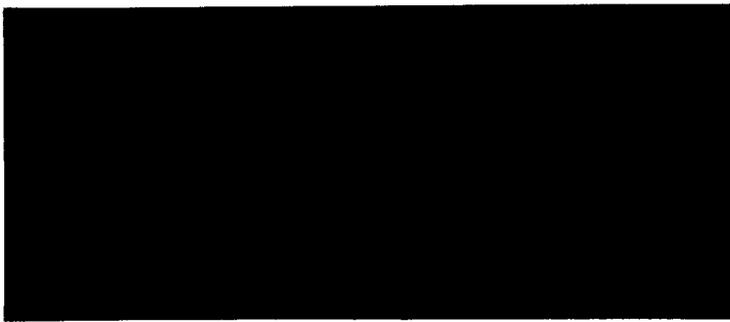


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PROJET  
**MRT**

TADLA RESOURCES  
MANAGEMENT



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PD-ABR-452

**TADLA RESOURCES MANAGEMENT PROJECT**

(USAID Contract No 608 0213 C 4002)

## **Project Workplan 1997-1999**

Report N 60

September 17, 1997

## Table of Contents

	<b>PREFACE</b>	iii
<b>SECTION I</b>	<b>INTRODUCTION</b>	<b>1</b>
<b>SECTION II</b>	<b>WATER SAVINGS IN THE TARGET AREAS</b>	<b>3</b>
A.	Improved Canal Conveyance Efficiency	3
A1	Establishment of a GIS System	3
A2	Complete Installation of the Agro-meteorological Network	5
A3	Installation of Flow Data Monitoring System	5
A4	Development of a Hydraulic Model	6
A5	Mobile Units for Monitoring/Controlling Irrigation System Flows	6
A6	Developing Computerized Irrigations Planning and Programming	7
B	Improved On-Farm Water Use Efficiency	7
B1	Level Basin Irrigation	7
B2	Monitoring and Evaluating Impact on Farms of the Project Activities	9
B3	Field days and study tours (See Section VII)	9
<b>SECTION III</b>	<b>REDUCTION OF WATER POLLUTION IN THE TADLA</b>	<b>12</b>
A1	Develop an integrated nitrogen management program	12
A2	Data Acquisition and Analysis from the Groundwater, Soil and Water Quality Monitoring Network	12
A3	Modelling Groundwater	13
<b>SECTION IV</b>	<b>ADOPTION OF INTEGRATED PEST MANAGEMENT PRACTICES</b>	<b>15</b>
A1	An Integrated Pest Management Program	15
A2	Training and Extension Efforts on IPM practices	15
<b>SECTION V</b>	<b>FARMER PARTICIPATION IN WATER USERS ASSOCIATIONS</b>	<b>17</b>
A1	Develop and Implement a Water User Group Strengthening Program	17
<b>SECTION VI</b>	<b>DISSEMINATION OF TECHNOLOGIES TO OTHER ORMVA</b>	<b>20</b>
A1	Training Courses in Tadla with Other ORMVA Participation	20
A2	Field Days and National Seminars	20
A3	Information Exchange Tours	21
A4	Use of the media	21
A5	Annual Evaluation and Workplanning Workshops	21
A6	Quarterly, Annual and Technical Reporting	21

**SECTION VII      POLICY REFORMS RELATED TO INTEGRATED WATER  
RESOURCES MANAGEMENT      23**

**ANNEXES**

ANNEX A	PROJECT INDICATORS AND PERFORMANCE TARGETS	24
ANNEX B	SUMMARY OF LEVEL OF EFFORT AND TIMING	31
ANNEX C	SCOPES OF WORK FOR LONG TERM TECHNICAL ASSISTANCE	40
ANNEX D	SUMMARY BUDGET	42

## PREFACE

USAID's Project Implementation Letter (PIL) No 9 for the Tadla Resources Management Project (TRM), of July 7, 1997 to the Director of the Office Regional de Mise en Valeur Agriculture du Tadla (ORMVAT) provides for a one-year extension of the TRM Project to a PACD, September 30, 1999 with no additional grant funding beyond the \$10,630,000 already obligated to the Project. The PIL stipulates that the extension will be granted to provide the additional time needed to (1) complete irrigation system management tools for water savings, (2) achieve five principal objectives for water savings and water quality control, and (3) complete on-the-job training of ORMVAT staff. With the countersignature by the Director of ORMVAT, July 14, 1995, PIL No 9 provides a basis for extending the Chemonics contract No 608-0213-C-4002 up to one year (through June 1999) and for transferring to the contract \$400,000 already obligated to the Project. The modified contract will thus include a budget for \$10,441,749.

This edition of the 1997-1999 TRM Work Plan updates an earlier draft which was submitted to ORMVAT and to USAID in April 1997 for comment. The work plan is predicated on modifications to the Chemonics contract including the statement of deliverables, inclusion of performance indicators and budgetary adjustments to bring the LOP budget to \$10,441,749.

## **SECTION I INTRODUCTION**

The Tadla Resources Management (MRT) Project, as amended, is a 6 year, 10.6 million dollar project with a PACD of September 30, 1999. A contract with Chemonics International provides \$10,441,749 to be expended for long-term and short term technical assistance, commodity procurement, training, and technologies transfer from December 1993 to June 1999.

In late December 1995, a joint USAID/TRM working group developed a set of five performance indicators for the TRM Project to support USAID/Morocco's strategic objective No. 2, "Improved Water Resources Management in the Agricultural, Urban and Industrial Sectors." A sixth indicator was added for the TRM 1996 Work Plan. Since then, all project activities have concentrated on achieving the following results:

- 1 increased volume of water saved through improved canal conveyance efficiency and through improved on-farm water management
- 2 reduced water pollution through a reduction in the amount of nitrate potentially leached into the groundwater
- 3 increased number of farmers adopting integrated pest management (IPM) practices
- 4 increased number of farmers in water users associations
- 5 number of discrete technologies developed by the TRM activity implemented in other perimeters
- 6 development of policy reforms recommendations for improved water resources management in Morocco

As of the end of June, the TRM Project had spent \$6,877,887, bringing total remaining funds available to \$3,563,862 (34 percent of the modified LOP budget). The Plan provides a strategy for the allocation of these funds and use of technical assistance and ORMVAT personnel to assure achieving project objectives by PACD. There are three key points to the work plan strategy:

- 1 Finish all modeling tools and other technologies in the process of development as early as possible, assure ORMVAT staff skill development, and launch technology transfer process to other ORMVAs
- 2 Assure that ORMVAT staff are using the tools and technologies appropriately, concentrate on extending technologies to other ORMVAs, and continue policy related initiatives, support for WUA development, IPM and nitrate management programs

3 Continue monitoring and evaluation of progress toward Project targets over the remaining life of the Project

Achievement of project performance indicator targets will require approximately 38 person months of short term technical assistance and 91 person months of long term technical assistance (See detailed scopes of work for long term technical assistance Annex C )

Sections II through VII provide by performance indicator a brief description of each work plan activity and an objective tree demonstrating the progression of project activities which leads to achievement of anticipated project results and program strategic objectives

Annex A (Tables 1 1 to 1 6) gives a detailed definition of the indicators and performance targets Annex B (Tables 1a-1f) provides by performance indicator, details of level of effort and timing required for the 1997-1999 Work Plan activities Annex C provides detailed scopes of work for the long term technical assistants A detailed cost budget is attached as Annex D

## **SECTION II WATER SAVINGS IN THE TARGET AREAS**

Volume of water savings in the Tadla Irrigation Perimeter depends on two anticipated results, (1) improved canal conveyance efficiency through improved irrigation system management, and (2) improved on-farm water use efficiency through technologies which lead to improved on-farm water management. Figure 1 shows the progression of activities over the life of the project which will result in water savings and lead to improved water resource management in the agriculture sector.

Tables 1a & b in Annex B provide a summary of level of effort and timing for these activities.

### **A Improved Canal Conveyance Efficiency**

Improved canal conveyance efficiency will result from a comprehensive irrigation management system which integrates the subsystems described below which provide a capacity for hydrologic analysis, geographic information system (GIS) analysis, real time telemonitoring of agro-meteorological and system flow data, water ordering and planning, irrigation scheduling and canal flow simulation model. When operational, such powerful computational capacity linked to real time data collection and rapid response capabilities will enable the efficiency, flexibility, reliability and timeliness needed to respond effectively to increasingly complex demands by perimeter farmers.

Through specialized formal and on-the-job training and active participation in the planning, establishment and operation of these systems, the project is building ORMVAT's human resource capacity to ensure the long run sustainability of these systems beyond the life of the project.

#### **A1 Establishment of a GIS System**

The GIS is a computer system that manages spatial data in digital form. Most of the models and systems that the project is developing to improve the management of water resources in Tadla are geographically location specific. GIS will therefore serve as a major planning and management tool through its capacity for integration, analysis and presentation of results in map form. The GIS will be used as an aid in the development of a comprehensive irrigation scheduling application covering demand analysis data (such as farm location and characteristics, seasonal crop patterns, soil types, agro-meteorological data) and system water distribution characteristics (such as physical system layouts linked to a computerized hydraulic model). This system will contribute to water savings through better timing of crop irrigation that takes into consideration the stage of crop development and soil types. In addition, the GIS will be used to monitor environmental problems (such as nitrate pollution of ground water, salinization, waterlogging, and agro-industrial and urban pollution) and to assess the environmental impacts of irrigated agricultural practices within the Tadla Perimeter.

Two ORMVAT staff are involved full time in the development of this tool, with Project provided technical assistance from the monitoring and evaluation specialist and short term consultants. In addition, an ORMVAT GIS working group are involved in the conception of applications and in data collection. The project procured and installed two GIS workstations and peripheral plotters, printers and digitizing tables controlled through a dedicated LAN. Six project sponsored formal short courses and on the job-training through 1996 and a GIS Study Tour in July 1997 have expanded the capacity of ORMVAT staff to effectively use GIS to contribute to Project objectives for water savings and improved water quality. By the conclusion of the project, ORMVAT will have a fully operational GIS with highly trained personnel capable of operations, maintenance, and expansion.

**Digitizing of base maps** To speed up the process of integrating applications and systems into GIS, the Project has sub-contracted with a professional US provider of data conversion services to digitize base maps for the irrigation perimeter, including farm parcels and blocks, irrigation and drainage systems. A pilot effort consisting of converted data for cda501 has been completed. Completion of the remainder of the perimeter (22 hydraulic sectors) is expected in early 1998. The Chemonics GIS Technical Support Unit in Washington is supervising the effort to assure quality control for the final product. Since this digitizing effort is based on original engineering drawings from the archives of ORMVAT, validation and updating will require substantial additional work by the TRM GIS unit once the provider has completed the data conversion effort.

