and environmental information (incl. on demography, water uses, pollution, resource management, sand mining, etc.) • Preparation of thematic maps on environmental and social issues • Initial consultations with various groups to determine key project stakeholders
Planning	<ul style="list-style-type: none"> • Consultations on issues and options (ensuring participation of all key stakeholders) • Participatory development (with analytical input) of Sub-basin Development and Management Plans and procurement documents • Facilitation of participatory drafting of MOU
<i>Appraisal</i>	<ul style="list-style-type: none"> –Gender –Tribal Development –Pest Management –Natural Habitats –Land acquisition/R&R –Participatory Irrigation Management –Construction-related
Implementation	<ul style="list-style-type: none"> • Community contracting • Community supervision • Monitoring any unforeseen environmental or social impacts
Post-Implementation	<ul style="list-style-type: none"> • Identify linkages and further work to improve social and environmental sustainability • Reflect environmental and social issues in the Implementation Completion Report for the Sub-basin

Monitoring & Evaluation Mechanism

Monitoring and Evaluation Indicators have been developed to ensure implementation of environmental and social elements that have been built into all the stages of the project namely:

- Area (ha), production (tons) and value (Rs) of higher-value crops
- Productivity of water (Rs/m³)
- Livestock (% stall fed)
- Fisheries (water spread area in ha by type, production in tons/yr, value in Rs/yr)
- Adoption of improved technologies (e.g. drip/sprinkler area, etc.)
- Reliability of irrigation
- IT adoption (WRO and MDPU MIS, # of e-kiosks, cell services, web portal use, etc.)
- GIS/Remote sensing/Management Information system should be made use
- PIM (No. of WUAs, # of meetings held, attendance at meetings, O&M money collected by WUAs, # disputes settled by WUAs)
- Income to farmers (survey on Rs/household/yr from farm and non-farm activities – baseline, mid-term and end of project) and migration patterns
- Process (Sub-basin development and management plans prepared, appraised, Implementation Completion Reports completed, Social and Environment Management Frameworks applied, IRR)
- Marketing (Marketing sites/access, modernization of existing centers, new centers, arrivals, post-processing equipment and centers, Public-Private Partnerships, etc.)
- Training (# of people trained in state, national and inter-national – line agency and WUAs, farmers, etc.)
- Institutional linkages

Training and Capacity Building

The need for training and capacity building of all stakeholders is imperative towards ensuring adequate appreciation and addressing environmental and social issues associated with the project. Training programmes for farmer's is suitably designed to update them to use the modern agricultural implements for obtaining higher yield and quality product. Training modules are designed for the line department representatives for better coordination and timely implementation of the projects designed. Training locations and the language selection for training should be customized to suit the convenience of the trainees. Where the turnouts of villagers is low, decentralized training locations close to the villages of the trainees, with the involvement of NGOs (if required) shall help achieve the desired results.

Principal aspects of training required for various stakeholders are as follows

S.No	Levels	Trainees	Principal aspects to be covered
1	State Level	MDPU, Officials involved in IAMWARM,	GIS based environmental & social planning Analysis of monitoring & stakeholder feedback
2	Basin Level	Line Departments, Bureaucracy and Politicians	Sensitization about of environmental & social issues
3	Project Level	Project Officials, Govt. Officials of Tamil Nadu	Sensitization about importance of environmental & social issues Methods to record impact monitoring & project evaluation indicators
4	Project Level	NGOs WUA, Farmers, Livestock farmers, Fisherfolk, Women, Self Help Groups	Sensitization about importance environmental & social issues Ways to address such issues in the project
5	Village level	Rural youth, Landless labourers, Shopkeepers/Vendors/Traders, General Public	Sensitization about environmental & social issues Mitigation & monitoring measures to address environmental & social issues

Tribal Development

Tribals are a vulnerable community and are prone to exploration and marginalisation. The need for Tribal Plan shall be triggered by presence of significant tribal population in the sub-project area. Special measures shall be undertaken for upliftment of the tribal communities residing in each sub-project area which include:

- Designing the sub-projects on a participatory framework where consultation with tribal stakeholders at every stage remains the main focus of project activity.
- Provision of access to local resources like ponds for fisheries, grazing grounds for livestock development, minor forest produce for economic returns, handicrafts, etc.
- Where existing schemes of the government are operational effective linkages with the programmes shall be established to maximize project benefits to the tribals.

Separate inclusion mechanisms for adequate representation into Local Decision making bodies like Panchayats, WUAs, etc.

Gender Strategy

Women are vulnerable in the project area owing to their comparative backwardness in terms of health, education, income, decision-making, access to and control over resources (as identified during consultations). Gender Action Plan is needed in all sub-projects. Broad principles for the Gender Action Plan shall be:

- Women's participation to be ensured in the planning of intervention measures
- Provisions within the sub-project to empower women for sustainable income generation on their own
- Training and creating alternative livelihoods for women through the project
- Social justice and protection measures should be devised for oppressed women.

In irrigated agriculture, detailed activities in irrigation as well as the allied sectors including lessons drawn from the Hanuman Nadi sub basin. Modernization plans have been developed for facilitating coordination between the line departments for all physical investments. Lessons drawn from DANIDA Women in Agriculture and similar projects for up scaling the IAMWARM project are also incorporated in the report.

Dam Safety

Safety of dams is also important for safeguarding the investments being made in the command area through this project. The MDPU/Sub basin project team shall identify the necessity of a dam safety plan based on a checklist approved by the Dam Safety Panel. Synergies with the proposed dam rehabilitation, improvement and ongoing hydrology to project will be strengthened. The broad procedures and components of the Dam Safety Plan shall be:

- Assessment of condition of dams and appurtenant works in the overall context of site accessibility, catchment runoff, rainfall intensity, downstream habitations, past incidents, etc.
- Conducting necessary surveys and field investigations to substantiate identified problems,
- Risk analysis of possible scenarios,
- Planning of remedial measures and proposing structural / non-structural and operational procedures for safety of the dam.

All details of dams shall be incorporated into the Knowledge Base and used for planning allocation of investments related to dam safety. This information shall be supplied in a simplified with easily identifiable indicators to the people at risk as a part of information disclosure. This information shall be maintained at the WUA and sub-project WRO offices. The contents shall include:

General details and Status of the Dam in terms of safety,

- Indicators to identify safety hazards,
- The responsible people with addresses and phone numbers to be contacted in case of any eventuality, and
- Emergency plan in case of a dam break.

Pest Management Strategy

The incidence of insect pests and disease problems as well as other problem manifestations (weed pressure, nutrient disorder, etc. are likely to intensify with increased agricultural intensification in terms of enhanced cropping intensity and crop diversification with inclusion of fruits, vegetables and other high-value plants. Pest Management Plan shall be required for all sub-projects. Linkages with other applicable projects will be strengthened. The plan should include the following:

- Integrated Pest Management (IPM) and Integrated Nutrient Management (INM) systems with the overarching purpose of developing the project areas as organic – based production model.
- Identification of issues for Technical training of farmers and NGOs and for field demonstrations by Extension agencies.
- Monitoring and forewarning mechanisms to farmers of pest and disease situations.
- Identifying means to providing subsidies and price premiums on agricultural produces based on IPM & INM technologies.
- Identifying institutional arrangements for IPM and INM enforcement.
- Issues for information dissemination through Mass Media such as TV and Vernacular News.
- Social and environmental management framework has been developed based on social and environmental indicators, out puts of impact assessment and compilation and analysis of the secondary data.

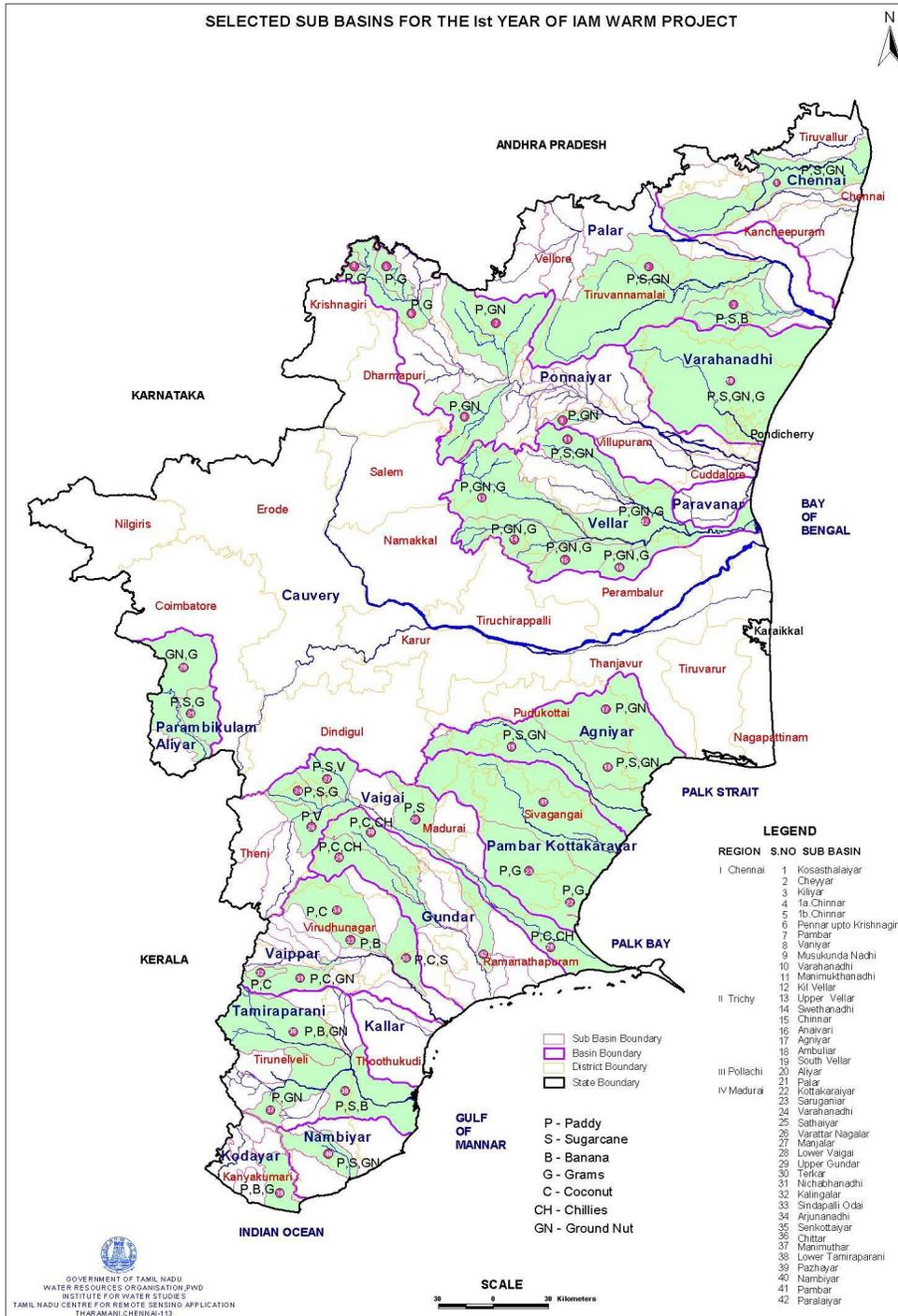
Suggested Mitigation Strategies

Environment has a direct bearing on rural livelihoods and rural the people directly depend on environment for their livelihoods. Therefore, to improve sustainable rural livelihoods, the following measures have been suggested for mitigation of environmental degradation.

- Regulation of groundwater exploitation;
- Conservation of soil and water;
- Regulation of water usage;
- Implementation of watershed management programmes;
- Recycling of wastewater;
- Restoration of water bodies;
- Removal of encroachments in the water bodies;
- Construction of check dams to arrest soil erosion;

- Restoration of degraded forests areas;
- Wasteland development through energy plantation;
- Disposal of tannery effluents after treatment;
- Installation of sewage treatment plants;
- Alternative cropping pattern;
- Sensitization of farmers to go for crops which consumes less water and have market potential for value addition;
- Promotion of organic manures and bio-fertilizers;
- Promotion of bio-gas plants using waterweeds;
- Implementation of zero-waste-management for MSW;
- Strengthening the sanitation and protected water supply infrastructure;
- Strengthening rural health infrastructure;
- Promotion of alternative energy technologies; and
- Promotion of integrated micro-enterprise development for women.

Appropriate institutional arrangements have been identified to ensure effective implementation of ESA. The budget for ESA implementation would be mainstreamed into the project cost.



1 INTRODUCTION

Tamil Nadu, the Southern State of the Indian peninsula is, spread over 1,30,058 km² and lies between 08° 05" N and 13° 35" N and 76° 15" E and 80° 20" E. It is surrounded by the States of Andhra Pradesh in the north, Kerala in the west, Karnataka on the Northwest, Indian Ocean on the south and the Bay of Bengal on the east. The population of Tamil Nadu is 6,21,10,839 as per 2001 Census. The rural population is predominantly dependant on agriculture.

1.1 Water Resources

Water is an important natural resource. Today every aspect of economic endeavor impinges on the availability of water, be it agriculture, industry, power generation, expanding trade and commerce and growing demands of the urban population for drinking water, all these are dependent on adequate availability of water. While this is the un-disputed reality, there is also the problem of declining availability of water. Working for a balance between the need and the availability and constantly evolving better and workable practices in the direction of water conservation and management is the need of the hour. In a way the thrust of our report is in the direction of identifying the problems confronting water availability and the means to overcome this problem. Given the fact, Tamil Nadu has a perennial problem of inadequate water availability. The productive management of river basins and sub-basins would go a long way in mitigating the problem to a considerable extent. The IAMWARM project is an appropriate initiative and could turnout to be a path breaking effort.

There are 17 river basin groups in Tamil Nadu, a majority of which are water stressed. There are 61 major reservoirs, about 40,000 tanks and about 3.0 million wells that heavily utilize the available surface water (17.5 BCM). Agriculture is the single largest consumer of water in the state, using 75% of the states water. Irrigation through a combination of canals, wells and tanks increases the reliability and availability of water for farming and is essential for cultivating crops in much of the state. About 30% of the net irrigated area is watered by canals, 21% by tanks and 49% is fed by wells. The remaining area is irrigated by other sources such as streams and springs. Rainfed agriculture employing about 25% of farmers accounts for 46% of the net sown area of 5.5 million hectares. The per capita availability of water resources in Tamil Nadu is 900 cubic meters a year as against 2200 cubic meters for all India.

1.2 Irrigated Agriculture

The predominant feature of Tamil Nadu's economy is the fact that agriculture has been and continuous to be the prime mover of the state's economy supporting as it does 60% of the population and contributing 13% of the state's income (2004 – 05). Though the agriculture sector has seen some form of restructuring, what is visible is the gradual shrinkage in the area under cultivation. Further, there is also fragmentation of holdings. All these factors have impacted in some form of the other the environment not merely ecological terms but also in social aspects and thus calling for improved irrigated agricultural modernization and water resource management. This is the focus of this report.

Irrigation systems modernization in a sub-basin framework (including participatory and sustainable modernization of any water storages and related irrigation infrastructure including system/non-system/rainfed tanks, pump set efficiency; measurement and monitoring covering about one million hectares expanding on the experience of the Hanuman Nadhi pilot. Irrigation systems need to be rehabilitated in the resent IAMWARM project.

1.3 Tank Systems

As per minor irrigation census carried out in 1987, there are about 1.5 million tanks in various States. The States of Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu and West Bengal have greater density. In spite of addition of new tanks during the period 1962-63 to 1985-86, the area under irrigation came down from 4.8 to 3.1 m.ha. It clearly indicates that maintenance of the tanks has been neglected and their capacity has been reduced due to siltation. It has been estimated that about 1.7 m.ha of net area has been lost under tank irrigation due to drying up of tanks and encroachment of the foreshore area. Rehabilitation and modernization of the tanks is under active consideration of the Government of India.

In Tamil Nadu, there are around 40,000 irrigation tanks and about 3 million wells, that heavily utilize the available surface water (17.5 BCM) and ground water (15.3 BCM). About 30% of the net irrigated area of 3 million hectares is watered by canals and 21% by tanks, while 49% is fed by wells. About 0.63 million ha of paddy fields are being irrigated by these tank systems. Whatever, the shortcoming at their creation, existing irrigation tanks remain as an asset to the sustainability of paddy agriculture in Tamilnadu, provided their live storage is not reduced and the related irrigation facilities are not deteriorated to serve the purpose. Past experiences show that availability of surface water resources are not always reliable, which has turned the paddy farmer's attention to the exploitation of ground water on a very much larger but manageable scale.

The tanks have been traditionally managed by the local communities and declined over time owing to interventions, which reduced the local communities' role. A major reason for this decline is poor operation, maintenance, lack of investment on the old tank infrastructure and growth in alternate system of irrigation through groundwater. The maintenance and repairs of many structural components of the tanks are poor. Almost all the tanks require repairs either in tank itself or in their components. Most of the irrigation tanks were constructed long time ago. After the declination of traditional maintenance system, no proper maintenance was implemented for the tank facilities including catchment treatment by farmers. The water distribution system, especially sluices, is not properly operated because of poor maintenance and poor water storage in tank.

The improvements of the tank system are critical to enhance the utility of these tanks, particularly in dry areas for supplementary irrigation and to meet drinking water and livestock requirements. As a part of the tank system improvement, active involvement of various types of stakeholders is required at all stages from planning to execution and its sustainability. This tank system improvement needs a substantial paradigm shift in the institutional, policy and legal frameworks, both at the State and grassroots levels.

There is no clear policy on tank system improvement. However, there have been a few adhoc projects over the last decades, which have not resulted in building up sustainable

community involvement in tank system management. In recent years, the State has shown keen interest in formulating an enabling policy and legal framework to rehabilitate tanks through community-based and demand-driven approaches. As a part of the general policy of decentralized governance of natural resources management of the State, participatory management of tank systems is being introduced both at major and medium irrigation and also minor irrigation. Currently, the tanks are administered by various institutional entities.

The multiple Government agencies like departments of Fisheries, Forestry, Mines & Geology, Revenue, Agriculture and Horticulture still have a role in tank systems, particularly so in the tanks having a command area above four hectares. These agencies are mostly administering the tank physical structure maintenance and improvements. Owing to a severe growing financial crunch, these tank structures are poorly maintained, leading to sub-optimal water use and under utilization of tank systems. The involvement of the users in these tank systems is currently very minimal. Over time, the poor financial allocations for tank improvement activities has also led to poor irrigation conditions and associated poor revenue generation. This situation has also led to lower dependence on the tank systems by the poor and vulnerable groups in the village communities. The problem is also attributed to lack of better approaches and the mono-discipline nature and inadequate capacity both at the State and local government level (Zillah and Taluk Panchayats). The existing institutional arrangements have led to poor coordination and lack of accountability.

Tank irrigation is a profitable technology in economic, environment and social terms; but under present conditions of management it is deteriorating rapidly. Extent as well as reliability of this technology is decreasing. Because of potentials for additional rice cultivation for about 16 million ha under tank irrigation, it is important to select holistic improvement strategies that fully exploit the potentials of tank irrigation.

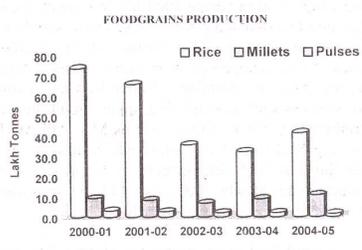
In general, sustainable crop production requires better performance of these small-scale irrigation structures tanks, which needs

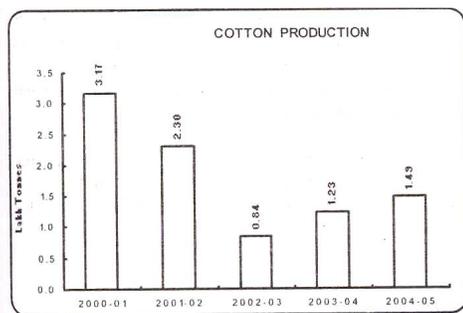
- (i) Modernization of physical structures
- (ii) Efficient distribution of water to and in farm fields as well as among the farmers
- (iii) Proper maintenance of tank system after the modernization through farmer's participation.

1.4 Overall Economy

The agriculture sector had witnessed vast restructuring through time. The net area sown has been on the decrease because of pressure of growth in population which results in conversion of agricultural land for non-agricultural purposes. Fragmentation of holdings is also visible. The Agricultural Census data shows that the number of marginal and small farmers has been on the increase resulting in high man-land ratio, casualisation and marginalization of labour.

The principal food and non-food crops such as paddy, millets, pulses and oilseeds, cotton and sugarcane are being cultivated in the State.





Paddy, a staple food crop, is grown extensively in the rice bowl districts viz. Thanjavur, Thiruvarur and Nagapattinam. Agriculture which suffered extensively during 2001 – 02, 2002 – 03, 2003 – 04 due to severe drought, experienced an appreciable revival fortunes during 2004 – 05. There was improvement in the area, production and productivity of various crops during 2004 – 05.

A final Forecast Estimate figure shows that area under paddy increased to 19.09 lakh ha during 2004 – 05 compared to 13.97 lakh ha in the preceding year. Area under millets and pulses also registered increases. Total area under food grains rose to 34.55 lakh ha against 28.37 lakh ha during 2003 – 04. Appreciable increase in area is also noticed in respect of oilseeds and cotton during 2004-05. In respect of cotton, increases in the area could be partly attributed to extension efforts backed with supply of quality inputs. Farmers are motivated to go in for short duration varieties which is remunerative alternative crop for rice fallow pulses.

Total food grains production during 2004-05 was expected to be of the order of 66.66 lakh tonnes compared to 43.12 lakh tonnes and 44.60 lakh tonnes during the preceding years. Total paddy production rose to 53.02 lakh tonnes during 2004 – 05, up from 32.23 lakh tonnes in 2003 – 04 and 35.77 lakh tonnes in 2002 – 03. About three-fourth of the total food grains production is contributed by paddy. Oilseed production is estimated at 13.20 lakh tonnes, improving from 9.64 lakh tonnes in 2003 – 04. Similarly, sugarcane production is estimated to increase to 23.40 lakh tonnes against 17.66 lakh tonnes in the preceding year.

Improvement in the productivity of crops plays major role in enhancing the production during the year. Yield rate of paddy rose from 2308 kg/ha in 2003-04 to 2777 kg/ha in 2004-05. In respect of millets per hectare yield rose from 983 to 1170 kgs and for pulses the increase is from 375 to 397 kgs.

1.4.1 Growth rate as compared to Government of India

Gross State Domestic Product (GSDP) has been growing at 4.73% per annum during 1994 – 95 and 2004 – 05. Disaggregated picture shows that the secondary sector is growing at 4.575 per annum while the service sector is growing at 8.41%. In contrast the primary sector has exhibited a negligible trend growth of 0.63%. During the last decade, the primary sector experienced a negative growth on five occasions during 1995 – 96, 1996 – 97, 1999 – 2000, 2002 – 03 and 2003 – 04.

Table 1.1 Growth in Gross Domestic Product (1993-94) Prices
A Trend Analysis

Year	(Percentage Change)			
	Primary Sector	Secondary Sector	Tertiary Sector	GSDP
1994-95	11.25	15.71	10.82	12.57
1995-96	(-) 12.56	8.84	8.49	3.45
1996-97	(-) 0.84	1.96	10.28	4.95
1997-98	8.53	1.93	12.99	8.20
1998-99	9.00	0.62	5.86	4.73
1999-2000	(-) 4.77	10.81	7.62	6.11
2000-01	4.54	7.94	8.54	7.61
2001-02	0.08	(-) 9.60	2.07	(-) 2.20
2002-03	(-) 20.98	9.29	7.81	3.03
2003-04	(-) 1.63	(-) 2.36	8.58	3.55
2004-05	14.31	5.13	9.40	8.73
AAGR	0.63	4.57	8.41	4.73

Source: Department of Economics and Statistics, Chennai – 6

Table 1.2 National Income (GDP) vis-à-vis State Income
(GSDP) and Per capita Income at Constant (1993-94) Prices

Year	All-India		Tamil Nadu	
	GDP (Rs. Crores)	Per Capita (Rupees)	GSDP (Rs. Crores)	Per Capita (Rupees)
1993-94	781345	7690	57549	8955
1994-95	838031 (7.25)	8070 (4.94)	64784 (12.57)	9932 (10.91)
1995-96	899563 (7.34)	8489 (5.19)	67021 (3.45)	10147 (2.16)
1996-97	970082 (7.84)	9007 (6.10)	70336 (4.95)	10451 (3.00)
1997-98	1016595 (4.79)	9244 (2.63)	76105 (8.20)	11260 (7.74)
1998-99	1082747 (6.51)	9650 (4.39)	79703 (4.73)	11592 (2.95)
1999-2000	1148367 (6.06)	10071 (4.36)	84575 (6.11)	12167 (4.96)
2000-01	1198592 (4.37)	10308 (2.35)	91011 (7.61)	12994 (6.80)
2001-02	1267945 (5.79)	10754 (4.33)	89011 (-)2.20	12484 (-) 3.92
2002-03	1318362 (3.98)	11013 (2.41)	91703 (3.03)	12696 (1.70)
2003-04	1430548 (8.51)	11799 (7.14)	94960 (3.55)	12976 (2.21)
2004-05	1529408 (6.91)	12416 (5.21)	103248 (8.73)	13999 (7.88)
AAGR	6.24	4.46	4.73	4.22

Source: 1. National Accounts Statistics, CSO, New Delhi & Economic Survey 2004-05, Go I 2. Department of Economics and Statistics, Chennai -6

1.5 Tamil Nadu Water Resources Consolidation Project (TNWRCP)

Tamil Nadu Water Resources Consolidation Project (Phase I) was taken up in 1995 with the financial assistance of World Bank at an estimated cost of Rs.11433 million and the project was completed on 30.9.2004.

The core objectives of the Project are:

- To introduce Water Resource Planning by river basins across all users of water
- To improve agricultural productivity through modernization and completion of irrigation system, upgraded water management and farmers participation
- To assure sustainability of water infrastructure and the environment and
- To improve Institutional and Technical Capacity for managing the State Water Resources

The TNWRCP project has contributed to improving the environment by developing a State Environmental Planning Framework, by creating an Environmental Cell (EC) in the office of Chief Engineer (Plan Formulation), formation of three WRO EC divisions as focal points for environmental activities in the WRO, creating and strengthening an environmental wing at the Institute of Water Studies (IWS). A special unit in the PWD Secretariat has been created for Land Acquisition and Economic Rehabilitation (LAER). Water Resources Research Fund (WRRF) capitalizing on the success of the WRRF established in the TN WRCP, this investment would expand the activities undertaken using the fund for targeted studies, awareness raising and applied research on key water and irrigated agriculture issues (including related environmental and social development issues) facing the state. The environmental performance was found to be highly satisfactory.

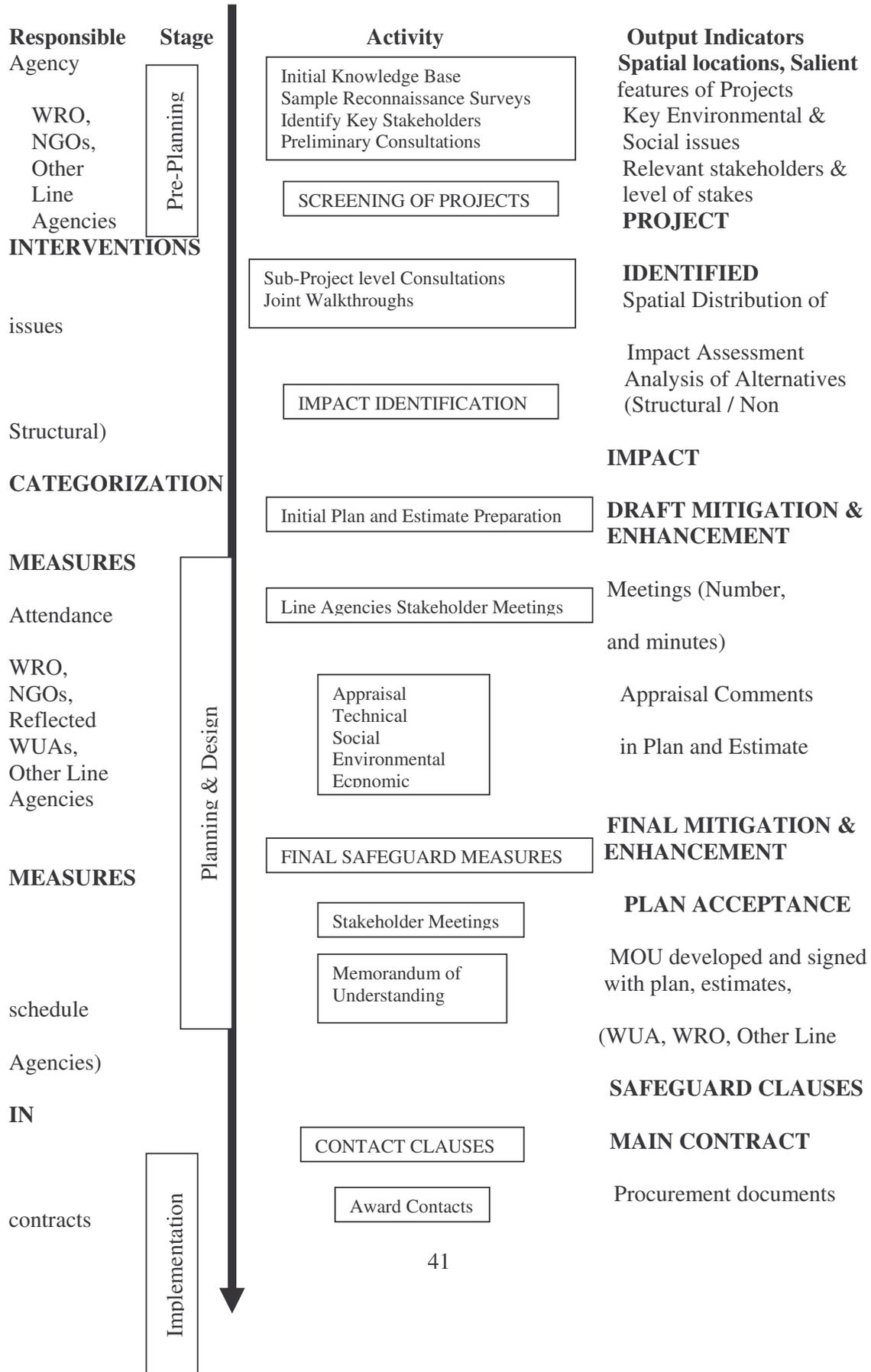
1.6 Context for ESA

As a part of the project, an ESA study was undertaken to provide inputs into the IAMWARM project in accordance with the World Bank Operational Guidelines, through identification of key environmental and social issues related to the project and devise opportunities to enhance the benefits and mitigate potential concerns. The integration of such issues within the project planning and implementation processes is to help minimize post design mitigation measures. The SEMF is the outcome of this study and has to be applied to all the proposed sub-project activities through various stages of the entire project cycle. Broad objectives of these stages are as follows:

- | | | |
|----------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pre-Planning Stage | : | Building up Environmental and Social Knowledge Base and inclusion of Initial Broad Stakeholder views |
| Planning and Design Stage | : | Plan effective and sustainable activities in a participatory manner that is technically, socially, environmentally and economically sound and agree on an Memorandum of Understanding with all key stakeholders |
| Implementation Stage | : | Implement activities and build capacity within the Stakeholders Departments and Water User Associations |
| Post Implementation Stage | : | Withdraw gradually by building sustainability into the sub-project. |

The project cycle for Physical Asset Improvement and the SEMF activities to be undertaken:

Framework for Physical Asset Improvement



WRO,
procured
NGOs,
WUAs,
Other Line
Agencies,

Works Execution Supervision Quality Control

awarded & equipment

Fund flow

Works executed

The ESA has been carried out to provide input into the IAMWARM Project in accordance with the World Bank operational guidelines. The primary objective of the ESA is to identify the key environmental and social issues in 41 sub-basins relating to agriculture (irrigation systems improvement, agriculture, horticulture, fisheries, etc.). A wide range of data has been collected pertaining to environmental and social issues and prepared SEMF.

1.7 IAMARM Project Description

The IAMWARM project is a successor to the recently-completed Tamil Nadu Water Resources Consolidation Project (TN WRCP) that was financed by the World Bank. The WRCP supported the state in a wide range of physical investments and institutional development that the IAMWARM project seeks to deepen. The key focus areas for IAMWARM are on irrigated agriculture modernization and on integrated water resources management to improve the productivity of water.

The proposed project development objective is to improve and sustain irrigation service delivery and productivity of irrigated agriculture with effective integrated water resources management in a river basin/sub-basin framework in Tamil Nadu.

The capacity-building activities would be state-wide in scope but the physical investments (rehabilitation of existing irrigation/water assets and support for agricultural diversification and improved livestock and fisheries management) under the project would be located in selected river basins/sub-basins throughout the State of Tamil Nadu, India.

The above objective is to be achieved through investments for modernizing irrigation infrastructure (including systems rehabilitation, on-farm works, technical and managerial upgrading of institutions involved in irrigation development, operation and management, diversification of agriculture with appropriate extension measures and market linkages, promoting public-private partnerships, piloting innovative irrigation infrastructure development and management options) and re-orienting and strengthening institutions and instruments required for integrated effective water resources management in the State (including unbundling resource management from service delivery institutions).

The proposed project would consist of the following two primary components:

- Irrigated Agriculture Modernisation
- Water Resource Management

1.7.1 Irrigated Agriculture Modernisation

This component is intended to improve the productivity of irrigated agriculture. These activities would include:

Irrigation systems modernization in a sub-basin framework (including participatory and sustainable modernization of any water storages and related irrigation infrastructure including system/non-system/rainfed tanks, pump set efficiency; measurement and monitoring covering about one million hectares expanding on the experience of the Hanuman Nadhi pilot. It is expected that this would be initiated in the Palar, Parambikulam Aliyar, Thambiraparani, Vaigai and Kodayar Basins and extended to other basins.

Institutional Modernization for Irrigated Agriculture (targeted modernization and improved asset inventory and management plans (for instance, dams, tanks, irrigation infrastructure, agricultural, horticultural, fisheries data) technical and managerial upgrading of irrigation development and service delivery institutions, modernization of manuals/procedures, computerization, LAN and WAN, knowledge management software, information management and sharing, public interaction, closer integration of WRO/PWD and Agriculture, Horticulture, Agricultural Engineering, Livestock/Fisheries Departments. Sustainable Agriculture modernization (cropping systems diversification and management to improve water conservation and farmer returns, integrated pest and nutrient management, public private Partnerships for extension, post-processing, certification, marketing)

An integrated Sub-basin Development and Management Plan would be developed for each sub-basin to provide a shared vision planning of proposed investments and capacity-building under the project.

1.7.2 Water Resource Management

This component is intended to strengthen the policy and institutional framework for improved sustainable management of water resources in the State. These activities would include:

State-level (converting the WRCRC to a State Water Council, amalgamating the associated sub-committees and upgrading the Institute of Water Studies (IWS) and the Surface and Groundwater Data Center (SGDC) to a State Water Resources Agency, establishment of a Water Regulator, development of appropriate policy and institutional arrangements, instruments, and information tools to promote flexible water resources management)

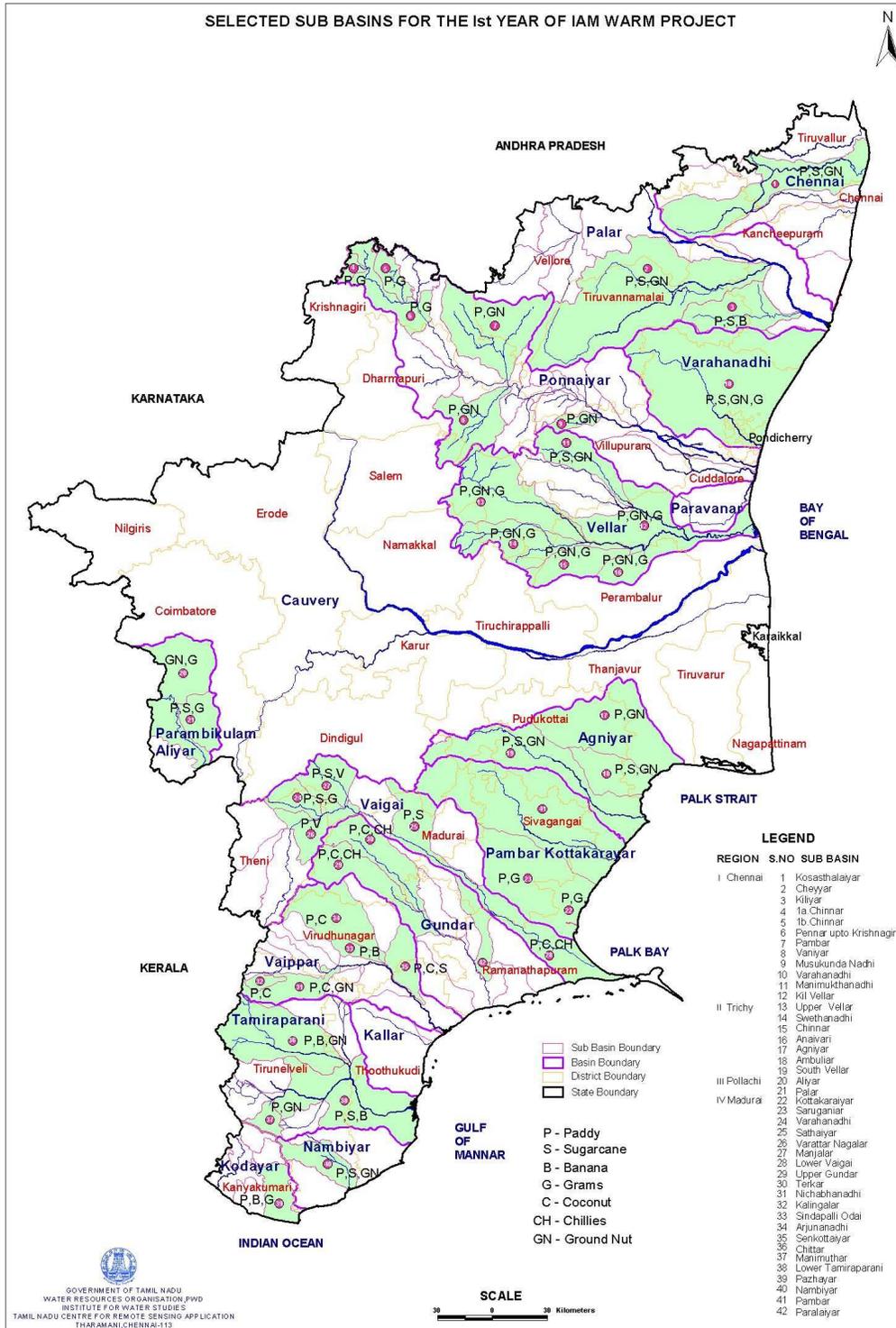
Basin-level (Strengthening, empowering and expanding Basin Development and Management Boards, development of basin analytical decision support systems targeted to support key policy and investment decisions, drought/flood preparedness, participatory structured consultations including strategic social and environmental assessments to systematically develop sub-basin development and management plans, demonstration pilots)

Capitalizing on the success of the WRRF established in the TN WRCP, this investment would expand the activities undertaken using the fund for targeted studies, awareness raising and applied research on key water and irrigated agricultural issues facing the State.

1.7.3 Study Area

The IAMWARM project is for the entire State of Tamil Nadu covering 117 sub-basins in 17 river basins of Chennai, Palar, Varahanadi, Ponnaiyar, Paravanar, Vellar, Agniyar, Pambar & Kottakaraiyar, Vaigai, Gundar, Vaippar, Kallar, Tamirabarani, Nambiyar, Kothaiar, Parambikulam & Aliyar Project. In the first year 41 sub basins are proposed under this project. The methodology adopted for this study includes stakeholders consultations, field visits, secondary data collection, compilation and interpretation.

The Policies and Acts related to Water resources and Irrigated Agriculture and the institutional set up are detailed in the next chapter.



1.7.4 PIM activities proposed for the IAMWARM

Completion of balance of tasks related to WRCP, by end of March 2006

- Finalise the proposals for:
 - appointment of Competent Authorities to the WUAs
 - delineation of the Distributory and Project Committee Areas.
- Obtain Government approval for the above two proposals.
- Up-date the assessment of vacant posts of President and Members of the Managing Committee of the WUAs formed under WRCP, to be filled up by fresh election.
- Obtain Government approval with necessary Budget provision for funds for distribution to District Collectors for the conduct of fresh elections to fill up the vacant posts.
- Conduct "One Day Seminar" inviting the elected presidents and members of the Managing Committee of WUAs **in batches** with due representation to the systems and regions of WRO. The objective of this Seminar is to obtain necessary "**Feed Back**" from the elected c presidents and members on:
 - the level of effective functioning of the Associations after taking over the (O&M) responsibilities of the distribution systems from WRO.
 - their excitements and experiences in handling the new responsibilities.
 - suggestions on "remedial measures" for overcoming certain problems encountered in carrying out the new responsibilities.
 - suggestions on amending the TNFMIS Act, Rules and Election Rules to remove the practical difficulties experienced in the preparation and conduct of the elections.
 - a comparison on the pre-WRCP project and post WRCP project conditions in terms of benefits accrued and problems encountered.
 - providing information on the level of interaction between the officials of WRO and the president and members of the Managing Committees of the Associations.
 - any other information, which will enhance the effective functioning of the Farmers Associations and interaction between the farmers and officials.
- The elected presidents and members of the Managing Committee of the WUAs felt that the one-day training already provided by IMTI is not adequate to undertake various responsibilities related to (O&M) operation of the systems. The "training needs" has already been assessed by the Senior Consultant (PIM) and discussions held with the Director and Faculty Members of the Institute. Follow up action is required from both ends to design and organize **intensive training** to cover all the WUAs. Necessary funds are to be received from the Government and then transferred to IMTI.

- Government orders issued earlier brought the TNFMIS Act into force in 20 Districts other than the 9 Districts of Cauvery Basin. Hence orders of the Government is now to be obtained to bring into force the TNFMIS Act in the balance 9 Districts.
- However, the Government has earlier ordered to implement the TNFMIS Act only in the command area covered by WRCP. It is now therefore necessary to get the orders of the Government to implement the TNFMIS Act in the entire command area maintained by the WRO, in the State.
- The officials of the Chennai, Madurai and Pollachi Regions have partially completed the preparation of the **draft documents** for the WUAs. These documents require scrutiny by the officials of the FOT cell in Chief Engineer ((O&M and ISW)) office at Chennai and the Senior Consultant (PIM). This work will be initiated and continued **beyond March 2006**.
- Organize **Awareness Creation Programme** on the TNFMIS Act, Rules and Election Rules and the process of its implementation to the benefit of the officials and farmers of Trichy Region.
- Arrange to commence the collection of information from all possible sources for amending the TNFMIS Act, Rules and Election Rules.

Project Year -1 (2006-2007)

Tasks to be performed for completing the implementation of PIM in Tamil Nadu including Cauvery basin area under "IAMWARM PROJECT" (2006 to 2011)

- Complete, elections to constitute the Managing Committees of the DCs and PCs in WRCP command area.
- Arrange to commence and continue fresh elections for filling up the vacant posts of WUAs formed under WRCP.
- Conduct training programmes for the elected Presidents, Chairmen and Members of the Managing Committee of WUAs, DCs and PCs of WRCP command area.
- Continue and complete verification of the documents for forming WUAs in areas other than WRCP command and area in Trichy Region, prepared by WRO officials and arrange to pass them on to the District Collectors concerned for verification, finalization of the list of voters and issue of necessary notifications.
- Arrange to complete all the preparatory works for the conduct of elections for the command area other than that covered by WRCP and Trichy Region and complete the elections as per TNFMIS Act.
- Commence the preparation of documents for the WUAs to cover all the systems in Trichy Region.

- Arrange for the design, procurement and installation of flow measuring devices in the distribution systems handed over to the farmers organization (WUAs, DCs and PCs) in Chennai, Madurai and Pollachi Regions. Commence training of farmers in flow measurements and documentation, and for effective functioning of the associations.
- Prepare a proposal and get it approved for re-organizing the present PIM unit in Chief Engineer (O&M and ISW) office for effectively monitoring the implementation of PIM in Tamil Nadu and ensuring the sustainability of the farmers organization(WUAs, DCs and PCs) activities, in the state. This needs the deployment of a separate Chief Engineer (PIM) with adequate technical and support staff both at head quarters office as well as in all the regional FOT cells proposed now in all the four WRO Regions and IMTI.
- Develop upgraded infrastructural facilities to support the PIM units at head quarters, WRO Regions and IMTI. There is also a need to create a separate data base to cover all the activities related to all the PIM units established in the state.
- Send proposals for building offices to WUAs, DCs and PCs established in the state and develop suitable terms and conditions for extending the required assistance to the associations.
- Arrange for the conduct of "Study Tour" for the benefit of Government officials and farmers.

Project Year - 2 (2007-2008)

- Complete scrutiny of the documents related to WUAs prepared by WRO officials of Trichy Region, by the officials of the FOT cell at Chennai and arrange to send them the District Collectors concerned for follow up action.
- Arrange for the completion of verification of the documents related to Trichy Region command by the District Collector concerned, finalization of the list of voters, publication of the documents with issue of necessary notifications.
- Complete all the preparatory works for the conduct of elections to WUAs for the systems in Trichy Region and conduct the elections to cover the entire area.
- Train the elected President/Chairman and members of the Managing Committee of WUAs, DCs and PCs established in Trichy Region.
- Finalise the DC and PC proposals in respect of WUAs formed in Trichy Region and obtain the approval of the Government. Arrange for the conduct of the elections.
- Provide training to all the elected President/Chairman and members of the Managing Committee of the DCs and PCs.
- Arrange for the Study Tours to cover the Government officials and farmers.
- Provide training on flow measurements and documentation to WRO officials and farmers and in other areas to ensure effective functioning of the associations.

- Complete re-organising of the PIM unit and installation of supporting infrastructural facilities.
- Continue with the construction of office buildings for the WUAs, DCs and PCs.
- Seek approval for the amendments to TNFMIS Act, Rules and Election Rules.

Project Year - 3 (2008 - 2009)

- Arrange for the completion of second election to the WUAs formed in the year 2004, after the expiry of the 5 year Term.
- Conduct study Tours to the Government officials and farmers.
- Develop case studies on "Success and failures" of the functioning of WUAs, DCs and PCs in all the four regions where implementation of PIM has been completed.
- Continue Training of Government officials and farmers on effective functioning of the WUAs, DCs and PCs.
- Organise evaluation of the performance of the farmers associations functioning in different regions and arrange for sustaining the achievements.
- Organise, regional level and state level Seminars to share the experiences of WRO officials, and farmers of the associations and improve upon their functional effectiveness.
- Design a Monitoring and Evaluation system to monitor the out comes of:
 - performance of the WUAs, DCs and PCs.
 - increase in water use efficiency in the distribution systems handed over to the farmers.
 - increase in agricultural productivity and farm income.
- Introduce new water management practices and other water saving decides.
- Intensify the spread of the knowledge of the new agricultural practices through agricultural extension and training.

Project Years - 4&5 (2009 - 2011)

- Organise a Mid-Term review of all the aspects related to implementation of PIM in Tamil Nadu and document the findings.
- Intensity the extension activities to the members of the farmers association, continue close monitoring of the outcomes and initiate suitable remedial measures, wherever necessary.
- Initiate necessary follow up actions based on the outcome of Mid-Term review.

2 POLICY AND INSTITUTIONAL FRAMEWORK

2.1 Introduction

Appropriate policies and formation of institutional arrangements must necessarily address the whole range of rules and regulations, customs and practices, ideas and information and interest of the community group network. These simple but important aspects would together provide the need-based and location-specific institutional framework or the context within which water management actors and other decision-makers operate. The institutional aspects broadly cover the formation of policy directions, mechanisms for effective water distribution and management systems and effective cost-recovery methods. The Government often plays these roles, and there is a need to involve stakeholders in the governance and management of water resources at all levels. There is a need to reform the existing institutions and establish new linkages.

2.2 Water Resources Organization (WRO)

The Water Resources Organization (WRO) under the Chairmanship of Engineer-in-Chief is assigned with the task of implementation of Model Rehabilitation and Modernization of Hanumanadhi sub basin in co-ordination with other departments and monitoring and evaluation of project achievements. Various works are taken up for 12 anicuts, 14 main channels and 50 tanks in the sub basin and the operational efficiency of the system is expected to improve after completion of all the works. They are as follows:

- Protective works in the river bed
- Strengthening of anicuts
- Construction of head sluices at open take off channels
- Lining of canals
- Bund Protection
- Providing shutters to sluices
- Channel bank formation with roads
- Providing ground water recharge ponds
- Improving surplus arrangements to tanks
- Cross drainage works

The rehabilitation works such as desilting of tanks, lining of canals, construction of retaining walls, strengthening of bunds, repairing of sluices, gates and weirs are being undertaken by the WRO. As per the proposal and concept, the head reach water shall go to tail end and there should be a minimum guarantee for equal distribution of water upto the tail end. The rehabilitation works can help them to fulfill the aim and objectives.

2.3 Dam Safety Directorate

The Dam Safety Directorate was established in the year 1991 in Tamil Nadu with the object of giving assurance to safety of large dams in Tamil Nadu vide G.O. Ms No: 725 dated 18-04-91. At present there are 75 nos of PWD dams, (including 7 nos of small dams and 5 nos of drinking water supply reservoirs) and 38 nos of Tamil Nadu Electricity Board large dams. The Dam Safety Directorate is headed by a Director in the rank of Superintending

Engineer and at present assisted by an Assistant Executive Engineer with supporting ministerial staff. The important works carried out by the Dam Safety Directorate are as follows:

- Preparation of Health status of Dams
- Technical investigation of large dams by Multi Disciplinary Committee
- Detailed technical investigation of dams by National level experts
- Geological mapping of dams
- History of dams
- State Dam Safety Committee
- Dam safety Project I
- Dam safety Project II

2.4 Water Resources - Institutions

Water is a dynamic element and requires dynamic management. Institutional arrangements are critical to develop and implement water management policies and plans. They drive the implementation of the Strategic Frameworks developed for the management of water resources. Tamil Nadu is laying more emphasis for efficient water management and initiated number of policy, institutional and legal framework to ensure additional productivity with the available water resources. As part of this, the following state level organizations have been created to ensure judicious exploitation of water resources.

2.4.1 Water Resources Control and Review Council (WRCRC)

The Government of Tamil Nadu has formed the Water Resources Control and Review Council to take steps to formulate water management strategies and implementation of the Water Policy vide G.O. Ms. 1404 PW (XI) Dept dt. 30.09.03 and in Govt. letter No. 31877/PW (R1) D/95-6 dt. 11.12.95.

The composition of WRCRC and functions are as follows:

- | | | |
|---------------------------------------|---|---------------|
| (1) Chief Minister | - | Chairperson |
| (2) Minister for public works | - | Vice-Chairman |
| (3) Minister for Local Administration | - | Vice-Chairman |
| (4) Minister for Agriculture | - | Vice-Chairman |

The other Members are

- (5) Chief Secretary to Government
- (6) Secretary to Government, Public Works Department
- (7) Secretary to Government, Finance Department
- (8) Secretary to Government, Agriculture Department
- (9) Secretary to Government, Municipal Administration & Water Supply Department
- (10) Secretary to Government, Environment and Forest Department
- (11) Secretary to Government, Rural Development Department
- (12) Secretary to Government, Revenue Department

- (13) Secretary to Government, Animal Husbandry & Fisheries Department
- (14) Secretary to Government, Industries Department
- (15) Secretary to Government, Planning & Development Department
- (16) Secretary to Government, Law Department
- (17) Commissioner of Land Administration
- (18) Member Secretary, Tamil Nadu State Planning Commission
- (19) Chairman, Tamil Nadu Pollution Control Board
- (20) Chairman, Tamil Nadu Electricity Board
- (21) Chairman & Managing Director, Chennai Metropolitan Water Supply & Sewage Board
- (22) Managing Director, Tamil Nadu Water Supply & Drainage Board
- (23) Engineer-in-Chief, Water Resources Organization
- (24) Chief Engineer, Design Research & Construction Support, Water Resources Organization
- (25) Chief Engineer, State Ground & Surface Water Resources Data Center, Water Resources Organization
- (26) Chief Engineer, Plan Formulation, Water Resources Organization
- (27) Chief Engineer, (O & M), Water Resources Organization
- (28) Director, Irrigation Management & Training Institute
- (29) Director of Agriculture
- (30) Vice-Chancellor, Anna University
- (31) Director of Industries & Commerce
- (32) Vice-Chancellor, Tamil Nadu Agricultural University
- (33) Chief Engineer, Agricultural Engineering
- (34) Director of Water Technology Center, Tamil Nadu Agricultural University
- (35) Director of Public Health and Preventive Medicine
- (36) Two representatives from the Water Users' Community in the private sector, who have demonstrated knowledge and interest in water use and development to be appointed by the Government and whose terms of office shall be defined in the order of appointment
- (37) Director, Institute for Water Studies - Member Secretary

The Council shall meet once in three months and such other times, as may be necessary to carry out its functions and activities. The other powers, functions and terms of references of the above council shall be as laid down in the G.O. read above. Statutory status to the above council, if needed, shall be accorded later.

Power and Functions of the Water Resources Control and Review Council (WRCRC)

With the high percentage of the State's surface water resources already utilized, the scope for construction of new surface water storage reservoirs is limited. Therefore, more efficient water management is the most promising source for additional productivity in Tamil Nadu. The opportunities for conservation and reuse, in irrigation, industrial use and

municipal water supply system have also to be explored. The proposed Council (WRCRC) shall set out policies in this regard.

The Water Resources Control and Review Council shall establish allocation priority norms for water use for different sectors with provision for drinking water, being given the highest priority.

No scheme proposed for exploitation of water shall be excluded from the purview of the Council.

The Council will take necessary steps to formulate the water management policy to be followed by the State. After the policy is prepared and accepted, after wide circulation, the Council will implement it, in an effective manner. Monitoring the implementation of the Policy will be the primary function of the Council.

While taking a look at the various schemes proposed by the user departments, the Council will get the technical input for these schemes from the various members of the Council. The Water Resources Control and Review Council will also examine the impact of extraction, utilization and conservation of water of the other users.

The Council shall also

- (i) Formulate water policies for the State and basin water development, control and management
- (ii) Establish principles, standards and procedures for allocation of water under licenses, preparation of comprehensive regional or river basin plans and for formulation and evaluation of water policy and related land resources projects using technical, economic, social, legal and environmental criteria
- (iii) Serve as an advisory and co-coordinating body for the State in water and related matters
- (iv) Review and approve State and river basin master plans; prioritisation of different sectional water needs
- (v) Review and approve macro planning, distribution management of water resources taking into account the water needs of different sectors (agriculture, industrial, drinking, social, etc.). Small schemes need not be referred to the Council (WRCRC). For e.g., drinking water supply schemes less than say 10 Million liters need not be referred to the Council.
- (vi) Review and approve for publication, on annual assessment of the adequacy of supplies of water necessary to meet the present and their projected State and basin water requirements
- (vii) Issue orders as may be necessary to carry out its functions.

Water Resources Projects/Programmes by the Government

Water Resources and related projects and programmes of the Government shall be submitted by the proposing agency/agencies to the WRCRC, which may, before taking action, if necessary, refer the matter to the Institute for Water Studies for comments, in accordance with the principles and guidelines laid down. No programme, plan, project or water works explicitly or implicitly included within the powers and functions of the WRCRC will be eligible for public funding and budgetary allocation without the recommendation of WRCRC.

The conflicts/problems arising during normal administration/ maintenance of irrigation systems shall not be referred to WRCRC and they may be resolved under rules and guidelines, procedures governing the systems existing at present.

On going Central and State schemes like Command Area Development (On Farm Development and Rotational Water Supply), Micro Irrigation Schemes, and Watershed Development Programmes under River Valley Project shall be excluded from the purview of WRCRC.

Any agreement among Government agencies involving the use of water for domestic and municipal water supply, irrigation, hydro power production, industrial or other commercial uses, watershed, coastal areas and environmental protection measures shall, in all cases, be subject to review and approval by WRCRC. In the review of such agreements, the WRCRC may consult the parties, other Government agencies concerned and the Institute. The WRCRC could evolve its own procedures to ensure proper functioning in the achievement of its objectives.

Resolution of Conflict Arising from Projects

Conflicts arising from project and agreements would be resolved by the WRCRC by public hearing or by any other method suitable and practicable.

Meeting of the WRCRC

The WRCRC, shall meet once in three months and such other times as may be necessary to carry out its functions and activities, At all meetings, decisions shall be made by a vote of the (simple) majority of those attending.

The WRCRC shall function for two years and thereafter, a review of the functioning of the Council shall be made and, if need be, appropriate statutory status could be accorded later.

The Government has also instituted the following sectoral sub-committees to support the functions of WRCRC as per the suggestions of the World Bank.

- (i) Irrigation and Agriculture
- (ii) Urban and Rural Domestic and Live-stock Water Supply and Sanitation
- (iii) Power and Industrial
- (iv) Ground Water Regulation
- (v) Environment

The Government after consideration constituted the technical working group committees as presented in the following tables

Table 2.1 Technical working group committees of WRCRC

S.No	Name of the Sector	Members	Designation
1	Irrigation and Agriculture	Engineer-in-Chief, Water Resources Organization, Public Works Department	Chairman
		Director, Center for Water Resources, Anna University	Member
		Director, Agriculture Department	Member
		Chief Engineer, Agriculture Engineering Department	Member
		Chief Engineer, (Plan Formulation) WRO, Public Works Department	Member
		Chief Engineer (State Ground and Surface Water Resources Data Center) Water Resources Organization, PWD	Member
		Officer in charge of Central Ground Water Board at Chennai	Member
		Chief Engineer & Director, Institute for Water Studies	Member Secretary
		Commissioner of Fisheries	Member
2.	Urban and Rural Domestic and Livestock water supply and Sanitation	Engineer-In-Chief, Water Resources Organization, Public Works Department	Chairman
		Engineering Director, Tamil Nadu Water Supply and Drainage Board	Member
		Engineering Director, Chennai Metropolitan Water Supply & Sewerage Board	Member
		Director, Animal Husbandry	Member
		Director, Centre for Environmental Studies, Anna University	Member
		Director, King Institute, Guindy	Member
		Director, Public Health & Preventive Medicine or his nominee	Member
		Chief Engineer (State Ground and Surface Water Resources Data Center)	Member

		Chief Engineer & Director, Institute for Water Studies (IWS)	Member-Secretary
3	Power and Industry	Engineer-In-Chief, Water Resources Organization, Public Works Department	Chairman
		Chief Engineer, Tamil Nadu Electricity Board	Member
		Director, Industries and Commerce	Member
		Chief Engineer, Planning Tamil Nadu Water Supply & Drainage Board	Member
		Chief Environmental Engineer, Tamil Nadu Pollution Control Board	Member
		Chief Engineer (Plan Formulation) WRO, Public Works Department	Member
		Managing Director, SIPCOT	Member
		Managing Director, Tamil Nadu Industrial Corporation	Member
		Chief Engineer & Director, IWS	Member-Secretary
4.	Groundwater Regulation	Chief Engineer (State Ground and Surface Water Resources Data Center) Water Resources Organization	Chairman
		Engineer-In-Chief, Water Resources Organization	Member
		Chief Engineer, Agricultural Engineering Department	Member
		Chief Engineer, Planning, Tamil Nadu Water Supply & Drainage Board	Member
		Chief Engineer (Plan Formulation) WRO, Public Works Department	Member
		Officer in charge of Central Ground Water Board at Chennai	Member
		Engineering Director, Chennai Metropolitan Water Supply and Sewage Board	Member
		Chief Engineer and Director, Institute for Water Studies	Member-Secretary

Table 2.2 Technical working group committees of Environmental Sector

S.No	Name of the Sector	Members	Designation
1.	Environment	The Secretary to Government, Public Works Department, Chennai-9	Chairman
		The Secretary to Government, Environment and Forest, Chennai-9	Member
		Engineer-In-Chief, WRO	Member
		Chief Engineer, Plan Formulation	Member
		Chief Engineer (State Ground and Surface Water Resources Data Centre) WRO	Member
		The Chairman, Tamil Nadu Pollution Control Board	Member
		Director of Agriculture	Member
		The Principal Chief Conservator of Forests	Member
		Director of Public Health and Preventive Medicine	Member
		Director, Center for Water Resources, Anna University	Member
		Director, Center for Environmental Studies, Anna University	Member
		Chief Engineer & Director, WRO, Institute for Water Studies	Member-Secretary

2.4.2 State Ground and Surface Water Resources Data Centre (SG & SWRDC)

The Groundwater Directorate was upgraded as one of the wings of PWD (Groundwater) in 1972 and subsequently it was renamed as State Ground and Surface Water Resources Data Centre (SG & SWRDC) in 1995.

The objectives of SG&SWRDC are as follows:

- Continuous monitoring of monthly hydrological, hydro meteorological, water level parameters and water quality for ground and surface water
- Consultancy services to Public, Government Departments and Private sector undertakings
- Storage of Data and dissemination

The SG & SWRDC of WRO monitor both Surface and Ground water quality and the ground water fluctuations continuously on a monthly basis. The quality of ground water is monitored twice in a year immediately before and after the monsoon period. The Surface water quality is also monitored under the Hydrology Project. Whenever there is flow in the river, the samples are taken and analyzed for various parameters. The water quality data are stored after validation. The ground water potential is assessed and reported in bulletins district wise. The data are also being supplied to other departments, universities etc., by collecting the rates stipulated by the government.

The organization is headed by the Chief Engineer with core staff in the areas of Geophysics, Hydrology, Draughting, Engineering and Drawings. The center has an excellent state of the art laboratory, GIS Centre. The total sanctioned staff strength is 1,646 and out of this about 340 posts are vacant.

2.4.3. Institute of Water Studies (IWS)

The Government of Tamil Nadu in G.O. Ms. No.457 PWD dated 8.4.1974 established the Institute for Water Studies (IWS) in the year 1974 in order to plan, assess and manage the water resources of Tamil Nadu in a scientific manner. A Director in the rank of Chief Engineer, PWD, heads this Institute and under him a team of Engineers, Hydrogeologists, Geochemists, Geophysicists, Environmental Engineers, Photogeologists and Remote Sensing Scientists and an Agro Economists are working. The total sanctioned strength is 93 and out of this 76 are in place now. The IWS and its existing environmental divisions are working in consonance with its original objectives.

The Objectives of IWS are as follows

- Development of a set of broad principles for planning and management of water resources
- Assistance in the formulation of water management policies
- Fostering or undertaking research related to planning and policy making in those areas where the needed work is not already being done and coordinating the efforts that is already underway
- Development of training programmes, particularly in connection with water planning and policy making
- Provision of advice to Government on specific policy matters referred to it, such as the development of principles for water allocation on the merits and costs of water diversion schemes and water usage schemes

Technical Secretariat

This Secretariat is a multi disciplinary unit functioning as an advisory body between the Government of Tamil Nadu and the Palar & Tambaraparani basin stations within the IWS.

2.4.4 Tamil Nadu Pollution Control Board (TNPCB)

Tamil Nadu Pollution Control Board (TNPCB), established in 1982, functions with Head Office at Chennai, headed by Chairperson, one Joint Chief Environmental Engineers office headed by Joint Chief Environmental Engineer, nineteen District Offices headed by District Environmental Engineers and five District Offices headed by Assistant Environmental Engineers. The Board has established three Advanced Environmental Laboratories, ten District Environmental Laboratories and one Mobile Environmental Laboratories to assist in the Analytical and Scientific side.

TNPCB is implementing the Pollution Control Legislations and Rules and Notifications framed therein. In discharging the duties entrusted to it, the Board investigates, collects and disseminates data relating to water, air and land pollution, lays down standards for sewage/trade effluent and emissions.

2.4.5. Department of Environment (DoE)

The Department of Environment was created in G.O.Ms.No.335, Environment and Forests Department dated 13.10.95 as the Nodal Department for dealing with Environmental Management of the State. The Department is entrusted with the implementation of major projects like pollution abatement in the river Cauvery, Vaigai and Tamiraparani; Pollution abatement in Chennai City waterways; National Lake Conservation Programme and all aspects of Environment other than those dealt with by Tamil Nadu Pollution Control Board.

Objectives of Department

- Implementation of National River Conservation Plan, for the abatement of pollution in River Cauvery, Vaigai and Tamiraparani and Chennai city waterways
- Implementation of National Lake Conservation Programme for the abatement of pollution in the selected lakes
- To carry out various environmental awareness programmes through National Green Corps and Eco-Clubs
- To enforce the provisions of the Coastal Regulation Zone Notification
- To provide web-based information through Environmental Information System (ENVIS) on the Status of Environment Tamil Nadu, the Biodiversity profile and the status of river cleaning activities in the state.
- To deal with all aspects of environment other than those dealt with by Tamil Nadu Pollution Control Board from time to time.

2.5 Water Resources – Policies and Acts

2.5.1 Constitutional Provisions

The Constitution of India in its Article 48 provides for the protection and preservation of the environment and states that "the state shall endeavor to protect and improve the environment and to safeguard the forests and wild life of the country".

Further the Article 51-A(g) on fundamental Duties emphasizes that, "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures".

These two provisions of the constitution are the guiding principles for various environmental legislations in the country and safeguarding environment.

2.5.2 Water Acts

Water (Prevention and Control of Pollution) Act, 1974

Water Act is the first environmental regulation that brought in the state and central pollution control boards to control / regulate environmental pollution in India. Amended twice in 1978 and 88, the Act vests regulatory authority on the State Pollution Control Boards and empowers them to establish and enforce effluent standards for industries and local authorities discharging effluents.

- Vests the regulatory authority on the State Pollution Control Boards and empowers them to enforce to effluent discharge standards to prevent water pollution (both for industries and local authorities)
- Section 24 of the act prohibits the use of stream or well or on land disposal for of polluting substances violating the disposal standards laid down by the board
- Section 25 of the act requires an application to be made to the state board to establish any treatment and disposal system that is likely to discharge sewage or trade effluent in to a stream or well or sewer on land
- Sections 41 and 44 provides for penalties for not complying the various provisions or directives of the board
- Section 48 deals with the offences committed by Government Departments
- Section 55 asserts that all local authorities shall render help and assistance and furnish information to the board as it may require for discharge of its functions, and shall make available to the board for inspection and examination such records, maps, plans and other documents as may be necessary

The act empowers the board to levy and collect cess on water consumed by the industry or local authority and to utilize and augment resources for the Pollution Control Boards. In line with this provision, The Water (Prevention & Control of Pollution) Rules, 1975 were formulated. This act will be of significant importance for the water supply and sanitation projects, as the project activities if not planned carefully are expected attract various section of the act. In the present case the increase in. supply water quantity due to continuous water supply will require the declaration from the respective local body for payment of additional water cess to the TNPCB.

Water (Prevention and Control of pollution) Act of 1974 (Central Act 6 of 1974) as Amended in 1988

This Act provides for the prevention and control of water pollution and restoration of water quality to desirable levels. States may establish Boards for Prevention and Control of Water Pollution. Boards have the necessary powers and functions to address water pollution

and abatement issues and problems and the technical and administrative staff to carry out their decisions.

Water (Prevention and Control of pollution) Cess Act No. 36 of 1977

This Act is a companion Legislation to the 1974 Act. It provides for the levying and collecting of fees from local authorities and industries based on water delivered or consumed.

2.5.3 National Water Policy

The National Water Policy lays down general guidelines in preparing basin-wise master plan, priorities for water use, inter-basin transfer, etc. The National water policy enunciated by the GOI in 1987 has recognized that water is prime natural resource, a basic human need and a precious national asset. It has recommended that resource planning in the case of water have to be done for a hydrological unit such as a drainage basin as a whole, or for a sub-basin. It has further emphasized that special multi-disciplinary units should be set-up in each State to prepare comprehensive plans taking into account the needs of not only irrigation, but also the various other water uses so that the available water can be put to optimum use. The National Water Policy has recommended to establish a standardized National information system with a network of data banks and data bases, integrating and strengthening the existing Central and State level agencies, and improving the quality of data and the processing capabilities for better planning.

National Water Policy- 2002

The National water policy was revised by Ministry of Water Resources, GOI in April 2002. The Policy recommends for water resources planning where water resources development and management will have to be planned for a hydrological unit such as drainage basin as a whole or for a sub basin, multisectorally taking into account surface and ground water for sustainable use incorporating quantity and quality aspects as well as environmental considerations.

The Policy recommends to establish river basin organizations for planned development of a river basin/sub basin and special multi disciplinary units for preparing comprehensive plans taking into account not only the needs of irrigation but also harmonizing various other water users. The Policy has prioritized water allocation in the order as follows:

- Drinking water
- Irrigation
- Hydropower
- Ecology
- Agro and non agricultural industries
- Navigation and other uses

The Policy addresses a participatory approach to Water Resources Management where all the stakeholders, Water Users' associations and local bodies should particularly be involved in the operation, maintenance and management of water infrastructures/ facilities at appropriate levels.

2.5.4 Tamil Nadu Water Policy

Based on the concept of the National Water Policy of Government of India, the Government of Tamil Nadu has also formulated a water policy called 'Tamil Nadu Water Policy'. Tamil Nadu is the pioneer in the establishment of river basin organizations suggested in National Water Policy 2002.

The institute for Water Studies drafted the above policy and submitted to Government in January 1994. It has been approved by the Government of Tamil Nadu and published in G.O. Ms. No. 716 PW (WR) Dept dt. 13.07.94. The Institute for Water Studies function as the implementing agency of the policy. The ultimate goal of the State's Water Policy is to develop a 'State Water Plan', which will be the blue print for all water resources development and use in the State.

Within the framework provided by the National Water Policy, the broad objectives of the Tamil Nadu Water Policy are:

1. Establish a Management Information System (MIS) for water resources
2. Ensure preservation and stabilization of existing water resources
3. Plan for augmentation of utilizable water resources
4. Promote research and training facilities for water resources management
5. Establish allocation priorities for water use by different Sectors with provision of drinking water being of highest priority
6. Maximize multi purpose benefit from surface and groundwater, land and other resources
7. Provide adequate water for domestic users
8. Maximize hydro power generation within the constraints imposed by other water users
9. Provide adequate water for industry

2.5.5 The Tamil Nadu Groundwater (Development and Management) Act, 2003

This Act extends to the whole of the state of Tamil Nadu except the areas to which the Chennai Metropolitan Area Groundwater (Regulation) Act, 1987 extends. It shall come into force on such date as the Government may, by notification, appoint and different dates may be appointed for different areas and for the different provisions of this Act. A specific authority called as Tamil Nadu Groundwater Authority will implement the Act. The constitution of this authority is under consideration in the Government of Tamil Nadu.

2.5.6. Regulations and Procedures

Compendium of Rules and Regulations, Part I, Rules for Water Regulation (1984)

It contains the technical day-to-day rules for regulation of Reservoirs in 11 river basins in Tamil Nadu and it provides for legislative authority to PWD officers to operate and maintain reservoirs and distribution systems.

Compendium of Rules and Regulations, Part II Rules for Flood Regulation (1984)

The reservoir levels, at which certain release rules are to be implemented, are prescribed. It provides the lists of the officials to be notified under prescribed conditions. It outlines steps to be taken in disastrous situations like cyclones and floods.

Inland Waterways Authority of India Act No. 82 of 1985

This Act calls for the creation of the Inland waterways Authority of India to develop, maintain and regulate inland waters for shipping, navigation and other related matters, such as removal of obstructions, control discharge of materials and for conservation measures to protect the water ways.

Inter-State Water Disputes Act No. 33 of 1956, as Amended

This Act Provides for the adjudication of disputes relating to inter State Rivers and River Valleys by a Water Disputes Tribunal constituted by the Central Government upon receipt of a request for such action from a State that feels an Inter-State river dispute has or is likely to arise with a neighboring State. Before establishing the adhoc Tribunal, the Central Government must be of the opinion that the dispute cannot be resolved by negotiation. The decision of the Tribunal shall be considered final and binding upon the parties.

Chennai Metropolitan Water Supply and Sewerage Act, Tamil Nadu Act, No. 28 of 1978, as Modified up to 31 August 1981.

As per this Act, the Board has power over construction, drilling and altering of wells, ponds, tanks, and cisterns providing drinking water and the power to regulate, control and charge for existing or future use of groundwater for all purposes except irrigation, in the Chennai Metropolitan Area

Tamil Nadu Water Supply and Drainage Board Act No.4 of 1971 as Amended

The Act creates a special board to address drinking water supply and drainage issues and problems in Tamil Nadu. The board is a corporate body consisting of appointed members of the public and officials from certain State agencies. Board is charged with developing and executing schemes for providing drinking water supplies and drainage facilities.

Chennai Metropolitan Area Groundwater (Regulation) Act No. 27 of 1987

This act authorizes the Chennai Metropolitan Water supply and Sewerage Board to prohibit drilling new wells in the designated area unless the user first obtains a permit from the Board and to prepare a register of all existing wells. As per this act, pre-existing users, except agricultural users, must apply for a license within 15 days of date of Act. All new users must obtain a license from the Board. This Act directs the Government to issue instructions to the Board on the implementation of an artificial recharge scheme; This Act grants the Board power to adopt regulations to prevent seawater intrusion.

Tamil Nadu Water (Prevention and Control of Pollution) Rules, 1983, No. SRO A-236 (a)/83 Gazette No. 348.dated September 30, 1983, Part III - Section I(a)

It provides for organization and functioning of the Pollution Control Board. It prescribes functions of State Water Laboratory.

The Tamil Nadu Pollution Control Board (TNPCB) enforces the enactment on Environment and Pollution Control on Water, Air, and Environment Protection. As per G.O. Ms. No. 213 (ECI) Department dated 30.3.89 Environment and Forests, no new industry is to be cited within one km from water sources. Annexure I to these G.O gives the list of industries for which total ban has been imposed for location of the industries from the embankment of the water sources mentioned in Annexure II. The TNPCB will examine the case and obtain the approval of Government for setting up highly polluting industries from water sources, other than mentioned in Annexure II. The TNPCB has prescribed the effluent standards in BP Ms. 30 TNSCP dated 21.02.84. The Government reconsidered the regulation of this G.O. regarding locating new industries with reference to Water Sources has been modified from one km. to 5 km. Government Order Ms. No. 127 Environment and Forests dated 8.5.98 states that no new industries (Red category type) will be sited within 5 km. radius from Water Sources.

The existing policy aspects both at national and state level have sufficiently empowered to execute water resource development projects and also to address the issues relating to environmental management for sustainable use of water and water development in the State.

2.5.7 River Basin Management and Development Board

The River Basin Management and Development Board was constituted vide G.O. Ms. No.31, Public Works (W2) Department, dated 12.01.2001 to manage the water based activities of Palar and Tambraparani basins initially. The Honorable Minister for Water Resources is the Chairman with the members from all the Water User Departments in the Government, MLAs representing the constituencies in the river basin, Panchayat Union Chairman, Municipal Chairman, Panchayat Presidents of the concerned districts, Presidents of WUAs, concerned district Collectors, representatives of the concerned departments, representatives of Industries, representatives of NGOs and the officials from WRO. The Chief Engineer, WRO is the member secretary

River Boards Act No. 49 of 1956 as Modified

This Act declares that Central Government may exercise control over the regulation and development of inter-State Rivers and river valleys to an extent necessary to protect the public interest. The Central Government can establish a River Board to advise as to development and regulation, co-ordination of activities, allocation of costs and progress of development

2.6 National Environment Policy

The current National policies for environmental management are found in the National Forest Policy, 1988, the National Conservation Strategy and Policy Statement on Environment and Development, 1992, Policy Statement on Abatement of Pollution, 1992 and the National Water Policy, 2002. They have contributed to environmental management substantially. Salient Features of the National Environment Policy, 2004 are set out below:

- **Conservation of Critical Environmental Resources:** To protect and conserve critical ecological systems and resources, and invaluable natural and man-made heritage which are essential for life-support, livelihoods, economic growth, and a broad conception of human well-being.
- **Intra-generational Equity: Livelihood Security for the Poor:** To ensure equitable access to environmental resources and quality for all sections of society, and in particular, to ensure that poor communities, which are most dependent on environmental resources for their livelihoods, are assured secure access to these resources.
- **Inter-generational Equity:** To ensure judicious use of environmental resources to meet the needs and aspirations of present and future generations.
- **Integration of Environmental Concerns in Economic and Social Development:** To integrate environmental concerns into policies, plans, programmes, and projects for economic and social development.
- **Efficiency in Environmental Resource Use:** To ensure efficient use of environmental resources in the sense of reduction in their use per unit of economic output to minimize adverse environmental impacts.
- **Environmental Governance:** To apply the principles of good governance (transparency, rationality, accountability, reduction in time and costs, and participation) to the management and regulation of use of environmental resources.

Enhancement of Resource for Environmental Conservation: To ensure higher flows comprising finance, technology, management skills, traditional knowledge, and social capital, for environmental conservation through mutually beneficial multi-stakeholder partnerships between local communities, public agencies, and investors.

2.7 Air (Prevention and Control of Pollution) Act, 1981

Similar to Water Act, the Air Act vests the regulatory authority on the State Pollution Control Boards and empowers them to enforce to air quality standards to prevent air pollution in the country. Section 21 of the act requires an application to be made to the state board to establish or operate any industrial operation. This act however, is not of major significance for the water and sanitation projects as no air polluting activities are anticipated.

2.8 The Environment (Protection) Act, 1986

The Environment (Protection) Act, popularly known as EP Act, is an umbrella legislation that supplements the existing environmental regulations. Empowered by EP Act, the Ministry of Environment & Forests (MoEF), Government of India has issued notifications regulating siting of industry and operations, procuring clearance for establishing industries and development projects with appropriate EIA studies, coastal zone regulations and other aspects of environment.

- Empowers the Government of India (section 6) to make rules to regulate environmental pollution by stipulating standards and maximum allowable limits to prevent air, water, noise, soil and other aspects of environmental pollution
- Prohibits carrying out any operations that emits pollutants in excess of standards (section 7)
- Regulates handling of hazardous substances and identifies the persons responsible for discharges and pollution prevention (section 9)
- Section 17 deals with the offences committed by Government Departments
- Formulated Environmental (Protection) Rules, 1986, Hazardous Wastes (Management and Handling) Rules, 1989 and Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 in accordance with the sections 6, 8 and 25 of EP Act.

While the water supply and sewerage projects are not notified as the projects requiring ministry's clearance in the EIA notification issued in 1994, investment / development projects costing above Rs.500 million however require ministry's clearance. However since the present project investment is spread over three cities it will not attract this clause.

2.9 The Indian Forest Act, 1927

Section 5 states that after declaring the particular land as reserved forest, no fresh clearings for any purpose shall be made except in accordance with such rules made by State Government.

Section 26 states the acts prohibited in such forest in addition to the section 5.

Sections 30, 32 furnish power to the State government to regulate certain acts (clearing for cultivation, or building or any other purpose of any land etc, in such forests) specified in the section, in protected forests.

Section 35 furnishes power to state government to prohibit certain acts (clearing of vegetation etc) in lands not being the property of government.

2.9.1 Forest (Conservation) Act, 1980(as Amended In 1988)

As per Section 26 of Indian Forest Act, 1927 number of activities are prohibited in forest areas and demands prior approval of the Central government to use forest land for non-forest purposes.

The Forest (Conservation) Act, 1980 prohibits large-scale diversion of forestland for non-forest use. As amended in 1988, no State Government or any authority shall make such diversions except with the prior approval of the Central Government.

2.9.2. The Forest (Conservation) Act, 1980

Section 2 of the Act restricts the state government on the de-reservation of forests or use of forestland for non-forest purposes.

2.9.3. The Forest (Conservation) Rules, 1981

Rule 4 states the procedure to make proposal by state government seeking prior approval to de-reserve the forest for non-forest purposes (section 2 of Forest Act, 1980), provided that all proposals involving clearing of naturally grown trees in forest land or portion or thereof for the purpose of using it for afforestation shall be sent in the form of working plan / management plan.

The provisions of this attracted in water supply and sanitation projects, when structures, transmission lines and other components are passing through forest areas. As presented in section 5.3.2, the proposed replacement of a part of the leaking rising main between Kundargi and Tumarguddi in Belgaum is aligned along the existing road abutting the reserved forests near Dasanhatti and Tumarguddi. Since the portion of the rising main to be replaced is not yet finalized the requirement of clearance from the forest department will be required only if the finalized portion falls within the designated forest area.

2.9.4. Wildlife Protection Act, 1972

This act promulgated to provide for the protection of wild animals birds and plants and for matters connected therewith. The provisions under this act are as below.

- Section 9 of the Act mentions that no person shall hunt any wild animal specified in Schedule I
- The act prohibits picking, uprooting, damaging, destroying, acquiring any specified plant from any forestland

- It bans the use of injurious substances, chemicals, explosives that may cause injury or endanger any wildlife in a sanctuary
- No alteration of the boundaries of a National Park shall be made except on a resolution passed by the Legislature of State and
- Destruction or damaging of any wildlife property in national Park is prohibited

2.10 Manufacture, Storage and Import of Hazardous Chemical Rules, 1989

These rules aim at providing control for the generation, storage and Import of hazardous chemicals. According to these rules, the user of hazardous chemicals has to perform the following and dispose the hazardous waste as mentioned in the rules

- Identify the potential hazards of the chemicals and to take adequate steps for the prevention and control of such hazards
- Develop or provide information about the chemical in the form of safety data sheet and
- Label the specified information on container of hazardous chemical and

Chlorine used for disinfection of water is categorized as hazardous chemical as according these rules and usage of these chemicals above 10 tons per year attracts the provisions of these rules. At the rate of around 1 mg/l, the usage of chlorine for the existing supply levels will be more than 10 tons in all the three cities. Hence provisions under this rule will be applicable for all the project local bodies.

2.11 Notification on Coastal Regulation Zone, 1991

All coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action up to 500 mts from the High Tide Line and the land between the Low Tide Line and the High Tide Line are declared as the area within Coastal Regulation Zone (CRZ). However, the distance from the HTL to which proposed regulations will apply in the case of rivers, creeks and backwaters may be modified on a case to case basis for reasons to be recorded while preparing Coastal Zone Management Plans by the competent authority. However, in this latter case, the distance from the HTL will not be less than 100 meters or width of the creek, river or back water, which ever is less.

These rules classify CRZ into three distinct zones of CRZ I, II and III. While no development activities are permitted in CRZ I, specific activities that will not interfere with the coastal eco-system are allowed in CRZ II and III. Water supply and sanitation projects, especially those in coastal areas or those projects, which are developed in CRZ areas, will attract the provisions of these rules. Since the present project activities do not fall near coastal areas the applicability of the CRZ does not arise.

2.12 Irrigated Agriculture- Institutions

The key focus areas for IAMWARM are on irrigated agriculture modernization and on integrated water resources management to improve the productivity of water. The proposed project development objective is to improve and sustain irrigation service delivery and productivity of irrigated agriculture with effective integrated water resources management in a river basin/sub-basin framework in Tamil Nadu.

Institutional Modernization for Irrigated Agriculture (targeted modernization and improved asset inventory and management plans (for instance, dams, tanks, irrigation infrastructure, agricultural, horticultural, fisheries data) technical and managerial upgrading of irrigation development and service delivery institutions, modernization of manuals/procedures, computerization, LAN and WAN, knowledge management software, information management and sharing, public interaction, closer integration of WRO/PWD and Agriculture, Horticulture, Agricultural Engineering, Livestock/Fisheries Departments. Sustainable Agriculture modernization (cropping systems diversification and management to improve water conservation and farmer returns, integrated pest and nutrient management, public private Partnerships for extension, post-processing, certification, marketing)

2.12.1 Multi Disciplinary Project Unit (MDPU)

Multi Disciplinary Project Preparation Panel (MDPPP) was constituted for evolving environmental action plan in Hanumanadhi Sub-basin drawing the professionals from all the line departments. The MDPPP has prepared an integrated micro level action plan for Hanumanadhi Sub-basin and implemented under WRCP Phase I. Since the IAMWARM project is a successor to WRCP Phase I, the MDPPP was converted as Multi Disciplinary Project Unit (MDPU) to review, monitor and implement the activities of various line departments under IAMWARM project.

The prime objective of this multi-disciplinary approach is to increase the productivity of water on a joint sector model and the farmers shall have to share part of the project investment cost.

The activities of the line departments under IAMWARM project are as follows:

Table 2.3 Activities of the Line Departments

Department	Responsibilities
WRO of PWD	Rehabilitation and Modernisation
Agricultural Engineering Department	Training and skill development to members of WUAs on high tech micro irrigation system
Tamil Nadu Agricultural University	Adaptive Research Trails
Agricultural Department	Procurement and supply of improved seed varieties, organic manure, introduction of System Rice Intensification (SRI) techniques
Agricultural Marketing	Transportation of agricultural products, information on latest market trends, cold storage, providing farm roads
Horticultural Department	Introduction of high yielding variety horticultural crops, application of organic manure, tissue culture for banana
Fisheries Department	Aquaculture in farm ponds, village ooranies and tanks, to provide additional income to the farmers
Forest Department	Raising “Social Forestry” on tank bunds, field boundaries, construction of check dams and growing vegetation in the catchment area
Social Welfare Department	Training on community organization, social welfare, education of the farming community

2.12.2 WRO- Environmental Cell Division

The activities of the Environmental Cell Division under WRO/PWD are as follows:

- Environmental base line data collection of the respective river basins.
- Documentation of environmental and social issues and monitoring the work.
- Water & Soil quality monitoring before restoration of water bodies and after restoration of water bodies.
- Conducting field oriented demonstration projects related to environmental issues.
- Creating environmental and social awareness among the stakeholders of the basin.

2.12.3 Agricultural Engineering Department

Agricultural Engineering Department proposes to disseminate the upgraded agricultural engineering technology information, high tech micro irrigation systems like drip, sprinkler and tower irrigation systems to all the water users in the basin. The main aim of the Agricultural Engineering Department works are as follows:

- To improve the productivity of water per unit per land.
- To improve the livelihood of farming and labour community
- To create an infrastructure base for water conservation techniques.
- To train the engineers and farmers on effective water management towards sustainable development
- The Agricultural Engineering Department has already carried out the following components for achieving the above said goals.

2.12.4 Department of Agriculture

The aim of the Agriculture Department is to improve the agricultural productivity through modernization of irrigation system, upgraded water management and farmers participation. The following components are being taken as action plan by Agriculture Department

- Paddy SRI (System of Rice Intensification) demonstration
- Improve the existing coconut garden
- Organic farming- green manure seed distribution
- Distribution of hand operated sprayers
- Technology demonstration
- Coconut coir compost demonstration
- Vermicompost demonstration
- Conducting seminars to create awareness by means of publicity

2.12.5 Tamil Nadu Agricultural University (TNAU)

The main objectives of TNAU are to increase water productivity in agriculture and horticulture crops of the project. To achieve the above goal, TNAU has taken six Adaptive Research Trials (ART) under 14 anicuts.

The principles in the ARTs are increasing the productivity of the crop through introduction of high yielding varieties

The activities being carried out by TNAU are as below

- System of Rice Intensification (SRI)
- High density banana with fertigations
- Drip irrigation in coconut, sugarcane
- Micro sprinkler to groundnut, cotton, vegetables and pulses

2.12.6 Horticulture Department

The Horticulture Department has taken very few assignments

- Tissue culture in banana growing
- Hybrid/ high yielding vegetables

2.12.7 Fisheries Department

The main objective of the Fisheries Department is to increase fish production and uplift the socio economic condition of the fishermen by implementing various welfare programmes such as

- Increase fish production by scientific fish culture in tanks
- Demonstration of fresh water prawn culture and fish culture in farm ponds
- Installation of cages for rearing of fish lings

2.12.8 Agriculture marketing and agri business

The main aim is to facilitate easy marketing facilities to the farmers. This department is undertaking the following activities.

- Installation of solar dryer for chillies drying.
- Construction of grading center for cleaning and value addition
- Supply of mini vans and vegetables crates
- Conducting farmers training

2.12.9 Forest department

The Forest Department proposed to raise babul/ karuvel plantations on tank beds in plain catchment area. They have submitted an action plan indicating details on catchment management works in sensitive areas of the river basins, forest produce, water conservation, environmental and social benefits.

2.12.10 Social welfare and development of Women Department

The aim of this department is to impart training for WUA's/ women farmers for which the following activities are being carried out under MDPPP

- Group formation
- Capacity building training
- SHG Members Training
- Animator & Representative Training
- EDP Training

- a. Skill Training
- b. Skill Up gradation Training
- c. Vocational Training

2.13 Participatory Irrigation Management

The Government of Tamil Nadu have accepted the concept of Participatory Irrigation Management (PIM) and encourages the farmers participation in the operation and maintenance of the irrigation water distribution systems in all the irrigation systems maintained by the Government in the State. Under WRCP, the PIM programme has so far been implemented to cover an area of about 6.0 lakh hectares; out of about 21 lakh hectares spread over 20 out of 30 districts in the State.

2.13.1 Water User Associations (WUAs)

Totally 1965 Farmers Councils (WUAs) were formed and registered, as detailed below:

Table 2.4 Farmers Councils

1	1997 – 2002 (irrigation systems)	1272 Nos.
2	2001 – 2002 (irrigation tanks)	620 Nos.
3	2003 – 2004 Under Scheme completion	73 Nos.
	Total	1965 Nos.

2.13.2 The Tamil Nadu Farmers' Management of Irrigation Systems Act 2000

This Act received the assent of the President on the 25th February'2001 and is published as Act No. 7 of 2001. It provides for Farmers' participation in the Management of Irrigation Systems and for matters connected therewith or incidental thereto. The main objective of this Act is to promote and secure distribution of water among its users, adequate maintenance of the irrigation system, efficient and economical utilization of water to optimize agricultural production, by involving the farmers and inculcating a sense of ownership of the irrigation system in them in accordance with the water budget and the operational plan. It also facilitates scientific and systematic development and maintenance of irrigation infrastructure through farmer organizations. The farmer organizations have been involved fully in the management and maintenance of the irrigation system for effective and reliable supply and distribution of water.

The Act is having Seven chapters dealing with the matters relating to farmers' organization, functions of farmer' organization, funds of farmers organization, offences and penalties, settlement of disputes and miscellaneous matters.

2.14 Irrigation Acts

2.14.1 Bhavani Reservoir Irrigation Cess Act No. 16 of 1933 as Amended

It covers allocation of water from the Bhavani Reservoir through the issuance of permits to registered landowners, designating the land, time of use, type of crops that may be grown, and distribution channel serving the land. It provides for the levy of water-cess (at maximum rates specified for type of crop) on permitted lands.

2.14.2 Tamil Nadu Irrigation Cess Act No.7 of 1865, as Modified unto 31 October 1980

This is the fundamental water-cess or fee act for irrigation water use. It provides the policy basis for imposing a water charge. It establishes a policy of recovering a rate of return from beneficiaries of government funded irrigation projects.

2.14.3 Tamil Nadu Irrigation, Levy of Betterment Contribution Act No.7 of 1955, as Modified up to 31 October 1980.

It provides for betterment assessments be made against the land which is significantly benefited by the completion of certain improvement works.

2.14.4 Tamil Nadu Irrigation Tanks (Improvement) Act No. 19 of 1949, as Modified up to 30 April 1949.

Under this Act, the Government has the authority to improve efficiency and capacity of government owned or operated tanks, regardless of location. The owners of land are subject to pay all or a portion of the costs of improvements.

2.14.5 Tamil Nadu Irrigation (Voluntary Cess) Act No. 13 of 1942, as modified up to 30 November 1980

This Act pertains to a special levy against lands for maintenance of certain irrigation and drainage works constructed or maintained by the Government.

2.14.6 Tamil Nadu Irrigation Works (construction of Field Bothies) Act No. 25 of 1959, as Amended

The District Collector is authorized to require landowners to construct or improve field channels or ditches. This Act prohibits anyone from obstructing or interfering with the flow of water in a field.

2.14.7 Tamil Nadu Irrigation Works (Repairs, Improvement and Construction) Act No. 18 of 1943, as Modified up to 30 November, 1980

It empowers the Government to repair and improve private irrigation works, supply water from Government facilities to private irrigation systems, and construct new irrigation works as defined by the Tamil Nadu Estates Land Act of 1908. This Act provides for recovery of costs and fees.

2.14.8 Mettur Canal Irrigation Cess Act No. 17 of 1953

This act provides specific legislation for levying of water charges on certain lands irrigated under the Mettur Canal.

2.14.9 Tamil Nadu Rivers Conservancy Act No.6 of 1884 as Amended in 1969

As per this Act the State government can declare a river or parts thereof, to be subject to conservation measures in designated areas.

2.14.10 Tamil Nadu Canals and Public Ferries Act No.2 of 1890

This Act extends the Bhavani Reservoir Irrigation Cess Act of 1933 to additional lands in Coimbatore and Salem districts.

2.15 Aquaculture Acts

2.15.1 Tamil Nadu Aquaculture (Regulation) Act. No 6 of 1996

It deals with aquaculture - culturing of shrimp, prawns, fish or any other aquatic life - in saline water, in saline soil but does not include fresh water aquaculture in coastal stretches of land, estuaries, creeks, rivers, and backwaters. The District Committee comprising District Collector as the Chairman, Chief Executive Officer of Brackish Water Fish Farmers Development Agency as the Member Secretary, Joint Director of Agriculture, Executive Engineer, PWD (Irrigation), Executive Engineer, PWD, (Ground Water), District Forest Officer, District Environmental Engineer of TNPCB, Regional Deputy Director of Town and Country Planning as members, shall examine applications, make enquiries in all aspects and forward the same to Director of Fisheries for granting license.

2.15.2 Nilgiris Game and Fish Preservation Act No.2 of 1879

It provides protection and prohibits selling of wildlife and fish from the Nilgiris District.

2.16 Tamil Nadu Agricultural Produce Marketing (Regulation) Act 1987

It deals to amend and consolidate the law relating to, and to make better provisions for, the regulation of buying and selling of agricultural produce and the establishment and proper administration of markets for agricultural produce in the State of Tamil Nadu.

It is expedient to provide for the better regulation of buying and selling of agricultural produce and the establishment on proper administration of markets for agricultural produce in the State of Tamil Nadu.

2.17 Panchayat & Land Acts

2.17.1 Tamil Nadu Panchayat Act No. 35 of 1958, as Amended

This Act prescribes purpose and manner of organizing village and town Panchayat. It authorizes Panchayat to construct and repair various small water related structures. This Act allows the Government to transfer to Panchayats the duty of protecting and maintaining any irrigation works or regulates distribution of water.

2.17.2 Tamil Nadu Land Improvement Schemes Act No. 31 of 1959, as Amended

The purpose is to carry out land improvement schemes in declared areas, public or private, other than forest preserves for conservation and improvement of soil and water resources (including groundwater), prevention and mitigation of soil erosion, protection of land against damage from floods or drought, protection of Reservoirs from sedimentation and reclamation of waste lands. It provides for establishment of Boards at three levels, viz., State, District and River valley catchment area for carrying out the Act. This Act could be considered as a key law for improving water resources development, utilization, management, and conservation in Tamil Nadu.

2.18 Implications of various Acts on IAMWARM Project

Whenever a new project is conceived such as the IAMWARM, there is often the apprehension that there might be some implications by way of impacting on the existing organizations, institutional frameworks, policies and programmes. By its very nature agriculture modernization and water resource management are highly evolving subjects and there is constant transformation in the practices pursued by different line departments. For instance, there are a host of organizations such as

- WRO, PWD
- Agriculture Engineering Department
- Tamil Nadu Agricultural University
- Agriculture department
- Agriculture marketing
- Horticulture department
- Fisheries department
- Forest department
- Social welfare department

Naturally the functioning of the above departments would have an impact on agriculture modernization and water resource management because of the policy formulations evolved over a period of time. However, what is important to note is to determine the diverse aspects of the policy outcomes of the above departments and make them to function in consonance with the IAMWARM project. This obviously would mean that the IAMWARM project need not necessarily be pursued in isolation. There is a need to bring in some kind of congruence between the IAMWARM project and the existing line departments to achieve demonstrable results in some specific areas such as

- Desiltation of tanks
- Catchment degradation
- Cold storage facilities
- Marketing accessibility and information technology
- Sewage treatment plants
- Water weeds and juliflora
- Migration
- Social and environmental problems

3 REVIEW OF PAST EXPERIENCES

The Tamil Nadu Water Resources Consolidation Project (TNWRCP) was planned for a holistic development with an integrated vision for water sector development and management and user participation in planning and management to achieve a demand driven process. The strategy emphasizes on environmentally and socially sustainable basin approach for water resources planning and management, including conjunctive use of water. Agricultural intensification and diversification to be supported under this proposed intervention would contribute to creation of both on farm & off farm employment and create enabling environment for private sector participation. The project contributed to the poverty reduction and sustainable growth. The TNWRCP project is implemented in all the basins. The Project is a multi hierarchical programme, which addressed the existing deficiencies through a mix of institutional reforms and rehabilitation of physical assets.

The ESA study has been carried out to provide input into the TNWRCP in accordance with the World Bank operational guidelines. The primary objective of the ESA study is to identify the key environmental and social issues related to the project. A wide range of data has been collected pertaining to physical, environmental and social aspects. The study has been carried out in seventeen river basins and environmental and social attributes has presented in the GIS platform in respect of Palar, Vaippar and Kothaiar. A detailed study is carried out on the Model Rehabilitation project being implemented in the Hanuman Nadi sub basin of Thamiraparani river basin on MDPU structure. The activities of various departments involved in this model project and the methodology adopted have been evaluated. Suggestions are made for each department's activities and for the over all structure of the MDPPP for incorporation while replicating the same to other basins.

3.1 Tamil Nadu Water Resource Consolidation Project (TNWRCP)

Tamil Nadu Water Resource Consolidation Project (Phase I) was taken up in 1995 with the financial assistance of World Bank at an estimated cost of Rs.11433 million and the project was completed on 30.9.2004.

3.1.1 Core objectives

- To introduce Water Resource Planning by river basins across all users of water
- To improve agricultural productivity through modernisation and completion of irrigation system, upgraded water management and farmers participation
- To assure sustainability of water infrastructure and the environment and
- To improve Institutional and Technical Capacity for managing the State Water Resources

A macro level planning has been completed for 16 basins out of 17 basins in the State leaving the Cauvery river basins due to water dispute on sharing of water. The Water Resources Management Project was also piloted in the Hanumanadhi sub basin of Tambraparani

3.1.2 Lessons learnt from WRCP

The lessons learnt from the TNWRCP Project area as follows:

- The Farmers' Management of Irrigation Systems Act 2000 (FIMS Act) is a much better basis for irrigation management than the Societies Act on which the SAR was based
- A separate component for Land Acquisition and Economic Rehabilitation, with a separate LAER Cell, works well for acquiring land but there are still limitations in the ability to economically rehabilitate project affected persons
- An extended and detailed policy preparation provided a sound basis for successful project implementation.
- The economic impact of an irrigation project will be improved by the inclusion of an agricultural component with strong agricultural support services at the outset. Investment in agricultural services should be flexible enough with government extension services and tied to marketing networks.
- More efficient procurement organization and procedures might avoid some delays in project implementation. A frequent training procedure during implementation is necessary, given the turnover of middle-level staff, to avoid delays in procurement aspects.
- Covenants such as that to reduce subsidies to TNEB, which have little direct relevance to project activities and are difficult to enforce, should not be imposed since dealing with these takes considerable time and effort of both the Bank and Borrower with negligible returns.
- Involving intended beneficiaries in planning, implementation and monitoring improved transparency, instills a sense of ownership and can reduce conflicts.
- NGOs played a useful role in training farmers and WUAs but NGOs without adequate experience in this works should only be employed in conjunction with other experienced organizations capable of training the inexperienced.
- Recognizing the role of WUAs as change agents, the involvement of women farmers and NGOs can create a multiplier effect. Convergence of various development schemes operating in WUAs should be routed through them to have additive effects.
- In the case of financial management it is better to contract reputed firms instead of local small firms for software development and for quality based selection (QBS).
- Twinning consultancies is a good idea but the terms of reference for such consultancies must be drafted with greater attention to details and the implementing agency should be supported derive maximum benefit from such arrangements.

- Focus on policy issues, institutional restructuring, cost recovery aspects should be consistent throughout the project implementation period.

The key goals of IAMWARM project would naturally have a bearing on the outcome and the lessons learned from WRCP. In other words, it would be feasible and practical to juxtapose the lessons learned from WRCP along side the key goals of IAMWARM project so that continuity is lent to the subject. What is important is to evolve the goals of IAMWARM project not losing sight of the outcomes of WRCP.

3.2 Participatory Irrigation Management (PIM)

The Government of Tamil Nadu had launched the scheme of Water Resources Consolidation Project (WRCP) in 1995, with the financing of the project by the World Bank. One of the four prime objectives of WRCP is “to improve the agricultural productivity through modernisation and completion of irrigation systems, upgraded water management and farmers participation”. This objective was mostly achieved through System Improvement and Farmers Turnover (SIFT) programme, which constituted a major and most important component of Water Resources Consolidation Project implemented during the period from 1995 to 2004

The Government of Tamil Nadu have accepted the concept of Participatory Irrigation Management (PIM) and encourages the farmers participation in the operation and maintenance of the irrigation water distribution systems in all the irrigation systems maintained by the Government in the State. Under WRCP, the PIM programme has so far been implemented to cover an area of about 6.0 lakh hectares; out of about 21 lakh hectares spread over 20 out of 30 districts in the State.

3.2.1 Experiences of PIM

After the "Institutional Reforms" carried out under WRCP with the technical guidance and advice from the World Bank, the Public Works Department had been reconstituted into four Regions Viz., Chennai, Trichy, Madurai and Pollachi covering four groups of river basins existing in the State. The department has also been renamed as "Water Resources Organisation (WRO) of P.W.D." Each Regional Office is headed by a Chief Engineer of WRO and functions as the Basin Manager for the group of river basins delineated as regional operational area and brought under his control: WRCP was implemented in all the Regions except Trichy, which covers the Cauvery Basin. Water Resources Organisation (WRO) thus had been made responsible for involving farmers in the operation and maintenance decisions, turning over of Operation and Maintenance responsibilities of distribution systems to the farmers and other related activities.

As a first step in the implementation of PIM under WRCP, the Centre for Water Resources of Anna University was involved and the methodology and approaches in implementing the programme of farmers involvement worked out. NGOs were also involved in mobilizing the farmers in the command area of WRCP and assist the field level officers of the WRO in forming the Farmers' Councils (equivalent to Water Users Associations - WUAs)

and registered under Tamil Nadu Societies Registration Act of 1975 since there was no specific Act on PIM in the State at that point of time.

3.2.2 Water User Associations (WUAs)

Totally 1965 Farmers Councils (WUAs) were formed and registered, as detailed below:

Table 3.1 Farmers Councils (WUAs)

1	1997 – 2002 (irrigation systems)	1272 Nos.
2	2001 – 2002 (irrigation tanks)	620 Nos.
3	2003 – 2004 Under Scheme completion	73 Nos.
	Total	1965 Nos.

Experiences in Formation of WUAs

In the initial stages, farmers were not cooperating with the WRO officials in organizing the village level meetings and they did not readily accept the new concept of PIM. Only a few farmers used to attend the meeting. The reasons for poor response was examined in detail and the ways and means to enhance the level of participation of farmers were discussed and analyzed taking into account the experiences of other States in this regard. 152 Assistant / Junior Engineers of O&M units of WRO were identified and appointed as FOT Team Leaders with necessary field supporting staff besides the deployment of 17 groups of NGOs.

With the constitution of FOT Teams and with the involvement of NGOs, there were marked improvements in the attendance in the meetings in villages. Since enhancing the level of participation involves bringing in attitudinal changes among the farmers, it was realized that this job could effectively be done by NGOs in association with WRO field officials. With the deployment of NGOs, with Teams of Institutional Development Specialists (17 Nos.) and Social Organizers (281 Nos.), the much-needed social input was provided to both the WRO field officials and farmers. By building up necessary rapport with the farmers, NGOs were able to convince the farmers about the new concept of PIM programme after organizing a number of meetings in the villages. Necessary training was provided to the NGOs and their group (before deploying them to visit the villages), on how to promote PIM activities, since such type of activities were new to them. They took long time to absorb the message and transmit to the farmers to complete their assigned jobs.

A Senior Advisor with necessary field experiences in the implementation of irrigation projects and with adequate management experiences was engaged during 1998 to fine-tune the process of implementation of PIM programme and to continuously encourage on the farmer's participation. His services are continuously being utilized.

With the combined and united efforts of both the FOT Team Leaders and NGOs, village level meetings with the farmers were organised creating necessary awareness about the need and advantages of their participation in the irrigation management activities. More enthusiasm and acceptance were observed among the farmers' group as well as the WRO officials.

The office bearers of the Farmers Councils (FCs) were also provided with basic training by the Irrigation Management Training Institute (IMTI), which had been identified as the Nodal Agency for the design and organizing of training programmes under WRCP.

With the completion of system improvement works mostly covering the rehabilitation and modernisation of the main canal systems of the irrigation systems proposed under IWRCP, attempts were made by the WRO officials in negotiating with the Farmers Councils (WUAs) for commencing the "Joint Management and Turnover Process" as contemplated under WRCP, to join together and make all decisions related to system operation and maintenance aspects. The members of the Farmer Councils were provided with an opportunity to get the benefit of "hands on experience" in the process of operation and maintenance of the systems atleast for one irrigation season. During November 2000, a Project Level meeting was organized at Pollachi covering the Parambikulam Aliyar Project (PAP) command, in which the Hon'ble Minister for Public Works and other political dignitaries participated, besides a very large gathering of farmers. Field observations and enquiries undertaken in some of the irrigation systems like Parambikulam Aliyar Project and Sathanur Project, indicated, the level of enthusiasm exhibited by the farmers (water users) in their participation in the process of decision making for system operation and maintenance.

During the joint management process related to irrigation water distribution, it was brought to the notice of WRO officials by the members of FCs (WUAs) that even though improvement to the main systems were carried out under WRCP, the rehabilitation works of the distributaries and minors comprising of the distribution system were left out for most of the systems, considerably affecting the delivery of assured water supply to the tail ends. A suggestion was made to examine the need for carrying out the Minimum required rehabilitation works in the distribution systems to be turned over, so that these systems will be fit enough for such turn over. Environmental training may be given to WUA's by EC Divisions, where the WUA is taking much behind Co-ordination with NGO.

3.2.3 Success stories after implementation of PIM

- It has provided a very good opportunity for regular contact between the farmers and the WRO officials and there is a good rapport developed. The farmers are generally ready to clean the supply channel and field channel systems of the tanks, where there is a possibility that the tanks may get some water. The distribution system under Major, Medium and Minor Irrigation systems are being maintained by WUAs concerned.
- The office bearers of some WUAs, walked through the command areas under the area of operation of WUAs, and carried out the desilting of the field channels & uprooted the 'Neyveli Kattamani (Weed)' in the water spread areas before the onset of the monsoon, by utilizing the additional maintenance grant apportioned to them together with their contribution collected as a membership fee.
- Dependence on the Government for everything is slowly getting reduced (Water distribution being done by the WUAs under WUA areas).
- When the department carries out the operations, the schedules are strictly followed. But in the operations done by the WUAs, there developed flexibility & adjustments among the farmers according to their need, resulting into mutual co- operation. (Resolution passed and implemented by the Udumalai Kalvai Kudimangalam Village,

is a representative sample, which states, "During the recent first and second zone irrigation in PAP, instead of 15 days continuous supply of water for irrigation, the system of 5 days supply of water in 3 shifts was resorted to, resulting into supply of water up to tail end, to the entire satisfaction of farmers. As the system is overwhelming among the farmers of this WUA, this General Body insists on, that the system of 5 days supply of water in 3 shifts shall be implemented during all the irrigation seasons".)

- Since a Managing Committee take the responsibility of solving the problems, then and there, the function of water regulation and distribution is going on smoothly.
- Water pilferage by the farmers is considerably reduced, since the management of water is regulated by the WUAs also (the jurisdiction of a WRO section, may be up to 30Kms stretch, where 8 or more WUAs are functioning, the responsibility of watching and controlling the pilferages are now shared by the office bearers of WUAs also.)
- It has provided an opportunity for some inter-transmission of water between the WUAs, to meet out the timely needs of water, developing a give and take policy.
- Number of police cases is under decline, since the differences in opinion among the farmers are solved then and there by the WUAs.
- Quality and standard of maintenance works carried out by the direct supervision of WUAs are coming up to the expected standards.
- Few of the court cases, which were long pending have been solved or withdrawn due to the strong and concrete efforts of the WUAs.
- It has provided an opportunity to the farmers, who have lost their belief in solving their grievances, to come forward and make them solved by the WUAs. Mainly the WUAs have become a forum for expressing the views of every water user, which would enable the Department to provide the required service to the farmers in the matters of irrigation management, which would ultimately result into increased agricultural productivity.
- Unity and co-operation developed among the farmers.
- Certain conflicts arise among them are settled down by themselves.
- When there is a failure of monsoon and scarcity of water, the mind set of farmers has been changed in such a way that the farmers themselves have come forward to distribute the available water equitably.
- The farmers in the head sluice reach are willing-fully ready to allow the tail end farmers to use their lands for cultivation, in case of no assured supply of water to the tail ends.
- The farmers extend their support to the WRO/Revenue Officials, in the eviction of encroachments in some catchment areas and canal systems.
- The farmers who are accustomed to the practice of irrigation by transacting oral instructions are now functioning by passing resolutions after meetings & discussions.

- Registers are maintained by them.
- The four sub committees as contemplated in the Act are formed and functioning in some areas.
- The disparity among the farmers based on the land holdings, resulting into first priority to the maximum landholder and least supply to the minimum land holders/tail-enders are being now eliminated.
- Farmers are participating in the water regulation operations, and the water for irrigation is being utilized economically.
- It has become useful to increase the awareness, participation and commitment of people and to protect and enhance their well-being. It is useful to follow a participatory, transparent and objective approach.
- Grievances of the farmers are solved at a single point in the field itself.
- The habit of encroachments in the commands by the farmers is slowly diminishing, since the responsibility of safeguarding the irrigation systems has been realized by them, as the sense of ownership of the irrigation system has been inculcated in them, after the implementation of PIM.
- Damages to the Public properties, by them either intentionally or unintentionally for their self-benefits have been reduced.
- There are more chances now, for getting the development of ayacut increased, due to the feasibility of ensuring sustainable & equitable supply of water up to the tail end.

3.3 LAER (Land Acquisition and Economic Rehabilitation) Cell

A separate component for Land Acquisition and Economic Rehabilitation, with a separate LAER Cell, works well for acquiring land but there are still limitations in the ability to economically rehabilitate project-affected persons

This cell was created as per the suggestions made by the World Bank to expedite the land acquisition and implement the rehabilitation plans for the projects under WRCP. This cell is functioning under the supervision of Secretary to Government, PWD in the Secretariat. The cell has expedited the land acquisition plans and fast compensation settlements have taken place for the projects under WRCP. Hence, the same plans and procedures for land acquisition and settlement of compensation to the project affected people may be extended to all the projects under WRO. The cell is engaged in taking care of redressing grievances and mitigating negative social impacts of the people caused due to the construction of canals, reservoirs and dams, it is suggested that the Government of Tamil Nadu may consider to continue the cell as a permanent establishment.

3.4 Environmental Cell Division (EC Division)

There are three environmental cell divisions under WRO, PWD. The EC divisions are headed by an Executive Engineer at the regional level. The EE will report to Superintending Engineer at Chennai. The Chief Engineer (PF) will head the three environmental cell divisions.

3.4.1 Activities of Environmental Cell Divisions

- Environmental base line data collection of the respective river basins.
- Documentation of environmental and social issues and monitoring the work.
- Water & Soil quality monitoring before restoration of water bodies and after restoration of water bodies.
- Conducting field oriented demonstration projects related to environmental issues.
- Creating environmental and social awareness among the stakeholders of the basin.

3.5 Pilot Project in Hanumanadhi Sub-Basin – Review

Multi Disciplinary Project Unit (MDPU) was constituted to implement the WRCP under WRO, PWD. Since, IAMWARM project is a successor to WRCP which is also be implemented under MDPU adopting integrated approach with the participation of the line departments and the stakeholders using water from the basin. The prime objective of this multi-disciplinary approach is to increase the productivity of water on a joint sector model and the farmers shall have to share part of the project investment cost. A pilot model rehabilitation project was implemented in the “Hanumanadhi Sub-Basin of Thamiraparani river basin” under the supervision of MDPU. The strategy focuses on convergence of the following Agencies/Departments.

1. Water Resources Organization, PWD
2. Agricultural Engineering Department
3. Agriculture Department
4. Forest Department
5. Fisheries Department
6. Social welfare Department
7. Horticulture Department
8. Agriculture marketing and Agri Business Department
9. Tamil Nadu Agricultural University

3.5.1 Options

- To go for rainwater harvesting
- Introduce high tech farming with post harvest techniques
- Ensure protection of farm produce till it reaches the consumers
- Consumption of Water for Agriculture which is 80% to be reduced by adopting conveyance efficient techniques like Micro irrigation, pressure irrigation and flow irrigation using pipes

- Increase the storage condition of aquifer by providing farm ponds and rejuvenation of wells etc
- Adopting cropping practices and tilling practices to reduce water consumption and increasing the yield per hectare by using less water

3.5.2 Water Resources Organization (WRO)

The Water Resources Organization (WRO) under the Chairmanship of Engineer-in-Chief is assigned with the task of implementation of Model Rehabilitation and Modernization of Hanumanadhi sub basin in co-ordination with other departments and monitoring and evaluation of project achievements. Various works are taken up for 12 anicuts, 14 main channels and 50 tanks in the sub basin and the operational efficiency of the system is expected to improve after completion of all the works. They are

- Protective works in the river bed
- Strengthening of anicuts
- Construction of head sluices at open take off channels
- Lining of canals
- Bund Protection
- Providing shutters to sluices
- Channel bank formation with roads
- Providing ground water recharge ponds
- Improving surplus arrangements to tanks
- Cross drainage works

The rehabilitation works such as desilting of tanks, lining of canals, construction of retaining walls, strengthening of bunds, repairing of sluices, gates and weirs are being undertaken by the WRO. As per the proposal and concept, the head reach water shall go to tail end and there should be a minimum guarantee for equal distribution of water upto the tail end. The rehabilitation works can help them to fulfill the aim and objectives.

Observations

Some people are objecting the lining of canals. Farmers expressed that a portion of the bed surface of the canal should not be lined to allow seepage of water which recharges the ground water.

Seasonal conditions may be kept in view while undertaking the canal lining to ensure uninterrupted supply of water to the villages around the canal

Proportioning of water should be done to ensure the proper supply of water to the tanks situated in the lower reaches of the basin.

3.5.3 Agricultural Engineering Department

Agricultural Engineering Department proposes to disseminate the upgraded agricultural engineering technology information, high tech micro irrigation systems like drip,

sprinkler and tower irrigation systems to all the water users in the basin. The main aim of the Agricultural Engineering Department works are

- To improve the productivity of water per unit per land.
- To improve the livelihood of farming and labour community
- To create an infrastructure base for water conservation techniques.
- To train the engineers and farmers on effective water management towards sustainable development
- The Agricultural Engineering Department has already carried out the following components for achieving the above said goals.

Observations

The overall issues and requirement of mitigation measures in the basin are not covered. Importance is given in the mechanization of agriculture activities by providing drip sprinklers, seed harvesting machines etc. Contour bunding, vegetative barriers to arrest soil erosion are also essential in watershed development activities.

3.5.4 Agriculture Department

The aim of the Agriculture Department is to improve the agricultural productivity through modernization of irrigation system, upgraded water management and farmers participation. The following components are being taken as action plan by Agriculture Department

- Paddy SRI (System of Rice Intensification) demonstration
- Improve the existing coconut garden
- Organic farming- green manure seed distribution
- Distribution of hand operated sprayers
- Technology demonstration
- Coconut coir compost demonstration
- Vermicompost demonstration
- Conducting seminars to create awareness by means of publicity

Observations

The Agricultural Department has taken many activities as said above. But there is not a clear correlation among the different components. According to a survey conducted in Pudukottai and Pollachi, farmers completely shifted from the inorganic cultivation practices to organic cultivation practices. They explained that total shifting is also possible and the yield is also good. While promoting organic farming mulching techniques, soil improvement, macro and micro nutrients, crop pattern, method of filling, control of insects by bio fertilizers and yield improvement plays important role. They shall have the detailed plan towards the policy change such as from inorganic farming concepts to organic farming techniques.