**Data conversion and analysis** For GIS application development and integration of irrigation system models substantial data bases are required. The ORMVAT GIS group and the project M&E specialist will continue the development and incorporation of basic data such as water and soil quality, seasonal crop patterns and irrigation water uses that will support the irrigation management applications and the monitoring of the environment in the perimeter.

**GIS training** In July 1997, 6 ORMVAT and MAMVA engineers most closely associated with Project GIS activities participated in a GIS Study Tour which covered the following aspects of GIS training:

- participation at ESRI International GIS Users Conference, San Diego California, for further exposure to new GIS concepts and applications
- GIS applications visits to the Imperial Valley Irrigation District, in El Centro, to the California State Department of Water Resources, and to the Bureau of Reclamation in Sacramento, and U S Geological Survey Center in Washington D C
- At Chemonics International GIS Support Unit, in Washington, training in quality control of the digitizing work currently in progress by a private U S firm to develop the Tadla perimeter base maps essential to improved systems management

**GIS Applications development and integration** The Project will provide up to 3 person months of technical assistance for development of advanced GIS applications which integrate and/or link GIS with such things as the irrigation planning and scheduling models, the canal simulation model, flow data, agrometeorological, and environment monitoring systems.

## **A2 Complete Installation of the Agro-meteorological Network**

The project procured, installed and calibrated 3 automatic weather stations (AWS powered by solar panels) during the first quarter of 1996. During 1996 and early 1997 data was downloaded to a laptop computer every two weeks from automatic data loggers at each of the three sites. ORMVAT engineers are using data on rainfall, temperature, humidity and evapo-transpiration rates to determine crop water requirements for improved irrigation system management. The AWS will also provide information useful to integrated pest management, to predicting crop yields and quality, and to more rational and efficient application of agro-chemicals. The AWS network provides another tool for ORMVAT to help manage water efficiently while adapting to the liberalization of cropping patterns and adopting a more responsive management system, as well as to contribute to a sustainable environment. The system is fully operational (ready for use by ORMVAT engineers and technicians).

During early 1997, the Project added, with short term technical assistance, the telemetric system for real time automated transfer of agrometeorological data to ORMVAT central and to each of the three hydraulic subdivisions. Training on the operation and maintenance of the system and on the use of data for irrigation management has been initiated.

Project will provide technical support for the following:

- as a part of on-the-job training establish with ORMVAT staff a method for disseminating and using weather data for improving irrigation planning and scheduling, and other pertinent uses
- complete training of ORMVAT staff in the maintenance and operation of the weather stations
- extend the set of agromet technologies developed to other perimeters through a seminar/workshop

## **A3 Installation of Flow Data Monitoring System**

The project designed a network of 11 automated flow measurement stations which will transmit real time data of water flows from selected sites in the Beni Amir and Beni Moussa irrigation systems. The automated water flow monitoring network will help ORMVAT improve the canal conveyance efficiency through timely control of the flow that goes into the system and what spills out over the end and back into the River. ORMVAT with PAGO II funds, completed the construction of physical works for these sites. Chemonics completed the procurement of equipment in 1996.

Installation of electronic measurement devices, data recorders, and the radio telemetric system (See also Agromet above) was completed during June and July 1997 with short term technical assistance. The system is fully operational (ready for use by ORMVAT engineers and technicians). The related training and use by ORMVAT for system management purposes will improve canal system conveyance efficiency. Remaining activities include to

- establish methods for using the flow data to improve canal system management

- complete training of ORMVAT staff in the operation and maintenance of the flow stations
- extend the flow data measurement technologies developed to other ORMVAs through a short course provided by U C Davis in September 1997, through a seminar/ workshop and through technical exchanges by Project experts
- Establish regular estimates of canal conveyance efficiency & monitor water savings

#### **A4 Development of a Hydraulic Model**

The Project has thus far provided 3 person months of short term technical expertise in the development of a dynamic hydraulic model, which will simulate the features of the Tadla irrigation canal systems. ORMVAT staff will use the model with data from the flow monitoring sites to study alternative operating scenarios to improve canal conveyance efficiency, respond to farmer demands for water and increase crop productivity. Because certain peculiarities of the Tadla system have proven difficult to model, the Project in June enlisted the author of the "Canalman" software in use to make the necessary changes in the unique Tadla model. While initial work has been successful, the expert will require another two to three months of model development to complete the model and provide the necessary training of ORMVAT engineers for model operations and maintenance work to be completed in late 1997. Remaining activities include to

Remaining activities include the followings

- complete development of working models for both Beni Amir and Beni Moussa canals from the CanalMan software for transient flow simulations
- calibrate the model
- train ORMVAT staff in the use of the model
- integrate the models into ORMVAT operations to improve canal system management
- extend the technology to other ORMVAs
- monitor water savings improvement associated with the combined system

#### **A5 Mobile Units for Monitoring/Controlling Irrigation System Flows**

Project technical assistance has developed portable broad crested weirs (flumes) in parallel with the development of the canal flow measurement system described above. These "Replogle" weirs provide a means of verification and calibration of fixed water distributing devices in various canals and control of water delivered to the farmers. ORMVAT engineers and technicians have been using these weirs to determine water delivery to farmers. The technology has been extended to other ORMVAs (Doukkala and Haouz) at their request.

The project, 1997 - 1999, will focus on a more generalized extension of this improved technique to the perimeter and national level, through on-the-job training of ORMVAT arrondissement staff and technical field days held both in the Tadla and in other perimeters.

## **A6 Developing Computerized Irrigations Planning and Programming**

In 1996, the Project, with short term technical assistance, developed two computerized programs to help ORMVAT, one, CROPREQ, to improve planning and programming of irrigation using data on crop water needs, soil types and canal system limitations, to assist ORMVAT staff to effectively plan and program irrigation prior to and during the irrigation season, the second, HORAIRE, was intended as a computerized substitute for the time consuming manual system for calculating water ordering and delivery (forms MV1 & MV2)

Both programs have been tested by ORMVAT personnel They are pleased with the CROPREQ program with qualifications The HORAIRE program does not meet their needs ORMVAT programmers have subsequently developed their own functioning software to replace HORAIRE and do not wish to use more project resources on the model

CROPREQ currently provides information on a monthly basis and is useful for long range planning, but is not adequate for day-to-day management of the irrigation system At ORMVAT's request, the Project will provide a short term irrigation engineer involved in the design of the CROPREQ program and a short term GIS consultant one month each, to enhance the CROPREQ program to provide information on a daily basis, to integrate the model into the GIS and to generalize the use to the whole perimeter to improve irrigation planning & scheduling Specific activities will include

- providing technical assistance to finalize the program and link it to GIS, September, October, 1997
- On-job-training focused on integrating the application into ORMVAT irrigation planning and scheduling operations
- extending the technology to other ORMVAs 1998-99 through a seminar/field day and on-the-job training

## **B Improved On-Farm Water Use Efficiency**

Through a combination of on-farm demonstrations and a related program of information dissemination, the project has introduced farmers to water saving techniques, and technical packages for increasing the value of existing production, for modifying practices detrimental to a sustainable environment and for long term productivity It is anticipated that an improved management of the water delivery system, improved on-farm techniques for irrigation and a more rational choice of crop varieties will come together at the farm level to increase efficiency of water application and contribute to improved management of soil and water quality and groundwater table levels

### **B1 Level Basin Irrigation**

Based on the project assessment, in 1995, of options for on-farm irrigation technologies appropriate to Tadla, level basin irrigation technology was selected as a promising new irrigation technology on which the project should focus The benefits of the level basins demonstrations include water uniformity across the field, more efficient

irrigation, less percolation loss, higher crop yields, and irrigation labor savings, as well as enhanced salt and nitrate management

The project initiated the installation of a series of on-farm pilot demonstrations in 1995. Data collected from the demonstrations show more than 20% of irrigation water is saved by using level basin techniques as compared to the traditional system of "Robta" most commonly used in the area.

The project has extended, this on-farm water saving technology to 20 farms and more than 25 hectares, covering a substantial array of commonly grown and high value crops, including sugar beets, wheat, field corn, and beans. ORMVAT staff have been trained by the project in conducting level basin demonstrations including laser leveling, basin design, monitoring, data collection, and conducting field days for extension of the technology. Laser leveling equipment purchased in 1995 is used to construct the level basin demonstration plots for more efficient irrigation and productivity. The Project rented a tractor from a local vendor to facilitate the increased amount of laser leveling to be accomplished during the life of the project.

The focus in 1997-1999 will be on the reinforcement of the extension of this technology to a larger population of farmers in the Tadla and to other regions through the following activities:

- develop and distribute extension information bulletins on the subject, train ORMVAT extension staff, organize field days and farmer visits
- continue installation of level basins in the Tadla perimeter
- install demonstration(s) in Doukala and Haouz
- involve the private sector in development of and supply of laser land leveling services specific to level basin irrigation
- Enlist support of MAP project for development of level basin technology in Agadir/Souss Massa region where large scale enterprises producing for export
- Link with WRS Project for the development of a system of level basins for used water irrigation of agricultural crops, part of the waste water treatment pilot project
- provide short term technical assistance to do a feasibility study for implementation of level basin technology on a commercial basis for Tadla and other perimeters
- complete technical report of the Project's level basin technology experience which includes findings, final conclusions and recommendations by end of 1997

## **B2 Monitoring and Evaluating Impact on Farms of the Project Activities**

The Project, in collaboration with ORMVAT personnel will continue to gather data necessary to monitoring and evaluating Project activities and results on farms adopting the following (1) level basin irrigation for improving efficiency of applying irrigation water, (2) integrated pest management to reduce number of applications and the quantity of pesticides, (3) nitrogen fertilizer management program to reduce the quantity of nitrates which could potentially pollute the groundwater, and participation in water users associations to improve the management of the irrigation system. The results of this monitoring and evaluation will be the basis for reporting progress on the Project performance indicators.

## **B3 Long Furrow Irrigation Technology**

On the basis of the Project's 1995 diagnostic of farm-level irrigation technologies appropriate to the Tadla, the Project chose to focus on the development of level basin irrigation as the most promising new technology. ORMVAT, in parallel has tried for a long time to develop long furrow irrigation. ORMVAT's Bureau des Techniques d'Irrigation (BTI) conducted a number of demonstrations on the subject. The Project has responded favorably to an ORMVAT request for one month's technical assistance to help them develop this technology.