The farmers' participation or willingness, while in change of cultivation practices are to be addressed.

3.5.5 Tamil Nadu Agricultural University (TNAU)

The main objectives of TNAU is to increase water productivity in agriculture and horticulture crops of the project. To achieve the above goal, TNAU has taken six Adaptive Research Trials (ART) under 14 anicuts.

The principles in the ARTs are increasing the productivity of the crop through introduction of high yielding varieties

The activities being carried out by TNAU are as below

- System of Rice Intensification (SRI)
- High density banana with fertigation
- Drip irrigation in coconut, sugarcane
- Micro sprinkler to groundnut, cotton, vegetables and pulses

Observations

The activities aim to reduce the input cost and to maximize the profits, while doing ART (Adoptive Research Trial). But after completing the demonstration project, the farmer should come forward to adopt the technology. From the activities it was observed that, the input in land will be increased due to mechanization. In many places, the drip irrigation reduced the yield of coconut. Drip irrigation combined with inorganic pesticides will increase the salt concentration which leads to soil degradation. Based on the views of the farmers, drip irrigation combined with bio fertilizers may produce better results.

3.5.6 Horticulture Department

The Horticulture Department has taken very few assignments

- Tissue culture in banana growing
- Hybrid/ high yielding vegetables

Observations

The intervention by horticulture department is comparatively very less. Horticulture crops play big role in building farmers economy. The waste lands can also be used for horticulture crops with less water and organic farming concepts. Hence they can do still better approach for all kinds of crops.

3.5.7 Fisheries Department

The main objective of the Fisheries Department is to increase fish production and uplift the socio economic condition of the fishermen by implementing various welfare programmes such as

- Increase fish production by scientific fish culture in tanks

- Demonstration of fresh water prawn culture and fish culture in farm ponds
- Installation of cages for rearing of fish lings

Observations

The scientific approach put forth by the Fisheries Department is appreciable in all aspects. The only one precaution shall be taken in fish culture is farm ponds. Still the farmers using extensive fertilizers and pesticides. The excessive fertilizers and traces are – through run off to farm ponds. Hence the water quality shall be checked often in the farm ponds. Bioaccumulation of fertilizers through fishes will affect the human being.

3.5.8 Agriculture marketing and agri business

The main aim is to facilitate easy marketing facilities to the farmers. This department is undertaking the following activities.

- Installation of solar dryer for chillies drying.
- Construction of grading center for cleaning and value addition
- Supply of mini vans and vegetables crates
- Conducting farmers training

Observations

The overall needs of the farmers for the marketing of their produce are not properly visualized. The basin wise concept was not taken into account, while preparation of their action plan for the basin and only the target-oriented works have been taken up. There are number of opportunities available for establishing marketing linkages to the farmers produce. A few areas are mentioned below for better understanding.

1. Establishment of decentralized cold storage may be thought of for the benefit of farmers using the solar energy.
2. Organic farming which is an emerging area may be promoted and capacity among the farmers built for obtaining certification and capitalization of available opportunities
3. Setting up of organic vegetable shops may be encouraged and special prices may be fixed to encourage the farmers to opt for organic farming.
4. Promote value addition to the agricultural produce by establishing micro enterprises with appropriate marketing linkages.
5. Capacity building may be planned to the farmers and self help groups in improving the quality in value addition products, packaging, branding etc to enter into the urban markets.

3.5.9 Forest department

The Forest Department proposed to raise babul/ karuvel plantations on tank beds in plain catchment area. They have submitted an action plan indicating details on social forestry, forest produce, water conservation, environmental and social benefits.

Observations

The hilly catchment area has degraded due to man made activities. But the Department proposed only one activity under MDPPP. Regenerating degraded catchment by undertaking by software and hardware approach is not covered. Since Hanumanadhi sub-basin is a model basin for water resources development activities, catchment plays an important role in arresting soil erosion, stopping deforestation and regenerating the degraded forest area, these activities shall also be considered as a basin wise approach.

The Forest Department should also concentrate on overall issues in catchment area and the remedial measures such as gully plugging, contour bunding, construction of check dams, vegetative barriers, tree plantations etc in the hilly areas to arrest the soil erosion and maintain the eco systems.

3.5.10 Social welfare and development of women Department

The aim of this department is to impart training for WUA's/ women farmers for which the following activities are being carried out under MDPPP

- Group formation
- Capacity building training
- SHG Members Training
- Animator & Representative Training
- EDP Training
 - a. Skill Training
 - b. Skill Up gradation Training
 - c. Vocational Training

Observations

1. The Overall issues and the requirement of the basin are not visualized.
2. The Department would have been identified the potential areas for training which are having potential for employment.
3. An integrated enterprise development approach may be promoted for the women who have undergone EDP training.(Promotion of micro enterprises)
4. Setting up of women haats may be thought off with backward and forward linkages for promotion of marketing the products produced by the women directly to the consumers.

After review of the existing reports and had discussions with the senior officers of PWD, the following lessons are drawn from the implementation of pilot project on Hanumanadhi.

3.5.11 Lessons learnt

- The pilot project launched at Hanumanadhi Basin is first of its kind in Asia integrating the activities of various line departments and has some results to show
- The change in cropping pattern, modernized agriculture techniques has led to increase in the yield
- Training given to farmers on latest irrigation techniques for high yielding variety of rice and other crops has changed socio economic profile of the farmers
- In places like Pudukottai and Pollachi the farmers have completely shifted to organic cultivation and achieved better yield. This is the out come of the farmers getting exposure to organic farming techniques. This is an area for possible replication in other basins.
- There are visible signs of empowerment among the farmers in the judicious use of water
- The project has fallen short of its goals essentially because of inadequate rainfall over the last four years resulting in poor renewal of tanks
- The project has not achieved results commensurate with the investments made due to project planning at short notice.
- Most of the stakeholders are not clear about the objectives and activities of the project
- Though a beginning was made to integrate all the line departments activities, the project could not achieve the full success due to gaps in coordination among the line departments officials.

3.6 Tamilnadu Women in Agriculture (TANWA) funded by DANIDA

Women, in small and marginal farm families carry very heavy load of work both in the farm and house as compared to men. In India 78% of women are engaged in agriculture, compared to 63% of men. Their contribution to agriculture is immense but they have very little control over resources. Their participation in decision making process is also less. In this context TANWA project is designed to reorient and involve to them in agriculture. TANWA Project funded by the Danish International Development Assistance (DANIDA), in two phases starting from 1986. TANWA aims at increasing agricultural productivity and improving food security among small and marginal women farmers. The project is ended in 2002.

3.6.1 Objectives

- Improving the productivity and quality of life of all family members through securing full utilization of women's potential in agricultural production on small and marginal holdings
- Transfer knowledge and skills from trained women farmers to fellow farmers
- Improve access to existing agricultural extension services to women farmers
- Increase women farmers' ability to use existing services
- Increase the number of women agriculture officers in the Department of Agriculture
- To strengthen farm women's position in society
- To guide farm women to adopt relevant new technology and give them the appropriate skills through practical training

3.6.2 Strategy

Technology is transferred to small and marginal women farmers through village based training, farm women conferences and follows up support at village level.

Women agricultural officers have been recruited to train farm women. The five day training course covers a maximum of 10-12 skills related to crop production, animal husbandry, agricultural techniques, agro forestry, bio fertilizers, sericulture, pisciculture, apiculture etc

3.6.3 Lessons learnt

- 215 women agricultural officers have been positioned for the first time with TANWA's initiatives
- 60,000 women farmers have now been familiarized with more than 200 technologies and in turn they have shared these technologies with nearly 400,000 women
- TANWA's farm women groups have gradually evolved and felt the need for joint action and networking
- Agricultural productivity in these women's farms have increased from 14% to as high as 80%

After review of the above scheme, it is proposed to establish and strengthen the women haats in the project for provide direct marketing facilities to the women group products.

3.6.4 Objectives of the Haat

- The women Haat to be on lines of trade fair to bring together buyers and sellers of various regions
- To help bring in the technology improvement in various product ranges
- Conducting of thematic Haats like food processing to reach out producer women to specialized market segments for support for a range of product
- To hold workshops with specialist in the various fields from the various parts of the Country as well as manufacturers who will be able to negotiate and discuss with women's groups, manufacturing various products for a tie up

- To create brand awareness and impart brand management techniques
- Improving and introducing new economical packing techniques
- Helping in evolving market accessible pricing strategies
- Financial and marketing linkages

Benefits of Haat

Table 3.2 Benefits of Haat

<u>Market Needs</u>	<u>Haat offers</u>
Exclusivity	Competitive advantage; uniqueness by way of its distinctive features and the cost and value benefits that it would offer the quality, variety and ambience of the service provided
Value (price/benefits)	Insignificant fee charged compared to host of benefits provided (storage, trolleys, conference rooms, R&D etc)
Comfort	Information center, online booking and information of calendar of events, “an umbrella service”
Performance	Experience of the corporation in strategy formulation and implementation
Networking	Existing network with the organized and un-organized women groups and institutions will allow immediate access to market the concept
Risk Reduction Strategy	Build reputation, nurture contacts, compete vigorously on basis of expertise and successful experience

3.7 Pudhu Vazhvu

Tamil Nadu has proposed to implement “Pudhu Vazhvu” project with World Bank’s assistance. The project was approved by the World Bank in May 2005.

“Pudhu Vazhvu” meaning ‘New Life’ is to create opportunities and build social capital in poor communities and to involve the communities themselves in designing and implementing the changes that will affect their daily life. It is envisaged that the project will cover around 3,50,000 target families in 2300 Gram Panchayats comprising 12185 habitations in 70 backward blocks spread over 15 districts.

3.7.1 Objectives

The specific objectives are to improve the livelihoods and empower the target rural poor (particularly women and other disadvantaged groups) through

- Developing and strengthening pro-poor local institutions/groups (including village Panchayats)
- Building skills and capabilities of the poor and
- Financing productive demand-driven subproject investments.

3.7.2 Expected Outcomes

- 20% increase in incremental income against base year for 50% of the target households by end of project
- 70% target households should have increased their income
- At least 70% of all identified vulnerable population e.g disabled and tribals are organized into SHGs and have accessed special assistance funds
- At least 70% of SHGs/EAGs of the poor have accessed funds through linkage with banks and other financial institutions.

In view of the above-mentioned ongoing developmental projects, the activities under this project facilitate integration of some of the ongoing development programmes in the State for the benefit of the stakeholders. The project will provide synergies and strengthen the development process of the State.

3.8 Social Welfare Schemes and Programmes

The government schemes and programmes that are being implemented are as follows:

3.8.1 Schemes

- Member Of Legislative Assembly Constituency Development Scheme (MLACDS)
- Namadhu Gramam
- Rural Housing Scheme
- Sampoorana Grameen Rozgar Yojana (SGRY)
- Swarnajayanthi Gram Swarozgar Yojana (SGSY)
- Pradhan Mantri Gramodaya Yojana (PMGY)
- Rashtriya Sam Vikas Yojana (RSVY)
- Pradhan Mantri Gram Sadak Yojana (PMGSY)

- Provision Of Urban Amenities In Rural Areas (PURA)

Member of Legislative Assembly Constituency Development Scheme (MLACDS)

MLACDS, a fully State Government funded scheme has the main objective of taking up works to bridge the infrastructural gaps in the Assembly Constituencies. Allocation per constituency was Rs.82.00 lakhs. The MLAs are recommended to prioritise the works for Drinking Water Supply works (Rs.15.00 lakh), Namadhu Grammam Scheme (Rs.15.00 lakh), Hostels for BC/MBC (Rs.5.00 lakh), laying of cement roads including Village Panchayat roads and street lights (Rs.15.00 lakhs). For the remaining Rs.32.00 lakhs MLAs have the liberation to propose other works in accordance with guidelines. During 2004-05, a sum of Rs.192. 70 crores was released and 9983 works were taken up.

Namadhu Gramam

The scheme implemented since August 2004 has the objective of achieving cent per cent enrolment of children in schools, reducing infant mortality, eliminating female infanticide, poverty reduction and achieving village sanitation through people's participation. To encourage greater people's participation, Village Panchayats are given incentives for an amount of Rs.55 crores based on their performance. Thus, the scheme Namadhu Gramam involves motivated voluntary action for sustainable and holistic rural development.

Highlights of Namadhu Gramam Thittam

The major objective of the Namadhu Gramam Thittam is to ensure all round development of our villages across Tamil Nadu. These bold initiatives will be implemented with an outlay of Rs.200 crores. An initial provision of Rs.52.21 crores has been made in the Budget Estimates for this purpose. NABARD also will support the funding of this programme.

Namadhu Gramam enables the principles of democratic decentralization and participatory approach to foster comprehensive development of every village in Tamil Nadu. Under this programme, the Gram Sabha will meet to draw up an action plan to ensure specific improvements in areas such as drinking water, sanitation, drainage, health, women empowerment, nutrition, cleanliness and hygiene, elementary education, environmental improvement, management of water resources, village roads and streetlights. The Gram Sabha will be assisted by officials from every Department to render all necessary assistance. Specific monitorable indicators will be spelt out to enable the Gram Sabha to monitor the performance of its action plan. This includes attention to dropout rates in local schools, village cleanliness and general health and hygiene. The purpose of this programme is to enable the Gram Sabha to focus on issues, which confer real benefits on the people and improve their quality of life and the living environment.

Rural Housing Scheme

The State Government formulated a new credit linked participatory programme for upgrading kutcha houses in rural areas. The scheme has the components of

- Beneficiary contribution (Rs.5001-)
- Government subsidy (Rs.25001-) and

- Loan component to be availed (Rs.70001-). The programme is being implemented through women SHGs. During 2004-05, a sum of Rs.5.00 crores has been released for upgrading 20.000 kutchha houses.

Sampoorna Grameen Rozgar Yojana (SGRY)s

The SGRY was launched in 2001 with the aim of providing wage employment in rural areas and thereby food security and improve nutritional levels by merging the Employment Assurance Scheme (EAS) and Jawahar Gram Samridhi Yojana (JGSY). The labourers engaged in works taken up under this programme receive rice as part of wages at the rate of 5 kgs. per man day. The Centre and State Government share cash component in the ratio of 75:25. During 2003-04, a total of 158996 works which includes 10630 Village Panchayat Tanks, 6651 thrashing floors, 6809 buildings for SHGs and 321 mat huts were taken up under this programme. Over 1,34,842 works including 12204 compost yards, 9177 village tanks, 188 multi purpose centers for fishermen, 733 mini godowns, 3180 Noon Meal Centre Buildings, 1254 Buildings for Self Help Groups and 246 drinking water ooranies were taken up during the year 2004-05.

Swarnajayanthi Gram Swarozgar Yojana (SGSY)

SGSY, launched in 1999, is a holistic programme of self-employment by organising the rural poor into Self Help Groups of 10-20 members through a mix of bank credit and Government subsidy. It brought all the earlier poverty alleviation programmes like IRDP, TRYSEM, DWCRA, SITRA, GKY and MWS under one umbrella. It is a credit-cum-subsidy programme.

During 2003-04, to provide marketing support for SHGs products, the Government launched the rural bazaar website and a State Level Federation i.e. District Supply and Marketing Societies (DSMS) in all the districts. Besides this, information kiosks i.e. RASI Centre (Rural Access to Services through Internet) was extended to all the districts. Tamil Nadu ranks second next only to Andhra Pradesh in terms of number of credit linked SHGs. As on 31st March 2005, a total of 185921 SHGs were functioning in the State with a membership of 30 lakh women.

Pradhan Mantri Gramodaya Yojana (PMGY) (Rural Shelter Component)

PMRY launched in 200-01 give financial assistance for selected basic services such as primary health, primary education, rural shelter, rural drinking water, nutrition and rural electrification. In 2003-04, 5803 new houses were taken up for a total outlay of Rs.1877.76 lakhs. In 2004-05, 5478 houses were completed with an allocation of Rs.18. 78 crores.

The total outlay on the above rural poverty alleviation schemes stood at Rs.88717.36 lakhs in 2003-04 and Rs.55330.00 lakhs in 2004-05. The Government of India's contribution towards the programmes constituted 43 per cent and 57.0 per cent in 2003-04 and 2004-05 respectively. Of the total expenditure of Rs.55330.00 lakhs in 2004-05, SGRY bagged a major share i.e. 56.00 per cent. Table below highlights the expenditure incurred on these poverty alleviation programmes.

Rashtriya Sam Vikas Yojana (RSVY)

A new initiative, viz. the Backward Districts Initiative under the Rashtriya Sam Vikas Yojana (RSVY) (Development and Reform Facility) has been launched by Government of India with the main objective of putting in place programmes and policies with the joint efforts of the Centre and the States which would remove barriers to growth, accelerate the development process and improve the quality of life of the people. The scheme aims at focused development programmes for backward areas which would help reduce imbalances and speed up development. This component would cover 100 districts in the country. The identification of backward districts within a State has been made on the basis of an index of backwardness comprising three parameters with equal weights to each: (i) value of output per agricultural worker, (ii) agriculture wage rate and (iii) percentage of SC/ST population of the districts.. The number of districts per State has been worked out on the basis of incidence of poverty. In addition, thirty two districts which are affected by Left Wing Extremism would also be covered. Fifty Backward Districts and 16 districts affected by Left Wing Extremism in the country were to be covered in the Annual Plan 2003-04.

The main objectives of the scheme are to address the problems of low agricultural productivity, unemployment and to fill critical gaps in physical and social infrastructure. The District Administration / Panchayat Raj Institutions accordingly would be required to prepare a Three Year Master Plan with nested Annual Action Plans. The Plan is to be based on a SWOT (Strengths, Weaknesses, Opportunities and Threats) Analysis, review of ongoing schemes and identification of a few lead bottlenecks in development. The additionality is to be used to meet local needs through schemes in this lead sectors which would make a dent on the poverty of the district in a time bound manner.

Thus, the prime objective is to address the problems of pockets of high poverty, low growth, low agricultural productivity, unemployment and poor governance by putting in place programmes and policies which would remove barriers to growth and accelerate the development process.

An amount of Rs.45 crores would be provided for each of the districts covered over a period of three years at the rate of Rs.15 crores per year for implementation of various developmental programmes such as drought proofing (soil conservation, afforestation, social forestry, wasteland development and minor irrigation); agriculture, horticulture, etc; infrastructure (road and power); social sector (health and education) and livelihood support (income generating activities such as hand looms, information technology, agricultural processing, etc). Under the scheme 15 per cent *of* the funds would be earmarked for maintenance of assets in health, education and veterinary sectors. The main focus and strategy of the scheme will be on infrastructure development and income generation for under-privileged. The NGOs and Self Help Groups will also be involved at every stage including plan formulation, implementation and monitoring. The districts from Tamil Nadu which have been identified for coverage under the Backward Districts initiative of RSVY are Tiruvannamalai, Dindigul, Cuddalore, Nagapattinam and Sivagangai. For the year W03-04, Tiruvannamalai district was approved for coverage and out of the allocation of Rs.1500 lakhs to Tiruvannamalai district, watershed development works in 14 micro watersheds in 8 blocks, afforestation of degraded forests in 30 villages, improvement of 71.20 kms. of roads, expansion of Horticulture, floriculture and Medicinal plants in 200 ha. mass education of 1500 Health Volunteers, establishment of 18 information centers one in each block, modernization of handloom sector by training of 400 weavers on korvai attachment, provision of computer for modern design, effluent treatment plant, repairs to 31 Health Sub-Centres and 37 school buildings, infrastructural facilities to PHCs were provided.

Pradhan Mantri Gram Sadak Yojana (PMGSY)

The PMGSY programme was launched in December 2000 with the objective of providing connectivity by way of all weather roads to the unconnected habitations in the rural areas. It aims to cover all habitations, with a population of 1000 persons and above in three years (2000-2003) and with a population of 500 to 999 by the end of the X plan i.e. 2007. It is a centrally sponsored scheme. The PMGSY covers only the rural roads i.e. Other District Roads and Village Roads. During the year 2003-04, 498 road works to a length of 1113.92 kms. at an estimated cost of Rs.26478 lakhs have been taken up. In 04-05 implementations of works costing Rs.11791 lakhs was taken up.

Provision of Urban Amenities in Rural Areas (PURA)

PURA which was christened on August 15, 2003 aims at self-sustaining development of the country. It also seeks to reduce congestion in urban areas and bridge the rural-urban divide.

The PURA model consist of 4 connectivities - physical, electronic, knowledge and economic - to enhance the prosperity of cluster of villages. Under physical connectivity, a group of 15-25 villages would be linked to one another by road and also a ring road accessible to each village. Besides roads, transport facilities and electricity have also been included. Electronic or digital connectivity means linking villages with modern telecommunication and information technology services, knowledge connectivity means establishing (in every 5-7 kms. of the ring road) a school, a higher education centre and a hospital and economic connectivity aims to establish good marketing facilities within this group of villages so that all the commodities and services of daily use can be produced and sold in these markets.

Government of India has envisaged development of over 4000 rural clusters located in backward regions. A sum of Rs.300 lakhs for each cluster has been provided and thus Rs. 120000 crores would be spent on the development of 4000 PURAs. In Tamil Nadu, out of 30 districts, 23 towns, with clusters / villages have been identified in 22 districts by Ministry of Rural Development. Government of India for implementing the PURA projects.

3.8.2 Programmes

- Empowerment and Poverty Reduction
- Self Sufficiency
- Village Infrastructure Development Programme
- Integrated Rural Housing Programme
- Member of Parliament Local Area Development Programme (MPLAD)
- Total Sanitation Campaign
- Central Rural sanitation Programme
- National Project in Bio Gas Development
- Drought Prone Area Development Programme (DPAP)
- Integrated Wasteland Development Programme (IWDP)
- Community Welfare Development Programme

Empowerment and Poverty Reduction Programme

This new programme implemented in 2004-05 would provide shelter, nutrition and health securities and welfare measures to 25 poorest of poor households in each village panchayat for which guidelines have been issued. A sum of Rs.5.00 crores has been released to the districts during 2004-05 for implementing the programme.

Self Sufficiency Scheme

This innovative participatory programme is implemented with demand driven approach. The objective of the scheme is to revive the concept of community participation in planning, execution and maintenance of community assets. Under this scheme, the public should contribute a minimum of 25 per cent of the total cost in the form of cash/kind or labour. The Government supplements the community efforts by providing 75 per cent of the project cost with technical support. By this way of participatory method, the scheme maximizes the utility value of the funds allocated by the Government. During 2004-05, Rs.40.00 crores was allotted and 2176 works were taken up.

Village Infrastructure Development Programme

Improvement of Village Standees was taken up with the assistance of NABARD for providing facilities such as construction of stalls, street lights, drinking water, toilets, approach roads, drainages etc. During 2004-05, 33 shandies at a cost of Rs.244.04 lakhs were provided with infrastructural facilities, such as construction of stalls, street lights, drinking water, toilets, approach roads, drainages, etc. with the assistance of NABARD

Centrally Sponsored Schemes

A slew of Centrally Sponsored Schemes are in operation in Tamil Nadu to address livelihood concerns and infrastructural requirements.

Integrated Rural Housing Programme

The Indira Awaas Yojana, a sub-scheme of JRY, operationalised from 1999-2000 with a view to help the rural people belonging to SC/STs, freed bonded labourers, non-SC/STs, ex-service men and disabled persons to construct dwelling units and upgradation of existing unserviceable kutcha houses. The total allocation under this scheme was Rs.154.25 crores in 2004-05.

The upper permissible limit of construction assistance per new unit was fixed as Rs.25000 in plain areas and Rs.27500 in hill/difficult areas. The funds under IAY are shared between Centre and States in the ratio of 75:25. During 2003-04, 36426 new houses were constructed with the State and Central Government's allotment of Rs.6240.15 lakhs and Rs.5606.80 lakhs respectively. During 2004-05, 37676 new houses were constructed under the scheme.

Upgradation of Unserviceable Kutcha houses into Pucca houses

This is a sub- component of IAY. Government of India has revised the construction assistance for Upgradation for Rs.10,000 to Rs.12,500. During 2003-04, 18689 kutcha houses were upgraded with State and Central Government's allotment of Rs.467.23 lakhs and Rs.1401.69 lakhs respectively. In 2004-05, 19265 kutcha houses had converted into pucca houses.

Table 3.3 Poverty Alleviation Programmes

Name of the Scheme	Expenditure Incurred					
	Govt. of India		State Government		Total	
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
SGRY	25201.50	20538.1	8400.50	6846.026	33602.53	30960.67
Rural Housing – IAY	7008.49	9026.48	6707.30	6398.355	13715.79	15424.84
Innovative Scheme for Rural House and Habitat Development	65.84	Scheme Discontinued	-	Scheme Discontinued	65.84	-
Pradhan Mantri Gramodaya Yojana (Housing)	1877.76	1877.76	-	-	1877.76	1877.76
Swarna Jayanthi Gram Swarozgar Yojana Scheme	4398.68	-	1463.23	-	5852.91	7066.734
Total					88717.36	55330.00

(Rs. in Lakhs)

Source: Department of Rural Development

Member of Parliament Local Area Development Programme (MPLAD)

The Member of Parliament Local Area Development Programme was introduced in 1993 to undertake developmental works of capital nature in the respective constituencies of the members of Parliament. In Tamil Nadu, there are 39 Lok Sabha MPs and 18 Rajya Sabha M Ps. Therefore the Government is entitled to receive annually Rs.114 crores from GOI under the scheme. The works undertaken under this scheme includes construction of school buildings, village roads 1 approach roads, irrigation channels, bus shelters, desilting of village ponds, etc. During 2004-05, a sum of Rs.102.00 crores was released by Government of India and 4135 works were taken up.

Total Sanitation Campaign

For improving sanitary condition in rural areas 'total sanitation campaign' project was implemented in the project districts. The cost of the project is shared between the Centre and State Governments and beneficiaries. So far this project is implemented in 29 districts with a total cost of Rs.327.32 crores.

Central Rural sanitation Programme

This programme was restructured and introduced as total sanitation campaign in March 2002. It is a community-led and people centre programme. It emphasises on information, education and communication (IEC), Human Resource Development (HRD) and Capacity Development activities. The objectives of the programme are to bring about an improvement in the general quality of life and accelerate sanitation coverage in the rural areas, generate awareness creation and health education to cover schools in rural areas with sanitation facilities and promote sanitary habits among students, encourage cost effective and appropriate technologies in sanitation and to reduce the incidence of water and sanitation diseases. During 2003-04, 440227 individual household latrines, 156 sanitary complex for women, 5965 school toilets, 5276 anganwadi toilets and 77 Rural Sanitary Mark and Production Centres (RSM/PCs) were constructed. A sum of Rs.1781 lakhs has been proposed in the budget estimate 2004-05 for this programme.

National Project in Bio Gas Development

This programme aims at promoting eco-friendly non-conventional energy source with multiple benefits. To prevent deforestation, production of enriched manure and to improve sanitation and hygiene by linking sanitary toilets with bio gas plants are the objectives of this programme. This is fully centrally sponsored programme with a subsidy component of Rs.2100/- for general category, Rs.2880/- for SC/STs and small farmers and Rs.3500 for hilly areas.

3.9 Area Development

In view of the fixed supply of area available for crop cultivation, agricultural growth depends critically on the increase in productivity, cropping intensity and crop diversification. In the above backdrop, rising population and dwindling net area cultivated have severely limited the potential for extensive and intensive cultivation. With a view to augmenting the availability of land resources ripe for development, the Department of Rural Development, Government of India has been formulating a host of area development programmes such as Drought Prone Area Programme (DPAP), Integrated Wasteland Development Programme (IWDP) etc. Ultimately, the goal is to make the arid and semi arid lands arable. The fecundity of the soil will improve thanks to the execution of these schemes. Two area development schemes are implementing by the Department of Rural Development in the State.

3.10 Drought Prone Area Development Programme (DPAP)

DPAP, which is implemented by adopting a holistic approach, is in operation since 1972- 73 covering 80 blocks in 17 districts. The major objectives of this scheme are optimum utilization of natural resources like land, water, etc., mitigation of adverse effects of droughts and prevention of ecological degradation. Apart from this, creation of gainful employment is fundamental to the philosophy of this programme. From 1995-96 onwards Watershed approach is being adopted in the implementation process and the participation of the local population is vital. Each watershed covers an extent of about 500 ha.

Cost of developing a watershed is fixed at Rs.6000/- per ha. with effect from 1.4.2000. The span of the implementation period is spread over 5 years. About 297 watershed projects were completed in 1995-2000 involving an expenditure of Rs.5920.25 lakhs.

Government of India and Tamil Nadu share the expenditure on a 50:50 basis. Total area treated worked out to 1.49 lakh hectare during 2003-04, the Central assistance received was Rs.2428 lakhs and the State share Rs.88 lakhs. The State share outlay under "Assistance to DRDA under DPAP" will be Rs.700 lakhs during 2004-05. This programme is being implemented through DRDA at the district level and by the Agriculture Department at the State level.

3.11 Integrated Wasteland Development Programme (IWDP)

The IWDP is being implemented since 1993-94 in non-DPAP blocks. This project aims at developing non-forest wasteland adopting watershed approach. The unit cost was set at Rs.6000/- per ha. with effect from 1.4.2000. It is a project funded through 100 per cent grant by Government of India. Expenditure of the scheme is shared between Government of India and State Government on a 11:1 basis.

So far Government of India sanctioned 41 projects for implementation between 1993-94 and 2003-04. II districts had been prioritized for developing wasteland at a cost of Rs.3300 lakhs covering an area of 55053 ha. during the period from 2003-04 to 2007-08. Districts selected are Coimbatore, Dharmapuri, Dindigu.J, Kancheepufam, Madurai (west), Ramanathapuram, Salem, Tiruvallur, Thiruvannamalai and Villupuram (west). Following the 73rd Constitutional Amendment, the Village Panchayat is being given more responsibility in implementing the IWDP. With effect from 2003-04 'Hariyali' guidelines are being followed for taking up new area development activities under DPAP and IWDP. The salient features of 'Hariyali' guidelines are that funds are being routed through the Presidents of Grama Panchayats, who are directly responsible for the implementation of the programme.

3.12 Provision of Infrastructural Facilities in Tribal Blocks

3.12.1 The objectives

- To assist the ST families to cross the poverty line with special emphasis on improving
- Agriculture, irrigation and education in tribal areas and
- To provide basic infrastructure facilities for better living conditions. An amount of Rs.51.23 lakhs has been provided under budget estimate for 2004-05

3.13 Community Welfare Development Programme

3.13.1 Clean Village Campaign

The clean village campaign programme encompasses all activities for environmental sanitation and protection such as management of solid and liquid waste including human and animal excreta, effective implementation of ban on plastics including collection and disposal of plastics, water conservation and rain water harvesting, conversion of bio-degradable waste into vermicompost through community participation. The major objectives of this campaign are:

- To raise awareness of the community and the adverse consequences of current open defecation practices;

- To recognize the needs of different categories of people and promote sanitation needs of specific groups like children, women and adolescents, aged people, disabled etc.
- To promote environmental sanitation in all institutions like anganwadies; schools, health centres, public places etc.
- To develop and promote technology options for different geographic locations and conditions of water availability, depth of water table etc.
- To promote the hygienic behaviour through change in knowledge, attitude practices and skills for improving environmental sanitations;
- To empower the community and local governments in planning, implementation and strengthening their managerial capacity and responsibility on all aspects of environmental sanitation
- To enable networking, coordination and better convergence of various agencies and groups working in the sector with a view to optimizing efficiency of implementation and ensuring sustainability of systems.

A State Level Rural Sanitation Society has been formed to coordinate and direct the Clean Village Campaign programme and it will be linked with UNICEF sanitation programme. A sum of Rs.75 lakhs is provided for this purpose in the Budget Estimate, 2004-05.

3.13. 2 Frame-work of Panchayat Raj Institutions (PRIs)

For effective implementation of all the welfare programmes of the Government, decentralized planning is essential. Decentralized planning and grass root participation pivot on the strength and dynamism of the PRIs. With a view to provide constitutional status to local self Government to impart certainty, continuity and strength, for devolution of powers to local bodies and for allotment of adequate resources were taken into account while the 73rd and 74th amendments to the constitution of India were carried out in 1992.

In Tamil Nadu, there are 12618 village panchayats functioning of which 60 per cent have a population size of 1000-2000. About 20 per cent of the village panchayats have 2000-5000 population.

A total number of 385 panchayat unions in the State are distributed in 29 districts. Villupuram district has the (22) largest number of panchayat unions and Nilgiris has the lowest (4) number of panchayat unions.

Table 3.4 No. of Panchayats as on 2003-04 by Population

Sl.No	Population	No. of Village Panchayats	% share to total
1.	Upto 500	1317	10.4
2.	500-1000		
3.	1000-2000	7628	60.5
4.	2000-5000	2473	19.6
5.	5000-10000	1113	8.8
6.	10000 above	87	0.7
	Total	12618	100.0

Source: Directorate of Rural Development

Training programmes have been proposed to the Chairpersons of the rural local bodies, covering areas like local administration, financial management, accounting procedures, constitutional provisions, Government Acts, rules, etc. to shoulder the administrative responsibilities of the bodies. These training programmes will be organised in a phased manner through SIRD and RETCs. An amount of Rs.65.73 lakhs including Central share of Rs.15.73 lakhs have been provided during 2004-05.

3.13.3 Finances of the Village Panchayats

Following the enactment of Tamil Nadu Panchayat Act 1994, two State Finance Commissions were constituted. These two Commissions had assessed the development that had so far occurred at the village level, identified gaps in developmental needs and recommended devolution of funds to the PRI to fill the gap between the total requirements and actual availability of funds. The Third State Finance Commission to study the financial position of the rural and urban PRIs as of 31.3.2005 in harmony with Article 243 of the Constitution and Section 198(I) of Tamil Nadu Panchayats Act 1994 has been formed.

The Terms and Reference of the 3rd State Finance Commission cover the entire gamut of issues ranging from collection of user charges for services rendered to governing principles in the distribution of finances between the State Government and PRIs. It will focus on the enhancement of efficiency in the functioning of the PRI and demarcation of functions of the State Government and that of the local body at the existing levels of delegation of administrative power: dimension of the debt-servicing burden of the local bodies etc.

Pool 'A' and Pool 'B' are two categories to which the State Finance Commission grant has been devolved. Pool 'A' category includes surcharge on stamp duty, local cess and local cess discharge, seignior age fees on minor minerals and 90 per cent of entertainment tax based on place of origin. Pool 'B' category forms all State taxes except entertainment tax. Under Pool 'B', 8 per cent of total tax available excluding entertainment tax is divisible as grant to Local Bodies (87%) and reserve, equalization and incentive fund (13%). Rural and Urban Local Bodies share the grant on 58:42 rates. Similarly reserve, equalization and incentive fund is also shared on the same ratio. Funds set up part for rural Local Bodies is shared on the ratio of 47:45:8 between Village Panchayats, Panchayat Unions and District Panchayats respectively.

Further more, the Eleventh Finance Commission Grant has also been devolved to rural panchayats to meet the cost of maintaining civic services including primary education, primary health care, safe and potable drinking water, street lighting, sanitation including drainage and scavenging facilities etc.

The quantum of resources accruable to Village Panchayats under Pool' A' category is influenced by interplay of factors such as location of Panchayats abutting urban centres, hub of services activities, robust performance of agriculture and small scale industry. Government establishments drive and initiative of the Panchayat Presidents in collection of property tax, water charges, voluntarily forthcoming of the villagers to timely pay their taxes and user charges etc.

Under pool-A total revenue stood at Rs.146.61 crores against Rs.223.49 crores in 2002-03. Surcharge on stamp duty is the single largest category under Pool-A contributing to 74 per cent of the aggregate resources in 2003-04.

Table 3.5 Distribution of Panchayat Unions & Village Panchayats by District 2004-05

Sl.No.	Name of the District	No. of Panchayat Unions	No. of Village Panchayats
1	2	3	4
1	Kancheepuram	13	648
2	Tiruvallur	14	539
3	Vellore	20	753
4	Tiruvannamalai	18	860
5	Cuddalore	13	681
6	Villupuram	22	1104
7	Dharmapuri	8	251
8	Krishnagiri	10	337
9	Salem	20	385
10	Namakkal	15	331
11	Erode	20	343
12	Coimbatore	19	389
13	The Nilgiris	4	35
14	Thanjavur	14	589
15	Nagapattinam	11	434
16	Tiruvarur	10	430
17	Tiruchirapalli	14	408
18	Karur	8	158
19	Perambalur	10	322
20	Pudukkottai	13	498
21	Madurai	13	431
22	Theni	8	130
23	Dindigul	14	306
24	Ramanathapuram	11	429
25	Sivagangai	12	445
26	Virudhunagar	11	450
27	Tirunelveli	19	425
28	Tuticorin	12	408

29	Kanniyakumari	9	99
	Total	385	12618

Source: Directorate of Rural development

3.14 Rural Poverty Profile

Poverty reduction has been a major goal of development policy. Thanks to implementation of wage and self-employment poverty alleviation programmes, the ratio of poverty has been on the wane over time. The proportion of people below the poverty line in rural Tamil Nadu, which was at 57.43 in 1973-74 declined 32.48 in 1993-94 and further to 20.55 in 1999-2000. The corresponding tall noticed in urban areas was from 49.40 to 39.77 per cent and 22.11 per cent respectively.

Table 3.6 Trends in Incidence of Poverty in Tamil Nadu

<i>Year</i>	(In percentage)		
	Rural	Urban	Combined
1973-74	57.43	49.40	54.94
1977-78	57.68	48.69	54.79
1983	53.99	46.96	51.66
1987-88	45.80	38.64	43.39
1993-94	32.48	39.77	35.03
1999-2000	20.55	22.11	21.12

Source: Union Planning Commission

For the purpose of providing assistance under the poverty alleviation programmes, the Ministry of Rural Development has been periodically conducting survey/Census at the beginning of each Five Year Plan. However, there were discrepancies between survey results and the State estimates of poverty. Therefore to rectify this lacuna, multiple criteria using qualitative parameters like household occupation, housing condition, number of earners, asset condition had been taken to calculate the poverty line.

In terms of Government of India guidelines, the State Government conducted the BPL Census 2002 as per the recommendations of the Report of the Expert Group on Identification of Households Below Poverty Line. A normative approach for identification of the rural poor was adopted by introducing a "score-based, ranking" based on relative deprivations revealed by certain socio-economic indicators in contrast to the 'income' and 'expenditure' approach adopted in the BPL Census, 1992 & 1997 respectively. The Methodology takes into account 13 scorable socio-economic parameters including operational holding of land, housing, clothing, food, security, sanitation, ownership of consumer durables, literacy, labour force, means of livelihood, status of children, type of indebtedness, migration and the nature of assistance preferred. The Survey was conducted using a Questionnaire Form having Basic Information about the individual household in Part A and Identification and sub-categorization of the household in the Part B Section.

The profile of household gives the basic information about educational status, average monthly income of the household, type of operational holding of land, availability of land for house construction and access to drinking water supply. Besides these the social status of the

family is identified and probed whether the family is a beneficiary of any of the Government Welfare Schemes, The questionnaire further helps to collect information on the participation of family members in SHG activity and the family was listed under BPL category during the last survey. The Part II of the questionnaire identifies sub-categorization of poor using thirteen scorable socio-economic parameters given in Part II - Statistical Tables of this document. Each of the indicators have "0" marks to "4" marks, Thus for the 13 parameters, the total marks will vary from 0-52 marks. From the above Score Based Ranking, the households have been classified into "Poor" and "non-poor".

Given the methodological problems and other operational constraints the Government has crafted an ambitious project viz., Tamil Nadu Empowerment and Poverty Reduction Project (TNEPRP) with the objective of effecting a significant reduction in the level of poverty, empowering the vulnerable section of the society and improving livelihood security. It intends to supplement the on-going intervention in poverty alleviation and also build upon the success and develop new strategies. A beginning has been made with the implementation of Puduvazhvu Thittam targeting 25 most poor (ultra poor) families in each village panchayats of Tamil Nadu.

The challenges involved in Rural Development are being resolutely tackled by a combination of good governance, aimed at effective implementation of programmes by ensuring synergy through convergence approach, people's participation and above all endeavoring to make rural development all inclusive.

Table 3.7 Performance of Important Schemes during 2003-04

Sl. No	Name of the Scheme 2003-04	Objective s of the Scheme	Employment Generated	Achievement	
				Physical	Financial
(1)	(2)	(3)	(4)	(5)	(6)
I. Rural Shelter Scheme:					
1.	Indira Awaas Yojana (IAY) (New Houses)	To Provide free houses to the houseless families below poverty line in rural areas.		37488	100.42
2.	Upgradation of Unserviceable Kutcha Houses	Upgradation of Kutcha houses of families living below poverty line		19581	19.40
3.	Innovative Scheme for Rural housing and Habitat Development	To popularise low cost technology and usage of locally available materials in construction of buildings in rural areas		3 projects	65.84
4.	Pradhan Mantri Gramodaya Yojana (Rural	To provide shelter, primary education, primary health, nutrition, water and electrification in rural areas		6477	19.52

	Shelter)				
II	Pradhan Mantri Gram Sadak Yojana (PMGSY)	To give connectivity with all weather roads to all unconnected rural habitations with population above 500 by 2007		50.76 kms.	43.370
III	Swarnajayanti Gram Swarozgar Yojana (SGSY)	To provide sustainable income to the rural poor who are below poverty line by organizing them into SHGs. Training them for vocation and providing them credit linkage with financial institutions		37607 SHG formed 60048 women. 1259 physically handicapped 23574 SC and 1858 ST benefited	
IV	Sampoorna Grameen Rozgar Yojana (SGRY) Stream I	The primary objective of the scheme is to provide additional wage employment in rural areas and thereby provide food security and improve nutritional needs	265.194 lakh mandays	105128	171.07
(1)	(2)	(3)	(4)	(5)	(6)
	Sampoorna Grameen Rozgar Yojana (SGRY) Stream II	The primary objective of the scheme is to provide additional wage employment in rural areas and thereby provide food security and improve nutritional needs	246.877 lakh mandays	48718	164.95
V	Member of Parliament Local Area Development Programme (MPLAD)	To take up developmental works identified by the concerned MP		5602	115.45
VI	Restructured Central Rural Sanitation Programme (RCRSP)	The programme envisages a demand driven approach with greater public participation and more emphasis give for IEC activities to create awareness among the rural masses		451701	43.58
VII	National Programme of Improved chulas	To present deforestation of minor forest product for fuel to climate hazards to improve health and		15000 chulas	0.150

		hygiene of women to reduce drudgery in collection of fuel materials and in cooking			
VIII	National Programme of Biogas	To promote eco-friendly Non-conventional Energy Source with multi benefits like prevention of deforestation production of enriched manure and to improve sanitation hygiene		2000 biogas plants	0.620

Note: i. Criteria adopted for selection is a need based and priority wise

ii. In respect of SGSY it is open to all (preference to RPL) that are willing to do manual work in minimum wages

3.15 HYDROLOGY PROJECT - I

The World Bank have come forward to assist five Government of India agencies viz CGWB, IMD, CWC, NIH and CWPRS, and nine states viz., Gujarat, Maharashtra, Karnataka, Kerala, Tamilnadu, Andhra pradesh, Orissa, Madhyapradesh and Chattisgarh in the formation & execution of Hydrology Project-I.

This project is intended to assist the Government of India agencies and the participating states setting up of a reliable and well designed network for collection, transmission, processing, storage and dissemination of data covering Surface water and Ground water both in terms of quantity & quality.

- Agreement was signed between the World Bank and the Government of Tamil Nadu on 22.9.1995
- Project has become operative from 21.12.95 for a period of 8 years i.e., up to 31.12.2003

3.15.1 Integrated Data Center For Surface Water And Ground Water - Activities:

The project can be broadly classified into two components viz., Surface water component and Groundwater component.

(i) Surface Water Components

- Collection of flow data from Gauging Stations in various river courses.
- Collection of storage data from major tanks by installing Automatic Water level Recorders.
- Monitoring of return / regenerated flows in select command areas and measurement of flow into sea.

- Surface water sampling locations have been designed for all river basins in Tamil Nadu and samples are being collected once in a month during flow period to assess the surface water quality.
- Collection of Hydro meteorological data from rain gauge stations, full climatic stations and automatic weather stations.
- Collection of data on reservoir sedimentation and water quality data by establishing level - I water quality laboratories and silt laboratories.
- Improvement of infrastructure facilities - Office buildings, Site stores & Quarters etc.,
- Creation of database in the dedicated hydrological surface data processing software Viz., HYMOS.
- Exchange of information within the State and Central Organization through the State Data Storage Centre.
- The data are collected and primary validated in the sub-divisional data processing centre and are secondary validated in the divisional data processing centre before sending to state data processing centre.
- Inter agency validation of data are done with India Meteorological Department and Central Water Commission.

(ii) Ground Water Components

- Collection of water level data from the existing 1746 observation wells.
- Construction of 690 piezometers in the hard rock areas and 162 piezometers in the sedimentary formations and collection of water levels from digital water level recorders installed under HP.
- Validation of water level data in three stages:
 - i. Primary Validation at Divisional Data Processing Centre.
 - ii. Secondary validation at Regional (Circle) Data Processing Centre.
 - iii. Integrated Hydrological validation at State Data Processing Centre.
- Creation of District wise database in Groundwater Data Entry Software (GWDES) at SDPC.
- Upgradation of four water quality laboratories with new building and sophisticated equipments to analyze more pollution parameters.
- Exchange of information within the State and Central Organization through the State Data Storage Centre.

(iii) Water Quality

- About 3400 ground water samples are being collected from shallow observation wells and bore wells. Surface water samples in all the 17 river basins are also monitored in 71 locations. The samples are tested for the suitability of domestic, agriculture and industrial purposes.
- To carry out the above study four laboratories are functioning at Chennai, Trichy, Madurai and Pollachi. All the above Laboratories are recognized under EPA (1986) by the Central Pollution Control Board (CPCB) Delhi.
- The laboratories are having the facilities to analyze General Parameters, Pollution Parameters in addition to the Bacteria analysis

- The Chennai Laboratory is having the facility to analyze pesticide and toxic metals. The presence of toxic metals and pesticides in Ground and surface water are also being studied by this Wing.
- Ground Water quality data are also available from 1972 onwards.
- For general public and other Departments water samples are analysed at prescribed rates.

(iv) Data Storage Centre

- Stores and administers the storage of all field and processed hydrological data collected in the State.
- Makes the data available to authorized Hydrological data users.
- Maintains HIS-catalogue of all data stored in its own database and those stored in the data bases of other States and of the Central Agencies.

(v) Creation of GIS Data sets under Hydrology Project - I.

Spatial database is organized with 15' by 15' geographic area, corresponding to Survey of India toposheet of scale 1:50,000. These digital data sets are of high quality following the Quality Checking / Quality Assurance test strategies proposed by the World Bank.

The following themes are generated digitally on 1:50,000 scale toposheet wise pertaining to Tamil Nadu.

1. Land use/cover
2. Soil
3. Geology & Structure
4. Geomorphology
5. Administrative boundary upto block
6. Hydrologic boundary upto water shed
7. Settlement upto village
8. Drainage
9. Transport network
10. Elevation Contours and spot heights.

Tamil Nadu State is covered in 228 toposheets. All the GIS data sets will be available for various spatial analysis and queries that are related to Hydrology and water resources planning.

4 BASELINE ENVIRONMENTAL AND SOCIAL INFORMATION

Tamil Nadu, the Southern State of the Indian peninsula is spread over 1,30,058 km² and lies between 08° 05" N and 13° 35" N and 76° 15" E and 80° 20" E. It is surrounded by the States of Andhra Pradesh in the north, Kerala in the west, Karnataka on the Northwest, Indian Ocean on the south and the Bay of Bengal on the east. The Eastern and Western ghats of India meet in Tamil Nadu and run along its eastern and western borders. The famous hill stations of Tamil Nadu like Udhagamandalam, Kodaikanal, Kothagiri and Yercaud are situated in this region.

4.1 Demography

The growth in human population over the years has had both the positive and negative impact on overall quality of environment. As the demand for energy has increased the potential for electrical energy production has also been tapped to a great extent. Apart from that we have also realized the importance of non-conventional energy sources to minimize the pressure on the conventional energy sources. Growth in population has led to the enhanced growth in tourism. It is now considered to be one of the fastest growing industries in TamilNadu. The ever-increasing population migration leads to the problem of urbanization and human settlement. Urbanization is an inevitable challenge, which has to be faced and handled properly in the right perspective. The sanitation facilities, hygiene, sewerage, water supply and above all, proliferation of slums are the important concerns.

As per 2001 census, the population of Tamil Nadu is 62405679 and the sex ratio is 987. The sex ratio of children in Tamilnadu is 942. The density of population is 480 persons/sq.km. The percentage of scheduled castes in the state is 19 and that of scheduled tribes is 1.04. The percentage of literacy is 73.45 in TamilNadu. The total birth rate per 1000 is 18.3 and death rate is 7.6

District wise population details are given in annexure. The details of population in rural and urban areas of TamilNadu are given in the table below:

Table 4.1 Total Population of Tamil Nadu

	Total Population	Male Population	Female Population	Sex Ratio	Area	Density
Total	62405679	31400909	31004770	987	130058.00	479.83
Rural	34921681	17531494	17390187	992	117532.75	297.12
Urban	27483998	13869415	13614583	982	12525.25	2194.29

Table 4.2 Total Child Population of Tamil Nadu

	Total Children (Age 0-6)	Male Children (Age 0-6)	Female Children (Age 0-6)	Child Sex Ratio (Age 0-6)	Area	Density
Total	7235160	3725616	3509544	942	130058.00	479.83
Rural	4232644	2189995	2042649	933	117532.75	297.12
Urban	3002516	1535621	1466895	955	12525.25	2194.29

Table 4.3 Total SC Population of Tamil Nadu

	Total Scheduled Castes	Male Scheduled Castes	Female Scheduled Castes	Sex Ratio SC	Area	Density
Total	11857504	5932925	5924579	999	130058.00	479.83
Rural	8308890	4159182	4149708	998	117532.75	297.12
Urban	3548614	1773743	1774871	1001	12525.25	2194.29

Table 4.4 Total ST Population of Tamil Nadu

	Total Scheduled Tribes	Female Scheduled Tribes	Male Scheduled Tribes	Sex Ratio ST	Area	Density
Total	651321	322404	328917	980	130058.00	479.83
Rural	551143	272397	278746	977	117532.75	297.12
Urban	100178	50007	50171	997	12525.25	2194.29

Table 4.5 Literacy rate in Tamil Nadu

	Total Literates	Male Literates	Female Literates	Literacy Rate	Area	Density
Total	40524545	22809662	17714883	73.45	130058.00	479.83
Rural	20319498	11835689	8483809	66.21	117532.75	297.12
Urban	20205047	10973973	9231074	82.53	12525.25	2194.29

Source:2001 Census of Tamil Nadu

4.1.1 Working population

The working population of Tamil Nadu, 24.2 million in 1991, had increased to 27.8 million in 2001. However, statistics reveal that the proportion of workers to the total population had actually declined during the 40-year period of 1961-2001 from 45.7 per cent to 44.8 per cent, though there was an upward trend between 1981 and 2001, from 41.7 per cent to 44.8 per cent. What is disturbing is that the number of marginal workers increased from 1.4 million in 1991 to 4.1 million in 2001. This implies that the increase in the worker participation rate (WPR) was the result of an increasing number of marginal workers rather than main workers. The higher rate of worker participation in the rural areas, as compared to the urban areas, has been a disquieting trend, though the urban WPR accelerated at a faster rate when compared to the rural WPR during the period 1981-2001. A positive feature was that female WPRs, in both rural and urban areas, increased at a faster rate than male WPRs with the result that total female workers increased from 31.4 per cent in 1981 to 34.7 per cent in 1991.

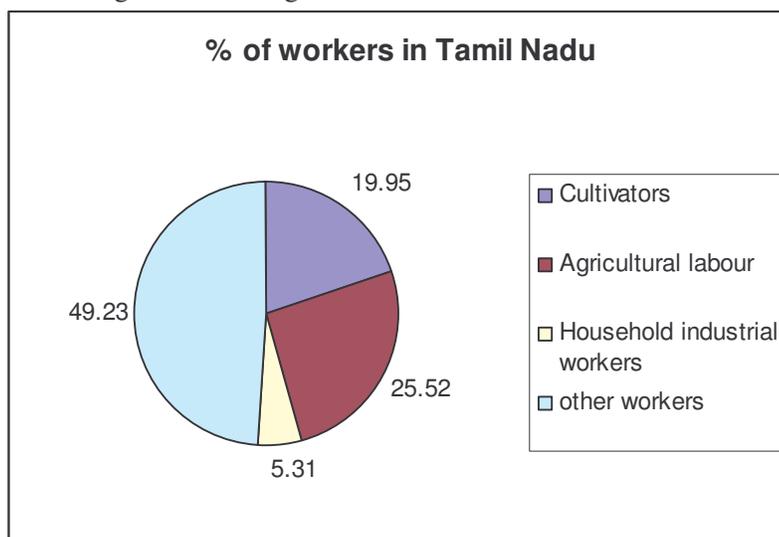
A salient point in the development of Tamil Nadu is that child labour has shown declining trends as the State's efforts in various social sector programmes have borne fruit.

Programmes such as mid day meals, incentives for school enrolment, free school uniforms, free bus passes, girl child development schemes and marriage assistance have made it possible for children to avoid entering the labour market. An accelerated growth rate of per capita income has enabled some households to withdraw the younger age group earners from working.

The total work participation rate in the State is 44.67. 19% are main cultivators, 25% are agricultural labour, 5% are in household industries while 49% are other workers.

Fig 4.1 gives the percentage of workers in Tamil Nadu.

Fig 4.1 Percentage of workers in TamilNadu



Source:2001 Census of Tamil Nadu

4.2 Tamil Nadu Human Development Report

The Tamil Nadu Human Development Report is important as it provides insights into the process of development in a State characterised by heavy industrialisation, urbanisation, better growth rates and poverty levels which are below the national average. It not only identifies problem areas, it also assesses the successes of Tamil Nadu, especially in the areas of women's empowerment and social development. Based on a candid appreciation of the ground reality, the document highlights the future thrust areas for the government and civil society in the State. While this Report examines the HDI in Tamil Nadu, it goes beyond the HDI in order to investigate the overall human development situation in the State. The Report recognises that the HDI too is "limiting" in the sense that other dimensions of human development, such as shelter, social security and decision-making etc. that are also important for increasing overall well being, are not necessarily captured by the HDI. This Report not only serves as a summary of the human development scenario in Tamil Nadu, but also seeks explanations as to why the State has fared well in certain areas but not in others. Factors contributing to human development are disaggregated and analysed at the district level with a view to understanding the regional disparities and the reasons behind them. The Report also highlights the policy interventions that are required to correct such imbalances. There is no doubt that in the years to come, the Tamil Nadu HDR will become an important tool in planning for growth, social justice and equity in the State.

4.2.1 Status of Human Development in Tamil Nadu

Tamil Nadu's HDI (2001) was 0.657 as compared to 0.571 for India. It is also well placed in the South Asian context and fares better than some of the neighboring countries of India. According to the Planning Commission, Tamil Nadu ranks third among the 15 major States of India, though on few specific indicators it lags behind some States. Within Tamil Nadu there are gaps and variations in the inter-district HDI, but its level of achievement suggests that high standards of literacy and health can be reached despite low per capita income. Even so, improvement of income levels would ensure improved literacy and health status.

Table 4.6: District-wise HDI and GDI values, 2001

District	HDI value	GDI value
Chennai	0.757	0.766
Kancheepuram	0.712	0.710
Thiruvallur	0.654	0.651
Cuddalore	0.644	0.643
Villupuram	0.587	0.582
Vellore	0.658	0.655
Tiruvannamalia	0.612	0.608
Salem	0.626	0.625
Namakkal	0.636	0.631
Dharmapuri	0.584	0.582
Erode	0.658	0.656
Coimbatore	0.699	0.697
Nilgiris	0.685	0.686
Tiruchirapalli	0.671	0.671
Karur	0.647	0.641
Perambalur	0.596	0.592
Thanjavur	0.630	0.629

GDI is important for comparing the stages of gender development and to assess the extent of gender equality. In this area, Tamil Nadu's achievement is better than the attainment of the country as a whole, while within the State there is a symbiotic correlation between human development and gender development indices. This reinforces the view that human development is not an end in itself; rather it is necessary to create an overall improvement in the condition of the people.

4.3 Climate

The maximum and minimum temperatures in the plains is 42.8⁰ C and 12.0⁰ C respectively and that of the hill stations is 33.5⁰ C and 4.6⁰ C respectively. The average annual rainfall in the State is 961.8 mm.

The state benefits from northeast monsoon rains (October–December), unlike other parts of India, where southwest monsoons (June–September) bring more rain. In Tamilnadu, 85% of the total area benefits from the northeast monsoon; only 15% benefits from the southwest monsoon.

4.4 Water resources

Water is the most important resource for the livelihood of the human beings. Tamil Nadu is water deficient state despite receiving approximately 950 mm of rainfall per year. Tamil Nadu has number of seasonal rivers. The surface water resources are almost fully harnessed by impounding the available water in 61 major reservoirs and also in 39,202 big and small tanks. As per the estimates, 60% of the ground water resources have also been utilized. So the management of available water resources on a sustainable basis becomes quite imperative.

There are 17 river basin groups in Tamil Nadu, a majority of which are water stressed. There are 61 major reservoirs, about 40,000 tanks and about 3.0 million wells that heavily utilize the available surface water (17.5 BCM). Agriculture is the single largest consumer of water in the state, using 75% of the states water. Irrigation through a combination of canals, wells and tanks increases the reliability and availability of water for farming and is essential for cultivating crops in much of the state. About 30% of the net irrigated area is watered by canals, 21% by tanks and 49% is fed by wells. The remaining area is irrigated by other sources such as streams and springs. Rainfed agriculture employing about 25% of farmers accounts for 46% of the net sown area of 5.5 million hectares. The per capita availability of water resources in Tamil Nadu is 900 cubic meters a year as against 2200 cubic meters for all India.