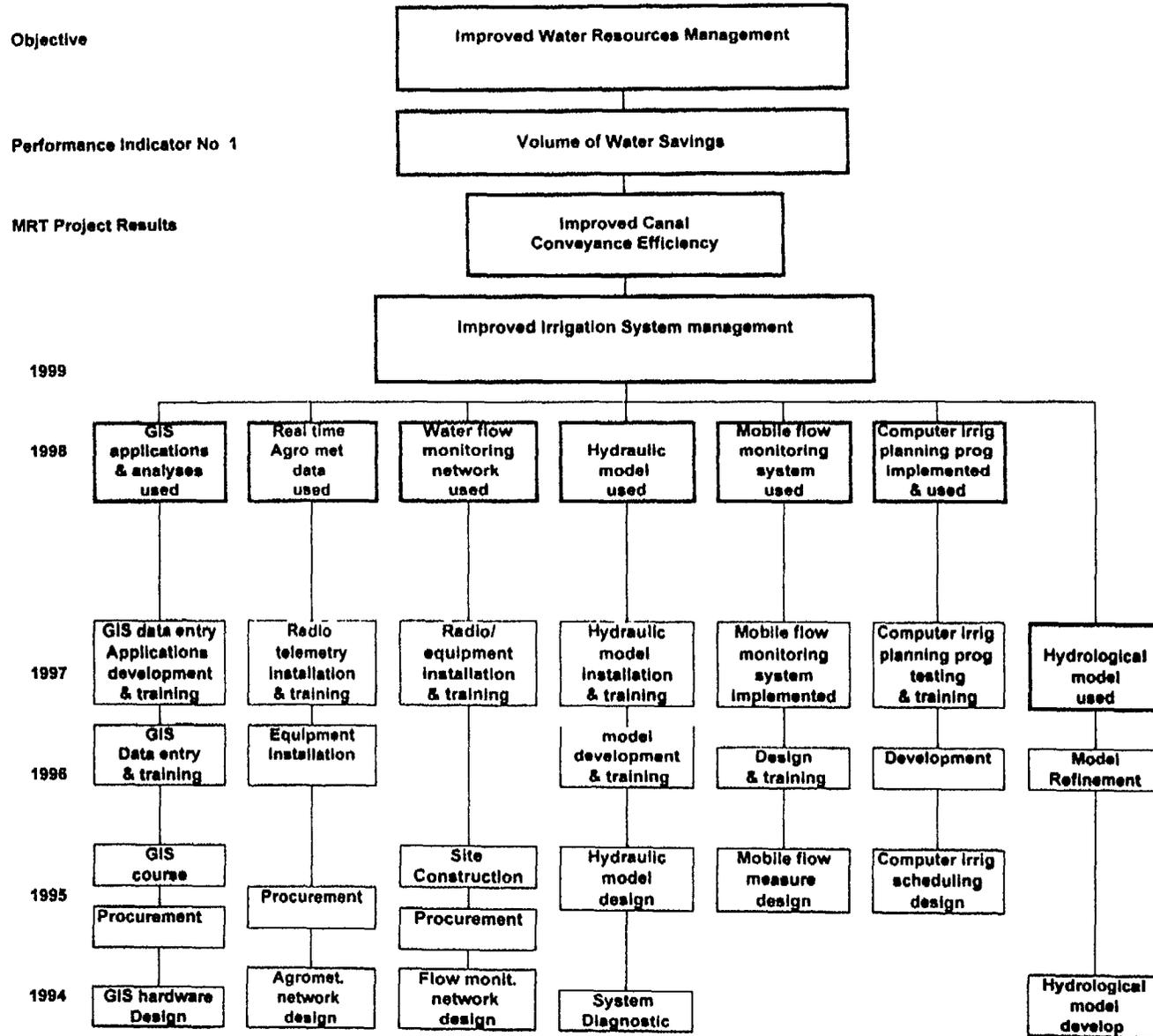


Figure 1a MRT objective tree related to the performance indicator Increase water savings related to Improved canal conveyance efficiency

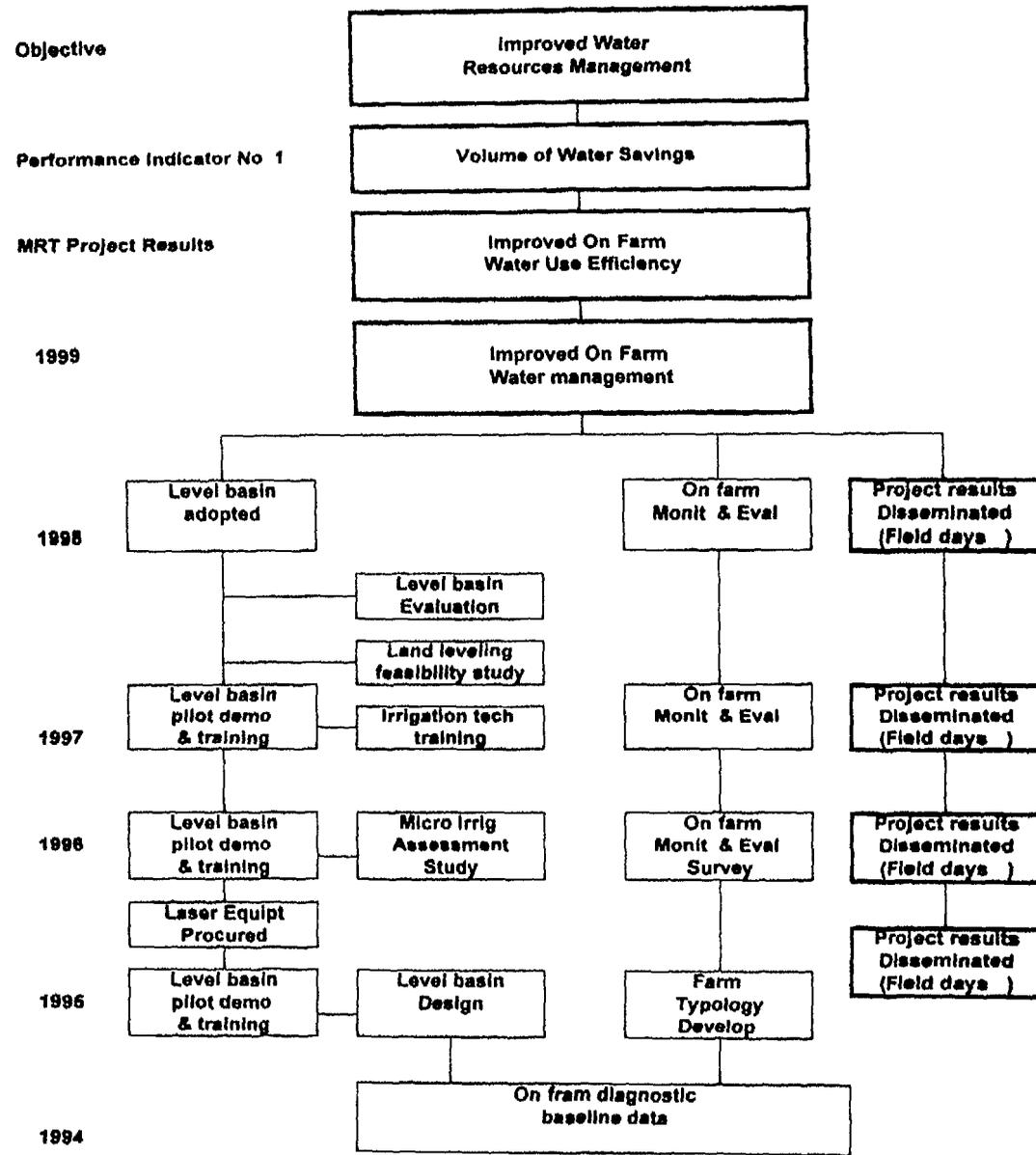


Figure 1b MRT objective tree related to the performance Indicator Increase water savings

### **SECTION III REDUCTION OF WATER POLLUTION IN THE TADLA**

The Project will focus on actions for the remaining life of project, which influence nitrates entering the ground water, as depicted in Figure 2. Activities include, (1) continuation of an integrated nitrogen management program and 2) periodic data collection from the network for monitoring groundwater levels, water quality and soil quality.

Table 1c in Annex B provides overview of environment related activities with their required level of effort and timing for the 1997-98 program.

#### **A1 Develop an integrated nitrogen management program**

In November, 1996, the project initiated an improved fertilizer program to reduce the amount of nitrate potentially leached into the groundwater in Tadla. This demonstration and extension approach to improving farmers practices now has 15 farmers participating. The objective of the program is to develop a series of best nitrogen management practices that improve farmers returns while reducing the danger of groundwater pollution with nitrates. An integrated demonstration and extension approach to improving farmers practices is called for which include 1) farmer level fertilizer demonstrations 2) redrafting "fiche techniques" to reflect realistic yield goals, fertilizer recommendations which include type to be used, quantity, placement and timing, and 3) introducing the concept of field nitrogen budgets. This farm extension program will be on-going through the life of the project with 4 person months of short term level of effort at least through 1998.

Specific activities in 1997 and beyond will include

- to provide technical assistance in monitoring the existing field demonstrations and extending the nitrogen fertilizer management program to more farmers in the perimeter
- to provide extension information on the subject through training ORMVAT extension staff, organizing field days and farmer visits, which also involve other ORMVAs such as Souss Massa and Loukkos

#### **A2 Data Acquisition and Analysis from the Groundwater, Soil and Water Quality Monitoring Network**

ORMVAT Environment Office continues periodic data collection from the project installed network of 97 wells for measuring water quality and depth of groundwater and the 40 points for monitoring soil quality. The information provides a means to evaluate the fluctuations of groundwater, quantify nitrate levels and their evolution and identify other potential problems such as waterlogging as a basis for taking action. Using the above data, the GIS unit produces analytical maps for this purpose. The project will continue to support this analysis.

The continuation of ORMVAT's groundwater monitoring program for water depth and water quality will provide information which can be used for groundwater management

### **A3 Modelling Groundwater**

In 1996, the project provided ORMVAT 3.5 person months of technical assistance to help install MODFLOW, a finite-difference numerical model (steady state) used to portray the groundwater flow system in the Tadla. An ORMVAT engineer, worked closely with the project consultant in the installation and calibration of the model. The ORMVAT engineer subsequently continued the calibration process of the steady state version of the model. The objectives of the Project were basically met at this stage. ORMVAT, however considers the further development of the model to be a priority for the purpose of reliable simulation of groundwater flow under transient conditions, (1) to better predict the response of the groundwater system to changes in stresses affecting recharge or discharge for better management of conjunctive use and (2) to monitor the transport of pollutants such as salt, nitrates and pesticides. Full development of the transient model will require substantial additional research and a protracted effort beyond the life of the Project. The Project has agreed to provide one additional person month of short term expertise to help ORMVAT further their model development.