4.5 Forest Cover

In Tamil Nadu 17.5% of the area is covered under forest out of which a sizeable area is under degraded condition. Tamil Nadu is extremely rich in biodiversity but adequate attention has not been paid in the past to assess it effectively; as a result many species have become endangered.

Tamil Nadu is rich in flora and fauna and some of its major wildlife sanctuaries like Mudumalai, Anaimalai (Indira Gandhi W.S), Madras Crocodile Bank trust, Guindy national park, etc, are situated in the hills of the Western ghats providing home to elephants, tigers, bisons and a variety of monkeys and deers. There are more than 3000 plant species found in Tamil Nadu, out of which a majority are found in the mixed deciduous forests of this region

4.6 Wetlands

In Tamilnadu, we have utilized more than 90% of the available surface water and more than 60% of the available ground water. Since Independence, many dams have been

constructed to utilize the surface water and further development is almost nil. The recent studies indicate that irrigation through tanks is decreasing and irrigation through wells increasing. Drinking water source for most of the cities in Tamilnadu is from rivers, lakes and tanks. In olden days, the local people maintained these water bodies, which has diminished over the past few decades resulting in their dismal conditions. Presently people have started looking to the government for assistance. The wetland details are given in the following table:

Table 4.7 Wetlands of Tamil Nadu

Total number of water bodies	39,202
Panchayat Union tanks	20,413
Public Works Department tanks	8,903
Ex-Zamin tanks	9,886
Length of rivers and canals	7,420 kms
Area of reservoirs	52,000 ha
Area of tanks and ponds	6,92,000 ha.
Area comprising brackish water (5,600 places)	400 ha.
Area under mangroves	21 sq. km.

4.7 Agriculture

43% of Tamil Nadu's geographical area is under agriculture with a per capita figure of 0.0982 ha. of agricultural land. While agriculture and allied sectors account for nearly 62% of the total employment of the state, their contribution to economy is only 22%. In order to increase the productivity we have relied too much on improved crop varieties, fertilizers and pesticides. The residues of these have affected soil structure and polluted the water through leaching. India is the leader in fruit production in the world. The horticulture and plantation crops occupy a total of 7,53,985 ha. of area. However, there is need to improve the productivity of these crops on sustainable basis without affecting the overall land and water environment

The principal food and non-food crops such as paddy, millets, pulses and oilseeds, cotton and sugarcane are being cultivated in the State. Paddy, a staple food crop, is grown extensively in the rice bowl districts viz. Thanjavur, Thiruvarur and Nagapattinam. Agriculture which suffered extensively during 2001 – 02, 2002 – 03, 2003 – 04 due to severe drought, experienced an appreciable revival fortunes during 2004 – 05. There was improvement in the area, production and productivity of various crops during 2004 – 05. The area production and yield rate of principal crops are given in the table below:

Table 4.8 Area Production and Yield Rate of Principal Crops

Crops	Area (Lakh ha)			Production (Lakh tones)			Yield Rate(Kgs./ba.)		
	2002-03	2003-04	2004-05 (FFE)	2002-03	2003-04	2004-05 (FFE)	2002-03	2003-04	2004-05 (FFE)
Paddy	15.17	13.97	19.09	35.77	32.23	53.02	2359	2308	2777
Millets	7.12	9.03	9.70	6.83	8.88	11.35	958	983	1170
Pulses	5.63	5.37	5.76	2.00	2.01	2.29	356	375	397
Food Grains	27.92	28.37	34.55	44.60	43.12	66.66	1598	1520	1929
Oil Seeds	5.92	6.95	8.22	7.60	9.64	13.20	1284	1387	1606
Cotton	0.76	0.98	1.43	0.84	1.23	2.18	188	213	259
Sugarcanes	2.61	1.92	2.32	24.17	17.66	23.40	9244	9192	10086

Source: Directorate of Economics and Statistics, Chennai-6

Anticipating a favorable situation, the target proposed for 2005-06 is given in the table below:

Table 4.9 Proposed productions for 2005-06

Sl. No.	Crops	Area (L.Ha.)	Production (L.MT)
1	Rice	20.00	78.00
2	Millets	11.00	15.51
3	Pulses	8.00	3.76
	Total Food-grains	39.00	97.27
4	Cotton (L.bales)	2.50	5.85
5	Sugarcane (Gur)	3.00	36.40
6	Oilseeds	10.50	18.59

The agricultural performance of the state is given in the Table below. (Kg per ha.)

Table 4.10 Agricultural performance of Tamil Nadu

Crop	Average Yield		Highest yield in India	Tamil Nadu's place
	India	Tamil Nadu		

Rice	1804	3350	3510 (Punjab)	Second
Jowar (Cholam)	769	962	962 (Tamil Nadu)	First
Bajra (Cumbu)	610	1348	1348 (Tamil Nadu)	First
Redgram	616	710	1301 (Bihar)	Fourth
Total Food- grains	1562	2238	3830 (Punjab)	Fourth
Total Oilseeds	710	1611	1611 (Tamil Nadu)	First
Groundnut	733	1784	1784 (Tamil Nadu)	First
Cotton	193	305	410 (Punjab)	Third
Sugarcane	6456 2	10677 8	106778 (Tamil Nadu)	First
Source: Agricultural Statistics at a glance 2004 - Agrl. Statistics Division - GOI				

4.7.1 Agriculture as major employment provider

Agriculture continues to be the main stay for rural workers. Despite an absolute reduction in farm employment over the years, there is increase in the share of both male and female employment in agriculture crop production during the post-reform period compared to the pre-reform period in Tamil Nadu. While share of male employment in field crop production activities rose to 91 per cent from 88 per cent that of rural women employment in the same activity rose to 85.4 per cent from 83 per cent. In terms of employment absorption livestock activity followed with a share of 8.7 per cent for women employment. At the all India level there was relative stability during both periods. The share obtaining for crop production activity was 84 per cent and livestock 12 per cent in respect of female employment.

It is evident that there is excessive dependence of rural workers on field crop production sector. The employment in field crop production in Tamil Nadu accounted for as high as 89.84 per cent and 89.52 per cent at All India. Although the excessive dependence on field crop production sector continued till the end of the nineties considerable restructuring of agriculture employment overtook in a number of States induced partly by shifts in domestic demand and partly by the opportunities thrown upon by the open economic regime

The growth of employment in agriculture oscillated over from being positive in 1983-94 to negative during 1993-00 in Tamil Nadu. The growth rates of employment (crop sector) in respect of field crop production for two sub-periods: 1983/1993-94 and 1993-94/1999-2000 was from 0.57 per cent to (-) 1.30 per cent in Tamil Nadu. Employment growth in non-crop segments (plantations, livestock and fishing) has shown fluctuation. The rate of growth of employment of rural workers in the plantation sub-sector witnessed a decline from 5.68 per cent in 1983-94 to (-) 1.02 per cent during 1993-00 in Tamil Nadu.

The labour-absorptive capacity of agriculture as a whole is under stress due to declining land man ratio, increasing marginalization of holdings, labour-saving cropping pattern of adjustments, increasing mechanization of field crop operations, increasing threat to domestic agriculture through open door trade policy etc. need to be reiterated. In particular, the employment in the non-farm sectors in majority of the States has witnessed varying degree of improvements in transport, storage – communications, construction and manufacturing (agro-based). However, the pace of rural non-farm employment expansion has failed to compensate the sluggish labour absorptive capacity of agriculture. Thus, the all-round setback in the non-farm sector is a matter of worry as it provides a major share of employment in rural economy. All accelerated pace of agricultural growth is the surest way of augmenting the pace of agricultural employment expansion.

The strategies of the Government to achieve the goal in Agricultural sector are as follows:

- Adoption of alternative cropping strategies derived for agro-climatic zone based cropping pattern evolved by TNAU to raise remunerative crops and to ensure maximum utilization of available land and water aiming to increase cropping intensity
- As a part of Alternative Cropping Strategy, cultivation of Jatropha, Sugar beet and Sweet sorghum are aiming at, as announced by the Hon'ble Chief Minister on Contract farming basis through approved Industrial entrepreneurs for the production of Ethanol and Bio diesel. These crops are highly remunerative and can be grown in moderately fertile lands with comparatively less water
- Taking up cultivation in vast tract of waste lands through Massive Comprehensive Waste Land Development programme as announced by the Hon'ble Chief Minister
- Much emphasis on dry land development integrating Watershed Development and Waste land Development programme
- Adoption of dry land development technologies and crop production technologies for dry land crops to step up the productivity
- Identification and promotion of relevant technologies to bridge the gap between the potential yield and actual yield of major crops
- Speedy transfer of technologies to the farming community through ICT (Information and Communication Technology)
- Conduct of Seminars, Workshops and Intensive Pre-season campaigns involving line Departments to enthuse and assist farmers to harvest good crops and to get good profit
- Efforts to provide technologies and advice on Agriculture, Horticulture soil and moisture conservation, Animal Husbandry etc., under one roof
- Introduction of Contract farming system for Maize, Oilseeds, Pulses and Cotton in potential districts with assured buy back arrangements at pre-announced price or prevailing market price if it is high. The main objective of the programme is to ensure expansion of area under these crops and to motivate farmers especially SF / MF farmers to get assured remunerative price for the produce

- Ensure availability of quality seeds on enhanced SRR through Public Private Partnership
- Massive adoption of integrated nutrient management and integrated pest management technology with emphasis on eco friendly Agriculture Development
- Much focus on restoration of soil through organic farming approach and to promote vermicomposting, compost making through plueorotus, green manuring etc
- Efforts to provide site specific macro and micro nutrient recommendations on the basis of soil test village wise fertility Index
- Promotion of micro irrigation to maximize water use efficiency
- Empowerment of women by revitalizing TANWA groups.

4.7.2 Agricultural Marketing in Tamil Nadu

Empowerment of farmers through what is called disintermediation in other words, eliminating the middlemen, common agents in marketing agricultural produce is essential. Because of revolution in Information and Communication Technology, E-commerce has been gaining momentum. Agricultural marketing is the process of encompassing all the steps involved from the producer to consumer including pre-and-post harvest processes such as assembling, grading, storage, transportation and distribution. Promotion of standardization and grading of agriculture products is the main function under institutionalized agricultural marketing. An effective quality control mechanism is imperative for improving the marketability of products.

Demand influences the prices of agricultural produce to a great extent rather than supply conditions since market period is very short. As a result, farmers become more vulnerable to price fluctuations. Therefore, farmers need easy access to well-built market network on a regular basis to secure better price for their produce.

In order to market agricultural produce, the Market Committee Act 1959 was amended as the Tamil Nadu Agricultural Marketing (Regulation) Act 1987. It was brought into force from 1.2.1991. At present there are 20 Market Committees with 273 Regulated Markets and 15 sub-markets covering the entire State except Chennai and Nilgiris districts. The strategy is to enable the farmers to realize a remunerative price for the produce on one hand and on the other to enable the consumer to buy agricultural produce at reasonable prices. To promote agricultural exports from Tamil Nadu three Agri-Export Zone (AEZ) one for cut flower at Hosur, Dharmapuri district, second for flowers at Doty, Nilgiris district and third for mango in Theni and 5 other districts has been established at a total cost of Rs.65.34 crores. It is also proposed to establish a AEZ exclusively for cashew at Cuddalore district through private sector participation at a project cost of Rs.10.36 crores.

Under this marketing network, forty important agricultural commodities are brought under the fold of the Marketing Cooperatives to sell the commodities through 273 regulated markets. 96 commercial grading centres, 11 kapas grading centres, one tobacco – grading centre. Total value of agricultural produce sold by agricultural marketing cooperatives during 2004-05 was at Rs.307.26 crores which is moderately lesser than in 2003-04. Sugarcane

Table4.11 Value of Agricultural Produce Sold by Marketing Cooperatives

Sl. No.	Crop	(Rs. In crores)			
		2001-02	2002-03	2003-04	2004-05
1	Foodgrains	24.75	40.44	38.73	35.08
2	Cotton	116.71	92.51	90.43	94.59
3	Chillies	1.53	1.56	2.81	2.81
4	Coffee	-	-	-	-
5	Sugarcane gur	150.78	138.34	92.72	79.74
6	Species/spices	0.37	1.93	0.11	*
7	Oilseeds	24.62	15.11	16.09	13.06
8	Others	112.35	120.17	100.10	81.08
	Total	431.11	410.06	340.87	307.26

Source: The Registrar of Cooperatives, Chennai - 10

gur and cotton are the major commodities traded through the regulated markets.

4.8 Irrigation

Tamil Nadu with a geographical area of 130 lakh hectares is ranked eleventh in size among the Indian States. The net area sown in Tamil Nadu is about 60 lakh hectares of which about 30 lakh hectares or 50% get irrigation facilities from sources as given below: -

Canals	9.50 lakh hectares
Tanks	9.00 lakh hectares
Wells & tube wells	11.50 lakh hectares

4.8.1 Development of Irrigation in Tamil Nadu

The National Commission on Agriculture in 1976 assessed the ultimate irrigation potential of Tamil Nadu through Major and Medium Irrigation sources as 15.00 lakh hectares. At the commencement of the First Five Year Plan, (1951-1956) there were 23 Major and Medium Irrigation Projects benefiting 11.00 lakh hectares. In the IX plan period upto 2001-2002, the area under irrigation has risen to 29.72 lakh hectares.

During the 10th Five Year Plan (2002-2007) upto 2003-2004, an additional irrigation potential of 2323 hectares has been created. During 2004-2005, additional irrigation potential of 7573 hectares is expected to be created and in the year 2005-06 an irrigation potential of 5143 hectares is proposed to be created.

4.9 Tank systems

Tank systems are an integral part of Irrigated Agriculture system. The importance of controlled water supply is indispensable for the sustainability in low land paddy production, which varies enormously from region to region and country to country. What is essential is the degree of importance given to the three elements of water management namely resource management within the watershed, conveyance to the crop fields and management within farm? KVBfields. While water losses in the paddy fields are to be discouraged, they need not necessarily amount to the losses to the watershed as a whole, if they are converted into groundwater and pumped back to the surface. In India, the second largest rice producing country of the world, 80% of water is used for irrigation..

There are around 40,000 irrigation tanks in Tamilnadu, India, irrigating about 0.63 million ha of paddy fields. Whatever, the shortcoming at their creation, existing irrigation tanks remain as an asset to the sustainability of paddy agriculture in Tamilnadu, provided their live storage is not reduced and the related irrigation facilities are not deteriorated to serve the purpose. Past experiences show that availability of surface water resources are not always reliable, which has turned the paddy farmer's attention to the exploitation of ground water on a very much larger but manageable scale. The tables below describe the categorization of tanks, area irrigated by tanks in TamilNadu and the constraints in tank irrigation development.

Table 4.12 Categorization of Tanks in Tamil Nadu

Type	Command area	No. of tanks
1. In charge of Local Government		
a) rainfed small size	< 20 ha	16,477
b) rainfed medium size	20-40 ha	3,936
2. In charge of State Government		
a) rainfed tanks	> 40 ha	5,276
b) system Tanks	varying	3,627
3. Old Private Tanks		
	varying	9,886
Total		39,202

(Source: PWD)

Table 4.13 Area irrigated by different sizes of Tank in Tamil Nadu

a) < 200 ha	39,102	838,000
b) 200 – 280 ha	40	11,000
c) 280 – 400 ha	30	11,000
d) > 400 ha	30	40,000
Total	39,202	900,000

(Source: AED)

Table 4.14 Constraints in tank irrigation development and required modernization measures

Component	Category	Constraints	Modernization measures	
Tank System Facilities	Tank	Catchment Treatment	<ul style="list-style-type: none"> • Soil erosion induced reduction in tank storage and tendency for silting up at intake points 	<ul style="list-style-type: none"> • Desilting of storage area and at intake points • Conservation of catchment through soil erosion control measures such as afforestation and terracing
		Tank Bund	<ul style="list-style-type: none"> • Insufficient top width and freeboard due to soil erosion of top level. • leakage 	<ul style="list-style-type: none"> • Restoration of top width and free board. • Reinforcement of bund top and slopes with lining.
	Intake and outlet Structures	Intake works	<ul style="list-style-type: none"> • Water leakage due to damaged shutters • Broken water control facilities such as Plugs and Barrels • Broken and damaged front and rear inlets and outlets 	<ul style="list-style-type: none"> • Provision of new slide gates and shutters • Provision of new plugs, plug rods and barrels • Reconstruction of inlets and outlets.
		Surplus Weir	<ul style="list-style-type: none"> • Insufficient length • Damaged leaky body wall and eroded rear protective works 	<ul style="list-style-type: none"> • Increase of length and modifications of crest shape to increase discharges. • Reconstruction and reinforcement of damaged works.
	Supply Works	Supply Channel	<ul style="list-style-type: none"> • Reduction of design discharge as a result of silting of channel • Deterioration of stone masonry channel • Insufficient flow velocity due to weed growth • Leakage 	<ul style="list-style-type: none"> • Periodical desilting of supply channel. • Reconstruction of damaged portion and strengthening at vulnerable sites. • Cleaning of vegetation in the channel.
Irrigation System	Distribution Network	<ul style="list-style-type: none"> • Slow movement due to obstruction by vegetation growth • Heavy seepage loss • Salt injury in inundated command areas due to channel leakage 	<ul style="list-style-type: none"> • Periodical repair of channel by Water Users Association. • Lining of main distribution channel • Proper maintenance of drainage channel 	
	Operation and Management	<ul style="list-style-type: none"> • Occurrence of non irrigated area due to insufficient water control structures 	<ul style="list-style-type: none"> • Lined channel with proper regulating and diversion structures at off-take points. 	
	Irrigation management	<ul style="list-style-type: none"> • Continuous over drawl without relevance to actual need, unofficial restoring subordinating equity to vested interests, small size plot-to-plot irrigation 	<ul style="list-style-type: none"> • Irrigation scheduling based on crop water requirements, cropping pattern and effective rainfall etc., land consolidation. 	

Tank irrigation is a profitable technology in economic, environment and social terms but under present conditions of management it is deteriorating rapidly. Extent as well as reliability of this technology is decreasing. Because of potentials for additional rice cultivation for about 16 million ha under tank irrigation, it is important to select holistic improvement strategies that fully exploit the potentials of tank irrigation. In general, sustainable crop production requires better performance of these small-scale irrigation structures tanks, which needs modernization of physical structures, efficient distribution of water to and in farm fields as well as among the farmers and proper maintenance of tank system after the modernization through farmers participation.

4.10 Dam Safety

The Dam Safety Directorate was established in the year 1991 in Tamil Nadu with the object of giving assurance to safety of large dams in Tamil Nadu vide G.O. Ms No: 725 dated 18-04-91. At present there are 75 nos of PWD dams, (including 7 nos of small dams and 5 nos of drinking water supply reservoirs) and 38 nos of Tamil Nadu Electricity Board large dams.

4.10.1 Dam safety project. I

The Dam safety Assurance and Rehabilitation Project in Tamilnadu was carried out from 1991-1998 with World Bank funds. Totally, an amount of Rs.22.82 crores had been spent under the following components:

1. Institutional strengthening	Rs. 3.43 crores
2. Basic facilities	Rs. 5.41 crores
3. Remedial works for dams	Rs. 13.98 crores

Basic facilities like access roads, back up powers, communication network, weather station etc. were provided for dams. Remedial works to the dams such as providing upstream face treatment to minimize seepage, providing additional surplus arrangements to discharge excess floodwater, strengthening of masonry and earthen dams etc. were carried out in 9 dams based on the recommendation given by the Dam Safety Review Panel.

4.10.2 Dam Safety Project. II

Now, another proposals for rehabilitation and improvement works to 22 public works Department dams and for institutional strengthening for a value of Rs.709 millions has been sent to the Central Water Commission, in November, 2005 by the Government. Of Tamilnadu for posing under the Dam Safety Project –II which named as “Dam Rehabilitation and Improvement Project (DRIP) for getting assistance of the World Bank.

In additional to the above, the World Bank has conducted workshops on DRIP and creation of new funding pattern, which is named as DRIF by World Bank with the public, private partnership and World Bank and other commercial and National banks and state Government. Contribution like RIDF is operated by NABARD.

4.10.3 PWD Dams

The list of PWD dams are given below:

Table 4.15 PWD dams

S.No	River Basin	Name of the Dam
1	Palar Basin	Rajathope Kanar
		Mordhana
2	Varahanadhi Basin	Vidur
3	Pennaiaru Basin	Krishnagiri
		Sathanur
		Thumbalahalli
		Pambar
		Vaniar
4	Vellar Basin	Willingdon
		Manimukthanadhi
		Gomukhi
		Kariakoil
		Anaimaduvu
5	Vaigai Basin	Vaigai
		Manjalar
		Marudhanadhi
		Sothuparal
6	Vaippar Basin	Pilavakkal (Periyar)
		Pilavakkal (Kovilar)
		Vembakottal
		Kullursandhal
		Anaikuttam
		Golwarpatti
7	Tambaraparani Basin	Gundar
		Manimuthar
		Gatana
		Ramanadhi
		Karuppanadhi
		Adavinainar Koil
		Vadakku Pachaiyar
8	Kodayar Basin	Pechiparal
		Perunchani
		Chittar Dam – I
		Chittar Dam – II
		Poigaiyar
9	Nambiyar Basin	Kodumudiyar
		Nambiar
10	Ponniar	Kelavarapalli
		Sulagiri Chinnar
11	Drinking Water Supply Reservoirs	Poondi Reservoir
		Chembarambakkam
		Redhills
		Cholavaram
		Veeranam

The detailed Dam safety plan, procedures and formats are detailed in Annexure II

4.11 Sand mining

Sand mining in the riverbed is a lucrative job. This process is going on for years together. Government has approved certain sand queries from where sand is to be removed subject to certain rules and regulations. The entire sand in the river bed has been removed and the rocky bed is exposed in many places. A list of quarries maintained by the PWD Department is given in the table

Table 4.16 Approved Sand quarries

S.No	Region	Total No. of Quarries Approved	Functioning
1	Chennai Region	124	35
2	Trichy Region	54	17
3	Pollachi Region	19	1
4	Madurai Region	42	11
	Total	239	64

Region wise authorized sand mining spots in Tamil Nadu are given in the following tables

Table 4.17 Authorized Sand quarries in Madurai Region

S.No	Name of the Quarry	District	River
1	Kamutdhi	Ramanathapuram	Gundar
2	Rajapati	Thoothukudi	Vaipar
3	Siragikottai	Ramanathapuram	Vaigai
4	Katchathanallur	Sivagangai	Saruganiyar
5	Virusampatti	Thoothukudi	Vaipar
6	Sirugudi	Sivagangai	Saruganiyar
7	Vasudevanallur	Thirunelveli	Vaipar
8	Eluvankottai	Sivagangai	Manimuthar
9	Sankaranatham	Virudhnagar	Vaipar
10	Athankarai	Virudhnagar	Vaipar
11	Mukkani	Thirunelveli	Tambaraparani

Table 4.18 Authorized Sand quarries in Chennai Region

S.No	Name of the Quarry	River
1	Panapakkam	Araniyar
2	Manpakkam	Araniyar
3	Veppedu	Palar
4	Pinayur	Palar
5	Ozhukuvakkam	Palar

6	Punjai arasanthangal	Palar
7	Sembedu	Kosasthaliyar
8	Vrinchipuram	Palar
9	Vadakarai	Palar
10	Poongodu	Palar
11	Tirumalaicheri	Palar
12	Thirupaachanoor	Malattar
13	Karadipakkam	ThenPennaiyar
14	Emapar	Pennaiyar
15	Melsevur	VarahNadhi
16	Thiruvakkarai	VarahNadhi
17	Kizhaku madurthur	ManimukthaNadhi
18	Kelapattu	ManimukthaNadhi
19	Karuvepalankurichi	Vellar
20	Alagianatham	Pennaiyar
21	Kanchankollai	Pennaiyar
22	Viramudaiynnatham	Vellar
23	Elanthapattu	Pennaiyar
24	Ippikonpalli/konjoji kothur	Pennaiyar
25	Theertham/nerlagiri	Markandeynadhi
26	Pathimaduvu/palanapalli	Markandeynadhi
27	Kolathi	Pennaiyar
28	Thatchur	Cheyyar
29	Eyyakulathoor	Cheyyar
30	Kilathur	Cheyyar
31	Pavakkal	Pambar
32	Kuppanatham	Cheyyar
33	Samanur	Chinnar
34	Murugampatti/karuveppampatti) (N o.1)	Pennaiyar
35	Kelavalli/kengarapatti/echampadi(No.2)	Pennaiyar

Table 4.19 Authorized Sand quarries in Pollachi Region

S.No	Name of the Quarry	River
1	Anaipalayam	Amaravathy

Table 4.20 Authorized Sand quarries in Trichy Region

S.No	Name of the Quarry	River
1	Murungapettai (Muthurasanallur)	Cauvery
2	Nochiyam	Cauvery
3	Thiruengoimalai	Cauvery
4	Chinthavadi	Cauvery
5	Thimmachipuravathiyamm	Cauvery
6	Vathiyam	Cauvery
7	Nanjai pugalur	Cauvery
8	Achampuram	Cauvery
9	Ogalur	Marudaiyaru
10	Thalavai north	Marudaiyaru
11	Kothamangalam-II	Marudaiyaru
12	Southpalamanneri (Thirukkattupalli)	Cauvery
13	Puthur	Cauvery
14	Siddhamalli	Cauvery
15	Vinnamangalam)	Cauvery
16	Sendakkottai (Muthalseri)	Nasuviniyar
17	Neyvellivadapathy	Agniyar

4.12 Fisheries

Tamil Nadu has a long and glorious tradition of maritime activities. The tropical climate is conducive for the breeding varieties of fishes throughout the year. The total fish production in the inland fishing was 1.01 lakh tonnes during 1996-97. However the marine fish products were in the order of 3.56 lakh tonnes

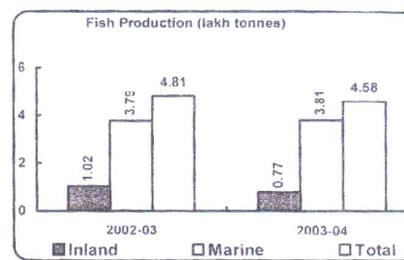
Tamil Nadu is one of the prominent maritime States with rich potential in fisheries. The State has a coastal line of 1076 km. sharing 13.4 percent at National level and a continental shelf of about 41412 sq.kms. The State possesses 0.19 million sq.km of Exclusive Economic Zone (EEZ) accounting for 9.7% of All-India EEZ. An extent of 56000 ha. Of brackish water area available for aquaculture production of which 4455 ha. (8.0%) are under aquaculture in the State. Besides this, the fisheries sector provides employment opportunities to the coastal people and earns export earnings.

Apart from marine fishing, the State is also endowed with inland fishing potential to the tune of about 3.7 lakh ha. Of water spread area comprising reservoirs, major irrigation and long seasonal tanks, short seasonal and ponds, estuaries and backwaters.

4.12.1 Fish Production

Due to urbanisation and increasing population, there is an increasing demand for

sea food. The State has introduced Fisheries Development Mission at Ramanthapuram district as a 15-point Programme during 2002 – 03. It mainly focuses on the production of both marine and inland fish through innovative and scientific methods in reservoirs, tanks and ponds.



The overall fish production in the State has come down by 4.8% from 4.81 lakh tonnes in 2002 – 03 to 4.58 lakh tonnes in 2003 – 04. The share of marine and inland fish catch put together accounted for 8.0% of total National production in 2002 – 03.

4.12.2 Marine Fish Production

The marine fish production through mechanised and non-mechanised boats had improved marginally by 0.5 per cent from 3.79 lakh tonnes in 2002-03 to 3.81 lakh tonnes in 2003-04. The total number of boats engaged in fishing operation decreased from 68036 in 2002-03 to 66684 in 2003-04. In marine fisheries, problems of over fishing, issues like crossing of international boundaries etc. are being addressed.

Table 4.21 Marine Fish Catches by Boats

Year	Boats in operation (number)			Fish catches through (tonnes)		
	Mechanised	Non-Mechanised	Total	Mechanised	Non-Mechanised	Total
2001-02	11444	53844	65288	187142	186719	373861
2002-03	11889	56147	68036	200468	178746	379214
2003-04	11969	54715	66684	204432	176716	381148

Source: Commissioner of Fisheries, Chennai –6

Tsunami of 26th December 2004, visually crippled the economy of coastal districts: impact being severe in the districts of Nagapattinam, Cuddalore, Kanniyakumari, Kancheepuram, Villupuram and Chennai. Thousands of boats, catamarans and fishing nets were destroyed (26112 wooden catamaran, 3402 RRP catamaran, 4170 Vallams, 2391 mechanised boats and 38177 fishing nets). There was extensive damaged to fishing harbours, fish landing centres and trading centres. Almost all the aquaculture farms were destroyed. Due to the damages cause to other infrastructure, Fishing and related activities came to a stand still for almost three months after tsunami. Even though restoration activities had been swiftly undertaken, tsunami had impacted the coastal economy considerably. Loss of marine fish production due to tsunami during 2004-05 is provisionally estimated at not less than 25 per cent of the normal production.

4.12.3 Inland Fish Production

In order to step up inland fish production Fish Farmers Development Agency has been in operation in the State since 1976. There were 12 Fish Farmers Development Agencies in 2003-04. They develop scientific cultural practices in inland water fisheries. The quantum of inland fish production is a function of number of fish ponds/tanks and availability of water and size of investment. There are 1061 major reservoirs, 34734 major irrigation

tanks, 39283 seasonal tanks etc. Total catch by the source reveals that seasonal, tanks and major irrigation tanks alone accounted for 83 per cent of total inland fish production of 77307 tonnes in 2003-04. Inland fish production in the recent past had witnessed a declining trend. It declined from 102217 tonne in 2002-03 to 77304 tonnes in 2003-04. The fall in production is due to failure of monsoon and drying up of irrigation sources in three consecutive years.

The Inland Fishery focuses on augmenting the fish production by utilizing the available inland water resources such as reservoirs, major and minor irrigation tanks, village ponds and tanks etc. The reservoir fisheries management is being undertaken in 44 reservoirs in the State by the Department and in eight reservoirs by the Tamil Nadu Fisheries Development Corporation. The Department has also taken over 32,000 ha. of major and minor irrigation tanks for stocking carp seeds and exploiting with the help of local fishermen.

Table 4.22 Inland Fish Production: By Source

S.No	Sources	2001-02	2002-03	2003-04
1.	Major Reservoirs	973	1095	879
2.	Major Irrigation Tanks (both perennial and long seasonal)	36182	34734	195
3.	Seasonal Tanks	42688	39283	64822
4.	Estuaries and back waters	8591	7500	2800
5.	Fish Farmers Development Agencies	3814	1686	2213
6.	Rivers, Streams, Canals and other Water Sources	11812	8500	-
7.	Miscellaneous (Rice fields, Swamps etc.,)	9631	9419	6404
	Total	113691	102217	77304

Source: Commissioner of Fisheries, Chennai –6

4.12.4 Export of Fish

Tamil Nadu is one of the major fish exporting States in India. The fish products are mostly exported through Chennai and Thoothukudi ports in the State. Marine fish export fetches good export earnings to the State. The total quantity of fish and fish products exported had come down by 2.4 per cent from 70147 tonnes in 2002-03 to 68462 tonnes in 2003-04. The State's share in fish export stood at 17 per cent at the national level (412017 tonnes). The value of total quantity exported worked out to 33.99 per cent of the all India export value.

Table 4.23 Export of Fish and Fish Products

Year	Tamil Nadu		All-India	
	Quantity (Tonnes)	Value (Rs. In Lakhs)	Quantity (Tonnes)	Value (Rs. In Lakhs)
2001-02	58482	201640	424470	595705
2002-03	70147	250787	467297	688131
2003-04	68462	207116	412017	609195

Source: Commissioner of Fisheries, Chennai -6

4.12.5 Other Development Initiatives

Apart from the above activities, the State is implementing certain schemes for the health and wealth of fishery sector such as Fishermen Sea Safety Scheme, Fishermen Free

Housing Scheme, National Fishermen Savings-cum-Relief Scheme, Group Accident Insurance Scheme for Fishermen and the Project like Integrated Marine Fisheries Development Project Phase I and II etc. The Phase II of Integrated Marine Fisheries Development Project was kick-started in 1.4.1998 in 13 coastal districts in Tamil Nadu and planned to distribute 3565 fishing inputs to 100 villages to a tune of Rs.4506 lakhs in the State. The Tamil Nadu State Apex Fisheries Co-operative Federation Limited (TAFCOFED) started functioning from 6.11.1991 in Chennai as a Headquarters. At present, 580 Primary Fishermen Co-operative Societies and nine District Fishermen Co-operative Federation had become members in Tamil Nadu State Apex Fisheries Co-operative Federation Limited (TAFCOFED) and paid a share capital of Rs.89.09 lakhs.

4.12.6 Sustainable Fish Development

In order to facilitate sustainability, the Government of India has imposed a 45-days ban on fish catching during summer season in notified areas in the sea with a view to arresting over-exploitation of fish. This policy contributes towards improved breeding of fish and ensuring sustainable development of fish population. The Supreme Court of India mandated that all the aqua farmers in the coastal areas should obtain approval from Aqua cultural Authorities of India. Aqua-farming is to be carried out beyond 500 metres from the high tide of the sea. This move is to regulate pisciculture in the Coastal Regulation Zone. The potential shrimp farming area consists of 56000 ha. in the State. As on March 2005, 2086 shrimp farms are functioning in 12 coastal districts (except Chennai) of the State. Of these, 883 shrimp farms had got approval from the Aquaculture Authority. The coastal aquaculture had become a thrust area under Fisheries Development Mission in the State. It is proposed to develop 1000 ha. of coastal saline land every year under aquaculture utilising low intensive traditional and improved traditional shrimp farming practices by utilising the support of other agencies like Marine Product Export Development Agency (MPEDA) in the State. During the past three years (i.e. from 2002) aquaculture farming has been under taken over an area of about 3100 ha. in the State with the approval of Aquaculture Authority.

4.13 Fertilizer Consumption

The consumption of total fertilizer nutrients recorded a spectacular increase of 42.3% during 2004-05, after experiencing deceleration in growth in the preceding 4 years. Total nutrient consumption increased from 0.713 M t during 2003-04 to 1.015 M t during 2004-05. All the three nutrients registered positive growth. The consumption of N, P₂O₅ and K₂O at 0.479, 0.206 and 0.330 M t, registered sharp increase of 26.6%, 29.8% and 87.3%, respectively, during 2004-05 over 2003-04. The fertiliser consumption recorded positive growth during both Kharif and Rabi seasons. Kharif:Rabi share in total fertilizer consumption changed marginally from 35.65 during 2003-04 to 36:64 during 2004-05. NPK use ratio changed from 2.2:0.9:1 during 2003-04 to 1.5:0.6:1 during 2004-05. The per hectare consumption of total nutrients increased from 114.5 kg during 2003-04 to 163 kg during 2004-05.

4.14 Pesticide Consumption

Pesticides demands have been influenced by more awareness of the farmers for better crop yield. Pesticide usage for the cultivation of food crops among the different states of India showed a mixed pattern. Tamil Nadu consumes 1.2 to 2 kg/ha of pesticide which is followed by Andhra Pradesh and Punjab where 0.8 to 1.2 kg/ha is the rate of consumption.

The environmental load of pesticides in India in term of kg/sq.km. land area presents an interesting picture. Maximum pesticide load is found in the environment of Punjab, Haryana, Delhi and Tamil Nadu. The pollution load in these areas ranges from 70-100 kg/sq.km. land area.

4.14.1 Common Pests

The list of common pests infected and the crops are given in the following table:

Table 4.24 List of Common Pests

S.No	Name of the Pest	Name of the Crop
1	Stem Borer	Paddy
2	Green leaf Hopper	Paddy
3	Leaf Folder	Paddy
4	Leaf Spot	Paddy
5	Powdery Mildew	Groundnut
6	Wilt	Sugarcane
7	Fruit Rot and Sigatoka Leaf Spot	Banana
8	Tikka Disease	Groundnut
9	Wilt of Paddy	Paddy
10	Leaf Spot	Groundnut
11	Red Rot	Sugarcane
12	Powdery Mildew	Grapes
13	Scab	Apple
14	Powdery Mildew	Peas, Pulses
15	Aphid white fly	Cotton
16	Boll Worm – Stem and fruit borer	Brinjal
17	Thrips and Mites	Chillies
18	Bud and Army Worms	Tobacco
19	Boll worm	Maize, Potato and Onion
20	Echinocloa	Grasses
21	Fusarium Leaf Spot	Paddy
22	Powdery Mildew	Soya bean, Tea
23	Cercospora Rust	Citrus and Vegetables
24	Broad Leaved Weeds	Cereals, Nuts and Maize
25	Powdery Mildew	Mango, Pulses
26	Kernel Burnt	Wheat
27	Blister Blight	Tea
28	Pearl Millet and Downy Mildew	Wheat
29	Leaf Blight	Potato
30	Pod Borer	Pulses

4.14.2 Integrated pest management

Integrated Pest Management (IPM) is being adopted in the State for effective and eco-friendly pest and disease management under plant protection. The farmers were given training regarding the identification of predators and stamp out them. This has made the farmers

aware of the need to adopt the IPM technology to minimize the pesticides consumption and thereby save about 20 per cent of the crop loss due to pest and disease.

During 2003-04, plant protection measures such as pest and disease management were carried out in the State. The pest management was carried out to the extent of 32.78 lakh ha. pest treatment under food crops and 17.7 lakh ha. under non-food crops. The area covered under disease treatment was of the order of 16.9 lakh ha. (food crops) and 9.2 lakh ha. (non-food crops) in 2003-04. Under Integrated Pest Management, the IP on demonstration has been carried out through Centrally Sponsored Schemes, Cotton Mini. Mission. II, Accelerated Maize Development Programme, Oilseeds Production Programme and National Pulses Development Project. It was of the order of 1500 nos., 70 nos., 30 nos., 1669 nos. and 536 nos. during 2003-04. During this period, the pest control measures such as seed treatment (26.4 lakh ha.) rat control (0.2 lakh ha.), weed control (0.2 lakh ha.) had been covered. The plant protection with regard to pest control is expected to improve by treating 12.4 lakh ha. for food crops and 8.0 lakh ha. for non-food crops during 2004-05 (upto October 2004). Disease control measures for food crops stood at 6.7 lakh ha. and non-food crops to 4.8 lakh ha. (upto October 2004) in 2004-05

4.15 Crop Diversification

Given the constraint in terms of availability of irrigation for crops, traditional hydrophilic crops (like paddy, banana, and sugarcane) are increasingly subject to moisture stress. Hence, a crop diversification strategy that aims at a shift to crops requiring lesser moisture is increasingly becoming imperative. Crop diversification by a critically re-designed alternative cropping pattern based on agro climate zone may be demonstrated in the farmer's holdings to effectively utilise the natural resources. This could stabilize production and productivity in the State. If focused on switching from low value to high value crops; single crop to multiple/mixed crop; crop alone to crop with crop-livestock – fish apiculture and agriculture production to production with processing and value addition. This would bring high value and labour intensive crops and it could provide adequate income and employment opportunities to farming community in the State. Thus, there arose a need for raising “more crops per drop” with focus on drought resistant and less water consuming crops.

Factors such as declining supply of cultivable land, growing population, rising urbanization, changing tastes and life styles have necessitated crop diversification. Monoculture leads to impoverishment of soil and low productivity. Hence farmers have to be advised to switch over the alternative crops which have assured market and consume less water. Cultivation of less water-intensive crops like sweet sorghum, sugar beat and *Jatropha* have the potential to intensify the crop diversification process and drive agricultural growth.

4.15.1 *Jatropha*

In the context of steep increase in the prices of imported oil, attention is being focused on the feasibility of bio-fuel to meet the energy requirements of the economy. Cultivation of *Jatropha* is being encouraged substantially both by the State Government and the Centre.

Jatropha cultivation is to be taken on one lakh acres under contract farming. The plant has the potential of providing employment to farmers and processors besides contributing to greening. It would contribute to the growth of rural industries for prolluction

of crude oil and refined oil. The cost of cultivation would be Rs.10760 under dry land condition and Rs.19560 under irrigated conditions. Economics of this crop are very encouraging. It is a diesel substitute. Lack of subsidy schemes and the need for higher investment are impeding the cultivation of *Jatropha* in the State. It is further reported that non-availability of quality seed material is also an inhibiting factor.

4.15.2 Horticulture

Demand for the horticultural crops such as fruits and vegetables are income-elastic. The consumption pattern over a period of time tilted towards horticulture products with steady increase in the per capita income. In the wake of growing population and swelling urbanization a favorable shift in consumption in favour of horticultural crops need more coverage of area. These value addition crops provide raw-materials to agro-based industries besides providing employment opportunities to rural masses. The crop diversification technique has been advanced to boost production and productivity of horticultural crops. The horticulture crops contain remarkable potential for export earnings in the State. The share of the State is 5.7 per cent in terms of area under horticultural crops and 7.7 per cent in terms of production at the national level.

India's share in world production of coconut is the number one, vegetables second, natural rubber fourth, coffee sixth, fruits tenth and tea 29th. The horticultural sector consists of a wide range of crops such as fruits, vegetables, spices, plantation crops, floriculture, medicine and aromatic plants, cashew etc. Mango, banana, citrus, apple, guava, papaya and grapes share the bulk of fruit production. Horticulture is a potential source of diversification in agriculture.

The shelf life of food grains is over three years or even more against fruits whose self life ranges between one week and 3 months. In view of this, strategies involve a separate road map for value addition in fruits and vegetables, adequate infrastructure such as cold storage, refrigerated transportation, rapid transit grading, processing, packaging and quality control.

The State has a vast potential for successful cultivation of crops like mango, banana. Cashew, tapioca, medicinal plants and flowers which are being exploited intensive under the Horticulture Mission. The State has set up a Mission for Horticultural Development aiming to achieve 8 per cent annual growth during X Five Year Plan in this sector. This gives impetus to production, processing for value addition and marketing of horticultural crops such as vegetables, fruits, flowers and medicinal plants. Tamil Nadu is the first State in India to set up a separate Mission for the development of horticulture. It also aims to double the horticulture production by 2011-12 in the State.)

Objectives of Horticulture Mission

- Improving production through balanced nutrition management
- Evolving suitable mechanism for regulating the production of quality planting materials and giving impetus to research;
- Creating & adequate infrastructure for post harvest management especially, preservation and marketing

- Encouraging active involvement of farmers Association in the adoption of modern technologies.

Beyond the Mission's thrust on the production of horticulture crops, it advocated crop development strategies such as adoption of IPM and INM techniques, training of farmers in latest technology, laying of demonstration plots, efficient irrigation management through installation of micro irrigation systems such as Drip Irrigation and Sprinkler Irrigation techniques.

The State signed a Memorandum of Understanding with the Agriculture and Processed Food Products Export Development Authority for setting up an Export Promotion Zone for cashew at Rs.10.36 crore. The zone will enhance export to Rs.100 crores in three years and provide employment to 20000 persons.

Despite the failure of the monsoon in the last three years, the area under horticulture increased from 7.77 lakh ha. in 2002-03 to 8.25 lakh ha. (15.1 %) in 2003-04 and this area has been projected to 8.91 lakh ha. in 2004-05. The fruits, vegetables and plantation crops shared more than 75 percent of the area coverage under horticultural crops in 2002-03 and 80 per cent in 2003-04 and projected to 78 per cent in 2004-05.

The overall production of horticultural crops had improved from 91.70 lakh tonnes in 2002-03 to 99.46 lakh tonnes in 2003-04 the growth being 8.5 per cent. The projected production stood at 107.45 lakh tonnes during 2004-05 showing a better prospect. The production of fruits and vegetables alone accounted for about 83 per cent in total production in 2002-03 and 85 per cent in 2003-04. The productivity of horticultural crops had experienced a dip of 14.2 per cent in 2002-03. However, it had regained its level by 2.2 per cent in 2003-04. Tangible improvement is anticipated in 2004-05.

4.15.3 Medicinal Plants

With the growing importance of ayurvedic and siddha medicines, the importance of raising medicinal plants is Central to the State's health policy. Area and production of medicinal plants which are confined to Western Ghat districts and also in the districts of Thoothukudi, Dharmapuri Thiruchirapalli. Pudukkottai, Perambalur, Karur and the Nilgiris remained statistic during 2004-05. While, the extent of area covered by medicinal plants was around 4000 ha. total production was estimated at about 8000 tonnes giving an yield per hectare of two tonnes. Area and production are almost in constant proportion.

The State implements State and Centrally-sponsored Schemes viz.. Integrated Horticulture Development scheme (IHDS). Integrated Tribal Development Programme (ITDP). Western Ghats Development Programme (WGDP) and Hill Area Development Programme (HADP) during 2003-04 and also continued in 2004-05. Implementation of these schemes has impacted on area, production and yield.

Table 4.25 Area, Production and Yield rate of Horticulture Crops

Crop	Area (lakh hectares)			Production (lakh tones)			Yield (tones / ha.)		
	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05	2002-03	2003-04	2004-05
Fruits	2.23	2.21	2.39	40.14	36.09	39.08	17.96	16.33	16.37
Vegetables	1.62	1.91	2.06	35.99	46.73	50.59	22.25	24.47	24.53
Spices & condiments	1.46	1.54	1.67	6.25	6.93	7.50	4.27	4.49	4.50
Plantation crops	2.28	2.34	2.53	7.95	8.02	8.68	3.49	3.43	3.44
Flowers	0.18	0.20	0.22	1.35	1.62	1.75	7.65	7.97	7.99
Medicinal plants	>100	0.04	0.04	0.02	0.08	0.08	- -	1.90	1.90
Total	7.77	8.25	8.91	91.70	99.46	107.68	11.80	12.06	12.09

Source: Directorate of Horticulture and Plantation Crops, Chennai –6

The State has an estimated 130 million hectares of coastal land. Of which 33 million hectares are available for reclamation. This programme aims at transforming the rural economy by providing employment opportunities to agricultural labour and the rural poor. The crops like Sweet Sorghum and Jatropa offer tremendous opportunities to farmers and improve their income and standard of life. The Sweet Sorghum crops need 40 per cent of normal water-consuming crops and provides an average yield of 30 tonnes per acre and realizes Rs.10000/- per acre as net income within four months. Similarly, Jatropa, a hard shrub, gives attractive yield for 30 years and thereby could fetch more than Rs.12000 per acre from the third year of cultivation.

4.15.4 Sericulture

Sericulture has potential for employment and income generation. The productivity of silk production depends mainly on the quality of silk worms. The cocoon and raw silk production has been carried out in 26 districts in the State. The improved bivoltine races are being introduced in the State to improve yield rate and fetch higher income to the farmers. In terms of the cocoon and raw-silk production, five districts, namely, Dharmapuri (50.3%), Vellore (12.7%), Erode (10.6%), Coimbatore (6.7%) and Namakkal (3.7%) constitute a high share (85%) out of the total area coverage of 13486 ha. in Tamilnadu.

The average yield of cocoons per 100 laying which prevailed at the end of IX Five Year Plan (2001-02) increased to 58.4 kgs. in 2004-05 (upto February 05) during the X Five Year Plan period. Tamil Nadu is also a major silk consuming State and the estimated requirement of silk would be 1500 metric Tonnes per year. The silk industry in the State is also in the process of adjusting itself to the changing requirements in post WTO. Marketing and branding initiatives like the Silk Mark also help in developing the market for silk products.

4.16 Water Weeds

Water weeds like Eichornia, Ipomoea, Salvinia, Pistia, Trapa, Typha and Prosopis cineraria were found commonly in the water bodies. The aquatic weeds cause enormous damages to the water bodies leading to large-scale water depletion and reduces the water holding capacity of the water body. It also increases the rate of evaporation. The weeds

block the irrigation channels and does not allow the un-wanted matters to enter outside. The quality of water becomes altered so that it as a shelter of many disease causing vectors. It also affects fishing grounds and even block navigation. The entire biotic communities which depend upon these water bodies will be affected.

4.16.1 Remedial measures

- The weeds such as Eichornia, Salvinia, Ipomoea and Pistia can be collected and used as manure
- They can be used for the preparation of vermicompost
- Some of the weeds can be used for the preparation of biogas
- Weeds can also be used as medicine, fodder and food
- Some weeds scavenge the in-organic and organic compounds from water so they can be used as a water purifier
- Some weeds can be grown as ornamental. Usually the dominant weed Eichornia is grown in mud pots by the villagers. They have been called as the water orchids.
- Tubers of Lotus and seeds of Trapa are the good source of food
- Typha can be mainly used for basket making
- Awareness programmes should be organised regarding conversion of water weeds into manure and production of biogas

4.17 Prosopis juliflora

The plant is a perennial deciduous thorny shrub or small tree, to 12 m tall; trunk to 1.2 m in diameter, bark thick, brown or blackish, shallowly fissured; leaves compound, commonly many more than 9 pairs, the leaflets mostly 5-10 mm long, linear-oblong, glabrous, often hairy, commonly rounded at the apex; stipular spines, if any, yellowish, often stout; flowers perfect, greenish-yellow, sweet-scented, spikelike; corolla deeply lobate. Pods several-seeded, strongly compressed when young, thick at maturity, more or less constricted between the seeds, 10-25 cm long, brown or yellowish, 10-30-seeded. Seed compressed and oval or elliptic, 2.5-7 mm long and brown.

Bearing fruits in 3 to 4 years, the trees are usually harvested by hand, often after the fruits have fallen.

Fast-growing, drought resistant, and with remarkable coppicing power, Prosopis is a natural fuelwood candidate. With specific gravity 0.70 or higher, the wood has been termed "wooden anthracite", because of its high heat content, burning slowly and evenly and holding heat well. This species provides >90% of the fuelwood in some Indian villages (Sharma, 1981). Although no direct data on N-fixation of Prosopis are available, Felker and Bandurski (1979) suggest that tree legumes (exclusive of Caesalpinaceae) fix between 155 and 580 kg/ha/yr. Soils under the crowns of legumes in the desert usually have 10 times more N (0.3%) than those under non nitrogen fixers (0-03%).

4.17.1 Economic applications

In places where juliflora is available, the rural people are directly depending on this for their livelihoods by selling the wood/converting as charcoal in the nearby towns. This needs to be up-scaled in the project for using this with a higher value added projects – Biomass based generation and biomass gasifiers.

4.17.2 Biomass based generation

State Government has initiated efforts to encourage new power generation projects using wood and other agro residues and waste. District level and Taluk level studies were carried out and the information regarding the availability and potential in selected places in the State are available. The entrepreneurs who wants to promote biomass power plants may be encouraged under this project to come forward for setting up of power plants in the places where juliflora is abundantly available so that the farmers can get better remunerative price for this wood. This will enhance the income levels of the farmers.

4.17.3 Biomass gasifiers

To meet the thermal and electrical energy requirements of industries and other organizations a new scheme of installing gasifiers is being promoted by MNES. The village Panchayat under this project may be encouraged to install gasifiers for water pumping.

4.18 Livestock

A perusal of total livestock population in Tamil Nadu since 1982 exhibits that there are variation across the Quinquennial Censuses particularly with reference to the population of cattle, sheep and goats. With respect to buffaloes, a steady decline has been noticed since 1982. As per the latest Quinquennial Livestock Census 2004, total livestock population stood at 249.41 lakhs – cattle at 91.41 lakhs, buffaloes 16.58 lakhs, sheep 55.93 lakhs, goats 81.77 lakhs and others 3.72 lakhs. In the case of poultry population, it increased by leaps and bounds – 182.84 lakhs in 1982. 359.41 lakhs in 2001 and 865.9 lakhs in 2004. Acceleration in the poultry is mainly due to heavy demand. Fodder problems is the main cause for decrease in cattle and buffaloes population. Government endeavours to upgrade the indigenous cattle and buffaloes to high quality animals.

Table 4.26 Trends in Livestock Population (lakhs) – Tamil Nadu

Year	Cattle	Buffaloe	Sheep	Goats	Others	Total	Poultry
1982	103.66 (-4.03)	32.12 (4.35)	55.37 (4.69)	52.46 (24.85)	18.26 (135.31)	261.87 (8.45)	182.84 (27.44)
1989	93.53 (-9.77)	31.28 (-2.62)	58.81 (6.21)	59.20 (12.85)	20.85 (14.18)	263.66 (0.68)	215.70 (17.97)
1994	90.96 (-2.75)	29.31 (-6.30)	56.12 (-4.57)	58.65 (-0.93)	21.75 (4.32)	256.79 (-2.61)	238.54 (10.59)
1997	90.47 (0.54)	27.41 (-6.48)	52.59 (-6.29)	64.16 (9.39)	24.76 (13.84)	259.39 (1.01)	365.11 (53.06)
2001	91.82 (1.49)	27.08 (-1.20)	53.47 (1.67)	68.08 (6.11)	4.78 --	245.22 (-5.46)	359.41 (-1.56)
2004	91.41 (1.03)	16.58 (-39.51)	55.93 (6.35)	81.77 (27.45)	3.72 --	249.41 (-3.85)	865.9 (97.62)

Source: Directorate of Animal Husbandry and Veterinary Services, Chennai -6

The cattle population is concentrated in the districts of Villupuram, Thiruvannamalai, Vellore, Dharmapuri, Thanjavur, Pudukottai, Coimbatore, Cuddalore, Dindigal and Kancheepuram whereas the buffaloes are preponderance in the districts of Namakkal, Villupuram, Kancheepuram, Erode, Salem and Thiruvallur. These districts are called milk belts of the State.

Productivity of cattle and buffaloes in Tamil Nadu is relatively low, going by the international standards. This is due to the predominance indigenous and native stock of animals. To improve the cattle stock, the Tamil Nadu Livestock Development Agency has brought all breeding activities under a single umbrella and an artificial insemination programme is being carried out. A decline in breedable female population is noticed in the 2004 Quinquennial Livestock Census – from 47.17 lakhs in 2001 to 41.17 lakhs in 2004 in respect of cattle and from 15.15 lakhs to 9.01 lakhs in respect of buffaloes.

Breedable Female Population

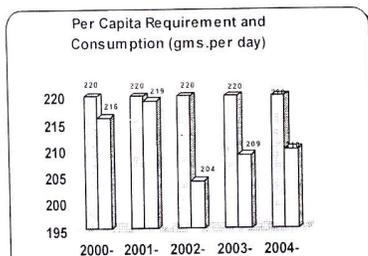
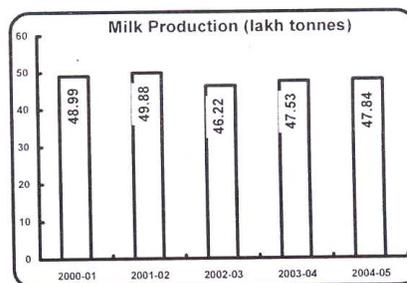
		Lakhs		
Category		1997	2001	2004
Cattle	○ Exotic and Crossbred	12.61	18.78	25.89
	○ Indigenous and Native pure	32.02	28.34	15.28
	Total	44.63	47.12	41.17
Buffaloes	○ Murrah & Graded	3.74	4.97	2.90
	○ Indigenous	13.64	10.18	6.11
	Total	17.38	15.15	9.01

The share of breedable female exotic and crossbred cattle accounted for 28.32% (25.89 lakhs) and indigenous and native pure works out to 16.72% (15.28 lakhs) of the total cattle population of 91.41 lakhs during 2004. Among breedable female buffaloes population the share of murrah graded was 17.49% (2.90 lakhs) and indigenous 36.85% (6.11 lakhs) out of the total buffalo's population of 16.58 lakhs during 2004.

4.18.1 Milk production

After agriculture, dairy is the largest employer in the State particularly among the women. The milk production and availability are as follows:

In conformity with the growing population, rising urbanisation and changing consumption pattern and increasing per capita income, milk production has grown to meet the current as well as the future demands. The milk production doubled in 1980's, whereas the pace of growth in milk production somewhat slowed down in 1990s.



Milk production rose from 46.22 lakh tonnes in 2002-03 to 47.53 lakh tonnes in 2003-04 and further improved to 47.84 lakh tonnes in 2004-05.

Despite increase in milk production, State's share during 2003-04 at All India level hovered around 5.9 per cent in 2001-02 and 5.4 per cent in 2003-04. The per capita availability of milk per day was 204

gms. in 2002-03, 209 gms. in 2003-04 and 210 gms in 2004-05, the increase being 2.9 per cent.

Tamil Nadu Cooperative Milk Producer's Federation procured milk through 7117 and 7493 Primary Cooperative Societies in the State during 2003 – 04 & 2004 – 05. The total milk production by societies had improved by 17.6 per cent from 18.88 LLPD in 2002-03 to 22.21 LLPD in 2003-04 and further improved by 7.0 to 23.76 LLPD in 2004 - 05.

These societies procured more than 17 per cent of the State total milk production of 47.53 lakh tonnes in 2003-04. The quantity of milk sold had also gone up from 6.53 LLPD in 2002-03 to 6.91 LLPD in 2003-04 and improved to 8.09 LLPD(17.1%) in 2004-05. The value was to the tune of 85.71 lakh per day and 90.70 lakh per day respectively. The value of the milk products had plummeted in the case of the products such as butter, ghee tetra pack SM I Ltr. tetra pack - SM 200 ml. cheese, mysorepak, butter milk and flavoured milk during 2003-04 compared to the preceding year 2002-03. The value of milk products sold for the quantity of SMP (12064.5MTs), Butter(1631.9 MTs) and Ghee (7949.1 MTs) to the tune of Rs.9244.46 lakhs, 802.62 lakhs and 8860.09 lakhs respectively. However, the quantity and sale of milk, milk powder (4437.6 mt.), Tetra pack - TM 1 Ltr. (75058 litre), ice creams (133841 litre), Gulabjamun (1525 kgs.), khova (289452 kgs.), curd (517900 nos.) and Maavin (77026 nos.) had witnessed an increasing trend from Rs.2300.04 lakhs in 2002-03 to Rs.4328.27 lakhs in 2003-04 in the State.