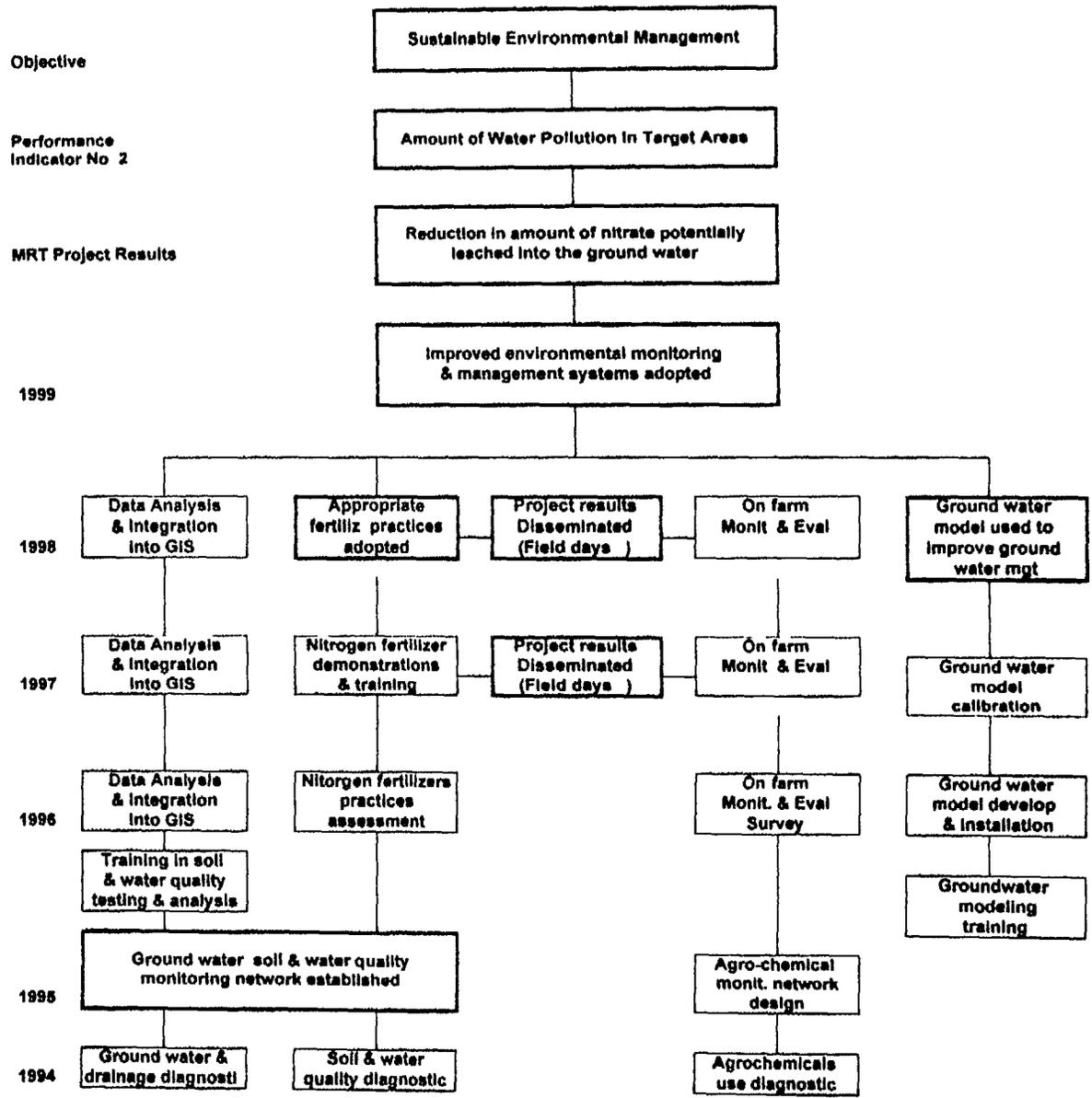


Figure 2 MRT objective tree related to the performance indicator Amount of water pollution in target areas

## **SECTION IV**

### **ADOPTION OF INTEGRATED PEST MANAGEMENT PRACTICES**

Figure 3 charts the progression of activities which will contribute to the adoption by Tadla farmers of integrated pest management practices. Table 1d in Annex A provides a summary of activities with the required level of effort and anticipated timing related to IPM.

#### **A1 An Integrated Pest Management Program**

IPM is one of the useful and important results of the reengineering which took place in late 1995. Because of the shortness of time left to initiate IPM, the Project confined the activity in the Tadla to a limited action farm-level program which has the most possibility of acceptance by farmers, while maximizing the impact on pesticide reduction during the Project's remaining life. Currently a IPM network of 25 citrus growers and 7 farmers with paprika (niora) has been established.

The citrus and paprika pepper (niora) crops were chosen for the following reasons: a) both crops are of major economic importance in the Tadla perimeter, b) the amount of pesticides used on these crops is high, c) residue levels must be respected for the exportation of these crops, d) several monitoring tools are available in Morocco for the major pests, e) there is on-going research in Morocco on certain pests for these crops.

The Project will provide 4 person months of short term technical assistance in 1997, and 2 person months in 1998 and beyond with increased dependence on support from the IAV Horticultural Centre in Agadir to assure the sustainability of the program. In 1997, the project supported the participation of a delegation from Tadla in the symposium "Integrated Production and Protection (IPP) in Horticultural Crops". The project provided a short term IPM expert to present the Tadla program and cover expenses of 8 persons from ORMVAT, INRA, and SPV associated most closely with the IPM network in the Tadla.

Specific activities in 1997 and beyond will include:

- to continue supporting IPM network activities in the Tadla
- to support the extension of the technology through workshops, field days and development and extension of information bulletins
- to extend our investigations and exchange information with other perimeters on IPM

#### **A2 Training and Extension Efforts on IPM practices**

Specialists fielded by the University of California, Davis provided a two week training module, April 14 to May 3, 1997 to 24 extension agents, 7 from other ORMVAs on extension methods applied to IPM practices. Emphasis of training was on assisting ORMVA extension personnel to learn methods which will enhance the adoption of IPM practices by local farmers. This represents the first in a series of training sessions which will help to extend the IPM technologies to farmers throughout Morocco.

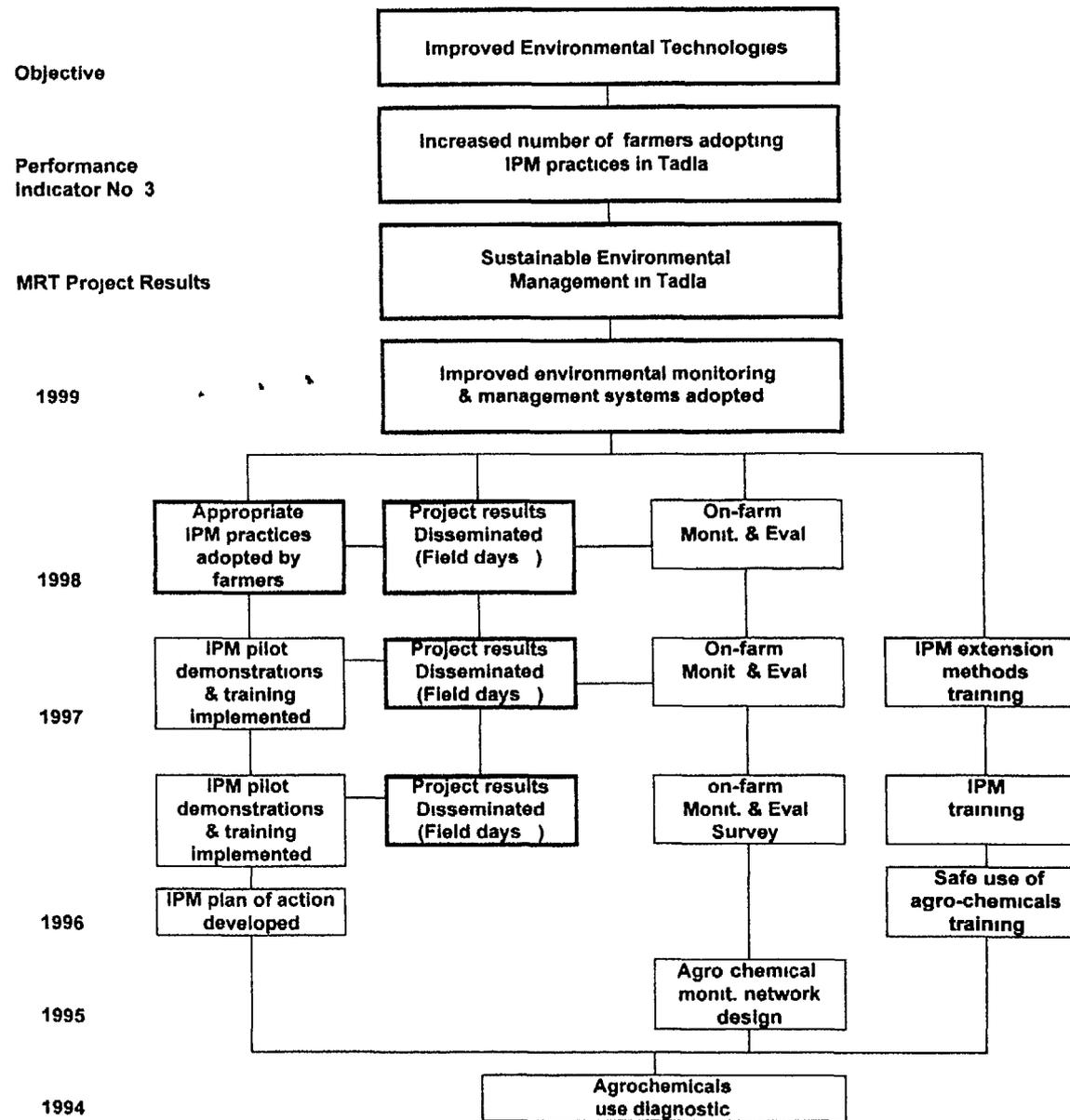


Figure 3 MRT objective tree related to the performance indicator Increased percentage of farmers adopting IPM practices

## SECTION V FARMER PARTICIPATION IN WATER USERS ASSOCIATIONS

Figure 4 illustrates the progression of activities over the life of project which will result in substantial numbers of Tadla farmers actively participating in viable water users groups

With ORMVAs in Morocco facing potentially wrenching changes, as their historical functions are called into question, while budgetary support is drastically reduced, the introduction of Water User Associations (WUAs) to the large scale irrigated perimeters has potential to contribute significantly to improving both the management and performance of these institutions. The Project has contributed the following to WUA development in the Tadla

- A diagnostic study in 1994, showing that WUAs in the Tadla hold promise for improving water use efficiency and that development depends on improved policy and supporting legislation
- Presentation by a short term consultant in November, 1995, to the National Symposium on Participative Irrigation Management, of the US experience related to WUAs. The consultant separately provided recommendations on forming WUAs in Tadla
- A study tour to Portugal which included visits to and discussions with WUAs
- an invitational water policy and management tour by the Director of ORMVAT and leaders from the Ministry of Agriculture in California, Arizona and Mexico with a major component involving the role and management of WUAs in irrigation districts
- A plan for the implementation of WUA in the Tadla perimeter, prepared by a short term consultant in June 1996. The program recommended a phased approach culminating in the creation of 48 WUA covering all the Tadla perimeter in 5 years

Table 1e in Annex A provides a summary of activities with their required level of effort and timing related to WUA development

The project will continue its support to strengthen WUA in the perimeter in 1997 and beyond

### **A1 Develop and Implement a Water User Group Strengthening Program**

Considerable work has been done by ORMVAT to define the number, the boundaries and the participants which will form the basis for creating 49 WUAs that encompass all the irrigated perimeter. Of these 49, eleven have received initial organizing efforts, including the preliminary activities of electing the WUA councils. ORMVAT has intensified its efforts to develop WUAs since the fall of 1996. After establishing a pilot project for activating one WUA (Alltihad) in 1995, with the primary responsibility of managing a quota system of water allocation, a program was developed to activate 5 more starting in the fall of 1996. The plan is to activate and add more WUAs each year until there is complete coverage of the

whole perimeter with a gradual transfer of water distribution and canal maintenance responsibility The project will participate in this process during 1997-99 with the following specific activities 1997-99 will include the following

- short term technical assistance to help implement the ORMVAT WUA plan of action
- specialized training and study tours for WUA members

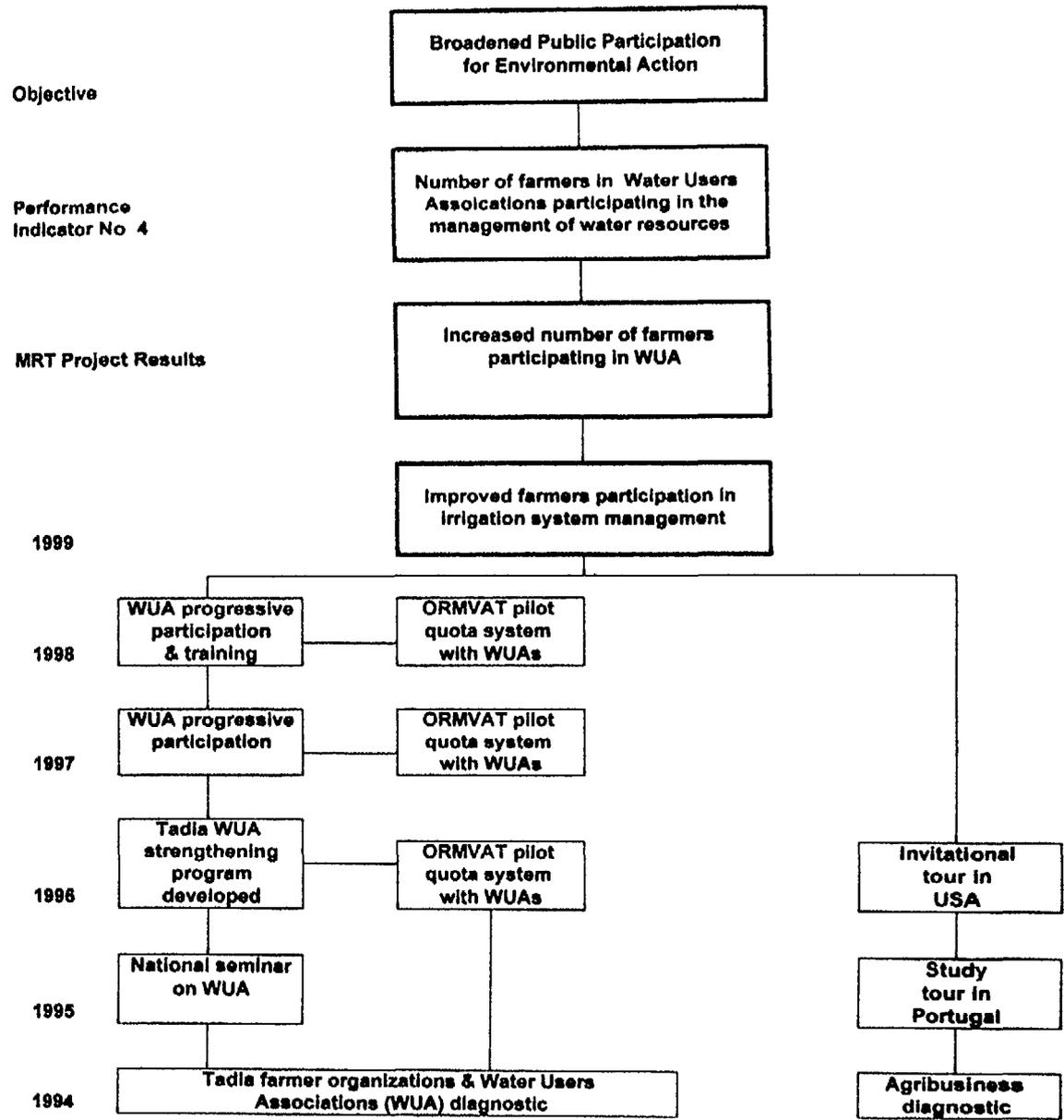


Figure 4 MRT objective tree related to the performance indicator Increased number of farmers participating in WUA

19

## **SECTION VI DISSEMINATION OF TECHNOLOGIES TO OTHER ORMVAs**

Figure 5 shows the progression of activities over the life of the project which will result in dissemination of technologies developed for the Tadla to other regions of Morocco. The plans for dissemination to other ORMVAs will provide a minimum of 350 participant days of exposure to these technologies through the remaining life of the Project by means of (1) formal short courses in the Tadla with participation by other ORMVAs, (2) field days and national seminars for extension of technology, (3) in-country tours for information exchange, (4) use of the media, (5) an end of project workshop, and (6) annual and technical reports dissemination.

The Project will provide some limited on-the-job training to other ORMVA personnel outside the Tadla, with the participation of ORMVAT project trained personnel, should the need arise, and where the systems and infrastructure are already in place. To facilitate the process, the Project will pay for food and lodging, both for ORMVA participants attending training and field days in the Tadla and for ORMVAT technicians traveling to other ORMVAs for information sharing tours and for on-site training of selected technologies.

### **A1 Training Courses in Tadla with Other ORMVA Participation**

Based on the Project's approved short course training plan, the University of California, Davis, will provide three additional modules in 1997 to complete their commitment to the Project. These modules are:

- On-farm irrigation techniques (June 97)
- Flow measurement in irrigation systems (September 97)
- Extension methods applied to IPM practices (April 97)

### **A2 Field Days and National Seminars for Extension of Technology**

Field days for farmers and technical staff including participants from other irrigation perimeters will be planned in 1997 and beyond to demonstrate the results of the project.

- Improved irrigation management using automated flow monitoring system (April 98)
- Improved irrigation management using hydraulic model (May 98)
- Improved irrigation planning using CROPREQ planning program & GIS (Feb 98)
- Improved irrigation system planning and monitoring using GIS (July 98 & Mars 99)
- Improved on-farm irrigation technology using land leveling and level basin irrigation (December 97)

- Reduction of groundwater pollution using improved nitrogen fertilization management (September 97 and September 98)
- Reduction of pesticides application using IPM technology (March & October 98)
- Experience of Tadla in the development of Water Users Association (July 98)
- Monitoring soil and water quality in the Tadla irrigation perimeter (December 98)

### **A3 Information Exchange Tours**

Visits of TRM technical team and counterparts to other ORMVAs and projects in Morocco to provide for exchange of information, and develop contacts for disseminating Project results

### **A4 Use of the media**

Project has had a dissemination program, with limited use of the media. Will investigate National Agricultural Extension Program of MEDI 1 radio station of Tangiers and use of the Audio Visual Center at the Meknes Agricultural School in the development of professionally done video(s) of Project activities and results

### **A5 End of Project Workshop**

The Project will hold a final workshop at the end of the Project in March 1999 to review toward achieving project objectives, with ORMVAT, USAID and other key stakeholders of the project. The outcome of this workshop will help ORMVAT and USAID to define ways and means for sustaining project results, and achieving Project objectives

### **A6 Quarterly, Annual and Technical Reporting**

Quarterly, annual reports and technical reports provide another means for monitoring and evaluating progress and for extending technologies to other ORMVAs. The Project will annually update a set of technical documents at the IAV Documentation Center and at AGR/MAMVA. Will also annually distribute to all ORMVAs a list of available Project technical documents

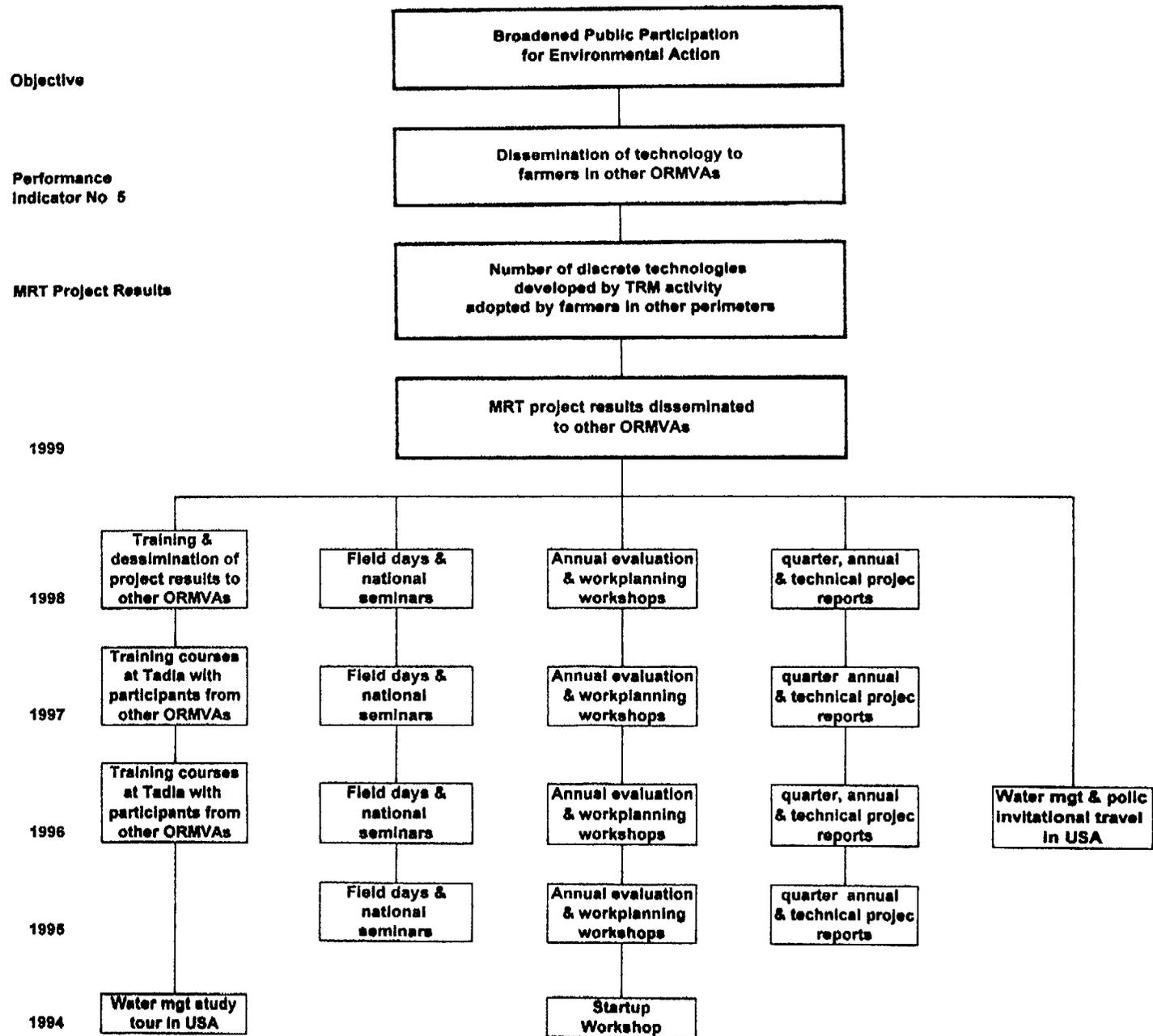


Figure 5 MRT objective tree related to the performance indicator Number of discrete technologies developed by the project implemented in other ORMVAs