Table 4.27 Milk Products and Value

Year	Tamil Nadu	All India	% Share of Tamil Nadu	Per capita availability (gms. per day)	
	(Lakh tonees)			Tamil Nadu	All India
2001-02	49.88 (1.9)	844 (4.3)	5.9	219 (1.4)	225 (2.3)
2002-03	46.22 (-7.3)	862 (2.1)	5.3	204 (-6.8)	230 (2.2)
2003-04	47.53 (2.8)	881 (2.2)	5.4	209 (2.5)	231 (0.4)
2004-05	47.84 (0.65)	-	-	210 (0.48)	

Source: Directorate of Animal Husbandry and Veterinary Services, Chennai –6

4.18.2 Milk yield

The average yield rate of milk from exotic and crossbred animals improved from 6.150 kgs. in 2002 – 03 to 6.177 kgs. in 2003 – 04 and further to 6.244 kgs. in 2004 – 05. The yield rate of indigenous cows rose from 2.554 kgs. in 2002 – 03 to 2.663 kgs. in 2003 – 04 and further to 2.680 kgs in 2004 – 05. The milk yield of buffaloes increased to 4.20 kgs. in 2004 – 05 from 4.125 kgs in 2003 – 04 and 4.112 kgs. in 2002 – 03.

Table 4.28 Average Yield Rate of Milk (Kgs., / Animal / day)

	Category	2001-02	2002-03	2003-04	2004-05
I.	Cows				
a.	Exotic and Crossbred	6.320 (4.0)	6.150 (-2.69)	6.177 (0.44)	6.244 (1.08)
b.	Indigenous	2.760 (-0.1)	2.554 (-7.46)	2.663 (4.28)	2.680 (0.64)
II.	Buffaloes	4.200 (0.1)	4.112 (-2.09)	4.125 (0.32)	4.200 (1.82)

Source: Directorate of Animal Husbandry and Veterinary Services, Chennai -6

4.19 Poultry

India is the fourth largest producer of eggs in the world and the eighth largest producer of broilers. The industry turnover is estimated at Rest 10,000 crores per annum. An annual output of 30,000 million eggs and 1000 million broilers yielding five lakh tones of poultry meat. The poultry sector provides employment to 100 million people and accounts for about 2 % of the total GDP of India. Bird performance is comparable to the best in developed countries.

Currently 4 states Andhra Pradesh, Maharashtra, Punjab and Tamil Nadu account for more than 50 percent of the total output of eggs and broilers in the country. The domestic market for eggs and poultry meat is large and growing due to changes in the life styles higher awareness of health consciousness of the urban populations.

Several breakthroughs in poultry science and technology have led to development of genetically superior birds capable of high production. Manufacturing of high tech poultry equipment for producing feed, pharmaceuticals and health care products including vaccines are factors contributing to the higher productivity. Corporate houses promoting fresh chilled or frozen chicken sales at superior ,clean, hygienic outlets has also added to the promotion of poultry products. In the coming future, India will see witness the new different ways the poultry products are sold. Live chicken sales will continue-to be sold along with the entry of big corporate players giving the sector a big boost, in the form of branding of eggs and chicken and its value added products, helping better promotion of the industry as such.

However domestic poultry industry is plagued with high costs of feed, high taxes and inefficient supply chain. Several measures are necessary to improve the status of the poultry industry. Unorganized slaughter processes need to be replaced by designated slaughtering areas with investments in rendering plants. Infrastructure in for transportation and cold chain has to be created to improve supply chain efficiency. Consumer awareness has to be improved as regards hygienic techniques of slaughtering. Poultry is a sector very appropriate for government - private sector joint man-ship

4.20 Water Borne Diseases

Water-borne diseases are any illness caused by drinking water contaminated by human or animal faeces, which contain pathogenic microorganisms. The full picture of water-associated diseases is complex for a number of reasons. Over the past decades, the picture of water-related human health issues has become increasingly comprehensive, with the emergence of new water-related infection diseases and the re-emergence of ones already known. Data are available for some water-, sanitation- and hygiene-related diseases (which include salmonellosis, cholera, shigellosis), but for others such malaria, schistosomiasis or the most modern infections such legionellosis or SARS CoV the analyses remain to be done. The burden of several disease groups can only partly be attributed to water determinants. Even where water plays an essential role in the ecology of diseases, it may be hard to pinpoint the relative importance of aquatic components of the local ecosystems.

4.20.1 Malaria

Malaria still continues to be one of the major Public health problems in certain pockets of TamilNadu. The following factors contribute for the persistence of malaria.

1. Migration of population for various reasons.
2. Rapid urbanization.
3. Tremendous developmental activities especially construction of buildings, over bridges etc.

4.20.2 Malaria situation in Tamilnadu:

- In Tamil Nadu State during 90's a total of 1,20,029 cases were recorded out of which 59.6 % were recorded from the urban areas and 40.4% in rural.
- The coastal villages of Ramanathapuram, Paramakudi and Nagapattinam and riverine villages of Dharmapuri, Krishnagiri and Tiruvannamalai were endemic for malaria.
- Due to the intensive control measures like active and passive surveillance, vector control measures etc. taken up by the PH dept the malaria case incidence has been drastically brought down to 43053 in 2000.
- At present the coastal villages of Nagapattinam which were once endemic are almost free from malaria.
- The incidence of malaria in Ramanathapuram and Tiruvannmalai show a decreasing trend. However, Malaria is emerging as a problem in Nagerkoil.

The following table shows the incidence of malaria in rural and urban areas of Tamilnadu.

Table 4.29 Malaria incidence in rural and urban Areas of Tamil Nadu

Year	State Cases	Rural Cases	Chennai Cases	Chennai %
1990	120029	48478	51272	42.7
1991	144762	57403	67013	46.3
1992	151633	52298	72314	47.7
1993	148057	42908	76749	51.8
1994	104964	39736	48352	46.1
1995	92375	40739	41822	45.3
1996	80586	27249	45930	57.0
1997	72426	23429	41735	57.6
1998	63915	16023	40475	63.3
1999	56366	12141	38165	67.7
2000	43053	7574	31861	74.0
2001	31551	5121	23652	75.0
2002	34523	5490	27205	78.8
2003	43396	12233	29058	67.0
2004	41640	10841	28229	67.8
2005	40594	13560	25153	62.0
2006(May) Provisional	9778	2512	6656	68.0

The following are the details of cases and deaths due to the ADD/Cholera in Tamil Nadu.

Table 4.30 Details of ADD/Cholera in Tamil Nadu

Year	Acute Diarrhoeal Diseases			Cholera		
	Cases	Deaths	Fatal rate	Cases	Deaths	Fatal rate
1997	78025	520	0.67	2261	2	0.09
1998	77677	368	0.47	1807	0	0.00
1999	74583	266	0.36	1807	1	0.06
2000	64130	195	0.30	1328	1	0.05
2001	59511	159	0.27	1110	1	0.09
2002	69889	199	0.28	1591	3	0.19
2003	58784	66	0.11	390	1	0.26
2004	77333	119	0.15	1500	2	0.13
2005	70465	65	0.09	777	1	0.13
2006 (Jan to May)	23933	18	0.08	99	1	1.01

4.21 Municipal Solid Waste

The implementation of Municipal Solid Waste (Management & Handling) Rules 2000, has become the mandatory responsibility of the Urban Local bodies. Based on the above Rules, Government of Tamil Nadu have issued instructions to all Urban Local bodies to set up waste processing and disposal facilities. In addition to this, the Hon'ble Supreme Court has directed cities with one million plus population to file an Action Plan for solid waste management and all the cities in Tamil Nadu having million plus population namely, Chennai, Madurai and Coimbatore Corporations have filed their Action Plans before the Hon'ble Court. The Commissionerate of Municipal Administration has taken initiatives in facilitating the preparation of similar Action Plans by all other ULBs in order to comply to the Municipal Solid Waste (Management & Handling) Rules 2000 in a time bound manner.

The main requirement in this regard is the identification of suitable land for locating disposal facilities. About 56 Municipalities and 5 Corporations have adequate land and the Government have so far assisted 19 Municipalities for procurement of land. Action is being taken to complete the process of identifying suitable land in the remaining Urban Local Bodies.

Apart from making available required land for compost yards, it is also proposed to

- improve efficiency in primary collection
- increase the fleet strength for the secondary transportation
- use modern equipments in the disposal / land filling areas.

The present generation of garbage in ULBs ranges between 9000 – 10000 M.T. per day. Collection and segregation of garbage at source is practised in 70 % wards in Municipalities in the State. The goal is to achieve 100 % source segregation, disposal of garbage in a scientific manner and making the streets and roads, garbage free. The privatization of Solid Waste Management has been encouraged in all Municipalities and Corporations. Self Help

Groups are also being involved in Solid Waste Management. In Chennai City, the per capita generation of solid waste per day is 500 gms. The estimated generation of solid waste per day is 3200 MTs of garbage and 500 MTs of debris.

4.22 Disaster Management

Managing unpredictable disasters such as floods and earthquakes had posed severe challenges to Administration (Government). But the occurrence of the devastating tsunami on 26-12-2004 which struck Indian coast causing enormous damages to the life and property in the coastal areas of Tamil Nadu was the most gruesome and daunting. Tsunami affected as many as 13 districts in Tamil Nadu and the scale of destruction was grave in the districts of Nagapattinam, Cuddalore and Kanniyakumari. Besides leaving nearly 8000 people dead, it rendered many thousands homeless and affected the livelihood security of lakhs of persons. It has virtually crippled the economy in the coastal areas due to the destruction of fishing gear (vessels, nets, boats, etc.) and severe damage caused to the infrastructure. The scale of destruction being unprecedented, relief and rehabilitation measures posed real challenges. Government of Tamil Nadu resolutely faced the challenge and a massive relief and rehabilitation programme was launched to tide over the crisis. The Government mobilized government machinery, civil society, NGOs and Corporate sector in Relief and Rehabilitation measures in the affected areas. The response to the challenge has been widely acknowledged.

4.23 Rainwater Harvesting

The State government has initiated rain water harvesting as a multi-pronged strategy under Government's 15-Point Programme to ensure water security to the State's entire population as mandatory. It was emphasized to save every drop of water for safe drinking and other purposes like agriculture, industry, government offices, schools, hospitals, buildings.

Rain water harvesting was recently introduced in the State for direct collection of water. Rainwater could be stored either for direct use or recharged into the ground water aquifer for use. The Rain Water Harvesting method viz., Roof-top Harvesting and Roof-top/Open Space. Harvesting is being adopted in the State. This could augment rainwater into open and bore wells and thereby improve the ground water recharge and meet the demand for water during water crisis. The Metro Water Board and TWAD Board have constituted exclusive RWH Units.

The rainwater harvesting concept has also become mandatory and implemented in the State with the following basic objectives.

- To conserve and augment the storage of ground water by creating awareness among public
- To reduce water table depletion by participating various agencies
- To improve the quality of ground water by imparting training to individuals/organizations/Government Agencies
- To arrest sea water intrusion in coastal areas and offer technical guidance and assistance based on the geological formations
- To avoid flood and water stagnation in urban areas and to promote RWH both in individual and in public places

- To control formation of cracks on walls and also to assure proper maintenance of the harvesting structures after installation.

The State had created rain water harvesting structures through the departments like Highways, Rural Development, Municipal Administration and Water Supply, Tourism Development Corporation and Hindu Religious and Charitable Endowment, Agriculture and School Education. Under this campaign, a total number of 257.76 lakh water harvesting structures were constructed in the State. Of these structures, structure created by Agricultural Engineering Department was for the purpose of augmenting rain water into wells and farm ponds. The RWH structures for agricultural purpose accounted for 1.41 lakh numbers, out of the total 257.76 lakh numbers.

Since the water resources are scarce, the State Government with the help of the Central Government is implementing the programmes viz. comprehensive wasteland development programmes and the National Watershed Development Project for rain fed areas. These programmes will help to enhance the conservation methods and recharging the groundwater levels.

4.24 Comprehensive Wasteland Development Programme

There are two components under this programme – Participatory Watershed Development and Development of Public Wastelands by corporate houses, small companies and federation of women-run SHGs. These two components are being implemented on a micro watershed approach.

4.25 Participatory Watershed Development

Under this programme a subsidy of Rs.8500/- is being provided per hectare. In 2002 – 03 this component was implemented in 10 districts of Tamil Nadu covering a target of 55,000 ha on a pilot basis with a fund of Rs.30 crores. An area of 21,771 ha was tackled and 23.66 lakh seedlings (15.39 lakh agro-forestry and 8.27 horticulture) were planted.

Measures for improving the water conservation can be adopted from the National Watershed Development Project for rain fed areas which is a centrally sponsored scheme. Under this approach village watershed committees have been formed and made mandatory on their part to plan, implement, monitor and maintain the watersheds. The objectives of all the initiatives that are launched are fostering natural resources, stepping, water productivity and protect ecological balance.

4.26 Information Technology in Tamil Nadu

Information Technology is used in various Government Departments of Tamil Nadu like Revenue, Transportation, Judiciary, Secretariat and also in Universities and colleges. The power of IT has reached the villages indicating an easier and faster communication access for the rural people. Public-private Government Academia jointly promoted the SARI (Sustainable Access in Rural India) rural connectivity pilot project in Melur taluk, Madurai district.

The State has a long tradition of scientific and technological innovation. The distinct advantages enjoyed by the State are: a large reservoir of highly skilled technical manpower (an annual turnout of 79000 Engineering Graduates and 58500 Diploma holders), investor-friendly policies, sound infrastructure facilities, sustained efforts to attract foreign direct investment and State level IT Task Force to implement the IT policies. Management Information System is increasingly being introduced by the Government in all the State Government Departments.

The State has already formulated a policy on IT. The policy on Information Technology - Enabled Services (ITES) and a comprehensive Hardware Policy are being prepared. With the formulation of the new Hardware policy (under preparation), Tamil Nadu will have comprehensive policy initiatives in all three major areas of IT industry. The Hardware policy will enable the State to emerge as a major destination for investment in hardware manufacture also and will provide a boost to employment opportunities. The phenomenal growth in IT and ITES sectors brightens placement opportunities for the professionals and other graduates in Tamil Nadu.

Tamil Nadu has succeeded in establishing a state of the art IT infrastructure system. Facilities at TIDEL Park have been fully utilized. Because of continuous demand for infrastructure facilities the State has made an effort to establish two more parks viz. one at Siruseri and other in Mahindra City with 1000 acres and 1700 acres respectively.

Apart from Chennai, Coimbatore is emerging as a tier-2 exporter of software and BPO services. During 2003-04, Coimbatore exported software and IT-related services to the value of Rs.100 crores. It is expected to increase to Rs.1000 crores in the next few years. The Government is also proposed to develop Coimbatore and Hosur as hubs for ITES and BPO and companies such as HSBC and WIPRO are showing interest to set up companies in Coimbatore.

The State Government plans to create a Knowledge Industry Townships (KIT) with an aim to set up knowledge-oriented industries and the Information Technology Corridor. The KIT is designed to provide high quality integrated township facilities with civic amenities and facilitate to set up new units.

4.26.1 IT Enabled Services (ITES) Policy 2005

The Government of Tamil Nadu unveiled ITES Policy on 9th September 2005. The basic objectives of the policy are:

- To get the maximum global ITES investments to Tamil Nadu
- To develop Human Resources specific to ITES Sector
- To create world class infrastructure for IT & ITES and an enabling framework or protection of intellectual property and data
- To generate employment and other ITES opportunities in major cities in Tamil Nadu
- To provide a conducive environment for the sector by reducing regulations and increasing Opportunities.

This policy seeks to establish the State as the global ITES capital and consolidate its leadership position by leveraging the inherent strengths of the State. IT Enabled Services are Human Intensive Services that are delivered over telecom networks or the internet with a range of business segments. The business segments include Medical Transcription, Legal Database Processing, Remote Maintenance, Back Office Operations, Data Processing Call Centers, Human Resources Services, Insurance Claim Processing, Business Processing Outsourcing etc.

All administrative, physical and infrastructure incentives offered in IT Policy 2002 shall be applicable to ITES sector also. The highlights of the Policy includes enacting legislation to entire data security, customer privacy and deal with IT related violations in general and encouraging establishment of information Technology Enabled Services (ITES) Parks in tier-2 and tier-3 cities. Strengthening the language capabilities of students will be a key sector the Government will focus on. The Government will encourage universities and institutions in the State to create institutional infrastructure for acquiring foreign language skills. Further the Policy states that taking computer literacy in schools to the next level, the Government will provide language and ITES skills to students. Being aware that the future manpower needed by the ITES sector is still in the schools, imparting of ITES skills at the level of standards 9 to 10 will be taken as a goal from academic year 2005-06 onwards. It is also proposed to celebrate the birth anniversary of the Mathematical Genius Ramanujam (Dec 22) and Information Technology day in Tamil Nadu.

4.26.2 IT Kiosks in Rural India

In rural India, more than half of India's villages lack telephone connectivity, let alone Internet access.

The lack of information and communication infrastructure results in people having to waste time and money chasing information and government officials. Lack of clarity in processes, and corruption and mismanagement in systems and operations, is rampant. The inaccessibility of information affects the rural poor more than other sectors of the community. Similarly, lack of market information (on commodity prices, various input suppliers, etc.) leads to loss of income and exploitation of rural entrepreneurs by middlemen. Such exploitation and losses further marginalize small and marginal farmers and village artisans.

The implications of this scenario on the rural people (with differential impacts on the poor and other vulnerable groups) are three-fold:

- Loss of income
- Loss of time
- Loss of opportunity

In this context, Information and Communication Technologies (ICTs) can play a significant role in making information available at a reasonable cost. ICTs promise to provide innovative solutions to the problems of poverty and inequality by accelerating development and introducing transparency into systems and operations.

The IT Kiosks can also be effectively put to use for disseminating the information on environment and social aspects. This will help in generating awareness among the community at large. The ultimate idea is to get the stakeholders to zealously work for the furtherance of environment and social concerns.

4.26.3 Information from IT Kiosks

- Market information and linkages
- Price of agriculture commodities
- Storage facilitation
- Knowledge and extension facilitation
- Irrigation facilitation
- Harvest and transportation of produce
- Seeds, fertilizers and pesticides
- Farm machinery

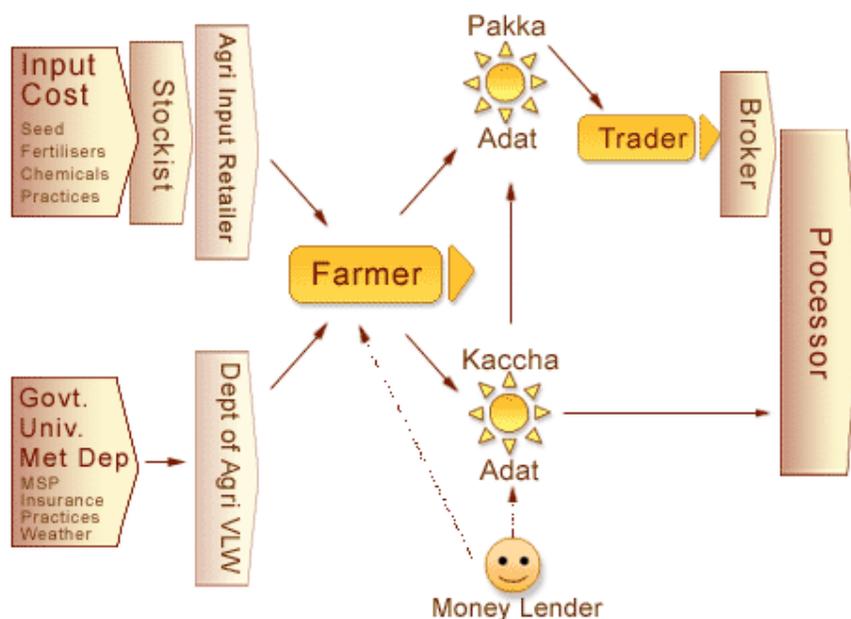
In the present context of IAMWARM project, additional information pertaining to the environmental and social issues in each river basin can also be made available to farmers through these rural kiosks. The issues that can be focused are:

- Soil types and suitable crops
- Crop yield
- Meteorological data
- Population and live stock census
- Encroachments in water bodies
- Government schemes and programmes
- Education and employment

4.26.4 ITC e-Choupal – A Case Study of linking Agriculture and CSR

ITC's International Business Division, one of India's largest exporters of agricultural commodities, has conceived e-Choupal as a more efficient supply chain aimed at delivering value to its customers around the world on a sustainable basis.

The e-Choupal model has been specifically designed to tackle the challenges posed by the unique features of Indian agriculture, characterized by fragmented farms, weak infrastructure and the involvement of numerous intermediaries, among others.



e-Choupal' also unshackles the potential of Indian farmer who has been trapped in a vicious cycle of low risk taking ability > low investment > low productivity > weak market orientation > low value addition > low margin > low risk taking ability. This made him and Indian agribusiness sector globally uncompetitive, despite rich & abundant natural resources.

Such a market-led business model can enhance the competitiveness of Indian agriculture and trigger a virtuous cycle of higher productivity, higher incomes, enlarged capacity for farmer risk management, larger investments and higher quality and productivity.

Further, a growth in rural incomes will also unleash the latent demand for industrial goods so necessary for the continued growth of the Indian economy. This will create another virtuous cycle propelling the economy into a higher growth trajectory.

The Model in Action

Appreciating the imperative of intermediaries in the Indian context, 'e-Choupal' leverages Information Technology to virtually cluster all the value chain participants, delivering the same benefits as vertical integration does in mature agricultural economies like the USA.

'e-Choupal' makes use of the physical transmission capabilities of current intermediaries – aggregation, logistics, counter-party risk and bridge financing – while dis-intermediating them from the chain of information flow and market signals.

With a judicious blend of click & mortar capabilities, village internet kiosks managed by farmers – called sanchalaks – themselves, enable the agricultural community access ready information in their local language on the weather & market prices, disseminate knowledge on scientific farm practices & risk management, facilitate the sale of farm inputs (now with embedded knowledge) and purchase farm produce from the farmers' doorsteps (decision making is now information-based).

Real-time information and customized knowledge provided by 'e-Choupal' enhance the ability of farmers to take decisions and align their farm output with market demand and secure quality & productivity. The aggregation of the demand for farm inputs from individual farmers gives them access to high quality inputs from established and reputed manufacturers at fair prices. As a direct marketing channel, virtually linked to the 'mandi' system for price discovery, 'e-Choupal' eliminates wasteful intermediation and multiple handling. Thereby it significantly reduces transaction costs.

'e-Choupal' ensures world-class quality in delivering all these goods & services through several product / service specific partnerships with the leaders in the respective fields, in addition to ITC's own expertise.

While the farmers benefit through enhanced farm productivity and higher farm gate prices, ITC benefits from the lower net cost of procurement (despite offering better prices to the farmer) having eliminated costs in the supply chain that do not add value

The Status of Execution

Launched in June 2000, 'e-Choupal', has already become the largest initiative among all Internet-based interventions in rural India. 'e-Choupal' services today reach out to more than 3.1 million farmers growing a range of crops - soyabean, coffee, wheat, rice, pulses, shrimp - in over 31,000 villages through 5200 kiosks across six states (Madhya Pradesh, Karnataka, Andhra Pradesh, Uttar Pradesh, Maharashtra and Rajasthan).

The problems encountered while setting up and managing these 'e-Choupals' are primarily of infrastructural inadequacies, including power supply, telecom connectivity and bandwidth, apart from the challenge of imparting skills to the first time internet users in remote and inaccessible areas of rural India

Several alternative and innovative solutions – some of them expensive – are being deployed to overcome these challenges e.g. Power back-up through batteries charged by Solar panels, upgrading BSNL exchanges with RNS kits, installation of VSAT equipment, Mobile Choupals, local caching of static content on website to stream in the dynamic content more efficiently, 24x7 helpdesk etc.

Going forward, the roadmap includes plans to integrate bulk storage, handling & transportation facilities to improve logistics efficiencies.

As India's 'kissan' Company, ITC has taken care to involve farmers in the designing and management of the entire 'e-Choupal' initiative. The active participation of farmers in this rural initiative has created a sense of ownership in the project among the farmers. They see the 'e-Choupal' as the new age cooperative for all practical purposes.

This enthusiastic response from farmers has encouraged ITC to plan for the extension of the 'e-Choupal' initiative to altogether 15 states across India over the next few years. On the anvil are plans to channelise services related to micro-credit, insurance, health and education through the same 'e-Choupal' infrastructure.

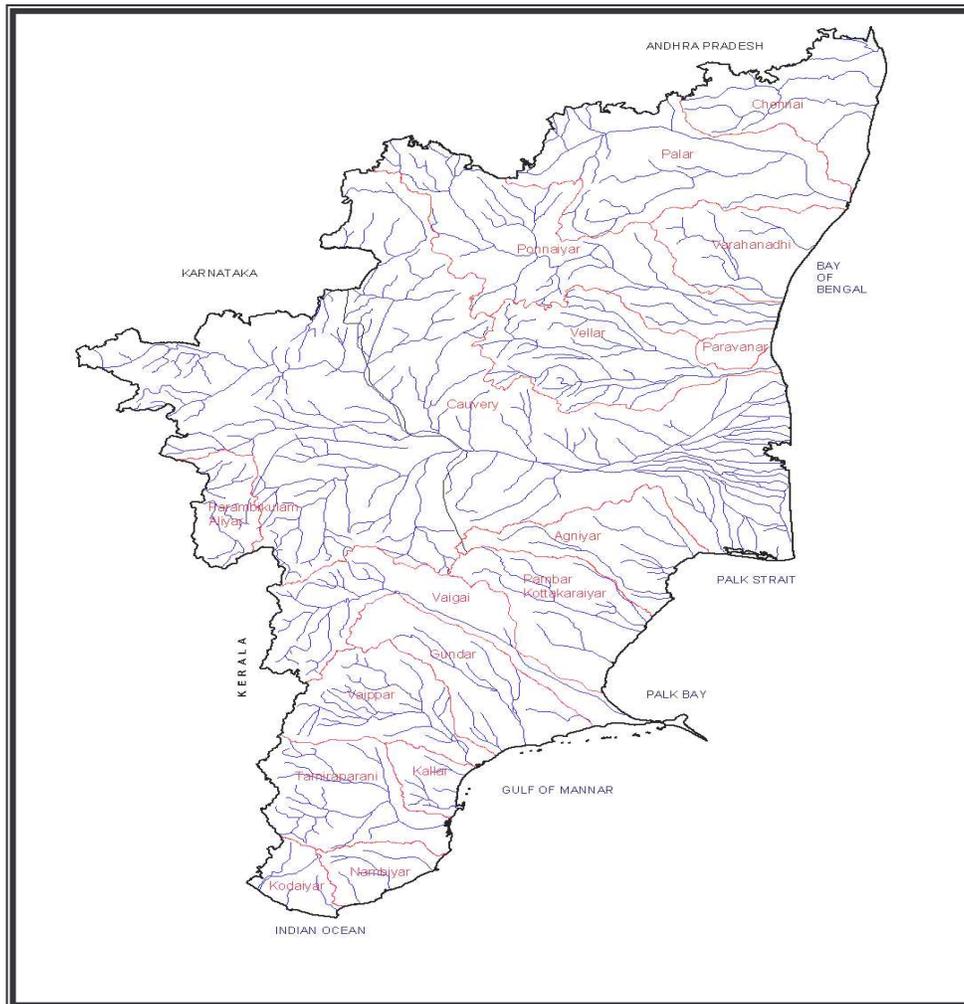
4.27 Study Area

The IAMWARM project is for the entire State of Tamil Nadu covering 117 sub-basins in 17 river basins of Chennai, Palar, Varahanadi, Ponnaiyar, Paravanar, Vellar, Agniyar, Pambar & Kottakaraiyar, Vaigai, Gundar, Vaippar, Kallar, Tamirabarani, Nambiyar, Kothaiar, Parambikulam & Aliyar Project. In the first year 41 sub basins are proposed under this project. The methodology adopted for this study includes stakeholders consultations, field visits, secondary data collection, compilation and interpretation.

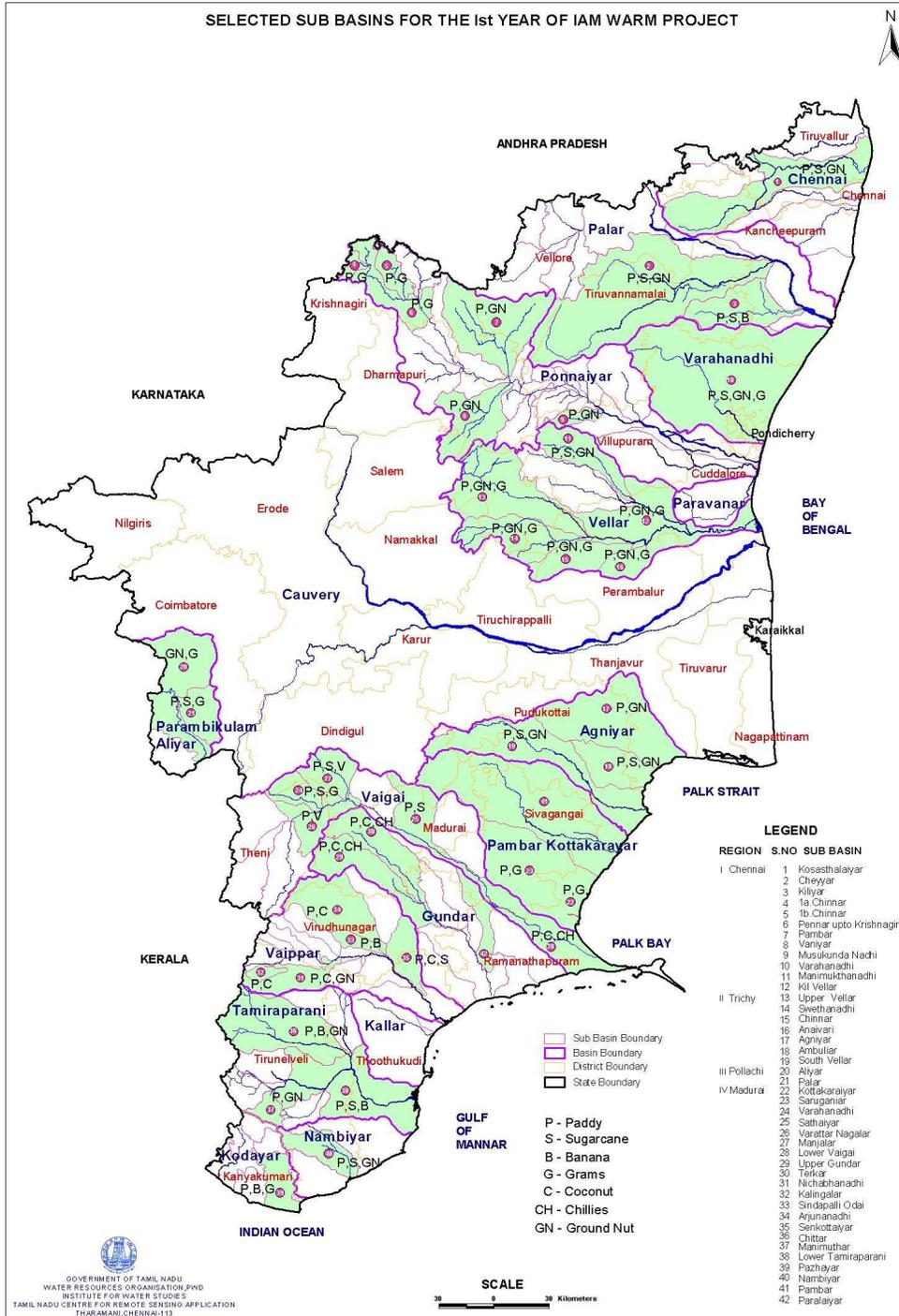
Baseline environmental and social information pertaining to the 17 river basins namely Chennai, Palar, Varahanadi, Ponnaiyar, Paravandar, Vellar, Agniyar, Pambar & Kottakaraiyar, Vaigai, Gundar, Vaippar, Kallar, Tamirabarani, Nambiyar, Kothaiar, Parambikulam & Aliyar Project are discussed in detail in Annexure I.

The maps of the sub basins are also given in Annexure I

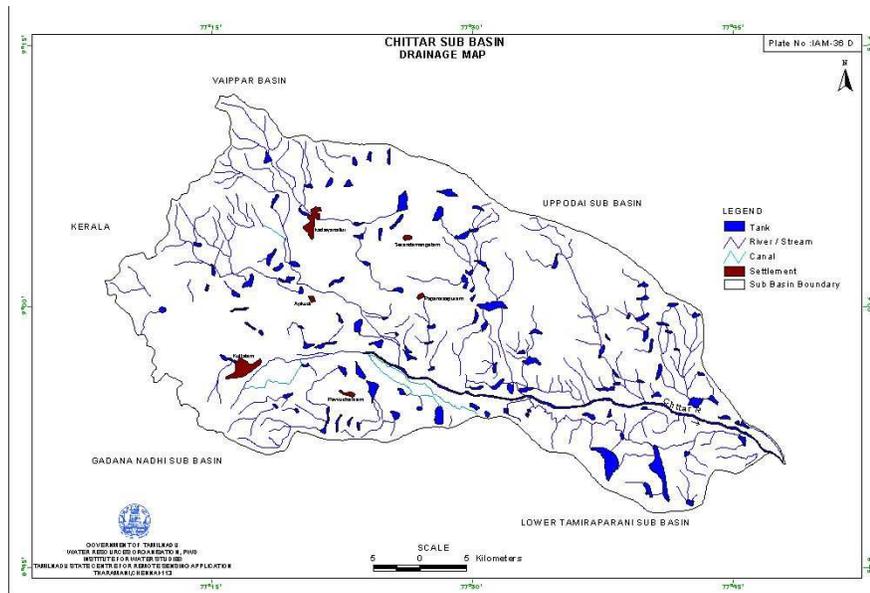
4.27.1 Basin Map



4.27.2 Sub Basin Map



4.27.3 Chittar Sub Basin (Drainage Map)



4.28 Environmental and Social Issues in the Sub Basins

Environmental and social issues pertaining to 16 river basins and 42 sub-basins that are taken under the project for the first year are presented here. The environmental and social issues in the sub basins have been identified through stakeholder consultative workshops in the river basins of Tamilnadu. EPTRI has conducted 17 stakeholder consultation workshops in 16 river basins. The objective of stakeholders consultation is to minimize the negative impacts in the area and make them feel that they are the ultimate beneficiaries of the project in this process the views ascertained from the stakeholders is analyzed and incorporated in the project document. The ESA study initially obtained the opinions of the stakeholders and the same has been analyzed and incorporated at the sub basin level. The meetings are conducted in the following places in 16 river basins.

Table 4.31 Stakeholder consultation workshops in 16 river basins

S.No	Major River Basin	Place of the workshop
1	PAP	Pollachi
2	Pennaiyar	Thiruvannamalai
3	Pennaiyar	Krishnagiri
4	Vellar	Athur
5	Agniar	Pudukkottai
6	Vaigai	Madurai
7	Vaippar	Srivalliputtur
8	Tamirabarani	Thirunelveli
9	Kothaiyar	Nagercoil
10	Nambiyar	Vallioor
11	Palar	Cheyyar sub basin Kancheepuram
12	Varahanadhi	Tindivanam
13	Kottakaraiyar & Pambar	Sivagangai
14	Vaigai	Paramakudi
15	Gundar	Aruppukottai
16	Vellar	Perambalur
17	Chennai	Kosasthalaiyar sub basin Thiruvallur

The key environmental and social issues specific to areas in 42 sub basins are detailed below:

Table 4.32 Major environmental and social issues in the sub basins

S. No	Main River Basin	Sub Basin	Environmental Issues	Social Issues
1	Chennai	1. Kosasthalaiyar	<ul style="list-style-type: none"> • Industrial Pollution • Sea water intrusion reduced the quality of groundwater • Sand Mining is prevalent in the river bed areas • Siltation • Coastal erosion • Weed growth • Industrial effluents released into river • Domestic Sewage released into river • Over exploitation of ground water • Dumping of debris into tanks 	<ul style="list-style-type: none"> • Encroachment in the river and tank beds • Poor sanitary conditions • Skin allergies • Mosquito breeding due to water stagnation and Elephantiasis
2	Palar	2. Cheyyar	<ul style="list-style-type: none"> • Ground water contamination • Dying Effluents In Arni Taluk • Water contamination due to Kattamanku • Sand mining seen in the river bed areas • Domestic Sewage of Arni town and Thiruvathipuram • Water weeds 	<ul style="list-style-type: none"> • Poor literacy levels • Anthrax disease in cattle • Provide good linkage for marketing

		3. Kliyar	<ul style="list-style-type: none"> • Sand mining seen in the river bed areas • Ground water depletion due to industries • Solid waste problem in Vandavasi Municipality • Sea water intrusion near Vayalur • Sugar mill effluents in Padalam • Water weeds • Lack of sewage treatment plant Vandavasi and Madurantagam Municipalities 	<ul style="list-style-type: none"> • Seasonal migration due to unemployment • Poor marketing facilities and poor value addition • Poor literacy levels leading to migration • Poor sanitary conditions and unhygienic conditions • Diseases surveillance due to mosquitoes and pigs
3	Pennaiyar	4. Chinnar 1 a	<ul style="list-style-type: none"> • Domestic sewage • Poor solid waste management • Drinking water pollution due to drainage water. • Sand mining seen in the river bed areas • Soil erosion seen in the river and tank beds • Water weeds 	<ul style="list-style-type: none"> • Livestock reduction with unidentified diseases • Poor sanitary conditions • Poor literacy levels • Water borne diseases in this river basin
		5. Chinnar 1 b	<ul style="list-style-type: none"> • Sand mining seen in the river bed areas • Water contamination • Domestic sewage led into rivers • Water weeds • Textile effluents 	<ul style="list-style-type: none"> • Seasonal migration due to poor literacy levels • Livestock reduction with unidentified diseases • Poor sanitary conditions and sanitation programmes are not properly implemented. • Health problems due to mosquitoes and stagnation of water

		6. Pennaiyar to Krishnagiri	<ul style="list-style-type: none"> • Water pollution due to industries • Mango processing effluents released into tank leading to water contamination and algal blooms • Sand mining is very high in the river bed area • Poor solid waste management • Soil erosion seen in the river and tank beds 	<ul style="list-style-type: none"> • Health problems due to industrial water pollution • Livestock diseases and decrease in the trend of livestock. • Encroachment of river and tank beds
		7. Pambar	<ul style="list-style-type: none"> • Lack of solid waste disposal method • Sago industrial effluents a major problem • Water weeds 	<ul style="list-style-type: none"> • Seasonal migration due to poor literacy levels • Livestock reduction due to diseases • Poor sanitary conditions leading to diseases • Encroachment of irrigation canals
		8. Vaniyar	<ul style="list-style-type: none"> • Lack of solid waste disposal method • Sago industrial effluents led into the river • Sand mining is seen in the riverbed areas. 	<ul style="list-style-type: none"> • Seasonal migration due to poor literacy levels • Livestock reduction due to diseases • Poor sanitary conditions in the residential areas
		9. Musukundanadhi	<ul style="list-style-type: none"> • Municipal sewage letting out into rivers • Sand mining in the river bed areas • Lack of sewage treatment plant 	<ul style="list-style-type: none"> • Seasonal migration due to poor literacy levels • Livestock reduction due to unidentified diseases • Poor sanitary conditions in the residential areas

4	Varahanadhi	10. Varahanadhi	<ul style="list-style-type: none"> • Mining of rocks • Municipal sewage letting out into rivers • Sand mining in the river bed areas • Water weeds 	<ul style="list-style-type: none"> • Seasonal migration due to poor literacy levels • Livestock reduction due to unidentified diseases • Lack of awareness in solid waste minimization and management
5	Vellar	11. Manimuthanadhi	<ul style="list-style-type: none"> • Coconut trees are affected due to water pollution • Sand mining is prevalent in the river beds • Over exploitation of ground water 	<ul style="list-style-type: none"> • Social conflicts in water utilization • Inadequate school teachers leading low literacy levels • Anthrax diseases in cattle
		12. Kil Vellar	<ul style="list-style-type: none"> • Municipal sewage letting out into rivers • Effluents from sugar industries released into river • Lack of sewage treatment plants 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Livestock reduction due to diseases • Poor drinking water supply and sanitation
		13. Upper Vellar	<ul style="list-style-type: none"> • Sago industrial effluents released into river • Sand mining leading to depletion in ground water level 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Livestock reduction due to diseases • Poor drinking water supply and sanitation • No marketing facilities
		14. Swethanadhi	<ul style="list-style-type: none"> • Ground water pollution • Sand mining in the river beds • Air pollution due to cement factory 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Livestock reduction due to diseases in cattle • Poor drinking water supply and sanitation • No marketing facilities • Problem of mosquitoes leading to malaria

		15. Chinnar	<ul style="list-style-type: none"> • Ground water pollution • Sand mining in the river bed areas 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Livestock reduction due to unidentified diseases. • Poor drinking water supply and sanitation • Females affected by cancer
		16. Anivari	<ul style="list-style-type: none"> • Ground water pollution • Sand mining prevalent the river beds • No proper solid waste management 	<ul style="list-style-type: none"> • Seasonal migration due to unemployment • Livestock reduction due to lack of veterinary hospitals • Poor drinking water supply and sanitation
6	Agniar	17. Agniar	<ul style="list-style-type: none"> • Excessive nitrate concentration in ground water • Poor solid waste management • Soil erosion seen in river and tank beds • Excessive use of chemical fertilizers polluting the surface as well as ground water. 	<ul style="list-style-type: none"> • Seasonal migration due to poverty • Reduction in grassing land and livestock • Low literacy rate due to poverty • Poor marketing facilities • Poor sanitary conditions leading to several diseases.
		18. Ambuliar	<ul style="list-style-type: none"> • Juliflora growth is predominant • Sand mining seen in the river beds • Excessive use of chemical fertilizers polluting the ground waters 	<ul style="list-style-type: none"> • Seasonal migration due to unemployment • Women empowerment through SHGs • School drop outs due to lack of teachers • Poor sanitary conditions leading to several diseases.
		19. South Vellar	<ul style="list-style-type: none"> • Juliflora growth is predominant • Sand mining seen in the river beds • Over exploitation of ground water 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Women empowerment through SHGs • No health care centers

7	Parambikulam Aliyar Project	20. Parambikulam Aliyar	<ul style="list-style-type: none"> • Soil erosion seen in the river and tank beds • Siltation and deforestation • Sand mining leading to depletion of water level. • Pollution due to coir industries • Excess fluoride and nitrate concentration 	<ul style="list-style-type: none"> • Improved livelihood due to coir industries • Decrease in livestock due to diseases • Women empowerment through SHGs • Water borne diseases due to unhygienic conditions
		21. Palar	<ul style="list-style-type: none"> • Soil infertility due to salinity • Ground water pollution • Catchment area degradation 	<ul style="list-style-type: none"> • Improved livelihood due to coir industries • Decrease in livestock due to unidentified diseases • Women empowerment through SHGs
8	Kottakaraiyar	22. Kottakaraiyar	<ul style="list-style-type: none"> • Juliflora and Ipomea growth • Soil alkalinity and erosion • Sand mining seen in the river beds • Chlorides in ground water • Sewage discharge into water bodies • Solid waste disposal • Water logging in coastal areas • Respiratory disorder in RS Mangalam area 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Skin diseases and health problems due to poor sanitary conditions • Lack of small scale industries in the areas
		23. Saruganiar	<ul style="list-style-type: none"> • Juliflora and Ipomea growth • Soil alkalinity • Sewage discharge into water bodies • Lack of solid waste disposal method • Respiratory disorder in Vellalore areas 	<ul style="list-style-type: none"> • Migration due to lack of employment • Skin diseases and health problems due to poor sanitary conditions • Lack of teachers in primary schools

9	Pambar	24. Pambar	<ul style="list-style-type: none"> • Juliflora growth • Ground water depletion due to exploitation • Lack of Sewage & Solid waste disposal method • Water weeds • Water logging in coastal areas • Industrial effluents into water bodies • Siltation in tanks • Dumping granite quarry waste along the road 	<ul style="list-style-type: none"> • Migration due to lack of employment • Livestock reduction due to lack of veterinary hospitals • Encroachment in irrigation canals, river beds
10	Vaigai	25. Varaganadhi	<ul style="list-style-type: none"> • Sand mining in the river beds • Siltation seen in tanks • Reduction in fish population due to sewage 	<ul style="list-style-type: none"> • Out seasonal migration due to lack of employment • Reduction in livestock due to lack of veterinary hospitals • Social conflicts in distribution of water for the tail end farmers • Lack of water storage facilities • No storage facilities for food grains • Prone to drought and floods
		26. Sathaiyar	<ul style="list-style-type: none"> • Juliflora and Ipomea growth • Sand mining in the river beds • Soil erosion in river and tank beds • Air pollution due to flour mills • Mixing of sewage into tanks 	<ul style="list-style-type: none"> • Out seasonal migration due to lack of employment • Reduction in livestock due to diseases • Social conflicts in distribution of water for the tail end farmers • Encroachments in river beds and tanks • Poor marketing facilities • Health problems due to sewage

		27. Varattar – Nagalar	<ul style="list-style-type: none"> • Juliflora growth • Soil erosion seen in river and tank beds • Poor solid waste management 	<ul style="list-style-type: none"> • Out seasonal migration due to lack of employment • Reduction in livestock due to unidentified diseases • Social conflicts in water distribution • Health problems due to indiscriminate dumping of solid waste
		28. Manjalar	<ul style="list-style-type: none"> • Juliflora and Ipomea growth • Sand mining and soil erosion in the river beds • Siltation leading to depletion in water level • Mixing of sewage into tanks 	<ul style="list-style-type: none"> • Out seasonal migration due to lack of employment • Reduction in livestock due to unidentified diseases • Social conflicts in water distribution
		29. Lower Vaigai	<ul style="list-style-type: none"> • Juliflora growth • Sand mining and soil erosion in the river beds • Salt water intrusion in the surrounding areas thereby making the water unfit for drinking • Ground water salinity 	<ul style="list-style-type: none"> • Out seasonal migration due to lack of employment • Reduction in livestock due to unidentified diseases • Social conflicts in distribution of water • No electricity connections • Problem of pigs and mosquitoes leading to diseases
11	Gundar	30. Upper Gundar	<ul style="list-style-type: none"> • Juliflora growth • Sand mining and soil erosion in the river beds • Lack of water supply in the entire basin • Lack of Sewage disposal and Garbage disposal method 	<ul style="list-style-type: none"> • Encroachment in river beds • Dry land agriculture reduction in livestock • Poor marketing and transportation facilities

		31. Terkkar	<ul style="list-style-type: none"> • Juliflora growth predominant • Sand mining seen in the river bed • Lack of Sewage & solid waste disposal method 	<ul style="list-style-type: none"> • Encroachment of catchment area • Dry land agriculture • Reduction in livestock due to diseases
		32. Paralaiar	<ul style="list-style-type: none"> • Juliflora growth • Sand mining seen in the river bed • Water borne diseases due to unhygienic conditions • Sewage & solid waste disposal method • Air pollution due to brick kilns 	<ul style="list-style-type: none"> • Drought prone area • Seasonal Migration due to unemployment • No marketing facility • No organized cattle farm • Reduction in livestock due to diseases
12	Vaippar	33. Nichabanadhi	<ul style="list-style-type: none"> • Soil erosion seen in the river bed • Siltation depleting the water level • Poor solid waste management • Dye industry effluents letting out directly into the river. • Lack of Sewage disposal method 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs • Inadequacy of teachers in schools • Prevalence of child labour due to poverty
		34. Kalingalar	<ul style="list-style-type: none"> • Sugar industrial effluent letting out directly into the river. • Ground water contamination • Lack of Solid waste disposal method • Untreated sewage let into river 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs

		35. Arjuna Nadhi	<ul style="list-style-type: none"> • Soil erosion and Sand mining in the river bed • Effluent disposal from match, fireworks, printing & willow industries • High TDS, magnesium, bicarbonates & chlorides • Lack of Solid waste disposal method • Untreated sewage let into water bodies 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs • No cold storage facilities
		36. Sindapalli Odai	<ul style="list-style-type: none"> • Sedimentation found in tanks • Soil erosion and Sand mining in the river bed • Dumping of solid waste in water bodies • Sewage pollution • Effluent disposal from match, fireworks, printing & willow industries 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs
		37. Senkottaiyar	<ul style="list-style-type: none"> • Drought prone sub basin • Sewage disposal into water bodies • Lack of Solid waste disposal method 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in livestock due to diseases • Women empowerment through SHGs

13	Tamiraparani	38. Manimuthar	<ul style="list-style-type: none"> • Sewage pollution • Encroachment of canal • Soil erosion in the river and tank beds 	<ul style="list-style-type: none"> • Seasonal migration due to unemployment • Reduction in livestock due to diseases • Lack of marketing facilities • Encroachment of irrigation canals, tanks • Lack of cooperative milk society
		39. Chittar	<ul style="list-style-type: none"> • Sewage pollution • Solid waste dumping into water bodies • Sand mining and weed growth. • Siltation leading to decrease in water level • Industrial effluents directly led into river 	<ul style="list-style-type: none"> • Seasonal migration due to unemployment • Poor sanitary and sewage conditions leading several health disorders • Malaria and other diseases due to indiscriminate dumping of solid wastes and mosquitoes
		40 Lower Tamiraparani	<ul style="list-style-type: none"> • Sewage pollution • Solid waste dumping into water bodies • Sand mining and weed growth • Sea water intrusion into the coastal areas • Industrial effluents directly led into river 	<ul style="list-style-type: none"> • Seasonal migration due to unemployment • Poor drinking water facilities • Health problems due to unhygienic conditions • Lack of veterinary hospital

14	Kothaiyar	41. Pazhayar	<ul style="list-style-type: none"> • Salinity and alkalinity • Soil erosion in the river and tank beds • Poor solid waste management at tourist spots • Water weeds • Entry of untreated effluents into water bodies • Agro industry effluents • Sea water intrusion in coastal areas • Increased use of chemical fertilizers in the fields pollutin ground as well as surface waters • Ground water depletion due to excessive withdrawl by pepsi and coke companies • Fluoride in ground water in Anjugramam, Azhuppapuram and Kattuvilai 	<ul style="list-style-type: none"> • Migration due to lack of employment • Reduction in livestock due to diseases • Women empowerment through SHGs • Poor sanitation and drinking water facilities, • Encroachment of river banks, tanks etc • Poor marketing facilities • High transportation costs
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15	Nambiyar	42. Nambiyar	<ul style="list-style-type: none"> • Sand mining leading to decrease in water level • Dumping of solid and agricultural wastes • Sea water intrusion in coastal areas • Soil erosion in the river and tank beds • River bed degradation and instability of stream course 	<ul style="list-style-type: none"> • Seasonal migration due to lack of employment • Reduction in livestock due to diseases • Women empowerment through SHGs • Poor sanitation and drinking water facilities • Agricultural labour scarcity • Water borne diseases like malaria & diarrhea
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4.29 Water Related Environmental Issues in River Basins

The environmental issues in the river basins pertaining to water are detailed below:

Table 4.33 Water related Environmental issues

Environment Problem	Sectors and Activities Contributing to Problem	Effort on Sectors and Other Water Users
Pollution of rivers and other water bodies	<ul style="list-style-type: none"> • Industry discharge of untreated industrial effluents • Domestic Sector: discharge of raw sewage and inadequate disposal of domestic solid water 	<ul style="list-style-type: none"> • Water supply: contamination of water for various uses. • Tourism: foreclosure of recreational uses • Religion: inadequacy of water for ceremonial use
Reduced river flow	<ul style="list-style-type: none"> • Irrigated Agriculture, Industry and Domestic Water Users: excessive withdrawal of river water • Construction of storage structures 	<ul style="list-style-type: none"> • Ecology: change or loss of aquatic ecology; loss of river regenerative capability • Fishery: loss of fish and foreclosure of fishing activities • Tourism: foreclosure of recreational uses • Religion: loss of water for ceremonial use
Nutrients: surface and groundwater contamination and eutrophication of lakes and reservoirs	<ul style="list-style-type: none"> • Agriculture: surface runoff or leaching of nitrogen, phosphorous applied as fertilizer and animal wastes. • Sanitation: discharge of raw sewage; infiltration from inadequate disposal of domestic solid waste 	<ul style="list-style-type: none"> • Domestic water supply: excess nitrate in drinking water • Energy (hydro-power), irrigation and flood control: impairment of reservoirs due to eutrophication • Fishery: loss of fish • Ecology: disruption of food chain and propagation of unwanted species.
Water logging and soil salinity	Irrigated Agriculture: over-use of water and inadequate drainage	Agriculture: loss of arable land
Waterborne diseases	<ul style="list-style-type: none"> • Urban and Rural Sanitation: discharge of raw sewage and inadequate disposal of domestic solid waste. 	<ul style="list-style-type: none"> • Domestic water supply: unsafe drinking water • Health: water-related illness

	<ul style="list-style-type: none"> • Education and Health: inadequate education in hygiene 	
Toxic pollution of surface and ground water	<ul style="list-style-type: none"> • Industry: inadequate disposal of hazardous wastes and discharge of industrial effluents 	<ul style="list-style-type: none"> • Domestic water supply: contamination of drinking water • Ecology: toxic effects on aquatic organisms and changes in aquatic community structure
Ground water depletion and contamination	<ul style="list-style-type: none"> • Irrigated Agriculture: excessive withdrawal of groundwater • Domestic water supply: excessive withdrawal of ground water 	<ul style="list-style-type: none"> • Domestic water supply: inadequate quantity and quality of drinking-water • Agriculture: inadequate water quantity for irrigation
Loss of wetlands	<ul style="list-style-type: none"> • Urban growth and industrial development in ecologically sensitive areas • Agriculture expansion • Water-related projects 	<ul style="list-style-type: none"> • Ecology: loss of biodiversity • Fisheries: destruction of coastal areas and loss of mangrove forests for fish breeding.

The anticipated environmental and social impacts due to the activities in the river basins are discussed in detail in the succeeding chapter.

5 ANTICIPATED ENVIRONMENTAL & SOCIAL IMPACTS AND ANALYSIS OF ALTERNATIVES

5.1 Introduction

The analysis of alternatives explores the opportunities that may be capitalized through sensitive inclusion of environmental and social safeguard measures into the project. Analysis of alternatives approaches for identification of sub-projects, prioritization of intervention measures and alternative physical and institutional interventions, which would help in eliminating poverty, and improve the well being of the stakeholder community. The applicability of these alternatives is based on the lessons learnt while implementing the project, such alternative approaches may be further developed and suitable amendments are made in the Social and Environmental Management Framework. The assessment of impacts of each of the proposed project activities would serve as an additional guideline for modifying or strengthening the activity to enhance positive impacts and to minimize negative environmental impacts.

The rehabilitation with community participation is expected to have positive impact on the environment. The rehabilitation result in the augmented supply of irrigation water, better recharge of groundwater, better quality of drinking water, increased productivity, enhanced employment opportunities and better well-being of the stakeholder communities. Moreover, project interventions or activities would help in better management of natural resources and improve the overall environment and local ecology.

5.2 Legal and Administrative Framework

The Government of India, in their Notification issued on 27-01-1994 have made it mandatory to obtain environmental clearance for projects as required under the Environmental Protection Act, 1986. The list of projects requiring environmental clearance from the Central Government includes:

“River Valley projects including hydropower, major Irrigation and their combination including flood control”

The consolidated guidelines for diversion of forestlands for non-forest purposes under the Forest Conservation Act (1980) state

“All proposals for diversion of forest land above 5 ha and up to 20 ha, are to be examined by the Regional Chief Conservator of Forests in consultation with the Advisory Group consisting of representatives of the State Government from the Revenue Department, Forest Department and Planning Department”.

Analysis of alternatives defines the issues and a clear basis for choice among the alternatives for the decision-makers. Deterioration began after the decline in the role of community in the management and taking over the responsibility by the State.

The major problems are:

- Siltation results in reduction in the storage capacity,
- Encroachment on natural and other water ways and feeder channels in the catchment area,
- Extension of cultivation and encroachment in the foreshore area, damage to the dam, surplus-weirs, main and field channels.

There are different alternatives to rehabilitate with short-term and long-term perspectives. The analysis of probable impacts of major interventions is presented below.

5.3 Environmental Impacts

Environmental impacts are expected not only on the site of the dam and the reservoir, but also in the watershed. The following locations are taken into account.

- Area that is to be inundated
- Catchment area upstream of the planned dam
- Catchment area downstream of the planned dam
- River upstream of the planned dam
- River downstream of the planned dam
- Reservoir area

5.3.1 Impact on land environment

Due to inundation land will be lost. The loss includes Patta Lands, Poramboke Lands and Forests. The economic loss as a result of the inundation is estimated as Rs 2,83,000 per year. The people who are living and working here must leave the area. They will receive compensation for the loss of the land. About Rs. 6.00 Million has to be paid as compensation.

5.3.2 Impact on flora and fauna

The river upstream is likely to be affected by the dam construction. The present riverbanks will be permanently inundated and effectively lost. The ecosystem will change thoroughly. Habitat of aquatic fauna that lives in flowing water with high oxygen content will disappear. Instead a stagnant water habitat will develop. Fish species and bottom fauna will be replaced by other species. Most probably biodiversity will decrease locally. Water vegetation is likely to develop, especially in the shallow parts of the reservoir. Water birds may also be attracted to the reservoir.

5.3.3 Impact on water environment

The water quality in the reservoir will depend on a number of factors. Since there are no industrial or agricultural activities upstream no nutrients or chemical contaminants are to be expected. If, however, vegetation is not removed prior to inundation, at least in the first year poor water quality due to decomposition of vegetation is expected.

5.3.4 Impact on siltation

The expected siltation rate of the reservoir is difficult to predict. However, since the slopes of the hill adjacent to the reservoir are only sparsely forested and the soil consists mainly of sand and sandy loam, rain may be expected to cause considerable erosion of the slopes near the reservoir. Further upstream the hills are still densely forested and the erosion here will be not severe. It is assumed that the reservoir is replenished 3 times a year, meaning an average retention time of 4 months.

The water that will be released from the reservoir may have decreased sediment concentrations, because the solids would have settled in the reservoir. The sediment sluice will only affect the siltation in a small area near the sluice. The lower sediment load in the downstream river may increase the erosion downstream.

5.3.5 Impact on downstream river

As a result of the presence of the dam the flow pattern in the downstream river stretch will change completely. The flow pattern will no longer depend upon the rainfall but much on the operation of the spillway, which is regulated according to the needs of the downstream water demand. The design discharge through the sluice is 7.63 M³/s. During the filling of the reservoir the downstream river stretch will be dry due to lack of flow. It is, however not expected that extreme high flows will be attenuated, and therefore the spillway is proposed with a design capacity of 1,850 M³/s.