## **SECTION VII POLICY REFORMS RELATED TO INTEGRATED WATER RESOURCES MANAGEMENT**

The Project Policy reform activities of the project can be divided into the following will contribute to on-going irrigation policy dialogue at national level through dialogue studies and direct intervention contribute to

- Encouraging progressive water pricing policies
- Decentralizing water management authorities
- Empowering water user associations
- Enhancing efficiency of regional irrigation authorities (ORMVAs)

Specific activities in 1997 and beyond will include

- In May 1997 the project provided short term technical assistance to assist ORMVAT develop a mission statement and action plan for the its transformation into a financially autonomous regional irrigation authority, which is more efficient and responsive to changing water resource management needs This study and plan will address water pricing policy roles and relationships with the regional watershed agency the roles and relationships of water user groups, policies and legislation required to support the modifications The implementation of this plan is to create of ORMVAT a pilot authority as an example to the other 8 large scale irrigation authorities
- Participation in Water Resources Policy Seminar sponsored by USAID
- technical assistance to help ORMVAT implement and adopt policy reforms related to efficiency Water Users Associations and water pricing

**ANNEX A**  
**PROJECT INDICATORS AND PERFORMANCE TARGETS**

**TABLE 1 5 BASELINE AND PERFORMANCES FOR TRM PROJECT ACTIVITY**

*Program Outcome No 2 3 Broadened Public Participation for Environmental Action*

<b>Indicator # 5 Dissemination of technology to other irrigated perimeters</b>																						
<b>Definition/Unit</b>	Defined as the number of discrete technologies developed by the TRM activity implemented in other perimeters																					
<b>Source</b>	TRM reports																					
<b>Comments</b>	This indicator will measure the number of discrete technologies developed by the project in the Tadia perimeter and adopted by one or more ORMVAs in other regions of Morocco																					
<b>Baseline &amp; target</b>																						
	<table border="1"> <thead> <tr> <th></th> <th>1994</th> <th>1995 Baseline 0</th> <th>1996</th> <th>1997</th> <th>1998</th> <th>1999 Target</th> </tr> </thead> <tbody> <tr> <td>Planned</td> <td></td> <td></td> <td>1</td> <td>2</td> <td>3</td> <td>5</td> </tr> <tr> <td>Actual</td> <td></td> <td></td> <td>1</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		1994	1995 Baseline 0	1996	1997	1998	1999 Target	Planned			1	2	3	5	Actual			1			
	1994	1995 Baseline 0	1996	1997	1998	1999 Target																
Planned			1	2	3	5																
Actual			1																			
<b>Critical assumptions</b>																						
<ul style="list-style-type: none"> <li>- Commitment of the GOM to nominate participants for training and field days (workshops seminars ) in Tadia</li> <li>- Commitment of the GOM to financial support of the new technologies</li> </ul>																						

**TABLE 1 4 BASELINE AND PERFORMANCES FOR TRM PROJECT ACTIVITY**

*Program Outcome No 23 Broadened Public Participation for Environmental Action*

<b>Indicator # 4</b>	<b>Number of farmers in viable water user Associations</b>					
<b>Definition/Unit</b>	Measured as number of farmers in viable water users associations participating in the management of the water distribution systems in the Tadla perimeter					
<b>Source</b>	TRM reports					
<b>Comments</b>	<p>The GOM is actively working to transfer water management responsibilities from the ORMVs to local water users associations USAID is promoting this approach at the Tadla perimeter and is working towards replication in the other eight irrigated perimeters</p> <p>The performance indicator reported here is the number of farmers who are members of an association involved in the Tadla system management and maintenance (planning &amp; scheduling)</p> <p>The process of having farmers effectively managing water resources at the local level is a long one and will take several years to complete</p>					
<b>Baseline &amp; target</b>						
	1994 Baseline 200	1995	1996	1997	1998	1999 Target
Planned		200	1000	3000	6000	10000
Actual	200	607	1847			
<b>Critical assumptions</b>	<ul style="list-style-type: none"> <li>- Commitment of the GOM to solve financial autonomy issues</li> <li>- Commitment of ORMVAT to strengthen Water Users Associations in Tadla &amp; to adopt project recommendations</li> </ul>					

**TABLE 1 3 BASELINE AND PERFORMANCES FOR TRM PROJECT ACTIVITY**

*Program Outcome No 2 2 Improved Environmental Technologies*

<b>Indicator # 3</b>	<b>Number of farmers adopting Integrated Pest Management (IPM) practices</b>																										
<b>Definition/Unit</b>	Measured as number of farmers adopting IPM practices for targeted crops in irrigated perimeter																										
<b>Source</b>	TRM reports																										
<b>Comments</b>	<p>The MRT project will help increase adoption of IPM practices in the irrigated perimeters of Morocco starting with Tadla &amp; Souss Massa Even though IPM methods could be developed for all crops grown in these perimeters it was necessary to choose a few crops to focus on considering the time and effort in changing pesticides management practices The citrus and paprika in Tadla and Tomato and citrus in the Souss Massa were chosen for the following reasons</p> <ul style="list-style-type: none"> <li>(a) They are of major economic importance in these perimeters</li> <li>(b) the amount of pesticides used on these crops is high</li> <li>(c) residue levels must be respected for the exportation of these crops</li> <li>(d) several IPM monitoring tools are available for the major pests</li> </ul> <p>Other crops could be added when research on certain pests of these crops are well advanced</p>																										
<b>Baseline &amp; target</b>	<table border="1"> <thead> <tr> <th></th> <th>1994 Baseline 0</th> <th>1995</th> <th>1996</th> <th>1997</th> <th>1998</th> <th>1999 Target</th> </tr> </thead> <tbody> <tr> <td>Planned</td> <td></td> <td>10</td> <td>40</td> <td>100</td> <td>300</td> <td>600</td> </tr> <tr> <td>Actual</td> <td></td> <td>8</td> <td>41</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>							1994 Baseline 0	1995	1996	1997	1998	1999 Target	Planned		10	40	100	300	600	Actual		8	41			
	1994 Baseline 0	1995	1996	1997	1998	1999 Target																					
Planned		10	40	100	300	600																					
Actual		8	41																								
<b>Critical assumptions</b>	<ul style="list-style-type: none"> <li>- Adequate coordination between the Ministry of Agnculture Departments in the region (ORMVAs DPA INRA IAV Hassan II) in the development IPM practices</li> <li>- Adequate IPM extension program adopted</li> </ul>																										

**TABLE 1 2 BASELINE AND PERFORMANCES FOR TRM PROJECT ACTIVITY**

**St. Objective # 2 Improved Water Resources Management in the Agriculture sectors**

<b>Indicator # 2 Amount of water pollution in target areas</b>						
<b>Definition/Unit</b>	Reduction in the amount of nitrate potentially leached into the groundwater (excess nitrogen used) in the irrigated penimeters (especially at Tadia) measured in parts per millions (kg of excess unit of nitrogen /ha) for targeted crops					
<b>Source</b>	TRM reports					
<b>Comments</b>	<p>The amount of nitrate leached into the ground water is closely linked to the amount of nitrogen respect to crop needs. When nitrogen application exceeds requirements, the potential Nitrogen loss goes rapidly. Therefore, excess of nitrogen applied (beyond the crop needs) is a proxy indicator for the amount of nitrates leached into the groundwater.</p> <p>Reducing the amount of nitrogen excess (beyond crop needs) will eventually result in substantial reduction in the amount of nitrate pollution in ground water. The focus is on wheat and sugar beet because (i) they occupy together more than 50 % of the area in the perimeter (40 % of wheat and 12 % of sugar beet) and (ii) they are among the crops that the farmers are over-fertilizing.</p>					
<b>Baseline &amp; target</b>	1994	1995	1996 Baseline 35 kg /ha	1997	1998	1999 Target
			Reduced by			
Planned			0 %	10 %	15 %	25 %
Actual			0 %			
<b>Critical assumptions</b>	<ul style="list-style-type: none"> <li>- On-farm water application efficiency improved</li> <li>- Integrated plant nutrient management practices adopted and implemented by ORMVAT extension staff</li> </ul>					

**TABLE 1 1 BASELINE AND PERFORMANCES FOR TRM PROJECT ACTIVITY**

**St. Objective # 2 Improved Water Resources Management  
in the Agricultural, Urban & Industrial sectors**

<b>Indicator # 1</b>	<b>Volume of water savings in target areas</b>																										
<b>Definition/Unit</b>	Volume of water savings in millions of cubic meters																										
<b>Source</b>	TRM reports																										
<b>Baseline &amp; target</b>	<table border="1"> <thead> <tr> <th></th> <th>1994 Baseline</th> <th>1995</th> <th>1996</th> <th>1997</th> <th>1998</th> <th>1999 Target</th> </tr> </thead> <tbody> <tr> <td>Planned</td> <td>0</td> <td>0</td> <td>5</td> <td>10</td> <td>30</td> <td>70</td> </tr> <tr> <td>Actual</td> <td>0</td> <td>2</td> <td>6</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>							1994 Baseline	1995	1996	1997	1998	1999 Target	Planned	0	0	5	10	30	70	Actual	0	2	6			
	1994 Baseline	1995	1996	1997	1998	1999 Target																					
Planned	0	0	5	10	30	70																					
Actual	0	2	6																								
<b>Comments</b>	<p>Water savings will come in particular from improved system level management and improved on-farm water savings in the irrigated perimeters (especially at Tadla)</p> <p>In Tadla the actual water savings for 1995 &amp; 1996 are derived from the current ORMVAT estimates of canal conveyance efficiency (79% &amp; 82% respectively) under the assumption that the project related activities contributed 20 % of overall ORMVAT water savings in 1996</p> <p>The project real-time measurements of water flow will be fully operational at the end of 1997. At that time the project will carry out systematic measures of system inflow and outflow at strategically selected locations of the canal in order to provide ORMVAT with improved means of estimating canal efficiency and improving their total management of the system</p> <p>Figures are for annual water savings not cumulative</p>																										
<b>Critical assumptions</b>	<ul style="list-style-type: none"> <li>- Continued effort by ORMVAT to reduce canal leakage</li> <li>- Improved system-level management tools adopted by ORMVAT</li> <li>- Contract for land leveling established with the private sector</li> <li>- Line of credit available for the purchase of land leveling equipment</li> <li>Irrigation Water pricing reviewed</li> </ul>																										

TABLE 1 6 BASELINE AND PERFORMANCES FOR TRM PROJECT ACTIVITY

**SO2 Policy Matrix Results 1995 - 2001**

Progress is rated as following

Identification phase 10%  
 Formulation 10%  
 Validation 20%  
 Adoption 30%  
 Enforcement 30%

Reform	Definition		Year						
			1995	1996	1997	1998	1999	2000	2001
Encourage progressive water pricing policies	Encourage progressive water pricing policies to bring demand into balance with supply. A pricing structure for irrigation water reflecting actual cost is adopted on a progressive basis with increases scheduled on a regular basis over the next several years. Technical assistance to MAMVA/ORMVAT through the TRM project will encourage the implementation of such policies in the Tadla perimeter.	Planned		10	20	40	40	70	100
		Actual		10					
Decentralization of water management authorities	Technical assistance will be developed by TRM and WRS project to develop implementing decrees for the devolution of water management authority to Watershed Agencies as called for in the Water Law. In Tadla TRM will provide assistance to MAMVA to help reach agreement with MTP regarding the clear allocation of roles and responsibilities of the Watershed Agency and ORMVAT for those water sector functions that both parties may claim.	Planned		10	20	30	40	70	100
		Actual		10					
Water Users Association empowerment	The TRM activity will assist ORMVAT to take steps necessary to support the progressive transfer of responsibilities to the WUAs. This will be accomplished through the provision of technical assistance to 1) assist ORMVAT and WUAs with organizational issues and related training 2) assist in reviewing legislative and administrative issues concerning financial autonomy of the WUAs and 3) move towards WUA member participation of the ORMVAT Board of Directors.	Planned	10	20	30	40	60	70	100
		Actual	10	20					
ORMVAs efficiency enhancement	Enhance the efficiency of irrigation authorities (ORMVAs) through reduction in state subsidies downsizing and increasing their autonomy. TRM project will assist ORMVAT to undertake a re-engineering process that will permit them to effectively respond to the on-going liberalization program of the irrigated agriculture sector in Morocco. This process will help all ORMVAs to become fully autonomous and consequently to be able to generate (through water fees) enough funds to support their personnel and to finance the on-going rehabilitation program of the irrigated perimeters. Through the re-engineering process ORMVAs will have to increase dependence on WUAs for maintenance and water distribution.	Planned			10	20	40	70	100
		Actual							

**ANNEX B**  
**SUMMARY OF LEVEL OF EFFORT AND TIMING**  
**OF**  
**PROJECT ACTIVITIES BY PERFORMANCE INDICATOR**

**Table 1 1a Level of Effort and timing of activities related to the performance indicator No 1  
Increase volume of water savings in target areas  
Workplan Jan 1997 June 1999**

Activity	KEY			ST Short-term level of effort				Sub-contractors				Che Chemonics					
	COP	IE	M&E	LT	Tec	Eng	ORMVAT	ORMVAT	ORMVAT	ORMVAT	ORMVAT	ORMVAT	ORMVAT	ORMVAT			
	Chief of Party	Irrigation Engineer	Monit & Eval Specialist	Long-term level of effort	Technician level (ORMVAT)	Engineer level (ORMVAT)											
	**	*****	*****														
				LEVEL OF EFFORT (pm)				1997				LEVEL OF EFFORT (pm)					
				MRT		ORMVAT		By quarter				MRT		ORMVAT			
				LT	ST	Eng	Tec	1	2	3	4	LT	ST	Eng	Tec		
<b>A Improved canal conveyance efficiency</b>																	
<b>1 System Diagnostic Study</b>																	
<b>2 Hydrologic Analysis of Water Supply</b>																	
Model development	****		**														
Use by ORMVAT for water supply analysis		*****	*****				6	6	-----	-----	-----			6	6	-----	
<b>3 Establish GIS</b>																	
Design GIS hardware & software	*****		**														
Procurement & installation	****		**														
Basic training	*****		*****														
GIS practical visit in USA (U C Davis & Chemonics)				M&E	0.5		2			**							
Incorporate data into GIS & applications development				COP	0.2												
				IE	0.5	Che	2.0	48	48	-----	-----	M&E	3.0	Che	2	80	80
				M&E	1.5	RMI	1.0					COP	0.5				
				COP	0.2												
<b>4 Install Agro-meteorological Monitoring Stations</b>																	
Design agroclima' stations	****		**														
Procurement	****		**														
Installation & training			**	IE	1.0	RMI	0.3	2	2	---	---						
				FM	0.5												
				COP	0.2												
Data acquisition & use by ORMVAT			**	IE	1.0			3	6	-----	-----	M&E	0.3		5	8	
												IE	0.4				
<b>5 Establish flow data acquisition system</b>																	
Design the system	*****		**														
Procurement			**														
Site construction			**														
Installation & training			**	IE	1.5	RMI	1.2	3	3	---	---						
				COP	0.2												
Course in flow measurement (U C Davis)			**	IE	0.2						**						
Data acquisition & use by ORMVAT for improving canal syst mgt			**	IE	0.5						----	M&E	0.3		90	60	
				M&E	0.2							COP	0.5				
												IE	1.0				
<b>6 Develop Hydraulic Simulation Model</b>																	
Conceptual design	**		**														
Model development			**	IE	0.4	RMI	1.0	2	3	-----	-----						
Installation & training			**	IE	1.0	RMI	2.5	3	3	-----	-----						
				COP	0.2												
Use by ORMVAT for improving canal system mgt			**	IE	1.0			21	15	-----	-----	M&E	0.3	RMI	1	32	30
				M&E	0.2							COP	0.5				
												IE	1.0				
<b>7 Develop mobile flow Monitoring System</b>																	
Procurement			**														
Design & installation			**														
Use for monitoring water delivered to farmers			**	IE	0.7			2	18	-----	-----	M&E	0.2		4	30	
				FM	0.5							COP	0.2				
				M&E	0.2							IE	0.8				
				COP	0.2												
<b>8 Computer Irrigation Scheduling</b>																	
Design & development			**														
Use by ORMVAT for improving irrigation planning & scheduling			**	IE	0.5	RMI	1.0	3	36	-----	-----	M&E	0.5		10	60	
				M&E	0.4							IE	1.0				
				FM	0.3												
Total 13 8 9 0 95 140 11 3 227 274																	

**Table 1 1b. Level of Effort and timing of activities related to the performance indicator No 1  
Increase volume of water savings in target areas.  
Workplan Jan 1997 - June 1999**

Activity	KEY			LEVEL OF EFFORT (pm)				1997				LEVEL OF EFFORT (pm)				1998		1999			
	COP	IE	M&E	MRT		ORMVAT		By quarter				MRT		ORMVAT		Quarter		Quarter			
	Chief of Party	Irrigation Engineer	Monit & Eval Specialist																		
	FM	Farm Manag Specialist	Specialist	LT	ST	Eng	Tec	1	2	3	4	LT	ST	Eng	Tec	1	2	3	4	1	2
<b>B Improved on farm application efficiency</b>																					
<b>1 Develop Farm Survey &amp; Typology</b>																					
Farm survey & baseline data																					
Farm Typology																					
2d on-farm monit. & Eval survey																					
On-farm M&E of project activities																					
					M&E 1.0										M&E 1.0						
					FM 0.5										COP 0.5						
<b>2 On-farm water savings pilot demonstrations</b>																					
Design																					
Laser equipment procurement																					
On-farm level basin Demonstrations																					
					FM 4.5		9	9							M&E 0.4	21	21				
					IE 0.5										COP 0.5						
															FM 1.0						
Micro-irrigation evaluation in Tadla																					
Level basin demo evaluation																					
					FM 0.5	Agr 1	1	1													
Land leveling feasibility study																					
					FM 0.8	RMI 2	1	1													
Course on-farm irrigation techniques (U C Davis)																					
					COP 0.2		5	5													
					FM 0.3																
Field days & results dissemination																					
					FM 1.0		3	6							M&E 0.5	5	9				
					COP 0.2										COP 0.5						
															IE 0.3						

**Table 1 2 Level of Effort and timing of activities related to the performance indicator No 2  
Reduction in amount of nitrate leached in the groundwater  
Workplan Jan 1997 June 1999**

Activity	COP Chief of Party			ST Short-term level of effort				Sub-contractors				Che Chemonics									
	IE Irrigation Engineer			LT Long-term level of effort				Agr Agrdec				RMI									
	M&E Mond. & Eval Specialist			Tec Technician level (ORMVAT)				RMI				NCBA									
	FM Farm Manag Specialist			Eng Engineer level (ORMVAT)																	
Activity	*****	*****	*****	LEVEL OF EFFORT (pm)				1997				LEVEL OF EFFORT (pm)				1998				1999	
				MRT		ORMVAT		By quarter				MRT		ORMVAT		Quarter				Quarter	
				LT	ST	Eng	Tec	1	2	3	4	LT	ST	Eng	Tec	1	2	3	4	1	2
<b>1 Establish ground water soil &amp; water quality monitoring network</b>																					
Diagnostic Installation & training																					
Data acquisition integration into GIS & analysis				IE	0.5		6	6						M&E	1.0		10	10			
				M&E	1.0									IE	0.5						
<b>2 Develop an integrated nitrogen management program</b>																					
Develop an action plan & demonstration program																					
Nitrogen management demonstrations				FM	0.5	Agr	2	1	4					M&E	1.0	Agr	2	4	20		
				M&E	1.0									COP	0.5						
Field days & results dissemination				FM	0.2		2	10						M&E	0.5		4	18			
				M&E	0.2									COP	0.5						
				COP	0.2																
<b>3 Establish Computerized groundwater model</b>																					
Development & installation				IE	0.5	RMI	1	3													
Training course Ground water modeling (U C Davis)																					

**Table 1.3 Level of Effort and timing of activities related to the performance indicator No 3  
Percent of farmers adopting integrated pest management practices  
Workplan Jan 1997 - June 1999**