After release of water from the reservoir the downstream river stretch will temporarily carry water. After a while, when the water has been let into the irrigation channels, the riverbed will fall dry again, apart from some pools that will hold stagnant water.

Availability of water

The amount of water that will be made available by the dam construction is expected to cover the water demands for agriculture, drinking, livestock and industries in the project area.

Ground water

Infiltration of surface water into the ground will take place in the reservoir, downstream river and the irrigation channels. It is expected that the groundwater level will increase in the project area. As a result of the large amount of surface water the evaporation will also increase.

5.3.6 Impact on human health

The likelihood of water borne diseases greatly depends on the developments in the ecosystem. Shallow parts of the reservoir may provide conditions for aquatic vegetation that host mosquitoes and snails which are vectors of water-borne diseases. Also the shallow, warm water pools that will appear in the downstream river provide possible habitats for mosquitoes.

5.3.7 Indirect environmental impacts

The increased accessibility of the area, made possible by road construction, and the availability of water can cause an increased pressure on the environment. The results may be on-site environmental degradation, decrease in water quality, and increase of sedimentation rate due to clearing forest for agricultural purposes or cutting tree for timber or firewood.

5.4 Social Impacts

Social impacts due to the project interventions are both positive and negative. These may be of long term or short-term impacts which are detailed below.

5.4.1 Positive Impacts

Empowerment of Social Groups

The groups like WUAs, SHGs will be empowered, provided there should be ensured membership for the landless and other deprived sections of the community. It acts as the conflict resolution mechanism and reduces the differences in access to water between the large and small farmers and the head-reach and tail end farmers.

Enhances the Standard of Living

Improved sources of irrigation will result in the increased income and reduces the unfavorable and conditional dependency of the poor on land lards and moneylenders. It arrests the seasonal migration and develops the non-farm activities.

Gender Equity

With the improved access to membership and enhanced income, there is opportunity, especially for the women groups for equity and in turn further improvements.

Prevents Migration

Agricultural and allied activities will be increased, with the improved irrigation facilities, which in turn lead to enhanced livelihoods and prevent out-migration.

5.4.2 Negative Impacts

Impact on quality of Water

Due to accumulation of minerals and water logging, the quality of water gets affected. It leads to water borne diseases and other associated health problems.

Induced impact on Water Quality

Due to the accumulation of minerals water quality will be decreased. Besides this, with the access to improved irrigation sources, farmers may go for more number of crops in turn increases the use of pesticides and fertilizers.

Food systems failure

Lapses in coordinating and strategizing the irrigation infrastructure may cause periods of food systems failure. Safeguard measures may be taken up as suggested in the social and environmental management frame work.

Chaos

In the absence of the proper planning for the crop diversification being the major intervention of the project, leads to chaos due to lack of information on crop planning, suitability of crops and availability of water. The farmers have to be trained in the areas of suitability of crops according to the agro, climatic and soil conditions.

Impact on Human health

At the reservoir sites there is more possibility for the water-borne diseases. Medical facilities at reservoir sites should be set up keeping in view of the number of accidents Regular visits of doctors to the site from the Primary Health Centers and district hospitals would be necessary. Proper First Aid facilities may be made available at all strategic points of campsite and educate labour for administering first aid in emergencies.

5.5 Environment Management Plan (EMP)

The Environmental Management Plan (EMP) aims to mitigate measures to restore and preserve the eco-system of the possible adverse impacts, if any, due to proposed project The mitigation steps are used to minimize or prevent negative impacts on environment due to proposed development activity. The environment impact, which may occur as a result of construction activity of diversion weir, intake structure, underground desilting tank etc are considered on following lines:

- Eco-system (both aquatic & terrestrial)
- Individual Species
- Geophysical environment of the area
- Human population

The main aim of Environment Management Plan is to ensure that the proposed development in study area, say 10 km radius, maintains its sustainable balance with cautious approach towards utilization of non-renewable resources. Government & non-Government agencies like State Environment Protection and Pollution Control Board and more importantly the people in the area and non-Government organizations, need to extend their valuable contribution, suggestions and co-operation.

The main impacts on Environment are likely to occur during construction phase. In the E.M.P., it is proposed to take possible corrective measures to ensure that these effects are kept to bare minimum. The E.M.P., therefore, shall start from planning stage itself and should focus on:

- A summary of biologically rich areas
- Catchment Area Treatment Plan
- Compensatory Aforestation Scheme.
- Landscaping of Colonies, Quarries and other works
- Environment monitoring management during construction and post construction period

5.5.1 Environmental Management - During Execution Stage

Fugitive dust emission and solid waste will be generated during site preparation, construction of labour huts, storage, approach roads etc. In addition there will be some increase in the noise levels around the site. These impacts will be temporary, occurring during cleaning/clearing for site preparation & will be localized. Water spray system will be adopted for suppression of dust, hence reducing the impacts to minimum. Solid waste will be disposed along with the muck in pre-identified and approved dumping sites. As there is little or no habitation near the proposed development activity as such slight rise in noise levels have no effect. Hence no additional measures will be necessary.

5.5.2 Construction

Management of Labour Camps

The strength of about 600 workers in the project area during the construction stage is likely to generate considerable impact on the existing environment of the area. The aim of the EMP is to minimize these stresses to acceptable limits. It will be made mandatory for the contractors to provide desired facilities at labour camps. Some of the conditions of contract shall be

Community Toilets

Properly desired block of community latrines as per strength of labour

Community kitchens

A community kitchen for each labour camp shall be provided. The fuel used in these community kitchens can be LPG or diesel /K. oil. The project authorities will make provision for opening a fuel wood depot as a back up measure

Provision of Water Supply

Water for drinking purposes shall be arranged from near by streams flowing upstream of labour camps and stored in tanks. Necessary filtration and bacteriological treatment, so required, will be provided. It will be ensured that water sources/storage and septic tanks/soak pits are planned far from each other.

Sewerage Treatment

One community toilet can be provided for each 20 labourers. For each 500 person or for 20 toilets, one septic tank would be provided followed by soak pits as per accepted design and portable sewerage treatment plants are to be provided wherever concentration of labour is high.

Solid Waste Management

The solid waste usually generated from labour camps contains, mostly of compostible wastes like vegetable matters and combustible waste like paper, cans, plastic etc. and some non-degradable waste like glass/ glass bottles etc. At peak season 650 persons are likely to be there during construction phase and @ 5 kg/per person per day, total waste requires management will be approximately 0.75 mt per day. One small covered tipper shall be provided for collection & disposal of waste. The compostible waste will be dumped in large pits/ low lying area combustible waste shall be collected and properly burned and non-degradable waste shall be dumped in muck disposal sites.

5.5.3 Health Environment

Unskilled and skilled workers are likely to be deployed during the peak construction stage. It is recommended that one dispensary shall be developed near site at a location, which is easily accessible to all the labour camps.

The dispensary shall be housed in a properly planned building. The proposed health center will have facilities for emergency care of insect bites, diarrhea, fever, minor accidental injuries and under all circumstances immediate medical care shall be provided for workers. A first-aid post with a first aid box with essential medicines, first aid appliances, dressing materials, splints, stretcher and wheel chair shall be places in a specially constructed medical booth/ check post at a site easily approachable from other construction sites. First aid posts shall have facilities such as telephone connection, fire fighting equipments and one vehicle or ambulance for effective functioning.

5.5.4 Air Environment Management

The air pollution shall be from construction of dams, tunnels, surge shaft & powerhouse etc. These activities will generate large quantity of dust during drilling, blasting and hauling operations. Measures will be taken to mitigate the fugitive dust from different operations.

- a) Polythene or rexin cover or any suitable sheets of height 7 to 10 m to be erected along the boundary of the site to reduce the dispersion of the dust during site preparation and construction activities.
- b) Water sprinklers shall be used regularly during this phase to attenuate dust generation.
- c) The workers within the site shall be provided with nose masks and goggles to Minimise dust inhalation

5.5.5 Afforestation

The loss of forest area must be made up by compensatory forest over twice the area of non-forest land. This reforestation must preferably be within short distance of the removed forest and within the same district.

5.5.6 Water Environment

The land use change to water spread and canals would bring in the potential benefits of the ayacut development. The accompanying plantation, along the canal bunds and the foreshore, would be the only measure, which can help rejuvenate lost bio diversity. The fisheries development programme in the reservoir would maintain water quality and encourage bird visits in turn introducing new ecological relationships, which in time would build up biomass for a new land use pattern.

5.5.7 Sedimentation

To prevent formation of sediment deposits at the reservoir entrance a sluice that enables sediment flushing must be constructed

5.5.8 Soil erosion

Engineering measures should be taken for erosion control in agricultural land. The various measures covered in this category are:

- Contour cultivation
- Contour bunding
- Graded bunding
- Vegetated waterways

Erosion control measures for non-agricultural lands

The non-agricultural lands requiring implementation of erosion control measures include herbs & scrubs, and open vegetation. These would require the following control measures:

- Afforestation
- Gully control
- Pasture development

5.5.9 Compensation of loss of agricultural land

The people who will be displaced must be suitably rehabilitated. Financial compensation for the loss of land and housing is not sufficient. They must be provided with new houses and land. Their standard of living must be maintained by ensuring access to resources at least equaling those lost.

5.5.10 Control of land uses in the watershed

To prevent sedimentation of the reservoir and subsequently loss of storage, conversion of forest into agricultural land must be prevented.

5.5.11 Replicate natural flooding regime

To decrease the loss of ecological values of the downstream river and to mitigate the decrease of economic values of the floodplains (agriculture) the regulation of the dam releases may be geared to the natural water and sediment demands.

5.5.12 Mitigate Disruption of Riverine Fish

To maintain the possibility of upstream and downstream migration of fish a minimum flow must be established. Fish ladders or other means of passage must be constructed. Spawning grounds must be protected.

5.6 With and Without Environment Management Plan

This scenario was based upon the assumption that the proposed development would go ahead without any environmental management options being implemented. If the environmental management strategies discussed above is fully implemented, the adverse impact of the project would be reduced, and there will be an overall improvement in physical, chemical, biological and socio-economic environment of the region.

5.7 Analysis of alternatives with and without project

Table 5.1 Analysis of alternatives

Concern	Without Project	With Project
Catchment area	<ul style="list-style-type: none"> • Depletion of land resources well continue soil erosion, loss of fertile top soil and nutrients • Feeder channels and natural waterways blocked and diverted by encroachers • Unsustainable land use • Fragile and poor lands used for cultivation of crops • Sparse vegetation, scarcity of organic manure • Unsustainable use of chemical 	<ul style="list-style-type: none"> • Treatment of arable and non-arable land will arrest soil erosion and loss of nutrients along with fertile soil • Treatment of natural drainage channels, cleaning of feeder channels • Scientific land use planning • Crops as per the land capability • Tree crops/dry land horticulture • Increased tree cover, higher bio-mass production

	<p>fertilizers, depletion of soil fertility</p> <ul style="list-style-type: none"> • Degraded pastures and grazing lands • Denudation of forest cover and shortage of fodder and fuel • Siltation of tank bed due to soil erosion in catchment and foreshore areas • Ecological imbalance 	<ul style="list-style-type: none"> • Increased supply of organic manure, better soil health • Rejuvenation of pastures and grazing lands through silvi-pastoral system • Higher production of fuel and fodder, less dependence of forest • Land treatment using eco-engineering techniques arresting soil erosion and reduction in the rate of silt accumulation in the tank bed • Better environment
Tank bed/off-shore area	<ul style="list-style-type: none"> • Soil erosion due to lack of soil conservation measures and faulty cultivation practices • Lot of encroachment and impediments for free flow of rain water into the tank • Most of the tanks have accumulated silt and reduced storage capacity by more than half of the potential storage • Tanks are infested with different kinds of weeds and thorny bushes (Prosopis juliflora, Ipomia camica jacq, Zandu grass, etc.,) • No vegetable barriers/silt traps of filters in foreshore area • The sluice and surplus-weir are under disrepair • At many places tank bunds/dams have developed cracks/stone pitching has given way and are weak and carry an element of security/safety risks 	<ul style="list-style-type: none"> • Application of appropriate soil conservation measures and adoption of suitable cultivation practices • Removal of encroachment and allowing free flow of water with the provision of silt traps, filter points, etc. • Desilting of tanks will augment the storage capacity of tanks • Tanks will be cleaned and made free of weeds during desilting operation • Planting of bamboo and other trees in the foreshore will serve as filters and also be used by the poor as raw material for handicrafts • Sluice, waste-weir and operating system will be repaired • Tank dam/bunds will be strengthened by using excavated silt / other material. Pitching of interior wall with stone will be carried out wherever necessary
Command and adjoining area	<ul style="list-style-type: none"> • A sizable area under the tank command is left fallow due to shortage of irrigation water from the tank. • Main and field channels are either damaged, encroached or 	<ul style="list-style-type: none"> • Productive lands can be brought back under cultivation after the rehabilitation of tanks • Main as well as field channels will be realigned for proper

	<p>disappeared due to lack of interest or non-availability of irrigation water from the tank for a long time</p> <ul style="list-style-type: none"> • Most of the farmers located at the tail-end of the command do not get enough and timely water supply, suffer losses due to shortage of water during crucial crop growth stage • Only single crop is grown in most of the command areas • Currently, flood system of irrigation is used wherein water from main / sub-channels is released in the field at the higher elevations and is allowed to flow into the lower parts of the command area by gravitation. This leads to wastage of precious water, loss of nutrients and helps the transmission of diseases and pests from one plot to another • Lot of water is lost through seepage from main channels • Depleting groundwater and lowering of water table • Lack of water and vegetation increases the temperature and desiccation effect in the surrounding area. This also results in higher frequency of irrigation 	<p>irrigation</p> <ul style="list-style-type: none"> • Tank users association will be responsible for equitable distribution of water among the command farmers. Decide about the schedule for release of water • There is good possibility of increasing cropping intensity once the accumulated silt is removed from the tanks • The main and branch channels (field channels) will be used to conserve and minimize wastage of irrigation water. • Main channels may be lined wherever possible and necessary to arrest seepage • Improved recharge of groundwater aquifers will arrest lowering of water table level. • Adequate water in the tank and vegetation around keeps the local atmosphere cool and humid, reduced requirement of irrigation
<p>Others</p>	<ul style="list-style-type: none"> • Shortage of drinking water for animals due to inadequate storage • Drying up of tanks and silt accumulation discourages fishing activity • Non-availability of water forces women to wash clothes near the bore well, which supplies drinking water. The washing of clothes near the bore well creates cesspool and 	<ul style="list-style-type: none"> • Rehabilitation will augment storage capacity of the tank structure and provide drinking water to animals • Availability of water in the tank for a fairly long time provides opportunities for fish culture. • Healthy water bodies attract water loving birds and insects. Many of these are predators of crop pests while others like honeybees help pollination.

	<p>breeding place for mosquitoes.</p> <ul style="list-style-type: none"> • Moreover, seepage of water pollutes the underground aquifers with detergents and other chemicals • Dried tanks in the state of disrepair do not provide any aesthetic value but an ugly picture of sick and dead. 	<ul style="list-style-type: none"> • Availability of water in the tanks for washing clothes and to meet other domestic needs will keep the environment clean and neat. The flora and fauna present in the tank has a great capacity to degrade the hazardous chemicals and thus keep the system healthy. • Tanks with clean water, surrounded by good vegetation, with birds around definitely provide a pleasing look and have great aesthetic value
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5.8 Social and Economic Impact and Alternative Strategies

5.8.1 Positive Impacts

Social, Economic and Environmental Impact	Benefit enhancing or Mitigating Alternative Strategies
<ul style="list-style-type: none"> • Improved source of irrigation is to result in a decline of an unfavorable dependence of the poor on the rich 	<ul style="list-style-type: none"> • Ensure membership of landless and sharecroppers in the WUA
<ul style="list-style-type: none"> • Possible increase in income through second crop in the command 	<ul style="list-style-type: none"> • Ensure activities to promote sustainability of tank and reservoir structures
<ul style="list-style-type: none"> • Minimizing of difference in access to water between the head-reach and tail-end farmers 	<ul style="list-style-type: none"> • Ensure the distribution channels are kept in good repair at the end of each crop. • Keeping space for small water paths to the fields down the command area to be made mandatory. • Practice of flooding the plot of land, allowing water to overflow only after a certain number of days of application of manure to be stopped. • Command area farmers with their own sources of irrigation barred from using field channels for harnessing water.
<ul style="list-style-type: none"> • Increased employment opportunities for women from the poorer and lower caste households 	<ul style="list-style-type: none"> • Greater involvement of women from all sections decision making process

5.8.2 Negative Impacts

Social, Economic and Environmental Impact	Benefit enhancing or Mitigating Alternative Strategies
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<ul style="list-style-type: none"> • Loss of income due to crop loss affected by water logging in the catchment /tank/ basin 	<ul style="list-style-type: none"> • Under the Integrated Tank Management Plan, plan and erect check dams, bunds and similar other structures.
<ul style="list-style-type: none"> • Increased dependence on market, under unfavorable terms, especially for credit supported agricultural inputs (fertilizers, pesticides, etc.) 	<ul style="list-style-type: none"> • The WUAs may undertake to supply these inputs to the member farmers to minimize market-determined vulnerability.
<ul style="list-style-type: none"> • The rich get richer; the bigger landowner gets more benefit of the project implementation. 	<p>While keeping the linkage between the extent of land owned and the costs to borne / user tax to be paid, a weightage has to be added to bigger landowners to determine their contributions.</p> <p>For instance:</p> <ul style="list-style-type: none"> • Calculate the average size of land owned per household in the command. Those owning double this average may be made to pay one unit cost extra; likewise, those owning thrice the average to pay an additional unit cost • Likewise, add an additional cess on those with additional source of irrigation from which the plot (s) in the command area receives supplementary water. The additional cess shall be at a higher rate if the source of water is located in the command area and supplied to fields outside it. • Farmers selling water or sharecropping for water should pay a proportion of their share received to the tank user association, annually or per crop. • Income thus additionally generated should be spent for creating tank-related assets to the tail enders, small and marginal farmers owning land in the command, or for the benefit of the vulnerable groups without lands either in the command or elsewhere. <p>Examples of such activities:</p> <ul style="list-style-type: none"> • Undertake watershed development activities in the dry lands, • Erect cement structures for water flow in the tail ends, • Undertake desilting activities in the distribution channels, • Subsidies agricultural inputs supplied by the WUAs, etc.

6 STAKEHOLDERS' CONSULTATIONS

Stakeholder consultation is an important aspect in this project to obtain the perception and views of the stakeholders on social and environmental concerns pertaining to the local areas. The objective of stakeholders consultation is to minimize the negative impacts in the area and make them feel that they are the ultimate beneficiaries of the project in this process the views ascertained from the stakeholders is analyzed and incorporated in the project document. The ESA study initially obtains the opinions of the stakeholders and the same has been analyzed and incorporated at the sub basin level.

The objective of consultation is to increase multi-stakeholders participation in the project. Women and vulnerable persons and families have to participate more effectively. Consequently, there would be higher participation of farmers, fisherfolks, WUAs, Line department officials, SHGs, women and decreased gender disparity with respect to access. Usage and fulfillment derived from water-increased participation would also help reduce poverty. Participation would generate awareness, enhance knowledge and allow for better income generation practices. Reorganized water sector would directly impact agriculture productivity that can be optimized by participative processes.

Purpose of participation is to increase productivity of water. Water is traditionally considered valuable in most part of India and Tamil Nadu is no exception. However, in reality there is wastage and inappropriate usage regularly. Insufficient availability of water is only a part of the water problem. Water productivity does not stop at storage or conservation of water and extends to its effective utilization. The utilization can be made more efficient by combine efforts of all using or managing water. The conclave is fairly encompassing and includes a number of stakeholders. These stakeholders should be consulted to improve efficiency of usage and productivity.

6.1 Target participants

WRO officials, Line department officials, Farmers, Farmer Associations, Members of Water User's Associations, NGOs, SHGs and Women.

6.2 Consultation workshops

EPTRI has hired the services of GAIA International Organization, Thiruvanniyur, Chennai for providing local assistance and resource persons to facilitate the consultations in the regional language. EPTRI professionals and the resource persons from the local organization have conducted 17 stakeholder consultation workshops in 16 river basins which are as follows:

Table 6.1 Stakeholder consultation workshops in 16 river basins

S.No	Date of workshop conducted	Major River Basin	Place of the workshop
1	13.2.2006	PAP	Pollachi
2	2.3.2006	Pennaiyar	Thiruvannamalai
3	3.3.2006	Pennaiyar	Krishnagiri
4	4.3.2006	Vellar	Athur
5	6.3.2006	Agniar	Pudukkottai
6	7.3.2006	Vaigai	Madurai
7	8.3.2006	Vaippar	Srivalliputtur
8	9.3.2006	Tamirabarani	Thirunelveli
9	10.3.2006	Kothaiyar	Nagercoil
10	11.3.2006	Nambiyar	Vallioor
11	3.3.2006	Palar	Cheyar sub basin Kancheepuram
12	4.3.2006	Varahanadhi	Tindivanam
13	6.3.2006	Kottakaraiyar & Pambar	Sivagangai
14	7.3.2006	Vaigai	Paramakudi
15	8.3.2006	Gundar	Aruppukottai
16	10.3.2006	Vellar	Perambalur
17	11.3.2006	Chennai	Kosasthalaiyar sub basin Thiruvallur

6.3 Process of Consultations

The processes of consultations are being kept very simple and largely interactive. The consultations carried out in two-way processes between facilitators and the participants. Consultations are held in a congenial environment at a venue, which is amenable to all the participants. All the consultations are held in the local language and the issues emerged

during the consultations are analyzed and recorded. The photographs of the stakeholder consultative workshops are enclosed at Annexure 2.

The basin wise environmental, social issues and the recommendations emerged during the consultative workshops are furnished as follows:

1. Pollachi (PAP Basin):

The main issues identified in the above workshop are:

- Avenue tree plantations should be encouraged in farmer's wastelands to increase the green cover.
- Coir related value addition industries are to be setup.
- Sprinkler and drip irrigation should be introduced in the entire canal instead of selected area.
- Rural enterprises should be taken up to reduce unemployment and to arrest migration.
- Live stock development should be encouraged.
- Dairy activities should be encouraged.
- Post-harvesting technologies should be promoted with alternative energy.

2. Thiruvannamalai (Pennaiyar Basin):

Environmental Issues:

- Water pollution due the release of sewage water into the river
- Poor solid waste management
- Mixing of drinking water along with drainage water
- Ground water level is decreasing (from 25 feet to 400 -500 feet), ground water quality is declining and also deteriorated.
- Soil erosion seen in the river and tank beds

Social Issues:

- Primary health center is 5 km away from the village and the water borne diseases are prevalent.
- Decline in Livestock.
- Encroachments in the river and tank beds
- Drinking water supply is prone to health diseases
- The village has a primary school and most of them have studied up to 8th -10th class.
- Villagers work in agricultural field, brick industry and rice mill.
- Youngsters are migrating to Kerala and Karnataka due to unemployment

Recommendations:

- Drip irrigation is a viable option for all the crops except paddy.
- Vegetables and fruits can be cultivated through drip irrigation to conserve water.
- Suggested introducing modern agricultural practices for increasing the productivity of the crop.
- Agricultural farmers can take up fish culture in their own land by ponds. Fisheries department will support such projects.
- Alternative cropping can be practiced in the drought prone areas.
- Department of Forest has suggested to plant tree crops in the catchment area of the tanks and riverbeds to prevent encroachment and soil erosion.
- Irrigation facilities like canal, tank and well irrigation should be improved by desilting, and rejuvenating tanks and wells.
- The ipomoea plant should be removed in all the tanks.
- Agricultural marketing should be improved and seed should be supplied through agricultural society and not through private agencies.
- Farmers should have good linkage for marketing their products. As the Price is not uniform within the district, the Government should fix uniform rates.

3. Krishnagiri (Pennaiyar river Basin)***Environmental Issues:***

- Effluents released from many industries has affected the river water quality.
- In Mittal village, tank water is used for fish culture. Waste from the mango processing unit is released into the tank leading to water contamination and algal bloom.
- In Arasambatti village, sewage is released directly into the tank leading to health problems/ diseases.
- Untreated industrial effluents and sewage from household are directly released into the river basin with out effluent treatment.
- Sand mining is very high in the riverbed area, leading to decline in ground water table.
- Due to indiscriminate dumping of solid waste in the riverbed and tanks, the surface water is getting polluted. The industrial effluent entering from Bangalore and Hosur are directly released into the river system and has resulted in water pollution.

Social issues:

- 50% of livestocks are infected with unidentified diseases.
- There are plenty of opportunities available in the agriculture sector but agricultural laborers are migrating to Karnataka for higher wages. They are employed in building construction and laying of water and telephone cables.

Recommendations:

- The main supply and branch channels should be cleaned regularly and the tank in the district must also be desilted regularly.
- Recommended to construct check dams after the tanks to store the surplus water.
- Water wastage is a major issue of concern. Moreover the tanks do not have bunds. Recommended constructing bunds along the tanks to save the water.
- Cold storage facilities should be provided for preserving fruits.
- Awareness should be created on vermi-composting and organic farming.
- All the encroachments in PWD tanks should be removed.
- Commodity groups should be formed for selling coconut and other agricultural products.
- Irally Panchayat Union near Kaveripattinam is generating power through solid waste. This project may be implemented in all the panchayats.
- Recommended to provide individual loan to purchase modern agricultural implements.

4. Athur (Vellar River Basin)***Environmental Issues:***

- Due to water pollution caused by sago industries, lot of coconut trees are affected and yield is also reduced
- Ground water level is depleting due to sand mining and over exploitation of the ground water.
- Due to indiscriminate dumping of solid waste in the riverbed and tanks, the surface water is getting polluted. The industrial effluents entering from the local factories (Sago industries) are directly let into the river with out any treatment.
- Water Pollution causes snoring in the bullocks

Social Issues:

- Due to water pollution water borne diseases are spreading in this river basin
- Most of the cattle are affected by Anthrax disease; no prevention methods have been identified.
- Public toilet system is currently very unhygienic.
- In the work place the male is getting higher salary than the female.
- Agriculture laborers are not interested to work in agriculture due to low wages. They are migrating to Karnataka for higher wages in different kind of works viz., building construction, laying of water and telephone cables.

Recommendations:

- Information should reach to the tail end farmers in the Ayacut areas.
- The municipality and district administration should take necessary action to provide hygienic drinking water.
- Recommended to plant trees along the tank bunds to check erosion.
- Strict enforcement according to the available base maps should be done to stop encroachment of riverbeds.
- Check dam system should be provided to recharge the ground water.
- Water treatment plants should be set up to treat the sewage water.
- Extension of Modern Agricultural Implements.
- Cold storage facilities should be provided.
- Milk powder factories, Sugarcane factories and modernized sago factories may be opened to increase the employment opportunity.
- De-siltation should also be carried out in the tank areas.
- Proper embryo transplantation techniques are required to get more hybrid livestock.
- Recycling of wastewater to avoid pollution from sago industries.
- Cattle sheds should be provided.
- Marketing access should provide for SHG products.

5. Pudukkottai (Agniar River Basin):***Environmental Issues:***

- Monsoon failure and mismanagement of irrigation source resulted in reduction of agricultural employment and in permanent migration to other places.
- Sewage water is released into the tank and ponds in the urban and semi urban areas.
- Most of the solid wastes are dumped in ponds and tanks.
- Excess nitrate concentration occurs in common areas, and a few saline pockets are highly in saline and alkaline.
- Grassing lands are reduced in the recent past.

Social Issues:

- Farmers are not getting reasonable price for their agricultural product like paddy, groundnut and banana.
- Due to poverty, children are working in the hotel.
- Majority of the students are not educated due to poverty.
- Sanitation programmes are not properly implemented; nearly 80% of the toilets are unused due to water scarcity.
- Female students are not continuing their higher studies, since they have to take care of their homes while their parents are moving to other places for work.
- Difference in the wage rate in farm level work. Male wage rate is Rs.100/ per day and female wage rate is Rs. 50/-per day.
- There is a decreasing trend in livestock.

Recommendations:

- To create awareness on cultivation of herbal plantation and Government should provide subsidy.
- Government should intervene and fix the reasonable prices for agricultural products.
- 100% insurance should be given to loss of crops due to natural calamities.
- Model market system should be established for agricultural product to get better price for the commodity.
- Workshop should be organized to educate people about the importance of toilet and hygiene.
- Mobile veterinary van should be provided for medical treatment.
- No user charge should be collected from the public for using the toilet and a provision should be made to provide water facilities to the public toilet.
- Community bore wells should be installed in the dry lands to assure irrigation in these areas. The well should be connected to the drip and sprinkler irrigation system.
- Water User Association should manage both wet and dry land community bore wells.
- All the wastelands should be converted to cultivable lands.
- For the prevention of soil erosion, trees should be planted in the catchments area of the tank.
- Check dam should be constructed every 2km in the river for recharging the ground water
- Water can be saved using drip and sprinkler irrigation to get better yield from the crop.
- Farm development through lining of field channel etc.
- To sustain ground water level, percolation ponds should be constructed in the basin area.
- To establish or lay road in ayacut area of the tank.
- Supply channel of the tank should be cleaned
- Encroachments should be evicted from the catchments and supply channel of the tank area.
- Establish paperboard industry and cashew industry to increase the employment opportunity.

6. Madurai (Vaigai Basin)

Environmental Issues:

- Around 40-50 system tanks are not able to get river water due to sand mining.
- Drought and flood seasons are more intensified in this location
- During flood farmers could not save water due to lack of check dams
- The Nitrate value in most of the wells in this basin is high, this may be due to the application of the nitrate bearing fertilizers and pesticides, high concentration of the Nitrate in the drinking water induce Methamoglobinemia in infants.
- The maximum concentration of the nitrate above 800 mg/l is found in the village Chittarkottai.
- Air pollution due to flour mills located in the town
- Salt water intrusion due to solar salt pans
- Ipomea problem in the tanks
- Inadequate ground water due to excessive sand mining.
- Agricultural laborers are employed for only three months
- Only source of water is surface water
- River level is lower that of the agricultural fields due to sand mining
- Sewage from towns and cities are released into the channels and canals.
- Fish kill due to sewage discharge
- Due to urbanization, solid wastes are dumped in the river, canals and tanks
- Solid waste of Paramakudi, Ramnad is discharged in the river.
- All the towns are along the Vaigai river basin must be provided with sewage treatment plants.
- Poor farmers have been affected without electricity connection in these areas.
- Over extraction of ground water has resulted in depletion of ground water table

Social Issues:

- In agricultural sector, the females are getting lesser wages when compared to males. The male is getting Rs.70/ as wages per day. However, the female is getting only Rs.25/- per day.
- There is decreasing trend in bullock population in this area.
- The village doesn't have common facilities to store food grains.
- Poor sanitary conditions in the residential areas.
- Health problems due to sewage.
- Abandoned pigs in the gutters causes health problems
- Encroachment of irrigation canal prevented the link between Ramnad big tank and small tanks used for drinking.
- Marketing through Self Help Group should be encouraged.
- Need for mobile veterinary hospital in these areas.
- Farmers are migrating for employment, (For every 6 months), Youngsters are also migrating to Tiruppur to work in the textile industries.
- Menace due to abandoned temple cattle's which spoils agriculture.
- Salinization of ground water. The ground water could not be used for drinking or for agricultural purposes.

Recommendations:

- The Government should take necessary steps for equal distribution of water from head to tail Enders in the river basin.
- Farm pond arrangement needed
- Fish culture should be encouraged
- Needs for direct marketing facilities
- Training in cottage industries, livestock rearing, fish culture, vermin-composting
- The Government should enhance the Paddy procurement price and other agricultural products.
- The tank fishing right should be given to the Water Use Association.
- Desilting should be done in the entire tank to maximize the storage level.
- A separate newsletter should be published to disseminate the modern agriculture techniques and share the opportunities for marketing, training, hiring of agricultural implements etc
- Adolescent girls must be trained in alternative employment
- Direct procurement of agricultural products by the Government
- Environmental awareness should be created among the villagers
- Basic facilities like primary health centre, roads, drinking water facilities, veterinary hospital and toilet facilities
- The Alnaga Nallur and Pandiyarajapuarm sugar factories are closed. Government should take necessary steps to reopen the sugar mill.
- Urgent need for sewage treatment Plant and (STP) Solid Waste management facilities.
- Training programme for the farmers on pond fish culture, mud crab and ornamental fishes to increase the employment opportunities.
- PWD department should allow the farmers to desilt the tanks and use the silt for brick making
- Both Panchayath and PWD tanks must be managed by any one of the organization
- Crop cultivation in the renovated areas of Juliflora thorny trees, such renovated areas does not require manure, fertilizers and pesticides
- Well water could be used for alternative crops like fruit trees, coconut etc through drip irrigation to conserve water.
- Check dam should be constructed in the catchment area for reducing soil erosion.
- Rotational water supply and rotational crop cultivation should be encouraged
- 50% subsidy for well irrigation
- Renovation of irrigation facility is required
- Bore wells are to be setup nearer to the check dams/shutters for crop irrigation during water scarcity period
- Sewage fed forage crop cultivation facility should be developed
- Aquatic weed Ipomea clearance is urgently needed
- Training on drip and sprinkler irrigation system for sugarcane, banana and coconut crops for farmers.

7.Srivalliputhur (Vaippar River Basin)***Environmental Issues:***

- This Basin has vast area of Vertisols (Black soil) because of this salinity and alkalinity problems are more predominant than acidic problem. This results in low yield in crop production
- The TANCEM Ltd, Alangulam has impaired the air quality upto a distance of 10 km. radius outside the plant in the southwest direction. The natural regulation and irrigated crops were affected severely due to dust deposition.
- Untreated sewage is discharged into the nearby streams for disposed on lands, In Virudhunagar town the untreated sewage is pumped into Kousiganadhi, which is passed around the town.
- Dyeing effluent released into the land in Rajapalayam has polluted the land as well as the irrigation and drinking water sources.
- Solid waste dumped in Rajapalayam has created air and water pollution problems.
- There is no equal distribution of water in the canals.
- All irrigation tanks, canal and channels are affected by encroachment.
- In Vaippar river basin, Vilathikulam and Kovilpatti taluks of VOC district, Sankarankoil taluk of Nellore district and Sathur taluk of Kamarajar district are subjected to frequent droughts.
- Destruction of coral reefs and eco system in coastal areas

Social Issues:

- In the agricultural sector, male is getting Rs 80/day and female is getting Rs. 40/day.
- There is no sufficient teacher in many schools.
- There is no water facility in public toilet in many villages. Water supply should be provided to the public toilet to avoid open toilet.
- Farmers need storage facilities and they need fair price for selling all agricultural commodities.
- Cotton price is not uniform, it always get fluctuation during the harvest time.
- Child labour is prevalent in the matchbox industry.
- People are migrating to other states like Uttar Pradesh and Karnataka for their livelihood.
- Prevalent diseases recorded are diarrhea, cholera, enteric fever and jaundice.
- Decreasing trend in cattle population due to reduced grassland.

Recommendations:

- Cold storage facilities for tomato and other fruit crops should be established.
- Efforts must be taken preserve the existing forest coverage and also take measures for afforestation
- Sustainable drinking water schemes
- Improving the overall irrigation efficiency
- Saving water to the possible extend, to implement RWH
- Development of less water consuming industries in drought prone areas.
- All the municipalities and Panchayats have to organize sewage collection, treatment and disposal system.
- The field channels should be lined to improve the irrigation management.
- Tree plantation should not be done in the irrigation tank areas.

- Desilting should be done in channels, canals and tanks. And also eucalyptus tree should be removed in the Western Ghats to sustain the ground water level.
- Check dam should be constructed in the river to maintain the ground water as well as to protect soil erosion.
- Old pump set motors should be replaced with new motors at a subsidy price to reduce the consumption of electricity.
- Agricultural instruments should be given to the farmers with 50% subsidy.
- To sustain ground water level percolation ponds should be constructed.
- Government should provide agricultural implements with subsidy rate.
- The cement industry may be asked to take all precautions as per the standards for the smoke emitted by the plant.
- The government should appoint teacher to improve the quality of education.
- Programmes like mulberry plantations, transfer of fodder development technology, water storage structures, and fish culture may be promoted.

8. Thirunelveli (Tambraparani basin)

Environmental Issues:

- All municipalities and Town Panchayats are letting sewage water in to the canal without any treatment.
- Out of about 880 tanks in the river basin few tanks have been taken up for modernization, hence possibility of rehabilitating the other in a phased manner has to be explored.
- Water scarcity in North kodaimel canal, due to unequal distribution of water.
- Water scarcity is prevalent in the Tamirabarani river basin due to the installation of the 160 pump sets.
- 4500 acres of agricultural lands were not cultivated due to water scarcity and improper maintenance of the irrigation system.
- There is no equal distribution of the water in this canal.
- In Thoothukudi area, seawater intrusion is prevalent during the summer season due to over pumping of ground water.
- Sand mining is prevalent in the Ramanathi, Patchaiyaru and Tamirabarani. Sand quarry contractors are mining sand beyond the Government's prescribed norms.
- SUN Paper mill is letting out water directly in to the canal without any treatment leads to various skin diseases.
- Soil erosion in the watershed areas and siltation in the reservoirs, tanks and channels.
- Agro-chemicals used in the agriculture get mixed with the surface water and leached into the ground water.
- Ground water quality get degraded due to geological formation in the sub-basin
- Various types of chemicals fertilizers used in the ayacut in Tamirabarani basin as well as pesticides applied on the crops contribute to pollution in the river.
- In Sawyerpuram area, where the ground water extraction is on a large scale, high salinity is noticed in ground water due to seawater intrusion and presence of marine calcareous materials.

- The India cements factory at Thalaiyuthu is creating air pollution in and around Tirunelveli town.
- Bio medical wastes directly dumped into Kannadiyan canal.

Social Issues:

- Only 25% of subsidy is provided to the farmers to purchase the agricultural implements. Very few farmers own the modern agricultural implements.
- There is no proper marketing for agricultural product; middlemen and traders are getting more advantage for all agricultural products.
- Children's are working in hotels as child laborers.
- Children are migrating to Tiruchy, Tirupur and Bombay for their livelihood.
- Male gets 40% higher wage compared to females.
- There is shortage of labour for agricultural works in this area.
- Malaria disease is prevalent due to sewage water disposal
- There is no mobile veterinary hospital

Recommendations:

- A proposal for artificial recharge in sawyerpuram teriland area of Chidambarer district.
- Farmers need cooperative milk society to get reasonable price for milk.
- Government should build separate pump sets and water tanks for toilets.
- To setup regulated market for agricultural product to get fair price.
- Government should arrange marketing for bio-fuel (jetropa) plant.
- Check dam should be constructed in every 2 kilometer through out the canal for maintaining the ground water level.
- Encroachment should be evicted for maintaining the irrigation system.
- The department should organize training centers to create awareness about modern agricultural implements and usage of those instruments.
- There are nearly 70 tanks in this canal, affected by siltation. Government should desilt these tanks to provide better irrigation and to maintain the ground water level.
- Agricultural department should provide modern paddy harvester with low rent.
- Government should initiate farm ponds to grow fishes.
- Fisheries department should provide subsidy and training to the farmers to improve the farm fish culture.
- Industrial and municipal waste should be treated and reused.
- Less water consuming industries should be located in place where the availability of water in plenty is in question.
- Action may be taken to take up drainage relief works to protect the valuable cultivated lands from inundation.
- Action may be taken closely to monitor the ground water quality in these areas and prevent over extraction of ground water to avoid seawater intrusion.
- Conjunctive use of surface and ground water.
- Improving the conveyance efficiency by minimizing seepage losses by lining the system.
- Creating percolation ponds to conserve the soil moisture.

- Providing community wells for irrigation.
- Renovating the old tanks and ponds, desilting of supply channel and construction of water harvesting structures to improve irrigation potential.
- Bringing the dry land under deep-rooted fruit plants and vegetative gardens to improve ecological condition.
- Introduction of drip and sprinkler irrigation for effective water management for effective farms and vegetable garden which will save large quantity of water
- Planting Palmyrah and other perennial trees in the wastelands to prevent soil erosion by wind
- Restoring the ecological balance through resources conservation, afforestation and positive land development

9. Nagerkoil (Kodaiyar basin)

Environmental Issues:

- Illegal sand mining reduces ground water table in this area.
- Catchment degradation and soil erosion is high.
- Acidity problem is more predominant than the saline and alkaline problem. The acidity problem is mainly due to the presence of aluminum, manganese and iron in toxic concentration. Soil acidity inhibits biological nitrogen fixtures.
- Encroachments in the riverbanks affecting the irrigation system and also pollutes the waterways.
- Agro industries are letting out effluent without treatment in to the rivers and canals.
- Accumulation of Solid waste in the tourist spots.
- Sewage water is directly letting in to the canal without any treatment at Sugandirma and Parattai canal.
- Cultivation area has been reduced due to the scarcity of water.
- There were about 40,000 acres of land was under cultivation, under the scheme Petchiparai anicut system. But, now only about 20,000 acres are under cultivation due to scarcity of water.
- Seawater intrusion in Kanniyakumari district lead to the salinisation of ground water.
- Land fertility becomes low due to chemical fertilizer.
- Ground water level is decreasing due to the extraction of water by the multi national companies like Pepsi and Coke companies.

Social Issues:

- Trader's are mining sand and selling it to the Kerala State.
- The prevalent diseases recorded are acute diarrhea, Cholera, Enteric fever, malaria and Jaundice.
- Only 50% of the people are using the toilet facilities.
- Marketing facility is very poor. Middleman is enjoying more profit than farmers.
- Due to high cost of transport, farmers can't take their product to the market.

Recommendations:

- Equitable distribution of irrigation water by better water management

- Improve the performance of the existing irrigation systems by suitable structural measures.
- The modern drip irrigation facilities may be utilized for crops and orchards, which not only increase the irrigation efficiency but also the yield.
- Conjunctive use of surface water.
- Adaptation of better agricultural practices such as crop as crop rotation, raising garden crops and other less water consuming crops.
- Drought control measures such as soil conservation measures, conjunctive use of surface and ground water may be introduced in the dry pocket.
- Recommended to construct percolation ponds for sustaining the soil moisture.
- Nagercoil municipality should construct STP for treating the sewage water before releasing in to the water bodies.
- Government should directly procure paddy from the farmers.
- Transport subsidy should be given to the farmers for transporting agricultural products.
- Awareness should be created on “Eco tourism concepts”
- Eco tourism should be promoted in these areas
- Drip irrigation should be provided to avoid wastage of water from Palayar River.
- Marketing facilities should be arranged to sell the agricultural products.

10. Valliyoor (Nambiyar River Basin)

Environmental Issues:

- Saline, alkaline and acidic soils are occurring in patches, saline and alkaline problem is more predominant in this basin
- High ground water depletion due to sand mining in this basin
- Soil erosion is also high in the catchment area.
- Solid waste is disposed in the Valiyuoor and Sathur river basin.
- Sea water Intrusion is prevalent in the coastal area of this basin
- Sand mining is prevalent in this river basin, affects the ground water level.
- There is 75% upland in this area, if government provides subsidy and training for bio diesel plantations the farmers are willing to do bio diesel plant.

Social Issues:

- There is labor scarcity in agriculture.
- Marketing facilities for organic manure.
- There is 50% wage difference, female is getting only Rs 40/day and male getting Rs.100/day.
- Due to uncertainty of agriculture, people are migrating to Kerala Bombay and Chennai for their livelihood.
- Requested to have veterinary mobile hospital and demand fair price for the milk.

Recommendations:

- Government should allot separate place for selling agricultural products.

- Government should provide 75% subsidy for the construction of toilet in the rural areas, the common toilet system is not functioning properly
- Recommended to divert the excess water from the Tamirabarani river basin to Nambiyar river basin.
- Feasibility of diverting west flowing rivers to Nambiyar, Hanumanadhi and Karumeniar basin may be studied.
- Action plan may be drawn to improve and maintain the wild life and bird sanctuaries in a more scientific way.
- Action plan may be drawn to improve the Eco tourism spots.
- Construction of farm ponds to improve the ground water level with the subsidy from the government.
- To clean up the old well for rainwater harvesting.
- Subsidy to replace the old irrigation pumps and set to avoid consumption of more electricity.
- To construct community bore well for drip irrigation during the water scarcity period with 100% subsidy.
- Agriculture department should provide threshing floor in each village.
- Horticultural crops can be cultivated in the windmill areas.

11. Kancheepuram (Palar River Basin)

Cheyar Sub basin Environmental Issues:

- Sand mining in Cheyyar river Basin
- Domestic sewage of Arni town and Thiruvathipuram
- Pollution due to dying and silk Industries in Arni block
- Ipomea, Juliflora and Vizhal in 20 taluks of Kovilur block.

Kliyar Sub Basin Environmental Issues

- Entry of domestic sewage with Suganadhi River, Chemavalam and Thiruthan tanks
- No STP in Vandevasi and Madurantagam Municipalities
- Solid waste problem in Vandavasi Municipality
- Sugar mill effluent in Padalam
- Sea water intrusion near Vayalur and aquatic weeds

Social issues:

- Primary health center required adequate facilities
- The agricultural product market prize is fixed by the middle man
- Most of the people studied up to +2, Literacy level is low and Migration is prevalent to Chennai and Kerala for the construction work and rubber industry.
- The agricultural marketing performance is very low
- Hospital facilities should be improved.
- Water transport from other peri-urban areas close to Chennai A good deal of groundwater is pumped from agricultural wells and transported into the city everyday for Kliyar sub basin

- Water, hitherto claimed only by the agricultural sector is used more and more for non-agricultural urban uses – there emerges competing demand for water – water transport from rural to urban areas in Kliyar sub basin
- Similarly water sellers – a few benefit a great deal by selling water to urban use by abandoning their agriculture but this affects groundwater availability in the adjoining wells; depletion of groundwater or fast declining groundwater table would affect the livelihoods of a majority of village population.

Recommendations:

- Rain water collection in ooranies, village tanks for recharging ground water
- Land reclamation Soil and water conservation measures
- Desilting of tank and supply channels
- Flood water management and supply channels
- Irrigation water management through drip and sprinkler irrigation methods

12. Tindivanam (Varahanadhi River Basin):

Environment Issues:

- In the Kazahaveli Swamp there is permanent problem of inundation of seawater and reclaiming waste area of cultivation.
- The Kazahaveli swamp is a large lagoon near the seashore full of water during rainy season, when dry, there is arid waste with salt efflorescence.
- 30-40 percent of the people are migrating to Chennai.
- Sewage water is directly released into the river and tanks.
- Mining of rocks (quarry) pollutes the village tanks.
- Problem of Kattamanaku weed in the tanks.

Social Issues:

- 80% of the farmers are marginal farmers owning less than 1hec and hence agricultural economy is very poor.
- There is increase in agricultural labourers with limited industrial activities and it may affect the overall economic status of laborers depending on agriculture in this basin.
- Increase in agricultural labourers to cities for want of employment during failure of monsoon and off-season.
- Boys are less educated when compared with girls.

Recommendations:

- All rights should be given to the Water User Association such as fish rearing in the tanks, earth work, channel lining and bund construction
- Kazahaveli swamp can be converted into fresh water lake and store water can be pumped to higher elevation to irrigate dry lands.
- The watercourses and drainage courses have to be periodically maintained free from encroachments. So that to discharge the flood waters without causing submersion and consequent breaches in upper reaches.

- Land use regulation to minimize water use during drought for example, changing over from traditional agricultural to pasture or grass land.
- Demand reduction strategies for example, changing crops and cropping practices and domestic water use.
- Drip and sprinkler irrigation may be encouraged.
- To provide improved conveyance efficiency by minimizing on way losses by lining the supply system.
- To mitigate drought, measures like compartmental bunding, application of gypsum as soil conditioner, enriching the soil fertility, summer ploughing to prevent disease carried over through crop residues and soil.
- Adopting integrated pest management and formation of broad beds and deep furrows etc. may be some of the soil conservation measures to mitigate drought.
- Effective utilization of ground water storage reservoirs including recharging.
- Rural labourers of this backward area to be provided with adequate employment opportunities in their locality by establishing more small-scale industries and agro based industries.
- Sustainable drinking water schemes may be implemented.

13. Sivangai (Kottakaraiyar & Pambar River basin):

Environmental Issues:

- The municipalities and Panchayat unions in this basin are practicing open drainage system and are letting the sewage in the local drains untreated.
- Opening of the hard soils, which are kept fallow for more than a decade with the help of tractor ploughing to retain rainwater to the maximum.
- Compartmental bunding, application of gypsum as soil conditioner, enriching the soil fertility, summer ploughing to prevent diseases carried over through crop residues and soil, adopting integrated pest management and formation of broad beds and deep furrows etc may be some of the soil conservation measures to mitigate droughts.
- As this basin is a “Basin of Tanks”, continuous maintenance of tanks is essential
- Scientific conjunctive use of surface and ground water
- Creation of percolation ponds to conserve the soil moisture
- Provide community wells for irrigation
- Renovating of old tanks and ponds, desilting of supply channels and construction of water harvest structures to improve irrigation potential.
- Bringing the dry land under deep-rooted fruit plants and vegetable gardens to improve ecological conditions.
- The overall efficiency of tank irrigation system is very low (it ranges from 30 to 45%)
- Crop diversification and short term crops could be introduced to conserve water
- Soil erosion in the riverbed and consumption of water by the thorny trees exotic tree *Prosopis Juliflora*.
- Increase in Chloride concentration in the groundwater
- Ipomea weed problem
- Water Users Association should be given more rights particularly in cutting unused trees, fishing, earthwork etc.

Social Issues:

- The watershed development should be implemented with short-term plans as a preliminary measure and long term plans as a permanent measure.
- Land use regulation is to be adopted to minimize water use during droughts. The integrated technology for dry land farming should be introduced among the farming communities.
- To provide alternative employment during lean season.
- Migration due to unemployment could be avoided.
- Civil works related to water resources could be entrusted to Water Users Association.
- Appointment of more numbers of teachers to improve the educational status.
- Adolescent girls are going for laborer work in Textile mills at the cost of Rs. 30-40/day.
- Employment through cottage industries should be promoted and alternative employment such as animal husbandry, fish culture should be promoted among and agriculture farmers.
- Training programmes on vermin-compost technology and biogas production.
- Market linkage should be promoted to sell the agricultural products of the farmers.
- Small-scale industries should be promoted.
- Improvement on status of livelihood through to livestock and fish culture.
- Prevalence of rural health problems and health problem due to Ipomea.
- Skin diseases due to poor water quality.

Recommendations:

- A comprehensive watershed development programme which encompasses the total development of a catchment area has to be prepared by looking into soil type, land gradient, rainfall, topography, moisture retention potential of the soil and evapotranspiration condition of the soil, to derive maximum returns per unit of land.
- Fencing of water bodies meant for drinking water.
- Promotion of Self Help Groups (SHG) in cottage industries and marketing.
- Cold storage facilities for fruits and vegetable.
- Training programmes on honeybee cultivation, vermin-culture, seed making technology, tissue culture, fish and mud crab cultivation.
- Facilities should be provided for seed making technology.
- Transportation/collection facilities for small-scale cow milk producers have to be recommended.
- Industrial and municipal wastewater should be treated and reused.
- The concept, namely the value of the produce obtained per unit of water consumed should be introduced.
- Possibility of diverting water from adjacent Vaigai river basin through Periyar Main Canal for irrigation purposes can be considered.
- Action plan may be drawn to improve the agricultural productivity by adopting the suitable crops for these areas under modern technology.

14. Paramakudi (Vaigai Basin)

Environmental Issues:

- Around 40-50 system tanks are not able to get river water due to sand mining which made the river deeper.
- Drought and flood seasons are more intensified in this location.
- Well water could be used for alternative crops like fruit trees and coconut etc through drip irrigation to conserve water.
- Use of farm ponds for fish culture and mud crab culture to increase the job opportunity for the youngsters.
- Farm pond should be promoted and fish culture in farm ponds.
- Rotational crops and promotion of suitable dry land crops.
- Street/abandoned pigs in the gutters leads to health problems.
- Urgent need for sewage treatment and solid waste composting facilities.
- Air pollution due to flower mills.
- Encroachment in the irrigation canal prevented the links between Ramnad big tank and small tanks meant for drinking water purpose for the Ramnad town.
- A common place for organizing farmers meeting/training.
- Insisted direct procurement of products by Government.
- Environmental awareness should be created among villagers.
- Urgent requirement of de-silting of Veeravanur tank
- The catchment area of the water bodies is reduced due to the poor water management.
- Water users association should be provided with tree cutting and fishing rights.
- Needed modernized agricultural practices.
- Salt water intrusion due to solar salt pans.
- Marketing should be promoted through the Self Help Group.
- Alternative employment may be created for the farmers.
- Farm ponds should be promoted.
- Menace due to abandoned temple cattle's, which spoils agriculture.
- Ipomoea problem.
- Ground water is saline and could not be used for drinking/agricultural.
- Surface level variation occurs between river and irrigation tanks due to sand mining.
- Only source of water is surface water
- Crop cultivation in the renovated areas of Juliflora thorny trees doesn't require manure, fertilizers and pesticides.
- Emphasized on crop rotation.
- Producers wanted to fix the price of the agricultural products.
- Training in cottage industries, livestock rearing, fish culture, vermicomposting may be given to the farmers.
- Revenue from sand mining should be distributed equally to concerned Panchayats.
- Fishes were killing due to the release of untreated sewage in to the river and tanks.
- Renovation of irrigation facility is required.
- Bore wells are to be setup nearer to check dams/shutters for crop irrigation during water scarcity period.
- Sewage fed forage crop cultivation facility needed.
- Sewage treatment plants should be setup to avoid pollution

- Fish stocking in irrigation tanks fisheries department
- Fishing rights in the irrigation tanks needed
- Fish seed stocking should be done through Fisheries department
- Health problem due to Ipomoea should be avoided
- Solid waste of Paramakudi, Ramnad must be disposed hygienically

Social Issues:

- Paddy procurement price should be enhanced.
- Health problems due to disposal of sewage.
- Migration of people for employment opportunity (6 months in a Year).
- Only for three months agriculturists are employed.
- Migration due to unemployment.
- Adolescent girls must be trained in value addition of palm products and eco- friendly paper making and marketing.
- Needs direct marketing facilities.
- Price fixation required for agricultural communities e.g. Red Chilies.
- Subsidy arrangement for exchange of old water pump.
- Health problem due to Ipomea.

Recommendations:

- A separate newsletter for the WUA must be arranged to disseminate the modern agriculture techniques and share the opportunities for marketing, training, hiring of agricultural implements etc.
- All the towns along the Vaigai river basin should be provided with sewage treatment plants.
- Rights of utilizing income from the tank should be given to WUA.
- Rotational water supply and 50% subsidy for well irrigation.
- Drought is drier and during floods farmers could not save water due to lack of check dams, more no of check dams should be constructed.
- Panchayath and PWD tanks must be managed by any one of the organizations.

15. Gundar Basin, Aruppukottai:

Environmental Issues:

- The entire basin is deficient in respect of surface water.
- The soil is generally poor in nature and rainfall and irrigation facilities are also deficient.
- Check Dams/Small reservoir facilities must be developed.
- Concrete lining of water supply canal is essential.
- Schemes for groundwater utilization needed.
- Act should be developed for rotational distribution of water.
- A model farm should be developed.
- Identification of cropping pattern is needed.
- Drip and sprinkler irrigation should be popularized and must be compulsorily implemented through governance.

- 37% irrigated agriculture-gives 45% agriculture production.
- 63% rainfed agriculture gives rest of the production.
- Water consumption/acre is more in Tamil Nadu and the crop yield /acre is less.
- Eco-friendly livestock rearing for e.g sheep farming is better than goat rearing.
- Developing the forest cover for eco-stabilization.
- Minimum 33% of forest should be maintained.
- Treatment at catchment area needed for eco restoration in river basin.
- Separate drinking tank for livestock.
- Insurance for livestock is available.
- Fodder supply is arranged in the AH department.
- Forest should be maintained.
- No coup system.
- Goat rearing in stalls.
- Fodder cultivation in waste lands.
- Wasteland could be developed through tree crop e.g. lilly, casuarina, eucalyptus etc.
- Forest extension division promotes forest development.
- Medicinal plants cultivation should be encouraged.
- Alternative employment programme for tribals living in forest is available.
- Water and soil testing lab is available.
- Soil quality management is essential.
- Organic farming increases profit.
- Commercial agriculture should be practiced.
- Bio-control of insects.
- Drip/sprinkler irrigation is to be used to safe guard water sources.
- Only in 1996 Gundar river basin was identified.
- 6000km² area covers five districts viz. Virudhunagar, Padukkotai, Madurai, Sivagangai and Ramnad.
- Juliflora is the main problem in irrigation tanks.
- Sewage from Madurai pollutes Gaundar River. A sewage treatment plant should be implemented for treating the sewage.
- Sewage fed fish culture should be encouraged.
- 40% of the land lacks water supply.
- Change in mentality of stakeholders needed.
- Stakeholders should avoid Juliflora plant cultivation.
- Juliflora should be eradicated from the irrigation tanks.
- Juliflora depletes ground water and spoils the well irrigation.
- Juliflora consumes water equal to sugarcane.
- Juliflora consumes 4500 crores worth of water/year. Eradication of Juliflora is highly essential to safeguard the water resources.
- Encroachment in irrigation canals.
- Maintenance of irrigation canal needed.
- Fish culture, livestock rearing training required.
- Land reclamation required for agricultural purposes.
- Modern agricultural facilities should be implemented.
- Air pollution due to brick kiln.
- Needs training in medicinal plants cultivation.

- Sand mining should be avoided.
- Storage facilities for agriculture crops.
- Encroachment in irrigation canal should be removed.
- 50% of people migrated to Madurai city for employment.
- Madurai city sewage farm pollutes the ground water.
- SHG should go for live stock rearing.
- Flower cultivation is the main crop.
- Alagar Firm-pollutes the air up to 5 km radius- it should be rectified.
- Due to drought, fodder depleted, live stock rearing dwindled.
- No facilities for disposal of house hold wastes.
- Drinking water problem is prevalent.
- Menace of Juliflora in the irrigation tanks and all irrigation infrastructures.
- Encroachment of supply canals should be removed.
- Biogas plant can be set up connecting public toilets.
- Regulated market for agriculture products needed.
- Vocational training for adolescent girls needed and Loan facilities should be arranged for farmers.
- Agriculture of this area dwindled.
- Agro industries need to be setup.
- More dams to be constructed e.g. Algar Anai.
- Cold storage facilities for vegetables and fruits.
- Training and funding is required for value added agricultural products.
- Every village must have a tank to hold the rainwaters harvesting.
- Marketing of medicinal plants without mediators.
- Training on value addition of cucumber needed.
- Demonstration farm for Jetropa plants.
- Transportation facilities and road facilities must be created to take care of agriculture products to Madurai market.
- Encroachments in the irrigation infrastructure should be removed.
- Tank should be renovated only by the farmers association.
- Ground water is hard in nature and correct advise of crop cultivation using that water is needed.
- Problem in the paddy procurement by Government.
- Environmental up gradation required.
- De-silting of irrigation tank

Social Issues:

- Increase of malaria is high in Ramanathapuram, Kamarajar and Pasumpon Muthuramalinga, Thevar districts.
- Migration due to unemployed.
- Separate tanks for livestock must be identified.
- Live stock rearing should be promoted.
- Marketing agri-products needed.
- Up gradation of present school status.
- Flower cultivation and tissue culture.
- Toilet facilities needed to maintain sanitation.

- Training needed on alternative crop cultivation.
- No cattle rearing, only goat rearing.
- Self-employment facilities may be arranged.
- Worst sanitation problem in the village.
- Prevalence of disease due to worst sanitation.
- More bore wells needed for drinking water supply.
- Cattle washing in the drinking water well should be prevented.

Recommendations:

- Self Help Group among females should be motivated
- Toilets are required
- Training in Jaggery preparation, Tailoring for adolescent girls is needed.
- Goat rearing along with social forest develop must be implemented Poultry farming should be promoted.
- Milk society should be created.
- Action may be taken to treat the effluent from the industries.
- Action may be taken to treat the domestic sewage from municipalities for developing fodder for cattle instead of leaving them raw in open space and watercourses.
- Action may be taken to bring more area under forest cover.
- Hospital facilities needed

16. Perambalur (Vellar Basin)

Environmental issues:

- Air pollution is above the permissible level in the vicinity of Ariyalur cement factory.
- There are number of sago industries located near Chinna Salem releasing the effluents directly into the river.
- Milk chilling plants near Chinna Salem discharges its effluent with out treatment.
- The Mangroove forest existing in the mouth of Vellar River joining with sea is at present being disturbed by human intervention.
- The air surrounding the sago factories and milk chilling plants near Chinna Salem is having foul smell.
- The major industries pollute the atmosphere is the Naively Lignite, Thermal Power Stations.
- Few pockets, which are facing water shortage even for meeting the domestic needs. They are Chinna Salem and few villages in Kallakurichi block.
- The quality of ground water is saline and the surface water is polluted.
- Sand mining is predominant.
- Plastic waste dumped in to the tank
- Industries in and around Vridhachalam lot of chemical industries, acid-manufacturing units pollutes both surface and ground water.

Social Issues:

- Water borne diseases such as acute diarrhea, cholera, jaundice and water related diseases like malaria are reported in this area.

- There is no laboratory facility in the primary health center
- Inadequate teachers in the schools
- Most of the farmers are marginal and small and they were engaged in quarry works as a coolie for a low wage
- Drinking water should be properly treated.

Recommendations:

- Facilities should be created for the Solid waste management.
- A separate website should be created to know the market price and the new technologies available in the field of agriculture, horticulture and agricultural engineering.
- Close patrolling may be needed to prevent this sort of human intervention to save the Mangrove forest.
- Action may be taken to treat the effluent on the open grounds and they create water pollution.
- Sewage Treatment Plant should be installed for treating the sewage.
- Production of agro based products like Pickles, medicinal plant, Banana plants, milk-based product etc should be encouraged.

17. Tiruvallur (Kosasthalaiyar Sub Basin)

Environmental issues:

- In a context of rapid industrial growth and vast urban expansion, cities experience a severe stress due to factors such as scarcity of land for urban use, pollution, lack of adequate drinking water and sanitation.
- Degradation of coastal ecology and seawater intrusion. In most of the situations, with a view to reducing stress, metropolitan cities eat into peri-urban areas. This builds up pressure and often results in conflicting interests in the use of natural resources in peri-urban areas.
- Deforestation, industrialization and urbanization have led to ecologically unsustainable practices.
- Over extraction of Ground water Notable well fields in these river basins are Minjur (about 120 agricultural wells have been converted into water selling wells), Thamaraiappakkam (over 50 agricultural wells) Panjetty (over 100 agricultural wells), Kanigapper (60 agricultural wells) and Poondi. Kadambathur (80 agricultural wells). However, sustainability of these basins is a big question mark due to round the clock pumping in these areas. It was apparent from our preliminary field visits in these areas that many agricultural wells and many wells, which were supplying water to the Chennai city, have become dry.
- Moreover, due to nearness to the sea, seawater intrusion has already reduced the quality of groundwater in these areas. In several places, farmers and local people are agitated over round the clock pumping of groundwater from agricultural wells to the city needs.
- Forest department is planting Casuarinas and Mangrove in the coastal area of Tiruvallur.
- Emphasized the importance of bio shield during the natural calamity.

- Recent Tsunami has resulted in seawater intrusion in the coastal villages of Tiruvallur.
- Agricultural Department is promoting Bio-diesel plants extensively. Mohan Brewery is the authority agent to receive the bio diesel plant. The initial cost of investment is Rs.6000 and the final product sold in the market for Rs. 25000. The southern railways is using bio-fuel plan for running the train.
- Usage of fertilizer is getting reduced.
- Linkage should be created between the farmer and the agricultural department for a better agricultural practices.
- Sand mining is prevalent.
- Ground water quality has been changed due to water mining and decline the ground water due to sand mining.
- Illegal occupation in the catchment areas.
- Drinking water problem in Thiruvallur, Poondi etc.
- Dying factory located in the R.K.pet, Pallipattu, polluted the waterways.
- Water pollution due to dying factory and other industries.
- Untreated sewage is released in the river

Social Issues:

- Water borne diseases such as acute diarrhea, cholera, jaundice and water related diseases like malaria are reported in this area.
- Separate tanks for livestock must be identified.
- Live stock rearing should be promoted.
- Marketing agri-products needed.
- Needs direct marketing facilities.

Recommendations:

- Fencing of water bodies meant for drinking water.
- Promotion of Self Help Groups (SHG) in cottage industries and marketing.
- Training programmes on honeybee cultivation, vermiculture, seed marketing technology, tissue culture, fish and mud crab cultivation.
- Facilities for seed making technology.
- Transportation/collection facilities for small scale cow milk producers.
- Industrial and municipal waste water should be treated and reused.
- Action plan may be drawn to improve the agricultural productivity by adopting the suitable crops for these areas under modern technology.
- Tank should be renovated, de-silted
- Encroachments in the canal, lakes and in the catchment areas should be removed
- Interlinking catchments to water shed area and it also recharges the groundwater
- Catchment area should be increased by desilting the tank
- Illegal occupation should be removed from the tank, canal.
- Training should provide on crop diversification and use of modern agricultural implements to the farmers.
- Awareness programmes on various issues like vermicomposting, herbal products and drip and sprinkler irrigation systems to the farmers.

- De-siltation of tanks required.
- Channel should be lined.
- Encroachments should be cleared through the revenue department.

Social and Environment Management Framework (SEMF) is prepared based on the environmental and social issues arising out of the stakeholders' consultations and the project interventions and presented in detail in the next chapter.

7 SOCIAL AND ENVIRONMENTAL MANAGEMENT FRAMEWORK

7.1 Introduction

The project will support the efforts of the Tamil Nadu Government to strengthen the water resources management. This project includes broadly- irrigated agriculture modernization and water resources management. In order to deal with the adverse impacts, the preparation of social and environmental framework has been undertaken. This has to be implemented by the Project Implementing Agency (PIA) and their staff and apply to all proposed sub-project activities through all stages of the project cycle for incorporation of environmental and social management measures. Good social and environmental management practice is a well –established element of project preparation and implementation. It is more important in the context of an effective water resources management where additional criteria must be considered such as physical investments, besides capacity building. Development of the SEMF therefore attempts to respond to the needs of the rehabilitation and the opportunities provided by it. It also contains Action Plans for various key issues like Dam Safety, Pest Management, Cultural Property Management, Rehabilitation & Resettlement, Tribal Issues, Gender Issues and Community Sensitization that need to be addressed through the project. The SEMF has to be further modified based on the lessons learnt from the first year projects.

7.2 Overview of TNWRCP and IAMWARM projects

Tamil Nadu has implemented a World Bank financed Water Resources Consolidation Project (WRCP) from 1995-2004. The WRCP project has contributed to improving the environment by developing a State Environmental Planning Framework, by creating an Environmental Cell (EC) in the office of Chief Engineer (Plan Formulation), formation of three WRO EC divisions as focal points for environmental activities in the WRO, creating and strengthening an environmental wing at the Institute of Water Studies (IWS). A special unit in the PWD Secretariat has been created for Land Acquisition and Economic Rehabilitation (LAER). Water Resources Research Fund (WRRF) capitalizing on the success of the WRRF established in the TN WRCP, this investment would expand the activities undertaken using the fund for targeted studies, awareness raising and applied research on key water and irrigated agriculture issues (including related environmental and social development issues) facing the State. Consideration of multi-sectoral aspects of water resources development has been enhanced through the Water Resources Research Fund (WRRF). National and International training was given by the project to improve capability in water planning and management. Agricultural productivity has been improved by rehabilitation and system improvement, organization of farmers and turnover of operation and maintenance (O&M) to water user's association (WUAs) in 16 major and medium irrigation systems, 25 minor schemes and 620 non-system irrigation tanks, covering 638,000 ha. Nine unfinished schemes undertaken by the State have been completed to serve a further 16,000 ha, considerably enhancing agricultural production. The estimated increase in agricultural production due to the project would include 376,900, t/year of paddy and 31,000, t/year of groundnuts.

Tamil Nadu is one of the driest States in India, averaging only 925 mm of rainfall a year. Per capita availability of water resources in Tamil Nadu is only 900 cubic meters a year, compared with 2,200 cubic meters for all of India. The State's dry season lasts five months (January through May) even in good years, and severe droughts occur in 3 of 10 years, severely limiting cultivation of crops between June and September. A recent series of droughts and water shortages has highlighted the importance of good water resources and irrigation management. Tamil Nadu's geographic area can be grouped into 17 river basins, a majority of which is water-stressed. There are 31 major river basins, about 40,000 tanks (traditional water harvesting structures) and about 3 million wells that heavily utilize the available surface and ground water. Irrigation through a combination of canals, wells, and tanks increase the reliability and availability of water for farming and is essential for cultivating crops in much of the state. Rainfed agriculture, employing approximately 25% of farmers, accounts for 46% of the net sown area of 5.5 million hectares. The agriculture sector faces major constraints due to dilapidated irrigation infrastructure coupled with water scarcity (both quality and quantity) due largely to growing demands from industry and domestic users for surface water resources. The rate of extraction of ground water has exceeded recharge rates, resulting in falling water tables. Water quality is also growing concern. Effluents discharged from tanneries and textile industries and heavy use of fertilizers and pesticides have had a major impact on surface water quality, soils and ground water. Long-term growth in agriculture and rural income depends in large part on increasing efficiency of use of water.

In addition, diversification into higher value, less water-intensive products, such as fruits, vegetables, spices and live stock products, may be one of the most promising sources of agricultural growth. Tamil Nadu's agro-climatic conditions are well suited for diversified agriculture. Rapidly increasing incomes and changing patterns of food demand also provide strong inputs for diversification. The increased agricultural diversification in higher value processing is likely to generate new rural non-farm employment opportunities. Increased availability of water and greater efficiency of water use in the dry season (for example, through the widespread adoption of drip irrigation) could enable cultivation of crops year-round, providing employment in agricultural production and processing, benefiting the rural poor. Improving efficiency of water use and diversification requires improved irrigation service delivery together with better resource management measures.

The IAMWARM project is a successor to the recently completed TN WRCP. The key focus areas of IAMWARM are - irrigated agriculture modernization and water resources management to improve the productivity of water.

IAMWARM Sub-Basin Project Cycle: Environmental and Social Aspects

Table 7.1 IAMWARM Sub-Basin Project Cycle

Stage	Key Activities
Pre-Planning	<ul style="list-style-type: none"> • Collation of available social and environmental information (incl. on demography, water uses, pollution, resource management, sand mining, etc.) • Preparation of thematic maps on environmental and social issues • Initial consultations with various groups to determine key project stakeholders
Planning	<ul style="list-style-type: none"> • Consultations on issues and options (ensuring participation of all key stakeholders) • Participatory development (with analytical input) of Sub-basin Development and Management Plans and procurement documents • Facilitation of participatory drafting of MOU
Appraisal	<ul style="list-style-type: none"> • Gender Issues • Tribal Development • Pest Management • Natural Habitats • Land acquisition/R&R • Participatory Irrigation Management • Construction-related
Implementation	<ul style="list-style-type: none"> • Community contracting • Community supervision • Monitoring any unforeseen environmental or social impacts
Post-Implementation	<ul style="list-style-type: none"> • Identify linkages and further work to improve social and environmental sustainability • Reflect environmental and social issues in the Implementation Completion Report for the Sub-basin

7.3 Social and Environmental Management Framework (SEMF) for the IAMWARM Project

The SEMF and its recommendations are not intended to be a separate stand-alone exercise that would risk being "out-of-sight". The SEMF, along with the re commendations of the Pest Management Plan, Resettlement Action Plan, Tribal Development Plan and Gender Action Plan is to be mainstreamed into project activities and treated as an integral part of the IAMWARM planning, implementation and monitoring. The plans presented should help ensure compliance with GOI, GoTN and World Bank policies and procedures on environmental and social safeguards.

Table 7.2 SEMF

Component: A Irrigated Agricultural Modernization					
Project Interventions (1)	Environmental		Social		
	Potential Negative Environmental Impacts (2)	Mitigatory Measures (3)	Potential Negative Social Impacts (4)	Mitigatory Measures (5)	Responsible Agency (6)
1. Modernization of Irrigation Infrastructure (System/non-system/ rain fed tanks, distribution system, pump set efficiency)	<ul style="list-style-type: none"> • Accumulation of debris due to desiltation. • Flooding during periods of heavy rains • Water scarcity during periods of drought. • Induced impact of increased pesticide and fertilizer use 	<ul style="list-style-type: none"> • Spreading the debris and leveling the banks of water bodies. • Inter connectivity of canals, feeder channels, tanks etc in the basin • Monitoring and maintenance of water distribution mechanisms • Promoting organic farming with improved training. 	<ul style="list-style-type: none"> • Decrease in drinking water quality due to accumulation of minerals • Possibility of water borne diseases • Social hierarchy in harnessing water sources causing disturbed social relations. • Lapses in coordinating and strategizing the irrigation infrastructure may cause periods of 	<ul style="list-style-type: none"> • Establishment of Mini water treatment units. • Creating awareness for hygiene and community participation in common property resource management. 	<ul style="list-style-type: none"> • WRO/MDP U • Dam Safety Department etc.

	<ul style="list-style-type: none"> • Increase in over all use of water resources • Likelihood of breaches to dams and tanks. • Dilapidated dams pose a hazard through breaching and over flows. 	<ul style="list-style-type: none"> • Awareness campaigns in water conservation • Making inventories of geological and physiographical features using GIS. • Dam safety through rehabilitation and maintenance is required. Detailed dam safety plan is at Annexure III. • Proper designing and maintenance of dams and tanks, and quality control. 	<p>food systems failure.</p>	<ul style="list-style-type: none"> • Ensuring equitable distribution of water through WUAs. 	
<p>2. Institutional modernization for irrigation agriculture (asset inventory; management plans for dams, tanks and irrigation infrastructure; agricultural, horticultural, livestock and fisheries data; and Modernization of</p>	<ul style="list-style-type: none"> • Risk of crop failure and low yield of horticultural produce. • Infestation by pests. • Depletion in fish resources. 	<ul style="list-style-type: none"> • Selection of suitable crops for both mono-crop and poly-crop irrigated agriculture and promoting organic Farming. • Effective measures as per the Pest Management Plan, which is annexed at IV. 	<ul style="list-style-type: none"> • Lack of full-fledged data on physiographical, ecological and traditional knowledge systems and lack of sharing and coordination will be an impediment to the effective implementation of the project. • Malnutrition, impact on income and livelihood • Tank System: Tanks have played an important role in the 	<ul style="list-style-type: none"> • As a safe guard alternative sources of livelihood management in non-farm activities like tailoring, leaf plates, candle making, and computers need to be taken care of. • Collection, 	<ul style="list-style-type: none"> • Agriculture University and Agriculture Department • Fisheries Department • Social Welfare Department • Horticulture Department

<p>documentation, computerization, LAN and WAN, Information management and sharing, public interaction, coordination of line departments)</p>		<ul style="list-style-type: none"> • Treatment of industrial effluents and pollutants to prevent contamination of the water bodies in the drainage system. • Reducing the organic pollution • Using fish waste as chicken feed • Control of water weeds, mosquitoes 	<p>culture of a community and several cultural and religious customs and rituals are intertwined with the sacrality of the tank. The project interventions may affect some cultural properties located on or next to the 'tank structure' (e.g. on the tank bund, in the tank bed). However measures taken to improve the tank system will be taken favorably by the village community, if the scarcity of cultural landscapes is not disturbed.</p> <p>Cultural property management is Annexed at V.</p> <ul style="list-style-type: none"> • Knowledgebase and Analytical improvement. 	<p>compilation, upgradation, computerization and sharing of data relating to census of human population and livestock, forests, agriculture, horticulture and fisheries would help in developing right strategies for sustainability of the project.</p> <ul style="list-style-type: none"> • Access to the fish seeds has to be improved. For the enhancement of livelihood recreational facilities may be improved along with fish seed banks, 	
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				<p>farm ponds, fisheries in reservoirs cage fishes, ornamental fishes. Market information may be included in the kiosks.</p> <ul style="list-style-type: none"> • Care should be taken in not disturbing the sacrality and emotional bondage to burial grounds, shrines of folk deities on tank bed, small places of worship on tank embankment, temples close to the waste weir and sacred trees/groves due to project interventions. • Knowledgebase 	
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				and analytical skills of the line department officials has to be improved in the areas of GIS, Modeling and Irrigation schedule/ Real time forecasting model etc.	
3. Agricultural Diversification Fisheries, Horticulture, Livestock.	<ul style="list-style-type: none"> • Pesticide & fertilizer use: Although the project will not finance fertilizers and pesticides, induced impacts of increased fertilizer and pesticide use (mainly because of diversification of cropping patterns and increased cropping intensity) will probably take 	<ul style="list-style-type: none"> • It is proposed to strengthen awareness and training activities for integrated pest management on use of organic manure, etc for both the command and catchment farmers. (Pest Management Plan is at Annexure IV) 	<ul style="list-style-type: none"> • Although the proposed project activities may not cause or induce any significant adverse impacts on the public health front, contaminated drinking water source may create health problems. 	<ul style="list-style-type: none"> • The proposed project provides an opportunity to enhance the management of preexisting public health concerns in the basin. 	<p>WRO/TNAU</p> <p>Dept. of Fisheries, Agriculture, Horticulture</p> <p>Agricultural Engineering Department</p>

	place in the project area - in both the command and catchment areas due to agricultural extension activities.				
4. Sustainable Agriculture Modernization (cropping systems diversification and management, integrated pest and nutrient management, public private partnerships.	<ul style="list-style-type: none"> • Risk of crop failure due to non-adoptability of certain crops to different soils and agro-climatic zones. 	<ul style="list-style-type: none"> • Diversification of cropping system needs to be undertaken using the expertise and knowledge of the local farmers and agricultural extension workers. • Nutrient management and pest control using indigenous knowledge base and organic farming combined with modern pest management techniques needs to be adopted. 	<ul style="list-style-type: none"> • Lack of adequate price structure and procurement mechanisms to promote income generation to the farmers leads to exploitation by middlemen and uncertain market conditions. 	<ul style="list-style-type: none"> • Public-private partnerships may be promoted to facilitate storage facilities; direct market linkages (like Rythu Bazars in AP) and access to IT kiosks would help in getting fair price to the farmers. 	MDPU/WRO

Component: B Water Resources Management					
<p>1. State Level interventions: Effective implementation of the Policies/Acts related to the Resource regulatory mechanisms.</p>	<p>Though the proposed project won't lead to the following issues, State Level Committees must address the issues like</p> <ul style="list-style-type: none"> • Encroachment of catchments, riverbeds, supply channels, tank beds. A separate strategy for the tribal development has to be adopted as per the Tribal Development Strategy annexed at VII. 	<ul style="list-style-type: none"> • A separate Resettlement Action Plan has to be adopted as per the Resettlement Framework is at Annexure VI. 	<ul style="list-style-type: none"> • Watershed Management • Waste Land Development 	<ul style="list-style-type: none"> • Inter linking of supply channels has to be taken up. Creation of percolation tanks to hold run-off water must be implemented and maintained. • Waste lands in the sub basin should be used for horticulture crops/bio-diesel plants with less water and using organic farming. 	<p>MDPU/WRO</p> <p>Dept. of Agriculture/ Animal Husbandry/Forest</p>
<p>2. Basin Level interventions: Execution of the State's Policies.</p>	<ul style="list-style-type: none"> • Sand mining 	<p>Non judicial and excessive sand mining has to be controlled. Mining to be regulated in the riverbed considering the following:</p>			

	<ul style="list-style-type: none"> • Ground water quality • Sea water intrusion 	<ul style="list-style-type: none"> • Sand to be mined evenly in the river bed without detrimental to the natural aquifer and the ground water at that location • Flow in the river to down stream should not be affected due to mining. • Quantum of replenishment of sand every year at the location is to be assessed and mining to be planned. • Dye effluents, sand mining etc has degraded the ground water quality. CETP/STPs have to be established wherever necessary and illegal sand mining has to be controlled. • This can be achieved by controlling sand mining and minimizing 	<ul style="list-style-type: none"> • Women’s Issues • Livestock reduction • Lack of market linkages • Drinking water problem • Public Health 	<ul style="list-style-type: none"> • Measures have to be taken in accordance with the gender action plan annexed at VIII. • Livestock provision and management • Farmers have to be linked with the IT kiosk for information and backward and far ward linkages has to be established. • Establishment of mini treatment plans to supply safe drinking water. • Waterborne diseases has to be controlled 	
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	<ul style="list-style-type: none"> • Deforestation 	<p>the extraction of ground water.</p> <ul style="list-style-type: none"> • Afforestation of barren & hilly slopes should be carried out. To protect forests the following are to be considered • Active participation of local population through VSSs for regenerating degraded forests. • Implementation of eco development programmes 	<ul style="list-style-type: none"> • Lack of awareness/information • Deforestation of the Mangrove, grass lands and savannah wood lands, the characteristic floristic zones in these river basins, has affected the subsistence and survival strategies of the indigenous people like Irulars, Kanikars, Paliyans, Sholagas and Nari Kuruvas who depend upon these forests for wild plant foods, honey, small game and minor forest produce. 	<p>through action plans and awareness campaigns</p> <ul style="list-style-type: none"> • Farmers have to be enlightened on environmental issues • Regeneration of these forested eco systems would not only benefit the indigenous peoples but also helps bio-diversity conservation. • Developing social forestry to meet the demand for the fuel wood and fodder. 	
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	<ul style="list-style-type: none"> • Siltation • Aquatic weed, viz., Hyacinth, Ipomea and Prosopis 	<p>Desilting must be done regularly. This silt and sediments cause not only the reduction in the storage capacity of the lake, but also accumulation of the nutrients that promote pollution of lake water and luxurious growth of aquatic weeds, algae and bio-organisms. To avoid this desilting and dredging work has to be given importance</p> <ul style="list-style-type: none"> • . The weeds along with channel courses can be removed by mowing using power equipment provided the banks of channels are relatively smooth and not too steep. The mowing operation is usually required at rather frequent intervals to control weed growth. • A heavy chain attached between two tractors can be dragged down the 			
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		<p>channel for removing the weeds grown in it. The chain tears the rooted weeds from the bottom.</p> <ul style="list-style-type: none"> • The weeds can be controlled chemically by spraying 2,4-D, glyphosate or paraquat weedicides as post emergence herbicides. However, in the use of above chemicals for the control of these weeds, special care is required as all these chemicals are unsafe to crops grown in the command area and fish life. It is recommended that spraying of 2,4-D can be taken up in the dry season or when there is no water in the channel or during the agricultural off seasons. • In small areas or lightly infested areas, the best way to control all these weeds is by manual weeding. 			
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	<ul style="list-style-type: none"> • Solid waste Management 	<p>Steps should be taken to control the dumping of coir and domestic wastes in the canals. The principal methods of refuse disposal are:</p> <ul style="list-style-type: none"> • Dumping • Controlled on sanitary land fill • Incineration • Composting • Manure pits • Burial 			
<p>3. Water Resources Research Fund</p> <p>Suggested Studies are</p> <ul style="list-style-type: none"> • Degradation of catchments area and its impact on the river basin • Sustainable use of Ground Water • Crop Diversification and optimal crop pattern • Status and feasibility of Integrated Pest Management (IPM) and Organic farming • Study of aquatic Eco System • Project impact on socio-economic issues of the Basin • Need assessment Studies. 					

7.4 Social and Environmental Management Framework (SEMF) for the IAMWARM Project-Sub-Basin wise.

Table 7.3 SEMF for the IAMWARM project

Sl. No	Main River Basin	Sub Basin	Environmental Issues	Social Issues	Mitigatory Measures	Responsible Agency
1	Chennai	1.Kosasthalaiyar	<ul style="list-style-type: none"> • Industrial Pollution • Sea water intrusion • Sand Mining • Siltation • Coastal erosion • Weed growth • Industrial effluents • Domestic Sewage • Over exploitation of ground water • Dumping of debris into tanks 	<ul style="list-style-type: none"> • Encroachment • Poor sanitary conditions • Skin allergies • Mosquito breeding due to water stagnation • Elephantiasis 	<p>Watershed management, waste land development and awareness campaigns on various aspects for hygiene and community participation may be taken up. Banks of water bodies maybe leveled after spreading the debris and silted material. Desilting must be done regularly and dredging work has to be given importance. Non-judicial and excessive sand mining has to be controlled and regulated. Seawater intrusion can be prevented by controlling sand mining and minimizing the extraction of ground water. The weeds can be removed by using power equipment at frequent intervals. Rehabilitation programme may be taken up for the encroachers.</p>	EC Division, Chennai, MDPU/ Dept of Public Health

2	Palar	2. Cheyyar	<ul style="list-style-type: none"> • Ground water contamination • Dying Effluents In Arni Taluk • Water contamination due to Kattamanku • Sand mining • Domestic Sewage • Water weeds 	<ul style="list-style-type: none"> • Poor literacy • Anthrax in cattle • Farmers opposition to vaccination 	<p>CETP may be established. Non-judicial and excessive sand mining has to be controlled and regulated. Steps should be taken to control the dumping of coir and domestic wastes in the canals.</p> <p>The weeds can be removed by using power equipment at frequent intervals. Awareness campaigns on various aspects for hygiene and community participation may be taken up.</p>	<ul style="list-style-type: none"> • TNPCB /EC Division, Chennai, MDPU

		<p>3. Kliyar</p>	<ul style="list-style-type: none"> • Sand mining • Domestic sewage • Ground water depletion due to industries • Sea water intrusion • Sugar mill effluents • Water weeds • Lack of sewage treatment plant 	<ul style="list-style-type: none"> • Seasonal migration • Poor marketing facilities • Poor literacy • Poor sanitary conditions • Problems due to mosquitoes and pigs 	<p>Non-judicial and excessive sand mining has to be controlled and regulated. Seawater intrusion can be prevented by controlling sand mining and minimizing the extraction of ground water. The weeds along with channel courses can be removed by using power equipment at frequent intervals.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Farmers have to be linked with the IT kiosk for information and backward and far ward linkages</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up.</p>	<p>EC Division, Chennai, MDPU/ Dept. of Agriculture/D ept. of Public Health etc.</p>
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3	Pennaiyar	4. Chinnar 1 a	<ul style="list-style-type: none"> • Domestic sewage • Poor solid waste management • Drinking water pollution due to drainage water. • Sand mining • Soil erosion • Water weeds 	<ul style="list-style-type: none"> • Live stock reduction • Poor sanitary conditions • Poor literacy • Water borne diseases 	<p>Non-judicial and excessive sand mining has to be controlled and regulated. Mini water treatment plants may be established. Steps should be taken to control the dumping of coir and domestic wastes in the canals.</p> <p>The weeds along with channel courses can be removed by using power equipment at frequent intervals.</p> <p>Livestock provision and management</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up.</p>	EC Division, Chennai, MDPU/ Dept. of Animal Husbandry, / Local Bodies
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		<p>5. Chinnar 1 b</p>	<ul style="list-style-type: none"> • Sand mining • Water contamination • Domestic sewage • Water weeds • Textile effluents 	<ul style="list-style-type: none"> • Seasonal migration • Live stock reduction • Poor sanitary conditions • Health problems 	<p>Non-judicial and excessive sand mining has to be controlled and regulated. The weeds along with channel courses can be removed by using power equipment at frequent intervals.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up.</p>	<p>EC Division, Chennai, MDPU/ Dept. of Agriculture/ Animal husbandry / Public Health</p>
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		6. Pennaiyar to Krishnagiri	<ul style="list-style-type: none"> • Water pollution due to industries • Mango processing effluents • Sand mining • Poor solid waste management 	<ul style="list-style-type: none"> • Health problems • Live stock diseases • Encroachments 	<p>Non judicial and excessive sand mining has to be controlled and regulated. Awareness campaigns on various aspects for hygiene and community participation may be taken up. Rehabilitation programme may be taken up for the encroachers</p>	EC Division, Chennai, MDPU/ Dept .of Animal Husbandry / Public Health
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		<p>7. Pambar</p>	<ul style="list-style-type: none"> • Municipal sewage • Sago industrial effluents • Water weeds 	<ul style="list-style-type: none"> • Seasonal migration • Live stock reduction • Poor sanitary conditions • Encroachment 	<p>Steps should be taken to control the dumping of coir and domestic wastes in the canals.</p> <p>The weeds along with channel courses can be removed by using power equipment at frequent intervals.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	<p>EC Division, Chennai, MDPU/ Dept..of Animal Husbandry / Public Health</p>
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		<p>8. Vaniyar</p>	<ul style="list-style-type: none"> • Municipal sewage • Sago industrial effluents • Sand mining 	<ul style="list-style-type: none"> • Seasonal migration • Live stock reduction • Poor sanitary conditions 	<p>Non-judicial and excessive sand mining has to be controlled and regulated. Steps should be taken to control the dumping of coir and domestic wastes in the canals</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	<p>EC Division, Chennai, MDPU/ Dept..of Animal Husbandry / Public Health</p>
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		9. Musukundanadhi	<ul style="list-style-type: none"> • Municipal sewage • Sand mining • Lack of sewage treatment plant 	<ul style="list-style-type: none"> • Seasonal migration • Live stock reduction • Poor sanitary conditions 	<p>Non judicial and excessive sand mining has to be controlled and regulated. Steps should be taken to control the dumping of coir and domestic wastes in the canals.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up.</p>	EC Division, Chennai MDPU/ Dept..of Animal Husbandry / Public Health
4	Varahana dhi	10. Varahanadhi	<ul style="list-style-type: none"> • Mining of rocks • Municipal sewage • Sand mining • Water weeds 	<ul style="list-style-type: none"> • Seasonal migration • Live stock reduction • Lack of awareness 	<p>Non judicial and excessive sand mining has to be controlled and regulated. Steps should be taken to control the dumping of coir and domestic wastes in the canals.</p>	EC Division, Chennai MDPU/ Dept..of Animal Husbandry

					<p>Weeds can be removed by using power equipment at frequent intervals.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	
5	Vellar	11.Manimutha nadi	<ul style="list-style-type: none"> • Coconut trees are affected due to water pollution • Sand mining • Over exploitation of ground water 	<ul style="list-style-type: none"> • Social conflicts • Inadequate school teachers • Anthrax in cattle 	<p>Non judicial and excessive sand mining has to be controlled and regulated.</p>	<p>EC Division, Chennai MDPU</p>

		12. Kil Vellar	<ul style="list-style-type: none"> • Municipal sewage • Effluents from sugar industries • Lack of sewage treatment plants 	<ul style="list-style-type: none"> • Seasonal migration • Live stock reduction • Poor drinking water supply and sanitation 	<p>Steps should be taken to control the dumping of coir and domestic wastes in the canals</p> <p>Mini water treatment plants can be established.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	<p>EC Division, Chennai MDPU/ Dept..of Animal Husbandry/ Dept.of Public Health</p>
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		13. Upper Vellar	<ul style="list-style-type: none"> • Sago industrial effluents • Sand mining 	<ul style="list-style-type: none"> • Seasonal migration • Live stock reduction • Poor drinking water supply and sanitation • No marketing facilities 	<p>Non judicial and excessive sand mining has to be controlled and regulated.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p> <p>Farmers have to be linked with the IT kiosk for information and backward and far ward linkages</p>	<p>EC Division, Chennai MDPU/ Dept..of Animal Husbandry/ Public Health/ Agriculture</p>
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		14. Swethanadhi	<ul style="list-style-type: none"> • Ground water pollution • Sand mining • Air pollution due to cement factory 	<ul style="list-style-type: none"> • Seasonal migration • Live stock reduction • Poor drinking water supply and sanitation • No marketing facilities • Problem of mosquitoes 	<p>Non judicial and excessive sand mining has to be controlled and regulated.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p> <p>Farmers have to be linked with the IT kiosk for information and backward and far ward linkages</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	<p>EC Division, Chennai MDPU/ Dept..of Animal Husbandry/ Dept.of Public Health/ Dept.of Agriculture</p>
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		15. Chinnar	<ul style="list-style-type: none"> • Ground water pollution • Sand mining 	<ul style="list-style-type: none"> • Seasonal migration • Live stock reduction • Poor drinking water supply and sanitation • Females affected by cancer 	<p>Non judicial and excessive sand mining has to be controlled and regulated. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p>	<p>EC Division, Chennai MDPU/ Dept..of Animal Husbandry/ Public Health/</p>
		16. Anivari	<ul style="list-style-type: none"> • Ground water pollution • Sand mining • No proper solid waste management 	<ul style="list-style-type: none"> • Seasonal migration • Live stock reduction • Poor drinking water supply and sanitation 	<p>Non judicial and excessive sand mining has to be controlled and regulated. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p>	<p>EC Division, Chennai MDPU/ Dept..of Animal Husbandry/ Dept.of Public Health/</p>

6	Agniar	17. Agniar	<ul style="list-style-type: none"> • Excessive nitrate concentration • Juliflora growth • Poor solid waste management • Soil erosion • Excessive use of chemical fertilizers 	<ul style="list-style-type: none"> • Seasonal migration • Reduction in grassing land and live stock • Low literacy rate, no marketing facilities • Poor sanitary conditions 	<p>Steps should be taken to control the dumping of coir and domestic wastes in the canals weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	EC Division, Coimbatore MDPU/ Dept..of Animal Husbandry/ Public Health/ Agriculture
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		18. Ambuliar	<ul style="list-style-type: none"> • Juliflora growth • Sand mining • Excessive use of chemical fertilizers 	<ul style="list-style-type: none"> • Seasonal migration • Active SHGs • School drop outs • Poor sanitary conditions 	<p>Non judicial and excessive sand mining has to be controlled and regulated. weeds can be removed by using power equipment at frequent intervals.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Special school drive programmes may be taken up. Awareness campaigns on various aspects for hygiene and community participation may be taken up through SHGs.</p>	EC Division, Coimbatore MDPU/ Dept..of Animal Husbandry/ Public Health/ Agriculture
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		19. South Vellar	<ul style="list-style-type: none"> • Juliflora growth • Sand mining • Over exploitation of ground water 	<ul style="list-style-type: none"> • Seasonal migration • Women empowerment-SHGs • No health care centers 	<p>Non judicial and excessive sand mining has to be controlled and regulated. weeds can be removed by using power equipment at frequent intervals.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p>	EC Division, Coimbatore MDPU/ Dept..of Animal Husbandry/ Dept.of Public Health/
7	Parambikulam Aliyar Project	20. Parambikulam Aliyar	<ul style="list-style-type: none"> • Soil erosion • Siltation and deforestation • Sand mining • Pollution due to coir industries • Excess fluoride and nitrate concentration 	<ul style="list-style-type: none"> • Improved livelihood due to coir industries • Decrease in live stock • SHGs • Water borne diseases 	<p>Desilting must be done regularly and dredging work has to be given importance Non-judicial and excessive sand mining has to be controlled and regulated. Livestock provision and management</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	EC Division, Coimbatore MDPU/ Dept..of Animal Husbandry/ Public Health/

		21. Palar	<ul style="list-style-type: none"> • Soil infertility • Ground water pollution • Catchment area degradation 	<ul style="list-style-type: none"> • Improved livelihood due to coir industries • Decrease in live stock • SHGs 	Livestock provision and management	EC Division, Coimbatore MDPU/ Dept..of Animal Husbandry/ Dept.of Public Health/ Dept.of Agriculture
8	Kottakariyar	22. Kottakaraiyar	<ul style="list-style-type: none"> • Juliflora and ipomea growth • Soil alkalinity and erosion • Sand mining • Chlorides in ground water 	<ul style="list-style-type: none"> • Migration and crop rotation • Skin diseases and health problems • Lack of small scale industries 	<p>Non judicial and excessive sand mining has to be controlled and regulated. weeds can be removed by using power equipment at frequent intervals.</p> <p>Migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	EC Division, Madurai MDPU/ Dept..of Animal Husbandry/ Public Health/ Agriculture

		23. Saruganiar	<ul style="list-style-type: none"> • Juliflora and ipomea growth • Soil alkalinity • Chlorides in ground water 	<ul style="list-style-type: none"> • Migration and crop rotation • Skin diseases and health problems • Lack of teachers 	<p>Weeds can be removed by using power equipment at frequent intervals.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	EC Division, Madurai MDPU/ Dept..of Animal Husbandry/ Public Health/ Agriculture
9	Pambar	24. Pambar	<ul style="list-style-type: none"> • Juliflora growth • Surface water pollution • Ground water depletion 	<ul style="list-style-type: none"> • Migration and crop rotation • Live stock reduction 	<p>Weeds can be removed by using power equipment at frequent intervals.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p>	EC Division, Madurai MDPU/ Dept..of Animal Husbandry/ Agriculture

10	Vaigai	25. Varaganadhi	<ul style="list-style-type: none"> • Juliflora growth • Sand mining • Salt water intrusion due to salt ponds • Siltation • Nitrate concentration in ground water • Reduction in fish population due to sewage 	<ul style="list-style-type: none"> • Out seasonal migration • Reduction in live stock • Social conflicts • Lack of water storage facilities • No storage facilities for food grains • Prone to drought and floods 	<p>Non judicial and excessive sand mining has to be controlled and regulated.</p> <p>Weeds can be removed by using power equipment at frequent intervals.</p> <p>Desilting must be done regularly and dredging work has to be given importance</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Common storage facilities may be established.</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	EC Division, Madurai MDPU/ Dept..of Animal Husbandry/ Agriculture
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		26. Sathaiyar	<ul style="list-style-type: none"> • Juliflora and ipomea growth • Sand mining • Soil erosion • Air pollution due to flour mills • Mixing of sewage into tanks 	<ul style="list-style-type: none"> • Out seasonal migration • Reduction in live stock • Social conflicts • Encroachments • No marketing facilities • Health problems due to sewage 	<p>Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Awareness campaigns on various aspects for hygiene and community participation may be taken up</p> <p>Livestock provision and management</p>	<p>EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Public Health/ Agriculture</p>
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		27. Varattar – Nagalar	<ul style="list-style-type: none"> • Juliflora growth • Sand mining and soil erosion • Poor solid waste management 	<ul style="list-style-type: none"> • Out seasonal migration • Reduction in live stock • Social conflicts • Health problems 	<p>Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals. Steps should be taken to control the dumping of coir and domestic wastes in the canals</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Public Health/
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		<p>28. Manjalar</p>	<ul style="list-style-type: none"> • Juliflora and ipomea growth • Sand mining and soil erosion • Siltation • Air pollution due to flour mills • Mixing of sewage into tanks 	<ul style="list-style-type: none"> • Out seasonal migration • Reduction in live stock • Social conflicts 	<p>Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals. Desilting must be done regularly and dredging work has to be given importance</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management</p>	<p>EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/</p>
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		29. Lower Vaigai	<ul style="list-style-type: none"> • Juliflora growth • Sand mining and soil erosion • Salt water intrusion • Ground water salinity 	<ul style="list-style-type: none"> • Out seasonal migration • Reduction in livestock • Social conflicts • No electricity connections • Problem of pigs 	<p>Non judicial and excessive sand mining has to be controlled and regulated.</p> <p>Weeds can be removed by using power equipment at frequent intervals.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Solar lighting system may be established.</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p> <p>Livestock provision and management</p>	<p>EC Division, Madurai MDPU/ Dept..of Animal Husbandry/ Public Health/</p>
11	Gundar	30. Upper Gundar	<ul style="list-style-type: none"> • Juliflora growth • Sand mining • Lack of water supply • Air pollution due to brick kilns 	<ul style="list-style-type: none"> • Encroachment • Dry land agriculture reduction in live stock • Poor marketing and transportation facilities 	<p>Non judicial and excessive sand mining has to be controlled and regulated.</p> <p>Weeds can be removed by using power equipment at frequent intervals.</p>	<p>EC Division, Madurai MDPU/ Dept..of Animal Husbandry/ Agriculture</p>

		31. Terkkar	<ul style="list-style-type: none"> • Excess fluoride and nitrate in Ground Water • Juliflora growth • Sand mining 	<ul style="list-style-type: none"> • Encroachment of catchment area • Dry land agriculture • Reduction in live stock 	<p>Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals. Livestock provision and management</p>	<p>EC Division, Madurai MDPU/ Dept..of Animal Husbandry/ Agriculture</p>
		32.Paralaiar	<ul style="list-style-type: none"> • Juliflora growth • Sand mining • Poor solid waste management • Water borne diseases 	<ul style="list-style-type: none"> • Drought prone area • Migration • No marketing facility • No organized cattle farm • Reduction in live stock 	<p>Non judicial and excessive sand mining has to be controlled and regulated. Weeds can be removed by using power equipment at frequent intervals. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management</p>	<p>EC Division, Madurai MDPU/ Dept..of Animal Husbandry/ Agriculture</p>

12	Vaippar	33. Nichabanadhi	<ul style="list-style-type: none"> • Soil erosion, Siltation • Poor solid waste management • Dye industry effluents 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in live stock • Women empowerment-SHG • Inadequacy of teachers • Prevalence of child labour 	Desilting must be done regularly and dredging work has to be given importance Steps should be taken to control the dumping of coir and domestic wastes in the canals Livestock provision and management. Teacher-student ratio may be increased along with bridge courses.	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Dept.of Agriculture
		34. Kalingalar	<ul style="list-style-type: none"> • Sugar industrial effluent 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in live stock • Women empowerment-SHG 	Common Effluent Treatment Plant (CETP) may be established. Livestock provision and management	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry
		35. Arjuna Nadhi	<ul style="list-style-type: none"> • Soil erosion • Sand mining 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in live stock • Women empowerment-SHG • No storing facilities 	Non-judicial and excessive sand mining has to be controlled and regulated. Livestock provision and management Common storage facilities may be established.	EC Division, Madhurai MDPU/ Dept..of Animal Husbandry/ Agriculture

		36. Sindapalli Odai	<ul style="list-style-type: none"> • Sedimentation • Sand mining • Soil erosion • Dumping of solid waste • Sewage pollution 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in live stock • Women empowerment-SHG 	<p>Non-judicial and excessive sand mining has to be controlled and regulated. Steps should be taken to control the dumping of coir and domestic wastes in the canals</p> <p>Livestock provision and management</p>	<p>EC Division, Madhurai MDPU/ Dept..of Animal Husbandry</p>
		37. Senkottaiyar	<ul style="list-style-type: none"> • Drought prone sub basin 	<ul style="list-style-type: none"> • Dry land agriculture • Reduction in live stock • Women empowerment-SHG 	<p>Drought Prone Area Development (DPAP) programmes may be implemented extensively.</p> <p>Livestock provision and management</p>	<p>EC Division, Madhurai MDPU/ Dept..of Animal Husbandry</p>

13	Tamirapara rani	38. Manimuthar	<ul style="list-style-type: none"> • Sewage pollution • Hospital waste dumping • Sand mining and Juliflora growth • Water logging • Encroachment of canal • Soil erosion • 	<ul style="list-style-type: none"> • Migration • Reduction in livestock • Lack of marketing facilities • Encroachment of canal • Lack of cooperative milk society 	<p>Steps should be taken to control the dumping of coir and domestic wastes in the canals</p> <p>A separate Resettlement Action Plan has to be adopted for the encroachers.</p> <p>Weeds can be removed by using power equipment at frequent intervals.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Livestock provision and management</p>	EC Division, Madurai MDPU/ Dept..of Animal Husbandry Agriculture
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		39. Chittar	<ul style="list-style-type: none"> • Sewage pollution • Solid waste dumping • Sand mining and weed growth. • Siltation • Paper mill effluents 	<ul style="list-style-type: none"> • Migration • Poor sanitary conditions • Malaria 	<p>Desilting must be done regularly and dredging work has to be given importance. Non-judicial and excessive sand mining has to be controlled and regulated. Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	<p>EC Division, Madurai MDPU/ Dept..of Animal Husbandry/ Dept. of Public Health</p>
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		<p>40 Lower Tamiraparani</p>	<ul style="list-style-type: none"> • Sewage pollution • Solid waste dumping • Sand mining • Juliflora and weed growth • Sea water intrusion 	<ul style="list-style-type: none"> • Migration • Poor drinking water facilities • Health problems • Lack of veterinary hospital 	<p>Non-judicial and excessive sand mining has to be controlled and regulated. Seawater intrusion can be prevented by controlling sand mining and minimizing the extraction of ground water. Steps should be taken to control the dumping of coir and domestic wastes in the canals</p> <p>Weeds can be removed by using power equipment at frequent intervals.</p> <p>Seasonal migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p>	<p>EC Division, Madurai MDPU/ Dept..of Animal Husbandry/ Dept. of Public Health</p>
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14	Kothaiyar	41. Pazhayar	<ul style="list-style-type: none"> • Salinity and alkalinity • Sand mining • Soil erosion • Poor solid waste management at tourist spots • Water weeds • Entry of untreated effluents • Juliflora growth • Agro industry effluents • Sea water intrusion • Increased use of chemical fertilizers • Ground water depletion due to excessive withdrawal by pepsi and coke companies 	<ul style="list-style-type: none"> • Migration • Reduction in live stock • Women empowerment-SHGs • Poor sanitation and drinking water facilities, • Encroachment of river banks, tanks etc • Poor marketing facilities • High transportation costs 	<p>Non-judicial and excessive sand mining has to be controlled and regulated. Seawater intrusion can be prevented by controlling sand mining and minimizing the extraction of ground water. Weeds can be removed by using power equipment at frequent intervals. Migration can be avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities. Livestock provision and management</p>	EC Division, Madurai MDPU/ Dept..of Animal Husbandry/ Public Health
15	Nambiyar	42. Nambiyar	<ul style="list-style-type: none"> • Sand mining • Dumping of solid and agricultural wastes • Sea water intrusion • Soil erosion • River bed degradation and 	<ul style="list-style-type: none"> • Migration • Reduction in live stock • Women empowerment-SHGs • Poor sanitation and drinking water facilities 	<p>Non-judicial and excessive sand mining has to be controlled and regulated. Seawater intrusion can be prevented by controlling sand mining and minimizing the extraction of ground water. Seasonal migration can be</p>	EC Division, Madurai MDPU/ Dept..of Animal Husbandry/ Public Health

			instability of stream course	<ul style="list-style-type: none"> • Agricultural labour scarcity 	<p>avoided with assured water supply by making use of technologies like Real Time Forecasting Model Analysis/ Irrigation Scheduling Model and by promoting non-farm activities.</p> <p>Awareness campaigns on various aspects for hygiene and community participation may be taken up</p> <p>Livestock provision and management</p>	
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Note: The above table is primarily based on the basin micro-level reports and stakeholders consultative meetings. It is suggested to prepare the micro level reports for the sub-basins.

7.5 Irrigation Scheduling Model

Irrigation scheduling is the process used by irrigation system managers to determine the correct frequency and duration of watering. Irrigation-scheduling scheme considers sensitivity of the crop to water stress at different growth stages.

The following factors may be taken into consideration:

1. Precipitation rate of the irrigation equipment
2. Soil infiltration rate.
3. Slope of the land being irrigated
4. Soil available water capacity
5. Current watering requirements of the plant.
6. Amount of time in which water or labor may be available for irrigation.
7. Timing to take advantage of projected rainfall

The goal in irrigation scheduling is to apply enough water to fully wet the plant's root zone while minimizing overwatering and then allow the soil to dry out in between waterings to allow air to enter the soil, but not so much that the plant is stressed beyond what is allowable.

In recent years, more sophisticated irrigation controllers have been developed. The devices that are helpful in irrigation scheduling are rain sensors, which automatically shut off an irrigation system when it rains, and soil moisture sensing devices such as tensiometers and gypsum blocks.

Real-time irrigation scheduling under limited water supply is considered. The goal is to develop an irrigation operation policy which maximizes crop yields and is responsive to current season changes in weather and other variables. As irrigation decisions are sequential and dependent on crop and soil water status, and also crop yields can only be known at the end of the season.

Irrigation scheduling model can increase irrigation efficiency and yield by proper timing and application of irrigation water. This is especially important in the conversion to improved irrigation systems, which have the potential to increase yields and irrigation efficiency, provided the concerned officials has to know how to manage the system through some form of irrigation scheduling.

Irrigation scheduling simulation models to perform the soil water balance using soil, crop and meteorological data and to provide information on the soil moisture status. Irrigators tend not to use climate based irrigation scheduling models, because of a lack of user friendliness of the models, lack of trust in the basic assumptions behind the models, and a lack of economic reward perceived by the irrigators if they were to take the time and effort to learn how to use the models. However, the use of models present serious difficulties for application in real time since they require not only validation but also a support advisory service and training of irrigation extensionists, managers and/or farmers.

7.5.1 Area of Application

- For automating irrigation at small and medium size farms.
- Suitable for drip and sprinkler irrigation.
- Can be used in Green Houses.

7.5.2 Advantages

- Adequate quantity of water and nutrients supply result in high yield.
- Low cost.
- It starts watering just at the right time.
- It stops the watering when field capacity is reached.
- It takes in to account the effective rainfall for scheduling irrigation.
- It saves water and labour cost involved with manual operation.
- No leaching of minerals and nitrogen vital for plants healthy growth.
- Eliminates the long term ill-effects of over irrigation causing development of salinity.
- The circuit can be interfaced to any resistance type soil moisture sensor
- There is option for soil moisture base irrigation scheduling or time based irrigation scheduling.

7.6 Real Time Forecasting Model

Agriculture is heavily weather dependent world over and is more so in tropical monsoon country like India. Further, India is one of the few countries in the world severely affected by cyclonic storms. Farming community needs to be advised in time by producing custom-tailored weather forecasts to initiate suitable measures to increase the production and minimise the losses as well. Agricultural contingency planning in real-time mode needs weather forecasts over agro-climatic zone level beyond the time scale of short-range weather forecasts.

Real time forecasting model is necessary for assured water supply. Forecasting should be done based on the seasons. River basin level forecasting is needed and the basin managers have to advise the farmers on the meteorological conditions prior to growing crops. Farmers will adopt this model if there is assured water supply.

Organizations fully equipped with state-of-the-art supercomputing infrastructure can develop suitable Numerical Weather Prediction (NWP) models to issue medium range weather forecasts, which can inform and guide the farmers in advance to undertake various farming activities based on the expected weather. Organizational set up at the basin level is required for effective monitoring of seasonal conditions and crop planning.

7.7 Application of World Bank Safeguard Policies

Table 7.4 Bank Safeguard Policies

Policy	Applicability	Comments
Environmental Assessment (OP/BP 4.01)	Yes	Significant adverse social or environmental impacts are not expected as all significant physical investments are expected to be in the nature of rehabilitation of existing assets. However, an integrated Environmental and Social Assessment (ESA) with an Environmental and Social Management Plan (ESMP) to both manage risks and maximize environmental and social opportunities will be finalized based on earlier work and experiences of the TN WRCP project and consideration of new activities proposed in the TN IAMWARM project.
Natural Habitats (OP/BP 4.04)	No	No adverse impacts on natural habitats expected, but this issue will be further tracked during the ESA implementation
Forests (OP/BP 4.36)	No	No proposed activities would trigger this policy.
Pest Management (OP 4.09)	Yes	No pesticides and fertilizers are expected to be financed directly by the project; however, there may be induced impacts of increased fertilizer and pesticide use due to improved agricultural intensification and diversification. The project will support scaling-up statewide Integrated Pest Management and Integrated Nutrient Management efforts and support for safer and organic food production and marketing. A pest management plan will be proposed as part of the ESA and ESMP.
Cultural Property (OPN 11.03)	TBD	No significant adverse impacts on cultural property expected, but this issue will be examined during the ESA (particularly in relation to proper management of any religious and other physical cultural property associated with tanks during rehabilitation).
Indigenous Peoples (OD 4.20)	TBD	No adverse impacts on tribals are expected, but the project will examine ways to improve benefits to tribals, women, and other vulnerable groups as part of the ESA.
Involuntary Resettlement (OP/BP 4.12)	Yes	No significant resettlement expected – but these will be examined further as preparation proceeds. The successful arrangements adopted under the previous TN WRCP project will also be adopted as required.
Safety of Dams (OP/BP 4.37)	Yes	The project will support safety of dams associated with the project areas (unless already addressed under other parallel projects). The project will also support safety improvement of tank systems as part of tank rehabilitation.
Projects on International Waterways (OP/BP 7.50)	No	No project activities in international waterways.
Projects in Disputed Areas (OP/BP 7.60)	No	No project activities in disputed areas.

7.8 Guidelines for Screening Social Safeguards

This provides guidelines for addressing potential social impacts in the proposed sub-projects that are eligible for funding under the Project. Typical activities envisaged to be financed are listed below with typical social concerns and opportunities as well as an identification of typical social mitigation measures, which are to be included in the sub-projects. The checklists prepared for each sub-project will enable the preparation of detailed Plans.

Table 7.5 Sub Project Activities and its Impacts

Sector	Sub-Project and type of activities	Potential impacts and social concerns	Typical mitigation measures
Fishing Infrastructure	<ul style="list-style-type: none"> • Harbour Support activities • Engine repair centers • Fishing Auction Centres • Communication centers • Drain Yards • Approach road 	<ul style="list-style-type: none"> • Positive impacts in increasing fishing infrastructure • Use of public lands • Acquisition of small amount of private lands • Loss of temporary access to lands. 	<ul style="list-style-type: none"> • Consultation and participation during preparation of mitigation plans and identification of infrastructure needs • Compensation for loss of assets at replacement cost.
Agriculture and Animal Husbandry	Reclamation of Sodic lands Shelter Plantations Livestock development	<ul style="list-style-type: none"> • Positive impacts to enhance • Livelihoods and bring land to cultivable status • Small amount of land requirement for plantations 	<ul style="list-style-type: none"> • Consultation and participation of identification of schemes.

Note: The above list is only illustrative and any additional activities that may be considered will be mitigated in accordance with requirements and needs.

7.9 Checklist for Screening of Land Acquisition and Resettlement Impacts

This Form is to be used by the Safeguard Focal Point (SFP) at the Sector/District level in Screening Subproject Applications in respect of PAPs/land acquisition. This information will be submitted as soon as sub-project is identified. Based on the impacts, the need for preparation of sub-project specific Resettlement Plan will be determined.

- (a) Number of Subproject:
- (b) Proposing Agency:
- (c) Subproject Location (include map/sketch):
- (d) Sub-project Objective:
- (e) Expected Subproject Activities:
- (f) Infrastructure to be constructed:
- (g) Infrastructure to be rehabilitated:
- (h) Estimated Cost:
- (i) Proposed Date of Commencement of Work:
- (j) Technical Drawing/Specifications Reviewed (circle answer): Yes ___ No ___
- (k) Major adverse impacts expected and mitigation proposed:
- (l) Will the subproject involve land expropriation or demolition of existing structures? Yes/No,

If yes, provide details in Land acquisition **Assessment sheet III (a)**

- (m) Current land uses of the above affected lands (use)_____ (ha)_____
- (n) Will the subproject negatively impact livelihoods Yes/No (If yes, describe impact separately):
- (o) Whether any common facilities or others structures affected due to acquisition of above land;
- (p) Indicate whether any scheduled caste/tribe population is affected or living in the affected villages. Yes/No (If yes, describe the group)
- (q) Type of Plan required: (a) Resettlement Plan..... (b) Abbreviated Plan..... (C) No Plan required.....(d) Whether Tribal Plan is required: Yes/ No

Signed by Sector/District ESMF coordinator: Name: _____
 Title: _____
 Date: _____

Signed by ESMF Coordinator at PMU
 Name: _____
 Title: _____
 Date: _____

7.9.1 Land Acquisition Assessment Data Sheet

(To be used to record information in case of requirement of use of land for sub-projects)

1. Likely land requirement for the sub-project (Ha):

(a) Government_____ha (b) Private _____ha (c) Temple Land_____ha

(d) Gram Panchyat_____ha (e) any other-----ha

2. Method of land acquisition (Land Acquisition Act, Private Negotiations or voluntary Donation³):

3. Locations:

4. No of landowners to be affected:

5. No. of structures affected:

6. Current uses of the affected lands:

7. Users:

a) Number of Customary Claimants:

b) Number of Squatters:

c) Number of Encroachers:

d) Number of Owners:

e) Number of Tenants:

f) Others (specify): _____ Number:

g) Common facilities affected: (Describe)-----

8. Details of standing crops to be affected:

9. Any other properties such as wells or trees, etc. to be affected:

10. In case of voluntary donation, sufficient proof must be obtained ((notarized or witnessed statements. Provisions of the government order in this regard will be made known to the private landowners in case of negotiations.