Activity	KEY			ST Short-term level of effort				Sub-contactors				Che Chemonics									
	COP	IE	M&E	LT	Tec	Eng															
	Chief of Party	Irrigation Engineer	Monit & Eval Specialist	Long-term level of effort	Technician level (ORMVAT)	Engineer level (ORMVAT)															
	FM																				
	****	*****	*****	LEVEL OF EFFORT (pm)				1997				LEVEL OF EFFORT (pm)				1998		1999			
				MRT		ORMVAT		By quarter				MRT		ORMVAT		Quarter		Quarter			
				LT	ST	Eng	Tec	1	2	3	4	LT	ST	Eng	Tec	1	2	3	4	1	2
<b>1 Agro-chemical use &amp; monitoring</b>																					
Dagnostic	*****																				
Network design																					
Training course Safe use of pesticides (U C Davis)		**																			
<b>2. Establish an appropriate Integrated Pest Mangement program</b>																					
Develop an IPM action plan																					
IPM on-farm demonstrations & training				COP 10	RMI 15	10	30	-----	-----	-----	-----	M&E 10	Che 2	18	50	-----	-----	-----	-----		
				M&E 10	Che 25							COP 10									
Field days & results dissemination				COP 02		4	8	**				M&E 0.5		8	16						
				M&E 02								COP 0.5									
				FM 02																	
Training course IPM technology & development (U C Davis)		**																			
Course in IPM extension methods (U C Davis)			**	COP 02		2	0														



**Table 1.5 Level of Effort and timing of activities related to the performance indicator No 5  
Number of discrete technologies developed by TRM activity implemented in other perimeters  
Workplan Jan 1997 June 1999**

Activity	KEY			ST Short-term level of effort				Sub-contractors				Che Chemonca										
	COP	IE	M&E	LT	Tec	Eng	LT	Agri	RMI	NCBA	LT	ST	Eng	Tec								
	Chief of Party	Irrigation Engineer	Monit. & Eval. Specialist	Long-term level of effort	Technician level (ORMVAT)	Engineer level (ORMVAT)	Long-term level of effort	Agr. Agri/dec	RMI	NCBA	LT	ST	Eng	Tec								
	FM	Farm Manag. Specialist																				
	****	*****	*****	LEVEL OF EFFORT (pm)				1997				LEVEL OF EFFORT (pm)				1998		1999				
				MRT		ORMVAT		By quarter				MRT		ORMVAT		Quarter		Quarter				
				LT	ST	Eng	Tec	1	2	3	4	LT	ST	Eng	Tec	1	2	3	4	1	2	
<b>1 Training course in Tadla with other ORMVA participants</b>																						
Water mgt study tour in USA		**																				
Training courses in Tadla with parboyan from other ORMVAS (see U.C. Davis courses table 1a. a)			**	**	COP	1.0	2	**	**													
<b>2 Training &amp; dissemination of project results to other ORMVAS</b>					COP	0.5	1	2				COP	1.0	Che	6	30	50					
					M&E	0.5						M&E	1.5									
					FM	0.5																
					IE	0.5																
<b>3 Information Outreach Workshops</b>					COP	0.5	2	1				COP	1.0			5	4					
					M&E	0.5						M&E	1.0									
					FM	0.5						IE	0.4									
					IE	0.5																
<b>4 Annual evaluation &amp; workplan workshop</b>					COP	1.5	4					COP	1.5			8						
					M&E	1.0						M&E	1.0									
					FM	0.5						IE	0.4									
					IE	0.5																
<b>5 Quarterly annual &amp; technical reporting</b>					COP	2.8	2					COP	2.5			2						
					M&E	1.6						M&E	2.0									
					FM	0.5						IE	0.2									
					IE	0.5																
<b>6 Water mgt &amp; policy invitational travel</b>																						

**Table 16 Level of Effort and timing of activities related to the performance indicator No 6  
Policy reforms achievement related to Integrated Water Resources Management  
Workplan Jan 1997 June 1999**

Activity	KEY			ST Short-term level of effort				Sub-contractors				Che Chemonics											
	COP	IE	M&E	LT	LT Long-term level of effort							Agr	Agr Agndec										
	FM	Mont. & Eval	Specialist	Tec	Technician level (ORMVAT)							R&E	NCBA										
		Farm Manag	Specialist	Eng	Engineer level (ORMVAT)																		
	****	****	****	LEVEL OF EFFORT (pm)				1997				LEVEL OF EFFORT (pm)				1998				1999			
				MRT		ORMVAT		By quarter				MRT		ORMVAT		Quarter				Quarter			
				LT	ST	Eng	Tec	1	2	3	4	LT	ST	Eng	Tec	1	2	3	4	1	2		
<b>1 Progressive water pricing policies</b>																							
Water mgt study tour in USA		**																					
Implementation of progressive water pricing by ORMVAT				COP 0.5			3	2	----	----	----	----	COP 1		6	4	-----	----	----	----	----	----	
				M&E 0.2									M&E 0.2										
<b>2 Decentralization of water management authorities</b>																							
assesment of intersectoral water management in Morocco			**																				
Water law decrees development & clarification of ORMVAS responsibilities				COP 0.5			3				----		COP 1		6	4	-----						
				M&E 0.2									M&E 0.2										
<b>3 Empowerment of Water Users Associations</b>																							
Strengthening WUA in Tadla (see indicator #4)				COP 0.5			12	6	----	----	----		COP 1		24	9	-----						
				M&E 0.2									M&E 0.4										
<b>4 Enhancement of the efficiency of ORMVAs</b>																							
enhancing ORMVAT autonomy				COP 0.5	Che 3		6				**		COP 1	Che 2	4	-----	-----	-----	-----	-----	-----	-----	
				M&E 0.2									M&E 0.2										

**SUMMARY OF THE PROJECT LEVEL OF EFFORT BY PERFORMANCE INDICATOR**  
**Workplan Jan 1997 Sept 1999**

LEVEL OF EFFORT TYPE	Jan1997 Dec 1997								Jan 1998 June 1999							
	Performance Indicator*								Performance Indicator*							
	1a	1b	2	3	4	5	6	TOTAL	1a	1b	2	3	4	5	6	TOTA
<b>TRM Project Specialist</b>																
<b>Long-term</b>																
<b>Irrigation Engineer</b>	83	05	10	00	02	20	00	120	42	03	05	00	00	10	00	60
<b>Monit. &amp; Evaluation</b>	30	10	22	12	02	36	08	120	46	19	25	15	10	55	10	180
<b>Farm Management</b>	13	76	07	02	02	20	00	120		10						10
<b>Chief of Party</b>	12	04	02	14	05	63	20	120	17	15	10	15	23	60	40	180
<b>LT Total</b>	138	95	41	28	11	139	28	480	105	47	40	30	33	125	50	430
<b>Short Term</b>																
Chemonics	20	00	00	25	00	00	30	75	20	00	00	20	00	60	20	120
RMI	60	20	10	15	00	00	00	105	10	00	00	00	00	00	00	10
Agrdec	00	10	20	00	00	00	00	30	00	00	20	00	00	00	00	20
NCBA	00	00	00	00	00	00	00	00	00	00	00	00	20	00	00	20
<b>ST Total</b>	80	30	30	40	00	00	30	210	30	00	20	20	20	60	20	170
<b>Total TRM Project LO</b>	218	125	71	68	11	139	58	690	135	47	60	50	53	185	70	600
<b>ORMVAT Staff</b>																
<b>Engineer level</b>	950	190	120	160	240	110		1770	2270	260	180	260	600	450	400	4020
<b>Technician level</b>	1400	220	200	480	240	00		2540	2740	300	480	660	500	540	170	5220
<b>Total ORMVAT LOE</b>	2350	410	320	640	480	110		4310	5010	560	660	920	1100	990		9240

\* Performance Indicator

## **ANNEX C**

### **SCOPES OF WORK FOR LONG TERM TECHNICAL ASSISTANCE**

Following are details of the strategy for fielding long term level of effort

- Extend the Chief of Party from June 1, 1998 until June 30, 1999
- Extend the Monitoring and Evaluation Specialist from January 1, 1998 until June 30, 1999
- Extend the Irrigation Engineer from January 1, 1998 to June 30, 1998
- The Farm Management Specialist will leave the project at the end of his contract January 30, 1998

#### **The Chief of Party will**

- continue responsibility for water user group development
- continue responsibility for water policy initiatives related to the policy reform matrix
- supervise and assist with the planning and execution of the technology extension effort
- provide backstopping for a project audit
- assure project closeout
- participate in a final project evaluation
- prepare the final project technical and financial reports

#### **The Monitoring and Evaluation Specialist will**

- monitor, evaluate, and report on performance indicators on all 5 indicators and the water policy reform matrix This will include the supervision of data collection effort to monitor impact of participating farmers in the IPM nitrogen fertilizer reduction and level basin irrigation programs, and water savings
- help in the project organize and conduct field days and national seminars to extend technologies to other ORMVAs and disseminate project results
- followup monitoring of technology extension efforts to all 8 other regions of Morocco
- continue overall supervision of data integration and development of the GIS applications
- assist the COP with supervision of short term consultants technical review of reports, preparation of quarterly, annual and end of project reports
- participate in a final project evaluation and reporting

#### **The Irrigation Engineer will**

- with short term technical assistance in 1997, complete the development and operationalizing of the canal hydraulic model, the flow measurement network, the agrometeorological network, the irrigation planning and scheduling program, and complete the training of ORMVAT staff in operations and maintenance
- in 1998, with short term technical assistance, focus on (1) the utilization of the

technologies to achieve project performance criteria, (2) assure that ORMVAT staff are fully capable of effectively using the technologies and (3) preparing demonstrations of the technologies for transfer to other ORMVAs

- review documentation related to the technologies developed and assist with the dissemination program
- write an end of tour report

**The Farm Management Specialist will**

- continue extension of level basin technology among Tadla farmers, with already well trained and equipped ORMVAT technicians
- set up at least one laser leveled level basin demonstration in the Haouz
- pursue contacts with the private sector for their involvement in developing laser, land leveling services in the Tadla as well in Morocco
- with short term technical assistance and ORMVAT staff prepare a national workshop on level basin technology
- write a technical report which documents the development and justification of level basin technology in the Tadla

**ANNEX D**  
**SUMMARY BUDGET**

Tadia Resource Management Project  
DRAFT PACD BUDGET November 12 1996

Item	Invoiced Thru June 97	July to Dec 1997	Total 1998	Total 1999	Total Budget Required
I SALARY	1 435 244	221 801	325 033	128 758	2 110 836
II Fringe Benefits	513 650	82 652	110 199	54 285	760 786
III Overhead	1 212 552	222 685	308 853	122 353	1 866 443
IV Travel & Transport	165 666	19 481	83 789	27 861	296 796
V Allowances	292 930	52 246	108 176	42 387	495 738
VI Other Direct Costs	529 680	129 400	210 093	108 204	977 378
VII Participant Training	91 322	16 000	75 000	10 000	192 322
VIII Equipment Vehicles Freight	779 672	98 000	1 000	0	878 672
IX Subcontractors	1 141 711	508 862	110 128	0	1 760 701
Subtotal I IX	6 162 426	1 351 126	1 332 271	493 849	9 339 672
X General and Administrative	197 156	62 962	62 084	23 013	345 216
XI Fee	518 305	113 127	111 548	13 907	756 887
XII Grand Total	6 877 888	1 527 216	1 505 903	530 769	10 441 776