3 In case of voluntary donation appropriate agreement will be executed between landowner and implementing agency prior to handing over of the land to prevent any further claims.

7.9.2 Guidelines for Preparation of Land Acquisition and Involuntary Resettlement Plans

1. Land acquisition and involuntary resettlement will be kept to a minimum, and will be carried out in accordance with these guidelines. Subproject proposals that would require acquisition of productive lands and demolition of structures will be carefully reviewed to minimize or avoid their impacts through avoidance or minimization process. The principle objectives of resettlement are as follows:

- a) Secondary involuntary resettlement will be avoided or minimized by exploring all possible options that have least impacts in terms of secondary land acquisition and resettlement ;
- b) In unavoidable circumstances, the affected persons irrespective of their legal status will be assisted in their efforts to improve their livelihoods and standards of living or at least restore them in real terms to the pre-affected levels; and,
- c) The compensation and assistance to the project affected people are based on the principle that people shall not suffer net losses as a result of the project.

2. Eligibility for Benefits

Project Affected Persons (PAPs) are defined as persons whose livelihood or shelter is directly affected by the project activities due to acquisition of the land owned or used by them. PAPs deemed eligible for compensation are:

- (a) Those who have formal legal rights to land, water resources or structures/buildings, including recognized customary and traditional rights;
- (b) those who do not have such formal legal rights but have a claim to usufruct rights rooted in customary law; and
- (c) those whose claim to land and water resources or building/structures do not fall within (a) and (b) above, are eligible to resettlement assistance to restore their livelihood.

3. Involuntary Resettlement Support Principles

The project implementation agencies will ensure timely provision of compensation and resettlement assistance to the project affected peoples. The following are the key principles.

- a) any resettlement will be carried out as a sustainable development project;
- b) replacement land with an equally productive plot, cash or other equivalent productive assets;
- c) materials and assistance to fully replace solid structures that will be demolished;
- d) In case of temporary loss of access to lands, compensation in the form of lease rent will be paid;
- e) replacement of damaged or lost crops and trees, at replacement cost;
- f) Project affected people whose remaining land holding become uneconomical will be offered an option to acquire residual lands and will be provided long term economic rehabilitation assistance.

- g) Individuals may elect to voluntarily contribute land or assets provided the persons making such contributions do so willingly and are informed that they have the right to refuse such contributions;
- h) in case of physical relocation, alternative provisions for replacement of houses with adequate basic civic amenities at the resettlement sites.

4. Support Principles for Different Types of Impacts

The support principle for broad category of impacts is summarized below.

Table 7.6 Category of Impacts

Type of Impact	Support Principles
Loss of land and immovable assets	<ul style="list-style-type: none"> • The Government will compensate the lost assets at their replacement cost • The option of voluntary donation is available to the asset owners
Loss of House and Shelter	<ul style="list-style-type: none"> • Every effort will be made by the Government to ensure that new housing is available before people are required to relocate. • If resettlement sites are developed close to the existing villages the local “host population” will also be consulted about their views and needs, and be given appropriate support to reduce any negative impact caused by an influx of new people.
Loss of Livelihood or Income Opportunities	<ul style="list-style-type: none"> • Assistance will be given to the affected population to reestablish their livelihood and income, and to compensate for temporary losses.
Group Based Development Opportunities	<ul style="list-style-type: none"> • Through designs, provision of infrastructure, and other support mechanisms, the project will replace lost assets and minimize any negative impact on groups, particularly groups that are considered vulnerable.
Targeted Support to Vulnerable Groups	<ul style="list-style-type: none"> • Vulnerable groups will be provided with additional options and support mechanism than those not considered vulnerable.
Unidentified impacts	<ul style="list-style-type: none"> • Unforeseen impacts will be documented and mitigation measures based on the principle of ESMF will be proposed.

5. Land Acquisition and Payment of Compensation

Land acquisition is likely to take place through combination of several methods. Identification of available vacant government lands will be most preferred method. In addition, the lands belonging to temples trusts, Gram Panchyats, etc. will also be

explored. In some cases the landowners or Gram Panchyats or temples may come forward for voluntary donation of lands. The private land acquisition will be made through private negotiations or using the land acquisition process. Based on the above support principles, the individual entitlements will be proposed and included in the RP.

6. The GoTN has brought out a Government Order (GO.MS. No.75 dated February 10, 2005) for using private negotiations for faster acquisition of private lands. Under this provision, a district level negotiation committee will negotiate the cost land to be acquired with landowners. The district committee is authorized to negotiate up to 200% of either the market value as defined under the land acquisition act or the guideline value fixed by the state government for collection of stamp duty during the registration of sale transitions, whichever is less. Provisions of the government order in this regard will be made known to the private landowners in case of negotiations. If their remaining land holding becomes uneconomical, the land owners will be offered an option to surrender the residual land against the compensation and long term economic rehabilitation measures will be provided to enable them to improve or at least maintain their pre project living standards. In case of private lands used for transits, appropriate lease rent will be paid. In case of any voluntary donation of land appropriate agreement between the land owner and implementing agency will be executed to avoid any claims of compensation at a later stage
7. In case of Pondichery, the relocation site lands will be acquired by using the Land Acquisition Act. Section 4(1) notices have been issued in certain cases. The compensation will be fixed at the higher of either the guideline value or market value. The guideline values are revised on annual basis and the highest transition sale value of similar lands in the preceding one-year before notification is being considered as market value. In addition, 30 % solarium and interest from the section notification will be paid. The lands will be acquired using urgency clause of land acquisition wherever required by paying 80% of initial estimated value and the balance amount will be paid after completion of the process. The process is likely to take about 6 months.
8. In case of losses to structures, the compensation will be determined in accordance with the Public Works Department's current Schedule of Rates for new construction of similar quality without depreciation.

9. Consultation Process

Implementing agencies will ensure that all occupants of land and owners of assets located in a proposed subproject area are consulted. Community meetings will be held in each affected villages to inform the local population of their rights to compensation and options available in accordance with these guidelines.

10. Sub- Project Approval

In the event that a subproject involves land acquisition against compensation or loss of livelihood or shelter, the implementing agency shall:

- (a) Not approve the subproject until a satisfactory RP has been prepared and shared with the affected person and the local community; and
- (b) Not allow works to start until the compensation and assistance has been made available in accordance with the framework.

11. Preparation of Resettlement Plans (RPs)

Having identified the potential impacts of the relevant sub-projects, the next step is to develop action plans to mitigate the impacts. The RPs provides a link between the impacts identified and proposed mitigation measures to realize the objectives of involuntary resettlement. The RPs will take into account magnitude of impacts and accordingly prepare a resettlement plan that is consistent with this framework for Bank approval before the sub-project is accepted for Bank financing.

- (a) Sub-projects that will affect more than 200 people due to land acquisition and/or physical relocation and where a full Resettlement Plan (RP) must be produced. Such plan will be prepared as soon as the sub-project is finalized and cleared prior to approval of the corresponding civil work bid document.
- (b) Sub-projects that will affect less than 200 people will require an abbreviated RP;
- (c) The above plans will be prepared as soon as subproject is finalized, prior to Bank's approval of corresponding civil works bid document; and,
- (d) Projects that are not expected to have any land acquisition or any other significant adverse social impacts; on the contrary, significant positive social impact and improved livelihoods are exempted from such interventions.

The indicative outline of Resettlement Plans is provided in annex IV (a)

Indicative outline of Resettlement Plans

The scope and level of detail of the resettlement plan vary with the magnitude of land acquisition and complexity of resettlement. The plan is based on up-to-date and reliable information about (a) the proposed compensation payment and resettlement of adversely affected groups, and (b) the legal issues involved in resettlement. The resettlement plan covers the elements below, as relevant. When any element is not relevant to project circumstances, it should be noted in the resettlement plan.

- (i) **Description of the sub- project:** General description of the project and identification of the project area.

- (ii) **Potential impacts:** Identification of: (a) the project component or activities that give rise to land acquisition and resettlement (b) the alternatives considered avoiding or minimizing land acquisition and resettlement; and (c) the mechanisms established to minimize resettlement, to the extent possible, during project implementation.
- (iii) **Objectives:** The main objectives of the resettlement program.
- (iv) **Results of census socioeconomic surveys:** The findings of surveys to be conducted in the early stages of project preparation and with the involvement of potentially affected people, including:(a) the results of a census survey covering; (b)current occupants of the affected area to establish a basis for the design of the compensation payment and resettlement program and to exclude subsequent inflows of people from eligibility for compensation and resettlement assistance;(c)standard demographic and socio-economic characteristics of affected households,(d) the magnitude of the expected loss—total or partial—of assets, and the extent of impacts, physical or economic;(e) public infrastructure and social services that will be affected; and(f)social and cultural characteristics of affected communities, including a description of formal and informal institutions (e.g., community organizations, ritual groups, nongovernmental organizations (NGOs) that may be relevant to the consultation strategy and to designing and implementing the resettlement activities.
- (v) **Eligibility:** Definition of affected persons and criteria for determining their eligibility for compensation and other resettlement assistance, including relevant cut-off dates.
- (vi) **Valuation of and compensation for losses:** The methodology to be used in valuing losses to determine their replacement cost; and a description of the proposed types and levels of compensation under local law and such supplementary measures as are necessary to achieve replacement cost for lost assets
- (vii) **Resettlement measures:** A description of the packages of compensation and other resettlement measures that will assist each category of eligible affected persons to achieve the objectives of the policy. In addition to being technically and economically feasible, the resettlement packages should be compatible with the cultural preferences of the displaced persons, and prepared in consultation with them. Any measures necessary to prevent land speculation or influx of ineligible persons at the selected sites. The provisions of housing, infrastructure (e.g., water supply, feeder roads), and social services (e.g., schools, health services); plans to ensure comparable services to host populations. Additional measures to ensure that such vulnerable groups as indigenous people, ethnic minorities, the landless, and women are adequately represented.
- (viii) **Income Restoration Measures:** Wherever the livelihoods are affected, appropriate measure for improvement or restoring of livelihoods including assistance during the transition period will be proposed which should be compatible with the cultural preference and skill of the affected people.

- (ix) **Community participation:** Involvement of affected people for consultation with and participation of in the preparation and implementation;(b) a summary of the views expressed and how these views were taken into account in preparing the resettlement plan;(c) a review of the alternatives presented and the choices made by affected persons wherever options available to them, including choices related to forms of compensation and resettlement assistance. And
- (x) **Integration with host populations:** Measures to mitigate the impact of resettlement on any host communities, including: (a) consultations with host communities and local governments;(b) arrangements for prompt tendering of any payment due the hosts for land or other assets provided to resettlers;(c) arrangements for addressing any conflict that may arise between resettlers and host communities; and (d) any measures necessary to augment services (e.g., education, water, health, and production services) in host communities to make them at least comparable to services available to resettlers.
- (xi). **Implementation Arrangements:** The description of agencies responsible for implementation of compensation payment and resettlement activities should be outlined and an assessment of the institutional capacity of such agencies and NGOs; and any steps that are proposed to enhance the institutional capacity of agencies and NGOs responsible for resettlement implementation.
- (xii). **Grievance procedures:** Affordable and accessible procedures for readdress of disputes arising from resettlement; such grievance mechanisms should take into account the availability of judicial recourse.
- (xiii) **Implementation schedule:** An implementation schedule covering all payments of compensation and other applicable resettlement activities from preparation through implementation, including target dates for the achievement of expected benefits to resettlers and hosts and terminating the various forms of assistance. The schedule should indicate how the resettlement activities are linked to the implementation of the overall project.
- (xiv) **Costs and budget:** Tables showing itemized cost estimates for all compensation payments and associated resettlement activities other contingencies; timetables for expenditures; sources of funds; and arrangements for timely flow of funds, and funding for land acquisition and resettlement should be described.
- (xv). **Monitoring and evaluation:** Arrangements for monitoring of compensation payments and resettlement activities by the implementing agency, supplemented by independent monitors as considered appropriate by the Bank, to ensure complete and objective information; performance monitoring indicators to measure inputs, outputs, and outcomes for resettlement activities; evaluation of the impact of resettlement for a reasonable period after all resettlement and related development activities have been completed; using the results of resettlement monitoring to guide subsequent implementation.

(xvi). **Abbreviated Resettlement Plan:** An abbreviated plan covers the following minimum elements

- (a) a census survey of displaced persons and valuation of assets;
- (b) description of compensation and other resettlement assistance to be provided;
- (c) consultations with displaced people about acceptable alternatives;
- (d) institutional responsibility for implementation and procedures for grievance redress;
- (e) arrangements for monitoring and implementation; and
- (f) a timetable and budget.

7.10 List of Ineligible Activities

Subprojects with any of the attributes listed below will be ineligible for support under the proposed project.

Attributes of Ineligible Subprojects

- Any project activity with the potential for significant conversion or degradation of critical natural habitats. Including, but not limited to, any activity within:
 - Declared Forest Reserves
 - Wildlife Reserves;
 - National Parks and Sanctuaries;
 - CRZ I or any CRZ zone where activities are not allowable in accordance with the CRZ Notification.
- Any project that is not consistent with applicable laws and regulations.
- Any project with the potential for significant damages to cultural property.
- Any project that is not consistent with the project description at time of project negotiations, unless subsequently agreed to with the Bank along with the appropriate level of environmental and social management.
- Any project or activity involving the procurement of pesticides not allowable under Bank guidelines

7.11 Indicative Outline Terms of Reference for Social Assessment (Working Draft) 4

Social assessment is the instrument used by the government to analyze social issues and solicit stakeholder views for the design of sub-projects. This draft ToR provides an outline of generic terms of reference for each District, covering the sub-

projects of relevance. The government will adapt this general framework based on the local context and the needs of specific District.

Introduction

The purpose of the social assessment is to ensure transparency and accountability in the delivery of Project reconstruction benefits or programs and to recommend appropriate measures to manage significant social risks. The feasibility and acceptability of the new relocation sites, the efficiency and equity of implementation mechanism, maintaining good relation with host population at new relocation sites and special needs of the vulnerable groups (women, widows, children, lower castes, physically challenged people, etc.) are some the important issues that will be examined during the social assessment process. The subprojects to be assessed in the Sector/ District should be briefly identified in this introduction and a brief explanation given on implementing arrangements for the social assessment

Background information

Include a brief statement of the rationale for the sub-projects to be included, their intended objectives, a description of their major components, implementing agency(ies), current status and timetable, and describe any associated existing programs or schemes.

Objectives

The social assessment's objective is to increase the likelihood of achieving sub-project's intended social outcomes, insuring their efficiency and equity. To achieve this objective, the consultant will assess the likely positive and negative social impacts, particularly on vulnerable groups, of the reconstruction activities planned and assess the level of awareness, concerns and attitudes of people towards these planned activities. The social assessment will be guided by the principles for reconstruction and resettlement of Project affected communities attached to this TOR. The Social Assessment will cover both categories of people affected Project and project activities. Summarize the scope of the social assessment and discuss its timing in relation to the sub-project preparation, design and implementation. Describe in the final ToR the specific tasks expected from the agency conducting the assessment, for example:

Task 1: Description of the proposed sub-projects and their intended social outcomes

Task 2: Brief description of the socio-cultural, institutional, historical and political context

Task 3: Assess legislative and regulatory considerations and role of local government

Task 4: Analysis of key social issues –for example, diversity and gender issues, institutional arrangements, information flows and rules for effective decision-making, participation of Stakeholders and potential social risks including, but not limited to, the feasibility and Acceptability of the sub-project outcomes, efficiency and equity of implementation arrangements, relations between beneficiaries and non-beneficiaries, efficacy of site selection, conflict

management or grievance-redress processes, and the maintenance of public assets created.

- Task 5: Assess land tenure issues such as loss of ownership documents, physical boundaries of properties affected during Project and related issues with a view to propose suitable measures to restore the property documents and update the land records.
- Task 6: Assess whether any impacts to known tribal groups in the affected villages and accordingly prepare the Tribal Development Plans in accordance with the World Bank's Operational Directives 4.20 Indigenous Peoples. These plans should be appropriate to the cultural preferences and the need of tribal groups.
- Task 7: Data collection and research methods –consultation approaches required to ensure participation of both categories of affected people (Project and Project), for example focus group discussions, key informant interviews and triangulation of data collection; as well as quantitative surveys needed and statistical techniques to be employed
- Task 8: Recommended strategy to achieve social development outcomes
- Task 9: Implications for analysis of alternatives, management and implementation arrangements
- Task 10: Developing a plan and indicators for sub-project participatory monitoring

Expected outputs, schedule and reporting relationships

Within 2 weeks the consultant will prepare an inception report including their work plan and methodology with a detailed schedule of the social assessment tasks to be completed, as described in the terms of reference. Within 2 months they will provide a draft social assessment report which will identify stakeholders and their expectations, interests or concerns, assess the social risks of the sub-projects (both the risk of the sub-project's impacts on the vulnerable, as well as other social risks to the sub-project's feasibility or success), and recommend design changes or mitigation measures or action best able to manage those risks during implementation. Note to whom the team will give preliminary and final drafts of each output. The final report will be completed by month 4, and will include relevant charts and graphs, statistical and qualitative analysis and, in some cases, raw data obtained during the social assessment. In addition to the outputs of the social assessment, include a note on the social assessment process itself, stating any difficulties likely to be faced by the team in conducting the social assessment, and the most appropriate dissemination strategy for its findings. The report and accompanying materials will be provided in English and Tamil and posted in District Administration offices.

Consultant team

Social assessment requires a multidisciplinary team to meet the different demands of the assignment. Key positions and skills should correspond to the sub-projects to be assessed. The terms of reference should specify key positions on the team. Individual time requirements should be specified for each assignment. One team member will be appointed team leader, and be responsible for the entire team's performance.

7.12 Land Acquisition and Monitoring Sheet

1. Name of the sub-project:
2. Village/Town:
3. Name of the Land Owner:
4. Area of land acquisition (Ha):
5. Type of Land: (a) Irrigated..... (b) Non-irrigated:(c) homestead..... (d) Barren.....(e) other (specify).....
6. (a) Market value (in Rs/Ha): (b) Guideline Value..(in Rs/Ha).....
(c) Date of latest revision of guideline value:.....
(d) Negotiated Price (in Rs/Ha)..... (e) Total compensation Paid... (....% of guideline value)
7. Date of Negotiations:
8. Date of registration of sale deed:
9. Payment Details : (Cheque No, etc.),
10. Details of standing crops affected and compensation payment details
11. Details of any other properties affected such as wells or trees, structures affected and compensation payment details
12. Area of left over land holding.....
13. Option for surrendering left over land if it is residual⁵
14. Long term rehabilitation measures (if required).....
15. Remarks.....

Signature of District/Sector SEMF Co-coordinator

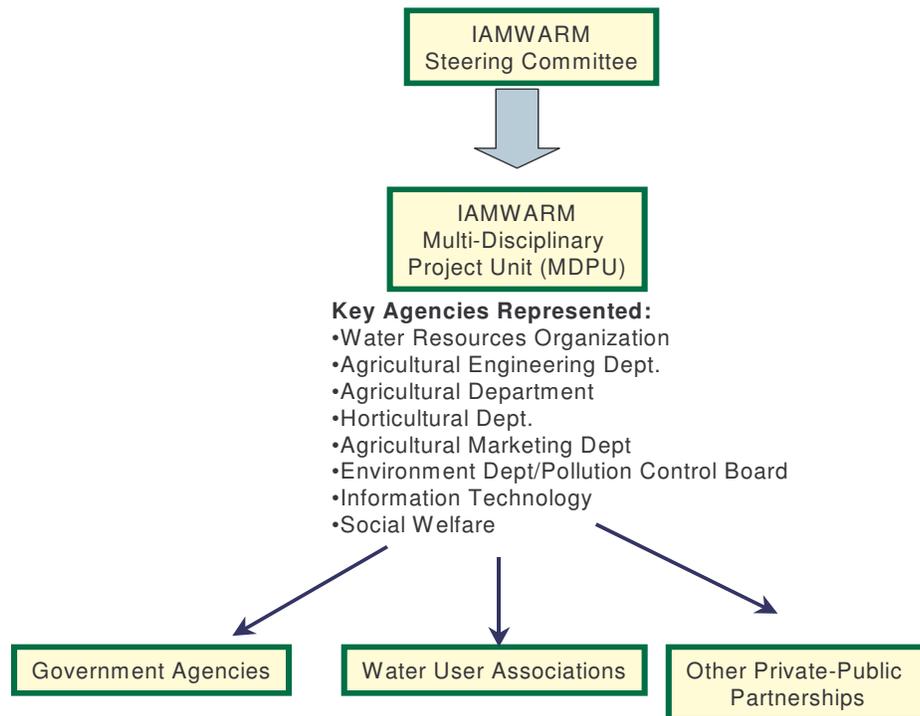
⁵ The thresholds for residual lands will be decided based on the local norms.

7.13 Overall Suggestions

7.13.1 Institutional Strengthening

Institutional strengthening and reform is a continuous process and will be continued. Special efforts are made to bring about the changes among the departments who are involved in the project for proper infrastructure development, strengthening, reorganization, training and orientation of human resources. The key entity in the institutional framework is to set up a management cell in the WRO and to expand environmental and social development cells.

- Orientation and motivation towards participatory approach in development and management.
- Induce professionalism and accountability.
- Develop work norms and culture.
- Develop a system for addressing public grievances effectively and timely.
- Ensuring quality assurance and safety structures.



T

he above institutional arrangements for implementation of different components would be made such that participation of different stakeholders particularly primary stakeholders and women are ensured. The components will also address sustainability arrangements during the project period. The focus will be laid on encouraging and supporting farmers

to adopt the propagated technology and practices, strengthening of marketing and other linkages. However, technological backstopping and evaluation activities will continue. In this section, a brief description of proposed training and capacity building initiatives, institutional arrangements and a SWOT analysis thereof are presented.

Table 7.7 SWOT Analysis of Institutional Strengthening under IAMWARM Project

Sl. No	Institution	Strength	Weakness	Opportunity	Threat
1.	MDPU	<ul style="list-style-type: none"> • Possess Technical and Professional staff • Apex Coordinating unit • <u>Regular review of the interventions</u> • <u>Responsibility of the agencies</u> Would be fixed • Decentralized process formulation • Need based implementation as desired • Facilitation of technical intervention • Support in Development of project action plan • Coordination with line departments for effective implementation • Regular monitoring and coordination • Regular training to field staff • Timely Flow of 	<ul style="list-style-type: none"> • Lack of coordination among the depts. • Weak project level structural linkages • Lack of technical persons • Lack of support for process monitoring • Lack of manpower • Improper Coordination may slow down the progress 	<ul style="list-style-type: none"> • Strong monitoring and feedback support • Data analysis and interpretation • Dovetailing of programmes at project level • Sustenance of institutions may be ensured • Provide technical trainings • Ensure sustenance of institutions • Facilitate the process for action plan development • Streamline project management 	<ul style="list-style-type: none"> • Discontinuation of Technical staff • Transfer of Project Coordinator • Funds needs to be properly and timely processed • Institutions developed must have a proper take over mechanism • Development of timely MIS • Lack of coordination with field staff • Lack of coordination with implementing agencies may affect the objectives

		<p>data and information</p> <ul style="list-style-type: none"> • Strengthening of institutions through networking 			
2.	Project Implementation Unit	<ul style="list-style-type: none"> • Availability of technical man power • Monitoring of project activities 	<ul style="list-style-type: none"> • Priority to focus upon their own departmental activity • Administrative control rests with department head 	<ul style="list-style-type: none"> • Proper coordination would bring high result • Sustenance of project implementation on effort may be ensured 	<ul style="list-style-type: none"> • Lack of continuous monitoring at the field level • Irregular maintenance of MIS may effect the project progress
3.	Farmers, Live stock farmers, Fisher folk, WUAs, Women, NGOs, SHGs	<ul style="list-style-type: none"> • Coordination at the project level for planning, implementation and monitoring of the activities. • Collective decision making • Involvement in planning, implementation and monitoring 	<ul style="list-style-type: none"> • Lack of farmers involvement may affect technology transfer • Difference among farmers may affect project implementation • Formation of unwilling group may discontinue the efforts • Lack of transparency may affect implementation process 	<ul style="list-style-type: none"> • May be developed as center for technology transfer and collective marketing • Involvement of farmers beyond Panchayat • Involvement of farmers may be promoted • System may be developed as a unit for collective marketing 	<ul style="list-style-type: none"> • May create dependency on the project • Groups may discontinue due to lack of facilitation • Group formed due to self-interest may create problem
4.	Partner NGOs	<ul style="list-style-type: none"> • Facilitation of effective community mobilization process • Promotion of farmers organization • Create an 	<ul style="list-style-type: none"> • Lack of skill staff may affect the pace of the project • Communication gap at field level may affect technology adoption and 	<ul style="list-style-type: none"> • An opportunity to maximize people's participation • NGOs may develop their own field for sustainability 	<ul style="list-style-type: none"> • Lack of trained staff would minimize project output • Discontinue o staff may break the dissemination process

		enabling environment for community participation	transfer <ul style="list-style-type: none"> • Lack of coordination with departments may lead to poor recognition of the project 	of the groups <ul style="list-style-type: none"> • Regular visit by field staff would develop effective monitoring system 	<ul style="list-style-type: none"> • Internal Irregularities by any NGO may damage project recognition • Lack of coordination would definitely affect the project management system
5.	External M&E Agency	<ul style="list-style-type: none"> • A source for unbiased reports • Continuous Process of concurrent monitoring • Facilitate corrective measures • Highlight the issues to the concerned 	<ul style="list-style-type: none"> • Lack of trained staff toward project may affect the cause • Lack of understanding with stakeholders may create differences • Communication gap may affect corrective measures 	<ul style="list-style-type: none"> • Development of good project management system • Gaps may be timely identified at the field level • Overall monitoring of project activities may be strengthened 	<ul style="list-style-type: none"> • Lack of coordination may create problem • Issues highlighted may not be timely addressed
6.	Banks	<ul style="list-style-type: none"> • Bank linkages processes may be strengthened • Coordination with departments would promote agri-business 	<ul style="list-style-type: none"> • Lack of support staff at banks may dilute bank linkage efforts • Priority not to groups may slow down credit flow 	<ul style="list-style-type: none"> • Banks may adopt the groups for agri business promotion • Capacitate the resources of groups • Develop a strong credit support 	<ul style="list-style-type: none"> • Priority if not given may dilute bank linkage process • Regular change of staff may create gaps • Irregular facilitation by field staff may create communication gap
7.	Training Institutions	<ul style="list-style-type: none"> • Regular capacity of the stakeholders may be 	<ul style="list-style-type: none"> • Lack of coordination may crate duplicity 	<ul style="list-style-type: none"> • Need based training requirement may be 	<ul style="list-style-type: none"> • Wrong identification of institution may minimize

		upgraded <ul style="list-style-type: none"> • Inputs to farmers may be given timely as per the need • Network with such institutions could develop effective master trainers 	<ul style="list-style-type: none"> • Trainings may be ineffective due to poor training module • Lack of orientation toward project may mis match training content 	developed <ul style="list-style-type: none"> • Regular monitoring and feedback may be ensured 	training process <ul style="list-style-type: none"> • Lack of coordination may affect training arrangement • Lack of monitoring may not reflect impact of trainings • Involvement of not good resource persons may lead to unsatisfactory
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The expectations of the direct beneficiaries extended beyond the project, into, empowerment - Social and economic. Realization and sustenance of the benefits depend largely on the project's efforts towards enabling the beneficiary households to absorb and sustain technical, institutional and management practices that the project activities sought to instill. Participation needs to be designed as decentralized governance framework. The challenge, thus, is to widen and deepen community participation by strengthening, the process - Beneficiary selection, Participatory planning, Social intermediation, Gender initiatives etc.

7.13.2 Training and Capacity Building

The need for training and capacity building of all stakeholders is imperative towards ensuring adequate appreciation and addressing environmental and social issues associated with the project. Training programmes for farmer's is suitably designed to update them to use the modern agricultural implements for obtaining higher yield and quality product. Training modules are designed for the line department representatives for better coordination and timely implementation of the projects designed. Training locations and the language selection for training should be customized to suit the convenience of the trainees. Where the turnouts of villagers is low, decentralized training locations close to the villages of the trainees, with the involvement of NGOs (if required) shall help achieve the desired results.

Table 7.8 Principal aspects of training required for various stakeholders

S.No	Levels	Trainees	Principal aspects to be covered
1	State Level	MDPU, Officials involved in IAMWARM,	GIS based environmental & social planning Analysis of monitoring & stakeholder feedback
2	Basin Level	Line Departments, Bureaucracy and Politicians	Sensitization about of environmental & social issues
3 a	Project Level	Project Officials, Govt. Officials of Tamil Nadu	Sensitization about importance of environmental & social issues Methods to record impact monitoring & project evaluation indicators
3 b	Project Level	NGOs WUA, Farmers, Livestock farmers, Fisherfolk, Women, Self Help Groups	Sensitization about importance environmental & social issues Ways to address such issues in the project
4	Village Level	Rural youth, Landless labourers, Shopkeepers/Vendors/Traders, General Public	Sensitization about environmental & social issues Mitigation & monitoring measures to address environmental & social issues

Course outline for MDPU, Officials involved in IAMWARM

- Environment and social impact assessment, case studies
- Environmental issues in irrigation systems
- Environment management in irrigation systems
- MoEF guidelines and notifications
- Environmental policy and regulations
- Carrying capacity based developmental planning
- Use of GIS in irrigation systems – case studies
- Conservation of water resources, pollution prevention, waste water treatment – case studies
- Conjunctive use of surface and ground water
- R & R plan
- Environment and Social planning
- Irrigation and public health issues
- Environment surveillance and monitoring and
- Field visit

Course outline for Line Departments, Bureaucracy and Politicians

- Components of environment
- Environmental policy and legislation
- Database management and decision support system
- Carrying capacity based developmental planning
- Environmental management tools
- Environmental surveillance and monitoring
- Watershed management
- Wasteland development
- Pest management & organic farming
- Crop diversification
- R & R plan
- Application of GIS in irrigation systems
- Field visit

Course outline for Project Officials, Govt. Officials of Tamil Nadu

- Environment protection: Water, air, land and socioeconomic
- Environment laws
- Environment impact assessment
- Watershed management
- Modern agriculture management techniques
- Crop diversification
- Wasteland development
- Promotion of low cost state of art alternative energy technologies
- SWOT analysis in irrigation systems
- Information management system
- Water conservation, available technologies in waste water treatment
- Soil conservation
- Lab sessions

Course outline for NGOs WUA, Farmers, Livestock farmers, Fisherfolk, Women, Self Help Groups

- **Water**
 - Water supply system at village level
 - Available water resources
 - Drinking water
 - Over exploitation of groundwater
- **Agriculture**
 - Cropping pattern
 - Use of pesticide and insecticide
 - Effect of pesticide on soil
 - Environment friendly pest control
 - Fodder for cattle

- Availability of water for agriculture
- Water logging and salinity
- Organic farming
- Agriculture marketing
- **Environment**
 - Water and waste water management
 - Sanitation and health
 - Water tank management
 - Vermicomposting
 - Alternative energy sources
- **Income generation**
 - Biogas from live stock
 - Bio-manure from farm waste
 - Organic farming
 - Composting
 - Bio-pesticide preparation from neem
 - Seed storage
 - Cooperative financing facilities
 - Water harvesting structures – in situ conservation measures
 - Field visit

Course out line for Rural youth, Landless labourers, Shopkeepers/Vendors/Traders, General Public

- Environment and eco-system management
- Rural environmental issues
- Indoor air pollution
- Water conservation
- Watershed management
- Crop diversification
- Agriculture marketing
- IT Kiosks

Income generation

- Biogas from live stock
- Bio-manure from farm waste
- Organic farming
- Composting
- Bio-pesticide preparation from neem
- Seed storage
- Cooperative financing facilities
- Water harvesting structures – in situ conservation measures
- Field visit

7.14 Training due to Mechanization

There is the aspect of some redundancy in the labour force as a consequence of mechanization in agriculture. Redundant labour force is merely idle manpower. This idle manpower either in the rural or in the urban context is reckoned with a huge social problem as such we cannot allow mechanization creating a social problem. The social problem can be adequately addressed by consciously evolving re-skilling programmes for the benefit of the labour force so that they have suitable redeployment avenues.

Training should be given to the line department officials on

- Water, soil quality analysis / and Sampling Techniques. .
- Environment , Ecology and development
- Resources conservation concept in Irrigation systems.
- Refuse, Reduce, Reuse, Recycle Concepts for sustainable agriculture practices.
- Traditional farming systems and modern farming system an over view.
- Restoration of water bodies using bio control systems.
- Need of Green projects or green construction, Green Consumerism and Green production in River Basins.
- Experiences of PIM in various states.
- Bio dynamic Farming towards sustainable Agriculture practice.
- Organic Farming and water conservations.

7.15 Institutional Framework

Institutional arrangement for the implementation of different components would be made such that participation of different stakeholder's particularly primary stakeholders, PRIs and women would be ensured. The design would also address the sustainability arrangements during the project period. Project will remain present in each basin. The focus will be laid on encouraging and supporting farmers to adopt the propagated technology and practices, strengthening of marketing and other linkages. However, technological backstopping and evaluation activities will continue. In this section, a brief description of the proposed institutional arrangements and a SWOT analysis thereof are presented.

7.16 Institutional Framework - State Level

MDPU would coordinate the project activities, which is being implemented by the line departments. Technical and professional staff located at MDPU provides technical and administrative support to the implementing agencies. The MDPU would be the apex coordination unit to monitor the activities of the project. Time to time guidelines and circulars as required would be sent by MDPU to all implementing agencies.

7.17 Project Implementation Agencies

Within each of the line departments Nodal Officer would be designated for effective implementation of the project activities. The Nodal Officer would coordinate with MDPU to implement their activities and he would be responsible to carry out the project activities as per the action plan and would also ensure timely submission of Monthly Progress Reports (MPRs) and other documents as per the need.

7.17.1 Basin level

All the line departments would implement the project activities through their line departments where a nodal officer would be appointed to coordinate the activities with MDPU.

7.17.2 Project level

WRO official will coordinate all the activities to be carried out under the project. He will be the key person.

7.17.3 Beneficiary organizations

NGOs, WUAs, Farmers, Livestock farmers, Fisherfolk, Women, SHGs etc.

7.17.4 SHGs/Stakeholders

These will be the basic for project implementation activities. The line departments at the project level in consultation with these organizations would decide planning, implementation and monitoring of the activities. Farmers, SHGs would also take up saving and credit activities and would also have bank linkages for cultivation, income generation and off farm activities.

7.17.5 Partner NGOs

All the activities with regard to community mobilization, gender initiative, credit and other interventions at the group level and community level would be facilitated by the NGOs who will be coordinating with respective departments and their performance would be assessed as per the indicators developed in the project appraisal document. As per the TOR, the services will be delivered by the concerned NGOs and their presentation of work would be evaluated by MDPU. The NGO functionaries will be trained on different subjects as per the training need and other institutions as per the arrangements under the training plan.

7.17.6 Commercial Banks

Banks as an institution plays an important role in organising and sanction of loans, especially regional rural banks play an effective role in lending process to the Farmers, SHGs. Farmers/SHG have their own bank account in the nearest bank, the bank officials also monitor their activities. Time to time Farmers/SHG members participate in joint workshop and training programme as organized by NABARD, Commercial banks etc.

7.18 Training Institutions

The training institutions identified under the project would develop the capacity of the farmers during the project period and as experienced under the pilot project implemented in Hanuman Nadhi, it will be further focused to design management / marketing training, specialized technical training and other technical training for all the stakeholders at different institutions. Services of district level and state level institutions would be taken periodically and specialized trainings would be outsourced to specific identified institutions all over the country.

7.19 External Monitoring & Evaluation Agency

To monitor the project activities and outcome, an external agency would be hired; the agency would periodically coordinate with departments and other stakeholders to assess their performance and provide appropriate inputs to improvise upon the concerned issues. The external monitoring agency would facilitate the project staff to adopt timely corrective measures at different levels to reduce the gaps.

7.20 Constitution of an Apex Body at State Level

The IAMWARM project aims at the overall development of the State by exploiting the full potential in the major growth sectors of agriculture and water resource management. The activities under this project aim at the holistic approach of all the line departments who are committed for overall development of the State. In this context, there is a need to look at the under employment and the contribution of growth rate of the major sectors like agriculture, animal husbandry and fisheries so as to identify the institutional gaps and to strengthen the same in the project for achieving the said goal.

7.20.1 Agriculture Technology Mission

From the foregoing, it is evident that there is stagnation in agriculture output and decline in growth of animal husbandry and fisheries thus resulting in under-employment. To address this issue as also the need for modernisation of techniques in the farm sector as well as other related sectors such as dairy, animal husbandry and fisheries, it is suggested that an Agricultural Technology Mission may be constituted at the State level to create and revive public institutions in the rural areas and implement policies which will immediately reduce agrarian distress, and over time provide protection to farmers, encourage the most productive and sustainable forms of land and water use, provide stable livelihood and employment to the rural population and improve the incomes of the rural population over time. The goal of this Mission is to

- The ATM must act as the umbrella organisation for the planning, direction and implementation of all of the policies relevant to agriculture and allied sectors and the welfare of farmers and farm workers. It should be a permanent body coordinating the activities of various departments.

- The focus should be on empowering the farming community, with the active involvement of locally elected bodies such as Panchayats and participatory institutions such as gram sabhas.
- The ATM must have a holistic approach to the problems of agriculture in the state, addressing the particular problems in each area within a broader context and in such a manner as to encourage co-operation and synergy between the activities of various state/central government departments/agencies and local level institutions.
- It should formulate policies and take action on meeting the challenges of the WTO regime, organising policy research on critical issues in agriculture and recommending policies to meet the changing needs in this sector and suggesting the measures required for educating the farmers through farmers' organisations.

The neighboring state of Andhra Pradesh has constituted similar Mission headed by the Hon'ble Chief Minister.

7.21 Suggestions for the Farmers for the sustainability of WUA's

- Due share in water cess, fishing rights, usufructs, tree rights, auctioning of lotus flowers, lotus leaves and utilization of poramboke lands within the WUA area for growing vegetation to raise revenue to the WUAs for active implementation of PIM.
- More participation of farmers is required, for which the Government have to arrange for more awareness campaigns through mass media also.
- Forming the other tiers of farmers organisation viz. DCs & PCs as early as possible.
- The existing encroachments should be evicted from the tank systems. Another one time grant as a financial support is necessary from Government to carry out the O & M functions of the system. All emergency repairs and special repairs works should be done by the WUAs from the funds granted by the Government. Specific orders to take legal action against the offenders may be issued by the Government for not handing over the assets to the WUAs by the defunct farmers councils.
- Sufficient percentage of amount has to be sanctioned exclusively for the irrigation system maintenance works from the MP / MLA's Constituency Development Funds, for which specific orders of the Government is required.
- Office buildings for each WUA is essentially required in order to have a common place to discuss and solve the disputes among the members of WUA and to keep the records and other materials under safe custody.

- Telephone facilities to be provided to the WUAs to have the effective communication between members and office bearers of WUAs.
- The duties and responsibilities vested with the office bearers as per the Act, shall be made known to the Police department, Revenue department, Bank etc., in order to enhance the effective functioning of the WUA.

7.22 Suggestions for speedy implementation of PIM

- PIM is to be implemented in part of the entire command area of a State, in order to gain experience and overcome the bottlenecks that may arise. Not only that, the success of PIM will attract the farmers in the remaining command areas resulting into 100% participation and gain momentum for the process.
- Formation of WUAs may be initiated as a first task and then the rehabilitation works could be done involving the WUAs also or vice versa, is considered the best way, rather than carrying out both the tasks simultaneously since the field officials as well as farmers may find it very difficult.
- Changing the mind set of the irrigation department officials as well as the farmers is very essential in the matters of turning over of O&M responsibilities, involving sociological aspects.
- Awareness creation and adequate training before and after implementation of PIM are the prime areas where no compromise shall be given.
- The success of PIM is directly proportional to assured supply of water up to tail ends and financial sustainability to the WUAs, which shall be ensured.
- Formation of PIM cell comprising of like minded members with involvement in this aspect will strengthen the belief of the farmers in the matters of best support in respect of PIM.

7.23 Suggestions for disaster management and institutional strengthening

- Development of state and district management plans
- Development of disaster risk management and response plans at village/ward, Gram Panchayat, Block/Urban Local body levels

- Constitutions of Disaster Management Teams and Committees at all levels with adequate representation of women in all committees and team.
- Capacity building of Disaster Management Teams at all levels. Special training for women in first aid, shelter management, water and sanitation, rescue and evacuation etc
- Capacity building in cyclones and earthquake resistant features for houses in disaster prone districts, training in retrofitting and construction of technology demonstration units.
- Integration of disaster management plans with development plans of local self governments
- Development of national/state database on vulnerability, disaster risk management and sustainable recovery
- Strengthening National and State Governments through support for hardware and software for disaster risk management and capacity building of institutions
- Awareness campaigns on disaster management in school curriculum and schedule to drills in disaster prevention and response for schools
- Development of training manuals in Disaster Management for District, Block, Gram Panchayat, Villages/ wards for each State in vernacular languages
- Strengthening disaster management information centers in programme states and districts for accurate dissemination of early warning and flow of information for preparedness and quick recovery operations.

7.24 Water Conservation Measures & Institutional Strengthening

The State government has initiated measures for water conservation through watershed development programme with the assistance of Govt.of India. The objective of watershed programmes is to adopt a holistic approach for development of society involving the local people as partners. The Panchayats have the overall powers and implement the watershed programmes involving village committees, NGOs etc.

The conservation measures adopted in this programme are construction of check dams, contours and injection bores. The water conservation measures are also implementing in the State under the food for work programme which is also sponsored by the Govt.of India. Every farmer, farmers' cooperatives, Panchayats and district Administration in water scarce areas has to

- Take up conservation measures like construction of bunds, check dams, contours, injection bores, desilting of ponds and wells and repairs of canals

opt drip, sprinkler and other water saving irrigation techniques

- Avail benefits of Union & State Government schemes

7.25 Suggested Institutional Arrangements

The existing policy, institutional and legal framework has been reviewed keeping in view with the proposed activities of the IAMWARM project and suggested the following institutional arrangements for effective implementation of the project which would include:

1. State-level (converting the WRCRC to a State Water Council, amalgamating the associated sub-committees and upgrading the Institute of Water Studies (IWS) and the Surface and Groundwater Data Center (SGDC) to a State Water Resources Agency, establishment of a Water Regulator, development of appropriate policy and institutional arrangements, instruments, and information tools to promote flexible water resources management)

2. The existing environmental cells under IWS and CE (Plan Formulation) need to be strengthened by adding the following specialists

- Environmental scientist
- Environmental engineer
- Environmental economist
- Statistician
- Agriculture Scientist
- Sociologist
- IT Specialist

3. Creation of two additional environmental cells by converting the two existing planning and design cells. All the five environmental cells can be under the control of a Superintending Engineer at Chennai. The following is the reporting system after converting the two existing planning and design cells into environmental cells.

4. After strengthening the existing Environmental cells under IWS & CE Plan Formulation of WRO with additional subject specialists as suggested and creation of two additional environmental cells, the following documents may be prepared in consultation with the Department of Environment, Government of Tamil Nadu.

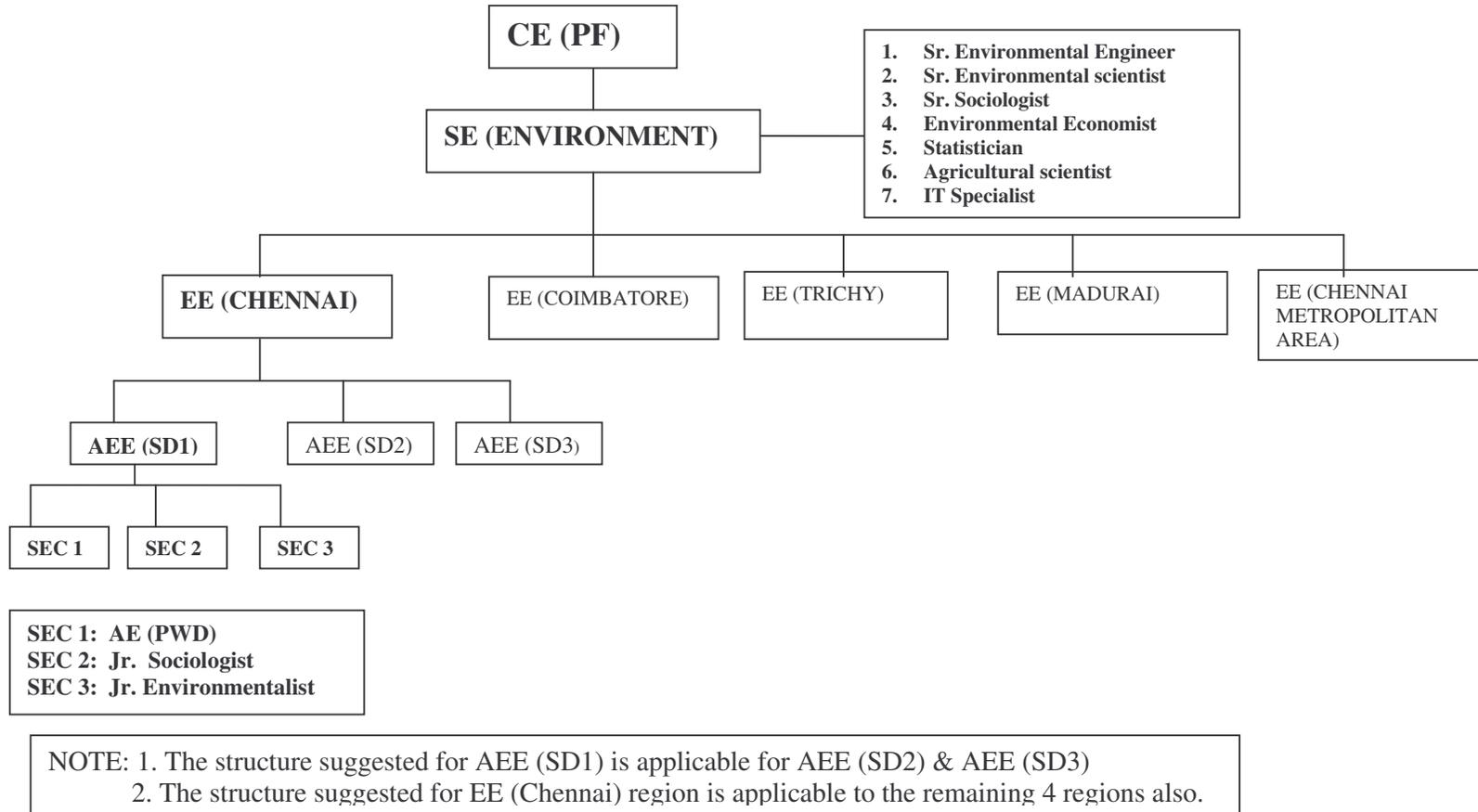
- Environmental Action Plan for River basins
- Master plans for specific works: e.g. artificial recharge or for coastal region
- Environmental Impact Assessment for proposed projects
- Database on environment-friendly technologies and practices
- Methods of conserving water resources in irrigation, industrial use and municipal water supply system
- Methods of recycling and reuse of water

- Performance of Sewage and Effluent Treatment Methods
- Clean technologies, methods of waste minimization and resource recovery techniques
- Clean practices for agriculture
- Inventory of waste items and pollutants
- Rapid appraisals of certain aspects for planning and evaluation
- Mid-term and long-term assessment of schemes and programmes
- Domestic and sanitary habits of local people that cause significant water pollution
- Propagate environment-friendly technologies and practices
- Facilitate public participation by awareness promotion, training and technical advice
- Conduct dialogue to make agencies and individuals responsible

The Environmental Cell Divisions may be given more research and development works to solve the issues. Continuous research and development is necessary to simplify and to identify the suitable technology for which all EC Divisions may be considered as in WRCP. The environmental cells will also show special attention for public participation in the following tasks

- Participatory management including maintenance of physical structures
- Water conservation and recycling
- Problems and damages caused to livestock
- Encroachment prevention and eviction
- Desilting and silt disposal
- Watershed development and artificial recharge
- Waste minimization
- Identification of sources of waste generation
- Monitoring of pollution
- Take up public complaints of water pollution and co-ordinate with TNPCB

7.26 SUGGESTED ORGANIZATIONAL STRUCTURE FOR ENVIRONMENTAL AND SOCIAL DEVELOPMENT CELL



8 MONITORING FRAMEWORK

8.1 Need for Monitoring & Evaluation

The monitoring and evaluation process is one of the most important tool for project management. The monitoring and evaluation process includes Internal and External Monitoring. Internal Monitoring which will be conducted at regular intervals and primarily reports on the progress of work and the process related indicators. Some impacts would also be included as identified in the project design stage. The external monitoring and evaluation, that will once be undertaken when the project is halfway through its time schedule and next at the end of the project (mid term and end term evaluation respectively). The external monitoring also focus on the impacts of the project as well the process adopted in the design, implementation and post implementation.

Adoptive major decisions should be taken to monitor the environmental and social indicators. The principal aspects for which the IAMWARM should have a sound monitoring and evaluation framework are as follows:

1. Evaluation of how successful the has been implementing its plans and how the results achieved contribute to the achievement of plan goals and
2. Monitoring the condition of Environmental and social parameters during implementation and post implementation period.

The monitoring and evaluation indicators can be broadly categorized into three parts:

- **Input /process indicators:** To monitor the progress of various activities proposed in the plan.
- **Out put indicators:** To monitor whether the inputs have resulted in outputs as desired.
- **Impact indicators:** To monitor the long-term impacts of the project, this establishes whether the goals of the project have been fulfilled.

Table 8.1 Use of Various Indicators

	Pre-planning stage	Planning stage	Implementation stage	Post implementation stage
Process indicators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Output indicators		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Impact indicators		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8.2 Monitoring and Evaluation for IAMWARM

Monitoring and evaluation process embedded in the information management system shall evaluate the physical and financial progress along with the target values in a time frame i.e monthly, quarterly, half-yearly and annually. This will also evaluate the effectiveness of the project in terms of achieving the benchmark values set forth for each indicator for social and environmental mitigation /enhancement measures.

For physical interventions and related expenditure the out put qualities can be directly measured and cumulative values can be compared with the target values at any time frame. For the social and environmental mitigation /enhancement measures the effectiveness of the project implementation can be compared with the pre project base line values (bench marks) of the indirect indicators for each output and out come and the target values in a time frame.

The project authorities after completion of each stage can evaluate the project performance and may suggest any modification/ correction in the project processes to meet the goal of the project .the following sections explain the importance of management information system (MIS) and how the M & E process shall be undertaken through the MIS.

8.2.1 Monitoring Mechanism

Monitoring and Evaluation Indicators to be developed to ensure implementation of environmental and social safeguard elements that have been built into all stages of the project like screening and selection, planning for interventions, detailed design, implementation, operation and maintenance and periodic performance evaluation by

- Water User Associations (WUAs),
- Project Authority at Sub Project Level,
- Basin Board /CE.

At each stage indicators have been framed for Inputs / Process, Outputs and Outcomes / Impacts. The Benchmarks and Indicators combine both quantitative and qualitative types of data. The implementing agencies, client groups as well as independent third parties shall record the indicators. A consultative framework is proposed to record relevant issues from the

village level institutions and villagers. Lessons learnt from monitoring and stakeholders feedback shall be used to make possible adjustments in the project design and implementation to better address the safeguard measures. The GIS database shall be upgraded as an integral part of Management Information System through regular data updation, data analysis and information dissemination to all stakeholders.

8.2.2 Monitoring Mechanism - Benefits

- Strengthening of Dams and Canals
- Equanimity and surety of Water distribution
- Acceleration of production and productivity in agricultural area
- Acceleration and development of production and productivity in agricultural area
- Management of village tanks and
- Participation and strengthening of water user agencies

8.3 Key Monitoring Indicators

The key monitoring indicators for projects are sub projects for the pre planning shall be

Table 8.2 Key Monitoring Indicators for Projects and Sub Projects

Process indicators (Monitoring agency)	Out put indicators (Monitoring agency)
Number of reconnaissance visits (EE, REGION WISE))	Salient features and spatial location of problems on sketches/ topo sheets & sub project maps (EE, REGION WISE)) Listing of key non spatial issues (EE, REGION WISE))
Number of consultations/ sensitization meetings (EE, REGION WISE)) Photographs/recordings and signed minutes at consultations (EE, REGION WISE))	List of stake holders and level of stake (EE, REGION WISE)) List of agreed intervention measures for each sub project (EE, REGION WISE)) List of required action plans or EIA requirement (EE, REGION WISE))

The above can be achieved by structuring and evolving an appropriate MIS. The MIS can cover all the important variables/bench marks that the IAMWARM project seeks to achieve. The MIS will help in the effective implementation of the project while identifying the bottlenecks, if any.

Monitoring indicators for Planning, Designing, Implementation and Post Implementation shall be:

Table 8.3 Monitoring Indictors for Planning, Designing, Implementation and Post Implementation

S.No	Environmental and social parameters	Benchmark indicators (before implementations)	Outcome indicators (during implementations)	Impact indicators (post implementation)	Monitoring Agency
1	Soil Erosion/Gully Formation	Area of waste lands		Area of waste lands	AED, WRO
2	Soil quality	Organic matter content/ nutrient content pesticide residue		Organic matter content/ nutrient content pesticide residue	Agriculture University and Agriculture Department
3	Soil moisture	Moisture content		Moisture content	AEE (Sub Div), WUA
4	Siltation	Silt load in catchment runoff water	Silt load in catchment runoff reservoir water	Silt load in catchment runoff water	WRO
5	Surface water quantity	Hydrologic parameters/irrigation system efficiency		Hydrologic parameters/irrigation system efficiency	State Ground and Surface Water Resources Data Center
6	Surface water quality	Salinity, nutrient content, pesticide residue presence of industrial effluents, pathogens	Pathogens in labour camp runoff	Salinity, nutrient content, pesticide residue presence of industrial effluents, pathogens	WRO
7	Ground water quantity	Depth to ground water		Depth to ground water	State Ground and Surface Water Resources Data Center

8	Ground water quality	Salinity, nutrient content, pesticide residue presence of industrial effluents, pathogens		Salinity, nutrient content, pesticide residue presence of industrial effluents, pathogens	State Ground and Surface Water Resources Data Center
9	Water logging	Area under water logging	Temporary water logging	Area under water logging	Agriculture Department
10	Seepage/leakage	Measure of leakage water		Measure of leakage water	WRO
11	Air pollution		Air pollution levels		TNPCB
12	Noise pollution		Noise levels		TNPCB
13	Deforestation	Forest cover area /density	Pressure on local fuel resources	Forest cover area /density	Forest Department
14	Weed growth	Quantity of weeds per unit area of reservoir bed		Quantity of weeds per unit area of reservoir bed	WRO
15	Wild life	Habitat area /habits of concerned wild life	Disturbance to wild life	Habitat area / habits of concerned wild life	Forest Department
16	Aquatic life	Health of aquatic creatures	Pressure on aquatic resources	Health of aquatic creatures	Fisheries Department
17	Biodiversity	Number of local flora and fauna species	Impact on flora and fauna species at risk from external agencies	Number of local flora and fauna species	Forest Department
18	Solid waste		Quantity and nature of solid waste		Local Urban Bodies
19	Fertilizer use	Average Fertilizer usage by type per filed unit area		Average Fertilizer usage by type per filed unit area	Agriculture Department
20	Pesticide use	Average pesticide usage by type per filed unit area		Average pesticide usage by type per filed unit area	Agriculture Department

21	Displacement	Number of people to be displaced	Number of people to be displaced	Number of people to be displaced	Social Welfare Department
22	Lively hood	Number of people lost lively hood	Number of people lost lively hood	Number of people lost lively hood	Social Welfare Department
23	Common property recourses	Number of people losing access	Number of people lost access	Number of people lost access	Revenue Department
24	Schedule cast/tribe	Number of project affected persons	Number of project affected persons	Number of project affected persons	Social Welfare Department
25	Work load on women	Distribution of women's nature of work in 24 hours	Distribution of women's nature of work in 24 hours	Distribution of women's nature of work in 24 hours	Social Welfare Department
26	Child labour	Distribution of child nature of work in 24 hours	Distribution of child nature of work in 24 hours	Distribution of child nature of work in 24 hours	Social Welfare Department
27	Conflict	Number of conflicts and issues	Number of conflicts and issues	Number of conflicts and issues	Revenue Department
28	Public health	Incidence and nature of work related diseases	Incidence and nature of work related diseases	Incidence and nature of work related diseases	Department of Public Health
29	Cultural properties	Spatial extent of impacts	Conditions of structure and its surroundings enhancement proposed	Conditions of structure and its surroundings	Archeology Department
30	Aesthetic/cultural /religious values	Number and nature of values at risk	Number and nature of values infringed	Number and nature of values infringed	HR & CE

8.4 Monitoring and Evaluation Indicators

Monitoring and Evaluation Indicators have been developed to ensure implementation of environmental and social elements that have been built into all the stages of the project namely:

- Area (ha), production (tons) and value (Rs) of higher-value crops
- Productivity of water (Rs/m³)
- Livestock (% stall fed)
- Fisheries (water spread area in ha by type, production in tons/yr, value in Rs/yr)
- Adoption of improved technologies (e.g. drip/sprinkler area, etc.)
- Reliability of irrigation
- IT adoption (WRO and MDPU MIS, # of e-kiosks, cell services, web portal use, etc.)
- GIS/Remote sensing/Management Information system should be made use
- PIM (No. of WUAs, # of meetings held, attendance at meetings, O&M money collected by WUAs, # disputes settled by WUAs)
- Income to farmers (survey on Rs/household/yr from farm and non-farm activities – baseline, mid-term and end of project) and migration EE (Region wise) erns
- Process (Sub-basin development and management plans prepared, appraised, Implementation Completion Reports completed, Social and Environment Management Frameworks applied, IRR)
- Marketing (Marketing sites/access, modernization of existing centers, new centers, arrivals, post-processing equipment and centers, Public-Private Partnerships, etc.)
- Training (# of people trained in state, national and inter-national – line agency and WUAs, farmers, etc.)
- Institutional linkages